LIFE AND WORK

AT THE GREAT PYRAMID.

VOL. I.

EDINBURGH : PRINTED BY THOMAS CONSTABLE,

FOR

EDMONSTON AND DOUGLAS.

LONDON . . . . . HAMILTON, ADAMS, AND CO.

CAMBRIDGE . . . . . MACMILLAN AND CO.

DUBLIN . . . . . M'GLASHAN AND GILL.

GLASGOW . . . . . JAMES MACLEHOSE.

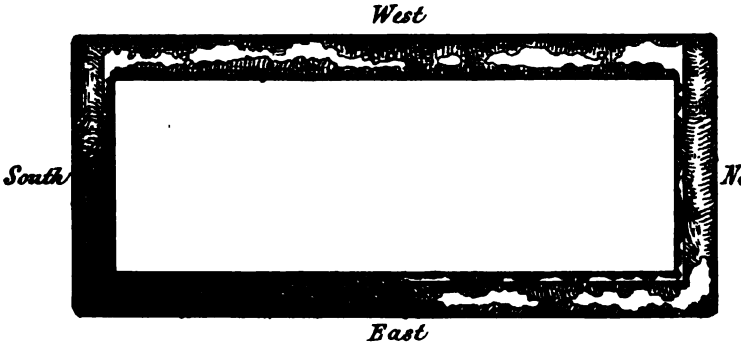
LIFE AND WORK

AT THE GREAT PYRAMID.

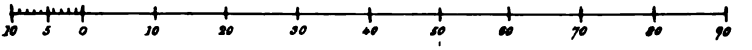
VOL. I.

The Coffer, in the King's Chamber, A.D. 1865.

Elevation, looking West.



Plan, looking from above, the shading in proportion to the deviation from a horizontal plane.



Scale of British Inches.

W. H. Mc Farlane, Lith. Edin.

LIFE AND WORK

AT THE GREAT PYRAMID

DURING THE MONTHS OF JANUARY, FEBRUARY, MARCH, AND APRIL, A.D. 1865;

WITH

A DISCUSSION OF THE FACTS ASCERTAINED.

BY C. PIAZZI SMYTH, F.R.SS.L. & E.

F.R.A.S., F.R.S.S.A.; HON. M. INST. ENGIN. SC., F.S. ED., AND R.A.A.S. MUNICH AND PALERMO;
PROFESSOR OF PRACTICAL ASTRONOMY IN THE UNIVERSITY OF EDINBURGH,
AND ASTRONOMER-ROYAL FOR SCOTLAND.

IN THREE VOLUMES;

WITH ILLUSTRATIONS ON STONE AND WOOD.

VOL. I.

EDINBURGH:
EDMONSTON AND DOUGLAS.
1867.

RC 99
S 63
V. 1
327321

TO THE MEMORY OF

PROFESSOR JOHN GREAVES,

IN THE YEAR 1638,

AND

COLONEL HOWARD VYSE,

IN 1837,

Alike distinguished in their respective epochs, for honourable labours and faithful research at the Pyramids of Jeezeh;

AND MORE PARTICULARLY

TO THAT OF

NAPOLEON BONAPARTE,

REPUBLICAN GENERAL IN 1798,

Who earnestly sought to moderate the rigours of war upon the ancient land of Egypt, by causing his army to become most efficient means for introducing there, step by step in its victorious progress, the elevating influences of science, and amenities of literary learning;—on a scale so vast, and with an intelligence so many-sided, as not only to have far surpassed all the wealthiest Kings and Princes of the earth, either of earlier or later times,—but to have been crowned with discoveries in the Great Pyramid, both possessing crucial importance for that primeval monument's metrological theory, and bringing to clearer light things long since dimly alluded to in Holy Writ:—this record of some further, though only private and individual, work performed on that foundation, is dedicated by

C. PIAZZI SMYTH.

PREFACE.

THE positive duty of prosecuting the subject of the Great Pyramid, had been earnestly as well as formally urged upon me by the late John Taylor,[1] during the last few months of his useful and laborious life; so that when he peacefully departed soon after, or in July 1864,—I suddenly found myself not altogether free from the pressing of a very serious responsibility.

Though but ill prepared for the task, and certainly not having sought it, I yet resolved from that moment to contribute whatever I could to the cause; and with this view lost no time in commencing to take a step, which, of all others, seemed just then to be the most necessary towards enabling the current of general investigation to flow steadily on. That step was, to try to add something prac-

[1] Author of *The Great Pyramid: Why was it built, and who built it?* 8vo. 2d edition. Longman & Co. London, 1864.

tical to the best of Mr. Taylor's literary researches; or, in other words, to visit the ancient Pyramid where it stands, and has stood for so many thousands of years; and personally remeasure those parts of it, concerning which all modern writers vary so much in their observations and statements, as to prevent every theory alike,—whether John Taylor's or any other man's,—from being either firmly founded, or satisfactorily refuted upon them.

Pondering much on the last words of the eminent deceased, and over-estimating, perhaps, the public appreciation of the objects aimed at,—I commenced their practical pursuit, in a frame of mind, unfortunately too hopeful, that the perfect and final time for the complete unrolling of the primeval world's greatest wonder, had at last arrived. But if I erred therein,—the mishaps, oppositions, ruinous expenses, and troubles of every kind which were experienced before getting further than Cairo, both fully disabused and largely punished me. Yet after I had then and there given up in grief those first fair hopes, and laid it to my heart merely to do with my own hands whatever was directly within my calling (though, too, all my own means and powers might appear ever so unequal to the task required), and determined not to presume to urge, or expect to push, the development of the Great

Pyramid subject in its entirety, to any extent or degree, and did work on painfully and laboriously in that manner,—then, if one may be allowed to draw some inference from facts experienced, and be thankful for mercies beyond one's deserts,—I am bound to confess, that the latter course and conclusion of the work were as fortunate, as its commencement had been discouraging: resulting altogether, in a greater number of original and independent scientific observations of the Great Pyramid being obtained, and securely brought home,—than had ever been accumulated before,—certainly on means so slender and apparently insufficient.

In simple justice to the great benefits derived (when engaged in the above operations) from his liberal concessions,—I am bound to give my best thanks most prominently to His Highness the Viceroy of Egypt, Ismail Basha; who, besides granting a free transit on the railway to all *our*,—for my wife accompanied me,—camping and scientific packages, was pleased, through his superintendent of monuments Mariette Bey, master of the ceremonies Zeki Bey, superintendent of excavations Signor Vassalis, and His Excellency the Governor of Jeezeh,—not only to convey our party at his own expense from Old Cairo by boat and camels to the

Pyramids,—but to establish us there before the Arabs in so official a manner, and with such authority,—that our safety was looked to through the whole period of our stay, with an efficiency which left nothing further to be desired for the complete security of both life and property; and could hardly have been exceeded in its good effect under the best European Government.

To T. F. Reade, Esq., Her Britannic Majesty's Consul in Cairo, my thanks are due; he always showing anxiety to acquit himself satisfactorily of the manifold, as well as difficult, duties which fall on our public representative in that city of many nations.

Likewise to Andrew Coventry, Esq., of Moray Place, Edinburgh, for his perfectly spontaneous contribution of a handsome sum of money, wherewith two first-class measuring instruments, one for the angular inclination and the other for the linear height, of the Grand Gallery of the Great Pyramid, were specially procured.

To John Hartnup, Esq., Director of the Liverpool Observatory, for much and hospitable kindness both when leaving, and returning to, the Mersey; to facilitate the navigation of whose ocean-going ships, he has done, and is doing, so much.

And finally to Messrs. W. B. Brough & Co., mer-

chants in Alexandria, an enterprising and generous firm, whose acquaintance it would have been greatly to our advantage to have made much earlier than we did.

The names of several other kind friends will be found gratefully alluded to in the course of the present book; which has been arranged in three volumes, on the following plan; viz. :—

VOLUME I. gives both a popular account of the general circumstances under which the observations were made, and a social view of the progress of the work during a four months' life in the tombs, and amongst the Arabs of the Pyramid hill. This latter part of the proceedings being found of especial importance,—in enabling any one fully to realize the strange situation, with all its ancient surroundings; and acquire thereby that desirable calmness of mind and freedom from new sensations, so important towards procuring impartial, rigid, and rigorous measures.

VOLUME II. contains the original numerical observations, in length, angle, and heat, arranged in order of subject. These form rather a heavy part to be read straight and steadily through by every one; but are useful, nevertheless, to glance over, in order to acquire clear ideas of actual detail; and are

even absolutely necessary to refer to, in all cases of *disputed* data; an unhappy characteristic hitherto of almost everything in modern literature connected with the Great Pyramid.[1]

VOLUME III. contains the *discussion* of the above observations in three several steps, as follows; viz.—

DIVISION 1 considers the more immediate results deducible from the observations, touching the chief facts of construction and position in the Great Pyramid; with the special view of eliminating accidents of dilapidation; and, from the present, arriving at the ancient, size and shape, —both of the building as a whole, and of its chief component parts.

DIVISION 2 takes up a higher or more recondite class of phenomena, and shows nearly all the detail of the building to have the effect of constituting the Great Pyramid,—in its origin and before it was used for any sepulchral purposes, —a *Metrological* monument; or, a grand com-

[1] See the Author's *Our Inheritance in the Great Pyramid*, 1864; where, on page 103, are given twenty-five authorities for the size of the coffer, varying from each other by inexplicable quantities in every element of length, breadth, and depth or height, both inside and out.

On page 67, sixteen authorities for the number of horizontal courses of masonry in the Great Pyramid, as being from 125 to 255.

And on page 266, eleven authorities for the height of the Grand Gallery, varying amongst themselves from 270 to 360 inches; with fourteen for the length of the same, varying between 1440 and 1947 inches.

memoration in stone of a truly cosmopolitan system of *weights and measures:* extending through nearly all subjects, such as length, weight, heat, angle, and time; with a wealth, too, as well as surpassing power, of exactness of reference to the great standards of Nature,—whether of the earth as a whole, or the precessional movements of the starry heavens,—such as may worthily excite the attention, and claim the respect of all the educated amongst mankind.

While DIVISION 3 endeavours to realize the *history* of Egypt, both public and private, in the long prehistoric days of the building of the Great Pyramid; to essay why, and by whom, that monument was erected with the characteristics now discovered; and to speculate wherefore it may be, that after so long a period of oblivion, the true idea of the Great Pyramid's original purpose, should only now be coming to be understood in the world.

And if the general result of the whole book be found by fair and able readers to show, that some of John Taylor's views have formed a true commencement and have indicated the right line of approach to further developments of the same ennobling order,—I trust that other men's minds

may be moved to examine the whole subject with new tests, and pursue it with far greater powers than mine.

Nor can it be doubted, but that some fine spirits will take up the investigation heartily, when they come fully to understand,—that the Great Pyramid may be looked on in the unique and invaluable historical light, of a *contemporary* record of the events of more than four thousand years ago : that its interpretation can be approached directly, by the application of modern exact science alone : and that its pages, so read,—in the very *ipsissima verba*, and even letter-forms themselves, of the original autograph,—reveal a most surprisingly accurate knowledge of high astronomical and geographical physics,—though at a date, nearly fifteen hundred years earlier than the very first, and extremely infantine, beginnings of such things among the ancient Greeks ; besides exhibiting some remarkable connexions with, as well as dependences on, the religion of Sacred Writ in the Patriarchal times of the world.

CONTENTS OF VOLUME I.

CHAPTER I.

APPLICATION TO HIS HIGHNESS THE VICEROY, . . . PAGES 1-15

CHAPTER II.

WAITING IN CAIRO, ... 16-39

CHAPTER III.

REACH THE PYRAMIDS, ... 40-66

CHAPTER IV.

REPORT ON THE GREAT PYRAMID, ... 67-96

CHAPTER V.

WORKING PRELIMINARIES, ... 97-117

CHAPTER VI.

ARRIVAL OF RAMADAN, ... 118-140

CHAPTER VII.

OF PASSAGES AND ANGLES, ... 141-169

CHAPTER VIII.

ROCKS AND ANCIENT RUBBISH, ... 170-195

CHAPTER IX.

PAGES

MODERN RUBBISH AND RAMADAN, ... 196-233

CHAPTER X.

THE SECOND PYRAMID, ... 234-271

CHAPTER XI.

INSTRUMENTALS, ... 272-311

CHAPTER XII.

TOMBS OLD AND NEW, ... 312-354

CHAPTER XIII.

ANTECHAMBER AND KING'S CHAMBER, . . 355-387

CHAPTER XIV.

PROGRESS OF THE SEASON, ... 388-424

CHAPTER XV.

ASTRONOMICAL OBSERVATIONS, ... 425-468

CHAPTER XVI.

MAGNESIUM PHOTOGRAPHY, ... 469-516

CHAPTER XVII.

CONCLUDING WEEK, ... 517-562

LIST OF ILLUSTRATIONS

IN VOLUME I.

(The following Plates, being mostly on very small scales, are capable of little more than giving first approximate ideas of the general nature of the subjects observed and measured. It is particularly requested, therefore, that no 'Pyramid measures' be taken from the Drawings; but that the numerical entries of the original measures, contained in Volume II., be always referred to, when exactness is required.)

No. of Plate.

I. COFFER IN THE KING'S CHAMBER—Frontispiece.
Referred to at p. 85, 377, and vol. II.

Inserted at page

II. MAP OF PYRAMID HILL, . . . xviii
Referred to at 62, 134, 186, 417, etc.

III. VERTICAL MERIDIAN SECTION OF GREAT PYRAMID, ... xviii
Referred to at 81, 94, 238, etc.

IV. GROUND PLAN OF GREAT PYRAMID, . xviii
Referred to at 201, 208, 212, etc.

V. WELL-MOUTH, PARTICULARS OF, . . 80
Referred to at 80, and vol. II.

VI. LOWER PART OF LOWER OR NORTH END OF GRAND GALLERY, . . . 167
Referred to at 167, 238, 302, and vol. II.

No. of Plate. Inserted at page

VII. PHOTO-LITHOGRAPH OF KING SHAFRE'S OVALS, ... 347
Referred to at p. 347.

VIII. AIR-CHANNEL MOUTHS, NORTH AND SOUTH, 414
Referred to at 413, 415, and vol. II.

IX. CORNER SOCKETS OF GREAT PYRAMID, . 526
Referred to at 526, and vol. II.

X. STEPS OF DECAY OF AN AVERAGE JEEZEH PYRAMID, ... 564
Referred to at 183 and 262.

WOODCUTS.

TWO SMALL VIEWS OF SECOND PYRAMID, . 254
ROYAL OVALS, ... 347-349

VOL. I.

JOURNAL

OF

PROCEEDINGS.

'The Great, The Mighty God, The Lord of Hosts, is his 'name; great in counsel, and mighty in work:—which hast 'set signs and wonders in the land of Egypt, even unto this 'day.'

JEREMIAH XXXII. 18-20.

CHAPTER I.

APPLICATION TO HIS HIGHNESS THE VICEROY.

HAVING left Edinburgh in November 1864 for Egypt, impelled only by the hope of contributing, during the following winter and spring, towards new and improved measures of the Great Pyramid being obtained,—*our* course, for my wife always accompanied me, became pretty definite after we had once arrived in the metropolitan city of Cairo.

The local authorities were of necessity to be consulted, especially as centring in their honoured and powerful head, His Highness Ismael Basha, Viceroy of Egypt; for without his countenance nothing could be attempted in such a land, at all times rather uncertain near its desert boundaries, and now requiring a long-continued and undisturbed visitation at a critical point.

The British Consul, Mr. T. F. Reade, was accordingly called upon without delay, and happily found to be actuated, within the limits of his instructions, by all praiseworthy enthusiasm and cheerful alacrity to do whatever belonged to his official part. That part was indeed rather unfortunately confined to

merely procuring me the honour of a presentation to His Highness the Viceroy, and then leaving me to plead the case as best I might; and see how far the ruler of all Egypt, freed from any approach to diplomatic pressure or consular advice, would voluntarily condescend in this instance of being applied to by a solitary and entire stranger, and for the cause of a peculiar branch, of a not yet very popular subject, of learned research.

Mr. Reade having, however, as a first step, suggested the advisability of a written memorial being prepared beforehand, I not only drew up at once something of the kind, for his private inspection, but during an enforced delay of several days caused by the non-arrival of certain boxes from Alexandria, endeavoured to obtain some assistance from local criticism, if not the benefit also of native counsel on a few of the special topics included.

Nor was this step by any means to be thought lightly of; for Cairo, during many years the seat of the Egyptian Scientific and Literary Institute, has its own *savants*, its own history of their labours and successes, its own rules of philosophic faith, and above all, its own ideas of the Pyramids, the monuments of the monuments of Egypt. Highly important therefore to learn from those gentlemen whatever they could teach; and in case of finding that they confirmed the recent Northern suspicion of there being still many sensible improvements that might be made in the exact mensuration of the

Great Pyramid,—would any of those experienced members of the old Egyptian Society, some of them Europeans by birth but now long naturalized in Egypt, be willing to join in, or of themselves to undertake, an immediate attempt to supply such defalcations of knowledge? and to what extent could the labour of such a work be divided, and the authority of its conclusions multiplied, by combining the efforts of different nationalities?

The many friendly conversations which were generated in discussing these questions with such few members of the late Institute as we could hear of or meet with in Cairo, proved highly interesting; for they showed that theories of the monuments, and sometimes of a most ingenious kind, were rife in Egyptian minds; that Egypt itself was looked on as having a superior right to settle many general scientific questions, by reason of the far greater length of time, measurable only by thousands of years, that written records of natural phenomena have been kept up in the cities of the valley of the Nile, than in those of any other civilized country whatever; and that much good investigation had been carried on during late years, by one person or another, even in the way sometimes of actual Pyramid measures, though they were to be met with as yet nowhere, except in the original manuscript.

But after giving full weight to every piece of information that could be brought up on this side,

the conferences also proved pretty plainly,—not only that large omissions in the metrical description of the Great Pyramid did really exist,—but that no one *savant* then in Egypt was believed to be either at liberty to undertake, or inclined to prosecute, the subject of supplying them during the coming season, in any manner or to any degree.

I should not then be interfering with the researches of any one else, or standing in any other man's light, if furnished with the Viceroy's permission to go out to the Pyramid and measure it in European fashion; and that was something to be assured of in the present day of multitudinous prosecutions of similar branches of knowledge. So after a little further counsel with special friends, the memorial was finally drawn up with more polish, though in a shape not radically different from its first sketch; and on December 21st, Mr. Consul Reade procured me the long-desired opportunity of presenting the paper to the Viceroy himself in his island Palace of Gezeereh, on the Nile, opposite to Boolak.

This facility of approach has long been a favourable characteristic of the rulers of Egypt. For, upwards of five hundred years ago, Sir John Maundeville, after stating that whoever will travel through this part of the country 'where the Sowdan of Cayr 'dwellethe comonly, he moste gete Grace of him 'and Leve to go more sikerly thorghe the landes,'—adds thereto—

'And also no straungere cometh before him (the 'Soudan of Cayr and Lord of 5 Kyngdomes), but 'that he makethe him sum promys and graunt, of 'that the straungere askethe resonabely, beso it be 'not agenst his lawe. And so dose othere Princes 'bezonden. For thei seyn, that no men schalle 'come before no Prynce, but that he be bettre, and 'schalle be more gladdere in departynge from his 'presence, than he was at the comynge before hym.'

In Sir John's day of tumult and war, the Sultans were nearly confined to the Citadel, which yet frowns on Cairo, from the heights leading up to the Mokattam Hills; or, as the antique traveller expresses it:—

'There dwellethe the Soudan in a fayr Castelle, 'strong and gret, and wel sett upon a Roche. In 'that Castelle dwellen allewey, to kepe it and to 'serve the Sowdan, mo than 6000 Persones, that 'taken all here necessaries of the Sowdan's Court. 'I oughte right wel to knowen it, for I dwelled 'with him as Souldyour in his Werres a gret while, 'agen the Bedoynes.'

But now, in times of peace and tranquillity, the chief of Egypt has descended from that warlike perch, and sought the amenities of modern life in a fertile island, and a palace near the level of the Nile.

Quite a new erection is this viceregal residence of Gezeereh, indeed hardly yet completed, and seeming to aim at the picturesqueness of a single-storeyed, cottage style of rural seclusion for one of the great

ones of the earth: surrounded by gardens, irrigated all day long by many water-wheels lifting up and pouring forth the muddy water of the Nile; and abounding with evergreen shrubs and graceful date palms; winding ponds with frequent bridges of white marble and gilded iron work, and with globes of ruby, silvered, and tinselled glass, putting, under a bright sun, all the tints of the flowers to shame. There were sufficient military and civil officers about to illustrate the character of the residence, but extreme quiet was the order of the day; and on entering a half-dark room by an open French window from an ornamental terrace, we were at once face to face with the ruler of Egypt.

His Highness had been admirably punctual in preparing for the interview he had vouchsafed, and was blandly courteous as well as free from all display in his manner. He had already been made aware of the contents of the memorial, which he was now pleased to accept, together with a copy of two late works on the Pyramid; and was well inclined to do something in the way of help towards more measures, of such parts of the Great Pyramid as were presently open, being secured. Not much though did he apparently like the prospect of himself undertaking any of those more important excavations and clearances which were alluded to in the second part of the memorial, and without which some of the most crucial measures of the building could not be obtained either by myself or any one else. But His

Highness had great trust in his officer in charge of the antiquities of Egypt, Mariette Bey, and into his department my application would go, with the understanding that *something* should and must be done.

At eight o'clock, accordingly, next morning, an officer from the palace arrived to conduct me to the Museum at Boolak, and there make the introduction to the said Mariette Bey. With him a long discussion ensued, and at its termination I was asked to write out my objects and requests once again, but somewhat in conformity to what I had now just heard of possibilities and practicabilities, as a memorandum for the Bey to take over to the palace and refer to in further consultation with the Viceroy.

I wrote out therefore something as follows :—

1*st*, A scheme of only moderate assistance to a small scientific party, but such as would be thankfully acknowledged, and consisting of the following items :—

A. Government leave to go out to the Pyramids of Jeezeh, and observe there for three or four months.

B. Loan of Government tents, and right to occupy any tombs that should be found suitable as a residence.

C. Protection for the time mentioned to person and property ; and

D. A general cleaning of the *interior* of the Great Pyramid, as a preliminary to accurate measures.

2*d*, A scheme of such far more important and larger assistance, as would inevitably give the first place beyond all compare, in the contemplated re-measurement, to the Viceroy; and perhaps even cause his name to be remembered hereafter in the history of the Pyramid, in connexion with that of Khaliph Al-Mamoon who opened, and of Kings Shofo and Nu-Shofo who built, the mysterious structure.

This scheme to be composed as follows :—

A. In addition to the several items of scheme No. 1,—to uncover all four sides of the base of the Pyramid.

B. To remove altogether, or pierce a three-inch observing-hole straight through the centre of, the granite portcullis at the beginning of the first ascending passage.

C. To clear the two ventilating channels of the king's chamber; and

D. To sink a shaft down to the water-level from the floor of the subterranean chamber.

The Bey rather shook his head at the probability of any of the last set of requirements being undertaken, but thought that all the former were very likely to be granted; meanwhile he obligingly introduced me to the Museum, and a very creditable institution to the Government of Egypt and to himself it certainly is.

A Frenchman by birth, and with his fortune still to make, as with many and many another man who

has done precisely the right thing at the right time, or in other words achieved a great success by dint of his own native genius, M. Mariette came into Egypt in the train of the Duc de Luynes, a number of years ago, and as little more, we believe, than an assistant excavator. But his gift for the employment, both the practical field-work, and the far higher one of hieroglyphic interpretation, in connexion with the classical notices, developing itself,—he was not only able to stand alone when his patron had left the country, but to continue making some minor explorations productive of antiquities, until he was in a position to come out with the full desire of his heart.

He had been distressed, and deeply, at seeing the remnants of ancient Egypt for ages ill-treated by the natives of almost every country. For years and years no one from Europe had visited the time-honoured valley, but to see what and how many art-memorials he or they could carry away. Belzoni was a well-intending individual; but we are inclined to doubt his advanced position in ethics, when he expresses contempt for the fellahs of Egypt, because, merely, they ceased to appropriate statues and columns on finding there was no actual gold inside them. He, Belzoni, flattered himself that he belonged to a higher civilisation; for, knowing what golden prices the said sculptured remains would bring in the Parisian market, he carried them off in scores: or, he knew a reason for stealing, and stole

accordingly. European Governments also competed in theft with private individuals, until from the largest obelisks down to minute signet-rings the treasures of Egypt became scattered over the earth; and the 'monumental land' itself seemed to be in danger of lapsing at last into the pre-monumental and entirely unliterary condition of either South Africa or Australia.

It was time, thought M. Mariette, that the pillagings of the ancient country should cease; and by first displaying his own collection of antiquities in the form of a Public Museum, and then calling the attention of the authorities in a variety of ways to the case, he got them both to adopt his Museum as the nucleus of a national one for Egypt, and at once to stop by law the exportation of native antiquities to other countries. He himself too was appointed to look to the safety of all the monuments, and also to conduct any excavations which the real interests of science might demand; in fact, to carry out his own system, in which the Museum formed a necessary part; for thereto were carried all the very small articles discovered, and which, if left at the place of their discovery, might be easily stolen. Nothing, too, but such portable curiosities were ever taken there, and no destruction of any large monument has at any time been made, in order that the Museum might have specimens to exhibit.

'How different,' says M. Renan, who was in Egypt at the time of our visit, and has published his ideas

on Egyptian antiquities in the *Revue des Deux Mondes* for April 1865,—'how different is all this 'from the Egyptian Museum at Berlin; for while 'that collection of the late Prussian king was formed 'by carrying the saw and the hatchet among pre-'cious monuments, which, since the passage of M. 'Lepsius, have offered nothing but the aspect of 'destruction, the inappreciable Museum of Cairo 'has never required the demolition of the least mor-'sel of a building.' It encloses, in fact, only loose, and in size minor subjects of antiquarian interest.

Entering, accordingly, the handsome and airy halls which the Government has recently built at Boolak, we see there chiefly the miniature work of the old Egyptians, and may well wonder almost as much at their peculiar artistic excellences therein, as we are ordinarily disposed to do on witnessing their triumphs in the colossal. The late Augustan Viceroy, the gorgeous-minded Said Basha, of whom every one seems to have a good word to say, was so well pleased with the early results of the new institution, as to appoint M. Mariette to the dignity of 'Bey,' equivalent to a baron of the turbulent Mameluke times, and gave him further powers, fully confirmed by the present Viceroy, both for protection and investigation in every part of his dominions.

Large excavations are therefore continually going on, in several divisions of the country at once, but all under M. Mariette's direction; and even his

enemies confess his genius 'in that he never put 'pickaxe into the ground without finding some-'thing;' occasionally, too, he alights on remains perfectly priceless for their literary worth, though the unlettered public may not think so; for the Bey seeks chiefly such 'inscribed' stones as may enable the blanks of old Egyptian history to be gradually filled.

Of his success in this praiseworthy object, a most glowing encomium has been recently published in the Report to the Minister of Public Instruction in France, by M. le Vicomte E. de Rougé, a name long respected as amongst the foremost in Egyptology, descriptive of his mission to Egypt in 1863-4. The mission consisted of a notable party; and 'during six 'months we have copied,' says their learned chief, alluding to Egyptian inscriptions, 'we have copied, 'copied, copied without resting; we have brought 'home six volumes of hand-copied inscriptions, and '220 photographs, and yet far more remain;' so immense was the amount of inscribed stones to which he was introduced by his countryman, Mariette Bey. The most precious of these inscriptions belonged to the earliest division of Egyptian history; and M. de Rougé mentions a certain 'tablet of Memphis,' discovered by Mariette, and which is to be to the kings of the third and fourth dynasties of Lower Egypt, what the celebrated tablet of Abydos has long been to the later dynasties of the Upper country.

But the crowning prize of all, was the discovery

of works of sculpture by the fourth dynasty; their architecture was already known in the Pyramids, and their flat-work in the tombs, but their performance in the round had never been witnessed before, and is the oldest in all the world.

What then was this most ancient example of sculpture belonging to man like, equal to, or reminding one of?

When Mariette Bey shows you the chief piece of it, you stand almost appalled before the presence it conveys. It is the life-sized portrait of a king who built one of the Pyramids, seated in the calmness of majesty and the isolation of rank, gazing honestly straightforward, and on high thoughts intent, into space. There is neither the total nudity of Greek sculpture, nor the encumbering frippery of modern royalty; but the man is there, slightly more muscular in the arms than the Apollo Belvedere, though not less justly proportioned or exquisitely rendered; yet still, his *forte* is thought and administration rather than manual labour, and his manner that of one who can afford to bide his time, and expects with solid reason to see all things eventually combine for good. The eye is large and peaceful, the lips are rather fine as well as precise, the nose straight and thin, but not so much in the Grecian as the Anglo-Saxon manner; and almost the only decoration is the quasi-heraldic supporter of a hawk developed out of, rather than exactly standing on, the summit of the back of the rocky seat, and folding its

wings with benign protective influence towards the monarch's respected head.

And in what material is this relic of the primal age of the civilized world? At first, you might be inclined to say, a greenish-grey black-veined marble. But had that been strictly the case, the men of the fourth dynasty would scarcely have had strenuous successors in another age equal to working in the basalt of Philœ, the granite of Syene, or the hardened porphyry of Gebel Dokkan. Marble was, in truth, effeminate stuff to the authors of the work before us, and they had rather sought out for themselves one of the hardest varieties of the proverbially hard trap rocks, 'Diorite.' This substance looks certainly at a distance not unlike such marble as described above, and is capable of taking even a higher polish; but by what means? for the diorite will cut like a file into the materials which modern sculptors usually think hard enough, if not overhard, to work in.

Called 'Chephren'[1] by some, and 'Rekof'[2] by others; but as we may be able to show by and by, much rather to be termed 'Shafre;' yet generally acknowledged both to have been of the fourth dynasty,[3] and to have had a share in the Pyramid building at Jeezeh,—this king's statue has been recently copied in plaster moulds, so that repro-

[1] Baron Bunsen's *Egypt's Place in Universal History*, vol. iv. p. 657; and M. Renan, *Revue des Deux Mondes*, for April 1865, p. 675.

[2] Hoskin's *Winter in Upper and Lower Egypt*. 1864.

[3] William Osburn, in his *Monumental History of Egypt*, says the fifth dynasty, but reigning contemporaneously with the fourth.

ductions of full size are obtainable at the Museum. Now, therefore, would seem to be the time for all those countries of Europe who have hitherto been revelling in the spoiling of Egypt; and who, whether in their Governments, or their wealth-endowed individuals, have been flattering their hearts, or quieting their consciences for so long, that, in tearing down, or breaking off pieces, and carrying away Egyptian 'antiques,' they were saving those remarkable treasures from destruction by the ignorant natives, —let them now, acknowledging the conservative Museum of Boolak, with the new system to which it belongs,—let them send back the choicest specimens of their former dilettante plunder to the country such things should never have left, and receive in return a copy of the earliest statue in the world, the most solemn and monarch-like figure that has ever yet been produced in stone.

CHAPTER II.

WAITING IN CAIRO.

RATHER anxiously passed on the time from day to day after that conference in the Museum of Boolak; for as yet no promised letter came, and no sign was given. Both my wife and self were desirous to be ready to start, the instant that the Government permit arrived; but on what scale, style, or footing was it to be? That must depend entirely on the manner in which His Highness the Viceroy should finally respond to the application.

We had, indeed, already brought out in the steamer from England, twenty-seven boxes of various sizes; but they were almost entirely occupied with scientific instruments intended for Pyramid mensuration; to be, in so far, my professional contribution, if any joint-stock scheme of working should be matured. 'Most extremely inconvenient,' had the mate of the said vessel remarked to us, 'would *he* think it, to travel about the world even with half that quantity of packages;' but we had the whole; and everything connected with living was still to be added. With no sparing hand too,

it soon appeared, must these additions be made; for to set up house in the desert for any long continued period, according to Egyptian ideas of what was right, most compellingly required almost interminable *etceteras* to complete our European outfit; and each article was purchasable only at a more extravagant rate than another, because, forsooth, Cairo in the winter of 1864, was in the height of what they called a 'cotton fever.'

This peculiar social malady, of which we had heard nothing in England, was positively raging on our arrival in the Valley of the Nile. American cotton having been withheld by the then four years' war, Europe demanded supplies from all the rest of the world, and at almost fabulous prices; whereupon, obedient to the call, both Upper and Lower Egypt were instantly turned into a cotton-garden, and with such terribly complete effect, that on a sudden there arose a cry, in a land that had hitherto fed others, that its people were starving for want of bread. Their cotton was certainly fetching extravagant premiums, but railway, and river, and roads, were insufficient to convey it quickly enough to market, or to carry back plain food to the agriculturists. Money was flowing into Egypt at a rate never heard of before, but rather with the effect of encouraging the wildest speculations, running up the price of all necessities to the poor and needy, and unhinging the relations of different classes of society, than producing any solid improvement to the community.

'Egypt,' said a native to us, 'is now like an inflamed 'arm; there is plenty of blood in it, but it is not 'flowing in constitutional channels, and the arm is 'therefore not strong.'

Already had this state of things metamorphosed the Nile travelling for this year; seeing that against one hundred tourists' boats that had started for Upper Egypt in 1861, only twelve were known to have set forth in 1864; for it is not every traveller who can afford £500 or more for three months' boating; nor is it agreeable to know you are actually throwing your money away, by purchasing in such an exceptional region; and where every trading man seems bent on raising each day the prices of his goods or services, and cheating the newly-arrived Franks, of all people, at every turn and every step.

Deeper gloom, however, than this was further overshadowing the country; for though a glut of wealth in some quarters had come to pass by dint of cotton and American war combined, the harvest had been a bad one. This arose from the inundation having been scanty; it was the second year too of insufficient Nile flood, and 'after a bad Nile, 'then comes the plague in the following spring,' is the maxim there. Plague indeed to man had not yet occurred, but it had broken out grievously upon the cattle; and in the summer of 1864 almost all the horned animals perished. Hence the real working agriculturists were in consternation; for how could they turn their sakiyehs or water-wheels without oxen? and without the continued supply of irriga-

tion furnished thereby, how could any crops be raised in a rainless land, under a ceaseless daily scorching sun? Was the cattle visitation too to be followed by something similar to man? Many appeared to expect it, and their expectation was most fully confirmed, as the thousands struck down by cholera in the May and June of 1865 sufficiently attested soon after; but meanwhile the ruling principle was too generally 'eat and drink 'now, and make money with maddened ecstasy.'

Though living ourselves as economically as possible, it was quite horrifying to see the pile of useful gold that we had to pay at the end of every week for mere hotel accommodation, without the measurement of the Great Pyramid being thereby promoted in any degree. Worse still, in those times of waiting and weariness of soul, my wife fell ill of the city fever; and the wonder is, looking at the stagnant marsh that lies evenly spread just under the festering, dead-flat, blackened soil of Cairo, and the bringing up of its unwholesome waters again and again to the surface by the numerous public water-wheels to serve for damping the slime-covered streets and supplying the inhabitants, the marvel is that every one therein is not always laid up with the worst of fevers. You see, too, round about the city's suburbs, earth's and heaven's fair horizon mostly cut off from view by huge artificial hills of hardened excrement, the immense scavenger accumulations, through rainless centuries, of drainless streets without any inclination; and yet

M. Vansleb, writing, alas! before European attention had been awakened to the virtue of sanitary arrangements, could fervently ejaculate of Cairo, 'This great and illustrious city, she is situated on 'a plain the most *delicious* in the world.'

Of Cairo and its narrow streets, gaudily dressed population, and crowded bazaars, a thousand and one English tourists, following the lead of the eminent Mr. Lane, have written abundance and superabundance praisingly. To an artistic eye, and to a rich man having nothing to do beyond going forth, like the Khaliph Haroun Al Rasheed, to see what street adventures should befall him, or what might happen out of which occupation could be extracted for hours hanging heavy on their owners' hands, things may appear thus enchanting and commendable. But the plain-spoken Signor Belzoni was nearer the ordinary British mark in thinking 'the 'multitude of tedious manners, luxurious customs, 'and inaptitude for direct business, but proficiency 'in dissembling,' rather a nuisance to a man of moderate means, and with a definite task to accomplish within a limited time. From a similar point of view, too, Dr. Clarke was inclined to question the truth of the epithets of those who had styled Cairo the 'Wonder of the World,' the 'Delight of the Imagination,' the 'Great among the Great,' the 'Holy City,' the 'Victorious;' and to agree with Bruce, who declared that he had 'never seen a 'place he liked worse, nor one which afforded less

'pleasure or instruction, nor antiquities which less 'answered their description;' and he added thereto of his own experiences much touching what he called the 'innumerable abominations of the dirtiest 'city in the whole world.'

From the window of a sick-room, overrun with flies by day and mosquitoes by night, even in mid-winter, the prospects were not likely to be encouraging. At night certainly there was a short calm, and the stars beamed down over the silent city in their own pure beauty; but long, long before day, began both the noise and the stir; first the cats, then the dogs awakened by the cats, then the pigs (our hotel was in the Uzbekéëh, adjoining the Copts' quarter) awakened by the dogs; then the pigs awoke the geese, and the geese the turkeys, and the turkeys the cocks and hens; then came choruses of several or all, sometimes in succession, sometimes in simultaneous rivalry.

By this time, the ruddy glow of morning began to appear, reflected only upon a few thin, horse-hair-like, cirrhus clouds near the eastern horizon. There are never, as a rule, any more bulky water-carriers of the sky in this rainless land; for its atmosphere is clean deprived of all the visible agents and misty scenery that belong to the lower current of the atmosphere; and even those fainter cloud-forms of the upper stratum, undergo some further thinning and evaporation still in passing, high as they do, above the dried-up desert plains on either

side of Egypt,—a land whereof the 'Knyht of Saynt 'Abone' remarked so truly, 'Egipt is a long contree, 'but it is streyt, that is to saye, narowe; for thei 'may not enlargen it toward the Desert, for defaute 'of Watre. For there it reyneth not but litylle in 'that contree; and for that cause they have no 'watre, but yif it be of that flood of their ryvere. 'And for als moche as it ne reynethe not in that 'contree, but the eyr is alway pure and cleer (dust 'excepted), therefore in that contree ben the gode 'astronomyeres, for thei fynde there no cloudes to 'letten them.' But to return to our dry Cairo day-dawn, let us note, as next in order, the yellow and stronger light in the East, and that then the disk of the sun itself comes up like a ball of liquid fire; glaring, as it beams through the dusty atmosphere and shoots its long luminous arrows both athwart picturesque minarets, ragged with the flag-staves and lamp-holders in this lazy land, of some last year's illumination, and amongst 'mulqufs' of tumble-down houses,—the 'mulqufs,' those ancient, Coptic, garret-like, angular wind-sails, all turned towards, but not succeeding now in catching, the 'life-giving Etesian winds.'[1] Here and there indeed is seen a smart-looking, Maltese-painted, new house; but then come acres of ruins, or ruin-

[1] The ancient mulqufs were double, and the two openings turned in opposite directions, which would tend much to establish a circulation of air throughout the house, such air entering at one aperture and leaving by the other; but the modern mulqufs seem to be all single, with their openings turned to the N. or N.W.

looking structures, little better than shapeless heaps of sun-dried mud-bricks; while a tall, graceful, date-palm waves, lamenting over the decay; and, as a mourner, is covered from head to foot with clay dust. But so are all other objects around; for none of them can partake, in this most earthy land fed by irrigation alone, of the rain of the waters of heaven to wash them clean.

Such roofs too, as the existing and inhabited houses generally had, viz., piles of old rubbish heaped upon them at top! for anything will do in a climate without rain. And there, on those roofs, are the cats of every house, muscular and most sculpturesque models of cats, sprawling in lion-like attitudes through the livelong sun-baked day, and intently occupied in merely regarding each other. With the early noon too comes on the rolling of grandees in their open carriages through the square of dust-covered sycamore and acacia trees, the prancing of others on horses, and scuffling through of others still on adorned donkeys; all 'cotton, cotton,' as a half-pay Bey, in a seedy coat, remarked wofully to us. But then the more distressful picture that always went to our hearts, of the little girls of Cairo as they ran after all the animals; those poor little girls supposed to be without any souls worthy of the name of souls, but with their long tails of platted hair and gauzy blue drapery flying behind them in the wind, as they vied with each other,—in an emulation certainly worthy of a better cause and quite superior to what-

ever is usually understood as that idle thing, 'le 'vrai génie Egyptien,'—in seeing who, even at the peril of diving in between the very hind-feet of a colossal camel, shall first pick up its hideous droppings, and pat them into nicely-shaped cakes with her braceleted fairy hands, and then deposit them in the flat reed-basket she carries so deftly balanced on her head; until she, the tender little girl, can triumphantly carry the morning's collection home to some haggard old being, who utilizes a stray corner in the ruined streets, by carrying on there in the sun, too truly a *manu*facture of such high-scented ammonia-fuel, as a supply for all the cooks of this gorgeous, illustrious, and resplendent city, the great 'Masr-el-Kahireh,' or 'the Victorious Masr.'

Yet was the period of sickness enriched to us by making the acquaintance of the Chaplain to the consulate, and his family. He had only recently arrived from England, an invalid from overwork in his parish there, but must needs begin immediately to do something in his new neighbourhood, in order to be of the workmen rather than of the idlers in Egypt also; well seconded too by the ladies of his family, whose extreme kindness and sympathy did almost as much in restoring my wife, as the prescriptions of the very clever Scottish doctor whose assistance was called in.

'In Cairo,' said Bruce, ninety-eight years ago, 'nothing can be concealed. All nations, Jews, Turks,

'Moors, Copts, and Franks, are all constantly on the 'inquiry, as much after things that concern other 'people's business as their own;' and it is very nearly the same still, whence it arrived that my having made an official application about Pyramid measurements to the Viceroy, came to be known and to travel. Some persons were sure that there must be great diplomatic influence working in secret, to result presently in a magnificent expedition being organized; in which, too, they might possibly find a well-paid post for themselves; not with any of the dull labour of looking after the thousands of workmen who would be employed, or of being accountable for ropes, and picks, and ladders, and other materials of excavation works,—but a sort of social science overseership, with mounted cavasses perpetually galloping about to carry orders to make every one else work, long ranges of viceregal tents wherein to receive visitors to public feastings, and absolute power over the peasants far and near.

But as Dr. Clarke long since most truly remarked of Cairo, and even anything or everything in Egypt, 'it has always been the subject of *amplification*, from the earliest periods of its history;' nor did we think the description less true, when on another day an acquaintance rushed in upon us and proclaimed, 'All Alexandria is in an uproar, and an uproar 'about you and your unwarrantable and tyrannical 'application to the Viceroy; they say you want to 'stop all visitors from seeing the Pyramid, and they

'won't hear of it. They report too that the Viceroy 'told you in answer, that he could not think, as a 'just ruler having the good of his people at heart, 'of standing between the poor Arabs and the 'presents they were in the habit of receiving from 'visitors to the Pyramid; and you were dumb-'foundered, they say, at the virtuous rebuke; and 'there has not been such a pitch of indignation in 'the maritime city for years.'

Well, thought we, if that is true, it shows that the population of Alexandria are still of the same nature as of old, when they had their great insurrection, because a Roman soldier killed a cat; a people always ready to be fanned up into a ferocious tumult, and on account of nothing, or next to nothing. How truly wrote the Emperor Adrian to the Consul Servian: 'I am convinced, my friend Servian, that of 'all the inhabitants of Egypt, the Alexandrians 'are the most trifling, wavering, changing at every 'change of public rumour, inclined to sedition, vain 'and insolent. But I wish them no other curse 'than that they may be fed with their own chickens, 'which are hatched in a way I am ashamed to relate.'

So I went on quietly as before with the only scientific question there had been a possibility of commencing in Cairo, at all bearing on any of the matters to be looked into afterwards at the Pyramid; viz., the mean temperature of the soil. The numerous wells in and about the city, delivering up water from a depth of from 300 to 400 inches in a constant

stream by the sakiyehs, seemed to offer a favourable opportunity for this sort of observation, and evidently enabled the subject to be treated at once very closely; for while in the winter months of December and January, with air varying from 45° to 65° Fahrenheit, the waters of the Nile were found to be 58·3° and 58·9°; those of the wells were all between 66° and 71°. Evidently the great heat-wave of the previous summer was settling slowly down into the earth at its average rate all the world over, of about 360 inches of ordinary soil in six months; and its maximum point, blunted no doubt by all the badly conducting substance it had passed through, was to be found just then very near the level of the great stratum of quiescent water which all these wells were drawing upon. Yet there were minute differences in the temperature of different wells, not very easy to explain; and one of them, the 'White Well,' on the road to Boolak, was always warmer than any other by two, three, or more degrees, though seldom a degree different from its own temperature; so that, at the early morning hours, or as soon as the many religious ablutionists had one after the other given the wheel two or three turns, lifted up a few buckets full of water, and performed their day-dawn orisons to the east and departed, allowing me then to move up with my apparatus before the bullocks arrived for the regular service of the day,—there was actually a difference in temperature of more than 22° between the air and the water; and a great crowd

of the faithful would presently gather close about, to see the temperature of many successive glasses of water tried; and to admire the nimbleness of the mercury in rushing up on each occasion through a large part of its scale.

Those wheel-worked water wells have a further feature of interest; for they appear to be the sole means by which large parts of the plain country east and north-east of Cairo,—formed, no doubt, of the mud of the Nile, but, as we were told, never now reached by the inundation,—can be cultivated. Except, indeed, the surface is artificially irrigated, it becomes, not only in summer, but all the rainless sun-shiny year through, as dry and desolate as a brick; yet irrigate it artificially by raising up the water from some 300 to 400 inches in depth, where the supply is nearly inexhaustible, and the whole plain may become a garden of herbs, even such as Moses described Israelitish Egypt to be.

Now there is at present,[1] and indeed has long been, much earnest discussion going on in literary circles as to the position of the Goshen of Scripture. The general idea first arrived at, is to place it eastward, or north-eastward of Egypt; but that leads to such barren lands, that many have followed the views of Bryant, who placed it in the Delta, near its southern termination. Yet there are many objections producible to that hypothesis, which would not apply to a position skirting the outside of the

[1] *Athenæum*, October 7, 1865, p. 269.

Delta in the eastern direction on the same parallel of latitude,—if only it could be shown that the normal fertility of Egypt might be secured there, in addition to the free run of the neighbouring desert-hills and plains.

But it was precisely at the southern beginning of this probable site of the Goshen of Jacob and his sons (for it was more extensive afterwards), that we saw much ground rendered habitable and useful to man solely by the water-wheel wells; or rather by the work performed there; for the first and total cost of the home-made machinery in each case seems very trifling indeed, while the labour is, on the contrary, so difficult to supply, more especially since the recent murrain amongst the cattle, that many wells are already falling into disuse and decay, to the decrease immediately of the cultivated area. Given therefore a people with a superabundance of cattle in this particular region, and there is no doubt its garden produce would increase immensely; and such a cattle-possessing people the Israelites of the captivity pre-eminently were.

Those speculations were presently cut short by a most timely letter from Mariette Bey, informing that the Viceroy had been pleased to appoint His Excellency Zeki Bey, Master of the Ceremonies, to arrange our affair, as I should duly hear on calling at the Palace of Gezeereh. There accordingly they detailed to me, next day, that all the items in scheme

No. 1 were graciously allowed by the Viceroy; with the very liberal addition of the following,—1st, Conveyance for the whole party from the east bank of the Nile to the Pyramids, and back again after the work should be completed; and 2d, Peremptory orders to the nearest villagers to furnish us with supplies of food at the usual market prices, during the entire period of our stay,—a piece of thoughtful care which we found in the end to be highly required in the country districts of Egypt. The polite officials further gave me two Arabic letters, one to the Commandant of the Citadel for tents, and the other to the Governor of Jeezeh, who was to be responsible for our transit to the Pyramid.

The last letter on being delivered, with some kind assistance from the Consul, disclosed a very courteous Turkish official, but brought to light a peculiar Egyptian traveller's difficulty. The reserve inundation water, long expected from the upper country, had just at that very instant come down and drowned all the land in the direct route to the Pyramids. This was not the inundation of the Nile—which had been over nearly three months before,—but was a certain half intended, half accelerated irrigation accident; and the Governor of Jeezeh was momentarily receiving in his little Court of Justice excited messages from one village or another, telling of the arrival of the destroying flood, and describing the depth of the waters around them. He promised, however, to send out his own people to make special

inquiries and fordings in the line of the Pyramid road, and let us know in a few days how soon he could undertake to conduct us along it.

Now, therefore, the domestic preparations were pushed on rapidly; and my wife, nearly recovered from her illness, and assisted by a bright-eyed, young English married lady, resident in Cairo, and accompanied by our two servants, an Abyssinian, and an Arab-Copt convert (both recently engaged by the kind advice of a very obliging member of the American Mission), perambulated the bazaars and wider streets to purchase the furniture, cooking-apparatus, provisions, water-jars, and all other *impedimenta* that were deemed essential to Egyptian life. Scarcely, too, was all this completed, when, on January 3d, we received notice that, on the following Saturday, the 7th of the month, the Governor of Jeezeh would be ready to perform his part of piloting us through the overflowed land, if we would repair with bag and baggage to the ferry of Old Cairo,[1] at an early hour of the forenoon.

This was indeed delightful, and we sent immediately for the two servants, Hanna Intana, the

[1] Old Cairo, Fostat, or Masr El Ateekek, lies, like Boolak, on the east or nearer bank of the Nile, but about three miles farther up the stream, and in the neighbourhood of the ancient city of Babylon of Egypt, concerning which Sir John Maundeville thus discourses:—'And undirstonde zee, that that Babyloyne I have spoken offe, where 'that the Sowdan dwelleth, is not that gret Babyloyne, where the 'dyversitee of langages was first made for vengeance, by the Myracle 'of God, when the Grete Tour of Babel was begonnen to ben made; 'but wyte thee wel this Babyloyne of Egipt, near the Cytee of Cayr, 'sytt upen the Ryvere of Gyson, somtyme clept Nyle.'

Abyssinian, and Wahabee Michael, the Arab Christian, and let them know when the real work was to begin,—their pay had been going on for three weeks, and their *baksheeshes* had been many, both on account of Christmas Day and New-Year's Day (when they had knocked at our door before sunrise, to remind us that they were in the new year, as much as in the old, our devoted slaves, ready for whatever was to occur at the Pyramid), and in compliment to some of their native holidays besides. But now, on receiving the stirring information, they were confused, talked seditiously to each other, and then wanted to know if I could not write to the Governor of Jeezeh to delay starting until Monday morning.

Why?

'Because Friday was the Copt's Christmas Day;
'and they would be so worn out with the festivities
'that they would be quite unfit for travelling next
'morning to the Pyramids.'

Yet neither of them was of Coptic faith; and while the tall, thin, high-cheeked, consumptive-looking, though coal-black Abyssinian was only inclined either to give very general reasons or to explode into anger if questioned why he brought up another Christmas, after having accepted the holiday and baksheesh of the Frank anniversary, —his shorter, brown-visaged, hatchet-faced, hook-nosed companion at once declared that, although he and all his family had long been converted to the evangelical Presbyterianism of the American Church,

his grandmother was a Copt; and, in honour of her, it was perfectly necessary for him to keep the Coptic idea of the day without omitting any of its honours, and without regard to any other Christmas Days he might, or might not, find it expedient to keep.

After a laboured discussion of their fancied difficulties, these geniuses were at length brought apparently to see that the date for starting, fixed, after so many preliminaries, by the Egyptian Government, was not to be lightly altered; and that the sun really rose at so very moderate an hour at this mid-winter season of the year, that there was no valid and sober reason why they should not be perfectly ready for work by the late daylight on Saturday morning, let Friday be whatever religious anniversary it might. So at last, with that day secured to them as a whole holiday, and final instructions given on Thursday afternoon, as to their going down very early to Boolak on Saturday to gather up certain water-filters, sacks of charcoal, and crates of fowls,—which they themselves had asked to be allowed to purchase there, because they could be had there so much cheaper than in Cairo, and were necessary to give the last finish to the completeness of Mrs. Piazzi's arrangements for the desert-home,—we dismissed them with good wishes for their second Christmas Day in the season, and congratulations on being engaged in a scientific Pyramid measurement which the Government of their own country had condescended to approve of and promote.

Late on Friday evening, visitors called,—the head of the American mission, and two brother missionaries, one from Alexandria, and the other from Syria. They kindly mentioned much of their professional objects, labours, disappointments and successes; also of the general spirit of inquiry that is springing up in Muslim minds to test the truth of their book; and of the inevitable though secret removal from this world of any young man of rank, should new-light manifestations on his part become known to the authorities that be,—authorities evidently wise as serpents to nip in the bud all attempts at free examination there. But the worthy chief has come to us bent on other objects too; for, though learned, literary, and fully employed, he can think for others even in the common affairs of life as well; and in the course of the day he had met our Abyssinian and Arab, and had not liked either their looks or their answers; in fact, he suspected they were going to desert their engagement to us when the morning came, though he could not get them explicitly to declare themselves then. But he had come down at this late hour of the evening to our hotel to forewarn us of what *might* happen, and to say that with the earliest daylight he would proceed to look out for any other servants who were to be had, if in any degree suitable and willing to enter on life at the Pyramid.

We were of course exceedingly obliged, though as much astonished; for the Arab had taken to such

airs of importance over his fellows on the strength of being engaged for the Pyramid expedition; and the Abyssinian cook, thinking as much of himself as if he had been of the Emperor Theodore's own establishment, had been allowed to lay in amongst other stores, every possible luxury he could think of for himself after the manner of his nation and to his own taste,—until some of the packages reeked again with garlic, and lard, and African maccaroni; and both the men had professed such personal attachment to us! The ungrateful traitors! we thought. 'Ah!' but then suggested the philanthropic Christian missionary, 'do remember how the morals of 'the country, especially of the lower orders, are 'strained by the sudden accession of these Californian times of unbounded wealth arising from the 'cotton mania. Such extravagant prices are given 'now in all the merchants' offices for assistants of 'almost any kind, if they can but speak a little of 'any European language, that few will remain in 'any ordinary service.' The actual circumstances, he assured us, would turn and spoil any human nature, more especially 'Arab human nature, which 'is so gentle, simple, touching, and easily deceived.' And therewith, after certainly saying all that could be advanced for that side of the question, he left us for the night, with the further parting, earnest request, that we would not judge generally of all Arabs by what we should see of the Pyramid Arabs; for they were wild, cunning, vindictive, and lawless to a

degree, as all travellers were continually complaining to their several consuls. But those Pyramid men were an utter exception, he argued, in the whole of Egypt, and not really to be thought of as Arabs at all.

Morning broke on January 7th, 1865, bright, dusty, and rainless, as usual with a winter Cairene day, but no servants came. I went over to the Merchant Company's stores hard by, and had all our collected stock of goods there packed on waggons, whereon room was still left for the additions to come up from Boolak; but yet these traps did not make their appearance, nor the servants either. I had previously applied, on the strength of both English and Scottish letters of introduction, to the said Company—who are the recent successors in a 'Limited' concern to a firm of great and deserved good fame in the history of the modern commercial development of Egypt,—that they should send down one of their clerks, or any one who could speak either English or French as well as Arabic, to accompany the waggons to the river bank, where the Governor of Jeezeh's men were expected to be found awaiting them. But one of the Directors, a portly man, with something of an Indian complexion, answered magniloquently 'that they really 'could not do anything of the kind; their business 'was so extensive, so rapidly increasing, and so 'lucrative, that they could not afford me the assist-'ance or spare the time of any one on the establish-'ment, either clerk or porter, to accompany the

'goods even to the distance of only a couple of 'miles; and the keeping of them in their stores for 'the last three weeks had been extremely incon-'venient to the Company; for the room occupied, 'would have been much more profitably employed 'in holding cotton, of which they had vast quan-'tities, and were daily making immense gain.'

These merchant princes, nay far more than merchant princes, had also been recommended to be our bankers; and, after notable percentages charged, were ready to advance what money was required, but only in gold; for 'they did not deal in silver 'money,' they said, pure and simple, when asked for small change suitable to country villages. But by an act of private grace the Secretary had this morning procured a bag of Austrian silver dollars, great pancakes of things dedicated to Maria Theresa; and with this very important help from our agents, I returned to the hotel once again.

There, behold a janissary, obligingly sent from the Consulate by Mr. Reade. We could not converse with him certainly, but he knew something of the work to be done; and when at a late hour the Arab servant, almost driven over by the American missionary, did come, but only to announce, with a sulky air and a savage tone, that he had taken another service,—that the Abyssinian had got the ophthalmia, and he did not know what he had done with the money for the contribution from Boolak,—Janissary Osman, though lame of one foot by a

recent fall, walked Mr. Wahabee over to the 'Chancellerie' of the Consulate to finish his explanations there. We then mounted our donkeys, following the waggons loaded with whatever they had, down to the prescribed rendezvous at Masr-el-Ateekeh; and not having a single person in the party with whom we could exchange an intelligible word, or consult on what we should do on arriving that night at the Pyramids, deprived of some of the first requirements of life.

It really called for courage in a lady to set forth on such a journey; but the spirit of her who was here concerned rose equal to the occasion, and encouraged itself by indulging the firm conviction that some turn in our fortunes for the better would surely soon take place; or some unexpected assistance befriend our efforts to hold to a complicated appointment in a good cause, after we had done everything that of ourselves it well lay in our power to do. But it was not until we had actually embarked on board the roomy boat sent over to the eastern bank by the Governor of Jeezeh, with all the packages too out of the waggons securely there on board under our own eyes, and with a gentle breeze from the south slowly swelling forth the great lattine sail that shot up high and brightly white into the pure blue sky, and gradually bore us noiselessly, as well as with delightful smoothness, to the west, across the ancient river, in that broad reach which extends in front of the Mekias or Nilo-

meter Observatory,—that we began to feel any large amount of rest or relaxation of spirit, from the nameless little vexations and anxieties of the last several weeks.

My wife's commissariat then produced some plain buns, and Janissary Osman, after duly washing out, filled one of the earthenware water-bottles we had bought in passing through the bazaar of Old Cairo on our way to the river side, with Nile water as the accompanying beverage;—muddy no doubt and as opaque as milk with suspended clay; but then was it not *Nile* water, so celebrated by nation after nation through four thousand years! Did not that glorious old Roman, Pescennius Niger, silence his murmuring legions by exclaiming, 'What! crave 'you wine, and have Nilus to drink of?' And in a subsequent age, did not an educated Saxon describe with equal admiration, but greater particularity, if not exact adaptation to our case, did he not detail lovingly 'how Nile water cureth the dolour 'of the reins, and is most sovereign against that 'windy melancholy arising from the shorter ribs, 'which so saddeth the mind of the diseased'?

At all events we ate our bread in thankfulness and took the water with satisfaction. For why? behind us now, and to be so for many months, lay the purse-proud modern Muslim city and its spring-tide of tulip-clothed individuals struggling after wealth; while in front rose the Jeezeh shore and the calm of the ancient land.

CHAPTER III.

REACH THE PYRAMIDS.

THE entrance into Jeezeh,[1] after climbing the steep clayey bank of the river, is effected between two little coffee-houses, and then by a narrow winding lane overshadowed with trees; a grain market on one side, and earthenware goolah shops on the other. This narrow thoroughfare was crowded with passengers to and fro; soldiers also, in their bright nizam dress, were numerous, and on the elevated stone bench before one of the coffee-houses a gallant Turk was blowing enormous clouds from a hookah, while we surveyed the scene from chairs placed for us on the opposite erection.

Confusing at first, yet method there was in it of some sort, for by degrees things were got into evident shape; camel after camel was introduced on the scene, made to kneel down, soldiers clustered about it as thick as bees, packed its back most

[1] Of the name of this little town, after which the chief Pyramids have been designated in modern times, we have collected the following spellings from different authors; besides the idea of Bryant, that it is derived from Goshen or Goshen, the location of the Israelites:—Gyzeh, Ghizeh, Gizeh, Giseh, Jizeh, Jeezeh, Gheezeh, Geezeh, Djiza, Dajise, Dschiseh.

astonishingly with our various boxes, lashed them on firmly, and then made each creature rise and wait ready loaded a little farther on up the winding street. When five or six camels have been thus treated, we quite lose sight of the earlier ones in front, but more still are brought up in succession —eight camels at last. One, a very vicious animal, who cries out at every one, shows his fearful incisor teeth all round, exudes a red bladder-looking thing at the corner of his mouth,[1] makes a sudden struggle to get up before half his load is on his back,—but instantly a dozen soldiers are upon him, and have him by the ears and stand on his bended legs before he can straighten them, and he is compelled to take a share equal to his fellows.

'How fortunate,' remarked my better half to me, 'that the Viceroy has ordered all this to be done 'for you; *you* would never have been able to 'manage it.' I confessed how much we were

[1] In W. R. Wilde's *Narrative of a Voyage to Madeira and other Places*, is given the then recent explanation of this red-bladder phenomenon, as determined by Dr. Paolo Savi of Pisa, who had discovered that such 'guttural bladder is nothing else than an extraordinary 'development of the uvula, which is usually fourteen or fifteen inches 'in length, and attached, not to the free margin of the soft palate, as 'in other mammalia, but to its anterior or adherent edge, and also to 'the arches of the palate; so that, hanging like a curtain in front of 'the *velum pendulum palati*, it appears to shut up the opening into 'the fauces.' And he then adds the necessary anatomical and physiological particulars for explaining how, when the animal gives a forcible expiration, the air, not finding a ready egress by the mouth, owing to the *isthmus faucium* being closed by the enlarged and distended uvula, forces it forwards in the shape of an elongated bladder, until it is protruded from the side of the mouth, and then retracted by the azygos muscle.

obliged both to the Viceroy and his able Governor of Jeezeh; and then up came, over the river bank, a well-dressed, grey-bearded, respectable-looking little Muslim, bringing a letter. A letter from the truly kind American missionary. He has engaged the bearer as cook and general servant for us, under such and such conditions of wages. We promise Ibraheem—for that is his name, and he speaks some English—to accomplish all that is written in the letter; whereupon he is perfectly satisfied, and throws himself into the spirit of the scene at once; talking friendlily, yet with dignity, to the great Turkish officer, his soldiers, to Janissary Osman, who now returns to Cairo, the camel-drivers, and every one about,—picking up thereby all the particulars of the business, and showing himself far from inexperienced in such affairs. Dressed in a red and white turban, a natty embroidered brown jacket, but furnished with a huge-pointed hood for drawing over the head in bad weather, large blue inexpressibles, yellow slippers, and on his finger a silver set turquoise-ring of size, squareness, and solidity almost fit for an ancient Memnon,—we cannot think of him as a cook at all; his philanthropic and experienced-looking countenance, united with his promptitude to embark at a moment's notice on a desert excursion, and his capacity for cheerfully making the best of any circumstances he should find himself placed in,—compel us rather to see in him Es Sindibad, the Sailor of many voyages, or a

first cousin at least of that notable overcomer of innumerable difficulties.

Now too, the last camel has been loaded; a tall stern-looking man, in red tarboosh and severely simple costume of a blue outer and a white inner garment, is brought up and introduced as the Sheikh of a Pyramid village,—having been sent for from there by Government that he may be personally charged with our safe journey; donkeys with carpets on them by way of saddles, but no bridles or stirrups, are produced, and we ride off for the Pyramids in earnest.

Yet not by the near route. Instead of striking straight across the plain westward, where there is still too much water for transit, our march is directed south-westward, along high mud-banks; flat are these at top, but not unfrequently cut deeply through by side streams, and forming then such awkward fissures for the donkeys to cross, that we speculate on the awful shaking which will be experienced by both boxes and camels when *they* have to step over, or into, or pass in any way the same places; for both they and Ibraheem have somehow fallen far behind, while we and our Roman-toga enveloped Sheikh were pushing on to the front.

The country hereabouts consists generally of garden-ground sprinkled with trees; the former increasing in proportional extent, and the latter resolving themselves more and more into separate groves of date palms, the farther we proceed. One

date-tree grove, *Phœnix dactylifera*, was almost a forest in extent, and remarkable for the bright green grass forming a velvety sward on the soil below and amongst the trees; exhibiting therefore a delightful combination of the best English meadow-grass, with continued colonnades on every side of what is so peculiar to the south, viz., palm-tree trunks; while high above our heads, through the groined and fretted roofs formed by the interlacing of curving compound fronds, the afternoon sun was darting its oblique and coloured rays.

On and on we thus went, passing mud-built villages, and date-tree groves, and mud-land, the day wearing away apace; then by boat over a canal running north and south; and then along another line of elevated mud-bank, trending south-westward, and on either side of which symptoms of the recent flood began to appear, in shape of cotton-fields half drowned in water; thus we progressed, gradually entering at last one broad scene of water desolation, where every green or growing thing was either carried away or completely covered over by the dark slime of the waters; the celebrated '*donum Nili*,' the agricultural gift of the patriarchal river. The landscape was now one huge plain of chocolate-coloured mud, coursed through here and there by several snake-like streams of yellowish water, the rearguard of that great and overflowing army which had so recently passed that way, leaving only those few stragglers to follow on behind.

Presently we arrived at a break in the embankment, for a whole section of it had been carried away by the flood, and a notable stream was now rushing violently along through the gap northward. Here the donkeys were sent back by their accompanying boys, and we crossed in a rickety boat with the toga'd Sheikh to the opposite side—only, however, to sit on the driest part of the ground, for there was no one there. And though the Sheikh every half minute folded his blue toga about him in some new arrangement of noble folds which would have captivated a classic painter, and used his hand for a peak to his red tarboosh where the ulemas of his religion allow no such projection to exist, and tried to peer into the extreme and sunshiny distance of the plain, just under the western hills, which were now fast throwing their shadows towards us,—he could see nothing but the motionless ranges of far-off date-palms. So asking us presently if we were afraid of being left alone, and receiving an answer to a quite contrary effect, off he started on foot to the west, and was soon out of sight.

Here then was an opportunity for studying Egyptian landscape, at the very witching hour too of setting sun and evening's purple tints. Dark mud, mud, mud on every side. I went to the edge of the water stream to collect from its very bank an undeniable example of inundation slime for subsequent examination in the microscope; but could

not manage it without getting huge clogs of mud sticking to my feet and increasing at every step; and even when I had returned to the top of the embankment, the difficulty was to get quit of them; for stone or stick or even blade of grass there was none, and what looked angular semi-rock like soil proved to be only old mud, dried somewhat hard, —with its microscopic particles of mica slightly glistening in the light, and ready to attach themselves on to, with every rub I gave to clean off, the great clay balls on my feet.

Then the much-bepraised soil of the Nile, thought we, must after all, with its adhesive pot-clay properties, be more adapted to brick-making than to agriculture. It is certainly untoward for trees, which as a general rule would have their root-pores completely suffocated in it; and what shall we say for the comfort and cleanliness of the inhabitants in a land of none but muddy water, and where all the soil is soft adhesive clay? We could only hope that Pharaoh's daughter had a nice set of stone steps, kept duly clean from all the peculiar and dark 'gifts of the Nile,' whereby to descend to her bathing there. Yet though the valley of this river is prevented by its clayey quality from comparing with that of, say the Ganges, the Irrawaddy, or Mississippi, for large botanical glory, it does derive some advantages from its close plastic composition; nay, perhaps it has even therein, considering Egypt's position in the rainless belt of

northern Africa, the very right thing in the right place. For had the ground been porous, what would have become of all the crops committed to its charge, when it only gets wetted once in the course of a whole livelong thirsty year? In other regions, and even where the soil is rather more compact than ordinary agricultural loam, we have seen attempts to water gardens artificially under an African sun; and half an hour after the watering they looked very much as they had done half an hour before, so very short-lived was the effect, and so utterly did the great furnace of that sun-illumined sky of brass, laugh to scorn all the attempts of man to bring into play an opposite force.

But here in Egypt, it was nature herself that was concerned: and only observe how *she* brings on the power, whatever that be, of water; viz., in a sheet so vast as almost to rival the spread of the blue sky above, and in quantity so portentous that the husbandman begins to tremble and fly from its presence as from a rushing mighty danger. In fact the water is brought upon this Egyptian land, whenever it is brought at all, in a quantity, and depth, and for a time and in a manner that enable the fluid to enter into and thoroughly soak that proverbially *impervious* clay; and then when that *is* wetted, what shall extract the moisture out of it again? Not even the mighty sun shining in its African glory for six months at a time, or until the destined inhabitants of the ancient valley have

gathered in their year's supply of food; for the clay holds in tenaciously the lifegiving moisture against all external influence, just as those thick-leaved plants of the succulent order, the euphorbias and aloes,—Africa's own special desert progeny,—resist all evaporation through their thick-skinned leaves, and remain the only signs of vegetable life, through the most scorching season of an ever torrid year.

Something else too could be said in favour of Egypt, wet, as we saw her then, viz., the colour and force of the landscape in a picturesque point of view. How frequently do we in many travellers' books meet with Egyptian views, characterized by being hard and red; or all red and yellow, in light tints too that weary themselves with sameness, and are flat, flat without air or distance. But now to the north-west, what a scene! The Pyramids of Jeezeh on their far-off desert hill; the Great Pyramid fully revealed with its confusion of sepulchres on the steep below, and underneath that again, on the flattened plain, a few thin fretted lines of distant villages with their beloved date-palms just showing their crowned heads. The second Pyramid is also visible, but half concealed by large palm-trees in the middle distance; and the third, conspicuous enough with an undulating Libyan background, but too small to interfere with the notability and majesty of that one of the three which all the world has long agreed to call the Great Pyramid. How far off through a tenderly illumined atmosphere are

all these monuments of the past; and how much farther by the aid of the tinted hills, and intervening plains and distant villages hardly to be made out but by telescopic gaze. And then came the strangely pronounced forms of the waving fronds of lofty palms in middle distance, with the sun's light striking full amongst them,—eclipsing some in rays of golden splendour, and again eclipsed itself in their deep purple shadows below; while, lower and nearer still, the eye wanders over long reaches of the dark-brown wetted plain; dark almost to intense blackness, yet always in some rich tint of Vandyke brown or chocolate-colour, that gradually lightens and brightens up to the more immediate foreground, with its tumultuous river of yellow waters and sentinels of snow-white, crane-like birds; reminding one of the mediæval traveller's description,—that 'about this Ryvere Nyle ben manye briddes and 'fowles, or Sikonyes that thei clepen Ibes;' for this fair bright egret is the nearest living representative here of the ancient ibis, and is equally a friend to, and confiding in, man.

On the opposite side, again, or to the south-west all gorgeous with the rays of the setting sun falling full in its direction, what force and power are given to all the nearer and middle distances by these mellow browns of the overflowed land; and then beyond them comes the end of a village into the view, its mud-hovels illuminated so resplendently on one side, and throwing shadows so pronounced

on the other, as to look like some natural fortifications improved by ancient kings. Beyond still, and south of these forms again, what distance is expressed in the dark green plain, where woods of date-palms rise behind woods of date-palms; each mellowing gradually into the far-off air, like the successive elm rows of the more fertile parts of England, when seen from an occasional height. But here the vision does not finish yet with these faint small forms; for beyond all the distance that mere tree-covered slopes and leafy vales can make manifest, rise to view, on the eastern or Arabian side of the Nile, the exquisitely aërial lilacs and blues of the Mokattam Hills. From their gaunt and serried sides were brought, four thousand years ago, the most compact of the blocks for building the Pyramid, and still they furnish the corner-stones and pavements for modern palaces in Cairo; and we can distinguish even from this spot the square and more determined angles of their composition over all the other hills, and see too the warrior faces of many a noble cliff, which lighten up for a moment into a golden glow with the last look of the sun upon them; and then only blues and aërial greys are seen encompassing their forms, while evening hastens to fall over the whole valley.

By this time many figures began to be perceived coming along the eastern or now farther line of the embankment we had already travelled over. They are the camels with our boxes and baggage; steadily

they come striding along, but at the appearance of the breach they are stopped, made to kneel down in a group, all the packages are removed, formed into a wall round about, and preparations evidently begun by the drivers to bivouac there for the night. The ancient Ibraheem, whom we had long distinguished amongst them by his white beard and his witch-like pointed hood, now thrown over his head, having seen all these arrangements duly completed, crossed the water and came over to us, but could give very little explanation. The stars were appearing one after another, and the silvery lustre of the crescent moon thrown down from a high angle, the complement of the sun's then wintry and night position, was overpowering the faint remains of day's twilight; imparting without doubt new beauties to the scene, but making it not look very much as if we were going to be at the Pyramids that evening.

Presently, before the absolutely last faint tinge of blue illumination had left the western sky, dark forms of horses, men, and camels, were seen, relieved against the low streak of faint level light in that direction, and all of them hurrying along towards us. Nearer and nearer they approached, following the top of the embankment. At last they arrive; first our friend in the toga, whom we can just recognise in the party by the light of the moon, and then a variety of other, and even higher grandees of rural kind. With salutations respectful, they request us to mount on the animals they have brought;

and we ride along, a winding cavalcade, leaving the high embankment after a time, and then closely following our leaders through the dark shades of palm groves, and through cultivated land, with sheets of water reflecting the horned moon and evening star; until finally, pushing up a steep ascent to a village, a true Egyptian village of mud-built huts, and then through an archway, we dismount inside it; are shown through a garden, and then into a notable house beyond, where, in the largest room, they seat my wife and self on the most honourable cushions at the head of the apartment; and we learn with thankful satisfaction that for the rest of the night we are to be the guests of the worthy Sheikh Deadar, of the village of Khatremar Omar,—a locality indeed far south of our original destination; but then, what an unsought and unexceptionable opportunity for seeing Egyptian manners, as they do really practise them amongst themselves in Egypt!

The guest-chamber was about thirty feet long, fifteen wide, and twenty high; covered over its floor with matting, and near the upper end with a Turkey carpet besides. There were three or four British chairs, but nobody used them; and the only other furniture was a huge lantern, standing about four feet high, and acting both as furniture and decoration too, so smart was it made with gilded tin-work, and so many piastres (230) had it cost the

Sheikh in Masr. They put one candle into it, but were so little satisfied with its illumination, that a second candle was brought, in an English green glass candlestick, and placed on a dirty little stool amongst the party seated in all decorum on the floor. This party numbered now three brothers of Sheikh Omar,—all of them Sheikhs together, if we understood aright,—with large white turbans, and extensive blue togas folded around them; our friend of the Pyramid village, full of gravity of expression; a Turkish officer in semi-military costume, representing the Jeezeh Governor; a variety of other village notabilities; and Ibraheem, who was alone able to interpret.

The honest men really did all they could to make the British strangers feel at ease; apologized often for their smoking, and tried to make it up by producing frequent cups of coffee, very full of sugar, and amazingly hot. Then came the dinner, a *multum in parvo* truly,—a dozen dishes all packed on a round metal tray, that was placed on a little stool of a table: mutton, fowl, and various vegetable dishes, both sweet and savoury, as well as the large flat cakes of bread that were to serve as plates, but no plates of course, or knives and forks either. It was, to tell the truth, the dinner prepared for the Sheikh himself, his brethren, and Muslim friends; but, with rare courtesy, offered to the Christians first to partake of as far as they would. The Muslims indeed could not remain in the room to witness such defilement; and one by one they departed, when a

Nubian slave entered, bearing a brazen basin and tall ewer, with two table-napkins. He proceeded to pour water over our hands, first the one, then the other, presented the napkins, which he left with us, and signified that all was ready to begin the repast; but before our actually commencing, the Sheikh returned with his youngest son, a child of about five years of age, dressed in blue and gold, a yellow sash, and red tarboosh. *He* may eat with us, though the father cannot; but the latter is amazingly pleased when we pull off with our fingers a tender piece from the scalding hot boiled fowl, and stuff it into the mouth of the innocent one.

O Sheikh, Sheikh! this is all most admirably meant on your part; but what a far warmer welcome should we not have appreciated it, and what a sunshine to the soul would there not have been in that room, if the ladies of your household, 'the 'angels in the house,' albeit you know them not as such, could have visibly assisted your hospitable endeavours! How the poor man has to labour, in consequence of his self-deprivation of helpmeets! for no sooner have he and his friends finished their dinner—and which we suspect they partook of under the archway outside, by the light of a blazing fire they have got up there,—than behold him returning again with Ibraheem, bringing two rolled-up masses of bedding, which they proceed to spread on the floor; and discuss again and again over the method of doing it, with the dignity of sultans and the sageness

of the greatest pundits that ever the East produced. Then, again, the Sheikh brings in sundry carpenter's tools, and works long and confusedly at the door of the room inside, his Roman toga requiring refolding many times during the operation, until at last he shows that the locking machinery will work, hands me the key, and we are left to ourselves until the morning.

Up early that next morning; Ibraheem soon appears; all symptoms of the bedding are quickly removed, and he is complimented by my better-half on how well he understands what requires to be done. 'Excuse me, madam,' says he,—his grey mustaches curling upwards with his honest smile,—'excuse me, 'madam, but I have been a great deal with English 'ladies and gentlemen, and have learned much from 'them; and besides that, I was with Colonel 'Howard Vyse, when he lived at the Pyramid.'

Here was news, and good luck too; and so with cheerful prospects we went out into the little garden, and admired to Sheikh Omar his great plane-tree, hoped he would see his young date-trees grow very high and have much fruit; and inquired the names of the copper-coloured wood-pigeons, and the crested black and white striped birds that were flitting about here and there, and the exquisitely blue-flowered creeper on the wall, until breakfast was announced. There the young man in the blue and gold cloak again appeared, and besides stuffing him with sugar, we gave him a portrait of Maria Theresa;

paid out small sums of money, under the advice of Ibraheem, to various members of the household; and finally mounted the carpeted donkeys in the midst of half the villagers congregated to look on; finding ourselves after that once more under the lead of the Pyramid Sheikh, and trudging along the great westward-trending embankment,—that long mud-mound some twenty feet high above the land on either side, and forty feet broad at top.

Across presently, by an Arab stone bridge of several arches, the Grand Joseph Canal; not the Patriarch's, but Sultan Saladin's, they say, but do not prove it; and then we can trace our way clearly enough to the desert edge without any further impediment. Pass a few acacia-trees with long white thorns, very similar to *Acacia Capensis* in South Africa, then perceive a pebble or two on the hitherto pure mud of the embankment, and in a few minutes more reach the desert itself with its world of yellow ochre sand, quartz or jasper stones, and little else besides. Next we turn sharp round, due north, riding thenceforward by the narrow sandy flat that lies all along between the light brown hills on the west and the cultivated land on the east, direct to the Pyramids; *i.e.*, those of Jeezeh, for their Abouseer and Sakkara rivals, which we had before closely approached, are now left far behind our backs.

South-eastward from us under the winter's morning sun were the Mokattam Hills, in the most delightful

faint-blue, or lilac of true distance; relieved below by the dark olive-green of many intervening ranges of palm-tree groves, and set off above by exquisite banks of delicate white clouds, all transfused with pure sunlight, and of a texture that made them look like level streaks of bright and wavy floss silk, extending all along the horizon from south-east to south, and even south-west. But due west were only the blue sky and the yellow hills. A strange appearance too they had, these hills of a 'rainless' land; for it was an appearance, first and most remarkably, of washing, and even superabundant washing, by rain; there were no cliffs about them, and except the sprinkling of brown pebbles over their summits they had no other natural markings than the distinct drainage of rain, forming young ravines over all their flanks.

It was rather a long ride that, approaching the Pyramids from our extreme southern starting-point, with the sun right behind us, and the country in front therefore very yellow and shadowless; but inventing improvements in the primitive saddle-gear of our donkeys partly occupied the time; and while still two or three miles off, the Sheikh, giving a great swing of his toga round his shoulders, and arranging it in a new manner still, called our attention to the Sphinx.

It is what we had been noticing for some time past, but could hardly believe in its paltriness and complete distinction from the Pyramids. It is ver-

tically under the Great Pyramid certainly, but so far under, as to be three times nearer the base than the top of that long table-formed hill, on whose summit not only the Great, but all the other Pyramids of Jeezeh, are situated. In fact, the Sphinx appears to us to be vulgarly shoved in at the base of the hills, merely to be away from the cultivated land, just like any trifling modern tomb! The head and face are visibly reddish, the neck and line of the back white, on the yellow sand; while a clump of plane-trees and a group of date-palms close in front of it, add another proof of how far below the eternal drought and solitude of the Pyramids, the said Sphinx must be.

At length, after heading the 'Southern Causeway,' and passing the trees with a dervish's well amongst them, we reach the man-monster, the andro-Sphinx as it has always been, though some writers will still call it 'she;' find there the camels and boxes, as well as a colonel's tent lent by the Egyptian Government out of the stores in the Citadel, already erected on the sand, 'for the lady and gentleman.' But we hold the position to be untenable as a permanent abode, for many reasons; besides expecting no grace from living there under the shade of the Horem-hou, the biggest, if not also the oldest, idol in the world. 'Where, then, will you have the tent 'erected?' said the guides, 'for it had better be 'put up in its final position before the men of the 'Governor of Jeezeh leave!'

The where was of course at that moment a problem; and though we would far rather have spent the rest of the day in quiet, we immediately organized a walking-party, consisting of the Sheikh, Ibraheem, and a few Arabs, who appeared no one knew how, to perambulate the Pyramid Hill all over, and endeavour to balance the respective advantages of the various sites for habitation.

First of all they took us west of the Sphinx to Dr. and Mrs. Lieder's tomb; a sepulchral chamber cut out of the rock; yet not where that worthy couple, who were still living in Cairo, had been buried; only where some other person's mummy was deposited four thousand years ago, and turned out of it again with ignominy one thousand or three thousand years afterwards; and where finally Dr. and Mrs. Lieder had entertained for several weeks a whole party of their friends, both ladies and gentlemen, one joyful springtime in Said Basha's reign.[1] But we found the place now half-full of sand, with seas also of moving sand in front, and the Sheikh said something about there being snakes there.

'Excuse me, madam,' put in Ibraheem, 'but let

[1] Poor Dr. Lieder is now dead, having fallen a victim in Cairo to the fearful visitation of cholera which occurred there in June 1865. Besides his life-long missionary labours, remembered with gratitude by many, he is honourably mentioned in Bunsen's *Egypt's Place in Universal History*, as supplying one of the great data in 'the beginning of 'the second period of the modern history of Egypt in the fourth age of 'the world;' or thus, under date A.D. 1834, 'Coptic again made intel-'ligible to the Copts as the language of the Bible by Protestant mis-'sionaries (Coptic School in Cairo, Gobat and Lieder).'

'me show you Colonel Howard Vyse's tomb:' and thereupon he led the whole party round by the east or south-east side of the Great Pyramid Hill to a quiet nook there, looking out in front over the green Egyptian plain, and gently spared by the storms of sand which come sweeping over the hill-top under violent winter winds chiefly from the south-west. On most parts of the hill-side, the sand-streams had buried the original outline; but in this happy corner there was part of the primeval escarpment or limestone cliff to be seen, and now stuck full of ancient tombs; that is, of little rooms with doorways opening through the face of the cliff, but their contents of humanity plundered ages ago, and distributed throughout all the museums of Europe. There were two or three storeys of the tombs, of various sizes and shapes, and they extended for several hundred feet along the length of the cliff, with various designs of architectural finish. Climbing up with difficulty above the lower storey, much encumbered with rubbish, we entered by a particular doorway a room carved into the substance of the hill, and some fourteen feet broad by twenty-five long: that was Colonel Howard Vyse's tomb, *i.e.*, the old Egyptian sepulchre which he used partly as a residence and partly as a storehouse during the many months of 1837 which he spent at the Pyramids. Down again, and up another rude staircase in the face of the cliff, and we entered into Mariette Bey's tomb, or one which he had excavated and cleared since

Colonel Howard Vyse's visit. Not quite so large as the former, but with a window-place as well as a doorway,—and decorations at the farther end of *alto-relievo* figures, as large as life, showing the former possessors of the property somewhere in the reigns of the fourth and fifth dynasties of the earlier Pharaohs before Abraham, and with some *basso-relievo* carvings about the entrance,—this tomb, on the whole, seemed to be the most desirable residence we had yet met with; protected also by the entire bulk of the hill, from being heated up at mid-day by the sun, as the tents would infallibly be, and with its doorway defended by a projecting rock from the direct attack of winds from any quarter.

But were there no tombs a little higher up the hill, nearer the Pyramid, and therefore close to the work for which we had come? One Arab, by name Alee Dobree, immediately offered to show tombs on any and every part of the hill; and he knew precisely what we wanted without having it explained. 'All right,' he said, 'I know,' and away he led us, with long vigorous strides, up the face of the hill, and over its sloping top towards the north-east corner of the Great Pyramid. Abundance of tombs and sepulchral wells we passed, but all open at top and encumbered with ruins; then reached the Great Pyramid itself, rounded its northern heaps of rubbish, and amongst other half-destroyed tombs, towards the north-west, came to a cleft in the ground, masonried on either side. 'Here is the place,' said

he; and winding his toga tightly about the upper part of his body, and leaving his shoes behind, he descended, straddling from side to side, sticking either toes or fingers into small joints of the stones, until at last he leapt on the solid earth at the bottom, went along a subterranean passage northward, and then turning west, declared that there were fine rooms there.

So there might be, thought we, but the mode of entrance is rather against them. That, however, he could not understand at all; it was as simple as possible to his Arab activity, and the rooms below so beautiful and large. 'Yes, but then the view from 'them was bad,' we suggested; 'could he not find 'something from whence we should see a date-palm 'waving in the wind?' So then he marched us to the west; but there was nothing particularly adapted there, though the external forms of the tombs rose often temple-like above the ground; then we passed between the Great and second Pyramids, and having inspected a tomb in the south-east, which had a spacious enough porch looking eastward, but of no great breadth, and attended with the inconvenience of a square well some seventy feet deep in one corner, we returned to Mariette Bey's tomb in the eastern cliff. (See Map, Plate II.)

'Excuse me,' began Ibraheem, 'but I knew it was 'the best from the first; and pray look here at this 'nice little tomb just opposite your door,—I'll make 'that into my kitchen; and we'll have those two

'mummy-pits that lie between, filled up to the sur-
'face, and then I can put up my great water-filters
'there in a quiet corner shaded from the sun; and
'if you'll only go three steps down the face of the
'cliff that way, what another beautiful room you
'come to there,—it will just do for the lady and
'gentleman to take dinner in.'

All this was quite true, and not only so, but a semi-secret passage within the face of the cliff led from this last apartment into Colonel Howard Vyse's grand saloon; so we immediately determined to have all our instrument-boxes brought into that stronghold; and make it the workshop, storehouse, comparing-room for the measuring bars, and whatever else we might require for the scientific service about to commence.

The camels, therefore, with their loads, were brought round from the Sphinx to the foot of the eastern cliff; by great hauling, and many hands, all the boxes were hoisted into the Howard Vyse apartment, secure there from all direct sun temperature; coffee was made, presents given, the Jeezeh men returned to their homes, and we were left alone with Ibraheem to make appropriate arrangements by nightfall.

The Sheikh, however, in the toga, and a certain old Arab of deep design, and with the most marked *vertical* wrinkles on his forehead we had ever beheld, had not entirely departed; for, after communing together at the base of the cliff for a while, they

came up again, and inquired 'how we were going to 'manage about guards at night?'

'In such a dangerous and out-of-the-way position,' they argued, 'we should not be safe without six men 'every night to guard us; and each of these men 'must be paid two shillings every ordinary night, 'and in cold weather three.'

'To guard us from what?' we asked. 'From the 'Bedouins of the desert,' they answered. 'Those 'hereditary robbers of peaceful men,' said they, 'might come down any night at a moment's notice, 'if they heard that unprotected travellers were 'there. Why! here in Colonel Howard Vyse's room 'close by, after he left, a Nubian tried to live and 'support himself by letting out lodgings to tra-'vellers; and he went on bravely for a time: 'until one dark night the Bedouins came down, 'killed him, robbed his wife of her necklace, 'ear-rings, finger-rings, nose-rings, and everything 'of value she possessed; and they, the perpetrators 'of the crime, could never be discovered, so there 'was no redress.'

From twelve to eighteen shillings a night during four months, besides cost of day guards, we thought a high tax to pay these children of nature; and for, after all, defending us from themselves, if the truth were known. So we told them that we had nothing to do with it, that the Viceroy had ordered them to see that no harm befell us, and if they thought that six men were necessary for our safety, they had

better send that number, and not one less, or they would be reported accordingly. This view of the case was not at all favourably received ; and when they became excited and tried to explain the whole affair to us from one end to the other, and prove every point of it, their semi-English passed into pure Arabic, and we failed to understand them altogether.

Evening was now advancing, and this grand question entirely unsettled, when help arrived. M. Vassalis, superintendent of excavations under Mariette Bey, and with instructions from his chief to aid our Pyramid projects, had just arrived in the neighbouring village, and now came up from there to see how we were faring. No sooner, too, was he seated in our dining-room bower of stone,—for it was that rather than a close tomb,—than he took up the disputed point; while the Arabs, who were again collected in numbers, squatted on all parts of the cliffy staircase, wherever they could find any foot-room, between him and the sky ; and had a deal to contend about wordily as to the propriety of their views. But M. Vassalis, an Italian of the grand Belzoni type, had a powerful way of putting the case before them in a very few unanswerable words ; and indicated so clearly to them what the Viceroy's proceedings would be, if any harm happened to the lady and gentleman during their stay at the Pyramids,—that we were presently informed the guards would be duly sent, and we should have no further trouble about them.

After sunset, accordingly, and when we, thankful for the many mercies vouchsafed to us, were reading in our stone bower, or occasionally looking over the land of Egypt, spread like a carpet before this hill of tombs,—and there was just moonlight enough to show the landscape but not to dull the stars,—three warlike figures, wrapped in shapeless white burnouses, and with long guns strapped at their backs, passed before us to take up their position at the top of the slanting path or steps in the face of the cliff; while three others similarly armed stationed themselves below: so that then, with the cliff immediately above, and the cliff below, our doorways, and the one and only path of oblique access defended at either end, we were as humanly safe as an admirably strong position could possibly make us.

CHAPTER IV.

REPORT ON THE GREAT PYRAMID.

On the next morning, 9th of January, there was work to begin upon early; for M. Vassalis came over from his village in the plain, and announced that Mariette Bey, on the part of the Viceroy, had instructed him, M. Vassalis, to take twenty men, under two Reis or captains, from the Government excavations at Sakkára, and place them at my service during a month, as a help towards preparing the interior of the Pyramid for mensuration, or for doing anything else that might be required in the interests of science; always excepting any 'breaking of the Pyramid;' and M. Vassalis was to see particularly that I did not do that. These Sakkára men, moreover, were already arrived, and the question for immediate settlement was, on what subject were they first to commence?

'Why, let them go and begin by brushing out and then washing down all the floors and walls of the several rooms and passages inside the Great Pyramid,' we answered.

'Oh, but that,' he urged, 'is not sufficiently pre-

'cise for them to work by. You must go in your-
'self and see exactly how matters stand, for not
'until you have directed your own eyes to things
'connected with the monuments of Egypt,'—and therewith he pointed with both fingers to his two eyes first, and then to objects before him,—'not until
'you have comprehended them *so* with the eyes, can
'you form any real notion in this country of what is
'to be done, and how. And you must be quick in
'coming to a conclusion, for it is not for a whole or
'complete month the men will be here to work for you;
'only from now up to the time when Ramadan be-
'gins; for Ramadan stops everything in Egypt, and
'not even Government can get its own orders exe-
'cuted then, for the people fast, and have no strength.'

Evidently at this rate not a day was indeed to be lost, for the Muslim month of Ramadan would be upon us within less than three weeks; and when the Viceroy had granted so much as the services of twenty men under two Reis, it was my duty to make it go as far as possible, for the credit of His Highness' very liberal contribution, as well as the furtherance of Pyramid knowledge.

For himself, M. Vassalis declined, as he said, the pleasure of accompanying me, for he had been too often inside the Pyramid to love overmuch the stooping in its narrow passages. All that was possibly quite true, for nature had cast him in a heroic mould of more than ordinary human proportions; but his declinature also arose, in part, from the

higher-toned motive of wishing to leave me quite free and unfettered in forming first ideas of what should be done. But he brought up with him, to attend upon me, two lithe and supple Sakkára youths, capable of going in anywhere like eels; and the local Arab, Alee Dobree, who had been so active the preceding day, volunteered his services also. Quickly, therefore, with their assistance, was one of the Edinburgh boxes unpacked, and a supply of its candles and candlesticks with glass shades taken out, to serve for our exploration.

'What 's the use of those glasses?' asked Mr. Alee, 'there 's no wind inside the Pyramid.'

'No natural wind,' we replied, 'but we shall make 'some apparent wind by our own moving about; 'and that will cause the candles to gutter, and drop 'spots of wax on the beautiful polished floors.'

'Well, but all the travellers, and the Arabs who 'go in with them, every day drop candle-grease all 'about,' responded he; 'and why should not we do 'the same, and save ourselves the trouble of carrying 'the heavy glasses?'

The glasses were, however, insisted on; and with them we were soon off on our march, under the brilliant morning sun, to the ancient Pyramid. A stiff breeze, as we approached its honoured form, was blowing from the south, eddying and whirling about the corners of the great building's northern side. Every now and then, in the midst of the otherwise perfect deadness and immobility of this vast sepul-

chral region, away went in the wind some antelope-like thing, bounding over the stones, or behind the various tombs and heaps of rubbish, or at last disappearing over the edge of the hill; anything, in short, to escape the intruder's gaze, as though we had been sportsmen on ruthless slaughter bent; but the frightened, springing, flying object proved in every case to be merely a large sheet of paper, that had wrapped up some tourist's pic-nicing provisions on previous days, and had been left defiling the ground and even littering the air. In quantity too, these things were almost incredible; while, as we doubled the north-east corner of the Pyramid, the usual site of those gormandizing operations, we had to tread most cautiously, especially my barefoot companions, among fragments of black bottles, and other needless refuse of thriftless feasting. Climbing up, however, rather slantingly along the northern face of the Pyramid, first by ascending the long slope of the hill of rubbish that lies against it, and for the last few yards by the rectangular stone ranges of the Pyramid itself,—we arrived at that well-known hollow, about fifty feet above the base and twenty-five feet east of its centre (*i.e.*, the central vertical line of the northern side), where the entrance passage presents itself to view. There, too, are first seen those strangely inclined courses of stone surrounding and forming the passage, not at right angles to the general side of the Pyramid, but kept with exactest care a certain small angle different therefrom; and

they are further, as is quite evident even on a first glance, of a whiter and denser stone than the ordinary vertical and horizontal courses of the mass of the building. (See Plates III. and IV.)

The floor, again, of the passage, very much harder than any other portion of it, extends out far in front of either the walls or roof; for these have in part been broken away to the depth of many feet inward from the original Pyramid surface, and thus form something of a grotto on the northern face, which is always in the shade during the middle of the day. Hence, alas! more broken bottles, more greasy scraps of paper, and also names innumerable carved, cut, hacked, painted, and marked in various ways on the fair and once beauteous stone. Even while we were lighting our candles preparatory to entering, there were three 'travellers' and their dragoman, who had just finished their 'luncheon,'—as these desecrating feasts are always termed by the Arabs who behold them, no matter at what hour of the day they occur,—and all four were now standing above the roof of the passage, engaged in adding their names in the space exactly under that remarkable double pair of cyclopean blocks placed '*en décharge*' above the entrance. These gentry were in the very position of the figures in Sandys' view of 'The entrance into the Great Pyramid,'[1] even to

[1] The entrance itself in his Plate is strangely disfigured by a pudding-shaped lump of stone, the original of which, as such, is simply incomprehensible. (See our Plate III. vol. ii.)

the thirst-inspiring accompaniment of an Arab boy climbing up to them with *a goolah* (earthenware bottle) of water, and helping himself up by the same fractured western corner of the roof-block, which was used as a handle in his, Sandys', day; and yet Sandys began his journey so long ago, as to have passed through France 'hard upon the time when that 'execrable murther was committed upon the person 'of Henry the Fourth, by an obscure varlet.'

Many therefore are the inscriptions, and inscriptions upon inscriptions,—for these inscribers are no great respecters of each other,—in this neighbourhood; yet none of their handiworks can compete in size with that of Dr. Lepsius, who has held forth at enormous length in praise of the virtues of the late King of Prussia, on the highest and westernmost of these remarkable blocks. That inscription is indeed noble in the space which it occupies, but the site of it must have been rather unhappily chosen by the courtly philologist; for, in the few short years that have intervened, there would seem to have been torrents of rain, 'rainless' though the region be generally termed, torrents that have brought vilifying streams of mud from the upper masonry right through the centre of the modern hieroglyphics; nay, worse still has happened, for certain obscene birds of night, for their own foul ends, have presumed to take a particular fancy to that neighbourhood; and, by a style of marking peculiar to themselves, have made confusion more confounded.

But our candles are now lighted, and we must enter; enter too the largest building in the world by the smallest of all doorways—*i.e.*, only 47·3 inches high by 41·5 wide; and that also not in the most convenient position, but tilted over towards the south, by the same angle that the floor inside dips in the same direction—*i.e.*, 26·3° nearly. There *might* therefore be dangerous slipping,—for, as Sandys truly observes, the descent is made, and with much stooping, not by 'stairs, but as down the steep 'of a hill,'—were not this danger guarded against by there being shallow notches cut across the smooth stone at every two or three feet of distance. Before, however, we had got very far down this declining passage, behold these cross notches increasing, both in depth, length, and closeness, until they began to form long holes in the direction of the axis of the passage; and at last, such notable trenches, as to occupy all the breadth of the floor to within five or six inches of its edge on either side, and to have an almost uninterrupted run lengthways. Though excessively rough at the bottom, and occasioning many a staggering step,—yet they constituted an effectual lower level to the floor; and such as would enable any person either ascending or descending the passage, to perform the task with less of 'that 'uneasy benefit of stooping' which annoyed the old explorers, than first appearances promised.

'Who made all these holes in the floor, Alee?' we inquired of our guide.

'Colonel Howard Vyse,' was his prompt reply.

We demurred nevertheless to his information, from the tenor of many paragraphs in the worthy Colonel's book; but could not fully discuss the matter just then; for, with every step of each of our party, up rose such clouds of fine white dust, the abrasion of Mokattam limestone, and remained from their fineness suspended in the air,—that we were all immersed in a thick chalky haze; in the midst of which, stooping, jumping, struggling downwards as the floor-holes allowed or obliged, and fending ourselves off with hands and elbows from either side wall to prevent going head foremost down in front,—we reached at last the end of this series of broken pits; coming then to an untouched length of smooth floor, down which we slid on our heels, and finally alighted full bump against a steep bank of sand, that visibly terminated the passage at that point.

Now this point was after all, at a distance of hardly one hundred feet from the outside or beginning of the passage; and all the world knows that 'the entrance passage' of the Great Pyramid, preserving the height, breadth, and angle given above, goes right down in one uninterrupted line to a distance of more than *three* hundred feet; diving down indeed into the solid earth far underneath the base of the built monument, and there opening into the subterranean chamber, the largest of all the chambers of the Pyramid, and the chief of those works underneath the surface of the ground, the prepara-

tion of which, according to Herodotus, occupied so many years previous to the commencement of the building.

'This is the road,' said Alee, trying to lead the thoughts he saw rising in our minds, by over officiously showing the way into a large cavernous-looking hole, that opened out sideways from the west wall of the entrance passage, just above the anomalous sandbank.

'Yes, I see it is,' was the reply, 'if you mean the 'way up to the first ascending passage; for that is 'Khaliph Al Mamoon's hole, and just where it should 'be; but stop here for a moment, if you please, 'O Alee, who knowest more than any other 'Pyramid guide; and explain what is the meaning 'of this great bank of sand, blocking up so cruelly 'all the lower part of the entrance passage beyond 'this point which we have reached; and preventing 'any access to the subterranean chamber.'

'Why,' returned he with a faint smile, and having seated himself despairingly in the Oriental manner, 'it just means what you say; precisely that and 'nothing more, for no one can go beyond the sand; 'but if they want to see the King's chamber and 'sarcophagus, and everything else that all the tra-'vellers come to visit, they must turn off here into 'Al Mamoon's hole, and so go up just as I told you.'

'Pray, though,' we asked, 'who first brought the sand into the passage?'

But Alee was not well pleased with this question,

and tried to parry it by asking argumentatively, 'How the travellers could ever get through the 'Pyramid quick enough, if they had to go down 'the long subterranean passage, in addition to 'visiting the upper galleries and the chambers 'there. They had not strength enough for it too,' he said; 'and so it was for the travellers' own good 'that the Arabs were *obliged* to stop up the pas-'sage completely, and show there was no hollow 'space beyond that; for if anything at all of a 'hole were left visibly open, the travellers were so 'troublesome in asking where that hole led to, and 'then insisting on being taken there.'

'What length of time,' we asked, 'has the sand-'bank been in this place?'

'Oh, a great many years,' answered he, 'more 'than he could recollect;' and then he became absorbed in philosophically examining the state of each and every one of his toes, in a sort of earnest and kindly manner too, as if they had been so many fingers on which he was about to draw kid gloves.

'And has no tourist, during all that time ever 'seen, or asked by name to be shown the subter-'ranean chamber at the bottom of this entrance 'passage?' we persisted in inquiring.

'But how are the travellers to know that any 'chamber is there, if they don't see it?' urged he, 'and if they don't know there is such a thing, how 'can they have any desire to see it? Once on a 'time perhaps there used to be travellers who knew

'all about the Pyramid; but,' muttered he, ruefully shaking his head, and bringing the examination of his toes to an abrupt conclusion, 'there 's a 'great change come over all the travellers in late 'years. Formerly, whenever they visited the Pyra- 'mids they would stay several days, and be a long 'time looking carefully at every tomb; and they 'would talk with us Arabs about our houses and 'our fields, and ask us how we were getting on, and 'seemed to think they would like to be Pyramid 'Arabs too; but now the travellers are always in 'such a hurry, and they are getting more and more 'in a hurry every year. One of the Arabs looking 'out now at the village, has only just time to cry out 'that travellers are coming, and immediately the 'Pyramid Sheikhs and all the guides run to the hill; 'but before they can get there the travellers are 'upon them, for they make their poor donkeys 'gallop through the sand; and the moment they 'arrive at the Pyramid they call out for their 'luncheon, never waiting for the corks to be drawn 'out of the bottles, but knocking their necks off on 'the stones and letting the pieces fall all about; 'and then they tell the Sheikh, "Now look sharp, old 'fellow, and get us three Arabs apiece to take us 'up to the top of the Pyramid that we may see the 'view, and be down quicker than any one else; and 'we 'll time you by our watches;" and they no sooner 'come down than they are on their donkeys again, 'and away they go over the plain to Masr, and we

'never see them a second time. Only a very few 'too of all those travellers ever go inside the Pyra-'mid; and as *they* don't pay any more than their 'friends who merely went up the outside,—the poor 'Arabs can't afford to let them know that there are 'many chambers or passages. It won't do at all to 'let the travellers stop too long inside the Pyramid; 'outside it might be well enough if they liked it, 'but inside they are burning our candles all the 'time, and Arabs can't find wax-candles by digging 'any day in the tombs.'

'Well! that will do, Alee, for the present,' said we, 'as to the stopping up; have the goodness to 'lead on now to the upper passages.' So therewith he heralded the way with his candle in the glass shade into Khaliph Al Mamoon's hole on the west; a ruinous place enough, where much of the component masonry of the Pyramid must have tumbled out, and the steep rising floor is a mass of dust and broken stones; but turning sharply round in the recess towards the south, and then scaling a little rock-like cliff by means of small holes worked in the rough stones for Arab fingers and toes to catch in, and turning eastward again while so doing,—he entered by a large side opening into the bottom of the 'first ascending passage,' at a point just above its lower portcullis stop.

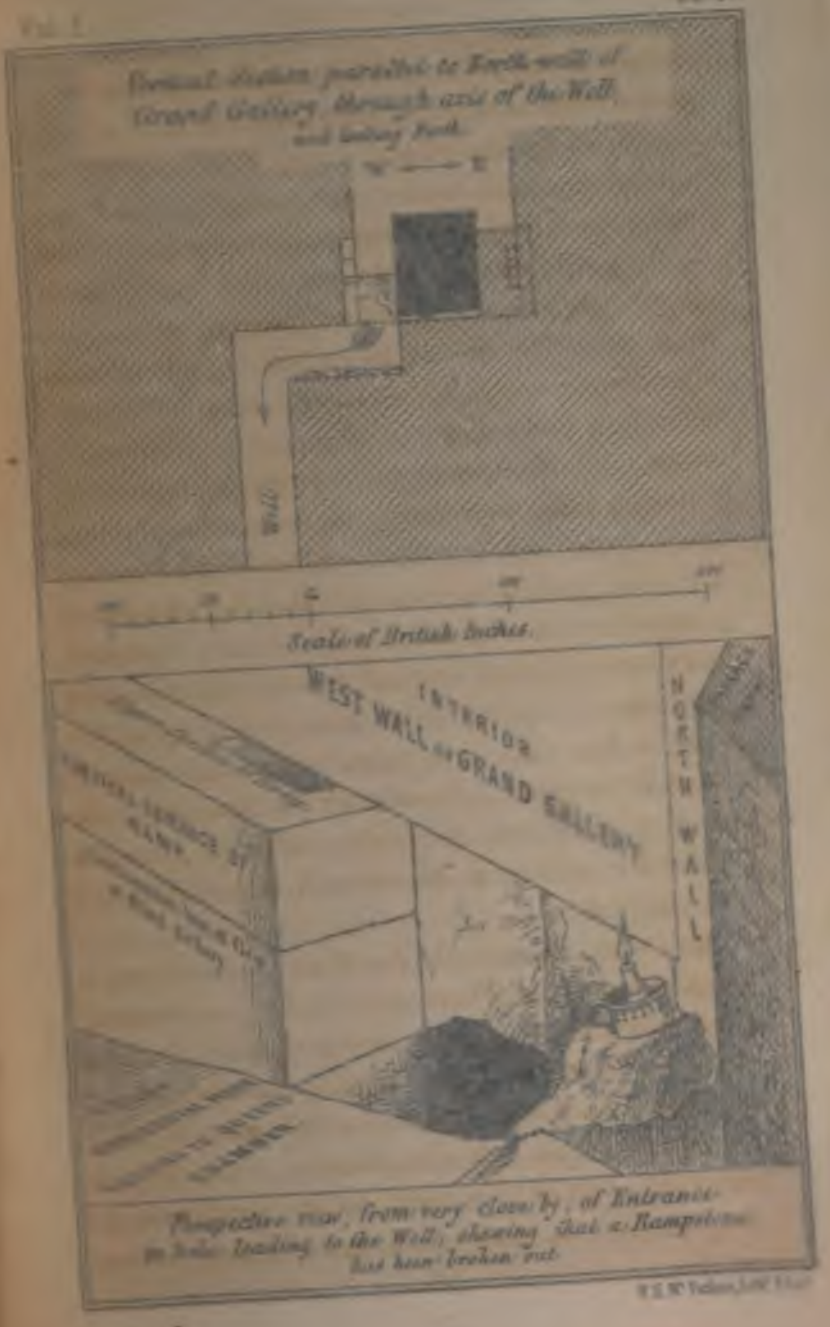
This, to us, new passage, is, as every one knows, in the same vertical plane with the entrance passage; but, instead of dipping, it rises, at an angle

of 26·3°, more or less, as it proceeds to the south. The floor is furnished with shallow notches to prevent feet from slipping, but was to our examination sadly covered with dust and limestone refuse; while both walls and roof exhibited such lamentable decay as to give much of the lower part of the passage a large and rounded cavernous aspect,—by candlelight of course,—for we were now quite beyond the reach of any daylight. But we could see enough of the ruin to call to mind Professor Greaves' description, nearly two hundred and thirty years earlier, to the effect of the beauty of the architecture of this passage, and to the greater 'softness ' and tenderness' of the stone composing walls and roof, over that of which the floor was constructed. 'The ingenious young man, Titus Livius Burretinus, 'the Venetian,' first made the observation, and Greaves afterwards confirmed it, apparently by trying the surface with his knife; and if the huge exfoliation of the stone now to be observed has chiefly been effected since their day, grave doubts may well be entertained as to how much longer those parts of the Pyramid are going to last, where the material is of the 'tender,' but the treatment by modern men of a decidedly untender kind.

Proceeding up and up, stooping always, and carefully carrying our lights, but immersed constantly in the dusty haze of our own stirring, we found the upper part of this passage in rather better preservation than the lower, as to the original plane

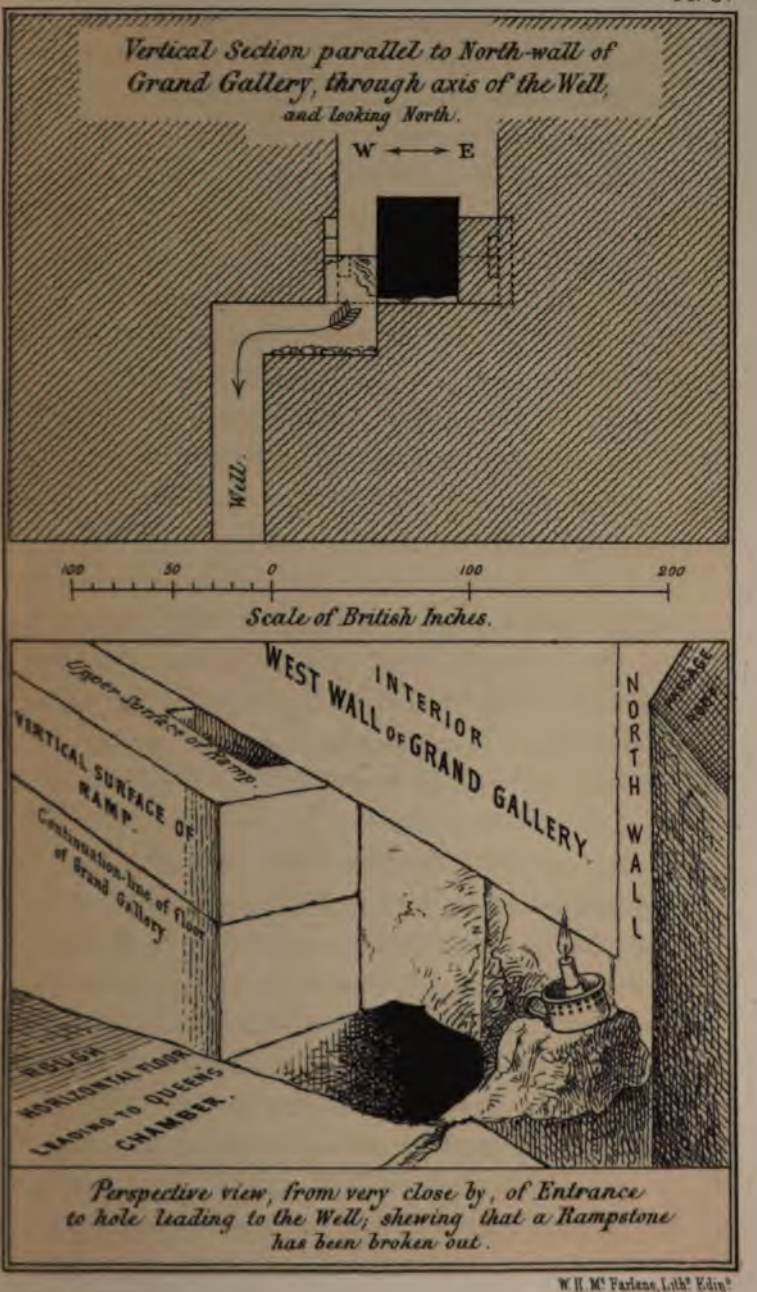
surfaces of its walls; yet the highest and southernmost roof-stone was ominously cracked through the middle along its central line. This mischief occurred at a point where said passage opened into the grand gallery or second ascending passage. Instantly on entering that, there was a feeling upon us of greater solemnity and perfect quiet. We could now unbend our backs and stand straight up, rather wondering in the awful room of twenty-eight feet high above our heads, and its ceiling rising still farther, and one could think unlimitedly, as it proceeded southward. Close on the right hand was a square hole (see Plate v.), leading, by a short horizontal duct, to the mouth of that celebrated well going down to the lower parts of the Pyramid; and so awfully deep, that the primitive Muslim who lucklessly fell down it in the year of the Hegira 345, 'was no less than *three hours falling*, according to 'his terror-stricken companions; who heard the most 'horrible cries; and then going out of the Pyramid, 'sat down in front of its northern face, and talked 'the matter over.'

Before us, southward, the floor was level to a small distance, and very narrow, but encumbered with fragments of stones; and even when we had come to the end of this part, and had climbed, by straddling in the most inconvenient manner from hole to hole (and rather remarkable holes too), in either side-wall or bank; and so had climbed up to the true inclined floor of the grand gallery, rising



Perspective view, from very close by, of Entrance to Hole leading to the Well; showing that a Rampart has been broken out

W.E.W. Parker, Lith. Hull



Perspective view, from very close by, of Entrance to hole leading to the Well; shewing that a Rampstone has been broken out.

W. H. Mc Farlane, Lith. Edin.

at an angle of 26·3°, and decorated on either side with the well-known ramps or long stone benches on the incline,—still every surface was thick with white powdery stone-dust, and the 'ramp-holes' absolutely filled with it. A long ascent there was, by that gallery-floor; stopping, as we did, every now and then to admire the lofty walls, and their 'seven 'overlappings of the tables of stone;' though occasionally to grieve over huge fractures from their edges; and then to find perhaps the ramp itself completely broken away for a distance of several feet, and the ascent at such places rather hazardous from the absence of an accustomed support for the hand. (See Plate III.)

By aid, however, of the cross notches cut on this floor also, and gradually increasing in depth and power towards the upper end, we reached the top of the incline, and came to the grand upper step; a noted architectural feature of the original construction, and not a small embarrassment to any one requiring to pass over it with a heavy burden: for it was planned to be a fine bold step, rising at once nearly three feet high vertically out of the ascending floor; so that there must be no slip backwards thereat, or the results might be ruinous. But now, alas! how is this great step fissured by two deep, snake-like cracks, and broken away by hammers to such an extent all about the middle, that there is little feature of any kind remaining.

From this point you enter, stooping, the very low

passage that leads on southward, out of the upper end of the grand gallery; entering thereby at once the *granite* constructions of the Pyramid, all previously having been in limestone of one sort or another. And now to see the chipping perpetrated on all the corners for 'specimens!' This was most apparent in the little 'antechamber;' where the 'pilasters,' or projecting rims, between the supposed portcullis blocks had, bit by bit, been knocked almost entirely away, and some of the last fractures of the fine red granite looked very fresh indeed.

Stooping again after leaving the antechamber, another low passage brought us into the King's chamber, that grand and final construction of the whole Pyramid, for which, and towards which, the entire fabric was erected. Here Alee and his two Sakkára young friends sat very dutifully on one side, with a single candle amongst them, while I took the remaining lights in either hand and began an inspection.

A magnificent room without doubt; granite the walls, the ceiling, and the floor; with the important coffer standing solemnly at the farther or western end.

In the north-western corner, a long hole, caused by the taking out of three floor-blocks, that men descending thereby, might burrow under the granite floor, and especially under that part where the coffer stands, and search for possible mummy-pits

in the underlying limestone masonry; an old mischief long before Colonel Howard Vyse's time, though further worked in by him. But he describes the floor-joints as exquisitely true and fine, beyond almost anything else in the Pyramid; while now, on the contrary, the floor is remarkably dislocated, with some of its stones an inch or two higher than the others! Is this the result of recent straining on the building by reason of the large amount of quarrying performed above, below, and round about this precious room by the many curiosity-seekers, who have plagued its existence and perforated its structure in all directions? One almost thinks it probable, for in the south-eastern corner are some frightful fissures in the wall, going right through two or three courses of the granite blocks as they stand, and evidently therefore produced by pressure on those blocks in their present position; and that is close to the very place in the masonry, at the back and above, where the Signor Caviglia of Vyse in 1837, the Captain Cabilia of Belzoni in 1817, was for so many years quarrying and blasting, in his false and entirely unfounded hopes of finding another chamber connected with the south air-channel. These walls of the King's chamber had been so tenderly cared for by the builders, lest too much weight should press upon them, that the architect had constructed his curious arrangement of the five hollow chambers of construction over its ceiling: but when the divisions between those chambers were

recently blasted, and the limestone backing of the granite below, largely knocked away,—no great wonder that the walls are now found to be cracking, and the floor giving and rending; for this room is in the Atlas condition of supporting the huge pressure of the whole upper part of the Pyramid.

Then looking round the walls, elsewhere truly composed of the 'beautiful and spacious polished 'tables of red granite,' behold names, names, names; not many cut, for the material is too hard for pocket-knives; but what with white oil-paint, and black tar put on with a large brush, and in letters eight inches high, the stains in the classic 'marble of Syene' are villanous indeed. If, too, the travellers had not *carved* anything into the granite, they had chipped its edges wherever they could get at them; whence it came, that all round the doorway not an inch in length remained unchipped; similarly round about the openings of both the south and north air-channels; at several places in the floor, and in the western wall, where the joints were not quite close; and last and chiefest of all, on the poor coffer.

Every possible edge of this was chipped away with large chips along the top all round, both inside and out; chip upon chip, wofully spoiling the original figure; along all the corners of the upright sides too, and even along every corner of the bottom, the latter being rendered more amenable to the vile hammers of petty destructors by being tilted up on a large round pebble thrust in below at the

southern end; while the upper south-eastern corner of the whole vessel was positively broken away by successive chippings, to a depth and breadth of nearly a third of the whole. Horrible in themselves, these extensive fractured surfaces had at least the merit of enabling one to settle in a moment the long-disputed question of the *material* of the coffer, and say it is *not* porphyry, but a blackish variety of red granite; and all honour should therefore be given to those amongst past authors who pronounced in their day for red granite against porphyry, black marble, and whatever else the substance has been called.[1] (*See Frontispiece.*)

Except the mere alteration of the name granite coffer for porphyry coffer, this correction possesses no further influence upon anything theoretical that has been advanced in connexion with the Pyramid; but our eyes almost at the same time caught sight of another feature, which appeared at first of most revolutionary character; viz., the western side of the coffer is, through almost its entire length, rather lower than the other three, and these have grooves inside, or the remains of grooves once cut into them, about an inch or two below their summits, and on a level with the western edge; in fact, to admit a sliding sarcophagus cover, or lid; and there were the remains of three fixing pin-holes on the western side for fastening such cover into its place.

[1] Chief among these authorities who were right, are Sir Gardner Wilkinson, Dr. Richardson, Dr. Clarke, M. Denon, Dr. Shaw, and M. Maillet.

The import of all this struck us almost dumb for a time; and we thought, if this cutting into the original proportions of the coffer, to convert it into a sarcophagus, is really an ancient work,—why and wherefore did the French *savants* of A.D. 1799, represent it, in the exquisite engravings of their great national work, without any such cuttings whatever; or, as a pure box-shape, with sides of equal height and thickness all the way round,—depriving us now of the serenity of our dependence on that mighty series of books of theirs, the glory-idol of far more extensive sections of the French people than their scientific men alone? But if, on the other hand, we really *can* depend on what the learned authors say they paid a great deal of attention to, and witness the special article criticising Professor Greaves' description of the coffer, (and he also mentions it as a mathematically formed solid, or 'two cubes set neatly together,')—why then, in such case of loyalty to Academicians of Paris,[1] this

[1] The following is extracted from the Travels of Dr. Clarke, who had several interviews with members of the Institute in Alexandria, shortly previous to their return to France:—'The French Institute of 'Egypt was divided into four sections, severally consisting of the 'Mathematics, Physics, Political Economy, Literature, and the Fine 'Arts. The following persons were its members:—

'Those marked with an asterisk had left Egypt at the time of our '(Dr. Clarke's) arrival.

'MATHEMATICS.

*Andreossy.	Costaz.	Malus.
*Buonaparté.	Girard.	*Monge.
Fourier, *perpetual Secretary of the Institute.*	Lancret.	Nouet.
	Le Pere.	*Quesnot.
	Le Roy.	

modification must have been worked into the coffer in the course of the present century.

In the earlier part of it, however, would *now* seem to be the conclusion; for we were not *then* aware of Mr. Perring's magnificent plans and drawings of the Great Pyramid, in Colonel Howard Vyse's folio

---

'PHYSICS.

*Beauchamp.	Delisle.	*Dubois (*père*).
*Berthollet.	Descortils.	Geoffroy.
Boudet.	Desgenettes.	Larrey.
Champy (*père*).	*Dolomieu.	Savigny.
Conté.		

'POLITICAL ECONOMY.

Corancey.	Jacotin.	Reynier.
*Dugna.	*Poussielque.	Tallien.
*Fauvelet Bourienne.		

'LITERATURE AND FINE ARTS.

*Denon.	*Parseval.	Rigo.
Dutertre.	Protain.	Rigel.
Le Pere.	Don-Raphael.	*Ripaut.
*Norry.	Redouté.	

'To these sections of the Institute were also annexed the following persons, under the several heads:—

'LIBRARIANS.

Coquebert. Méchain.

'COMMISSION OF AGRICULTURE.

Champy (*père*). Delisle.
Nectoux.

'COMMISSION OF ARTS AND SCIENCES.

Antiquaries.

*Ripault. *Pourlier.

Architects.

Balzac. *Norry.
Le Pere. Protain.

Astronomers.

Nouet. Méchain (*fils*).
*Quesnot.

Botanists.

Desfisle. Nectoux.
Coquebert.

Chemists.

*Berthollet. Descotils.
Champy (*père*). Champy (*fils*).

Surgeons.

*Dubois. Lacypierre.
Labate.

Artist for Design.

Dutertre.

Geometricians.

*Monge. Costaz.
Fourier. Corancey.

publication, dated 1837-1839 ;[1] where the sarcophagus features in the sides of the coffer are duly shown ; viz., cuttings into it suitable for sliding on a lid ; but no lid given or reported discoverable, even to the smallest fragment.

Engraver.

Fouquet.

Civil Engineers.

Le Pere. Arnolet.
Girard. Caristie.
Faye. Favier.
Le Père (*Gratian*). Dubois.
Devilliers.
Martin. Moline.
Saint Genis. Duchanoy.
Lancret. Alibert.
Fevre. Regnault.
Chabrol. Bernard.
Jolloia. Potier.
Raffeneau. Viard.

Geographical Engineers.

Jacotin. Bertre.
Simonel. Lecesne.
Levesque. Laroche.
Jomard. Faurie.
Corabeuf.

Engineers—Constructors.

Boucher. *Gresié.
Chaumont.

Oriental Literature.

Marcel. Raige.
*Joubert. Delaporte.
Belletete.

Literati.

*Denon. Lerouge.
*Parseval.

Mechanics.

Conté. Coutelle.

Artists.

Adnès (*père*). Adnès (*fils*).
Aimé. Couvreur.
Collin.
Cécile, *Mechanical Engineer.*
Lenoir, *Mathem. Inst.-Maker.*

Musicians.

Rigel. Villoteau.

Mineralogists.

*Dolomieu. Roziere.
Cordier. Dupuy.

Naturalists.

Geoffroi. Savigny.

Painters.

Redoubte, *Pt. of Nat. History.*

Apothecaries.

Boudet. Rouhieres.

Sculptor.

Casteix.'

[1] Published by James Fraser, 215 Regent Street, London, 1839. Originally the size of the book was 24 inches high by 36 long ; rather unwieldy, no doubt, though excellent for reference to the plates; but a lately purchased copy of the same edition has had all the plates folded in two, and with them, of course, the printed pages as well, making the opening of them out for reference or reading, as inconvenient as well can be imagined.

We looked at the affair, therefore, for a short time in that point of view; and found undoubtedly, that the present sarcophagus appearance has nothing about it which is in *excess* of the assumed original coffer; the characteristic being merely a small amount of defect therefrom; so that, given the coffer complete as the French *savants* pictured it, or as it proves itself to have originally been,—a clever granite-worker with appropriate tools could very soon do all that was required to bring about the present alterations; that is, to take off some very modest parings, from one angle chiefly, near the top. So proportionally small are they, indeed, to the whole work, that they *may* have been effected long before the French visit, and even in a certain not only pre-Al Mamoon, but now suspected pre-Cambysean, entrance into the Pyramid by Egyptians themselves; and have, by their insignificance, escaped the Argus-eyes of the learned Academicians.

Be that, however, as it may,—the Pyramid theory which brought us to Egypt, concerns itself not with what the vessel may have, at any subsequent time to its birth, been cut down to and made to measure as a sarcophagus, nor with the names of the perpetrators of such reduction,—but with what precisely were the vessel's cubical contents in its first and original shape as a coffer; and for the determination of this query, sufficient materials fortunately remain. The coffer question was therefore, in this manner, found to be essentially similar to every other problem

requiring settlement in and about the Pyramid, including the very Pyramid itself as a whole; for what that body measures now, after the injuries of four thousand years—injuries that have always been in the way of reduction of, and abstraction from, the original figure or size, never of adding anything thereto—is of no theoretical importance whatever; unless as leading to the discovery of original marks, capable of showing satisfactorily what the primitive size, at the time of the building, must have been.

With this general principle, therefore, strong on my mind; and some idea, too, that Bonaparte's French Academicians may have looked through the intervening reductions, up to what they concluded, on good mechanical ground, must have been the *original* form of the vessel before them, when they prepared its elevations, plans, and sections,—we went on with our present mere inspection of repair and disrepair; and, on looking over the edge into the coffer's interior, saw there only dust, dirt, and a huge lump of limestone.

'What is this great stone doing here, Alee?' I inquired.

'Why, the travellers want it whenever they come,' returned he, 'to hit the coffer with hard, and make 'a sound like a bell.'

'Then just have the goodness to take it out, and 'throw it down into that deep excavation under the 'floor,'—was the only answer that could be made

in the spirit of obedience to His Highness the Viceroy's desires touching the preservation of the monuments of Egypt, and with due respect to the principles of the Museum of Boolak.

But this little operation raised, into a smoke-like cloud, the dust that was more than two inches thick on the bottom of the coffer; and not for ten minutes or more could we see into it again. The whole floor of the room too was similarly covered with the infinitely fine, white, and dry limestone powder, that rose in misty haze with every step we took across it. This accompaniment causing the heat of the room to become oppressive, we examined interestedly the two openings of the ventilating channels in the north and south walls. Not a breath of air was passing through them. Alee Dobree said that was always so in the winter time; but that in summer, on a very hot day outside, a little motion of air could just be seen. He took us, however, afterwards to an excavation of Signor Caviglia's, tending north-westward from the entrance of the antechamber; and there we perceived the north air-channel, not only intercepted and cut in two; but the small remaining portion leading off to the King's chamber,—and where we had been experimenting very carefully for traces of ventilation-currents,—rammed full of stones and sand; and the same very modern choking was afterwards found to have been performed upon the larger remnant of the shaft leading outwards to the open

air; as well too with the southern as the northern channel.

I questioned the guide specially about these air-channels, drawing a vertical section of the Pyramid to 'place' every passage we had yet visited or seen; and he surprised me much by saying that there was another air-passage still; and when asked to take the pencil and show where,—he drew a shaky line leading out just over the entrance passage of the Pyramid. This being quite unrecorded by Howard Vyse, Gardner Wilkinson, or any other explorers, I immediately demanded that he, Alee, should take me to where it opened on the outside of the Pyramid. So in our way out, we merely stopped a few minutes to look in at the Queen's chamber, and take note of a monstrous quarry-hole in the eastern side of the floor, under the strange niche in the wall, and a huge heap of stones and rubbish in the north-west corner, rising nearly a third the height of the room: 'noysome savour,' indeed, 'and grave-like smell,' such as offended Sandys, we did not perceive, but of his 'rubbidge' there were whole waggon-loads; and then, in a few minutes more, we were ascending the outside of the Pyramid at its north-eastern angle.

Why we should go so far away from the vertical of the entrance passage, if the new air-channel had its opening close above that noted portal, did not appear; but Alee declared he was going the shortest

and easiest way. Yet still it was a long climbing up and up and up; so long, indeed, that at last we arrived at that large break-out in the corner, which is technically known to all the guides as 'half-way,' but is really rather more than half-way, to the top of the Pyramid; and when Alee began climbing higher still, I was obliged to remind him that we were not wanting then to visit the summit of the Pyramid, but only to see the air-hole he had spoken of, and shown in the drawing to be very much lower down. Still he said he was going to it as straight as he could go; and at last when there appeared very little more of the yellow Pyramid left between us and the blue sky, nearly overhead, he began to strike off horizontally towards the central vertical line of the northern face.

Now began the critical work; for hitherto, though the stair naturally formed by the courses of masonry at the corner slope, was often most inconveniently high for any man, other than a long striding Arab, to step up, viz., forty or fifty inches at a time, yet they were sure and safe; for they are generally composed of the hard Mokattam limestone, are free from *débris;* and, rising only at the *corner* Pyramid angle of 41°, have more horizontal than vertical surface. But the courses forming the general *side* of the Pyramid, were composed only of the friable rock of the Pyramid's own hill; were of the steeper slope of 52°, or necessarily with less horizontal than vertical surface; and were so decayed by the

weather, or obscured by gravelly matter brought from above by rain, that the ordinary stepped side of the Pyramid, in some cases degenerated to little better than the sloping surface of a mouldering but dangerously steep hill.

However, in one way or another we contrived to climb along with our faces to the Pyramid, until Alee came to a worked hole trending down towards the centre of the Pyramid at an angle notably different from the passages proper, or 32° 45′, as a pocket clinometer seemed to indicate. On noting this angle, however, and the height above the ground, I was obliged to exclaim, 'Why, this is Colonel Vyse's 'northern air-channel! where, Alee, is the other 'lower channel you promised to show me?'

'This is it; and it is the only one in all the 'northern face,' said he. (See Plate III.)

'But this is not in the position you marked in 'my drawing,' I returned, taking the paper out of my pocket, and showing him what he had there put in with his own hand.

Whereupon, borrowing the pencil again, he began to discourse on air-channels, and passages, and chambers; and while showing he did really know a great deal about them in themselves, yet exhibited the most singular incapacity for accuracy with regard to a drawing. For although the one before him, was on the small scale of only about three inches for the whole height of the Pyramid, he considered that putting the pencil-point within a whole inch or two

one way or the other of the right place on the paper, was quite close enough for all practical purposes; and that in fact, his zigzag marking for an air-channel near the bottom of the Pyramid was, to his eye and judgment, an absolutely identical line with my straight one near the upper part of the Pyramid; and that they both spoke with equal accuracy to one and the same air-channel, viz., the well-known one of Colonel Howard Vyse.

We had therefore been led a most needless climb after a fatiguing inspection of dark interiors, and began accordingly rather to underrate the faculties of Alee Dobree as a Pyramid guide; but when he presently turned round and pointed out, from that very notable height where we were then suspended on the Pyramid side, all the villages in the fertile plain of the Nile and southern end of the Delta; and named them by their names, and spoke of the old Arab bridges; discussed the recent inundation; described the various species of agriculture then commencing in the dark brown, well-wetted ground; and went into the hopes and fears and hard toil of the peasants at that, their cold season; but painted a glowing picture of the happiness that would ensue on the arrival of genial summer, when all the plain, now so black, would be bright green, and there would be food for everything with life, for the birds, the beasts, and the Arabs with all their families; that delightful Egyptian summer-time, he said, when all the crops would be so abundant, both the corn

in the fields and the cucumbers in the gardens, that every one might eat and have enough to spare for his neighbour, and no one need feel his heart contracted, or think the world was black before his eyes,—why, on hearing all this fluent outpouring both of local topography and good native sentiment, we could not but begin to see that Alee Dobree was a man of sterling moral worth; endued too, with quite enough general knowledge to become a very good helper in mechanical researches about the Great Pyramid, though not to be trusted again in any matter involving minute accuracy on a small-sized paper plan.

CHAPTER V.

WORKING PRELIMINARIES.

On returning to the 'East Tombs,' affairs were found there greatly advanced toward the possible, for modern civilized life. Old Ibraheem of the snowy beard was fertile in expedients; he had rediscovered, too, most of the wooden plugs inserted by Colonel Howard Vyse in the rock-walls of these convenient chambers; and driven nails or hooks anew into them, whereby to suspend both cleanly tapestry and curtain-doors; while at the same time he kept a whole drove of little Arab boys employed all the morning in bringing him water and Nile mud, wherewith he plastered up unsightly holes that might conceal a snake. He also made himself a whole kitchen-range, by building several little cast-iron boxes into a bank of stones, cemented and finished off at top with this cheap substitute for lime-mortar, so conveniently present to the hand of every inhabitant in the favoured Egyptian valley.

He had a peculiar gift likewise, in spreading the native reed-mats, to make a flat and clean floor; of which full advantage had been taken; both in the

bedroom decorated with the alto-relievos of the 'lady and gentleman'—or rather of the ladies and gentlemen, for there were two pairs of them—of four thousand years ago; and in the bower of stone, which had become a very respectable sitting-room for a modern party; with table, chairs, and boxes that held both sideboard fittings and writing-desk luxuries. An assistant, moreover, had been engaged; one Smyne by name, a regular Arab villager in look and costume, but very smiling, cheerful, and ready to help Ibraheem in anything and everything; besides continually declaring his purpose to serve us as long as we should remain at the Pyramids, and then accompany us back to Scotland, if we would take him. He was perhaps rather too abundant in protestations, and had given out already a large variety of information about himself; so that I was immediately instructed, among other things, that he was a pure Arab, and not an Egyptian at all, was aged twenty-two, and was going to be married the week after Ramadan.

Of course I complimented him on his prospects, which he acknowledged pleasantly, but then declared that his intended marriage was 'maleysh,' or no matter at all, and of no consequence whatever: which was of course thought very strange by the lady. But now Ibraheem demanded help, for dinner was ready to be served up, and the whole world would be out of joint with him if anything was to interfere with his arrangements there; so

the table being spread with a fair white cloth and the appointments of a small canteen, we waited to see what would come. First, a messenger with hot plates, wrapped up in a towel to prevent sand blowing on them in the short transit along the face of the cliff from the tomb-kitchen to the tomb-dining-room. How has that ancient mariner, thought we admiringly, been able both to cook the dinner and heat plates too at that miniature kitchen-range of his, where only a pinch of charcoal is burning in each of his primitive little grates? But while we are wondering, and have heard the lid of the big box,—the biggest of all our travelling-boxes, and which when emptied of its original contents of bedding, tent (lent us by our kind friend R. M. Smith, Esq., of Edinburgh), etc. etc., Ibraheem had immediately applied for and conveyed into the recesses of his tomb, to be both closet and lockers for all the paraphernalia of his art and his kitchen,—had heard the lid of this box open and close frequently with vehement bangs that made its hasps ring again,—suddenly, behold a procession; Ibraheem in his dragoman costume leading the way with one element of dinner, and Smyne in a long toga following him with another, and after him a similar but smaller chocolate-faced youth, and after him another smaller still, but each having something or other out of Ibraheem's big box; and our table is covered in a trice with everything that hungry human nature need

desire. A really good soup, rich, well-flavoured, and fair to contemplate besides; a small roast of lamb, done to an exquisite turn; pleasant-looking potatoes, not over-boiled outside, and yet, strange to say in modern times, done thoroughly through to the heart, such was our Sindibad's magic skill; and presently followed a sweet pudding, that looked pure as Oriental alabaster, and yet wanted nothing that pudding should possess. Of course we showered compliments upon the artist-author of all this performance in the desert, and the twinkling of his one eye which ophthalmia had spared, and the rising of the ends of his grey mustaches, told how much the praises were appreciated; evidently expected too—as why should they not have been, when he had been continually, morning, noon, and night, imagining and arranging the whole subject in his mind with the enthusiasm of any French *chef;* combined, however, in Ibraheem's case with the dignity of a Roman senator?

Who, however, were these little mites of Arabs, small by degrees, and, by courtesy, beautifully less, following Smyne? Oh, these, we were told, are his younger brothers; he has brought them over to do his work for him; it is not usual in Egypt for any one to perform other than the lighter and more ornamental parts of the work he may be paid to do. From head Basha to cook's scullion it is all the same: the man who is paid, pockets the money, and then looks out for some smaller or younger

man whom he can compel to do the hard work for him. The true 'génie Egyptien,' of all Cairenes, and others too, is to recline all day long on luxurious cushions; accomplishing nothing more than smoke tobacco and drink coffee in the cool shade, and see other men in the distance and broiling sun doing their work for them.

'Well, but all that is very immoral,' we remarked.

'Oh, not at all,' answered our Sindibad philosopher, 'not at all *here;* this country is not like 'yours, and there is no other way of getting work 'performed well in our land. If a man had to do 'with his own hands the work he is paid to do, 'why, his first thoughts would of course be to spare 'and cherish his own flesh—for what does a man 'care for so much as his own self?—but if he has 'some unfortunates under him to do his work for 'him, he never thinks about sparing their flesh or 'cherishing their muscles. Only look at Smyne 'now, so dignifiedly smoking a huge cigarette of 'his own lazy twisting up; he is already retired 'for the day from all active work, and which he 'can so well afford to do, because he has his small 'brothers before him to attend to any little *et-* 'ceteras there may be about the kitchen or the 'water-jars; and if they attempt to shirk the 'smallest portion of such duty, he cries out at them 'like an "efreet;" so then you see it is excellent 'education for them in the way of learning what 'they will have to perform as men; and it is not

'less useful for him, because it teaches him how to 'comport himself in any high office to which the 'Governor of Jeezeh, or the Kaimakan may raise 'him some of these days; and, as he says, who 'knows how soon Smyne may be elevated to be a 'Reis, and perhaps even made a Sheikh of Pyramid 'guides? But poor Smyne is always fancying that 'he is just going to become a great man, or that 'some very good fortune is to befall him,—though 'it never comes, and his friends are rather afraid 'that he is not very wise in the head.'

As we were far too much of strangers to presume that we understood the affairs and modes of going on in this country, we heard all and denied nothing. Besides, a report had to be written out on the state of the interior of the Great Pyramid, together with a project for its thorough cleansing; and the sensible Alee Dobree was waiting all this time to take said report over to M. Vassalis in his village on the plain. He had to wait too long after dark, for although there had been a blazing sunshine, blue sky, and high temperature throughout the day, yet the darkness came on lamentably soon, for it was yet the winter season of short days and long nights in this southern land; whence strange differences as well as resemblances began to develop themselves, day by day, between such an Egyptian sojourn and an ordinary summer excursion in the northern hemisphere,—where, when the weather is warm enough for tent life, or open cave and stone-

bower occupation to be indulged in with pleasure,—the days are so long, that little of stores for the night are required. But here, in Egypt, during January, we soon found that our hopes of making the best of opportunities, depended in no small degree on abundant supplies of lamps and candles, and the utilization of many of the nightly hours.

It was some time after my wife had retired to the sculptured room for the night, and I was still writing at the table in the stone bower,—when Ibraheem looked in at the upper corner, from the staircase ledge on the face of the cliff, and called my attention to something. 'Oh, so fat!' exclaimed he, while the fitful rays of two wax-candles twitching in the open but not windy air displayed his sage smiling countenance, and his hands holding up a couple of unfortunate fowls; and 'Oh, so fat!' exclaimed he again, on perceiving he was recognised.

'Are they not always fat?' I hastily answered; but the worthy man's philanthropic visage implied deep grief for my ignorance of the important things of life; for fowls in the Egyptian country are as a rule kept starving until close upon the time they are wanted for the table; and though several had been brought from the village that day, Ibraheem would have none of them, they were so poor and lean, fit precursors only to a famine in the land. So he had sent at last a special messenger to a village a great way off, where there was a Sheikh reported to have a couple of fowls really presentable before a cook.

Well, the time passed on again; moths from the desert came flying into the bower in abundance; and every now and then a great scarabæus entered with a grand tantarara of sound, knocking himself violently against something or other, and requiring to be forcibly turned out. The Egyptian land in front lay level and silent under the silver moonlight and the sparkling canopy of stars, while every now and then the Arab guards at top of the cliff were calling to those at the bottom, or *vice versâ*, 'Are 'you awake? open your eyes, open them very wide.'

Presently in comes Ibraheem again, looking now very solemn, and arrayed in a long white robe like a ghost; he seats himself on a tent-package half in and half out of the bower, and says, with a gravity that admits of no declining, that he has come to 'count with me.'

On what system of numeration? I am almost inclined to ask, raising my eyes from the paper; but he immediately begins to unfold an impressive tale,—so many paras spent for one article of provisions, and so many for another, and his powers of memory must not be disturbed in calling up the vision of the whole day's proceedings, for his brains are his only account-books. But as soon as the drift of his visit is apparent, he is told that he must not come to the gentleman about these difficult things; let him speak to the lady about them every day in the forenoon, and she will 'count with him' as far as he desires, and let him have all the money

too which he needs. And in fact that system was found to act ever afterwards so perfectly, that the gentleman was left with nothing but the Pyramid and its proper mensuration to think about, during all the rest of our occupation of the Eastern tombs.

Up soon next morning, and in time to see the earlier dark and coloured dawn of day before the brighter one, when colour is mostly lost in light; and splendid depth of coloured hues too did appear, —for the green of the cultivated land in the middle distance, relieved by the brown-yellow of the desert sands in the foreground, went off in the further distance actually into deep Prussian blue, before they faded again to join the haze on the horizon,— that warmed once more as it rose up to the general glow of lurid red, which belted all the lower sky. Such intensity of blue we had never seen before in any landscape, and the accompaniments rendered it perfectly harmonious.

As the day approached, the colour-effect decreased; but when the sun itself rose above the Mokattam Hills, and darted its long arrows of light through and amongst the palms of the nearer villages in the plain, there were powerful effects of simple light and shade that balanced or overcame everything else. Our night-guards were now seen on the illuminated sandy plain below, having performed their prostrations towards the east, wending their way towards their respective villages; whence

the shepherds with their flocks, as often leading as driving them, were diverging to their search after scanty herbage in stray nooks and corners of the desert; while between the nearest Pyramid village and our tombs, were observable, in long straggling line, Smyne and his little brothers coming in easy style to their practical school; with sundry others too, whom the calculating Ibraheem had organized into a service for bringing water and butter and eggs, and we know not what besides.

When during breakfast, he came to show a large plateful of fresh eggs just procured, and to receive compliments on their beauty; but was asked 'had 'he not got in plenty of eggs the day before?' then this untiring factotum explained, that for the present time merely, he had; but it would never do in the desert, to have supplies to last only from hand to mouth. For not on the ultimate, but the penultimate furnishings must we live, if we would avoid an occasional *contretemps;* and that at all events it was his duty to have something more and further always safe in his big box, beyond what all the Arabs round about knew anything of.

His calculations were indeed incessant, and ever forerunning the time; and were guided apparently in his mind by such an awful sense of the responsibility that rested upon him, combined with the duty of a certain amount of gentle despotism,—that it was quite bewitching to behold. So that, when my wife complimented him after breakfast this morning on

the magnificent bowls of coffee and milk; and asked, as an innocent matter of course, 'Are we to have coffee again to-morrow?' 'No!' said he, with the ponderosity of the Medes and Persians, but at the same time with a respectful bow, and a smile to assuage the rigour of the announcement,—'No! *tea* 'to-morrow: coffee the one morning, and tea the 'other.' There was, in fact, no disputing such a degree of firmness, relieved with philanthropy, and all being exerted for our good.

But now comes another party over the sandy plain from the village El Kafr, and bearing right to our tombs. It is M. Vassalis, and his host, the Reis Atfee; and when M. Vassalis arrives, he is in consternation at the report sent to him.

Now, the paper had rather struck me in writing it, as very moderate; for I had carefully omitted all notice of the four more important subjects contained in the second part of the memorial to the Viceroy,—as the contemplation of them had not seemed very agreeable to the Viceregal feelings; and I had merely described a cleaning of the interior of the Pyramid, beginning with the King's chamber, and so going downwards.

'Very well,' said the Superintendent of Egyptian excavations; 'but to effect that, you require that 'the coffer should be lifted up, and the flint pebble 'that is pushed in under one end, should be re-'moved; and you want all the rubbish, filling the 'ramp-holes in the grand gallery, picked out; and

'the broken stones on the floor of the Queen's 'chamber carried away, or filled into the hole there, 'and the obstruction in the lower part of the 'entrance-channel removed; and then, to have the 'whole of those chambers and passages swept out, 'and finally washed down with soap and water. 'Now, all that,' added he, 'will occupy a great 'deal of time, and Ramadan will be here before it 'is finished, and what will you do then?' Upon which the Reis Atfee shook his head in chorus, and intimated that he, Reis Atfee, did not understand how it could be done at all.

But M. Vassalis went on, regretting that he had not near enough men for the work; they were called twenty men, but there were really only two or three grown men amongst them, and all the rest were merely little boys. He qualified that indeed presently, by saying, that Arab men were too lazy to work, and all the great excavations in Egypt were carried on by boys. Colonel Howard Vyse's conclusions, after he had had the experience of employing from one hundred to three hundred, of men and boys, for six months together, was very similar; and the local report is now, that the Arabs are not such good labourers as formerly, even to the very moderate extent they ever attained to. Formerly, they were ordered to work, and beaten if they did not; whereupon they accomplished whatever they were desired to do; but now, men say, there is a new order of things—no compulsory

labour throughout Egypt for nothing. On the contrary, each man is paid something as labour-wages, and instantly the ungrateful fellahs exclaim,—'Hah! 'hah! the Basha is afraid of us; that is why he 'pays us;' hence they care not to work overmuch, in order to show their independence. It was a pity, some think, that the Basha, in his improvements, had rather put the cart before the horse; for he ought to have *educated* the people, *before* he treated them like free and civilized men. But in the meantime, were it not for the more pliant natures of the little boys, there would be little progress in all the land. Each of these boys was to be paid by Government one piastre a day, and the Reis five piastres.

But then, to return to the case before us, whether they were men or boys, what could a mere twenty do inside the Pyramid, when they had come here without anything beyond their baskets and hands? That was actually the primitive fact! for they had no brooms, no cloths, no soap, no ladders, no ropes; and in short, no anything at all, of all the many things that were absolutely necessary in any proper redding-up of the inside of the Pyramid.

Then, could not M. Vassalis apply to his chief, Mariette Bey, to furnish him with necessary stores?

Not then, for Mariette Bey had gone to Upper Egypt in company with M. Renan, and such stores were rather in keeping of other officials, who had their strongholds in the Citadel. The supplies existed there in immense quantity for the public

works; but the keepers thereof would not listen to him, M. Vassalis; or, if at all, not for weeks and weeks, and then Ramadan would be down upon us, and the whole thing would be over. In short, he considered there was nothing else for it, but for me to write to the British Consul, and ask him kindly to intercede with a certain Minister in charge of the materials of public works; applying urgently for an immediate supply of these stores, so evidently necessary to the good intentions and favouring orders of His Highness the Viceroy, towards Pyramid mensuration being carried out.

The Reis Atfee again shook his sapient head, as he sat just on the edge of the cliff outside the stone bower, enveloped in his toga, listening to everything; and remarked that he could not see how anything was ever to be done. But we thought there was much in the last part of the Superintendent's remarks, for the Viceroy had no doubt come out excellently well in favour of a scientific project, had given most liberal orders, and now his intentions were being neutralized by some want of correspondence between certain much smaller officers of his state.[1]

[1] Something of the same sort, but on a larger scale, had occurred to Colonel Howard Vyse, which he describes thus, under date April 24, 1837:—

'The work at Campbell's Tomb was again resumed. As the depth, 'particularly in the foss, had become very great, and the ropes were 'much worn, and therefore ill calculated to sustain the weight of the 'casks, which were secured with iron hooping, I entertained great ap- 'prehensions for the safety, not only of the people who worked at the

So the affair resulted in my writing a full account of it, both to Mr. Consul Reade and to our Consul-General also, for he had now returned from England; requesting their action in the matter, and mainly as they should see it for the interest of the Viceroy's credit in European scientific circles, that any small obstruction to the carrying out of his enlightened and liberal orders should be removed.

This done, and funds for the payment of boat-hire, etc., being supplied,—M. Vassalis and his attendant Reis left us, to see that the letters were immediately taken to Cairo by two of the biggest members of the youthful working party; though indeed Reis Atfee expressed his fears, that if they were very big, they might take the opportunity of running right away and never coming back. But when *he* had at length taken himself away to his

' windlasses above, but also of the boys, who were employed below in ' filling the casks. The greatest care was taken to keep the latter out ' of the way when the machine was at work, and luckily no serious ' accident happened: and an application was made to M. Piozan, the ' consul, by which I obtained an order for a rope to be made at the ' citadel; but, notwithstanding the order proceeded from Habeb ' Effendi (the Governor of Cairo), the people refused to make it, ' alleging that a "new machine was required to do so," although ' larger ropes had been made by the same people for Mr. Hill, when he ' had the care of the steam-engine at the copper-works in the citadel. ' As the application failed, Mr. Hill found in the Basha's stores some ' rope, that by splicing would have answered the purpose tolerably ' well. Another order was obtained, and was signed by the Governor ' and by all the different authorities, excepting one person, who, upon ' being informed that the rope was wanted for the Pyramids, refused ' to sign it. I was therefore obliged to send to Alexandria (one hundred ' and forty miles distant), and in the meantime to buy up any old ' cordage of sufficient size that could be met with at Boolak.'

darling village,—there attended upon us the other Reis, viz., Reis Alee Shafei, to see what could be done as a beginning of Pyramid-cleaning, pending the arrival of all that magnificent furniture now applied for from the Citadel.

Reis Alee Shafei was as brown as the Reis Atfee, and similarly costumed in red tarboosh, with bright blue tassel, a dark purple-blue toga folded around a nondescript dress of white, and supplied with sulphur-yellow slippers; but he was a much more noisy man; his eyes were large and prominent, as belonging to a loquacious temperament; and his beard, with the chin included, projected continually forwards, after the fashion of the language of self-esteem. He belonged apparently to Sakkára, from whence he had brought up his detachment of little men, and was now living with them in some of the tombs of the lower storey of our sepulchral cliff. Being furnished, therefore, out of our private stores, with lamps, candles, brooms, and lucifers, and taking with him his long wooden-stemmed pipe, off went Reis Alee Shafei and his little ones to the Pyramid, accompanied by Alee Dobree (who had now entered our service permanently), to show how the beginning of the cleansing was to be effected.

The latter soon returned to the Vyse instrument-room, and announced himself ready for work. Now the first thing was, to make a window-frame, door-frame, and door for the tomb-bedroom; whereupon

he stript himself of all outer clothing down to his long white shirt, and was ready, he intimated, for most egregious carpentry. 'All right, I know,' was his constant remark; but he set about hacking the wooden planks with the saw in such a style, that I had to stop his sawing, in order to teach him how to draw a straight line with a chalked string. 'All right, I know,' was the word again as soon as the paraphernalia were produced, so I left them with him for a time, while attending to other matters; but on returning, lo! he had discarded the string, chalked a wavy line, some two or three inches broad on the board's surface, and was sawing away anywhere within its broad limits; expending his strength uselessly in forcing the flat plane of the saw into a sinuous cut, but really flattering himself all the time that nothing could be straighter or more exact. So I found, alas! that I must do all the sawing myself, and there was much to be done before our rooms were properly fitted; but it proved excellent practice and useful preparation for the scientific carpentering, that afterwards fell to my undivided lot, inside the Pyramid.

Meanwhile the Reis Alee Shafei contrived to fill nearly all our horizon. Twice a day would he come for more candles, and lucifers, and brooms, and wooden apologies for scrapers, picks, and shovels; and announce that his work was going on gloriously, but was supereminently difficult. Each time that they swept the King's chamber, the dust for the

most part rose in clouds, filled the air, and made their breathing so difficult that they had to leave after a couple of hours of it; and when they went back next day, there was all that raised and flying dust of yesterday, neatly deposited again on floor and coffer and everything else, very much as before. Then when they came to the Grand Gallery, and began to sweep out its centuries of dust, and clear the ramp-holes of their collections of ages,—he made out, that the limestone powder rose in whirlwinds perfectly volcanic; and they heard travellers entering at the lower end, and saying 'What's all this? Dreadful!' and then exclaiming wildly, 'O take me 'out, take me out, or I shall die!' But the gallant Reis and his little men went on bravely for all that, and worked, they said, until they could see no longer; that is, they worked and he looked on, squatted orientally on the great step, and smoking his long pipe until the air was so thick, that there was no escape for the clouds he puffed out of his mouth.

When these heroes returned to the tombs, they did most assuredly look very dusty; and the poor little boys had white lines round their black eyes, caused by the quantity of white dust which had settled on their long eyelashes. And they were well worked too; for the Reis Atfee came over from El Kafr quietly and seriously, with very little talk and no noise, and gave them a spell at the sweeping, whenever an expedition to a neighbouring village for more tobacco or any other equally important

occasion prevented his co-chief, Alee Shafei, from occupying his usual post of distinction.

Once there was great excitement,—the Reis brought out of the Pyramid one of the little fellows in his arms, they said, half dead; first it was reported that he had fallen down the well; but then, that it was one of his companions had let his pick fall from a height on the other's forehead, and the news-telling in and about Ibraheem's kitchen was immense.

When my wife went to ascertain the facts of the case, and had the little boy brought up that she might see him,—finding him with a severe cut above his eyebrow,—she had the wound cleansed and bound up with plaster and a cambric handkerchief, desiring the wound to be looked after and kept clean. But Ibraheem said, 'O no! Arabs never 'touch a wound from the time it is bound up until 'it has become whole;' and true they kept to this maxim, as the little boy left a fortnight afterwards with the handkerchief still about his head, and certainly looking more black than white,—though, too, with a little care and quiet, not forgetting occasional tea and cake, the child had been able in a few days to resume his work merrily with his companions.

Next day, January 13th, arrived letters from both Consul and Consul-General; each of those powerful officials stating, that application had been duly made to the proper administrative Basha in the Citadel, who had admitted the propriety of the request and granted it to the full; so that the stores required,

would be sent out to us immediately. The only alteration, indeed, which one of these obliging officers had made in the text of my letter, was, that whenever I had asked for any smaller number of articles, a full dozen had been at once interpolated; and that instead of a few spars of palm-tree wood, a whole palm-tree trunk would be sent, and a carpenter also to cut it up, as we should desire: so that evidently the Government working-party at the Pyramid would soon be overflowing with ladders, and wooden scantling, and ropes, and candles, and lamps, and soap, and brooms, and water-skins, and everything else that was necessary to their employment; and likewise to prove before the world, that modern Egyptian civilisation is no untutored inefficient sham,—but a reality, capable of acquitting itself satisfactorily before Europe and America, even to the intricacies demanded by a new scientific question of the present day.

This was indeed good news; and the Reis Alee Shafei, whenever he was out of the Pyramid, was parading continually up and down the catlike path that led from the base of the cliff, past our bower of stone, into Ibraheem's tomb-kitchen, where coffee in little cups was always dispensing. Thereabouts was the Reis for ever to be seen; going and coming with his purple upper-garment gathered about his shoulders in many folds, and his brown legs protruding below out of his manifold white wrappers, —as he picked his way gingerly along, in his prim

sulphur-coloured slippers. But though in ever so great a hurry otherwise, yet he never failed to stop before our open sitting-room, to describe the excellence of his work in the Pyramid, and the unwearied diligence he was displaying; and to apply, at all sort of inconvenient times, for more of our candles and lamps; or, more frequently still, to express his deep regret, at our not appearing to know that there was in our service one of the best Reis in all Egypt, a man with few equals in looking after and making others work, and a perfect lion at cleaning out, by their means, the inside of a Pyramid. Ah! such neglect he might experience now, he would exclaim, but when once the Citadel stores from Masr should have arrived,—according to the magical effect of that wonderful letter which had been written,--then his light would no longer be concealed; and we should witness such performances, as should teach us from that time forward, eternal admiration for the abilities of the first captain of the excavations at Sakkára, viz., that inimitable 'warrior,' the Reis Alee Shafei.

CHAPTER VI.

ARRIVAL OF RAMADAN.

On the 14th of January a regular meteorological journal was commenced at the East Tombs; not merely for that general satisfaction to the mind which one feels, when something of the sort is being carried on during a temporary residence in localities seldom observed in,—but as having a bearing on one of the great standards, believed from theory, to exist in the Great Pyramid.

In this point, as well as every other that was successively examined by measurement either in or out of the Pyramid,—the sole use made of any theory, was merely to direct attention as to what to try to measure with all available accuracy, and by means of checks from various sides; but that amount of assistance having once been obtained, all further reference to theory was postponed for a year and a day, or until the whole mass of observations should have been finally taken, recorded, and set in their proper order as mere observations of facts and phenomena.

The time, indeed, during which we were to stay in the neighbourhood of the Pyramid,—a portion of

time too short for all desirable objects, but yet too costly for extending,—was to be even further restricted to nothing but observing; all reductions as well as discussions being left to other times, places, and perhaps hands also.

Thus it was that we set up the little Venetian-blind box containing several thermometers, wet-bulb and dry, with an aneroid, duly tested, in the stone-bower dining-room tomb,—a famous place, with its broad, breezy opening to the north-east for true *shade*-temperature; and began the register, which, after three or four months' daily work, seemed in bulk at least to give promise of some useful data. And if that eventually prove to be the case, the credit is due to my wife, who took almost entire charge, even to the hourly observations which were frequently indulged in.

On first unpacking the thermometers, which had been lying for a week in the Howard Vyse instrument-room, in the midst of the generally non-conducting matter filling some of the large boxes, they all showed a temperature of 59°; very probably a good mean temperature for the early part of January in this region; though for the latter part of the month, something like 60° or 61° seemed to be closer to the true quantity; and with a range between maximum by day, and minimum by night of from 12° to 18°. At all events, whenever the night-air was registered below 50°, our Arab guards were very restless; complained of cold; and the three men

at the top of the staircase—would establish themselves all night in the little court between our bedroom and Ibraheem's kitchen; and there they would smoke and spit and eat dates, throwing the stones all round about, regardless both of Jinn and the sons of Jinn, while they did continue to talk, talk, talk incessantly; and all their talk, we were told afterwards, was about money.

Sometimes we had to call out to Ibraheem, that the lady could not sleep on account of the noise, and he would reprove the talkers with the dignity of a prophet; but when they had given us time to doze away again, back they came to their favourite subjects; viz., gold, and the astonishing prices that Arabs were now getting for every article of produce in these times of Egypt's cotton-fever; as well as the wealth, dimly alluded to, that they themselves were hoarding away somewhere or other, unknown both to the Government and their Coptic tax-gatherers, —all these mammonian topics would afford them occupation for an earnest, steady, grinding sort of talk, that went on thenceforward, without one minute's interruption, until daylight did appear.

Whenever, on the other hand, the noontide temperature rose to 70°, the day was voted hot; and the 'travellers' from Cairo would be so exhausted, that great six-foot men scorned not to be carried up the steep slope of the Pyramid hill, sitting on Arabs' shoulders. Where all these streams of travellers, as their generic appellation among the Arabs seemed

always to be, were coming from, we could form no idea. Divers and sundry books of modern travel, had led us in past years, rather to infer that their respective authors had distinguished themselves among their kind, by an act somewhat uncommon, combined even with a dash of heroism,—in that they had not only visited, but actually ascended, the Great Pyramid. Yet now, behold every day, and day after day without fail, party after party of travellers, either coming to or going away from the Pyramids; and continuing so to do, from early morn to an eve, which here was not dewy, but warm and, for expression of dryness, maintaining a difference between wet and dry bulb thermometers of from 7° to 10°. This never-ending succession too of strangers was occurring, notwithstanding that the late irrigation-flood had left such long deep pools of water remaining persistently behind it,—that the riding donkeys from Cairo, unable to ford the depths, were still obliged to remain on the farther bank; while their late riders performed the concluding part of their journey either on foot or Arab-back.

Our position, too, in the East Tombs was singularly convenient for overlooking all these social phenomena, and yet without being positively disturbed by them. For, right in front, or eastward, lay the nearest Pyramid village; and when the travellers had rounded its mud-houses and date-palm groves, and passed through its breadth of cultivated land in Indian file, and in line directed due west or straight

to us,—they always slanted off ultimately, slightly northwards or southwards, on reaching the sandy plain at the foot of the hill: the former parties intending to visit the Pyramid first, and return by the Sphinx; and the latter parties blessed with the idiosyncrasy of doing it *vice versâ*. So that those who with them, charged the hillside about a quarter of a mile to the *south* of us, running straight towards the great idol's face, and then were lost sight of for a time away at our backs westward, as they went round to where the Pyramid stood,—would reappear several hours after, their bulky luncheons disposed of, and the sights 'done,' descending leisurely about the same distance *north* of our position:—a happy position, left thus unannoyed personally by visitors, untouched by traffic, and solitary in the health-giving desert; yet having withal streams of human life passing by it within easy eye-shot on either side.

So easy, indeed, that we could speculate, by the air of the several members of a party, as to whether they were English, French, German, or Dutch. And yet, abundant specialities though they had connected with their nations, there was one point in which they all coincided; viz., in having such an abundance of white drapery about their hats, that they looked, all of them, more or less like a set of negative undertakers, or as funeral mutes displaying a wedding-garment where the crape should have been. Of course, all this was to keep them from having sun-stroke; and being so generally adopted

must be concluded to be necessary ; but then what should make the sun strike so fearfully hot in an Egyptian winter-time, when the sun rises no higher in the sky at noonday, than it does in Scotland at springtime ! Nay, it rises in Lower Egypt, whether in winter or *summer*, hardly any higher towards the zenith, than it does in our healthy colony of the Cape of Good Hope ; and yet men are not there for ever putting tablecloths round their hats, either in the hot, or much less in the cold season of the year.

So we began to doubt whether our meteorological journal was correctly representing the climate by rendering only the shade-temperature—which was exquisitely moderate even at noon-day, say 60° to 70°,—and not that in the open sun also, which might occasionally rise to 100°. A few trials, however, soon showed where the puzzle lay ; and that though there was a certain amount of effect from the general surrounding temperature, the main influence was the wind ; for, in a perfect calm, the exposed thermometer got extraordinarily hot ; but the instant a breath of wind began to blow, away went the heat, *i.e.*, all the excess of heat above a shade-temperature, to visit distant lands, or wherever the movements of the atmosphere should carry it. One and the same sun, therefore, shining from the same angular height in the sky at the Cape and in Egypt, is, in the former region, quite innocuous, because there is always such an eternal wind blowing for ever and ever there, from one end of the year to the

other; but in the latter region, we were daily entering in our journal, 0,0, for the wind return: and *therefore* no Frank ventured forth without his head-gear enveloped in seven-fold white linen, and with streamers of the same hanging down at the back of his neck, to protect the spinal marrow.

Ought a meteorologist then to note in his journal exposed, as well as shaded, thermometers? If his object is the climate for social and agricultural purposes, for the good of those constant crops, crops, which one always hears of in a landlord's meteorological society at home, let him do so if he has time; but it is not necessary; for, given the shade-temperature, height of sun, and velocity of wind, the exposed temperature can be readily approximated to, within such limits at least as it need ever be inquired about. If, however, his object is to obtain, in the interests of high physical science, the direct radiating power of the sun, quite apart from the temperature actually impressed upon anything material, under circumstances too which include many other unknown quantities,—let him shun an exposed thermometer as he would the Evil One; and take instead to regulated observations with Sir John Herschel's blue-fluid, adjusting, actinometer; the only instrument ever invented which really meets the case; and at once, the most exquisite, troublesome, and ungratefully treated by practical meteorologists, of radiation instruments which the learned world has ever had placed in its hands for noble ends.

All this attention to matters of the weather was not paid without divers interruptions; the most conspicuous of which were without doubt, whenever the gallant Reis Alee Shafei came out of the Pyramid, and had yet more magnificent accounts than before to give of the progress of his cleaning operations; or demanded still more of our candles and other stores, all to be repaid when the Government supplies, promised through the British Consuls, should arrive. But one Sunday morning came another and a more serious affair; for, enter Ibraheem into the stone bower, looking very solemn, and he seats himself at once on the tent-bundle, near the entrance, as if there was a long piece of business to discuss; behind him comes Alee Dobree, who sits native fashion, on his heels, all crouched up within a few inches of rock; Smyne follows, leaning half in and half out of the bower; and on the rock-cut flight of steps beyond, or on any projecting crag of the cliff, wherever a view of the interior of our bower can be obtained, clusters a variety of Arabs whom we have never seen before.

To something of this congregation kind, indeed, we had become tolerably well accustomed; viz., to living not only in the open air, but in open view of every one who should choose to take the trouble of coming to sit down on the rock and look at us, whether we were, at the time, observing, writing, dining, or anything else; while, if strangers called on us for any purpose whatever, these Arabian chil-

dren of Heth sat themselves closer still in our doorway, so that they might hear every word that was said; and rather thought they were showing profound respect, and paying us immense honour thereby, than otherwise. But on this Sunday morning they accumulated to an unprecedented degree, and Ibraheem began to unfold before them, as well as ourselves, what he had come about.

He commenced indeed with his usual clear English of 'Excuse me,' but then passed into a sad jargon of several languages; so that we had to appeal for explanation to Alee Dobree, who cleared up some parts of the other's harangue, but mystified others by the frequent use of 'I know,' and 'all right,' accompanied by other words which were totally unintelligible; and then Smyne sometimes put in his speech to assist, one-fourth in English, one-fourth in French (the which he gave too with infinitely more of the true Gallic *verve* than we could do), and one-half in his own tongue unalloyed.

So after listening patiently to all three, we had to sum up the several intelligible items, and then put it to the speakers whether we had understood the case; viz.: Alee Dobree's brother lives in the Pyramid village yonder in the plain, whence all our milk and eggs and fowls are derived, and he is a Pyramid Sheikh. He is not Sheikh of the village —that is quite a different office,—but he is Sheikh of the guides who attend upon travellers when they visit the Pyramid; he is one Pyramid Sheikh, and

the Sheikh Murri of the second and southernmost Pyramid village, who accompanied us from Jeezeh, is the other. Now, only yesterday, Alee's brother, or Sheikh Abdul Samed, was going into Cairo on some business of his own ; and when he was passing through Jeezeh, the Governor there got hold of him and put him into prison,—the news whereof had just arrived in village El Kafr, and the people were all in dismay.

'Is that what you mean to say?' we asked.

'Yes, that is it,' gravely replied Ibraheem ; and 'Yes, that is it,' shouted all the children of Heth sitting in our doorways and pathways, and wherever they could look in upon us. 'That is it, and 'that's the way the French Consul treats us ; and 'we have no liberty at all, and we are always 'afraid of our lives whenever we pass through 'Jeezeh.'

'But what has the French Consul to do with it?' we inquired.

Then began Ibraheem, and after him Alee Dobree, to recite,—that there had been a party of French travellers at the Pyramid the previous week, and one of them on returning to Cairo found that he had been robbed of his purse : so he reported the matter to his Consul, and he to the Governor of Jeezeh, who then laid hands, as described, on the first Pyramid Sheikh who came into his neighbourhood ; and that one, as fate would have it, happened to be poor Abdul Samed. Yet Abdul Samed had

not committed the theft, nor yet any of his people; but it had been the work of the 'bad Arabs' of another village, much nearer to Jeezeh, where the travellers had had to leave their Cairo donkeys, and be carried through the water on men's shoulders. And Abdul Samed had told the soldiers so, but they would not listen to him.

'But of course the Governor of Jeezeh,' said we, 'will inquire into the whole affair; and when he 'finds that it was the people of another village 'who committed the theft, he will immediately 'release Sheikh Abdul Samed.'

'Ah! that might be so in your country,' replied Alee, 'but it's not so in Egypt; for here, the 'Governor of Jeezeh will only listen to the French 'Consul, and he again will only believe what the 'French traveller says; and then they will order 'my brother to be bastinadoed, if he does not pro-'duce the purse the Frenchman lost.'

'Yes,' added Ibraheem, looking very doleful indeed; 'they'll throw Abdul Samed down on the 'ground, and they'll fasten his feet to a piece of 'wood, and hold up the soles of his feet,—and then 'two soldiers will stand on either side with sticks, 'and they'll beat the soles of his feet until they 'are all broken and the blood running down. Poor 'fellow! poor fellow!'

'Yes, poor fellow! poor fellow!' cried all the children of Heth outside; 'and that's the way 'the travellers treat us poor Pyramid Arabs. We

'take the travellers up the Pyramid, which they 'could not do by themselves, and bring them down 'again so safely that their feet never slip; and then 'they go back to their Consul and tell him what-'ever they like, and the Governor of Jeezeh puts 'us into prison. So the poor Arabs have no 'peace or comfort, and all because European travel-'lers will come every day to eat their luncheons at 'the Great Pyramid.'

'Well, this is a very sad story,' we replied; 'but what can we do?'

'Oh, you can send a letter to the English Consul,' answered one of them, 'and that'll make it all right.'

'I don't see that at all,' was naturally the reply; 'it is a case of a French traveller and the French 'Consul.'

'Well, that's precisely what makes it so bad,' said another of them; 'because the Basha always 'does whatever the French Consul asks him to do; 'and he'll send Sheikh Abdul Samed to dig in the 'sands at the Suez Canal, and the poor fellow will 'never see his village again.'

'Then if the French Consul is so very powerful 'with the Egyptian Government, what is the use of 'writing to the English Consul?'

'Ah, it would be of great use,' was the Arab's answer; 'because he could tell the Governor of 'Jeezeh that it was not the Pyramid Arabs that 'stole the Frenchman's purse, but the Arabs of the

'other village; and then the Governor would send 'for them, and he would find out the truth.'

That was certainly not any very extravagant demand, yet we pleaded that we had no power with the English Consul; and that, if he thought in his own mind, and for his own reasons, that it was not a case where he could with propriety interfere, he would not do so, though we should write him letters never so many on the subject.

But one or other of the party argued, that if we were to describe the case just as it had happened, or rather been related to us,—the English Consul would then know something that he did not know before; and perhaps he would then do something which otherwise he would not have done; and in his, the British Consul's land, the governors did not punish one man for what another had done; and then a letter was in itself, the Arabs averred, a wonderfully powerful thing; it was a talisman: and had it not produced all the stores of candles, and spades, and ropes, and ladders, and everything else that I had wanted from the Citadel for cleaning the Pyramid?

The promises of them only, we explained; for the articles themselves had not yet arrived.

But all the children of Heth sitting in our doorway again raised their voices together, and declared that a letter would do everything, and without a letter being written Sheikh Abdul Samed would never be let out of prison; so at last I wrote a mere description of the event, as of what had just

been told us, to Consul Reade: and warning them all that it could not *oblige* him to do anything, read the contents before the assembled multitude, and then handed the paper to Alee Dobree; who, with a particular friend of his, immediately started off to walk with it under the broiling sun to Cairo; while the rest of the assemblage peacefully dispersed, and were soon lost sight of among tombs and sand-hills, leaving us to that quiet which we so much desired.

But it was of short duration, for within two hours, back came Alee Dobree with the letter unopened, and with Sheikh Abdul Samed too and his eldest son,—the prison deliverance having already been accomplished. A large French pic-nic party had wished to visit the Pyramid that morning, and desiring to have a particularly good guide, their Consul requested the Governor of Jeezeh to release Abdul Samed for the office,—the affair of the purse notwithstanding,—and it had been done; wherefore here was the Sheikh sitting in our bower, delighted at the escape he had made. Of course Ibraheem brought in coffee, and after handing cups to the Sheikh and Alee, we innocently did the same to the son, who was standing behind them; but the elders cried out at him, on account of the unheard-of indecorum he was about to commit, viz., a young son to take any bodily sustenance in presence of his father! and the youth had to dive behind a projecting corner of the rock and drink off

the draught there out of our view; which he did, however, in a masterly fashion, from the quickness with which he returned presenting the empty cup.

Next morning came our standing dish of excitement, viz., the Reis Alee Shafei with one of his peculiar difficulties; he had tolerably well cleaned all the upper part of the Pyramid in a dry way, and was now exceedingly busy removing the obstruction in the entrance passage; he had already taken from thence unnumbered baskets full of sand, if we could believe him, but had just come suddenly to some great blocks of rock which he could not move. We paid him therefore a visit at his work, and found him seated with the dignity of a Basha, smoking a long pipe, on one side of the top of the entrance passage, and timing the poor little boys, who came up at intervals, one after the other, and then emptied their baskets of sand and limestone rubbish over the cliff-like edge of the lower part of the Pyramid side,—whence there rolled up again a white smoky cloud on each occasion.

Giving the boys therefore a respite for a while, I went down the passage, and found sure enough that some monstrous blocks of stone were included in the remains of the bank of obstructing sand: but then they were no part of the passage itself, having been rolled into it out of Al Mamoon's hole to give strength and solidity to the abnormal heap so recently put there for no good purpose. I noted

therefore that if the blocks were so big that they could not be pulled out whole, they should be broken in pieces where they stood, and so be taken out; and this opinion I sent to M. Vassalis. But then came that gentleman from the village, attended by his faithful henchman, Reis Atfee,—as woe-begone, desponding, and respectful as usual,—inspected everything, agreed perfectly as to the architectural correctness of my views; yet feared, that as his instructions so pointedly said he was not to allow me to 'break the Pyramid,'—he might get into trouble if he allowed anything whatever to be 'broken up;' for mere officials would take hold of the fact of breaking, and not care to inquire what it was that was broken, whether the Pyramid itself, or something recently brought there to do mischief. Besides, added M. Vassalis, he had not at present any hammers, or wedges, or necessary implements for breaking up such large stones; all these things were still in the Citadel; could I not therefore forego the full cleaning out of the entrance passage, and find something else to utilize the remainder of the men's time, until Ramadan came? But he would in the meantime write to Mariette Bey, and when that chief had finished attending upon M. Renan and M. Pereira, the rich French banker, in Upper Egypt,—doubtless he would come to the Pyramids with plenty of men and means to do all that was further required.

Now, it did happen rather fortunately for such a

conjunction of affairs, that according to John Taylor's theory of the Pyramid, there is very little scientific importance in the lower part of the entrance passage; and we had, in the meanwhile, in our daily walking and exploring round about the Pyramid, alighted on certain features on the hill-surface outside, which seemed to have something about them that promised to be, theoretically, of amazing interest. These features were, a system of three large trenches on the eastern side of the Pyramid, radiating from a common central point; that, could not be accidental, if it was exact; and there seemed also to be something special in the angles, at which the forms diverged one from the other. (See Map, Plate II.)

Now, these trenches are represented on most modern maps of the Pyramid, though not very accurately, nor with any geometrical qualities hinted at as belonging to them; they are, on the contrary, by some called tombs, and by others said to have been places for mixing the mortar in. With all such explanations, we did not then presume to quarrel at all,—but only set Reis Alee Shafei and his little men to clear out the rubbish from the ends of each trench, —and thereby found square terminations chiselled more or less accurately into the firm and solid limestone rock of the hill. These fiducial terminations, therefore, rendered us happily independent of the generally ragged and mouldering sides of the trenches (reduced to this state merely from having been more exposed to the weather), in fixing the

positions of their central axes. On removing, too, a certain intercepting heap of stones, a fourth trench, cut likewise in the lime rock at some antique date, but of much smaller size than the rest, was found to trend on the same centre as the three larger ones.

But meanwhile, time was flying apace; and daily did the Reis Alee Shafei warn us of the approach of Ramadan, and how soon we must lose his valuable services. So at last we turned again to the inside of the Pyramid, leaving the exact work at the trenches to a future occasion.

One day, indeed, besides the ordinary Frankish travellers, and their attendant Arabs, the whole plain was in motion with Turkish soldiers, galloping hither and thither on spirited Arab horses, and in attendance around a cavalcade of some extraordinary native grandees. Who can these be? thought we. Our desires prompted the ready answer,—'Of 'course it is Nubar Basha, from the Citadel, with all 'the ladders, and ropes, and water-skins, and build-'ing materials, so long promised, so long deferred; 'and he must be accompanied by the British Consul-'General in full costume, with his cocked hat and 'long white feather; for that eminent official must, 'by this time, have become determined to see that 'what was promised to him, as the representative of 'the might of Britain's Queen, shall be performed; 'and that the very moderate character, and trifling 'amount of a scientific demand, are not therefore to 'be the excuse for breaking faith,—which is holy, and

'regards alike both small and great.' But, alas! the party was nothing of the sort. The grandees were from Constantinople, attended by Egyptian troops, and their feasting was glorious at the foot of the Pyramid; a few went to the summit to look at the fatness of the land; and one private soldier of all that enormous party of Bashas, Effendies, and Nizam, one private soldier was the only man who had curiosity or enthusiasm enough to go inside the Pyramid. It made Alee Dobree quite mournful to have to tell how the Pyramid had that morning been despised by the present national owners thereof.

But for ourselves, we now gave up all hope of the promised stores, and in default thereof, turned out all our own pots, pans, tin boxes, portable bath, and everything that could hold fluid; made up impromptu mops, etc. etc.,—and then there was soon a great carrying of water to the Pyramid, and a grand washing down of its interior floors, which had been already, in preparation for it, dry-cleaned again and again. Then an inspection was made by M. Vassalis, myself, and both the Reis,—and the several chambers were found cleaner than they had been for ages; the ramp-holes unchoked; and the floor of the Queen's chamber freed from all that hideous encumbrance of 'rubbidge,' that had for ages quite destroyed its fair proportions.

The coffer was still tilted up by the stone shoved under one end; 'but when Mariette Bey comes,' said M. Vassalis, 'he will doubtless bring beams of

'wood and powerful cranes, and he will lift the 'coffer right up; and besides taking away the stone, 'let you see if there is anything on the under side, 'as some persons suppose; and then he will put the 'vessel down flat on the floor again, so that it may 'stand without any strain, and enable you to get 'the most exact possible measures.'

So we had every reason to be thankful for the large amount of preparation of the Pyramid that had by this time, in one way or another, been accomplished by orders of His Highness the Viceroy, as well as for what more was now promised; and therefore took kindly leave there and then of M. Vassalis, who was to quit his village for Cairo early next day. But the Reis Alee Shafei, being anxious to start off for Sakkara, with all his little men, immediately required our attention; so Ibraheem was ordered to prepare an immense amount of coffee, and to sugar it well; and all the little men were brought up to the level of the tomb dining-room, regaled with coffee and biscuits, had some silver baksheesh given, and a little speech made to them,—as to how, if they continued working on bravely as they had been doing, they might all come to be Reis, even like the gallant Reis Alee Shafei. But prospect of promotion on account of merit, seemed incapable of conception by any of them, and caused not the brightening of a single eye; or at least, not to the hundredth part of what the first glimpse of either coffee or silver produced.

The Reis Alee Shafei, as his merits demanded, received a speech too, and a golden baksheesh; and, at his particular and urgent request, he had a 'letter' written for him also; everything was then complete; and after a great shaking of hands, he descended the cliff, bestrode his bridleless and saddleless donkey, fired into the air his huge flint-and-steel horse-pistol, charged with about four times as much powder as was safe, 'to show that he was very 'happy,'—and in a few minutes more, he with his little troop were seen small as ants on the distant plain; while their tombs, those they had so long occupied just below ours in the limestone cliff, and where they used to make their smoky fires every night of grass roots dug out of the sand, were now as silent as the grave.

A little too much so indeed that night, for no night-guards came; and Ibraheem was greatly troubled, urgently requesting me next morning before sunrise, to send in a special letter about it to M. Vassalis before he should leave the village. This was done, and that gentleman very kindly took such energetic action, that presently the Sheikh swore to him, by a most immortal oath, 'that such a neglect 'should never occur again;' and in the course of the day he, the Sheikh, came over and described all his arrangements for securing the service, repeating on his fingers again and again, sounding Muslim names of all the men who were charged to come in turns to defend us during the hours of darkness.

Thus encouraged, Ibraheem returned with complacent satisfaction to our instruction; both telling us how he had seen the new moon last night, and describing the grandeur of the month of religious fasting, which was therefore (*i.e.*, so far as the moon was concerned) to begin for him and his brethren that evening, January 27th; he even went beyond the law, declaring that he not only would not eat all day long, but that even by night he would only partake of anything at midnight,—yet that all our meals should be prepared just as usual, and Ramadan should make no difference to us. Smyne was also loud in his declarations of the heroism with which he was going to act when the time came; but Alee Dobree was more quiet, and both of those men took themselves off early in the afternoon, to have one more daylight meal in their village, before the period of abstinence should begin.

So it came to pass, that with Ibraheem alone in our neighbourhood, we saw the sun's light that evening gradually fade,—saw the long-pointed shadows of the Pyramids slowly advance over the plain towards the east; further and further, even to the distant palm-groves on the Nile banks; and then to the rock-faced Mokattam Hills beyond,—decorated at their northern termination with the dome and minarets of Mehemet Ali's mosque in the Cairo Citadel, and the sterner single minaret tower of the mosque of Sultan Hassan below.

We gazed on them from our elevated cliff until

the last reflection of sunset had faded from the scene,—and then, flash like lightning went one gun, then another, and another,—first from the southern side of the fortified keep, and then the northern,—then from out of a concealed battery some way off on the top of the hill-range, came a new series of cannonadings, in answering flashes like the return-strokes of many lightnings, or like their fitful playing about some high mountain-top, when dense clouds have accumulated during hot and calm summer weather. Presently the booming sounds of the guns began to arrive, though, on account of their great distance from us (about 38 seconds in time), at no intervals very easily recognisable with the immediate flashes; and when twice twenty-one reports had spread their low thunders over the valley, old Ibraheem exclaimed, with extended arm, 'Fasting, fasting,'—and Ramadan had fallen on all the Egyptian land.

CHAPTER VII.

OF PASSAGES AND ANGLES.

On the first morning of Ramadan, Alee Dobree made his appearance punctually; and, taking him into the instrument-room,—where, though I was rather appalled to look round at the number of boxes, and think that all their contents had now to be employed in measuring the Pyramid in one way or another, yet he uttered the encouraging sentiment, 'Some of them may be very heavy, and re-'quire many men, but let us see first what we can 'carry ourselves,'—taking him there accordingly, I gave him for load a variety of measuring-rods; and, furnishing myself with pens, ink, and paper, was just in the act of setting off to begin my own particular portion of work in the enduring monument of the primeval ages of the world,—when behold Reis Atfee, and looking more cast-down and hopeless than ever.

'O Reis Atfee, what hast thou now come to tell 'us cannot possibly be done?' Then he calls Ibraheem, and they both sit before us in rabbit-fashion on the stone step in front of the bower, and explain,

that though the Reis Alee Shafei had made all the noise in the recent Government proceedings for cleaning out the Pyramid, yet a full share of the work had been performed, or superintended by Reis Atfee; wherefore he, having heard that Alee Shafei had had a *letter* written for him, now desired a similar document for himself.

So then a raking-up of the coals takes place; and Alee Dobree, joining the sitting-party, assists in testifying that Reis Atfee, though much given to lugubriously mourning the impossibility of things as seen in the future, and always distrusting his own capabilities for what may fall eventually to his share to perform,—yet ever attended to present work with unflinching perseverance and an abiding sense of duty. That whenever it was his turn to take the boys to the Pyramid, he conducted them there and back by the shortest road from their tombs, and *that* lay out of view of ours; whereas Reis Alee Shafei as invariably made a detour with them purposely past our doors, so that we might see to the utmost everything he was doing on our behalf. From all which, the public opinion of the Arabs seemed to be, that if the Great Pyramid was now in a cleanly condition, as much of the credit,—granting always the superior places occupied by M. Vassalis and Mariette Bey, with the orders of His Highness the Viceroy,—fully as much was due to Reis Atfee as to Reis Alee Shafei. This being the case, a letter, as requested, was forthwith in-

dited, in no very glowing style, though Reis Atfee accepted it most gladly; deposited it low in an endless depth of pocket; and when we added baksheesh, declared he had not come for any purpose of that sort, but merely for the unnameable advantage of a 'letter,' which he could not read, and I had no opinion of. To carry out, however, our notion of even-handed justice, we were compelled to force the money upon him, and then escape up to the Pyramid.

There, at the north-east corner, were already assembled not only the Cairo servants and travellers, feasting as through the last month,—but now all their donkeys were there as well, glowing in those scarlet saddles and decorated bridles so invariable in the city, so rare in the country. The intervening water, it then appeared, had shallowed so much that those small quadrupeds could now ford it, and were made without scruple to bring their hirers the whole way to the Great Pyramid itself. We saw accordingly marked off on their haunches and saddle-girths, precisely how far the water had reached; noting, too, day after day, from this time forward, on these moving Nile-overflow-meters, how the depth abated apace; until in three weeks' time they all came through dry-shod, and then Cairo travellers swarmed over with their luncheon-boxes, and experienced neither let nor hindrance any more.

Meanwhile, on this first morning of the country's solemn fast, Alee and myself made up to the entrance passage of the Pyramid, on measures alone intent,—

but found the place completely in the hands of a host of travellers, their Arabs, and half their donkey-boys; and such horrible confusion was enacting as to the prices they would have to pay for going in or going up, combined with declarations that they did not believe there was anything to be seen in either direction, but that it was a mere sham and imposture of the Pyramid Arabs to get money out of them, the travellers,—all this, united with the discussion amongst the Frankish portion purely, as to whether they should have their luncheon before or after they had seen the sights,—made us willingly abandon the place to them for a time.

On returning after an hour and a half, the region was silent, the travellers had seen all they cared to see about the greatest of all the seven wonders of the world,—the only one of them that has come down to our own times,—and were back to the 'victorious city;' while the Pyramid Arabs had wrapped themselves up in their multitudinous woollen garments, to sleep under shadow of a few projecting stones at the north-east corner, but be ready and on the spot for the next party of travellers at whatever moment they should arrive; keeping themselves too under favourable circumstances, for stifling the calls of forbidden hunger within them. Under this improved aspect of affairs Alee Dobree and I returned to the entrance-passage work, and now came the question what were we going to measure?

The length of the passage, of course. But what

defines that length ? Originally, the exterior surface of the Pyramid above, and the subterranean chamber below ; but the latter,—thanks to those great blocks of stone which the hero Reis Alee Shafei could not move (as, indeed, the Reis Atfee had duly warned him before he made the attempt), and the great bank of sand below them,—was inaccessible ; and the former, or exterior surface of the Pyramid, has been removed ages ago, to a depth of eight or nine feet inwards from the ancient crust. Nay further, the material of the Pyramid has been removed to a greater depth still, about the mouth of the entrance passage ; and so unequally, that the floor now begins at one place, the walls at another, and the roof at another different still ; and each of them is hacked, chipped, and fractured to an extent totally depriving any one of them, of all claim to form a starting-point for linear measure.

Then if there are no quasi-natural marks to measure between, shall we make something in the way of apology for them, according to the method of accurate base-line work in modern surveying ; *i.e.*, cut a microscopic line near the top, and another near the bottom of the passage, or as far towards the bottom as we may go, and measure the interval between such marks to the thousandth of an inch if we can ? Well, such distance, to carry the surveying principle out completely, must be reduced from its length on the inclined surface of the passage to its true horizontal length ; and then, what should we

have obtained? Nothing, so far as I could see of any theoretical or practical importance to the Pyramid; and nothing that could be checked by subsequent observers with any certainty,—if piece after piece of the end of the passage is to be broken off from time to time.

Then is the entrance passage a something after all, to which accurate measure cannot be applied, and which does not deserve it? No certainly! Such a doubt would be erroneous, and such a suspicion unjust; for, only enter within the actual walls of the passage, and then, see how fine and straight the joints of the masonry courses are there; so straight that no modern optical instrument-maker could work better straight edges, and so close, after four thousand years of wear and tear, expansion and contraction, lightning and earthquake, as to compete with the best of recent work in stone anywhere.

Now this fineness of these particular passage-joints, is a something totally different from the masonry of the Pyramid generally; for there, where mere internal substance was all that was wanted, at least so says theory, and experience does not indicate anything different, the breadth of the joints is often measurable by inches; and they are rammed full of a coarse pinkish mortar mixed up with fragments of pottery, stone, and other matters; making however a substantial style of building, for the stones are arranged to break joint scrupulously, and both vertical and horizontal chinks are equally filled

with cement. Yet precisely hence, when one comes on the very much closer joints at the beginning of the entrance passage, also cemented both in the vertical and horizontal seams, but with a fine white cement in a sheet almost miscroscopically thin,—why, the fact is immediately evident that the builders of the Pyramid took a great deal of trouble, and must have gone to great expense about these parts; and the conclusion may well be allowed, until disproved, that they had some good reason for their proceedings.

'Then let us measure these joints,' I was compelled to say, 'and note all their particulars step 'by step throughout the passage laboriously; and 'it may be, we shall be enabled at last to look on 'the work performed there with *some* of the same 'feelings as those men were influenced by, whose 'hands performed it in the early ages of the world.' The style of measurement therefore, now became transformed from a rigid mathematical admeasurement, aiming at extraordinary minuteness between two artificial terminal points only,—into a physical description of all the visible phenomena; and where, a less amount of extreme accuracy to numerous decimal places of an inch, was made up for by many points being submitted to moderate measurement.

First, then, we took the floor; measuring in inches and tenths of inches the distance from joint to joint, noting the character of each joint, the

quality of the stone, nature of surface as influenced by weather or otherwise, etc. etc.; and this was done first on the west and then on the east side of the passage. As moreover, the steep incline of the floor, or 26·3°, is some ten degrees greater than the 'angle 'of repose' for wood resting on stone, according to frictional philosophy,—the 100-inch measuring-bar had to be held at every moment by Alee, while I clambered up or clambered down to get repeated readings at an upper, and then lower, joint some sixty inches apart; and had to make quite sure, that what I entered in the observing-book as the length between those joints, did not include a slip of the measuring-rod in the interval, often not very short, between two readings. Errors of this sort have been indeed the great bane of most Pyramid measures yet published, sometimes to an extent of whole feet; and I therefore proposed to myself not to attempt to be any authority on tenths, hundredths, and smaller quantities of an inch, until the whole inches should be satisfactorily settled. Hence after going all the way down one side of the passage from top to bottom, we then began measuring again from bottom to top; and in some cases went over all the joints even a third and fourth time.

Now this operation having to be performed to critical satisfaction, on each side of the floor, on each side of the roof, and at the top and bottom of either wall, extended itself to several days; for the air was mostly something choky with dust, not

very wholesome in chemical quality, daylight faint towards the lower part of the passage, and both forenoon and afternoon spent in it rather more than any man's constitution would stand; not to say anything of the frequent bursting in, and rattling down upon us, without either notice or apology, of whole tribes of travellers,—driving us, measuring-rods, note-books, and everything else right down before them on to the sand-bank at the bottom, and filling the narrow tube with a dense earthy haze, while they were bundling into Al Mamoon's hole *en route* for the King's chamber.

At length a sufficient stock of measures being obtained, a comparison of them began to be instituted *in situ*, and results educed as follows. The floor blocks are very much harder than those of roof and walls; but all of them have better stone and closer joints near the top and bottom of the passage than the middle; there is no regularity in sizes of stones in any of the sides, but they all break joint well; the object is evidently to make the passage as a whole, and insure its truth on the entire run with the least possible expenditure of money or labour; hence no ornament, no cutting of stones merely to make them tally to the eye of the mason on opposite sides of the passage; the end and aim of the whole of it appearing to be, merely a tube of that length pointing upwards at a certain angle, and in a given azimuth. That such must be the ruling principle of the whole follows also

from this, that both in the broad sheet of fine stone which passes under the walls of the narrow passage to form its floor, and equally with the parallel sheet that forms the roof,—errors in the rectangularity of the joints, as compared with the axis of the passage, to the extent of two and even three inches on a run of forty-one inches, are common; but in the joints forming the walls, excepting certain two joints approaching a vertical direction, the others have seldom an error of even one-tenth of an inch on a run of forty-seven inches.

To test this matter still further, I constructed with my own hands, in the Howard Vyse instrument tomb, a large wooden square, with a tail-piece of fifty inches, and a vertical bar forty inches long; and we went over all the joints on either wall at the Pyramid, reversing the square upon them, and finding in the end,—that the errors of the ancient joints from a perpendicular to the axis of the passage, were smaller than the error of my laboured piece of carpentry; or rather, I may perhaps be allowed to say, for it had stood some close tests before leaving the tomb, smaller than the errors induced in it by the sunshine, as it was being carried to the Pyramid. But when after many days spent in this one particular passage,—I discovered a line on either wall, ruled apparently by a master hand as a guide to the original working mason,—and applied and reapplied the square to that,—the mean of all the readings for error, came out 0.

Alec was not acquainted with these lines until I pointed them out to him, and he gazed at them in silence. But when I asked him about the evident injury inflicted on certain finer wall-joints at the top of the passage, he knew all about that, and only wondered I did not too; 'Why, it 's the travellers 'again,' explained he; 'one of them says to another, 'I say, Peterkin, isn't this a fine joint? and there-'with, not content with pointing to it, he must rub 'down all along its length with the point of a cork-'screw. Whereupon the Peterkin alluded to, tries 'it with his knife and says, Why, I can't get the 'blade of my knife into it anywhere; they must 'have been ingenious dogs those old Egyptians; 'but could not, for all that, compare with us, you 'know,—because we live in the days of electric 'telegraphs and lucifer-matches.' However, I am happy to add, that there is one joint in that neighbourhood, which has escaped the notice of all these examples of modern march of intellect men; it is a joint that only manifested itself to me on my third time of going over the wall, so extremely fine and next to invisible is it through the whole of its run; and any one who chooses to read the more serious numerical pages of the second volume of this work, will find there where to look for it.

A more practically important discovery, fortunately, waited us at the lower end of the passage. Some seven or eight feet in length of that part, as

already mentioned, is untouched by the ditch-like holes that have marred all the upper and middle portion, and forms in consequence a sort of smooth slope down which every traveller must slide as he or she best can. Now the reason of such singular preservation appeared to be simply the extraordinary hardness, hard as flint, but tough as slate, of the stone just there introduced; so that it had alike fatigued the devouring tooth of time and laughed to scorn the hammers of destroying traveller-men. Such was the fact; but then came the question, was that hardness there accidental, or had it been sought out and accomplished for a particular purpose? Close examination showed two joints crossing that hard portion, so that there were three of the hard stones together, and that did not look accidental; but, more noteworthy still, these two joints were both of them sensibly diagonal to the run of the passage: not merely affected with a moderate error from a rectangular position, as many of the other floor-joints were, but so largely deviating therefrom as only to be termed diagonal: and when following up and down in the book of measures the numbers expressive of the position of every floor-joint, these two in the hard limestone formed the one grand anomaly of the whole passage.

The one great anomaly, be it remembered, and yet only when close examination had been employed; for otherwise, the very existence of the joints might have escaped observation, let alone

their unusual position; and if it should be said by any one, that such nearly invisible markings could not be of much consequence—the reply is, that in a monument like the Great Pyramid, where the greater part of it is, by the confession of all men, intended for secrecy and security, *the most vital features would certainly not be marked in any very ostensible manner, such as could be recognised by every one in passing.* We have therefore rather to look to these two following points: first, are we certain that the fiducial markings supposed to be discovered were made at the building of the Pyramid, and at no other time? and, second, could they at the building have been made with ease by any single workman for his private caprice, or do they imply a consentaneous action in public of many of the workmen and the architect also?

Now fine, and next to invisible, as these two diagonal joints alluded to are, yet being joints in the *structure* of the part, they imply the accurate fitting and grinding together of the broad and weighty blocks of stone forming that portion of the passage; forming, indeed, the whole plane of the basal sheet of the floor, and inserted in their places there, *before* the ponderous blocks for walls, roof, and, in fact, all the upper part of the Pyramid too, were laid upon them; they could not therefore have been substituted at any subsequent time without a rebuilding of the whole of this part of the Pyramid, and by crowds of masons working together to

carry out the orders of a supreme architect,—which answers both our principles of doubting at once.

Were these unusual joints then, two secret key-marks? and if so, what for? And what purpose can indeed be sufficient to account for all the pains connected with them? for they have no structural necessity practically, architecturally, or æsthetically. I looked up at the place itself, with my head between the two lines, and the whole thing was revealed. 'Alee,' I then said, having still a great respect for him, as one acquainted with all the Arab traditions about the Pyramid, whatever they may be worth,—'Alee, you are a Pyramid guide, do 'you see these two diagonal floor joints?' Yes, he did see them; and confessed, now they were pointed out, that they were true joints of the masonry, going *under* the walls of the passage on either side. 'Now why, Alee, did the kings who built the 'Pyramid make these two joints run in such very 'different directions from all the other joints in the 'passage floor?'

He only looked up and down at the different joints, saw that 'the two' were an exception, but said he could form no idea.

'Then look up, Alee, at the roof, and see why;' so, turning his head in the narrow passage, he saw he was then *vis-à-vis* to the lower butt-end of the portcullis-block closing the entrance to all the ascending passages of the Pyramid; to everything constituting the interior of the Great Pyramid

essentially different from every other Pyramid in Egypt; to all of it which is important for the metrological theory; and to all those features too, of which the Egyptian priests in the days of Herodotus, of the Ptolemys, and the Roman Emperors were entirely ignorant: and which the world might still have been ignorant of, but for that accident, which was more than an accident, of the 'heavy stone' which was heard to fall in a hollow place,' when Khaliph Al Mamoon was hewing his way into the substance of the Pyramid with axes and fire.

The heavy stone was the so-called triangular stone of some authors; really rectangular in plan, viewed from below or above, though triangular in side elevation; and when fitted into its place (which place we see now precisely by the sharply cut vacant space left) must have formed, with its lower surface, a smooth and ordinary-looking part of the passage roof; so that no one of the uninitiated could have had the smallest idea that behind one particular pair of joints, of all the pairs of joints in the roof,—lay a concealed entrance to the secret, but most glorious, internal constructions of the Pyramid. In fact, no one did have any idea of it; and Greeks, Romans, and Egyptians went down and up the entrance passage, penetrating even to the subterranean chamber under the Pyramid, and were blinded into the belief that that was all the Great Pyramid had been constructed for. Greeks and Romans went in merely as spoilers or curious travellers; but early Egyptians

went in to note and copy any ideas they should think suitable to lasting and noble burial; and they did copy off and realize in many and many another Pyramid, built after the time of the great one, even in the eight other Pyramids still standing at Jeezeh, all they thought or suspected the great one contained; viz., the descending entrance passage and subterranean chamber.

In another place we may discuss whether that arrangement was a good idea for their purpose; history indeed indicates that it has not been; and the subterranean chamber was, after all, not used for sepulture by the builders of the Great Pyramid,—the room only having been *begun* to be cut out of the rock from the ceiling downwards, and left in that unfinished state; enough, however, to serve for a blind; a part, too, which it did act most effectually. But though so scrupulously concealing their chief or real and favourite works from the profane, we may now see that the builders, or planners rather, of the Great Pyramid, did not leave their building without some testimony to its chief secret; for there, before the eyes of all men for ages, had existed those two diagonal joints in the passage floor, pointing directly and constantly to what was concealed in the roof just opposite them, and no one ever thought of it. Practically, then, we may say with full certainty, that these two floor marks were left there to guide men who, it was expected, would come subsequently, earnestly desir-

ing, on rightly informed principles, to look for the entrance to the upper parts of the Pyramid; and the time when these men were expected to come must have been a very distant time indeed from the date of the building.

This follows from the consideration, that otherwise the diagonal direction by itself, executed in any ordinary soft stone, would have been quite enough; and such economical builders as those of the Pyramid were, would have gone no further than absolutely necessary to secure their purpose; but as we have now found that an exceedingly hard and more expensive material had been picked out for all three stones forming, and yet, by the fineness of the workmanship, concealing, the sign in the pavement,—the conclusion is forced upon us that the clue was not prepared for any immediate successors of the builders, but was intended, on the contrary, to endure to a most remote period. And it has so endured, and served such a purpose even down to these our own days, although all the neighbouring stones have been hacked or have perished to the exceeding degree already mentioned at page 73; and have assisted thereby in proving that nothing less hard than what the builders selected, would have answered the end they proposed,—if they really looked for the solution of the Pyramid's mysterious mission to take place in the nineteenth century A.D.

Standing then here on the slide, or portion of un-

touched floor with the builder's sign in its substance, just under the prismoidal hole in the roof of the passage, which discloses so easily now to all mankind, the long-concealed lower butt-end of the granite portcullis of the first ascending passage,—we may recall, with ease, all the circumstances of that eventful morning, when the half primitive, but very strenuous followers of Khaliph Al Mamoon, were working in their long cavernous hole, a few feet westward of this passage, and heard the ominous fall of the said prismoidal stone. They were so far westward, because they had begun their operations outside in the middle vertical line of the northern face of the Pyramid, while the plane of the entrance passage is twenty-five feet east therefrom; and they were now nearly on the same level, because they had pushed on almost horizontally from their commencement near the base,—while the entrance passage, though beginning high up the side, dips downwards rapidly as it proceeds.

The moment, then, that the sound of the fall was heard, the Muslim quarriers turned their course south-east, towards where the noise had proceeded from; and presently broke into the west side of the entrance passage, precisely in the place where all men now see the shapeless dark hollow, generally known as the Khaliph's hole, and used by all who wish to ascend to the upper passages. At present, travellers in general are only aware of the globular or cavernous termination of the hole, communicating

round the portcullis with both upper and lower passage, and are often ignorant of the long pipe-like communication which exists from thence to the outside of the northern face ; well they may be too, for the space is quite dark, and much choked with rubbish ; yet no so completely, but that a deal of air passes up the chimney of the entrance passage on windy days, derived by indraft at the lower communication of Al Mamoon's hole.

For the clearness with which all these arrangements can now be seen, the world must thank Colonel Howard Vyse ; for it was he, who, by cutting down the centre of the northern bank of the rubbish lying high against the Pyramid, in his search for casing-stones, exposed incidentally the external mouth of Al Mamoon's hole ; and proved it to be just in the very place where the old Arab historians had described it to have been worked. And, as to how singularly important this simple, but real practical discovery has been to understanding first the facts of construction, and then much of the history of the Great Pyramid, let our readers only refer to the Travels of that excellent and most able man, Dr. Clarke, in 1800, the Cambridge Humboldt of his day, and read his theory of the Pyramid.

The worthy Dr. Clarke, then, not having seen *through* the rubbish heap, totally disbelieved any other entrance into the northern face of the Pyramid, than the one entrance passage proper ; and, as that was in so strange a position to modern European

ideas, being so high above the base, and so far east of the central vertical line, it could not have been hit on, he argued, by accident at the very first shot of the excavators. *Therefore* there were no excavators, and never had been any; and least of all, any ignorant fellows bearing the name of Khaliph Al Mamoon, son of the Khaliph Haroon Al Rasheed,—but the passage must have been left open by the original builders, or their immediate successors, and must have remained open ever since.

But we need not follow any further the Doctor's argument, which, with the instability of an inverted Pyramid, or standing on its apex, rests entirely on the assumption of the non-existence of a certain second entrance, which any one whatever can now, without any learning at all, see does exist; and, in fact, may feel too, by the draught on a windy day.

It was indeed a very remarkable day on which we first noticed the above fact; for the barometer, which had in previous weeks ranged between 30·10 inches and 30·30 inches, had gone with a slow, steady sinking through two or three days, down to 30 inches; 29·9 inches; and then 29·8 inches, while the horizon gradually became hazy, and a violent wind commenced to blow from the south. For a long while, the living establishment at East Tombs found itself admirably protected with the back of the hill to windward, and we saw from time to time violent gusts of wind sweeping over the plain below,

and raising the sands tumultuously as they flew whirling along. Farther too, in the distance, and apparently along the course of the Nile, many a walking whirlwind of sand would raise up its tall faint column like a ghost, marching slowly along; and as the day of February 2d grew on apace, all the city of Cairo, and its Mokattam hills, at length vanished from our sight, in the increasing density of the dry haze. Driftings of sand also became more frequent near us; the wind grew stronger and stronger, turning round now from south to south-west; we began to perceive too, without knowing how or where, that everything in the dining-room tomb was covered with sand, and were obliged to confess at last that we were in the midst of a sand-storm.

Not, however, until next day, did the *meteor*, as French meteorologists would term it, come upon us in its full proportions. The sun rose weak and pale; I attempted to get my usual before-breakfast observation for time,—but, though protected by the cliff from all direct blasts of the wind, and seeing, or rather knowing, that the sun was visible,—yet all the air was so strangely full of sand, that every time I put the sextant to my eye,—eye, face, sextant, hands, everything, were full of floating eddying sand; and to such a degree as compelled me, after many efforts, to give up the point, and trust to the watch-rate that day for timing the meteorological journal. As the hours advanced, too, the wind became a roaring gale from the south-west, and the sand, vexed with the

frequent squalls by which it had been only partially raised and tormented for so long, now became fully excited, and seemed to rise for good and perpetuity into the air. The Pyramids, notwithstanding all their bulk, gradually faded out of view in this sandy atmosphere, the sun also was presently lost sight of, and evening's darkness fell on us at noon-day.

Then came the cry that the Colonel's tent was going, and the day-guard's tent was already gone,—so down the cliff to where those tents, so obligingly lent by the Egyptian Government, had been pitched (in useful reserve, if tombs should not be found pleasant abodes for the living), just below our sepulchral doorways, we rushed with mallets and new tent-pins ; and the medium through which we rushed, was not air, but a sort of mixture of air and sand. The storm indeed had in a way annihilated for the time the distinction where earth ended and air began, and the mixture of the two, under the excitement of the storm, was something for demons to dance in. By the evening, however, of this day, the barometer had begun to rise ; the wind had gone farther round, or to due west ; the strength of it somewhat abated in the course of the night ; and by next morning, the barometric pressure had risen above the touch-stone point of 30 inches, while the country appeared smiling once again under a pleasant fresh breeze from west-north-west.

We had thus gone through a true cyclonic gale ; one of those grander ones too, which announce

themselves long beforehand by the barometer,[1] and which come sweeping over large tracts of the globe with almost the regularity of astronomical courses, bringing rain as well as south-west wind to Western Europe and the Mauritanian coast of North Africa. It was further, by far the most marked storm of the kind that visited the Pyramids during our stay, and presented all the characteristic sinking, and rising again, of the barometer, together with veering of the wind,—though not one drop of water fell from the sky; for that was the startling effect on even all the moisture of a south-west storm fresh from the Atlantic, after it had run the gauntlet of Africa's parched desert of Sahara; viz., it had been deprived of every particle of its watery burden, so as not to have a single drop of rain left, wherewith to relieve the twisted, torn, and dust-begrimed fronds of a single one of all the dried-up date-palms of Egypt.

At the Pyramids, plainly, we were surrounded by a world of sand, and sand must serve many of the purposes of water. So Mohammed taught his disciples with regard to ablution, and so we found in some other matters, both of beauty and æsthetic variety; for in some of our first walks after the storm was over, we were astonished and delighted at the strength and regularity of the ribbing of the sand. 'As is the ribbed *sea*-sand,' we think the

[1] The thermometer in shade had kept to the moderate limits of 68° by day, and 55° by night, with a depression of the wet-bulb never less than 7°, and oftener 10° to 12° Fahrenheit.

poet sings; but had he enjoyed an opportunity of walking forth either among the tombs at the Pyramid on this occasion, or wherever the sand was deep drifted in clefts of the rock, he would have been in ecstasies with the markings,—for they presented all the ranks and ranges of ripple on a fresh-water lake, from the tiniest commencement to a respectable swell; but frozen still in a moment, and submitted thereby to man's quiet contemplation in all their crispness and variety of waving, sinuous beauty. At what rate these waves of sand had travelled, when the force of the wind was upon them, would have been an interesting inquiry; but we had only to remark at the time, that their lines were invariably trending north and south, or at right angles to the brave west wind that had controlled their final destinies at the conclusion of the storm.

As they were left arranged then, however, they were not long to continue; for by and by a north-east wind began to blow, and on going to the broad sand-plain north of the Pyramid, rather hoping to get a good photograph of expected stationary waves, —behold all the grand lines of ribbing, long and lank as they had been, nearly effaced. They had got mixed up indeed with a new set of lines of ripple, just beginning to form at right angles to the blast of the new wind; and for several hours there was what the water-colour painters of sea views call a 'jaugle' on the face of the sands, or a dull lumpy-looking sort of swelly heavings, rather than waves;

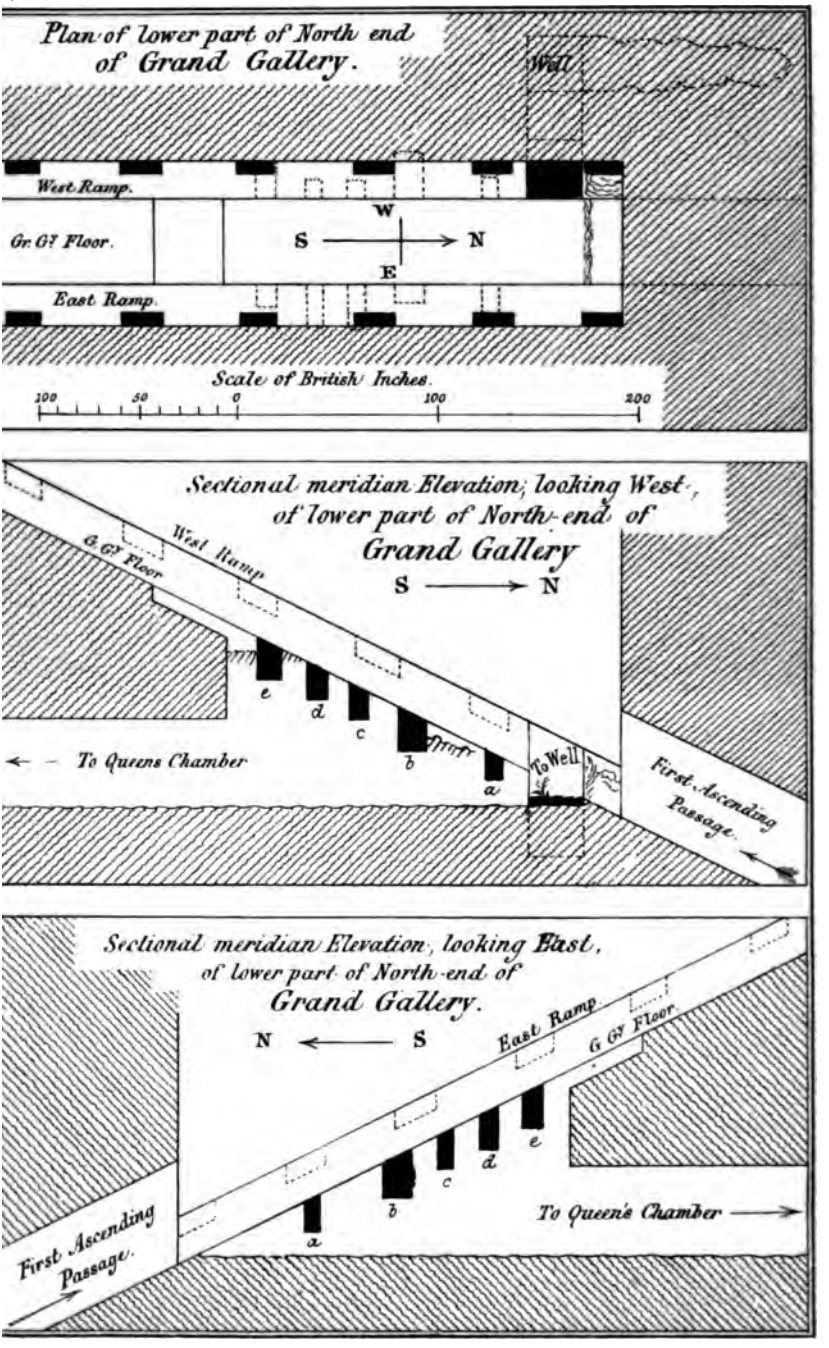
and it needed several more hours of blowing by the north-east wind, before the new set of long wave-like ripples belonging to its direction, were completely established in the ascendant; and then the desert surface seemed rolling along once more, in wavelets as joyous, as those which any swan-adorned, park-like lake in England can show, during the breezes of early spring.

But the moment the weather moderated at all, Alee Dobree and myself were back to our work at the entrance passage; its angle from the horizontal having to be measured. I had indeed been furnished, when in Cairo, by a gentleman there, of great learning and intelligence, with the results of his measures of this element, taken apparently with very powerful apparatus; and they had come within so few seconds of Colonel Howard Vyse and Mr. Perring's of 26° 41′, that there did not seem much improvement possible. But considering it a salutary course at the beginning of my Pyramid experiences, to check everything,—and thereby measure myself sometimes against my elders and betters,—I prepared for the work with a new clinometer, expressly designed for the Great Pyramid, and supplied to me by the kind liberality of Mr. Andrew Coventry, of Moray Place, Edinburgh.

In itself, comprising a gun-metal circle of eight inches in diameter, divided on silver, reading to ten seconds, and by three pairs of opposite verniers,

with arrangements also for shifting the angle measured, on the divided circle, and checking the spirit-level to single seconds,—there had never been a clinometer approaching it in exactness employed at the Great Pyramid. This fine instrument was further mounted on a grand beam of mahogany,—resting on two metal feet in the plane of the circle, but fifty inches apart, so as to span over a long length of passage surface at a time,—and with a third foot some six inches removed from the plane of the other two, and opposite the middle space between them, to preserve the cross level.

With this combined instrument, then, viz., the angular measuring apparatus above, and the mahogany beam below, fortified by various extempore handles, holdfasts, etc.,—which actual trial in the passage indicated the machine to require for either comfort or safety, and our tool-chest at the tombs afforded us the means of supplying,—Alee Dobree and myself stepped all the entrance passage in steps of fifty inches at a time, reading off the angles carefully, first along one side, and then the other of the passage, to eliminate the instrument's index-error. Then shifted the position of the circle, to bring into bearing a new set of its divisions, and went through the passage again; and finally examined the error of division of the circle yet further, by comparing the mean of two with the mean of six opposite readings, and showed that it was probably under two seconds.



W.H. Mc Farlane, Lith. Edin.

But with what result for the passage? Why, with the rather provoking result of so wide a difference from the measures previously recognised in the world for good, as to say, that the angle was neither 26° 41′, nor yet 26° 40′ 20″, but 26° 27′ about. Now the latter quantity was, no doubt, much closer to the theoretical value than the others; but then, as the entrance passage is looked on there, as in part a sort of blind to the more important divisions of the Pyramid, serving as it does for mere entrance to both departments of the building at once,—I had neither at any time expected a high degree of pure angular accuracy about it; nor entertained any thoughts even, about the theory, in making the measure; but had looked then, only to procuring a correct determination of a simple existing fact, and one which had been already well measured, as I did really believe, by the two previous observers above quoted. (See Plate VI. for a nearly similar practical angle of sloping floor.)

A new method was therefore tried before long, after the suspicious-looking ending of the clinometer measure. To this end, a signal of carpentry was fixed in the top of the entrance passage, and wedged fast exactly half-way between roof and floor: then the same sextant-apparatus, with artificial horizon attached, which was in daily employ at the east tombs,—and therefore daily tested, in time and latitude observations,—was mounted at the lower end of the passage; on a stand, too, expressly constructed

in our tomb-workshop, so as to rest firmly on the stone slide under the portcullis, and at the same time carry the central axis of the sextant's motion exactly half-way between floor and ceiling.

The mutual linear positions of angular instrument at lower south end of passage, and observing-signal at upper north end, were then tested again and again, both by vertical measures and rectangular set-offs from floor and ceiling; and then came the angular observation of the signal, as though it had been the sun or a star for latitude,—but again came out a result, not exactly that of the clinometer, but sensibly the same, or 26° 28′.

In one way I could believe this result, because all the preliminaries of the observation had been well settled, and I was familiar with the instrument; but in another it was quite incredible. What could be the meaning of this huge difference between my observations and those handed me in Cairo, under circumstances that testified their author to be a philosopher indeed;—one who, in mathematical reading as well as practical experience, was a perfect storehouse of information; and, with eminent public spirit, had commenced Great Pyramid measures years before, with the express object of introducing into them, for the credit of modern science, more accurate methods than of old; and also, perhaps, for the sake of enjoying a little of the spicy pleasure to a resident Cairene, of picking some possible holes in the jacket of Colonel Howard Vyse? For was not

the Colonel a stranger, who had come to and gone again from the Siriadic land, like a meteor? while Egypt has never liked strangers, from the visit of King Menelaus downwards, and is inhospitable to them still.

Yet even to that righteous-minded attempt at mischief, nothing beyond a modicum of seconds could be found to correct in the Howard-Vyse angle; and now my observations, made without any such views at all, were many minutes different from both corrector and corrected. I could only at the time venture the conclusion that the Pyramid was bewitched; and mentally determined, that before leaving the neighbourhood altogether, I would try even a third instrument, and one of most amazing proportions, but whose proper time for appearing on the scene had not yet arrived.

CHAPTER VIII.

ROCKS AND ANCIENT RUBBISH.

COINCIDENTLY with the progress of measures inside the Pyramid, did we try to make ourselves acquainted with the nature of the rock outside; and generally, of the geological structure of the region around. Our own tombs were of course an excellent beginning, cut as they were into the eastern escarpment of the Pyramid hill; and showing its formation in a comparatively recent limestone, in vast and tough sheets, having a slight dip south-south-east: whence, in going either towards the summit of the hill, or southwards, we were always approaching the later formations.

In front of our cliff lay a sand-plain, more than half a mile broad, before the cultivated land began beyond; but that sand was an affair brought by winds from the western desert within history: for the bridge or rectangular opening under the hill-end of the southern causeway, indicates a canal to have run along at the foot of the hills and the then edge of the cultivated land, from south to north,—just as the Bahr Youssef now does, some three-

quarters of a mile eastward, and a little within the present western boundary of the still watered and waterable plain. There is even an Arab village towards the south-west, which is now encompassed by sands, and separated by them from its own fields; and yet has no greater appearance of antiquity about it than any of the ordinary mud-villages of modern Egypt,—at such rate must the sands in this particular locality be advancing still.

Underneath the sand-plain thus superficially skirting the eastern slope of the Pyramid hill, and forming a large plain north of it, with a depth of some ten to fifteen feet,—lies the dark-coloured mud of ancient Nile-inundations; and at a further depth of about ten feet therein, is the usual *wet* stratum supplying all the agricultural wells of the region. Hence in Colonel Howard Vyse's time, there was a well dug without any great difficulty in the plain just opposite his, and now our, tombs,—whence his large party derived their daily supplies of water: but, after his departure, it was filled up by the Arabs, who dislike any feature that may attract squatters into their neighbourhood.

To return however to the genuine geological rock of the region, viz., the limestone in which the tombs are excavated,—its strata may be from ten to twenty feet thick; the separations being formed by interstitial softer portions with colouring of iron, and tendency to decay in a columnar manner, which mixes itself up at times strangely with the door-

posts of rudimentary pillars cut by architects of the fourth dynasty. Yet how nature manifests her power to last and hold her own distinguishing types; for, and equally with the tombs excavated *in situ* on the eastern escarpment, as with other tombs on the higher slope, or even summit of the hill, built of prepared, worked blocks of the stone,—as fast as they are decaying, and their hieroglyphics, once deeply sculptured, are by slow degrees evaporating completely away—so do the fossil shells become more and more clearly revealed; some univalves, a few bivalves, but, above all and all, the peculiar form of the nummulites.

Of various sizes, these nummulites affect two mostly, one the size of a flattened pea, and the other of a penny piece; smooth outside, but when split open,—as often occurs from the spontaneous separation of the two sides or shell plates,—displaying internally a microscopically fine helix-work of cells, perfectly marvellous to behold; and ever as the rock still more progresses to decay, these medals of nature, deprived of the matrix or cohering matter between them, drop off one after the other, pure and simple to the ground; whence they are picked up by Arab boys as Strabo's beans, and offered at a great price to an approaching traveller, who does not know that in a few minutes more he will see them by thousands.[1]

[1] 'Nummulite (from *nummus*, money, and λίθος, a stone).—The 'nummulites compose a fossil extinct genus of multilocular cephalopods,

Near the eastern face of the hill, the small nummulites make up three times the mass of the large; but near the Great Pyramid, more especially about its south-western and north-eastern corners, the large variety amounts to seven-tenths the bulk both of the small and every other constituent of the rock; so that when a massive block is met with, cut perchance across the general plane in which the disk-like shells lie, it appears almost entirely composed of something in shape like short chopped straw; or when a weathered fragment is found, exposing the complete forms of the creatures clinging close to each other, they look like masses of hard beans agglomerated by boiling and compressed. In fact, as the worthy Custom-house officer at Liverpool remarked incredulously a few months after, when I showed him a fragment, and told him the old story of Strabo's beans and the lentils of King Cheops'

'presenting, externally, a lenticular figure, without any apparent open-'ing, and, internally, a spiral cavity, divided by septa into numerous 'chambers; they do not possess a siphuncle, but their chambers com-'municate by means of small foramina with each other.

'Nummulites vary in size from less than an eighth of an inch, or 'even microscopic minuteness, to an inch and a half in diameter. The 'number of spiral turns seems to depend on the age and size of the ani-'mal; in those of a quarter of an inch in diameter, being three or four, 'while in those of the largest size the number of whorls is frequently 'upwards of twenty. Lamarck divides the genus into four species.

'Nummulites occupy an important place in the history of fossil 'shells, on account of the prodigious extent to which they are accu-'mulated in the later members of the secondary, and in many of the 'tertiary strata. They are often piled on each other, nearly in as 'close contact as the grains in a heap of corn. Entire calcareous hills 'are composed of fossil nummulites.'—Humble's *Dictionary of Geology and Mineralogy*.

workmen,—'But you surely do not mean to say 'that these are *not* beans?'[1]

In so far, then, a mass of the Pyramid hill material can be instantly identified, when found in the masonry of the Pyramid itself, or anywhere else; but the whole hill is by no means so rich as that just described, or so peculiar either; for, as the rock stretches away to the second Pyramid, there are fewer nummulites and a partial appearing of echinus-spines, bivalves, and lobster-looking shells; while near the third Pyramid, the smaller nummulites seem to pass into a delicate form of ammonite, or at least have helixes of larger angle. All this on the surface stratum; but if we take a lower depth, as may be most satisfactorily seen at the base of the cliff on the north-east part of the hill, and west

[1] The following generalizing notice of nummulites is extracted from Sir Charles Lyell's *Manual of Elementary Geology*, fourth edition, page 206:—

'The nummulitic formation, with its characteristic fossils, plays a 'far more conspicuous part than any other tertiary group in the solid 'framework of the earth's crust, whether in Europe, Asia, or Africa. 'It often attains a thickness of many thousand feet, and extends from 'the Alps to the Apennines. It is found in the Carpathians, and in 'full force in the north of Africa, as, for example, in Algeria and 'Morocco. It has also been traced from Egypt into Asia Minor, and 'across Persia by Bagdad to the mouths of the Indus. It occurs not 'only in Cutch, but in the mountain ranges which separate Scinde 'from Persia, and which form the passes leading to Caboul; and it 'has been followed still farther eastward into India.

'Some members of this lower tertiary formation in the central Alps, 'including even the superior strata called *flysch*, have been converted 'into crystalline rocks, and changed into saccharoid marble, quartz 'rock, and mica schist.'[1]

[1] Murchison, *Quarterly Journal of Geology*—see vol. v., and Lyell, vol. vi., 1850, Anniversary Address.

of the causeway, the constituent fossils are chiefly echini,—forming by their sections oval and semi-oval figures, very much like those employed in hieroglyphics to express the sounds *tu* and *nb*.

This lower stratum of rock is likewise harder, whiter, and much rarer in its fossils of any kind than the upper portion,[1] as may be seen again towards the base of the Sphinx; a matter also to be borne in mind in judging of the origin of many of the whiter and better blocks of the Great Pyramid building. For though Mr. Perring and Colonel Howard Vyse, excellent authorities, both attribute most of that variety to the Mokattam Hills, on the east of the Nile,—whence too Herodotus, in a general way, derives the whole of the Pyramid material,—yet they both consider that all the ordinary, yellowish, and indifferent stone was derived from quarries in the Pyramid's own hill, 'which quarries were 'afterwards utilized as tombs.' But if we may agree therein, that the majority of the tombs were once quarries, it is worthy to note,—that all over the eastern and southern surface of the hill, the tombs there are generally in the form of square wells, descending twenty, fifty, seventy, or even more feet, and then opening out, doubtless in a denser and whiter stratum, into a variety of sepulchral chambers.

[1] Excepting always, for hardness, certain small tracts of the upper rock, where its usual granular texture and yellow colour pass insensibly into a close, smooth, compact, and dove-coloured variety of limestone, affecting rather square and blocky forms, and flying into splinters like flint when struck with a hammer.

This soft and recent, though doubtless sea-formed limestone of the eocene or earliest of the tertiary group,—is however the only substance which the Pyramid hill can contribute towards the bulk of the mighty monuments upon it. For, in spite of mediæval and more modern assertions also, that the Pyramids are volcanic cones, or basaltic masses merely cased about by man with limestone masonry just wherever nature had been pleased to exude those products of internal fire,—there is not over the whole region the smallest trace of igneous agency; either in hardening the limestone, forming dykes, or bringing in any extraneous mineral; such fragments of basalt, diorite, greenstone, porphyry, and granite as may be met with, having, together with the alabaster, or arragonite, been brought there by man.

Nor is there on this side of the river any other good or prominent locality for a quarry, except the very hill of the Pyramid; certainly nothing comparable in extent to the Mokattam and Maasara of the Arabian side, and they are Neptunian also. Far to the north-west, in the neighbourhood of the Aboo-Roash ruins, the white slopes only of chalk-hills, the latest of the secondary formation, can be observed; while between them and the Pyramid hill, and round about by the west, only a rolling or undulating sort of country can be perceived, where no rock stratum crops boldly out, and the very rounded forms of the hill-tops are dotted over with brown pebbles. These at first sight look like water-worn stones,—but in

which case they would have been distributed more probably towards the bottom, than the summit, of the eminences: and they prove ultimately to be flint or Egyptian jasper, and must have acquired their rounded oval shape from having been formed in the similar-shaped cavities of some superficial rock-matrix, which has since decayed slowly *in situ*. For that reason, it would seem to be, that the round stones were left crowning every eminence; just as melting icebergs and glaciers in northern latitudes have poised many a large block on the very summit or ridge of various mountain-elevations, to the astonishment of travellers in a warmer age, when the ice-porter is no longer to be seen.

The conclusion, however, with regard to the Egyptian pebble, is due to Dr. Clarke; who, long before the day of ice-action being much inquired into, specially called attention to the often accompanying fragments of fossil wood, evidently dropped by the dissolution of the same matrix as the rounded stones, and yet showing no symptoms of rubbing, rounding, or attrition in running water. These fragments of fossil, or rather silicified, wood, sharply angular, and with pores best filled towards the original lower end of a tree mass, we frequently found; together with some small portions of the general matrix, still holding in its grasp chiefly small quartz pebbles of various colours.

Round about, farther west and south-west, there

were rock-roughened tracts, extensive sandy hollows, and broad streams of sand advancing from the desert in that quarter; but no good cliffs, until we came due south to the northern termination of the long line of hills, forming the edge of the desert along by Sakkara or Abooseer; and terminating finally just over against the valley south of the Sphinx, and its three or four trees so conspicuously notable in all that long, broad, landscape of white and whitish-yellow, far and near.

These vegetable phenomena consist now of one plane-tree in great density of dark-green foliage,—making a perfect blot of blackness in most of the photographs,—two lean and miserable specimens of the same tree showing the anatomy of their branches picturesquely as well as photographing more harmoniously, and a knot of date-palms; these rather tall and shapely, but with trunks so fearfully contracted every here and there, as though by dry seasons,—that one wonders how the broad leafy top can be held up against the wind. Date-palms are, however, always pleasing to behold, and in the midst of sands and tombs are positively ravishing; wherefore it may be satisfactory to men of the present day to learn, that the scene has more amenity now than in a former century, and even during the glorious era of the great Napoleon Bonaparte; for though in the immortal French work of 1799, there are some *five* plane-trees represented in this spot, the date-palms were then only beginning to run

their botanical race, and are pictured as not much higher than somewhat overgrown cabbages.

But the hill south of these trees, is more worthy than themselves to contemplate; for, with its northern cliffs, it gives perhaps a good idea of what the similar escarpment of the Pyramid hill must have been, in an age before any royal masons had begun to plan improvements or alterations thereupon. The south hill, for instance, shows midway, and to a third from its summit, level strata of dense limestone, so strangely regular as to give one the idea of more than cyclopean courses of masonry; but the very summit, is craggy and ragged with a rubbishy sort of rock, formed chiefly of congeries of shell-fish, and glistening with crystals of gypsum.

Well, if such good engineers, fully understanding rock, as did the late James Jardine and the present James Leslie,—when, in the service of the Astronomical Institution of Edinburgh, they levelled and cut away the whole of the somewhat acuminated summit of the rocky Calton Hill,—until they reached good, solid, and nearly fissureless material, and were able to lay bare a plateau of it so firm and so extensive, as to serve at once for founding both walls of building and piers of instruments upon, without any built foundations, usually so called,—if such engineers, we say, had had to erect on that southern hill at Jeezeh, either an astronomical observatory or a pyramid, they would certainly have cleared away those more recent and less consoli-

dated matters at the top, and have lowered the general surface in a masterly manner, until they touched, with an artificial plane, the compact strata.

Now something very much like that, has undoubtedly been carried out on the site of the Great Pyramid. The escarpments east and north-east are indeed mostly natural, but the top surface north-east and north is an artificially excavated or levelled area; and that is mostly the reason why, in the trenches already alluded to as forming remarkable signals there,—such fine, clean, and solid rock is found instantly underneath the apparent surface of the ground. In fact, not only all the primitive and rotten, though geologically recent, surface-matter (whence, perhaps, the stray shark's tooth, and various interesting casual fossils which we picked up occasionally), but also much solid nummulite rock, must have been cut away and removed; both outside the Pyramid, to flatten the area, and inside its borders also, to make the naturally inclined strata accommodate themselves to the level courses of the building; for wherever the existing rock could be used *in situ*, those thoroughly economical and most able of practical builders, the masons of the Great Pyramid, appear to have so employed it.

Hence, at the north-east corner, the lowest course, and part of another, are visibly formed of rock, trimmed off square *in situ;* and the undisturbed rock may be again met with in the entrance passage a few feet below Khaliph Al Mamoon's hole, and

again in the course of the *well*, at a point between twenty and thirty feet above the base of the Pyramid. That, however, is probably the full extent to which, in any part of this wondrous building, the natural hill is taken advantage of; for, wherever else excavations have been made, and verily they are legion,—witness the cruel holes at and about the *well-mouth*; in the Queen's chamber, and passage leading thereto; in floor of the King's chamber; at both ends of the grand gallery; near root of both air-channels, and in and about all the five chambers of construction,—in all these places, and some others also that were tedious to enumerate, nothing but well-built limestone masonry has been found. Wherefore, M. Vansleb's statement, 'that the greatest Pyramid is nothing but 'a rock cut out as a Pyramid, and covered over with 'a wall of stone;' and another traveller's, 'that the 'Great Pyramid is built on two hills, and that is 'why the entrance goes downward first, and then 'up,—viz., down one hillside, and then up the other 'and greater one, right as far as the King's chamber,' —may just be returned to those gentlemen, as being entirely without proof in themselves, and with serious facts standing in their way besides.

The Great Pyramid is in truth, on the whole, a raised mass of built masonry, stupendous to contemplate by reason of its total amount (more than eighty millions of cubic feet), much more than on account of the large size of the individual stones. These may

be generally, though sometimes more than, about four or five feet thick, seven or eight long, and as many broad; but what is that compared to the stones in the old Temple wall, at the Jews' place of wailing in Jerusalem, nineteen and twenty feet long; or to those of Balbec, sixty-three feet long, and proportionally thick and broad; or to many of the Colossi of the later periods of Egyptian Empire at Thebes? We were never therefore very much taken up, as to how or wherewith the stones of the Pyramid were raised up to their places; for with plenty both of men and time, there were many methods in vogue in early days, and are still, by which even greater stones could be handled.

In so far too, as each stone by itself was concerned, there could be no more serious or real difficulty at the first and greatest, than at the second, or any of the other smaller Pyramids of Jeezeh; the work in the former case being only longer, because it contained a greater number of landing stages to be overcome. These stages are supposed by Mr. Perring, and other Egyptian explorers and residents, to have included five, six, or more, of the present courses of stones, which would then have offered a breadth sufficient for the requisite hoisting apparatus, whether by machinery direct, or through agency of inclined planes, temporarily constructed; the hollows having afterwards been filled up by the single courses, as now seen.

This general idea was afterwards put into a more

methodical shape, and claimed by Dr. Lepsius as his theory of *Pyramid building;* but we found a more satisfactory employment at the place, in noting the progress of *Pyramid decaying;* admirably illustrated too in all its phases, either at, or within sight of, the Jeezeh hill. As thus (see Plate x., end of volume) :—

1*st*, There is the complete and perfect Pyramid, with its oblique coating of casing stones planed down to such a uniform surface outside, that the whole monument resembles in the distance a neatly prepared mathematical model.

2*d*, There is the Pyramid with the casing stones removed, probably backing stones too, and showing in their place the rectangular edges of the several courses of masonry of which the whole bulk is composed ; and appearing like a set of steps or ladders, primarily intended for visitors to be ever clambering up and down.

3*d*, When time has acted longer, and more severely still on the structure, the portions of courses which were merely put in,—to fill up the larger rectangular gaps of the building-stages and partition-walls,—gradually drop out, and the Pyramid becomes one, by name of 'degrees;' or with several large terraces running round and round it, distinguishable at a distance of many miles. And then, 4*th* and last, even the partition walls give way, and the whole structure falls together as a mere shapeless earthen or rubbish mound.

This last stage has supervened with most of the brick Pyramids, and with some of those of stone, where the spaces between the partition walls had been filled with mere rubble, or other imperfect work. But at the Great Pyramid, the building has been conscientious throughout, and ages may therefore yet elapse before it gets much worse than it is at present, or beyond the second stage of Pyramid degradation. Still, this very conscientiousness in building everywhere throughout the mighty mass in a solid and square manner, is precisely what must elevate all men's conceptions at the pure quantity of work which was performed; and when we consider further, that every block of stone was more or less trimmed somewhat square; and with the prevailing ideas on economy and the use of mortar, *must* have been brought pretty nearly true to prevent a waste of much valuable cement,—we may well imagine, what an amount of chippings there must have been produced: and consider, with Diodorus Siculus, that the chief wonder about the practical building of the Great Pyramid, consists in, 'what became of the pieces?' 'There is no 'vestige,' says he in astonishment, 'not the smallest 'trace, of the chippings of the stone; so that the 'whole building seems as if placed on the sur-'rounding sand by the aid of some deity, rather 'than by the sole and gradual operations of man!'

All the stranger, too, would he have thought such absence, if the Egyptians of his day had begun

to indulge in the same easy tastes as those at present occupying the hereditary land; for *they* seem to have a strange disinclination to removing rubbish; and, side by side with most of the new palaces in Cairo, you may see still lumbering up the ground, large heaps of crumbled mud-bricks, that had formed the original tenements of the site; while every public building is disfigured by painted boards for carrying illumination-lamps; and because these hideous guys, having once been erected for a temporary festive occasion, it is too much trouble for the true Egyptian genius of modern times, to remove them again.

Yet that which so exceedingly puzzled the Agyrian of old, is abundantly unravelled now by nature herself; for the occasional winter storms, which have washed with sudden torrents the northern face of the Great Pyramid, have disclosed,—that one half in horizontal thickness of the apparent hill-substance all along its northern front, is, from top to bottom, nothing but the chippings of the stones of the Pyramid, banked up artificially against the true hill thereof. From the Pyramid base, northward, to the edge of this true hill with its terminal edge of limestone, hereabouts too much harder than ordinary,—the waters, as they run, produce little effect; but the moment they pass beyond that well-marked line, they cut steep ravines sixty and seventy feet deep; and through the whole of that depth, the sides are nothing but chips of yellow building stones.

Nicely flattened at top must these exterior mounds have been 4000 years ago, and making a most effective addition to the table-land surface northward, and north-eastward of the Great Pyramid; where otherwise, the natural edge of the hill would have come far too close for safety or effect; and not improbably, Diodorus Siculus, Strabo, and Pliny too, must all have walked over that very surface of artificial exterior banking up of the Pyramid hill, exclaiming all the time, 'What can the ancient 'builders have done with the pieces? for they are 'not here; perhaps they never had any existence; 'nor is the Great Pyramid the work of man.' (See Map and Section in Plate II.)

Yet to close observation, traces of human diligence are manifest everywhere; and Colonel Howard Vyse calls attention to the several series of circular holes in the rock north-east of the Pyramid,—or close to the place where stones brought by the northern causeway (an excellent example, too, of long inclined planes being used by the Pyramid builders to overcome any very serious vertical lift), would first be discharged on the summit of the hill; and Mr. Perring, as a practical engineer, having himself had to work stones both on the 'Arabian hills' and at the Pyramid, considers that there were several rows of those rough-and-ready engines, called 'poly-'spaston' by Vitruvius,[1] placed there,—the butt-ends of their masts entering the said holes, and offer-

[1] Vitruvius, chapter 5, book 10.

ing facilities for the masons lifting and turning the stones while chiselling them into regularity. Many similar round holes, too, did Mr. Perring find in various parts of the Pyramid masonry itself, indicating that similar engines must have been employed there in raising and setting the blocks; strangely confirmative, therefore, of some of the earlier traditions related by Herodotus.

'Now for secrets,' thought we, as we paced about amongst the deep cuts effected by recent rains in these ancient rubbish heaps; 'for what stray or 'forgotten or anomalous things may not be dis-'coverable here?' But we became wearied with seeing nothing but chippings of limestone, forming hills and hills; and who indeed will ever pass them all through a mighty sieve, and detect a lost pick, or signet-ring, or anything unusual; or who, again, can wait until rains shall have at last washed away all this heaped-up rubbish from the northern cliff of the hill, and then laid bare perhaps some troglodyte caves of men, who possessed these lands long before Egypt became the heritage of her historical races! At last, however, and without going to any extraordinary lengths, we did hit on something rare and strange; it was towards the top of the heap, and just in front of, though at a great distance from, the Pyramid's entrance portal: for there, appeared frequent splinters and fragments of green and white, or black and white *diorite*, exceedingly

similar to, if not exactly the same as, the material of the celebrated statue of the Pyramid King at the Boolak Museum.

But the tomb where that marvel of early sculpture was found, lies a long way south-east of the Great Pyramid: and when we asked Alee if the pieces now before us could have come from there,—he answered, 'But who would take the trouble to 'bring them all that distance, and so high up the 'hill, and mix them up with the earth here?' and then, shaking his head, he said, 'It was not possible; 'and besides that, there are too many of them;' and therewith, as he sat on the ground, he looked at all his toes and all his fingers, and at the greater number of the diorite fragments scattered immediately about him, and repeated 'it was impossible.'

'Then where do they come from?'

Of that he could form no idea, but testified again and again that never had he alighted across a single portion of such diorite forming any part of the structure of the Great Pyramid, or of a single tomb round about it; nor had he ever heard of any vase, figure, or anything made of it being found in them, either below or above ground. That statement he thought settled the case so completely, that after its enunciation he went on quietly passing, as before, his toes in review under his fingers, and looking seriously at a rub which one of them had sustained; but I was compelled to gaze up at the Pyramid, with its vast bulk, and believe that there is another

chamber still to be discovered there, and one which will prove, when found, to be the very muniment-room of the whole monument. But how to find it?

There is nothing new, or difficult either, in imagining how there *may* be more hollow spaces within the walls of that vast structure; for every traveller and every antiquary during ages have so indulged, and have hacked, hewed, and excavated at their own sweet wills, or untutored fancies,—yet never found anything thereby; or have succeeded only in proving this, that their ideas were not the ideas of the original builders. Colonel Howard Vyse discourses eloquently in divers portions of his sterling volumes, upon how mere thought never yet discovered anything in the Pyramid; that what has been laid open there has resulted either from pure accident, or the following up of a clue furnished by the building itself; and that many of his own thousands should never have been expended at all, in the manner in which they were. He has indeed made a lamentable disfigurement in the southern face of the Pyramid, and yet that and other negative results were evidently required to convince him, and others too, that the building was *not* stuck full of rooms; for we see in his journal the change of opinion stealing over him day by day; and as his purse lightens but his practical experience increases, he perceives mechanical proofs of a general focussing of the excellences of the whole building towards the King's chamber, in a manner which

almost absolutely precludes the idea of any other hollow part of importance remaining to be found.

May the Colonel's experience serve for all men, and no more random quarryings be allowed in the ancient edifice! Wherefore we will say no more of our one additional expected room, until our linear measures give illustration, approaching to proof, of the idea being founded on fact. Such were my thoughts at the time, and therewith we went back to daily measurings of the passages and their details.

The portcullis proved rather a tough piece of work to render a full account of; and there was no standing on the 'slide' under it, until I had made a plank ladder to lay over the steep slippery surface. But then how the 'travellers,' as they passed, always coveted the use of this simple contrivance; particularly the elderly ladies, who had extreme objection to sitting on their heels and sliding down the smooth stone slope, as the Arabs always wanted them to do. To a temporary use of my carpentry I of course had no objection; but then the poor creatures, once upon it, were generally too frightened to go any further, and would remain there immovable, gazing speechless, and with awe-struck countenances, into the gloom of Al Mamoon's hole,—until their husbands or brothers or sons returned with their guides from the further bowels of the monument, which they made sure must be regions of eternal blackness and darkness indeed.

Amongst the many parties, however, helping not at all, and apologizing less,—there was one of better order, from a boat returning down the Nile, where the patriarch chief had ideas far beyond the common run ; and having come to me for some explanation about the 'triangular stone,'—he likewise spoke out involuntarily and spontaneously his admiration for the gallant Howard Vyse. 'He held property 'in our *county*,' was the first bond of sympathy with the deceased hero ; but then the speaker went on to expatiate on the noble giving up of himself to a great work manifested by the Colonel ; the innumerable vexations and oppositions which he had to encounter, enough to have turned away ten ordinary men,—and they did turn away his faint-hearted ally the then Consul-General,—but Howard Vyse's devotion only rose proportionally to the difficulties ; for he thereupon took the whole work of the intended confederation on his own shoulders, and became day after day for months together the employer, superintendent, and paymaster of more than three hundred Arabs ; working them in directions and on subjects of his own choosing, planning, and final discussing. How too, these Arabs did try to overreach him in every particular ; and while they were receiving from him such pay as they never had before, and were saved in his service from being ordered off to work at a deadly canal by the old *régime* of Mohammed Alee,—yet they endeavoured to shirk their work and inveigle him into difficulties and into giving

them all manner of needless gifts and perquisites besides; nevertheless Howard Vyse always kept to his word rigidly, though they had cheated utterly.

There was that Sheikh of Kafr-el-Batran, who, as the Colonel writes, 'came with a request that my 'blacksmith might be allowed to make for him an 'instrument to cut grass or grain. I readily con- 'sented, as I understood from his description that 'it was a trifling affair, which would soon be com- 'pleted. It proved, however, to be an immense 'machine, composed of nearly a ton of iron. The 'metal, in fact, was his chief object. I kept my 'promise, but carefully avoided such engagements 'in future;' and then the same old serpent Sheikh could come sidling up to him very soon after, with such a sanctified air, requesting leave to 'take some 'stones, that he might build a tomb to his deceased 'brother,'—but really that he might induce the Colonel to break the terms of his firman, under which he had been allowed to pursue his excavations at the Pyramid.

'Oh! I can assure you,' said the Lord of the dahabeeah with enthusiasm, '*our county* man was 'one of whom the whole land might well be proud; 'his book was of course all well enough in its way, 'the best description of the Pyramids from original 'measurement ever printed in any language; and 'the faithfullest digest of all the innumerable works 'that have ever been published on them, either 'among eastern or western authors, from the times

'of Herodotus, Manetho, and Mohammed, on one side,
'down to—oh down to "the author of *Recollections*
'*of the Peninsula, etc.*, and the *Encyclopédie Pit-*
'*toresque des Sciences et des Arts, Paris,* 1835;"
'but what we of the *county* admire most, is that
'matchless style of the complete gentleman in
'which he did the honours of the Pyramid so long
'as he lived in front of it. Not a single traveller
'ever came there with anything approaching in
'the least extent to an introduction, but what he
'was entertained at dinner, or accommodated in the
'tents, and had attendants told off to wait upon
'him and show everything of interest in the neigh-
'bourhood, including even the last of the Colonel's
'discoveries. And when the very greatest of the
'native dignitaries arrived, with their eastern polite-
'ness of the grand old Abraham school, even such
'as the Scheriff of Mecca, our *county* man was as
'truly lordly as any of them; feasting them as
'lavishly and giving back presents three times as
'costly as all he received. But if any overbearing
'grandee appeared and presumed to take liberties,
'how politely the Colonel foiled him! so when the
'mighty Prince Pückler Muskau came galloping up
'with his retinue and equipage, and very coolly
'wanted to encamp the whole of them, within the
'Colonel's narrow enclosure, he quietly remarks,—
'"To this I did not consent, but directed a person
'to conduct his Highness to the great tomb in the
'plain generally occupied by travellers." And what

'sort of person was his Mighty and Serene Highness?
'Why, precisely one of those who writes, or pays
'others to write, their names on the noblest monu-
'ments they can find; and I myself have now, only
'just come down from Nubia, and seen the name of
'this potent Pückler Muskau, with all his titles in
'big domineering letters, sprawling across the breast
'of one of those Remsean giants who, for three
'thousand years before the race of Pückler Muskau
'was known under the sun, have sat guarding the
'entrance to the rock-hewn temple of Abu Symbel.'

Much more would the enthusiastic advocate for English *county* history and its heroes, have willingly related, as we stooped there uneasily under the granite portcullis; but Alee Dobree had long been calling down to us from the top of the entrance passage, and indicating something or other of a threatening aspect which we could not understand, and therefore did not attend to. Soon, however, it appeared that he had had reason enough on his side, —for in a minute afterwards, there began pouring into the top of the narrow funnel a perfect torrent of travellers, the contents of two mail-steamers at least. One of the sight-seers followed close after another, or with Arabs between, until the whole length of the entrance passage was thick with smoke of candles and crammed full of struggling specimens of humanity, blocking out the daylight from above and driving suffocating clouds of dust before them,—as they loudly vociferated and tumbled

confusedly from one side to the other of 'the low 'and narrow way that descends as down the steep 'of a hill.' A Pyramid Sheikh was ready at the appointed spot, to turn them westward into Al Mamoon's hole; but the time they occupied clambering in there seemed interminable, and still fresh torrents poured in at the summit of the passage, without cessation.

We two prisoners on the sand-bank of refuge below, looked up from time to time through the din and dusty turmoil, and saw 'travellers' of every conceivable kind,—some of them half stripped of their clothing, as if going to cricket or a boat-race; or perhaps, like Sandys visiting the Great Pyramid two hundred years earlier, 'forewarned of the heat 'within, not inferiour to a stove;' while others, again, had wrapped up their heads and fly-away whiskers curiously in cambric handkerchiefs; but each of them had the assistance of at least two brawny Arabs to help him along; occasional candlemen intervened, and active little black boys, with goolahs of water for the thirsty ones, brought up the rear.

CHAPTER IX.

MODERN RUBBISH AND RAMADAN.

After doubling the portcullis with measuring-rods and plumb-lines, our progress up the first ascending passage was comparatively rapid,—for there were not so many features there very worthy of note; and again, on entering the grand gallery,—as in that part we confined our attention at first, merely to the narrow continuation of the floor of the former passage, which keeps the same breadth and same southward direction, but as to angle of altitude changes to horizontal,—the measuring became so much easier, as both rods and candles did not there for ever require to be held tightly, lest they should slip and shoot off downwards right away from us.

After a few feet too, this horizontal passage passes under the elevated floor proper of the grand gallery; and continuing on in the same direction, and protected manner,—reaches the so-called Queen's chamber; a *cul-de sac* without thoroughfare, and a perfect haven of quiet after the continual disturbances experienced elsewhere. *Especially* calm, moreover, was it; as this said Queen's chamber was

apparently not considered any part of the 'show' for travellers, and we only heard their noises and shoutings, multiplied by echoes and dimmed by many reflections, making strange streams of noises, like the voices of innumerable waters,—as the various parties prosecuted their triumphant progresses to the King's chamber, far over our heads in the bulk of the Pyramid.

But what was there to notice in the Queen's chamber?

Many unusual if not mysterious things, and features of which no explanation has ever yet been given, and hardly even attempted.

Firstly, There is no flooring to either passage leading into it or to chamber; *i.e.*, in the sense of the ordinary floor lining of white Mokattam stone; what you actually tread on, being simply the surfaces of the ordinary courses of masonry belonging to the mass of the Pyramid, and occupying two different levels in the run of the passage!

What has become, then, of the finer flooring blocks, if they were ever put in? and what would have been their thickness and the reduction they would thereby have made on our present measures for the height of the walls, if they had been now in their places? Or, were they perhaps never inserted? And if so, why such a contrast, in the finish of its floor, to all other parts of this room, as well as to every other floor throughout the Pyramid?

Secondly, The *walls* of the Queen's chamber *are*

lined; and with the finest and purest white stone yet met with anywhere. It is something which is whiter, closer in texture, and takes a higher polish than any of the other stones, even the 'casing 'stones,' and was originally exquisitely planed; with the accompaniment too of the joints being the truest and closest ever observed. Some which were specially examined were really to be called microscopic, and yet duly cemented both in vertical and horizontal courses.

'But what did they, the builders, put cement 'in between the joints for?' asked an American clergyman, who one day found his way into the room. He was a magnificent elderly gentleman, and I had fancied him at first an archbishop, or a bishop at least, with two or three small attendant chaplains, and yet not exactly that either. The Arabs, his guides, were very disinclined to let him stop and talk; but they soon found what a commanding example of human nature they had to deal with, and being summarily ordered to wait outside,—they sat down there in patience and blank despair, blowing out their candles, however, to save the consumption of wax while the talk went on.

Then again demanded our questioner, who proved to be the first minister of Buffaloe City (and one who had been offered again and again the bishopric of New York, but had refused on conscientious principles), again demanded he, 'What did the 'builders put lime between those joints, even the

'vertical joints, for?' To make their work good, and enable it to last long, was the *first* evident answer; and the metrological theory suggested also a *second*, —or, that *lasting* power was of extraordinary importance; seeing that the builders had worked, not for their own or the succeeding age, but for one separated from theirs by many thousand years. This was only theory; yet further research about the building produced instances showing, that whatever the chief intention, one further result had been,—both to put, and keep, on record some most unexpected testimonies to important features that once existed; and in parts where destroying men had in the interval been visiting, breaking, and perhaps thought they had carried everything of importance away,—and would have done so, but for the faithful grasp of the almost invisible sheet of cement.

3 *Thirdly*, Roof and walls of passage, and walls, perhaps roof also (but I had not a ladder tall enough to examine that) of Queen's chamber,—are covered to the thickness often of a quarter or even half an inch, with a coating of a hard saline incrustation, almost stony sometimes in external appearance; sparry excrescences Colonel Howard Vyse calls the substance, filling accidental fissures in the stone, and still exuding or growing,—for certain letters scratched on the wall in 1823, have now *raised* outlines in this species of salt. Whence comes this salt then, and why is it so peculiarly confined to this chamber and passage?

Fourthly, What is the meaning of the great niche, some fifteen feet high, several broad, and more than three deep in the eastern wall of this room; elaborately wrought with all perfection of mechanical accuracy, and yet more than two whole feet out of the centre of the side of the apartment; and that a most pointed side, literally as well as figuratively, from the ceiling being formed in two halves leaning against each other at a sharply cut angle? There is nothing else whatever either in the Great Pyramid or any other Pyramid like this niche, or capable of leading to its explanation; and yet its size, together with the finish of its work, shows that it must have had some special and important object.

'To conceal treasure,' said the Arabs of old, and burst out the back of the niche,—and found nothing. 'To show a passage under ground leading 'to the great Sphinx,' said mediæval Europeans, attaching, though Christians, greater value to an idol than ever did barbarous Mohammedan natives; but after forcing their way for fifty feet eastward, and finding only solid masonry, they gave up their quest in despair. Then came the modern sepulchral theorists, and said, 'There must be a mummy-'pit under the floor just in front of that niche,'—so therewith they excavated, and excavated, but found nothing; while they heaped up all round about their hideous chasm, that enormous mound of rubbish which the two Reis, Alee Shafei and Atfee, with all their little men, had to put back at our

desire last month, so as to enable the room to be seen once again in something like its original proportions.

As for myself, I could only look on and wonder, recording the measures, and keeping them for future discussion; employing alternate days in examining other much older rubbish-heaps outside the Pyramid, and of not inferior, though a perfectly different sort of, interest.

These new rubbish-heaps were not, however, the grand remains of ancient chippings before alluded to,—and which are outside the Pyramid hill itself, as well as the Pyramid, and vie in extent with Nature's own erections,—but are comparatively very small and modern accumulations, banked close up against the sloping walls or sides of the builded monument.—(See Plan in Plate IV.) Yet small though they be, these modern rubbish-heaps led the Rev. Mr. Gabb, in his fine, cheerfully expressed, and rhetorically written work, entitled, *Finis Pyramidis*, to conclude that 'this interesting monument, this 'paragon so replete with principles of science, the 'great Pyramid of Jeeza, was erected by the ante-'diluvians'!

The argument, which is conducted by the reverend gentleman with the greatest fairness as well as most inspiring brilliancy of expression, is wholly based on the belief 'that the heaps of matter which 'environ the Pyramid, and hide a great part of its

'reclining sides, next to the foundation, are *entirely*, 'or *all but, composed of sand*, and *sand adventi-* 'tious to the locality. On that,' he says, 'all authors 'are agreed, but by what agency is the question.' Wherefore he proceeds to show that the general opinion is, that the sands have been brought there by the winds; but such an action, he says, 'is 'directly contrary to common experience, since the '*removal* of a deposit of sand is rather the natural 'and invariable effect of that agitated element, the 'wind, especially on the summit of a hill.' Such, too, he argues, *has* been the slow effect of ages of wind upon a great mass of adventitious sand, once on a time heaped about the Pyramid, subsequent to its completion, and brought there by no less a carrier than 'the universal deluge, called Noah's 'flood.' 'These sands, on the subsiding of the 'waters, were probably very near the summit of 'the Pyramid. Nor do I' (Rev. T. Gabb) 'doubt 'but the apex of the Great Pyramid was severed 'from it by the impetuosity of the waters while in 'their unabated rapidity, and thus left flat, which 'has furnished various conjectures.' All which ideas are prosecuted by the ingenious author, until he at last culminates in showing 'the *absurdity* of 'the opinion of the Great Pyramid being built '*since the Deluge.*'

The other Pyramids in its vicinity, he then considers, 'as doubtless antediluvian also; and, from 'their more entire state of preservation, to have

'been erected much nearer the time of the Deluge.' But he does not consider them, for various reasons given, to have been erected for the same virtuous, scientific, and religious, ends as the Great Pyramid; on the contrary, Mr. Gabb pronounces the founders of these other Pyramids 'to have been some of 'those who, after their intermarriages with the 'daughters of men, became not only degenerate 'despisers of useful knowledge, but altogether 'abandoned to luxury; intent constantly, not on 'profiting society in ages to come, but on evil, in 'all kind of extravagance, pomp, and vanity; and 'apparently built the Pyramids now in question 'merely for ostentation, instigated, perhaps, by the 'urgent entreaties of the vain females, who swayed 'and overruled the faint efforts of expiring virtue 'in the breasts of the husbands of their new 'alliance.'

Yet the theory, so successful on paper, rests on nothing but *reputed sand;* and, unhappily for it, even that sand has no real existence; for when these heaps 'that hide part of the reclining sides of the 'Great Pyramid' come to be examined, they are not composed of sand at all, but entirely of fragments of building stones!

One of the earliest travellers specially to note that these heaps *did* consist of broken stones, and *did not* consist of sand, was that accurate and eminent observer of nature, as well as men and manners, the late Mr. Lane, as described in his

sister Mrs. Poole's *Englishwoman in Egypt*; though it does not appear whether his remark was pointed at the refutation of Mr. Gabb's theory or not. But at any rate, though opposing, we must speak respectfully of that gentleman, who had not himself made the erroneous observation at the Pyramid, but had taken it on the report of books which he believed to be true; and he encases himself further with this mantle of truth and good feeling, which we trust may be allowed to others also,—that 'if he 'should have deceived himself, and should fail in 'his attempt to establish the right theory, still the 'Great Pyramid will neither fail nor suffer any 'diminution of its beneficent utility in assisting 'towards further discoveries.'

How truthful the sentiment will probably appear from what follows, touching a further examination of the same heaps lying against the Pyramid, and the numerous witnesses they have thereby furnished to a leading question connected with the mechanical theory; viz., Was the Great Pyramid always the same stepped or laddered monument that we see it now; or, was it once smoothly covered in by casing-stones; *i.e.*, a stratum of well-worked masonry,—square-angled at the back to fit into other square-angled backing stones, and these into the rectangular courses of the great core of the Pyramid,—and then bevelled off at the outside surface according to the general figure of the whole

monument, so as to give it a perfect smoothness and oneness of superficies from top to bottom?

The conception of these casing-stones is surely simple enough in itself, though some authors who visited Egypt at the beginning of the century, would persist in translating the French word expressing that peculiar sheet or covering of stones, *revêtement*, by *rivetings;* which, to a nation of steam-boiler-makers and iron-shipbuilders, conveys quite a different idea. Worthy Signor Belzoni was nearer the mark in speaking of casing-stones, as 'a jacket;' and he knew well enough, no one better, of the remains of such a casing still existing towards the top of the second Pyramid; yet strangely, he was decidedly set against anything of the kind having ever attached to the Great Pyramid. 'It has been 'supposed,' he writes, with all the clearness of an old Roman, 'that the first Pyramid, or that of 'Cheops, was *not* coated. I must agree in this 'opinion, for there is not the slightest mark remain-'ing of any coating.'

The unfavourable opinion which Belzoni in 1822 refers to as then existing, was not improbably based on the writings of M. Niebuhr the elder;[1] to whom, as the chief of a large and national scientific expedition, almost implicit confidence was paid in his own day, and he has been highly lauded since for his accuracy by Baron Bunsen in the world-

[1] Swiss edition of 1780; M. Niebuhr sailed from Denmark in 1761.

renowned volumes of his *Egypt's Place in Universal History*. This first-class man, then, M. Niebuhr, holds no quarter with any advocates of a once existing coating on the Great Pyramid. 'To aug-'ment,' writes he, apparently of *all* the Pyramids, but speaking on the strength of a visit to the Great one only,—'To augment the high opinion which 'scribes have endeavoured to inspire of the magni-'ficence of these monuments, they have advocated 'that the Pyramids had been coated all about with 'marble. But in spite of all my researches, I have 'never been able to find any trace, nor even any 'indication, of such a covering.'[1]

Now, so far as the word *marble* is understood by some persons in the present day, viz., 'statuary 'marble,' or limestone altered by plutonic heat under pressure, and become dense, crystalline, and free from visible organic remains,—there is nothing of that sort about the Pyramid at present, nor has there ever been; nor does Niebuhr make his rejection of the hypothesis of 'coated all about with 'marble,' rest on that mineralogical difficulty; for in his day 'marble' was applied to any stone that would cut in any direction and polish well,—including, therefore, serpentine, porphyry, and granite; or if he had perchance already become of the more rigid of the new school, he would merely have excluded these extraneous minerals, and with many

[1] 'Je n'ai pu découvrir aucune trace, ni même aucune indice, d'un 'tel revêtissement.'

of the geological text-books of even the present day, have used no more discriminating definition for marble, than 'any hard limestone which is capable 'of receiving a high polish.'

Under such a definition, the Mokattam limestone *may* be received as marble; for I have had a variety of examples of it submitted to a lapidary, with brilliant result, and there is plenty of *it* about the Pyramid. I would not, though, myself indulge in calling it by the luxury-inspiring name, having the same conscientious scruples in using *marble* to any one variety amongst a number of limestones,—that Cicero had in applying the term, a *good man*, to any one whatever amongst all his acquaintances, very respectable citizens though they might be. But the world, from the time of Greaves to that of Niebuhr, would have called the Mokattam rock freely by the name of marble; and so would Niebuhr too, we feel convinced,—while his previous paragraph, declaring the whole Pyramid, so far as he had examined it, to be composed of the rock of the Pyramid's own hill,—simply shows that he had not distinguished, mineralogically, amongst the blocks of nummulite material, the occasional purer masses from Mokattam. With him, therefore, to say that he had not found 'any trace, nor even any 'indication of there ever having been any coating 'of marble to the Great Pyramid,' is perfectly equivalent to saying, that he had not found any trace of Mokattam stone which could possibly be

attributed to the once existence of such a coating; and in that sense spoke Belzoni too.

Such was the understanding, then, of modern antiquity on this subject; and doubtless Sir Gardner Wilkinson had much difficulty to contend with in improving public opinion upon the point, when he commenced his matchless literary and antiquarian labours in Egypt; but the hero of the tale is undoubtedly Colonel Howard Vyse, who cut down through obstructing rubbish on the northern face of the Pyramid, right down to its foot, and discovered there two huge casing stones, and part of a third *in situ*, this *part* having been maintained there by the astonishing hold of the cement, as a testimony to *more* than two having once existed. These stones were rectangular at the back, level and horizontal on the upper and lower surfaces, but sloping on the outside, and at just the angle, when produced, to finish off the Pyramid in a point a little way above the present flat top; they were likewise composed of a beautifully hard and white variety of the Mokattam stone.—(See Plate IV.)

Now, inasmuch as Herodotus describes the Pyramid to have been cased in his day, and that such casing was begun to be put on and finished off from the top downwards,—the finding of these two blocks at the base of the Pyramid, was bringing to light the proof that the casing *had* once been completed, and the very last stones of the series inserted; freeing therefore the great monument from the ani-

madversion of Belzoni on the second one, viz.: 'Yes, 'there is some coating about the top of the second 'Pyramid, for the masons began to put it on at the 'top as the Egyptian priests described; but they 'could not get any further than the little distance 'which you now see; and that is all the amount of 'coating the second Pyramid ever had.' In fact, Colonel Howard Vyse's great discovery of the finishing, because the lowest, blocks of the whole sheet at the Great Pyramid, gave a double holding turn to the casing-stone theory.

So at least we had thought: and made sure of the same with every one else in the world whose mind is capable, in a mechanical subject, of admitting mechanical evidence; but to our extreme surprise on arriving in Egypt, we found the matter perfectly scoffed at by some of the literati of Cairo. 'Oh, cer-'tainly,' they said, 'we know as well as you, that 'the Colonel found two stones at the foot of the 'Great Pyramid; but there were never any more 'than those two; and they, by themselves, have 'no more power to explain the whole Pyramid sur-'face, than two pebbles found on the sea-beach to 'tell you what the bottom of the entire ocean 'is like. Read,' added one of the gentlemen, 'my 'invented conversation between an Egyptian priest 'and a Greek philosopher, who had come as an 'humble student to learn something of the famous 'mysteries and secret wisdom of the Egyptians, in 'the cloisters of the temple of Amun-ra at Helio-

'polis, in the year 700 B.C.,—and you will find, col-
'loquially expressed, what all we Egyptians know so
'perfectly well,—that the Great Pyramid was always
'the *laddered one* of the group, and always trun-
'cated near the summit as you see it now; for pur-
'poses too, that none but pure Egyptians have ever
'been able to comprehend.'

'Then what becomes,' we asked, 'of Sir Gardner
'Wilkinson's very consistent historical notices of the
'casing having been removed, by early Arabian
'Khaliphs, to furnish material for building aqueducts
'and mosques for their new capital of Cairo; and
'the long Arab bridges, by which the heavy stones
'were conveyed across the alluvial flat to the river
'bank?'

'Why, vanished in smoke,' returned the Cairene unabashed, 'gone off into the same nothingness as
'the casing stones themselves. Casing stones,' he added with emphasis, 'pray what use would such
'queer-angled things as casing stones of a Pyramid
'be, to masons engaged in any rectangular work?
'the idea of casing stones is simply a myth!'

At the time, we were only getting up opinions; but on going out to the Pyramid, my conscience often suggested the propriety of trying some clearing up of these remaining native difficulties about the casing stones. Sometimes we thought of uncovering again Colonel Vyse's two; but then he records, that they were excessively broken by mischievous visitors before he, on leaving the neigh-

bourhood, could shield them safely with rubbish; wherefore, though I might have brought from Scotland more accurate means for measuring the angle than he had, there would not be found now so much to measure upon; and besides that, any degree of accuracy whatever procured on those two particular stones would not satisfy the learned and jealous of Cairo. We turned our attention therefore to the Pyramid as a whole, and soon began to perceive something remarkable.

A friend had told us long before, that he had seen fragments of the casing stones, still existing here and there high up on the sides of the Pyramid, and glistening like snow in the morning sun. He judged from a distance by their whiteness as compared to the general yellow of the whole, and was deceived; for we found, on examining such instances, that they were merely occasional white examples amongst the other blocks composing the rectangular masonry. But then it was, that we began to note the heaps of rubbish lying against each face of the Pyramid near its foot; their form is most peculiar and full of suggestion; for it is a function, so to speak, of the height of the Pyramid-side vertically above them; coming therefore to a culmination always, and regularly, in the middle of every side. This obtains exactly on the east, south, and west sides; and if it does not at present do so precisely on the north also, it is because Colonel Howard Vyse gashed the original mound there with one

grand cut in the middle, running north and south, and then with two other parallel ones on either side, in search of pavements,—and then with two or three other cuts running east and west, when he was looking for a *lower* entrance into the Pyramid; converting thus the original and single large heap into a collection of several smaller ones. But the shape of the original mass may yet be traced by a discoloration on this north side of the Pyramid, and shows it to have been perfectly similar to the others. (See Plate IV.)

Now this shape is, as clearly as may be, a proof that the heaps observing it are formed of matter that has come off the side of the Pyramid; and the external coating of both, is now the same in colour and consistence; viz., yellow ochry and friable. In the instance of the poor Pyramid side, oh how friable! for the miserable nummulite variety of limestone is weathering away to the extent of several feet in some places, threatening to wash down bodily with a few more showers of rain, and bidding one despair of ever arriving at the original state of the Pyramid in these latter days of its dissolution.

Let us take courage, however, at least to look at the ruins and examine their character. On every side the external crust of the heap is, as we have said, the same in matter, as that of the Pyramid; and so it continues to a depth of about one or two or occasionally three feet; but underneath that yellow crust, the mass below is made up of nothing but artificial fragments of *white* limestone, dense, com-

pact, free from fossils, and in every respect like Mokattam stone generally, and the material of Colonel Vyse's two casing stones in particular. Now these cannot be the chips made by the workmen at the original building; for, long after that was finished, Diodorus Siculus relates notoriously, that he could see no traces whatever of any heaps of refuse banked up near the Pyramid. The area where we find these heaps now, was consequently entirely unoccupied in his day; and by their form, they must have come down from the side of the Pyramid; what last came down is at the top, and is yellow, like the present side of the monument; but what previously came down is below, and is white, —wherefore we assume, that the Pyramid was once externally covered with such white stone.

'Alee Dobree,' we asked, 'who made all these 'great holes by which we can see the white stones 'underneath the yellow crust of these heaps?'

'Oh! it's the Arabs,' confessed he at once; 'when 'an Arab wants to make an oven, he always comes 'and digs here in these rubbish heaps lying against 'the Pyramid sides; for the sort of white stone 'he finds there, will stand heat better than any 'other; and though it is in small pieces near the 'top, he can always find larger by going down 'deeper.'

This statement seemed to be quite true, from our inspection of a number of the holes; and in one of them my wife's sharp eye detected a mass, one of

whose sides had evidently been worked flat by the hand of man. It was lying inverted and wedged in amongst other similar blocks, but by dint of poking with tent-pegs it was extracted; the worked surface was some fifteen inches by ten, but irregular in bounding figure, being met on every edge by fractured surfaces, from behind, and having evidently once formed part of a much larger block. Every poke with the tent-pegs loosened and set free clouds of white dust; but this was merely a product of the dry decay of the limestone, and perfectly different from the Rev. Mr. Gabb's desert sand; which, *i.e.*, the true desert sand, consists chiefly of sensible sized particles, often to be called miniature pebbles, of quartz and jasper. We went on therefore with our examination, quite confident of being at work on a conglomeration of later date than any visited by Greek and Roman authors; in whose days too, by their own accounts, fully translated, the Great Pyramid *was* covered over with a smooth casing of Mokattam stone.

Seeing us at something like amateur quarrying, though on a very small scale,—divers Arabs emerged from behind rocks, and brought us 'antiques' for sale, such as legs and heads of green idols, stone scarabæi, doubtful-looking signet-rings, Egyptian colour-boxes, and what not, procured by themselves out of tombs near and far from where we then were; but we refused to purchase any one of them, and declared the utmost contempt for all 'antiques' of

every kind and degree. Such things we were not desiring at all, we told them; but cared only for taking measures and photographs of ancient things as they stood; or, if there was anything more than another we would like to accomplish, it was, to find amongst that multitude of fragments of white stone which they were all treading under foot,—a single specimen where two of its worked surfaces met together. But the sellers of smuggled antiques being quite unable to see the money advantages of that,—dispersed again to their hiding-places, ready to pounce on the first traveller whom they might secretly persuade to purchase from them, things which the new edicts in favour of the Museum at Boolak, forbid all good subjects to traffic in.

Alee Dobree, however, attended to a little lecture which I gave on right angles, and the angles by theory peculiar to casing stones: and soon plumed himself on knowing more than his brother Arabs, or that the angles of 128° and 52° were not angles of 90°, and possessed an important meaning for the structure of the Pyramid. Zealously, therefore, at all the intervals which the putting up of the camera for dry-plate photographing offered, he set himself to look about for fragments with two worked surfaces meeting. Presently he found an example,—but the angle was a right angle, and both sides white, and with traces of cement.

'That is only one of the back corners of a casing 'stone,' we said confidently; 'look again, Alee, and

'doubtless you will at last find one with the front 'angle.'

'Of 128° or, 52°?' said he proudly.

'Precisely so.'

At last he came running from a hole in the heap on the eastern side of the Pyramid, and declared he had found one. It was a huge mass, was the stone containing the reputed angle,—some twenty-seven inches long on one worked surface, but met on every side by fractures, except at one little spot, where there was a portion of nearly three or four square inches of another worked surface, and meeting the first decidedly at *not* an angle of 90°.

It was growing dark that evening when thus much had been ascertained, and the stone far too heavy for carrying to the east tombs; but next morning we went in force to the spot, placed the block with its large surface uppermost, as well as duly level; and then with a pocket clinometer measured the angle of the small attached portion of the other worked side,—and, 52° came out for its depression, or 128° for the angle of the stone itself.

That then must have been part of a casing stone of similar composition, and the same angle (as clearly as could be judged on so small a fragment) as Colonel Howard Vyse's two colossi; but extending the mechanical testimony from the north, to the east, side of the Great Pyramid.

Subsequently, too, we succeeded in finding specimens provable from their angles, on every side of

the Pyramid ; several examples from each side, and without a single anomaly ; that is, the angle was always either 128° or 52° ; and never different therefrom by half a degree ; so that they could not have belonged to anything else in all that region but the casing of the Great Pyramid. The sides, moreover, that had been external on the building, proved themselves by a peculiar brownish, painted-looking surface of a bright walnut-wood brown ;[1] while sides that had been interior, were usually white, and with traces of white cement. Whether, too, it was that these fragments had been preserved by having been buried, or that Mokattam stone is really so very much more lasting than Pyramid Hill nummulite,—these casing-stone fragments would often delight us by the beauty of their surfaces and sharpness of their lines ; some of them being far beyond the work of a chisel even of our own day, and must have been the result of an accurate process of grinding and polishing down after they were fixed on the Pyramid's side.

Nothing was *then* wanting to complete proof of the whole casing-stone theory ; and if most of our specimens were small in size, that might be merely due to their being fragments knocked off by early Arab workmen to suit those grand old stones to the rectangular masonry of the new build-

[1] This species of brown is that called *red* by the late Mr. Agnew and Signor Caviglia in some of their dissertations on the Great Pyramid ; and is very different from the actually red ochre used occasionally by the ancient masons for drawing lines or quarry marks.

ings in Cairo, destined thus to be raised; but it was also attributable in part, to our not making any deep excavations, and only pushing about with feet and hands among the loose matter near the surface. Had His Highness the Viceroy at the beginning, only listened to our petition, that he would be pleased to open up all four sides of the base of the Pyramid,—according to article A, of the second part of our application to him (page 8),—who knows how many complete specimens, and large ones too, of casing stones might not have been found; for the east, south, and west rubbish heaps of the Great Pyramid have never yet been cut through by any man.

But it was not our business, nor within the compass of our means, to perform such excavations; and as the month of Ramadan drew its slow length along, we had often hard work to prevent being deserted altogether, and left without a single native to help us at anything. At first it was a touching, and rather exemplary sight, to see the poor Mohammedans submitting morally to so severe a trial of the flesh; and there was something of unspeakable grandeur in the idea of one illiterate man, and not born to kingly state, whose influence over millions is still, after a lapse of twelve hundred years, so powerful, that ruler and peasant, in many lands, alike bow down to his dictates; and, in defiance of all that civilized and learned Europe can write, or print, or do, will persist in commemorating, by a

searching penance on themselves, their false prophet's self-asserted statement of his having received an inspiration from on High during that month. 'But 'by their fruits ye shall know them,' and the growths of Ramadan became at last far from edifying.

At first, and so long as the effects were to try every man's temper, and show what his weaknesses were, while he struggled all the while manfully against them,—we were all pity mixed with sympathy, and the whole region was one of prayer from morning to night. Our servants seemed to be perpetually either on the hill-top or on the plain below, prostrating themselves towards the east, upon some portion of their garments, previously laid on the ground before them to serve as a carpet. Old Ibraheem had a stern solemnity and rigid completeness about his supplications, that pretermitted nothing of all the innumerable forms that are ordered for the five times a day of his creed. He accordingly began his ablutions long before daylight; three times washing the inside of his throat, and three times the outside; three times his nose, his eyes, his ears; three times passing his fingers through his beard (and that beard of the orthodox length of a handbreadth); three times washing his hands up to his elbows, and three times from his feet up to his knees, and repeating the prescribed prayers after each operation. Alee Dobree, on the other hand, did not apparently know so many prayers to repeat; but what he did know, he

groaned out from his inmost soul, as if giving up the ghost; while Smyne, I am grieved to say, gabbled over his as fast as he possibly could, and was then off to something else more agreeable to his tastes.

Yet we had the impression of their all being the better for *trying* to keep Ramadan,—for it was an education towards raising the mind above the body, the moral above the physical, the religious above the earthly; and proof, too, which should not be forgotten, that Mohammedanism does not entirely consist of self-indulgence, nor allure its votaries by promises of nothing but pleasure. Unlimited pleasure must soon cloy any man intended for something higher; and many are the old Scandinavian legends,—which may, too, have originally had Eastern audiences,—of heroes captivated into fairy-land, and surrounded with every indulgence that sense could ask for; but presently tiring of the uniform bliss, and flung back to the trials and straits of earth again. A diet of sugar-plums will evidently not make either a soldier or a saint; and in a primitive land and rural life, something stern is required to force peasant souls to look upwards from mere eating, sleeping, and living.

So long, therefore, as Mohammedanism lasts in these Eastern countries,—where enthusiastic travellers tell you that everything is so exquisitely patriarchal, and naked little boys hang about lordly oxen as they step majestically around the threshing-floors

treading out corn, exactly as they used to do 4000 years ago ;—*i.e.*, in retrograde countries and debased, where the whole people are convicted, by the testimony of their very admirers, of not having made a single step of advance, or an iota of improvement during all that mighty interval of time and magnificent opportunity, which has accumulated to them since the days of the early patriarchs of the Bible, —we hope, for their own sakes, that the peasants in such lands will always *try* to observe Ramadan, and be good keepers thereof, even to its severest penance. Nor do we wish much success to those Christian missionaries, who, overlooking the laziness of these idle lands, and forgetting their own general argument against the 'gross sensuality of the Moham-'medan religion,'—try to ensnare weaker brethren among the Muslims, and make easy converts, who will assuredly fall away when persecution cometh,— by telling them, that under Christ's benign religion, there is no such cruel and unauthorized tormenting of the flesh as this dreadful Ramadan. And we are of such opinion, because firmly believing that this said tormenting of the flesh, and keeping it under during that one month at least of the year, is not only the best, but even a saving part of Mohammedanism ; nay, even further, that there is, though in a higher manner, with a purer spirit, and more willing obedience, under Christianity, infinitely more of such self-discipline and denial as a daily exercise, and continual trial ; and that, when it is blessed

by Divine grace, it both purifies and elevates the mind of man.

In its earlier days, Christianity promised its disciples in this world only buffetings, afflictions, persecutions, and adversities of every kind and degree; or Ramadan far surpassed. And if these trials have ceased now to a great extent, because Christianity has grown strong in the world, and has encompassed whole nations,—they have given place to an anxious, care-worn, intellectually-toiling existence, where every educated man is, or should be, for ever struggling to the full extent of his vital powers; for ever keeping down the body to subserve the higher behests of the mind, and assist the nobler aspirations of the soul: and observing more or less every day of his existence,—not a rigid rule of Ramadan enacted by a false prophet whose life he cannot approve of, and whose faith is a bar to progress,—but a living principle of a Divine religion,—at all times present, yet leaving infinite freedom to every man according to the dictates of his own conscience, aided in its choice by the instructions of revealed wisdom. A system which we now see resulting, after more than eighteen hundred years of its operation among North-western peoples, in national scenes of activity, of benevolence, progress in power, advance of general prosperity, and ceaseless development up to the present moment, of nature, as well as man,—such as the whole world has never witnessed anything approaching to before.

But, with the poor Mohammedans, the vacuity of their minds becomes the chief evil they have to contend against; and one which, neither their imperfect Ramadan, nor their erroneous Muslimism, by any means suffices to fill. Thus, when the stated prayers were over, the men whom we had before us, know not what to do, or whereof to think. Seven times a day would old Ibraheem, in despair, apply to my wife at the tombs to look at her watch, and tell him 'how long to sunset?' Then, as sunset approached, there was an immense deal of time to be killed in merely sitting and watching, long before it was possible, for the flash of the Citadel gun,—which was to announce when eating might begin. And through great part of the night also, the guards, together with our servants, used to sit out on the rock ledge before our doors, and do nothing but look at the moon,—and wonder again and again in the same words, how much longer that bright luminary would take to go through all its Ramadan phases, and die, and let them eat freely once again.

Another makeshift employment, however, there was, in each man watching the other, to detect either any private indulgence, or any breaking down of the system. Alee Dobree was the first to give way; his digestion had always been very poor, requiring only small quantities of food at a time, but to be repeated at frequent intervals; and these long fasts were to him a medical perdition, which not all the three sentences of the Koran that he pos-

sessed on scraps of parchment safely sewed into the tassel of his tarboosh, could avail to modify. Unhappily, too, his fellow-servant, Smyne, soon found out the weakness, and danced upon it roughshod. 'Hah! hah!' he would come to us exclaiming, when Alee was lying in the agonies of indigestion behind a rock,—'hah! hah! Alee Dobree, he no like to go 'any more into the Pyramid with Mr. Smyth; he 'sorry he ever engage himself. Mr. Smyth take me 'with him now, and my brother Mabrook come to 'help Ibraheem.' But when we argued patience and compassion,—the speaker's smile vanished at once; and we next saw him cutting the throat of some unfortunate fowl with a blunt knife,—its head duly turned towards Mecca;—and then, with loud execrations, he would fling the miserable wretch, still alive, and with cries gurgling through its mangled windpipe, to die as best it might on the sand in front of our general abode.

Nor was Alee Dobree by any means faultless; for he took to absenting himself more and more from me when measuring inside the Pyramid,—although the work there was growing daily more difficult from the larger size of the apparatus, the necessity of many candles, and the difficulty of keeping them all from slipping on the inclined surfaces. The reason of his truantism, moreover, turned out to be,—not that he desired to pray outside where he could see the east, nor needed to go into the open air for breath and relief,—but that, although he was receiving from

me the full wages he had desired, viz., £4 per month, he yet sought all forbidden opportunities for accompanying travellers up to the top of the Pyramid, in hopes of obtaining baksheesh from them. Then, if I attempted, on his return, to show him the impropriety of his breaking his promises and formal engagement,—he was clever enough to know how to stop me at once, by instantly, in any place, and at any time, flinging off his outer garments, and in long robes of white, beginning his groaning prayers towards Mecca.

Next Smyne began to imitate him; was always ill when at the tombs in our service; but during his absences, which were continually increasing in length, was frequently detected acting the part of guide to any travellers whatever; and ranting, roaring, and befiguring in the grand gallery like any half-naked savage of them all. Ibraheem was the most dependible, and was never found absent from his post; yet, even his 'countings' began to be less satisfactory than of old; and when plagued by Ramadan, he allowed himself larger commissions on his purchases, and made the exchanges of money more and more favourable to himself.

One bright burning day, when the sand-plain in front was glittering and boiling under a combined action of sunlight and heated air,—a single Arab chief, with weapons of war flashing about him, was seen pricking across the plain,—like a knight-errant of old,—on a spirited desert steed, and directing his

course right to our abode of delight,—the East Tombs of Pyramid Hill. The novelty of the thing put all our crustified servants into sudden good-humour; for they had now something to think about, and became quite excited with wonder and conjecture; but as he came closer, who else should the stranger turn out to be, than Sheikh Omar, of the village of Quatremar Omar, our hospitable host on the first night of leaving Cairo! We were of course delighted to see him, tried our best for his entertainment; and, if unable to offer him himself refreshment at the instant, on account of Ramadan, gave him a supply of oranges to carry home to his children. But when he found that we were not excavating at the Pyramid, and would therefore not hire any of his people after Ramadan was over, he became rather distant and stern,—particularly to our servants, and to Reis Atfee, who, having looked in for the opportunity of collecting news, and saying that something or other was not possible, and quite beyond his comprehension,—got completely cowed with awe up into a corner.

We could ourselves hardly but wonder at the Sheikh's grandeur; 'his turbant,' as Sandys would have said, 'was like unto a pompion, but thrice as 'large;' and he took out of his sash one of his silver-mounted flint-and-steel pistols, and asked us, 'What 'would people in England say to that?' and then he went on to describe,—that the real reason of his coming this way on such a broiling morning, was,

that one of his slave women, a Nubian, had escaped the night before ; so, with the first light of morning, he had tracked her to the desert, and then through the sands to some caves on the other side of the Pyramid ; and there he had bound her hand and foot, and given her to his people to convey back again ; whereupon we wondered to ourselves what indeed people in England would say to that.

After him, there came to us Sheikh Abdul Samed, with complaints that he could no longer manage the people of his village, for they were becoming restive under Ramadan, and refusing to serve any longer as our night-guards; wherefore, he being rather troubled by the oath he had voluntarily sworn before M. Vassalis, wished to free himself decently of its obligations by resigning it into our hands then and there. This, however, we could by no means permit : but it cost us a long time in argument ; and we had to allude dimly to certain baksheesh which we had all along intended to give, on leaving the neighbourhood for good, to all who should have helped us well, whether Government servants or our own,—before the chieftain consented to gather up all the folds of his toga, and stride across the plain once again, with his responsibility still hanging unwillingly about him.

Sad scenes, too, enacted themselves on the plain in front of the villages. It was indeed and always had been, the occupation of every afternoon, Sundays and week-days alike, for the guides of the two villages, after the mass of the Cairo travellers for

the day had left, to hold friendly meetings in the sand for the due division of spoil; and many a group, so 'Job and his friends like,' had we often admired for the picture they presented; but during Ramadan, they grew noisier, quarrelled in various degrees, and at length on one occasion, the men of both sides suddenly plucked off all their garments, and had a battle-royal. Yet their bickerings next day were none the less; and their shoutings and abuse of each other resounded.

'Why, there's an Arab fallen down as he was 'walking along,' exclaimed my wife one day in pity; but our ancient Ibraheem, who was also looking on at the time, shook his head mournfully, intimating it was a bad case. 'It's old Hassan,' said he. Now this 'old Hassan' had been appointed when we first arrived, as our day-guard, by the united villagers; for anybody they considered was good enough for a day-guard; and as he, Hassan, was unable from age to act any longer as a Pyramid guide, they thought that the post of protecting East Tombs by daylight might suit him very well, and bring him in some little profits also.

This pleasant effect, too, did realize itself; but then he was so often breaking away from us, to join one or other of these financial parties, in order to claim his share of their earnings, due to him legally as a *retired* guide,—that he had to be replaced at the tombs by another man,—'Alee the day-guard,' by name; and one who could

not walk very far on account of epileptic fits,—into a train of which he had recently fallen, to the utter impoverishment of himself, wife, and young family,—the whole of whom it was expected would reap benefit from his fulfilling the merely nominal post of day-guard with us; and, indeed, we got on very famously with him ever afterwards. But as to old Hassan, he never had after that any other occupation, than to be wandering uneasily over hill and plain, like a bad disembodied spirit, in search of wherever Arabs were dividing their gains; and ever, as on the present occasion, the moment he caught sight of a group,—he would cry out at them, execrating them every one for not waiting for his arrival; and would rush fitfully at them, assisting his tottering steps with a long walking-stick, but falling down, as just seen, from his too great vehemence of rush; yet getting up again, and shrieking at the party like a fiend of darkness, and falling again; but never stopping, until, in one way or another, he had at last reached the group, and screamingly claimed,—what he frightfully alleged they were going to keep back from him,—with clutching fingers and maniac eyes. Wherefore, as Ibraheem truly intimated, old Hassan's was a very bad case, for the demon of money had gained entire possession of his soul.

Again, whether it was the effect of Ramadan fasting or the season, we know not, but funerals in the villages opposite our tombs seemed to become

rather frequent; morning after morning, and usually when I was away in the Pyramid, the drums began to beat, and the shrill wailing voices of the mourning women sounded wildly over the desert sand,—and then came a long procession of men and women, in their dark-blue robes, looking black in the distance; in the centre of which line was seen the dervish's flag held aloft, and floating over the bier whereon the body of the dead was laid: and so the procession wound itself slowly out of the palm-groves covering the village, and looked like a long dark serpent's track, trailing towards the burial-ground, that lay about a mile to the south.

'Well, Smyne, who's dead now?' would my wife ask of that genius, who was last arrived from the village.

'Oh! it's an old man,' was the answer.

'And what did he die of?'

'What he die of? hah! hah!—why, of old age, of 'course; and because he could not live any longer, 'to be sure.'

'How old was he?'

'Why, fourteen months, ten years,—what you like. 'Who knows how old he is? No Arab does, nor 'ever cares to know how old; he doesn't know 'what you mean by it.'

They were not all old men, however, who died,—for in one part of the month the beating of the funeral-drums and the sad sounding wailings of the women, went on more melancholily than ever; and

then they said it was for the son of a Sheikh, and the people loved him so, that they were to mourn and wail for him seven days continuously.

But Ramadan could not last for ever; and when the nights became practically moonless, and men could count the remainder of the fasting days on the fingers of one hand, they became rather more cheerful. The horrid old Arab with the vertical wrinkles in his forehead, who threw so much difficulty in the way of our getting night-guards before M. Vassalis arrived,—would now take all opportunities of sidling up to me, as I went in or out of the Pyramid, intimating with the utmost profusion of courtesies and profligacy of smiles, that I was going to present him with a new dress when Ramadan was over. We sent in to Cairo, too, just about then, for our usual ten days' supplies; but found that nor butter, nor sugar, nor honey, nor flour were to be had; for they were all bought up, out and out, in every shop, towards the making of the cakes wherewith old and young were presently to regale, at the coming feast which follows the fast.

The versatile Smyne, moreover, now began to talk again of his approaching marriage, and drew a portion of his wages beforehand that he might buy for himself, at a bazaar to be held in a neighbouring village, clothing suitable to his prospects. He was half the day on the business, and then came arrayed in his purchases for our admiration. A marriage-garment it was indeed,—one great shirt of white

calico, reaching from his neck to his heels; it was fastened somewhat about the shoulders and breast by a black silk cord with tassels; and, being surmounted by a turban of white muslin, while his yellow slippers shone below, he thought himself the best dressed young dandy Arab of all the region; though a stranger seeing him stand on the edge of the cliff at set of sun, would have taken him for not a bad example of the angels of the German and French schools of painters; *i.e.*, if they could have kept his chocolate-coloured face out of view, and should not be too particular in demanding wings.

Each evening now, the look-out for the Cairo Castle gun was kept up with the full earnestness of old, but with more good-humour: and it was strange, the instant that the flash had been seen,—and long before the thirty-eight seconds were expired that brought the report,—how there burst forth, from every village near at hand, where also the flash had evidently been looked for and seen, such a mingled shouting of men and dogs, children and small stock of all kinds, as showed that they every one appreciated it as the signal for eating and enjoyment; though, of course, only the humans amongst them fully understood, that there were not many more such evenings to come; that they had in a manner touched soundings; had land in sight; and were now very near the end of their trying voyage through Ramadan.

At last, on the evening of February 26th, instead

of a single gun only from the Citadel, and the answering one from the fort above,—there came twenty-one thundering fires from the former, and twenty-one from the latter, stronghold; while in all the villages of the land, men popped off their muskets and pistols again and again far into the night,—for Ramadan, to their joy, had died, and the feast of el-Eed es-Sugheiyir, the Beyram of the Turks, was ready to begin.

CHAPTER X.

THE SECOND PYRAMID.

WITH sunrise on the 27th of February, both the whole hill of the Pyramids, and the plain in front of them, were covered with visitors of every kind and degree. Frankish travellers from steamers just arrived either at Suez or Alexandria, were there very much as usual,—but native excursionists infinitely predominated, resplendent in their garments and picturesque in their groupings. Twenty-one great guns sounded from the Citadel, and twenty-one answered from the Fort, early in the morning; again at noonday the same friendly cannonading took place, with its accompaniment of fairy-like wreaths of white smoke, eight miles distant, through the bright pure African air; and again at sunset, when the sky behind Mehemet Ali's mosque was flaming pink with reflected light, and blue-grey shades began to fall on the ramparts below,—the firing once more took place, and the flashes from the embrasured guns were then brilliantly visible.

All day long it was a genuine holiday-making; Sheikhs and Fellahs and Pyramid-guides were call-

ing on us at East Tombs hour after hour, mostly bringing presents of *fateerehs*—sweet cakes in ring-form,—and who knows what besides, which some of their wives, Zobeydeh this or Fatmeh that, had been labouring upon for days past, and contrived at last to turn them out very hard and indigestible; for none of those talented ladies, though adorned with ten necklaces, twenty bracelets, and rings perfectly innumerable, could approach our ancient Ibraheem in the triumphs of culinary art. But then the said ladies would despatch across the plain their youngest daughter, or their smallest son, in charge of older brethren, to present their gift; and such messengers were sure to go back loaded with presents of Edinburgh confectionaries in exchange, and specimens of the silver coins of many nations.

But as for the gaily-dressed native crowds from the metropolis, they cared naught for the Pyramids, or the ancient tombs, or the Arabs thereof; they had come out into that region merely as being a professed one, and now long hereditary to Cairo, for holiday-keeping; and all the day through, they seemed to do nothing but wander about as if to form picturesque groups on the top of every sand-hill, with their brilliancy of garment and flowing folds of attire,—a horse or two, a soldier, or a big spear raised up against the blue sky, usually rendering the composition pyramidal according to a painter's idea of the name; while in every hollow were social little circles of men with scarlet robes,

or blue, or mauve, or magenta, with yellow sashes and large turbans, friendlily feasting amongst themselves. No women, indeed, were to be seen; and as one consequence of the want of their inspiring presence and ever fresh little fountains of talk,—the sage-bearded men, who, the moment before, might have served as examples of Sultans, Viziers, and law-givers of the people,—were compelled, for lack of anything better to amuse themselves with,—to tuck up their long-flowing garments, and begin playing at leap-frog over each other on the sandy plain.

But again, at sunrise on February 28th, all the cannons of the Citadel called forth the people to play; and encouraged them at it by noonday; and saluted them while still so engaged in the evening. And once again, on the morning of March 1, the thundering signals reverberated in the valley, resounded at mid-day, and boomed in the gloaming light.

The happiness of the people ought to have been most intense, and nine times multipled, and may have been; I was obliged, however, to be attending to work; and, being so inexpressibly favoured as to have the *inside* of the Great Pyramid all to myself on the first and second day of 'this feast after the fast,' was able to accomplish a variety of measuring detail on special features in the grand gallery. While on the 1st of March, with the assistance both of Alee Dobree (who had been indulging his peculiar digestion up to the very top of its bent, or with a little pick of eating about every hour during the last

two days), and of a young friend, indeed a brother-in-law, of his, Abduwahad by name,—a series of vertical heights of the said gallery were measured with a grand slide-rod, expressly prepared for the purpose, and capable of measuring everything up to four hundred inches in height.

It was rather a heavy affair that four hundred-inch measurer, consisting mainly of square mahogany tubes firmly fastened together, standing on a strong steel spike below, and having a pointed slider above, —which slider, by means of a string worked from below, could be pulled up to touch the roof, and clamped at that precise place the instant when certain spirit-levels told that the whole rod was being held for the moment truly vertical. To hold it so was a grand struggle for us all three, for the steep incline made it difficult for any one simply to stand still, without doing anything else; but Alee Dobree straddled manfully across the floor from ramp to ramp, and Abduwahad presented his right foot, between the big and second toes of which he held the steel peg, from slipping on the floor; and thus, by dint of keeping a good look-out that the great rod did not at any time oscillate from the vertical so far as to exceed our powers of holding it up, and tip us all over with it down the north descent,—and being favoured also by no loose pieces of ceiling-stone coming tumbling down when touched by the rod (as had occurred again and again the day before with the measurement of lower side 'overlappings'

of the walls), we were enabled to obtain a series of readings on the side of the great rod for the heights required. This was accomplished, too, as we hoped, with fully sufficient accuracy to clear up many uncertainties in published accounts; while, so satisfactory a result would by no means have followed, had we endeavoured to make shift with any much smaller, or less troublesome, apparatus. (Plates III. and VI.)

We returned, therefore, to the East Tombs rather well pleased with our day's work; and found on arriving there, that happiness reigned likewise among its more stationary tenants; for not only was this the third and most glorious day of Eed-el-Fitr (the festival of the breaking of the fast), and when Ibraheem had been entertaining all comers with seven cups of coffee at a time,—but Smyne had announced to my wife, that he would that afternoon introduce his intended to her.

In his long flowing dress of white, he had sat watching for half the day on the top of the cliff like a luminous beacon, and now he rushed down to say that the object of his regards was approaching. She came modestly tripping across the plain, attended on by some of her brothers, who were in white skull-caps and whitey-brown gowns,—though she was chiefly enveloped in dark-blue, except where the many necklaces, whose number Smyne had again and again enumerated, shone glittering in the sun. As the damsel drew near, Smyne and the brethren

rather retired, and she was left, according to etiquette, to make the British lady's acquaintance by herself; but so dreadfully modest was the village fair one, as hardly to be able to spare a hand from keeping her long veil over her face, even when baksheesh was being presented to her.

But all *that* was considered only the more to show the propriety of her manners and perfection of her education; wherefore Smyne was intoxicated with joy,—while Ibraheem said smilingly, that he, Smyne, was really a very fortunate young fellow; and we congratulated him likewise. Meanwhile the damsel had retired, and her two big brothers came rushing down the hill again, to escort her home; Smyne following her with his entranced eyes until the whole party was safely across the sand-plain, and had entered the green fields beyond. Then we all sat out on the edge of the cliff, and watched the pointed shadows of the Pyramids, under the quickly setting sun, gliding silently across the Eastern plain,—and throwing their protecting mantle of ancient days over the innocent country villages and modern habitations of the children of men: and we kept on sitting there, until the last ruddy tint of light had departed from the sky, and the ever-living stars began their turn of patient watching over the scene.

It was long after our tea, by candle-light, was over,—long after all the villages had twinkled with lights, and the sounds of their evening festivities had spread over the plain,—that an unusual moving

to and fro of the guards began,—accompanied with a fearful, anxious talking under breath, and a clambering up and down the steps in front of the dining-room tomb. Then a crowd of men came pressing and pushing up the difficult way, bringing, as it was thought, a corpse, stiff and stark, along with them; but every now and then the apparently inanimate object uttered a deep groan, or gave forth an exhaustive exclamation of 'Allah illah Allah!' Of course we rushed out to see what had occurred; and then, behold, it was poor Smyne, late so joyous, and long since gone back to his village,—but now here again, and only able to lie on his back and call out 'Allah illah Allah!'

'He had *not* been shot, he was *not* dying, nor in 'want of any of our medical help,' Ibraheem said; but he could explain no more then, than what could be conveyed by mere repetition of 'Meskeen, 'meskeen,—poor fellow, poor fellow!' And still through the live-long night the prostrate Smyne could only groan forth 'Allah illah Allah,' and seemed to recognise no one,—not even Sheikh Abdul Samed, or Reis Atfee, or Alee Dobree, who all came over from the village to try to comfort him.

But next morning my wife extracted the whole affair out of them. Smyne, though he had been so confident about his marriage from the first moment of joining our establishment, and had considered himself so secure in the damsel's affections,—or rather because of it,—was not thinking much that

the girl's father had demanded to receive a dowry of ten purses, while he, Smyne, was able only to pay five. Smyne was thoughtless, but the parent was stern; and another man having recently come forward with the full sum, was accepted by him at once; so the father and his favoured bridegroom waylaid the damsel as she returned last evening from her unsuspecting visit at East Tombs,—and, carrying her off forcibly to the house, where they had dervishes ready for reading the appointed portion of the Koran, and everything necessary for the complete performance of the 'betrothal' ceremony (a something as binding as marriage itself),—they then and there made her go through such betrothal accordingly; and the posse of muskets which we had heard fired off soon after dark, was the announcement that the whole was accomplished. It formed, too, the first intimation to poor Smyne, that anything was threatening his prospects of perfect happiness.

'But what did the girl do; did she not resist?' asked the British lady.

'And what would have been the use of that?' replied Alee; 'for if she, a daughter, had refused 'to be married according to her parent's command, 'the men of the village would just have taken her 'the next morning and drowned her at Jeezeh; there 'would be no escape to her, for has not Sidi Moham-'med ordained it so? Besides, her now betrothed 'husband is an experienced hand; he has three wives 'already, and knows how to manage in such cases.'

'Three wives! the dreadful man! and he to 'come down and take away the one from poor 'Smyne, who has none.'

'Well, but this country is not like your country,' urged Alee Dobree; 'it's all in the ordinary course 'here, and we don't think anything of it at all.' With which and similar arguments he endeavoured to pacify Mrs. Piazzi's indignation; but she insisted in one way or another that it was cruel, and unjust, and oppressive, and a variety of other things; and concluded with an urgent appeal that, after witnessing all this misery, sprung from the rich man oppressing the poor in the unhallowed race after appropriating many wives,—that he, Alee Dobree, would never think of taking another in addition to his one present wife.

Whereupon Alee Dobree pulled a mighty long face; and, looking on the sand rather uneasily, he muttered out 'that wives were so dear now, their 'price was enough to ruin an honest man; his 'present wife cost him twenty purses, and he, in his 'position, could not get one now under forty purses.' In short, he would give no promise of always being content with one wife, though woefully afraid that he would never be rich enough to buy a second, if prices went on increasing as they were doing.

However, in his secret mind, Alee Dobree, together with Ibraheem, did think there was something peculiarly hard in Smyne's case; and they spoke or acted to him most feelingly, through all

that sad day which followed the shipwreck of his fondest hopes. He seemed also to need the sympathy, so utterly had his usual elasticity departed from him; and at last my wife and self tried to get up a little diversion to the current of his ideas, by proposing an exploration to the second Pyramid.

Accordingly off we started in the quiet afternoon, the unfortunate one taking to the notion kindly; and as we defiled up the narrow staircase in face of the cliff, passing close to the little hole that formed both window and chimney to Ibraheem's kitchen-tomb,—that ancient worthy looked out quite affectionately after the disconsolate young man,—with all a father's regard and half a mother's care for him pictured in the many lines and wrinkles of his weatherbeaten, but philanthropic, old countenance.

From East Tombs to the second Pyramid the way lies directly west, and is quite straight, if you can only manage to keep it so,—for there is a constant going up and going down, or winding in and winding out of rubbish heaps, ejected at the spoiling of innumerable tombs. In some of them, portions of the ancient wall, well built, of large stone blocks, and leaning back at a memorable angle of 75° of altitude,—crop out for small distances; in others the interior of white stone builded apartments, or occasionally of black sun-dried brick enclosures,—are laid open to the face of day; but in the greater number, a central hollow, much like a little

crater, terminates in a deep and square-shaped well, —whose sides are duly oriented, and out of which have been extracted the human bones and vases of coarse red earthenware, now smashed to bits, which lie strewed over hill and valley, with fragments of rose-red granite far beyond counting.

Passing south of both the Great Pyramid and its southern row of methodically-arranged, though now ruined tombs, and still trending westward,—we enter rather a broad sheet of open ground swept by west wind, and showing a covering chiefly of bright quartzy pebbles, like a portion of the desert itself. Of course all this time the second Pyramid is looming large almost in front of us, with black-bodied, bare-necked vultures perched on its most inaccessible heights ; but, directing our course rather towards the north foot, and leaving the cyclopean blocks forming the so-called temple on its east front to our left,—we enter the sort of excavated alley which continues along both north and west sides of the monument.

This alley, some two hundred feet broad on the north, and one hundred on the west, with a depth of about thirty feet in its central portion,—results purely from an area having been accurately levelled in the substance of the hill, for the base of the huge edifice of the second Pyramid. For the hill extends itself west-north-west, in an inclined table-form fashion, and with rather increasing height as it goes; so that its actual culmination is a long way westward,

and far too distant to enable a monument, if placed there,—to overlook in any immediate manner the very low and *inhabited* land of Egypt to the east. Something of a compromise was therefore effected, —a site neither exactly overhanging the valley-cliff, nor again on the more inland and absolute summit of the hill; and of the two methods that must then be chosen between, for building on a slope, —the Pyramid kings had preferred cutting down the higher corner of the area, to building up a platform on the lower; though there is really a something of each plan, besides some ten or twelve feet in height of living rock, left under the western half of the Pyramid to save masonry.

But to see how truthfully they cut the rock down outside, and how economical those masons were of good building stone—or of that material whereof earth is so prodigal to the sons of men, but which they need not waste for all that;—because, not only are the escarpments of the excavation perfectly smooth (barring modern injuries and growing decay), as if severed through at once by an enormous saw,—but the remains of a quarry-floor in the north-western corner testify, that all the removed substance was carefully, as well as regularly, cut down in squares and removed for use, like so many rectangular cheeses. Certainly very unlike the modern plan of quarrying, whenever men are allowed unlimited use of gunpowder, or more particularly of nitro-glycerine; for then they delight in fracturing the rock with

explosions, and sending it flying; rushing up after the 'shot' has been effected, to see if perchance some of the fragments are of such a size or shape as may be useful; if not, to try another blast,—accomplishing speedily such a scene of ruin, and such heaps of splinters, that it is not easy to clamber over the ground. Yet, at the Pyramid quarry, the stone had been cut so neatly that there appeared no useless fragments at all; only the bases were visible of closely adjoining artificial square pillars of rock,—each of which had been sliced off transversely until close to the ground; and every stone thus procured, when we laid a one-hundred inch measuring-rod on the space it had quitted, appeared to have been exactly of that size, both in length and breadth.

Along this remarkable enclosure's western side, various tombs (small rooms, with an occasional sepulchral pit in the floor) have been worked into the substance of its artificial cliff, and there is the beginning of another on the north side. But they are all probably of a date long subsequent to that of the Pyramid; as are more eminently still, two hieroglyphic inscriptions of large size and admirable preservation on the faces of the cliffs, which speak clearly to the age of Remesses the Great,—or the nineteenth dynasty, in place of the fourth, of Pyramid-building notoriety, and to the year 1300 B.C., when Thebes was all-powerful in both Upper and Lower Egypt.

What precisely the man was wanting who wrote up in this place his name, titles, and the king he

served, has not been made out by any of the Egyptologists ; and we are rather inclined to suspect that it was nothing but vainglory, with the idea of showing to inhabiters of the old Empire districts, how 'we of the new Empire do these things now in 'Thebes.' With those Diospolitans, indeed, the art of mural engraving most assuredly culminated in force, size, and superabundance. In the tombs, on the other hand, of the fourth dynasty, round about the Great Pyramid,—though sculptured picture-signs in plenty are to be seen, oftener inside than out,—they are always modest in size, and shallow, though sweet, in the cutting ; so that Alee Dobree, who on many occasions had taken us into one tomb or another, especially to 'show King Cheops' name,'—had to kneel down upon the drifted sand on the floor, and look up slantingly at the wall-surface for some time, before at last he recognised the two little ducklings, the horned viper, and solar sieve within the royal oval. But in a Theban, and of course more modern, temple, the selfsame types are magnified like a strong photograph in the oxyhydrogen lantern ; and the mere *cerastes* becomes a deep-cut muscular monster, from which a man need to fly, while gigantic *asps* or cobras raise their hissing heads on every side ; and colossi of all kinds demand attention to their existence in a manner that no one can deny.

Mixed up, too, with this increase in size of the representations of the second empire, is their thorough transfusion, by symbolical imagery representing the

dread future in store for disobedient souls; and their devotion to setting forth the mighty powers of a mysterious system of hierology, or detailing the various powers of an innumerable crowd of animal-headed gods; a priest-invented system which entangled and enveloped every layman born into the world, as hopelessly and irresistibly as did the serpents of Pallas hold the unfortunate Laocoon with his sons; of all which characteristic hieroglyphicism hardly a vestige can be found in the more placid scenes of rural life, described in the sepulchral records of the fourth dynasty.

Wherefore it is really well that 'Mari, superin-'tendent of (clerks?) under Remesses, beloved of 'Amun, in the abode of Haroeri, son of the super-'intendent of the carriers Bokenamun, justified in 'Egypt, the pure land of truth,'[1] did come to these, at the time, decaying northern districts of his country,—and give us then and there an example of the peculiar developments produced on the sons of ancient Mizraim, by their having been permitted to follow their own devices during a thousand years of superabundant national prosperity in the south. He selected, too, we must confess, the site for his inscriptions to admiration; for while above and below them the rock has since decayed deeply in its columnar, interstratified manner,—the region of the incised figures holds its chiselled surface still.

Yet looking now at all this range of excavations in

[1] Birch's translation for Colonel Howard Vyse.

the light of descriptions of Greaves' day, what ruin, what decay since then! One part of the cliff westward, has fallen out towards the Pyramid; another farther north, has fallen vertically downwards doubling up a doorway; and many others are undermined to an extent that seems to threaten they cannot last much longer,—or that the very material of the Pyramid hill is losing its consistence, and failing in its powers of holding together. The last chance therefore which men may ever have of unravelling the long-kept mysteries of the Pyramid will soon slip through their fingers altogether,—if they be not instant with earnest endeavours to chronicle faithfully whatever may still be observed and observable.

And now to turn from its surroundings merely, to the central monument itself. Seated farther in, and farther up, the hill than the *Great* one, the *second* Pyramid has not only an advantage of a few feet in height for its base,—but it looks in no small degree as if it had had, at its origin, the first choice of the hill for building upon. This superiority, too, of site, combined with its very nearly equal height from its base upwards, and with the happy preservation of nearly a fourth of its external sheet of casing stones from the summit downwards,—causes it from some quarters in the distance, often to make the greater show of the two. Yet for all that, its smaller breadth of base, by close upon fifty feet, has entirely

ruined its fame in the eyes of tourists; so that, from the days of Herodotus to our own, the crowd invariably rush to look at the Great Pyramid, and having seen it,—simply hasten away again, without caring to visit anything else that there may be, even close round about.

Mere difference of size is not, however, the only argument which can be urged in favour of the Great Pyramid; for a close scientific observer there, is delighted by the thoroughness of the work, its mechanical excellence, rigid economy, and the combination of every feature towards obtaining and preserving the greatest amount of geometric truth; hence the squareness of all the stones, the perfect break joint system throughout, the universal cementing, and the picked mineral capable of most exact working introduced into the passages, the casing, and wherever external figure is to be demonstrated. But with the second Pyramid, the mass of its structure is simply execrable; or, as Sir Gardner Wilkinson has very gently put it, 'the style of building in 'the *second Pyramid* is inferior to that of the first, 'and the stones used in its construction were less 'carefully selected;' while Howard Vyse more boldly describes much of it, as 'being only a kind 'of gigantic rubble-work,' or something 'so irregu-'larly built, that since the removal of the casing, 'the desert sand and rain have penetrated in several 'places to a considerable distance; and it is owing 'to this looseness of construction, that Signor Bel-

'zoni was unable to work his way through the 'stones, which had collapsed in the forced entrance, 'supposed to have been made by the Khaliphs; and 'that, in 1837, the Arabs could not be employed in 'another part of it.'

Yet neither these, nor any other observers I am acquainted with,—have noticed, that all the above animadversions apply only to the lower half, or rather more, in vertical height of the structure; whose *upper* half, so far as it can be seen underneath the termination of the casing, suddenly takes on a perfectly new and improved style of building; a style indeed which is even more square, regular, and solidly put together than that of the Great Pyramid itself. This noteworthy fact took our attention again and again, and was examined under varying illumination during months.

So nice too did our discrimination of such matters become at last by frequent trial, that to scan the surface of the lower part of the second Pyramid courses of building, was, from their irregularity, quite vexation to the eye; but to turn one's gaze therefrom towards any part of the Great Pyramid gave relief unspeakable. The courses there, might no doubt be often far from equal in height, the one to the other; and often, after having decreased in thickness for several successive layers, they began anew with thick ones; but that did not touch the solidity of the whole mass so formed, for each layer or course preserved its own thickness, whatever that

was at any one point, round and round the Pyramid; and was composed everywhere of well squared, well fixed, well cemented stones.

There was a unity too in the style of the building that prevailed without a break or flaw from top to bottom of the Great Pyramid; a unity indeed of architect rather than mason, which permitted small deviations in unimportant detail, but kept principles and objects not only always in view but absolutely paramount; allowing, for instance, the mason for economy's sake to utilize without needless cutting down the varied sizes of blocks furnished by the quarries,—but still in such a manner only, as should *not* let that difference of size in the smallest components, interfere in any way with the final end proposed for the whole building; the angle of the sides with the base, for instance, being exactly the same over the region of small, as of thick, courses. Looking up therefore at the flanks of the Great Pyramid, —you saw plainly how, vast as they may be, exposing at one view no less than ten acres of masonry, yet that they must have been reared under one architect, upon one well considered and fully sufficient mechanical plan; for a single purpose well kept to, and in a comparatively small number of years.

But on turning again to the second Pyramid, you saw just as clearly that there, there had been two architects, two times of building long removed from each other, and two entirely different styles of work-

manship, which do not blend into each other in the smallest degree,—but begin and end in abruptest of manner; showing, in fact, a new top on an old Pyramid. The new top, built by those whose prentice hands had been taught the virtue of exactness on the Great Pyramid; and the old substructure, by their early predecessors, on whom the light of the improved style of building introduced by the Great Pyramid architect, had never dawned.

These mechanical features, on which many historical points may be found to rest, were brought out admirably in not a few of our photographs; so clearly, indeed, that we wonder they have not earlier excited attention; and the reason *may* be, that the very superlative style of building near the top of the second Pyramid has only recently been made fully plain,—by the falling off from it of an insterstitial coating of stone-work, which formed the backing, or adjustment, as it were, of the casing stones. It is only in this manner that the very curious, yet most positive, testimony furnished by Dr. Pococke in 1743 can be explained.

'According to my observations,' says he, 'the 'casing of this (second) Pyramid *did not project* 'beyond the angle of *the steps*, as it did in those 'beyond Saccara, but was executed as represented in 'the sixteenth plate. I observed on the north and 'east sides, the upper part of the Pyramid was entire 'for forty or fifty feet down from the top, as I con-'jectured, and *the stone seemed to set further out*

'*for near a hundred feet from the top than it does* '*below,* which I could not account for.'

Now we need not be too hard in judging of the Doctor's lengths by feet, because they were only 'conjectures,' and are yet quite enough for distinguishing comparatively the various parts; and the real feature to be noticed is,—that whereas the space which intervenes between the lower end of the fragmentary casing (which forms a sort of Norman helmet to the structure), and the beginning of the bad part of the masonry far below,—is now a region of depression—it was one, in his day, of elevation, measured both by what was above and what was below it; so that the respective appearances in 1743 and 1865 may be thus easily represented :—

1743. 1865.

Evidently then the good masonry courses of the upper part held their packing for the casing stones, long after the casing stones themselves had been violently stripped away, and after the similar but slighter packing had left the ruder portions below; and if we are still so fortunate as to see in this one example of the second, and only one, of all the Pyramids of Jeezeh, something of what their origi-

nal appearance must have been with their armour of casing entire,—it is from the tenacity with which the stones of the topmost and best built part, yet hold everything together. The introduction therefore of better workmanship over the upper part of the second Pyramid has been of extraordinary and varied importance, for enabling men in these latter days to uphold the true theory against the 'laddered' hypothesis, so much insisted on in several quarters; and also to approximate to some personal matters of its history. The very recent falling off, moreover, of the casing, which had so long concealed an amount of unexpected excellence of workmanship, has disclosed a fact of signal purport; and as effective for the cause of truth, as was for untruth, the falling away of the plaster in subsequent days to its building, from the Ptolemeian Pharos of Alexandria; when the name of King Ptolemy Philadelphus, cut only in that plaster, fell with it: but on the stones behind, deeply carved in secret long before, appeared in its place the name of the plebeian architect,—who *then* headed the rest of the inscription and made it appear to all men that he, and not the king, had built the lighthouse out of his gracious regard 'for 'those who travel by sea.'

When the casing was put on the second Pyramid, of course good and bad work underneath were covered alike, and for two or three thousand years acted equally well; but not for more, as the bulging of the loose rubble-work in the lower part

must have been one of the first means of loosening the outside coat. This in itself, judging from the portion left, as well as by hand specimens picked up on the rubbish heap below, is almost faultless; being composed of good Mokattam stone, and worked, though to a different angle, with the full mechanical skill acquired by masons during, or subsequent to, the building of the Great Pyramid. Yet one feature of weakness crops out, *i.e.*, of human weakness,—for as time went on and wealth increased, the desire to realize truth gave way before the craving for ornament; a vice manifesting itself in the two lowest, and therefore last applied, courses of the casing of the second Pyramid,—having been constructed in red granite. A more splendid-looking stone before the world, but by no means so well adapted for being worked into, and then keeping, under inclemency of weather, a perfect figure, as the limestone rock of Mokattam; and infinitely more expensive, though that is another attraction, and almost principle of adoration, to some idolatrous minds.

The great blocks which composed these two ranges are lying, some nearly *in situ*, and others scattered about the base here and there; but sufficiently conspicuous, if interpreted aright, to have assured Belzoni practically,—seeing he would persist 'in not 'reading any old books about the Pyramids,'—that the casing of the second had been completed by its builders, though subsequently despoiled and reduced

to its present small proportions by decay, combined with the demands during the last thousand years of a new rising city in its neighbourhood. The Muslim spoilers of the years 800 and 900 A.D., took the limestone and left the granite; just, in fact, as their Muslim successors do now,—for they advance not, neither do they change: and day after day did we see camels from neighbouring villages loading up limestone blocks, at the tombs around the Pyramid, and carrying them off, for building such things as outside stairs to mud-brick houses, whenever their owners indulge in a second storey,—but studiously avoiding the intractable granite.

Hard this granite mineral is, doubtless; and when employed in inside work, perhaps splendidly capable of keeping the shape once given to it by art,—but in outside situations, and under pressure, it has a lamentable tendency to break away at the angles, and approach a boulder figure. When we went therefore on another occasion to the third Pyramid, and found several ranges of its casing stones, one over the other, perfectly *in situ*, and of granite,—and hoped, therefore, to measure an angle accurately to seconds,—what was not our horror to find them more like round pebbles, than the thin-edged, precise-lined, Mokattam limestone blocks of either the Great, or second, Pyramid. Of the ancient casing stones of the third Pyramid, besides those already alluded to, you may find almost as many as you

like, lying about in heaps on every side, and still whole; but as they are of *granite*, they are of no use in recovering the exact angle; this is the reward of those who could not be satisfied with the beauty of truth in a cheap and plain-looking material, but must get something dazzling, ornamental, coloured, and, forsooth, costly.

The third Pyramid was built certainly after, some aver very long after, the second; and the diseased craving for show had grown meanwhile on the nation to such an extent, that peculiar size, with its symbolical meaning, and almost everything else having reference to astronomical or geometrical perfections, were sacrificed to gorgeous expensiveness: whence came the excessive amount of granite, employed in its casing, even half-way up the sides! Of course, in its, the third Pyramid's, day, this gewgaw was admired, and known pre-excellently as 'the 'coloured Pyramid;' strangely enough, too, it holds a fascination still over modern Egyptologists of the hieroglyphic and hierological schools, who admire it for precisely the very points where it has deviated most from the purer example and nobler objects of the Great Pyramid. Thus one of notable literary fame in this country writes: 'The third Pyramid is 'indeed the smallest of the three, but was the last and 'most perfect of those erections, and more expensive 'by far than any of them;' while another similar-minded author, but of wider-spread fame, and blowing the trumpet with a firmer breath and

stronger lungs, holds forth: 'This, the third Pyra-
'mid, is styled by the classics the most sumptuous
'and magnificent of all the Pyramids; and so it
'appears even in its dilapidation. It was cased
'in *granite* up to a considerable height.'[1] Then being at a loss how to prove all the praise by any known details of the building itself, especially seeing that it is less than half the linear size of the Great Pyramid,—the author tries to eke out the case by saying something about the foundation. 'The third Pyramid surpassed,' says he, 'the greater
'ones, in the boldness and grandeur of its substruc-
'tion as much as in beauty. In order to obtain a
'level for it, instead of lowering the rock to the
'westward, a substruction more than *ten feet* in
'depth was laid in the opposite direction, and par-
'ticularly towards the north-eastward, where the
'rock falls considerably.' Yet all this is merely a lavish waste of money to obtain a less secure standing ground than what excavation in the opposite direction would have given.

Granite, however, in plenty, and enormous blocks, by the testimony of authors of all creeds, is lying about on every side at the third Pyramid; shiploads and whole fleets of dahabeeah-loads are there, such as must have occupied the stream of old father Nile for years to bring down from Syene. What, then, can M. Niebuhr mean when saying, 'By the
'side of the third Pyramid you may find, it is true,

[1] Bunsen's *Egypt*, vol. ii. p. 165.

'some morsels of granite among the ruins, but these 'pieces are neither sufficiently large nor sufficiently 'numerous to make one believe that even a part of 'the Pyramid could have been covered with them. 'These blocks have served perhaps for ornaments, 'and have contained inscriptions, of which the 'Pyramids themselves do not show now any ves-'tige'?[1] What, too, can the learned Baron Bunsen mean by putting prominently forward, near the head of his chapter on the 'Pyramids of Jeezeh and 'field of the Pyramids,' and far above many excellent workers bearing British names, 'among the 'earlier describers, Niebuhr's measurements are the 'most trustworthy, his views the soundest'?

But let us return to the northern side of the second Pyramid; and, passing the lower entrance, which is in the flat ground and now blocked up by sand and stone,—let us climb the hill of rubbish to the upper entrance, which is just about the same height above the base, and same distance east of the centre, as that of the Great Pyramid is there. The passage itself, too, is of the same bore, or 47·3 inches in transverse height and 41·7 in breadth, and at nearly the same angle of dip; but it has none of the

[1] 'A côté de la troisième pyramide, on trouve, il est vrai, des morceaux de granit parmi les décombres; mais ces pièces ne sont ni assez grandes ni assez nombreuses, pour faire croire qu'une partie seulement de la pyramide ait pu en être couverte. Ces blocs ont servi peut-être d'ornemens, et ont contenu des inscriptions, dont les pyramides elles-mêmes ne montrent aujourd'hui aucun vestige.'—*Voyage de M. Niebuhr*, Swiss edition, 1780.

symbolization and none of the extraordinary mechanical means for producing stability or realizing exactness, so pre-eminent in the grand example. Here, in the second Pyramid, the entrance passage is simply a square-built tube of granite blocks, inserted in the midst of the ordinary, and that is thereabouts very ordinary, or rather positively bad, masonry. Nor did the builders care much about fineness of joints and closeness of fit, for the broad and irregular seams of white cement, still visible, prove that accuracy was to those men something secondary; they wanted the parts which were immediately beholdable, to look to men's eyes rich and coloured, and they got it in the rosy granite.

Down the steep descent Alee Dobree led the way, my wife and I followed, and Smyne was left outside to guard the photographic apparatus. At rather more than one hundred feet from the entrance, a granite portcullis has to be crawled under, —a good and true portcullis, for it is a slab sliding in vertical grooves in the wall, and in a vertical slit in the roof, only just broad enough to receive the block; so that, if you cannot crawl underneath it, you certainly cannot pass above it, or to either side. Beyond this point are two such awkward little cliffs, connected with the entrance to a lower passage, as induced me on a second visit to come armed with a handy nine-foot ladder; but that point and its heap of stones once passed, the rest was plain sailing,—easy upright walking along a

horizontal passage, nearly six feet high and four broad,—with bats in numbers swiftly flying past us, though happily sparing our candles,—until we entered the grand room, forty-six feet long, sixteen broad, and twenty-two high in the middle of its angular roof, and lying vertically under the centre of the whole Pyramid. (See Finis Plate.)

The floor is in a lamentable state of disarrangement, for after Colonel Howard Vyse had left, but at his expense, Mr. Perring raised the whole of the stonework, packed its chief portion up at the eastern end of the room,—and then began to dig madly under the sarcophagus at the west end, and in various other places, in search of a fancied opening into some equally fancied secret lower rooms,—but which he did *not* succeed in finding. Now we, having come to make, among certain other little measures, some of temperature, placed a thermometer, with its bulb covered with floor-dust, to acquire the heat of the place; and then sitting down on some of the disjointed blocks at a distance, burnt a few grains of magnesium wire, and looked around and cogitated.

The first thing that came out in the new illumination was Belzoni's name, painted up on the south wall in enormous characters, and within a long bracket,—as having opened, or *scoperta*, this chamber, *on this identical day* on which we were there, viz., on the 2ND OF MARCH, but in the year 1818. The walls of the horizontal passage leading into it, as

well as those of the chamber itself, which are all hewn out of the local rock, were then garnished with large growths of the saline efflorescence; 'six 'inches long, and like an endive leaf' he describes them, though now they are small enough. In his day, too, there was still visible the Arabic inscription, indicating that Muslims had broken into the place some nine hundred years before; but that was the only decoration, if so it could be called; for even the slight attempt by the builders to get up a coloured entrance passage by means of red granite blocks, ceases when you have passed the portcullis; and after that, all further advance is merely between bare walls of dull earthy colour, without a single line of moulding, or scrap of painting, and not one stroke of engraving.

This astonishing plainness, so at variance with the tombs of the same age round about the Pyramid, must have struck cold on the Italian heart of one like Belzoni,—just returned from æsthetic revelling in the painted splendours of his chief discovery at Biban-el-Malook, in the valley of the tombs of the kings at Thebes. There, every passage, every ceiling, every wall, glows with painted forms; each one of such figures having been first carved neatly into the stone, before the decorative tints were applied; and both the brilliancy of colour and vigour of drawing continually increase in every successive room, until they positively blaze up in their culmination of chromatic glory in the final sepulchral chamber of

the king; and with so happy an effect, that even a Turkish grandee who visited Belzoni there, soon after its discovery, could for the moment forget the illegality, to him and his creed, of representations of the human form,—and condescended to say, that 'really the place would make a capital hareem, be-'cause the women would have something to look at.'

But in the second Pyramid, Belzoni and his party rushed along the passage to gain there the sepulchral chamber of *that* king; and the enterprising Paduan has even given us a picture of his friends storming into the final room, torch in hand, and finding it all the colour of mud, and just as void of human artistry; *i.e.*, with the single exception of the granite sarcophagus sunk in the floor near the western end; a well-shaped and admirably wrought sarcophagus truly, but without a sculptured line of any kind or degree on its perfectly bare and unimpassioned sides.

Why was this king's chamber so infinitely plainer than those of any of his subjects, of which there are a profusion round about outside; nay, why so absolutely plain? is a question that has been asked again and again, but totally in vain on any Egyptological view of the facts. What the early Muslims may have found in the room when they broke into it, say in 900 A.D., there is no ascertaining now; it was not even known in European circles that they had done so, or that there was any chamber to break into, until Belzoni's proceedings proved its existence; and they have since been confirmed by Colonel Vyse's

excavations; with the addition too, of indications of this Pyramid having been broken open much earlier still, or by Egyptians themselves of the ancient day, when both the existence and structure of the secret chambers were probably still understood.

The whole history, indeed, of the second Pyramid, as of most of the other Pyramids as well,—certain parts of the Great Pyramid alone excepted,—has been a history merely of successive violations of its sepulchral chamber; so that the mighty mass of its builded bulk, covering eleven acres of ground, has added strangely little, or nothing at all, to the security of the tomb below it. Lord Valentia has preceded Colonel Howard Vyse, in pointedly asking, 'if the 'object of the Pyramids *could* have been the preser- 'vation of a buried body, when they are furnished 'with entrance passages lined with white marble '(stone), as if to prevent the possibility of the spoiler 'doubting his way for one moment, or deviating one 'foot to the right or left until he had arrived at 'the very central chamber of the whole; when 'the simple expedient of extracting such lining, or 'never putting it in, and building up the passage 'with ordinary masonry after the deposition of the 'corpse, would have required a moiety, or more, of 'the building to be removed before its treasured 'secret could have been touched upon!'

Belzoni, somewhat excusably, tries to make out his discovery of the entrance to the second Pyramid, as being the result of extraordinary acuteness, ex-

perience, observation, and deduction on his part; but it was simply nothing more than this, that he went to the Great Pyramid close by, measured how high above the base, and how far east of the centre the entrance there was,—and then laying off those same measures on the second Pyramid, found that their intersection fell on a place covered by a cloak of rubbish; whereupon he very naturally cut into that rubbish, to see if the entrance really was there underneath the heap, and came at once on the granite-lined passage. The praise, therefore, of the discovery, if any, should rather be conferred on the architects who gave the entrance passages of the two Pyramids such a perfectly similar position—that, when one was found, the other might be considered as also known. Belzoni's discovery too, was only such a one as the unlearned Muslims of many hundred years earlier *had* made for themselves; and they must have had far more serious trouble in clearing the passage when found,—if its *closing* blocks were still inside.

These closing blocks, a peculiar pyramidal institution, were huge things regularly cut and shaped to slide down, and completely fill up the passage all the way from bottom to top; they offered, therefore, when once in position, great difficulty in the way of any occasional prowler, on the impulse of a sudden thought, breaking into the giant tomb; and they completely ruin the theories of some astronomical *savants* as to the entrance passages having been open

tubes for Pyramid priests observing the pole-star in, or from,—but they do not materially alter Lord Valentia's argument, as to a clue being given by the *lined* walls to any powerful and determined depredators, showing them exactly how to proceed, and where to go. We may speak so confidently now of the entrance passages having been originally thus closed, for it was reserved to Colonel Howard Vyse to clear out, and to be the first since the time of the builders, to clear out the *lower* entrance of the second Pyramid. This lower entrance had its mouth concealed by the pavement,—a flat sheet of masonry about twenty inches thick and thirty feet broad, supposed to run all round the Pyramid, and the pavement had never been broken up over the spot; *therefore*, he was undoubtedly the first man to come on that entrance since the pavement was fixed; and when he did so come, and did lay bare the mouth of the passage, it was full, as described, of these long rectangular blocks; which he had then at great expense to split up as they lay, and afterwards draw out the pieces. No particular result seemed to follow that laborious and expensive operation, for the passage led only to subterranean rooms that were accessible also, and had by others been reached from the upper passage,—beyond finding it very notably different in angle from the upper, or 22° in place of 26°; and much theoretical as well as historical meaning may be found by and by to result from that change of direction.

In so far, however, as knowledge instructs, directs, or guides the literary world at present, we must (putting aside for the time all small doubtings to the contrary) take the large chamber of the second Pyramid as having been intended for sepulchral purposes. And then, to any one seated as we were, waiting for our thermometers to take the temperature of the room,—some comparisons on that foundation may arise in the mind, touching that in so far admitted sepulchral room on one side, and on the other, the King's chamber, with its much contested coffer in the Great Pyramid: as thus,—are not the two cases essentially similar; viz.,—in each instance a long room running east and west; a granite sarcophagus, placed with its length north and south in a position near the western end of the chamber; and then two holes in the north and south walls for ventilating purposes?

Appearances did at first look very funereal, by analogy, for the King's chamber of the Great Pyramid; but relationship with the second, dissipated rapidly on further consideration. Thus, 1*st*, the King's chamber of the Great Pyramid is one hundred and forty feet above the ground outside, and in the midst of worked masonry,—or in a position where no Pyramid was ever yet known to have any chamber or to bury a man; while the large chamber of the second Pyramid is excavated in rock, and has its floor below the level of the ground outside,—or a position suitable to burying. 2*d*, The sarcophagus

of the second Pyramid is shaped like a sarcophagus, is sunk in the floor, and has an excellent, tight-fitting, fast-fixing lid; but the coffer of the Great Pyramid is deeper, as well as more capacious, than was ever known for a sarcophagus; no man has ever recorded seeing its lid, and the vessel stands free on the open surface of the floor. 3*d*, The holes in the north and south walls of the chamber of the second Pyramid, says Mr. Perring, who abundantly examined them as an architect, *may* be the beginnings of making ventilating tubes, or *may* have been to support a wooden frame-work to facilitate laying on the slabs which form the roof of this excavated room; but as the utmost length of one hole is seventeen, and of the other thirteen, inches, they do not reach the air outside; and cannot compete with the real ventilating-tubes of the King's chamber of the Great Pyramid, which are one hundred and eighty feet long, and stop not until they reach the exterior. 4*th*, And we add this merely out of superabundance of arguments, and to make assurance doubly sure, as well as touching also on one of the magistral mysteries of all those Pyramids! While the chamber of the second Pyramid is directly led *to* by the leading of the entrance passage, and its conspicuously lined walls,—the King's chamber of the Great Pyramid is just as directly led *away from* by the entrance passage there; which seems rather to have been a blind and shield to it, and a diversion to all who

would come to seek for that remarkable chamber; positively inducing them to go past the concealed point of junction of the passages; *i.e.*, all but those very few, or perhaps even that one only man who has been previously instructed to look for a certain almost microscopic mark on the floor. Hence *the* chamber in the Great Pyramid, which is truly the representative of the large one in the second Pyramid,—can be no other than that usually despised, but nevertheless very large, subterranean chamber which is excavated in the rock at the bottom of the long entrance passage; and, equally with the chambers excavated in other Pyramids, must have been intended to be easily discovered, and looked on as sepulchral; while the so-called King's chamber of the Great Pyramid stands absolutely unique; raised up on high, and yet concealed; unadorned, and yet filled with symbols; but symbols, whose only ornament consists in perfect workmanship, whose only allusions are to the great things and true of both terrestrial and cosmical science, and whose exact resemblance is to be found nowhere else.

Satisfying ourselves at the place with this interim reasoning upon a matter yet further to be discussed, we now clambered our way out of the second Pyramid, and reached its exterior a little after sunset,—both when the darkened blue light of the sky reflected down to earth, was giving all eastern sloping ground that look of *dampness*, which is there so far from the truth, and even so

impossible to be real in the yellow parched-up desert,—and when the wheeling vultures overhead were returning home for the night to their inaccessible summit of the smooth casing stones, and were barking a bark as gruff as that of the heads of Cerberus himself. The scene therefore both looked sad and sounded sombre, making us fear that poor Smyne had been left alone with his doleful thoughts rather longer than was prudent; but to our intense surprise we found him perfectly joyous, and merry as a cricket.

'O yes, I all right,' he exclaimed exultingly; 'my 'heart quite dilated again now; I no care about that 'young lady at the village any more; I know where 'there is another much better; I go to see her 'father to-morrow.'

My wife looked at the young man with fear mingled with deep pity,—believing that his reason must have given way under the intensity of his grief, since that great calamity befell him, dashing all his life-prospects in a moment to the ground, only twenty hours previously. But he was never more sane than at that very instant, and the worst of what he had just uttered about himself was,—that it was all perfectly true.

CHAPTER XI.

INSTRUMENTALS.

Of all the advantages which we were enjoying through the Viceroy's authority at the Pyramids, there was hardly one of such continual and self-evident importance to a serious attempt at scientific measures on the part of a private individual, as the license given us to choose and occupy any number of 'tombs.' Not only did these ancient sepulchres, excavated in the eastern cliff, and whited now within as well as without, prove themselves so admirable for modern human dwelling,—that having once tried them, we made no other use of the 'Colonel's tent' than to have it standing on the sand below, as proof to all Arabs whom it might concern that we were there with the approval of his Highness the Viceroy,—but they, the tombs, were also invaluable, under an Egyptian sun, for storing all scientific instruments in, and preserving them not only from the disturbances and sandy agitation of tent life during windy days, but from the more insidious effects of high temperature, and excessive drought on calm ones.

Even as it was, in the deep shady recesses of the cave tombs, where the temperature seldom rose above 67° at any part of the day, or not 20° higher than it would have been in Scotland under similar circumstances,—the packing-cases were day by day opening their seams; and every two or three days, I was obliged either to take out a chisel and shave off some part of the internal fitting blocks, before an instrument, that had only recently been extracted for use at the Pyramid, would go into its box again,—or to make some modification of sides or lid, before the top would close properly and permit the lock to act. Wherefore, what would not have been the consequences to these boxes, if they had had the sun shining directly upon them, or the choky heat to bear of a sun-exposed tent during the last two months,—and the difference of temperature thereby made three times as high, and of dryness perhaps five times!

With the mere packing-boxes themselves, to be sure, it was only an affair of trouble to recover them to their shapes and uses; but with the linear measuring-rods, the evil was far deeper and more difficult of elimination. For convenience of handling, carrying, and reading, these rods had all been constructed of wood, as box or lance, mahogany or deal; some of them painted, others only waxed or oiled; some being adapted to taking outside measures to an accuracy of 0·1 of an inch, and others to taking inside measures to something smaller still.

A numerous and heterogeneous family truly these rods were, and not one of them could be regarded as capable of keeping its length exactly, for more than a short space of time; but then it had been arranged that they were all to be tested on a certain reference scale before and after every measure, and their various lengths would then be known in terms of that reference.

The 'reference scale' was therefore devised to be quite an institution in these Pyramid measures, and was contained in a huge box, some ten feet long and eight inches square in cross section; armed internally at either end with thermometers for giving the temperature; and provided, on one hand, with neatly prepared contact pieces of gun-metal, for conveying to its own divisions the lengths of the several portable rods to be tested; and, on the other hand, with a microscopic beam-compass of extraordinary powers, for comparing its (the reference scale's) divisions with those of a true standard measure. This most important part of the whole system having been prepared in a very dense block of solid black stone; and by its nature calculated, it was hoped, to keep a record of the length of the inches with which the Pyramid was measured on the present occasion, to distant ages.

In this manner the measures taken every day in the Pyramid, with various wooden scales, would be practically equivalent to having been made with the stone standard; and thus would be avoided one

source of error with previous Pyramid measurers, —whose wooden scales were actually of a different length when they were being used hot and dry at the Pyramid,—from what they were or would be when compared with standards in Europe, immersed in air of European coldness and sensible moisture, both before they set out for, and after they came back from, the sunny south.

This complete reference system was what was intended; but alas for the man of small means who requires any original instruments of his own, to be made by a great optician! There may be, and indeed there are, some opticians whose word may be taken, and performance trusted, as well as those of any other class of business men; but in dealing with your very great opticians, all ordinary ideas are transcended. He was a notable optician of whom the story is told, that when he had on one occasion sent home a telescope ordered by a customer,—he was complimented as being true to the day, but wrong in the year,—though the story does not say how many years he was behind his promised date. And of greater opticians, still more extraordinary stories are told; so that even Royal Observatories must consent to wait until '*los grándes artistas*,' of a recent Spanish bulletin, may be pleased to redeem their promises.

Something of this characteristic doubtless arises, from the peculiar demands of the optical profession

for almost superhuman mechanical accuracy; or certainly for greater truth and refinement of work than was ever attained to before, by any man under the sun. Though whether it is to be the greatest also that ever *will* be obtained, is the practical problem to be solved; and in deference to which, all ordinary attention to common punctuality, appears to sink into nothingness; and a peculiar state of mind is developed, dissatisfied with a shade; and either recommencing *de novo*, just when a structure was thought by others to be complete; or apparently idling over unfinished work, but really thinking how the next step is to be accomplished, and in some manner, perhaps, never before realized by mortal hand, or brain either.

With the splendid living practitioner, however, in fine metals, to whom application had been made for the finishing off of our Pyramid-measuring apparatus, I had believed that where his mind was excited with the scientific importance of a subject, he would struggle to keep his appointments,—and had therefore sent him a copy of *Our Inheritance in the Great Pyramid* in the summer of 1864, before detailing the orders for what was required. He had taken to the project, too, very kindly; even to twice visiting Edinburgh, where he had discussed by day the instruments to be made, and by night the probable history of the Pyramid. Time however passed away after that, time long enough to have made the whole apparatus again

and again; and when, with everything else duly prepared and packed up for the voyage to Egypt, I wrote to him to send me his contribution that it might be examined at home,—he replied that he would go across the country with it the following week and give it to me at Liverpool when embarking: concluding his letter, though, by asking a question about the microscope beam-compass, which showed it had not been begun, in fact never thought about during all the interval.

But then this man was a born genius among opticians; and where genius is concerned, no one else must presume to say what its flights may not attain to; and I still hoped that in presence of the practical necessity of the case, the gentleman concerned would outdo even himself, and successfully finish everything in a manner that would make his name favourably connected with Pyramid mensuration. And sure enough he did come to Liverpool with three boxes of apparatus, which I was asked in the haste and inconvenience of a railway station to examine, approve of, and there and then accept as a fulfilling of the long previous order.

A number of the articles certainly were remarkably well got up, and moderately charged; but when we came to the reference scale, some doubtful features began to appear; and by the time the stone standard and microscope-compass were reached, I was compelled to take formal objection; for the order had been entirely departed from, and some-

thing produced which would not work. But the good ship 'Thessalia' delayed her sailing for several days, in order that she might load up some hideous big iron boilers on her deck; both to the consternation of her captain and sailors,—who, in the ensuing voyage, were nearly sent to the bottom thereby,—and to the utter straining of every iron plate in her frame; to an extent also, which it is devoutly to be hoped the good people at Lloyds' will find out, and charge the wealthy owners with treble insurance rates ever after,—receiving in return the thanks of 'all who travel by sea;'—during these few days therefore of grace to him, our first of modern opticians promised to rectify the microscope-compass. But again he brought it up imperfect, and saw it was imperfect, and that the stone scale also was not the sort of stone scale I had intended to be guided by during Pyramid measures; so there was nothing for it, at the last moment of setting sail for Alexandria, but to hand him back that part of the apparatus, with full instructions how to alter it; appoint him a month to alter it in, and then send it out to Egypt after me,—under penalty of ten shillings per day for every day's delay after the month should be expired. Paid, therefore, for the instruments he *had* finished, and finished well, the full amount charged,—the great optician, after a little wincing, signed the deed, and took home both stone standard and microscope-compass; promising again and again, to have every

desired alteration performed upon them; and then to get them sent out so speedily, that they would arrive in Egypt before I could well have reached the Pyramids, or been inconvenienced to any extent by the absence of such important apparatus.

On this faith, therefore, it was that my wife and I had set sail in November 1864, without the veritable keystone of our measuring system; but in such full trust of immediately receiving it, that we never for one instant paused in our onward progress of occupying the ground at the Pyramids, and beginning whatever measures were locally possible. But we did not know fully, what it was to have to deal with a genius. For into whose mind except that of a genius, and indeed a most magnificent one, of the optical instrument-making class, would it ever have entered,—after those trying scenes in Liverpool, and with a copy of the one-month penalty paper in his pocket,—to return innocently to his Downshire home, and not look at the instruments concerned, for *three* whole months!

Yet such was the case; and there were we, at East Tombs,—week after week, and month after month, in a rising temperature, and with our wooden measuring-rods altering in length,—writing frantically to our agents at Alexandria to inquire everywhere, and from all the Liverpool ships in particular, if no instrument-box had arrived for us, marked for immediate despatch. But of course there was nothing of the sort; and from the time we had left the

Mersey and plunged into the stormy seas beyond,—rolling in the troughs of the waves at the mercy of those big boilers on deck,[1] and in the midst of some of the very worst of weather of all that autumn and winter,—we had been cut off from the whole British world by an impervious bank of more than Cimmerian darkness; and might as well have drifted out on the ocean in an open boat, for any help received from whence it had been expected, or sympathy from those amongst whom it might have been demanded. But fate eventually was kind; and the Arabs, under the wholesome control of a strong Egyptian Government, were a sufficiently respectable, though not very instructed, set to be amongst for a time.

Linear measures had therefore been commenced at the Great Pyramid without waiting for the arrival of stone standard and microscope-compass. 'Of 'course though with due employment of the good 'reference scale instead?' may remark many an intelligent reader.

It should have been so, but there was unhappily wheel within wheel of misfortune. The reference scale *was* originally to have been of metal, and would then, in its great box, have been, for a few weeks, a very fair reference indeed for rectilinear length; but when I proposed that material to the

[1] A species of cargo unknown in Utopia; and in any other state where the lives of seamen are valued by Government and the people more highly than a few £ *s.* *d.* of freight.

great optician he urged such a variety of objections, and especially the greater expense over wood, as put it quite beyond my private means to ambition possession of. And when he further asked, with considerable cleverness, 'What importance there would be in having the reference scale of an unchanging material, if it could be at any moment compared by means of the microscope-compass with the stone standard?'—of course I was taken captive by my own arrangements. Doubly so in the end, when the stone standard and microscope-compass never arrived; triply so, when the heat and drought of an Egyptian climate began to bring to light, a peculiarity in the action of the *wooden* reference scale, that had eventually been prepared in the learned optician's workshop.

Among those who are fastidious about accurate measuring scales, though not to the very highest requirements of science, there is a great appreciation of wood, when used in the direction of its fibre, and that fibre straight, dry, and well-seasoned; wherefore they find, that good sound deal is about as trusty a substance as can be employed; and the question is only, among different examples of it, to pick out the most shapely in grain and thoroughly seasoned. Now a friend in Manchester, who had taken a special scientific interest in this proposed visit to the Pyramid, had advised me last autumn of certain old organ pipes, recently taken out of an organ, dating from the reign of good Queen Anne;

old enough therefore to have dried most thoroughly; and composed of such admirably straight-grained wood, that one of his friends was making measuring-rods of it; and found,—that when they had been covered with copal varnish, they were 'unchangeable.' My kind friend, moreover, did not stop here, but procured a slice, one hundred and five inches long, five inches broad, and three-quarters of an inch thick, wherewith to construct the important reference scale for Pyramid measuring in 1865. This precious example, therefore, dating from England's Augustan age, was duly handed over in the rough to the great optician; and re-appeared under his auspices with many fine fittings, at Liverpool, when the long bar-box was opened there.

'It looks very dark?' said I.

'Oh, that's the drying oil,' replied he, 'which has 'been rubbed into it.'

'Oil!' I exclaimed, with a pang of anticipated horror; 'what made you think of rubbing in oil, 'when you were asked to coat it with copal varnish?'

'But what,' he persisted, 'could be better than 'oil; when, mark you, it is drying oil?'

'That may be,' was answered, 'but it is not dry 'yet; and oil has the effect of moisture in revivi-'fying vegetable fibres: nullifying therein, too, all 'the good effects of age for mensuration purposes. 'Just as when you take at the Cape of Good 'Hope, the old, dry, and closed-up head of seed-'vessels belonging to a certain plant, dip it into

'water, and lo! in ten seconds it softens, swells, 'twists, and presently expands into what,—though 'scentless, brown, dead, and no flower,—they 'prettily call the *rose of Jericho.*'

At the time,—I concealed most of my grief and apprehension; but on afterwards finding,—even in the shaded recesses of the instrument tomb,—that the oiled scales were still sticky, and the Queen Anne's organ reference scale was not only curling up like a shaving, but had in a few weeks become twisted in the very plane of its breadth by a whole inch-and-a-quarter,—I could no longer think of using it for its original destination; and even ventured an idea, for indulging in which I trust to be forgiven, respecting the greatest genius of modern opticians,—and to the effect, that his future portion may be amongst the roses, of that ancient and celebrated city which has just been mentioned.

My first practical proceeding, however, on finding that we had been undoubtedly deserted and left to our own unaided devices in the desert,—was, to make a new reference scale, on the material of the bottom of the box of the original one; for the wood there had not been oiled, and was of such a degree of solidity as argued a chance of not changing either very much or very quickly. Divisions were therefore put in at every fifth inch by a fine cut with a penknife, not perhaps very regularly, but the errors of each cut on the mean of the whole, were afterwards determined by a fine ivory scale divided to

hundredths of an inch, and capable of being read off by a hand-magnifier to thousandths; so that there was then very little difficulty in comparing every rod, long or short, used in the Pyramid, and stating its length in terms of this one *impromptu* reference.

But how about that reference, and the standards of British measure in Great Britain! for of course some more trustworthy and permanent carrier of length must be employed between Africa and Scotland, than the bottom of a deal box, how thick and massive soever. In fact, a stone scale was also to be accomplished.

Now in our visits to the Museum at Boolak in December 1864, we had looked, and with eyes rather covetous towards this particular end, on certain basalt coffins there, of Egypt's Pharaonic day; for the material was so remarkably fine in grain, besides being hard, and free from either fissure or fracture. Some geologists tell us, that trap rock is trap rock all the world over, and there is no use in bringing a specimen of basalt or greenstone from the other side of the world, because it is precisely the same as what we have at home. But I can positively attest to having searched a notable part of Scotland over, and have never found a piece either of porphyritic trap or fine-grained greenstone or basalt, but what was rent at every few inches by cracks, or preparations for cracks, in a manner to quite unfit it for use as anything approaching to a good

standard scale. The nearest approach to what we desired in mineralogical quality, was a small hand specimen of 'basaltic clinkstone,' from a certain hill in Linlithgow,—for it was capable of taking a high polish, and the grains were so fine as to be almost invisible to the naked eye. But on sending an expert to the place, he looked all over the quarry and could find no fragment a foot long without a crack; and though he was sent again, and brought down by blasting a large part of the brow of the cliff, and thought that some two or three lumps were thereby procured of solid quality,—yet, on throwing water over them in the sunshine, the retention of moisture along certain lines showed, that even those best portions were utterly infused with the principles of fissuring, and were ready to reveal their weakness more decidedly at any moment.

But in the Museum at Boolak, there stood almost dozens of basalt coffins, where the length was between six and seven feet, and the whole material not only finer still in grain than the carefully selected chip of Linlithgow basaltic clinkstone, but without the smallest apparent desire to fissure at any point whatever: even too, though the toughness of the stone had been tried to the high degree for so hard and brittle a material, as first of all to have been worked into a hollow box, of shape resembling a man, and hardly more than three inches thick over any part of its curved sides; and then, to have been tumbling about in the sun and wind amongst

temple ruins for two or three thousand years! With what tools those early Egyptians could have sculptured so perdurable a substance, is almost as extraordinary as the natural circumstances under which the Egyptian basalt was poured forth by nature, so fine in quality, and condensed so evenly, and free from flaws. Yet there were both the wonders patent before us, as to mere fact; with the addition too of the lids of some of these basalt boxes being covered with minute hieroglyphics, carrying nearly a side of the *Times* newspaper amount of information; and in a neat style of artistic engraving, where you saw, most charmingly portrayed in a multifarious microcosm, the manners, characteristics, beauties, and weaknesses of hawks, owls, ibises, pelicans, geese, and almost all the birds of ancient Egypt; while treacherous snakes glided here and there with such natural bends, and clear though minute curves, as gave the impression of the creatures being in motion still.

The basalt then having kept all these small markings thus faithfully, from a time anterior to the formation of either the Roman or Greek nationalities, and having also refused, by its hardness, to be scratched, worn, or otherwise injured by accidental abrading influences,—what a material must it not present for national standard scales of length; and how little doubt would there have been now upon the length of either the Greek or Roman foot, if their copies had come down to us engraved on a

slab of *this* basalt. Wherefore, we inquired of Mariette Bey, as to whereabouts in Egypt this peculiar species of stone could be procured; and he very obligingly answered, that he had cart-loads of it there at Boolak,—in shape of sarcophagi or coffins which had been so far broken as to spoil them for exhibiting in his Museum, but not to prevent their abundantly affording such lengths as would be quite enough for my purpose, and he would let me have as much as I desired.

Some difficulty had occurred at the time, to prevent my obtaining the promised slab then; and I was afterwards induced to place all my hopes upon, when Mariette Bey should come down from the upper country, and pay his expected visit to us at East Tombs. But now we had entered on the third month of our residence there, and Mariette Bey came not; neither did the longer promised stone-standard of black marble arrive from the chief genius of optical instrument-makers of Britain; so we had to look about and see what could be done to help ourselves on Pyramid hill.

Of limestone, we could of course have got a slab anywhere, but cared not for anything that could be scratched so easily. Nothing in fact but one of nature's *hard* stone castings, that was melted long ago by the primeval heat of the earth, would fully suit the occasion. For, as when one said to us, while still in England,—after appreciating that an oxidizable metal, as usually employed, was not exactly the

thing to carry thin cut lines on its surface down to distant ages,—'Would not a plate of glass suit you?' —we replied, 'Not unless you can assure the world 'that its secular, as well as periodical contraction 'after melting has been overcome, by the practical 'security of at least six thousand years having 'intervened since it was last in a state of fusion.'[1]

Now, in front of the eastern side of the second Pyramid, are the remains of cyclopean walls of what most travellers call a temple; to whom or wherefore erected, no one knows; and they, the travellers, have shed all the light they are capable of affording on the subject, when they add, 'It was probably *an hypæthral temple*;' that is to say, was open to the sky; and this is likely enough, for there are no remains of any roof (whose span too, if it ever existed,

[1] Standard scales or bars for linear measure are usually, if not universally, made of metal: why then did I not have one constructed in that material, and trouble no one about Utopian fancies?

At pages 303-314 of *Our Inheritance in the Great Pyramid*, I have attempted to show the successive changes, approaching even to revolutions, which have been effected nearly every half generation during the last seventy years, by the authorized makers of the national standard measures for the time being; these changes being indeed all within the circle of the metals, and varying only as to the particular metal or alloy employed, and the mode of manufacturing it. So many suspicions, however, attached to metal, as metal, even in the latest and most improved form and mode of employment, that I hinted that other improvements still, even amounting to *bouleversements*, would be heard of; and actually, before the present year of 1866 is concluded, a report has been presented to the British Association for the advancement of Science, by its 'Mural Standards Committee,' rejecting every form of metal, and adopting in its place hard glazed porcelain, to carry down to distant ages the respective lengths of the British yard and French metre!

would have required to be enormous), only a few gigantic limestone blocks forming the walls,—rude, weather-worn, gaunt, and world-defying masses, like any natural craig or scaur on northern hill. Precisely thus too, even when Halicarnassian Herodotus visited the locality, did this group of monster blocks lie lonely and deserted under the beating sun,—forming a ruin descended from a time so early, that men had ceased to have any party, or national, feelings about it, and had left off even speculating upon its origin and purposes.

Yet this grim spectre of the early world, must once have been replete with delicate furnishings of architecture, and costly finishings of art, heaped upon it too by loving care, and the liberality of princely hands; for round about its ruined area now, as one treads the heaps of tell-tale rubbish, where every storm of wind that blows another film of dust away, reveals a new page of history,—one finds the soil perfectly filled with smashings of snow-white alabaster, or arragonite, often in shape like great fossil teeth; greenstone of choice varieties; black basalt and granite rosy red; in fragments all comminuted, and yet occasionally showing parts of surfaces once exquisitely smoothed by the hand of man, and sometimes even with traces of sculpture visible still. Wherefore, after having previously lost one's-self in myriads of years, endeavouring to realize the ages of devotion and labour, triumph and respect, with which these costly works were devised

and executed,—then introduced into the massive building, and there inaugurated and honoured,—one has next to imagine an addition of ages of indifference, or change of opinion, and of revolution at home, or conquest by the foreigner, combinedly becoming the parent of as eminent a display of persevering labour in breaking up utterly and destroying, as before in building up. And then, long afterwards, when for ages both builders and destroyers had equally sunk into oblivion, came the earliest of ancient Greek travellers, and the best,—the matchless Herodotus,—but could make out nothing from the scene.

Yet amongst many other fragments which my wife picked up here, was one of black basalt, a perfect gem in the way of working hard stone into geometrical shape; *i.e.*, so far as it went, for it was merely a corner of something very much bigger, but a corner where three worked surfaces met. Exquisite planes they were, the material harder than flint and much more tough, while the whole lump was undimmed by four thousand years' exposure to the elements, dark, glossy, and close-grained; admirable therefore for drawing fine lines on, and wanting nothing to fit it at once to become the groundwork of a modern standard of length than that, it was so very small. Nor did all our further examination at this spot, though resulting in a whole bagful of specimens of the fine grained black basalt, succeed in bringing one to light which had

not been smote again and again into mere splinters by the hammers of early iconoclasts.

Foiled at this place, therefore, we turned our attention to the eastern front of the Great Pyramid, where, as every one who has read Sir Gardner Wilkinson's volumes, (and who is there who has not, and confessed how much he has been indebted to that representative of all the excellences of the best Egyptologists of every learned nation!) every such person knows that there are there, large collections of 'black stones and portions of basalt 'pavement.' Colonel Howard Vyse appeared to think them symptoms of a temple similar to those in front of the second and third Pyramids, having once stood on the spot,—and began excavating accordingly; but gave up the work again some time after, apparently on account of its barrenness of results. Sir Gardner Wilkinson, on the other hand, appears, if I understand him aright, to look on the basalt pavement as the remains of a tramway for the carriage of blocks at the building of the Pyramid; and defends such an hypothesis by similar examples, better preserved, at Sakkara.

To this opinion, too, we were inclined, after much examination, to assent; not indeed imagining that this black terminus before the Great Pyramid's eastern front, communicated slantingly with the line of the acknowledged northern causeway of limestone blocks (and which tends rather east-north-east, or to ancient Heliopolis and the flat country),—but

that it had a black tram-line or causeway of its own, trending off straight eastward, and making therefore a much shorter passage to the Arabian stone hills on the other side of the Nile. This idea is, on one hand, rather negatived by finding much of the supposed line of a direct eastern causeway undermined now by tombs; but there were such numerous ages for constructing them, long after the Pyramid was completed and the causeway no longer required for its original purposes, that the objection is of no great moment; while, on the other hand, there are three notable points directly *in* such a line,—if not also clearly marking it out, and extending the proof down even into the flat plain,—where large collections of worked basalt blocks are to be found. The escarpment too of the cliff has been neutralized so completely by enormous heaps of rubbish, in the direct line between two of the basalt groups, as to form the present actual and effective soft causeway, by which all modern travellers ascend the hill for the purpose of visiting the Great Pyramid; to the entire neglect by them of the so-called northern, and usually considered one and only, ancient causeway erected for such a purpose.

All along this eastern black causeway line, however, I walked again and again, examining the stray and long-kicked-about basalt blocks,—finding very many of them with famous worked surfaces, but all of them, as to material, coarse to a degree.

This was melancholy, after that gem of fine-

grained basalt discovered before the second Pyramid; but the necessity for a certain larger size than that, obliged me finally to adopt a lump of the coarse. A piece was therefore selected with a worked surface on the top, and all the corners were hammered, until everything that would break off by mere ordinary hammering had been removed; and the result was, a hard, tough lump of basalt, smoothed on the top in the ancient days of the world, before history began,—but now rather porous, from the decay of the smaller component superficial crystals. So we thought we must try to cut it down to a fresh surface ourselves; and as this new want occurred soon after the appearance of 'Alee, 'the day-guard,' for our diurnal defender, and he was burning with anxiety to turn an extra penny in any honest manner, and could use his hands well, though not his feet,—Alee Dobree and I furnished him with a nice supply of desert sand, a pipkin of water, a second block of basalt, and full instructions for grinding the two blocks together with water and desert sand between; by a series of circular motions too, accompanied with a continual rotation also of the revolving block.

So at once the poor worthy man began with his tedious grinding, circulating the upper stone as regularly as if his arms had been part of a speculum-grinding machine, while Alee Dobree and myself went off to our work at the Pyramid. But we had miscalculated the astonishing hardness and sharp-

ness of African desert sand; for, on making an inspection towards evening, the embryo standard-measure slab had acquired an odiously concave surface. Next morning, however, forming an idea of the why, we reversed the stones, making the one which had been the stationary bed below, now the revolver above; and again our hard-working, exemplary day-guard ground and ground at the two stones, and with such untiring perseverance, from another sunrise to another sunset, that he had soon changed the curve to convex.

This, however, showed that the means of correction were at hand, and by dint of several reversals, and a final finishing with Nile mud in place of desert sand,—a surface was at length obtained on which fine engraved lines could be creditably placed. A box was next made, suitable for keeping the now-to-be-precious fragment; but a new difficulty presented itself, viz., the hardness of the stone, which resisted all attempts to put in the graduation with either a hard steel cutter or sharp flint edge,—when in despair a happy idea struck us, that my wife's diamond-ring might do the work; and so it proved, for with one angle of the diamond the necessary lines were at last satisfactorily cut into the basalt, and a permanent scale of very nearly five British inches, more or less, was constructed.

At the time, we had no means of ascertaining the real value of the space so defined; but whatever it might eventually prove to be, we at once de-

termined the lengths, first of the reference scale, and then of all the measuring-rods, in terms of those five basalt *reputed* inches; and having since succeeded in bringing the basalt to this country, have measured here the lengths of its inches, in terms of the inches of a Government standard originally prepared by Captain Kater, and now in possession of the Magistrates of Edinburgh, who obligingly lent it to me for the purpose.

Thus the Howard Vyse instrument-room was in continual requisition for mechanical work of one kind or another, and was exceedingly appropriate thereto,—being seldom troubled by wind, while the sun never shone into any, except a small, part of the front of it, and that only for a short time each morning. At one period we had feared there was the inconvenient neighbour of a worse than hornet's nest, in a fissure of the roof,—where a dozen big wasps of five times the ordinary size were crowding very busily; but after killing *them*, no angry companions assailed us, and the few occasional visitors of the same genus who subsequently appeared, were rather interesting,—as being so precisely the same royal fly which figures largely among the ancient Pharaohs' names in hieroglyphics. A noble fellow truly, both in size, form, and brilliancy of colour, is this fly,—really, too, with something gentlemanly in his manner, for he always seemed to have occupations of his own, and though armed with a sting

capable of doing much execution,—yet if given, on any of his calls, the slightest hint of not being wanted, he was off like a shot into the far blue air, never to return. Somehow or other, though, we fancied that the vital principle is not very strong in the family, for none of them ever recovered from the smallest blow given them; and we often wondered whether they, having figured so largely in the world's history, and having had their portraits so abundantly sculptured, engraved, and painted between three and four thousand years ago,—are now doomed to disappear shortly, and be replaced on the busy scene of the world by smaller and more vulgar, impudent, vivacious, and cantankerous representatives of their kind, more horribly worthy of the name of wasp.

We took a fancy, too, for a pair of little black and white birds, something like water-wagtails, and very closely resembling the hieroglyphic bird connected with King Shafre and the Pyramid. Wherefore every evening, my wife strewed crumbs on the steps of the dining-room tomb, to be ready for them at their early morning visits to those quarters where their ancestors were so well known, in and about the year, 2000 B.C.; very clever too they were in picking up the smallest of crumbs, their tails wagging up and down most unweariedly the while; and when the huge flapping hawk came by on his twice-a-day visitation of all the line of the cliff to see what was for him,—they would dive into some

one or other of the hieroglyphic-adorned excavations, as if there perfectly at home.[1]

But close acquaintance sadly dimmed the moral beauty and innocence of these delicately-fashioned little birds; for though they were of such a diminutive size and slenderness that a single cock-sparrow would have thrashed three of them, yet one of the pair, because he was a trifle bigger than the other,—his legs thicker, perhaps, by the hundredth of an inch, and his weight greater by the twentieth of an ounce,—must needs go swaggering about and thinking so highly of himself, that he could not let the other *birdie* pick up a scrap in his mighty presence; and this, though at a distance of several feet, and all the ground between them covered with far more crumbs than both of them together could consume. So what used to be, when they first arrived half starved, a very pleasant scene of their peacefully and thankfully feeding together, gradually became, as they waxed fatter,—such an unlovely example of a bigger, bullying a

[1] Large hawks on the wing are a frequent feature of Egyptian landscape; but their prey would seem to be often very different from what is usually imagined; being, according to Dr. Wilde, in his *Narrative*,—'a large species of grass, or sand, hopper, with remarkably 'brilliant crimson legs.' 'I dissected,' says Dr. Wilde, 'several of 'these kestrils, and found that, instead of the usual membraneous 'stomach, peculiar to rapacious birds, theirs had been altered to meet 'the exigency of the case, and had become a perfect *gizzard*, having a 'detached cuticle, stained of a bright red by the colouring matter of 'the grasshopper, pieces of the hard shells of which, and small pebbles, 'I invariably found in the digestive apparatus of this insectivorous 'hawk.'

lesser, but yet necessary, companion,—that we were rather glad when the advancing spring seemed to remove them amongst the migratories, and replace them by active, industrious swallows.

These swallows were truly ever on the wing, and diligently feeding themselves,—though indeed, from their light ashy-grey backs, you might have thought them ordinary swallows, that had rather lazily or by some mistake turned out for once in the shabby dishabille of grey dressing-gown costume. Yet their sun-reflecting tint must have been important to them, for they had evidently come to this sun-burnt tract of desert for the summer, not winter, season ; and we found even now, in the early spring, each day almost becoming sensibly hotter and brighter, and bringing up more and more of the characteristics of African desert-life.

On one occasion, having arrived at something anomalous in the instrumental levelling of the floor of the so-called horizontal passage leading to the Queen's chamber,—I thought to try a rude practical experiment by pouring water overflowingly into the great 'polyspaston hole,' which is found near the centre of that floor,—and then seeing which way the fluid would run. The matter was accordingly mentioned to Ibraheem, who in the hot weather watched like a dragon over his supply of water; but the experiment took his fancy so amazingly, that he was quite anxious to show he had water enough

and to spare. Both he and all the other Arabs indeed near about, to whom he immediately began talking enthusiastically of the proposed trial, could instantly perceive that there really was some sense in *that*;—while as to all the true scientific instruments they had previously seen produced one after another, they looked on them as of no practical use whatever, and held them rather as signs of weakness in those employing them; proofs, unhappily, in their minds, that a European cannot get on at any occupation without some queer and troublesome contrivance *to peep through*,—when an Arab has only to look straight at a thing with his simple eyes, and perceive its whole bearings at once; or at the utmost, to refer to the running of water.

So Ibraheem cheerily furnished Alee Dobree with one bucketful of water; and then, after a while gave a second to Abduwahad, while I followed them in a short time with lamps and lucifers. Not at all too soon either, for that soft young man Abduwahad, having emerged from all the beaten part of the road, where there is nothing but going up and down over ruined tombs,—having thus just emerged on the open slope that extends thence to the north-eastern corner of the Pyramid,—he stumbled there, at the hottest hour of the afternoon, full upon Reis Atfee, baked through and through with solar heat. The Reis was indeed a good, innocent sort of man enough, but he must ask the news, and being told why the water was being taken to the Pyramid,

gave it as his sapient opinion that the thing was perfectly impossible: and therewith, taking the bucket out of the bearer's pliant hands, he raised it to his lips, and drank with the volume of a horse when he is decidedly thirsty and *wishes* to drink; so that, by the time I came up, the possibility of a successful experiment was very materially reduced. But the poor Reis looked so much the better from his draught of clayey water (for Ibraheem had carefully given out what had *not* gone through the filter),—even in the fashion of a cactus plant, after it has shrivelled during a long scorching summer and then gets the first heavy showers of the rainy season,—that I could not be very violently angry with him. Of course, too, for accurate statements, I did put my trust in scientific instruments still; and with reason,—for invariably the more perfect they were in themselves, and the more completely they could be adapted to the parts of the Pyramid they were intended to test, the more admirably close did the results come out; especially when the parts so examined still showed any of their surfaces at all approaching the state in which they had left the builders' hands four thousand or more years ago, and were also parts to which those remarkable men had attached more than ordinary importance.

Now of all the features peculiar to the Great Pyramid, and capable of exact measure, there is none of equal value with that of the exact tilt, or large vertical angle from the horizontal, of the

several inclined passages ; and of all these passages, again, there is not one which can compare in length, height, architectural splendour or theoretical importance, with that one known under the name of the Grand Gallery. Wherefore if, as we have been led to believe from several other indications, the builders were chary of refined workmanship, because it cost money, and only introduced it where circumstances imperatively called for it, and then in proportion to the importance of the occasion,—why, the angle of the Grand Gallery must be the most crucial test of the true theory of the Pyramid on one side, and the capacity of the builders to work up to it, on the other.

Already I had made some important observations upon this angle, with the little sextant and artificial horizon apparatus ; having this latter mounted at the extreme north end of the Gallery, on a stand duly proportioned and knocked together, so as to stand easily over the protruding step of the floor of the first ascending passage ; besides being furnished myself, with a sort of stage to keep the observer from slipping down the steep passage away from the instrument ; and found it practically, in Pyramid passage-observing, to be an absolute essential : while a luminous signal, well centred, was erected in the southern doorway, or at the upper and farther end of the Gallery. With this, to a certain extent Robinson Crusoe style of apparatus, then, I had got some tolerably respectable measures, which came very

close to Colonel Howard Vyse's numbers,—and they are singularly near what theory requires,—but then there were the French Academy, the Cairo Institute, and other learned Cairenes all standing like lions in the path, and refusing to receive from any mere private man, and a stranger, any angle but what should come very near to theirs. (See Plate VI.)

Now the French angle for the Grand Gallery, as duly given by the worthy M. Jomard, is 25° 55′ 30″; but modern Cairo had obligingly handed me a note in December 1864, which gave one result from measurement of a hypothenuse and perpendicular as 25° 42′ 53″, and another from a base and perpendicular equal to 25° 17′ 36″; poor theory all the time demanding 26° 18′, nearly. So there was no resource left, but to try the fact again with an instrument decidedly superior to any of its kind that had ever been employed in the Pyramid before; and which should discover intermediate, as well as final, errors, in order to throwing some light, if possible, on these strange anomalies.

The instrument appealed to in such a juncture, was of course the admirable circular clinometer kindly furnished me by my friend Mr. Andrew Coventry; for to its angular apparatus, no objection *could* be taken; and if it required rather a longer foot to stand upon, than that originally constructed, why, I set to work to make one; and by dint of cutting up the old fifty-inch mahogany base into three pieces, and fastening them symmetrically with abundance of

powerful screws on to the lid of the reference scale box, as the best slab of seasoned wood then procurable,—a new base for the instrument was obtained, measuring no less than one hundred and twenty-six inches from foot to foot in plane of the divided circle,—with seven inches in radius for cross-level, and eight inches in depth, with 1·3 inch in thickness, for strength and resistance to flexure; care being, however, still further taken to use the apparatus in such a manner, that only the *difference* of flexure between each half of the joist-like bar should be felt on the observation. Four lamp-shelves were also fastened on this ponderous beam, two at angles suitable for holding the lights level when going up the Gallery with the face of the circle west; and other two when coming down with the instrument reversed, and its divided face looking east.—(See Plate I. vol. ii.) A wooden anchor for holding on to a ramp-hole above, was also provided, with a rope and clamping apparatus,—so that the clinometer machine might be held accurately and securely at any desired position; and thus armed, on one fine Thursday morning, the 9th of March, Alee Dobree and I set forth to see what we could make of the chief internal angle of the Great Pyramid.

Happily no travellers had yet appeared; and as we worked our way up to the entrance on the northern side, where there was still a little shade,—though only to last a few days more, when the date comes whereat, even at noonday, the Pyramid, accord-

ing to the mysterious science of the ancients, 'consumes its own shadow,' on every side,—the only creatures to watch us were a couple of little owls, about the size of moderate thrushes, but with intellectual heads half as big as their bodies. Wise no doubt as any of the larger examples of the bird of learning,[1] but without their slowness; for these smart little owls seemed all brain, nerve, and activity together; and instead of merely turning their heads round solemnly to see who was coming, they would jump bodily right round, with more than harlequin activity and columbine ease,—first to one side and then to another; stamping the while with both feet at once, in well-feigned anger, on the Pyramid stone they were standing on,—and then, after a further show of high indignation at their solitude being disturbed, away they flew as keenly as any swift in its full career.

But as to Alee Dobree and myself, we got early to work, with plenty of candles duly placed to correct the darkness of the Grand Gallery, and mounted our noble clinometer apparatus on the eastern ramp; commencing then a long and toilsome series of successive level adjustments and various readings as we stepped up, by base lengths, that remarkable slope: the anchor and clamping apparatus proving invaluable, and everything else working uncommonly

[1] Athenian Minerva's owl, we believe, was a *small* variety, but have no means of ascertaining how small, or if comparable in that way to this miniature variety of the Pyramid.

well too. In fact, so well, that that astonishingly quick-witted genius, Alee Dobree, thought I could go on by myself for a time; so off *he* went, on the plea of urgent religious business to accomplish, but under abundant promises of returning most speedily. Yet one hour passed, and a second too, and no Alee Dobree.

I contrived, however, to go on with the work by myself, gradually getting higher and higher up the steep inclined floor and rising ramp, in the dead silence and perfect stillness that reigned throughout those dark heart-cavities, the central chambers and passages of the most mysterious monument of the world. Another hour still passed in absolute silence under the seven overlappings of those solemn walls. I had indeed the whole interior of the Great Pyramid to myself, and to observation; in which service I had just succeeded in getting the apparatus advanced above a very dangerous break of the eastern ramp,—when faint, distant noises were heard, as of many waters; or as if a certain living Egyptian philosopher's theory was then being realized, and causing the Pyramid slowly to sink beneath the level of the sea, at that moment rising with its tumultuous waves against the mouth of the entrance passage, and closing that narrow exit for ever.

Of course it was nothing of that sort; but in such manner came the first intimation, of 'travel-'lers' having arrived; and my heart, so far as fixed on accurate scientific observing that day, sank

within me. By and bye the sounds waxed louder and louder, growing more human-like—and that meant that the travellers were entering Al Mamoon's hole; then some very distant lights were seen twinkling at the bottom of the narrow, first-ascending passage; next they were evidently approaching, but undergoing numerous eclipses, the noises, however, increasing all the time up to a perfect Babel of confusion,—until the mingled stream of diverse-coloured men and flaring candles at length rushed up overflowingly into the northern end of the Grand Gallery,—surging up upon the ramps and floor-end on every side,—amid such shoutings and waving of lights, and momentary glimpses of brown-limbed frantic figures, engaged in bewildering motions, as could hardly be imagined on any earthly scene.

But the travellers were now actually mounting the long incline of the floor of the Grand Gallery; and I had only just time to hook the front foot of the clinometer into a ramp-hole as an additional precaution to its anchor and clamping-rope, and to secure every loose light in other ramp-holes, note-books in my pockets, etc. etc.,—when the earlier of the visitors began to pass in trios with their Arabs,—roaring out their songs, and waving their big pipes, the Arabs brandishing their candles the while, and assuring their employers that they were at that moment transcending all the great ones of the earth. The numbers who passed were almost interminable; both Australian and Batavian steamers,

it was said, had the previous day disgorged their loads of passengers at Suez; and with them now, the Arabs of at least three villages must have been here present. Some go-ahead men tried to push past their companions unceremoniously; and these, almost knocked off their feet, often tried to catch hold of the clinometer to save themselves; others, again, were at all times so fearful of the long smooth slope of the floor, that they could only be got up by two extra stout Arabs apiece,—these Arabs having candles in their outer hands, but taking the traveller round the waist with their inner hands, while he, the traveller, hugged with both his arms close round the Arabs' necks on either side of him; in the same fashion, indeed, as that in which lady travellers *usually* ascend the Grand Gallery.

Costumes were very various, many men in thin silks, but one sickly elderly gentleman in a mackintosh cloak, of all things for such a heat, and the Arabs in very little clothing at all; but every one was vying with another in making multifarious noise; while the earlier arrivals, having already entered the King's chamber, had got up there a wild dance, to the banging of the poor coffer's sides with big stones, that brought out painfully its deep bell-like sound, as though it were the very death-knell of the ancient Pyramid; producing, too, from the reflected echoes of polished granite walls, and their strange emission through the low entrance passage,—a sort of continued bass stratum of de-

moniac organ-music, on which all the individual whoops and yells of particular 'travellers,' were set off like streaks of crimson on a lurid neutral tint.

At length the crowd had all passed upwards, and happily without the poor clinometer having been pulled from its fixings, though sometimes very near it; but the comparative calm was of short duration, for hardly had the last component joints of the tail of this long Python-like train of men coiled itself into the King's chamber,—than the earlier-arrived portions, forming head and neck, began to emerge in order to descend; so I had then to take my station near the upper end of the instrument chiefly, warning, praying, and gesticulating to those who *would* come too close as they passed, that that instrument was *not* a handle for 'travellers' to hold on by.

'But what *is* it then?' shouted one.

'It is a clinometer,' was the explanatory answer.

'Well, what's that for?' the violent man demanded again, betraying thereby a sadly neglected classical education; while his heels at the same moment slipping up, he came down backwards on the sloping pavement. His Arabs, too, let him fall; and then picking him up, seriously bruised, hurried him along, saying it was dangerous to stop still. And so they all passed again downwards in trios, each red-faced, excited traveller between two Satanic-looking, brown-skinned demons, teaching him a few additional methods of uproar and madcapism,—until they all fell into one inextricable mass of

horrid confusion, just at the point where the cut-off at the lower northern end of the Grand Gallery floor, makes a sudden descent of about seven feet vertical. (See Plate VI.)

On perceiving such plain symptoms that they were not coming up again,—I immediately reorganized the clinometer; reached, by successive steps, during another hour, the summit of the east side of the Gallery, took the clinometer into the King's chamber, turned it round there, so as to get the necessary reversal for index-error, and had actually placed it on the west ramp, and began its descent,—when that faultless repeater of prayers towards Mecca, Alee Dobree, coming up without audible foot-fall of his bare feet on the solid stone, suddenly reappeared: and as if accidentally, and quite ignorant that more than five minutes had elapsed since he had left his duty four hours before, under promise of instant return. 'He had no watch, like a European, and how 'was he to know how fast the time went?' and much more he added, trying to fend off inquiry into the baksheesh he had been earning, by accompanying the late uproarious travellers, and many others, to the top of the Pyramid, and aiding them also to dispose of the remains of their profuse luncheons. But being at last somewhat convicted by his own conscience of having been rather too bad that morning,—he soon set to work, as he well knew how, by exceeding diligent attention, to make up in some measure for his scapegrace conduct,—and then our

progress down the western ramp, measuring the angle at every one hundred and twenty-six inches of its length, was quick and prosperous.

Two more parties of travellers came past, while we were so engaged; both, however, small ones, composed, too, of quiet individuals and good subjects; so that with Alee to watch one end of the clinometer, and me the other, the work was not delayed by their transit; and at last, after six hours of uninterrupted toil, in the heated and bad air, where twenty minutes are usually enough to tire any European,—the two sides of the Grand Gallery had been measured throughout their whole length, and all data secured for determining the crucial angle.

And what did this turn out after all to be? On summing up the whole of the numbers that night, they gave 26° 17′ 3″; showing, too, in their details, another illustration of the Great Pyramid having been carefully finished and admirably brought up to truth for final ends and purposes; or on and for the *whole*, rather than for *each* petty and unimportant intervening part;—because, although the differences in the course of the long run of the Gallery were often large, some one way and some another, yet the ends of the Gallery, and on either side, were extraordinarily close to the mean of the whole length.

And even as to what we have hinted at, as the *large* errors towards the middle of the Gallery, there

was nothing there that ever left 26°, and some few minutes less or more; so that how the Cairene philosophers could have got away from 26° altogether, and far down into 25°,—and still fancy they were measuring the angle with a degree of modern march of intellect accuracy, far surpassing any crude notions of angle which primitive Pyramid-builders, —'poor, miserable, degraded wretches,'—could have possibly possessed,—we were unable to conjecture. But there was one more string still left to the Edinburgh instrumental bow, applicable to this case; and the progress of sidereal, gaining day by day on mean, time, was then hastening the epoch, during which we should have to see how *its* arrow also, might succeed in speeding to the mark.

CHAPTER XII.

TOMBS OLD AND NEW.

WHEN our walks from East Tombs were directed northward, they passed in front of the mouths of various sepulchres,—from which, over and above the usual fragments of pottery and granite, the very bones also of their once possessors were turned out in heaps and streams, and with every possible mark of contempt. Skulls were rather generally wanting, because Cairo collectors gave a price for them ; but deeply curved ribs, hip-bones, collar-bones, arm and thigh bones, and all the innumerable others that tell every one instantly the sacred human form is there, under all that insult and destruction,—greeted one hideously on every little rubbish-mound. Skulls, too, might be seen by any one gifted with a taste for exploring, wherever drifted sand might allow, into the inner chambers of some of these mansions of the dead, in both the east and north-east cliffs of Pyramid hill ; and the number of skulls there accumulated on *quasi*-shelves, indicated how vast must be the total number of human beings, represented

by the whole extent of the cemetery about the Great Pyramid. (See Map, in Plate II.)

Seeing, too, that some of the freshest-looking and largest heaps of bones, had come out of tombs, evidently of the fourth dynasty, or almost the earliest of certified Egyptian history,—we could not help often, out of very pity to the poor creatures themselves, lamenting their proficiency in the art of embalming, and their inveterate taste for making strong sepulchres in secret and difficult places. For what has it all resulted in at last, but merely delaying the process of earth returning to earth, some three or four thousand years; and in having that change, which would have been decorously conducted by nature at the time, within the interior darkness of the ground,—now performed in the light of day, amid the trampling and execrations of Mohammedan Arabs; who, while they are perhaps the most ignorant and generally incapable of men occupying high places in the earth, have not retained the least spark of respect for, or sympathy with, any of their greater predecessors in the ancient land of Mizraim?

Again, when our walks trended from East Tombs, southward,—a special feature in several places there, over the mere ordinary signs of violated tombs, was the immense quantity of tubular glass beads, blue and green generally, mixed up with the sand and particles of lime; the adornments, these beads, of princesses or ladies in former times, but recently

stripped off their too long-preserved bodies; stripped off, too, by modern peasant hands, and trodden under heel with disdain, because they were not immediately to be converted into gold.

Portions of little, green-glazed, earthenware idols were also frequent; but a more noticeable phenomenon of the place lay a few hundred paces farther to the west,—where, all of a sudden, amongst the more ordinary heaps of comminuted fragments of something or other that Egyptians once set great store upon,—you almost stumbled on a large white stone coffin, with its lid only just emerged from the soil. There it was, sculptured in shape of a man, lying prostrate on his back, and looking up to the blue sky with a calm, fat, blanched face, a roll of a beard under his chin, and large flat collar over his shoulders,—making him look like the ghostly resemblance of a mediæval bishop in bands and adornments of lawn. This coffin, extracted out of a sarcophagus from a neighbouring pit, was cracked across near the feet, and therefore spoiled as well as unfit, men said, for the Boolak Museum; where, too, it would certainly have failed in much of the remarkable prestige which it carried with it here.

But by deviating southward from this spot, you came upon an enormous pit cut in the rock, a sort of double pit; having one large pit in the middle, some thirty feet long by twenty-five wide, with a depth of fifty feet; and that surrounded by a second pit of an annular form, clean chiselled in the solid

limestone of the hill, and forming a trench running nearly sixty feet square, with a breadth of six feet, and a depth of seventy feet. On crossing this outer trench by a bank of sand, which has recently almost filled the south-west corner, you walk on the flat surface of the smooth-cut rock of the middle space, —and look down into the deep central pit upon a gigantic broken sarcophagus ; from one end of which has exuded a black stone coffin, in shape of a man, with many hieroglyphics on his breast, and looking up likewise at the clear blue sky, most helpless, most melancholy ; while in certain openings in the interior of the western side of the pit, two other sarcophagi of different forms are seen ; and imply the existence of many others.

This spot is no other than the celebrated Campbell's tomb. A name, however, most inappropriately given ; for that Consul-General of the day, did little more than make an *appearance* of beginning to work in partnership with Colonel Howard Vyse ; and then left him unaided to go through the real toil, labour, and expense which thence resulted. Full nine-tenths indeed of the whole excavation were executed by the Colonel, or at his sole and entire expense, together with the careful drawings and measurements which abundantly appear in his book ; while a large sculptured sarcophagus, with many other relics of the place, which now grace the British Museum, are gifts presented by him. Once there, they came under the intelligent notice of the

learned Mr. Samuel Birch, who has described the hieroglyphics contained on the remains so laboriously and extensively,—that, if Howard Vyse's name, for any good theory of occult reason, be not applied to this tomb,—the place should rather be known by the honoured title of Samuel Birch; he having done so much for its history, besides generally translating hieroglyphics for most explorers of the Egyptological school during the last thirty years.

Looked at in a general way, the defence of the inner, by the outer or surrounding, pit, is an exceedingly clever arrangement to prevent underground robbery; for on this part of the hill, where the square sepulchral wells abound, whose principle is, that after going down vertically some fifty or sixty feet, they then form horizontal galleries or chambers in various directions,—one of these burrowing architects might easily break into the regions of another, without anything being visible on the surface of the ground: even as occurs at the Australian gold diggings, when *some* active diggers, having sunk their shaft through the surface drift more quickly than their neighbours, begin tunnelling far and wide, and under their neighbours' lot as well as their own, on reaching the auriferous clay. But any tomb-tunneller of old in this neighbourhood, breaking unexpectedly into the trench surrounding, what we must for the time go on calling, with the rest of the world, Campbell's tomb,—would find an unmistakable warning there, to go no farther.

The contents, then, of that so carefully enclosed inner pit, whether according to this rude explanation, or some other,—were held to be of extraordinary importance. And they were even further protected by the interior having been, when Colonel Howard Vyse uncovered it, occupied by a very remarkable building, both having an arch of well-cut stones for its roof,—the earliest stone arch known to have been built by man,—and also a sort of cyclopean quadrangular apology for an arch, in much larger blocks beneath, serving as a separation between two of the internal storeys. But every particle of the material of that most notable building has been carried away within a few years past, by Arab Sheikhs, for stone enlargements to their mud-houses,—leaving only, by an act of unusual grace to European visitors, the broken sarcophagus and basalt coffin already alluded to.

For full particulars, therefore, we cannot now do otherwise than refer to Colonel Howard Vyse's volumes; and there we learn, chiefly through Mr. Birch's translations, that this great Campbell's tomb is a chronological anomaly on the Pyramid hill,—having been formed not under the fourth, but the twenty-sixth, Egyptian dynasty. Or somewhere about 600 B.C., when Memphis, after having for ages been reduced to play a very secondary part, to Thebes, in ruling Egypt,—suddenly revived to a considerable extent, and continued for a time a fitful existence,—straining after connecting itself once more

with the ancient glories of Pyramid hill; but yet falling into irremediable decay soon after, notwithstanding, too, the favour of Delta-dwelling kings.

During this last gasp, however, of the primeval taper's light,—the large tomb alluded to was constructed to afford honourable burial for public functionaries belonging to Memphis; this at least is stated in large hieroglyphics cut into the lower part of the walls of the inner pit, and is also confirmed by the smaller writing on several of the sarcophagi. It was thus a notable effort of its time; and being, too, perhaps the last and latest instance of any grand Egyptian burial on Pyramid hill, is worthy of attention, as an example of what Egypt had come to, in sepulchral matters, towards the close of its long empire.

Thus, if we attend to the progress of the gallant Colonel's excavations, and particularly about the period of his entering the internal sarcophagus-holding house,—we find him speaking much of the numerous little 'idols' deposited in various corners. And then we come on notices in his journal of the day, such as, 'I sent the idols to Consul-General 'Campbell;' or, as in the final balance-sheet, 'seventy-three green idols delivered to Consul-'General Campbell;' and again, after the finding of them near one sarcophagus, in several tiers, and standing in double rows, 'three hundred and ninety-'seven green idols delivered to Consul-General 'Campbell.'

On another occasion, April 8th, when Colonel Howard Vyse had reached the principal sarcophagus, near the base of the inner house of this tomb, and found its lid opened only a few inches,—he hoped exceedingly that the mummy might be inside; and sent immediately to Consul-General Campbell, Mr. Perring, and Mr. Hill to come out from Cairo, and assist at the expected finding next day; for the Colonel had instantly determined to delay further investigation until then, and ordered two Janissaries and some of the Reis to watch over the place throughout the night.

This was surely very liberal-minded of Howard Vyse, especially after having for so long endured, without companionship, the noisy working days of many months; days such as that of the 8th, when he had at work in his pay, 'Reis, nine; men, one hundred 'and eighty-two; and children, one hundred and 'fifty-four,'—but he now kindly prepared for a nice quiet morning of discovery on the 9th with his friends, and retained no more than 'seven Reis and 'sixteen men.' Mr. Hill, however, seems to have been the only one of the trio written to, who actually arrived; so with him the Colonel immediately visited the tomb, and then 'found the sarcophagus entirely 'empty, excepting a few trifling ornaments of stone.' This, too, was the invariable result found also with every other sarcophagus in this remarkably strong tomb of the time of Psammetichus the Second. Not a single corse of all those honourable functionaries of

Memphis, for whom the place had been erected and surrounded with triple enclosures, had been allowed to rest in peace; though who were the spoilers, and when they spoiled,—whether Persians, Greeks, Romans, or Arabs,—there is nothing left to tell.

So the very next day the untired Colonel was at his general excavations again, with nine Reis, one hundred and eighty men, and one hundred and sixty-nine children; and had even increased them on April the 12th, to nine Reis, two hundred and five men, and two hundred and nineteen children. But the engravings on the sarcophagus he sent home, are fortunately capable of throwing not a little light on the belief that once animated the bodies which had been filched away. The vessel in question is of red granite; sculptured on its lid in form of the deceased recumbent; and engraved round about with hieroglyphics and devices of the solar disk, the heavenly scarabæus, and symbolical cobras rearing on their tails. On each side, too, is a procession of twelve figures representing gods and goddesses, either animal-headed or otherwise symbolized. All these are made to address the deceased under his burial name of Osirian, in the most flattering and comforting manner.

The first deity of the train, according to Mr. Birch, is Re, Ra, or Phre, hawk-headed, whose mode of address is, 'I, Ra, lord of the two worlds, 'the great god, lord of heaven, I illuminate the 'body of Osirian, let him not be troubled for ever

'and ever.' Second, the god To or Tore, having on his head the scarabæus, saying, 'I, Tore, give adora-'tion to the Osirian, together with the guardian of 'my arms.' Third, Anubis, jackal-headed, 'I, Anu-'bis, director of embalming, have come to thee, 'Osirian; I fill thee with bitumen.' Fourth, Taut, or Thoth, ibis-headed, 'I, Taut, the Lord of Shmo-'un, the pure god, I accord that thy name, Osirian, 'be established in the divine writings for ever; 'thou shalt be before the Tot gods, abiding with 'and accompanying Osiris.' Fifth, Neith, 'I, Neith, 'the greater mother goddess, do so and so for thy 'good,'—but it would be wearisome to go through their twenty-four addresses, especially when we see now, how completely they have failed in their promises and prophecies to poor Osirian,—known amongst mortals under his earthly name, as 'Saotou, 'justified son of Taisaenonkh, superintendent of 'the signet, chief purifier, scribe of the divine books 'of Amoun-ra-sonther, and prefect of the Nilometer 'Observatory, or abode of the inundation.'

Yet we may do well to remember that all this striking variation on the Great Pyramid and its coffer, or the second Pyramid and its sarcophagus, though it be exceedingly modern compared with them,—is yet near two hundred years earlier than the visit of Herodotus, 'the father of history.'

Hardly three hundred feet, however, from Campbell's tomb, and lying straight east of it, evidently

farther down the slope of the hill, lies the great Sphinx, exhibiting only the ridge of the very rude and mere rock-like back, head, neck, and shoulders above the *sand*. We infer that it must be sand, and to a depth of fifty or sixty feet, we are treading on,—because we have read accounts of excavations about the Sphinx to that depth; but otherwise the said sand has got so strangely intermixed with large fragments of limestone, far too large to have been moved by any ordinary wind,—that there is not much difference between these adulterated sand-hills, and the heaps of masonry rubbish on the last portion of the firm hill north and west of this spot. Only where, for some reason, there may be a new hollow, there you see the latest driftings of pure sand; either with a perfectly smooth surface, or with exquisite ripple-marks, in the distance like watered silk, and here and there the tape-like trail of a scarabæus that has manfully worked his laborious way right across this wearisome yielding sea.[1]

Now as to the Sphinx itself, in so far as we can see it, there it is gazing out with its large, but now broken eyeballs, placidly to the east,—a huge head and shoulders, and little besides; but whatever there is, appears all cruelly cut into by the weathering of

[1] The acute Mr. Balfour Stewart, of the Kew Observatory, suggested recently that the occurrence of so many blocks of limestone on the older sand-hills might be due to difference of specific gravity, the said blocks rising like corks in water through the heavier sand; and there seems much in the idea, for the limestone is very light, or has specific gravity equal to 2·1, while the sand, composed of round miniature pebbles of jasper, has a specific gravity more nearly equal to 2·6.

its rock, showing well-marked strata dipping slightly to the south-south-east. About the face and head, though nowhere else, there is much of the original statuary surface still; occasionally painted dull red; and the curvature of the cheeks and cheek-bones shows a certain degree of high sculpture, especially when we observe the scale on which it is wrought. Pliny gives the circumference of the head round the forehead, as one hundred and two feet; but this, even granting the usual difference between Roman and English feet, is slightly in excess; for having taken two photographs of the Sphinx from different quarters, with measuring-rods placed up against it to give the scale, I find they indicate the following numbers rudely,—

	Feet.
Head, height of from bottom of chin to top of forehead,	= 19
„ horizontal diameter on level of forehead,	= 23
„ circumference, at do.,	= 72
„ horizontal diameter near broadest part of wig,	= 29
„ circumference, at do.,	= 91
Neck, height of,	= 5
„ horizontal diameter,	= 22
„ circumference,	= 69
Breast, height of portion visible above sand,	= 13
Whole height at present above sand,	= 37

How much in depth is beneath the sand, of course our photographs tell not, but it may be nearly as much as what is above; or, judging from Mr. Salt's drawings, taken at the time of Captain Caviglia's notable excavations down to the fore-paws, it may

be somewhat more. Such therefore must have been the height of the original limestone cliff which was chiselled out, as it stood, into this leonine monster; for it is reported to be all firm rock, except the two horizontal fore-paws, each fifty feet long and constructed in masonry.

Why and wherefore many travellers will go on calling this Sphinx 'she,' when there is nothing feminine about it, and when every large Sphinx yet found in Egypt has been an 'andro-sphinx;' or, according to Sir Gardner Wilkinson, 'an emblema-'tical representation of the king, uniting intellect 'and physical force,' we cannot conceive. Yet they still persist; and the last Scottish minister who described his gallop through the Holy Land for the benefit of his parishioners, and had of course taken Cairo and the Pyramids in the grand tour, uses the expression roundly; as likewise does the last appointed United States consul to a Syrian station, who equally, or still more of course, must go the prescribed circle,—and then write out the impressions acquired, to enable his not yet travelling countrymen, while improving their lands in the new West, to realize mentally the decayed scenes of the ancient East. Still more remarkably, a French author of genius, whom we recently fell in with, perpetually raves of the beauty and seductive air of the '*fille*,' and '*demoiselle*,' who sits at the foot of the Pyramids in mystery sublime,—proposing to the men, who are enchained by her charms, impossible problems, and

then making them feel, when too late for escape, the sharpness of her cruel claws.

George Sandys also, two centuries earlier, was under much the same error, describing 'the Colossus, 'as wrought into the form of an Ethiopian woman, 'the face something disfigured by time, or indigna-'tion of the Moores, detesting images;' wherefore the present sad breakage and flattening of the nose is by no means a very modern mischief. 'Colossus' was the usual name in Sandys' time, though he admits that some men 'do call it a Sphinx,' and Pliny 'gives it a belly; which I know not how to 'reconcile unto the truth, unless the sand do cover 'the remainder;' but of that Sandys must have assured himself afterwards, as he confidently speaks of the upper part of the Sphinx representing a 'maide,' and the lower a lion, in order to 'defigure 'the increase of the River, then rising when the 'Sunne is in Leo and Virgo.'

The fact is, we must dismiss from our minds entirely all classic prejudices, and no more think of explaining this great Egyptian Sphinx, by the long subsequent Greek successor at Bœotian Thebes, than by means of the talking seal at Mr. Barnum's show in New York; for they belong to totally different ages, and diverse-minded peoples. If, too, this colossal andro-sphinx has no kingly beard now, that is because what *was* there originally, has been broken off amongst other modern dilapidations; but the sculptured blocks which formed it, have been

found in the sand ; and the accompaniment is given complete in the hieroglyphic *views* of the Sphinx, discovered by M. Caviglia on the tablets forming the small temple between its paws. But over and above that testimony, the massive build of the jaws bespeaks not only a man, but a very powerful one ; while the lamentable protrusion of the lower part of the face, combined with the low forehead, and large, as well as badly-placed ear, show a decidedly evil and animal-minded disposition, to which the huge wig adds no idea of fine æsthetic perceptions.

Yet Alee Dobree could not see anything wrong in the wig, and he said truly, that it was the custom in the country at the time for all people, women as well as men ; and so it is still, in some parts,—for we saw women with such thick mats of wigs having fuzzy tails of ancient horse-hair hanging down numerously behind their ears, that they looked as if plundered out of an old Egyptian tomb. ' Four ' thousand years their dusky wings expand,' is a grand expression of a great poet ; and may be elevating as applied to marble ; but when appertaining to a dark, bushy wig worn by some one who comes close to you in a warm climate, it is positively hideous ; and yet, filthy as these ungainly head-dresses appeared to us, the little girls in Egypt were never so proud as when, for a particular reward any day, they were allowed for a short time to wear one of their elder's wigs, and strut about like popinjays among their wigless companions.

There is little to be learned about the Sphinx from ancient authors, for it is hardly ever noticed by one of them before Pliny ; not, however, because, as with some modern enthusiasts, 'it must have 'been in earlier days still covered up with the mud 'and silt brought by the Noachian deluge, and only 'gradually brought to light in Pliny's epoch by the 'slow action of the winds in removing such cover-'ing matter,'—but merely because the older travellers were so entirely taken up with the Pyramids, and more especially the Great Pyramid, as to care about nothing else. It was the fashion, indeed, in that day, to overvalue all the former and undervalue the Sphinx,—just as much as this last is now generally exaggerated in importance by the crowd. In the Greek and Roman day, indeed, men had the full Sphinx before them, body, fore-paws, temple, and grand staircase leading thereto from the plain,—and made use of it merely to mark upon its paws, or elsewhere, who had, or who had not, appreciated the Pyramids. For thus runs one of the inscriptions brought to light by Mr. Salt, well illustrating, too, how little some features in the characters of men and facts may be trusted, merely from their being found inscribed on an ancient stone.

'TO GOOD FORTUNE.

'Whereas, the Emperor Nero, *the good genius of the world*, 'in addition to all the benefits he has conferred on Egypt, has 'shown the most especial care of its interests by sending us 'Tiberius Claudius Balbillus as governor, through whose favours

'and acts of kindness, Egypt, beholding the gifts of the Nile
'yearly increasing, is now more than ever enjoying the proper
'rising of the deity, it has seemed good to the inhabitants of the
'village Busiris, who live near the Pyramids, to vote and dedicate
'a stone column, that it may preserve his godlike figure, and his
'name in sacred character, to be remembered for ever, both for
'having come to our nome, and for having worshipped the sun,
'Armachis, and for having been delighted with the magnificence
'and . . . . of the Pyramids.'

This inscription, like some seventeen others, found on various parts of the Sphinx, is in the Greek character; which had become, with the Ptolemys, the language of the upper classes of Egypt; yet there is still a something of the ancient land speaking through the modern dress, and the head of the Nero stone above quoted, is rather creditably got up, as an Egyptian imitation, with a solar disk and wreathing cobras,—which, after half enveloping the sacred orb, descend awhile, and then rear their heads and swelling necks on either side, in defiance to all comers.

In Greek likewise, but with far less of the Egyptian tone, is the plainer cut inscription of Arrian, so admirably Englished by Dr. Young:—

'Thy form, stupendous here the gods have placed,
'Sparing each spot of harvest-bearing land;
'And with this mighty work of art have graced,
'A rocky isle, encumbered once with sand;
'And near the Pyramids have bade thee stand;
'Not that fierce Sphinx which Thebes erewhile laid waste,
'But great Latona's servant, mild and bland;
'Watching that prince beloved who fills the throne
'Of Egypt's plains, and calls the Nile his own.

'That heavenly monarch (who his foes defies),
'Like Vulcan powerful (and like Pallas wise).'

But in truth, neither Greeks nor Romans knew, or had the opportunity, or went the right way to work to improve any opportunity, of approximating to the real history of the great Sphinx; and the earlier of modern Europeans erred more widely still, in imagining out of the recesses of their minds all sorts of underground passages, from the Sphinx to either the Great or second Pyramid,—they could not exactly settle which. No real progress indeed was made until Caviglia's excavation in 1818; for then, with the assistance of the earlier of the new-school Egyptologists, were immediately seen, on a granite slab, forming the western side of the little temple between the two paws,—the figure and Titles of King Thothmes the Fourth of the eighteenth dynasty; and, on two side tablets, Ramses, or Remeses the Great, of the nineteenth dynasty, offering worship and oblation to the figure of the Sphinx, in a manner, and with accompaniments, which none but a pure Egyptian could have invented.

Of Thothmes the Fourth, who lived about 1410 B.C., the Sphinx is made to declare[1] in hieroglyphics, —'We decree that the Sun, the establisher of the 'world, shall be crowned on the throne of Seb; 'that Thothmes, the crown of crowns, shall be 'adorned with the glory of Athom;' and again: 'We, Hor, in the solar mountain, grant life and

[1] Birch's Translation in Howard Vyse—third volume.

'power to Thothmes, the lord of the world, the 'crown of crowns.' And still again: 'In the first 'of the year, on the nineteenth day of Athyr, under 'the purity of Horus the mighty bull; the esta- 'blisher of diadems, the lord of the upper and 'lower hemispheres; established with dominion, the 'golden hawk, the director of the years, the Sun, 'the great God, the preserver of worlds,—we decree 'that King Thothmes shall wear the two crowns 'which compose the royal pschent; and sit on the 'throne of Seb, the youngest of the gods.'

Mr. Birch's translation gives the commencement of the last quotation, as 'in the first year,' which he understands as the first year of the reign of Thothmes Fourth, and then finds himself in a difficulty as to so vast a monument as the great Sphinx having been completed within a year. I have ventured, however, to insert the words 'of the' before the 'year;' because,—without saying anything for, or against, whether the Sphinx was formed in the times of Thothmes, or perhaps much earlier,—the whole paragraph seems to be plainly and certainly descriptive of that primitive year of the Pleiades, which Mr. R. G. Haliburton, of Halifax, Nova Scotia, has so abundantly shown, to have been a prehistorical tradition; and spread amongst almost all races of mankind in both the new and old hemispheres, and alike in the north and south. The leading characteristics of that year being,—that it began on the nineteenth day of Athyr, or November; when the Pleiades,—

or their containing constellation the Bull, the great *Tau* of the Egyptians, *Taurus* of the Latins, *Thor* of the Scandinavians, and Attyr and *Arthur* of the ancient Britons,—was on the meridian at midnight.

To continue, however, with the side tablets of Ramses the Great, who lived about 1350 B.C., it is there declared that 'Ramses, beloved of Amoun, the 'chastiser of nations, the lord of diadems, offereth 'a gift of incense and of libations to Har-Hat the 'Sphinx, the giver of life, of stability, and of power, 'the director of truth, the ruler of the upper and 'lower world, the giver of victory and magnanimity, 'like the sun for ever and ever.'

Now, putting all these inscriptions, and others like them, together,—Sir Gardner Wilkinson concluded that the great Sphinx had been completed in the time of Thothmes the Fourth, and redecorated under Ramses the Great; but had been commenced under Thothmes the Third about 1460 B.C.,—that king having been a great architect during his long reign of forty-seven years; and most persevering in carrying out some strange and eccentric flights of his own genius in that lasting art, or game, which, though perfectly peaceable, few but kings can play at. Here and thus then, if we may fully confide in Sir Gardner,—Thothmes the Third struck out the idea of representing himself as 'the great glory of Egypt, 'and like the sun for ever and ever;' allying his serene portrait with a lion's body, both because the Egyptian king is supposed to resemble a lion among

inferior animals,—treading down and destroying; and because the sun in the heavens is likewise symbolized by a lion, whose name, 'Moui,' signified also splendour, wisdom, and intellect. But in so doing, Thothmes III. was evidently making the great Sphinx statue by, and for, itself alone, and without any connexion with the Pyramids.

So far, Sir Gardner Wilkinson's conclusions seem to have been accepted by nearly all the world;[1] especially after Mr. Birch's statement of the oldest known representation of a sphinx on either amulet, scarabæus, or mural inscription—being one 'on the erect obelisk at Karnak, where Thothmes the Fourth, under that form, is 'offering to Ré.'[2]

But within a short time past these views have met with a total denial by M. Renan, in the *Revue des Deux Mondes* for April 1865; not, indeed, that he refuses to admit the hieroglyphic inscriptions on the tablets saying all which has just been attributed to them,—but that he contends they have nothing to do with the formation of the Sphinx, and are as essentially posterior thereto, as are the Greek and Roman inscriptions under the later Emperors. Also that Thothmes the Fourth, and even Ramses the Great, were in fact mere cuckoos, laying their eggs in a nest built ages before their time, and for quite other purposes than their aggrandizement. Either

[1] Exception will be taken for W. Osburn's views, in our third volume, and we have since heard that Sir G. W.'s are somewhat changed.

[2] Howard Vyse's third volume, p. 116.

'a divinity itself, or representing the divinity of 'Horem-hou or Armachis,' this great Hou or Sphinx, M. Renan contends is 'the most ancient 'idol in the world, and mounts up to a date far 'anterior to the Great Pyramid.'

This is surely a bold innovation on the teaching of the best hieroglyphists of the age; but on what does it depend? So far as we can ascertain, on these two statements,—*First*, that Mariette Bey has discovered an inscribed stone, now in the Museum of Boolak, stating that King Cheops, the very Cheops of the fourth dynasty and the Great Pyramid, besides constructing and restoring several temples,—caused sundry reparations to be made to the great Sphinx, 'whose image is given on the 'stèle as it was in the time of Cheops.'

Second, That the entrance passage of a neighbouring most ancient building, inclines to the Sphinx, in a manner which shows the Sphinx must have been the prior of the two.

Now, respecting the first of these statements, M. Renan himself adds in a note, 'The inscription 'is altogether so dazzling, that we may be allowed to 'reserve some doubts about it;' and in fact we *had* better do so, until both Sir Gardner Wilkinson and Mr. Birch give the world their ideas also upon the original stone. But the second is a plain mechanical matter, which we can look into pretty well ourselves.

Yet let us take breath for a while, before rushing

at a new subject, and of the ancient building order. Even on our chief Sphinx evening, and amid all the excitements of the scene, when Alee Dobree offered to show us 'another tomb larger than any we had 'yet seen,'—we put off the project to another day, having our heads and note-books too full at the time to receive anything more with due advantage. So we returned to East Tombs; and then, of course, the impressible Smyne was again before us with his eternal affairs of the heart.

He had been to the village of his new love, had been this impetuous Smyne,—his internal organ completely cured of all its recent lacerations, and rendered as tough as new, or like a piece of vulcanized india-rubber. He had been accepted, too, by the parents, after showing how much money he was prepared to pay down; and was to have the betrothal very speedily gone through; wherefore, every morning, noon, and night, from this time forth, there came some brother or cousin of the damsel to have 'a 'look at Smyne,' they said; and also to test the truth of the magnificent reports he had been giving them all, as to the honourable situation he was occupying at East Tombs, of cook's assistant to Ibraheem;—all which particulars the young men duly did test in their way, by drinking Ibraheem's coffee, and gloating over all the pots and pans and kitchen implements,—some of which they prophetically expected might fall to Smyne's share, when the lady and gentleman should eventually leave the Pyramids.

And then, as for Smyne himself, he took so many opportunities of reciting to us the prodigious wealth, of his new fair one, in trinkets; the number of golden coins on her face-veil; and the rows of them strung upon her hair,—that we conceived her at last to be a very Cleopatra both in presence and personal adornment, and Smyne about to become a perfect Antony from his fatuous love of her.

Again, after a while, we set out on our walks, accompanied by Alee Dobree. My wife had much hoped to have been able to tame and civilize one of the Egyptian village-dogs, as an additional guard; for one of them having followed Reis Atfee to East Tombs on a special occasion, was so well pleased with what he got there, as to come again and again afterwards by himself. So, although the ancient Ibraheem looked rather askance at any favour being shown to, or good expected from, a *dog*,—she continued to feed him, and he to eat at every meal-time. A tall, lean, hungry-looking, half terrier, half greyhound sort of a dog he was, with erect ears and a triangular head, something between a wolf and a fox; in fact, the ordinary style of Egyptian dog, which is little more than a coarse-haired variety of the fox or jackal order, living under tacit permission in and about cities or burial-places of men,—but no more cared for or looked after by human kind, than are the hawks which one sees here perpetually sweeping through the sky and flapping over the fields.

Week after week the dog became fatter; but somehow, its coarse stand-on-end hair would never lie down smooth; he became therefore very fat, but never sleek; he looked in at every meal-time regularly; but came at a gallop across the sand-plains, and went away at a gallop too; his only object, as the Arabs remarked, being 'to luncheon 'well, like the travellers at the Pyramid;' and he declined all advances towards closer acquaintance or longer visits. The favours showered on him were unwearied; but the longer they continued, the more it was proved that a few weeks, or even months, of kind treatment were not going to reverse the effects of long ages of Eastern pariah persecution to dogs; and to produce in their dispositions, that delightful sympathy with man and his affairs so invariable with dogs of Europe, of Scotland more particularly,—any more than to convert the coarse bristles of the Egyptian dog's coat, into the fine silky hair of a well-trained spaniel.

At length the barbarous creature took to disgorging himself occasionally, and of all places just in the little court-yard before our bedroom tomb; giving proof, too, that he had not been satisfied with the food given to him there, but that he must either have been visiting the graveyard, or feasting on the remains of some torn animal left by the jackals. On a repetition of the offence, therefore, the cry quickly got up—*imshee, imshee*, the Arabic for begone, begone; and without more ado off he went,

and never came near East Tombs again during all the rest of our stay; a dog of fortune evidently, and caring for no human being under the sun.

But now we are walking with the faithful Alee Dobree, bound for the great tomb; the road is almost exactly that for the Sphinx itself; we pass, indeed, under its very visage; and, at hardly more than one hundred feet south-south-east of it, over a very moderate sand-heap, beyond which no one could well have expected to see anything but another sand-heap,—behold a scene, of which all our days at the Sphinx had given us no idea whatever. Before us now is an immense excavation, showing, at the depth of some twenty feet or so under the sand, an enormous palace-like building, in cyclopean, almost Stonehengian, architecture, and near one hundred and thirty feet square. In the interior are ranges of square pillars, horizontal beams from pillar to pillar, and massive walls, all of polished red granite; while rising above, and closing them in on every side, are limestone walls, built of masses so huge, yet so well joined comparatively, and now so much weathered in horizontal streaks, as to appear like portions of an ancient cliff; or to give one the idea of the whole place having been built in an excavated hole, like the Campbell's tomb affair,—only fifteen times larger. Yet, though now so low beneath the outer ground and on every side, there can be no doubt that this ruin,—which, for reasons presently to be

tendered, we shall call 'King Shafre's tomb,'—once stood up, by the full height of its external limestone walls, above all the ground immediately around it: and we can even see down to a considerable depth of the external side of its west wall, in one spot, where a deep pit has been dug in the sand outside, to expose the entrance-door, and render it somewhat accessible or permeable.

How these palatial remains could have escaped former explorers seems inconceivable, now that they have been actually uncovered; for they are so excessively close to the Sphinx,—that Sphinx so popular with all excavators hitherto, and round about which they have all ambitioned to discover something: and where all have essayed to dig,—Lepsius, Vyse, Caviglia, Salt, and many others,—and yet they never found anything of the thousandth part the importance of this new discovery.[1] Nay, even the Greeks and Romans who scribbled their mementos on the now buried paws of the Sphinx,—even they knew nothing whatever of King Shafre's tomb close by them; for the walls of crude brick, whose top may yet be seen, and which had early been built to keep the sand from invading the little temple of Thothmes, and the flights of stairs in front of the Sphinx,—must have

[1] It should be duly recorded that Sir Gardner Wilkinson claims to have been aware that some ruins were concealed at this spot; but he does not seem to have expected them to prove more than any of the ordinary tombs scattered about all over the hill. An earlier notice will also be given in Chapter XV., from Dr. Clarke's Travels, which is the more curious, as the French *savants*, whom he immediately succeeded in 1801, are entirely silent about anything of the kind.

assisted in throwing the sands back, and heaping them higher over Shafre's tomb. Not even, therefore, in the day of Herodotus, nor the much earlier epochs of Ramses the Great or Thothmes IV., did any eye see, or apparently any mind remember, the marvel of ancient art, and the almost miracle of diverse sentiment concealed under the sand within a few feet of them.

Well, therefore, may M. Renan exclaim that this 'inappreciable monument' is the cream of all Mariette Bey's excavations; and that he, M. Renan, 'puts it at the head of all the results with which 'Egyptian archæology has been enriched within the 'last half century; a vast temple, absolutely different 'from all others known anywhere else, a monument 'absolutely unique and separated by an enormous 'interval from the temples of the classic epoch of 'the Amenophs and the Thothmeses; a temple no 'more like theirs than the ancient temple of Jerusa-'lem was like one of the existing Catholic churches 'in Spain or Naples; but a striking confirmation 'of a celebrated ancient treatise of the goddess of 'Syria, falsely attributed to Lucien, which mentions, 'that formerly among the Egyptians, there also were 'temples without sculptured images; or, as Strabo 'was pleased to say, edifices of a barbarous order, 'with many ranges of columns, but without orna-'ments, and without artistic figures.'

Let us enter; the doorway is at the northern end of the west wall,—a portal formed of three red granite

blocks,—which we should think mighty in size, if it were not for the far mightier blocks of limestone mounted above, and causing the former to look quite puny. The modern external hole leading down to the doorway, is rapidly filling again with drifted sand,—which may consequently take something away from the height of the door-posts, and the proportions as to depth of the entrance passage beyond. But the sand-drift cannot give that passage its peculiar *azimuthal* angle, running to something like east-south-east, in place of directly east,—as it should do conformably with the due orientation of the building as a whole, and the consequent due east direction of the neighbouring north wall.

This position, however, of the entrance passage is as notable a fact, as the very existence of the passage itself; which, though open to the sky, is some five feet broad, and lies between red granite walls and low-roofed portions of the building, through the whole of its length. This passage, at its eastern end, emerges into a colonnaded space running north and south; having a similar arcade, but with a double, instead of single, row of columns running off westward, from its centre, between low-roofed masses, all red granite. While on the east, is a tall doorway through a giant wall of the same Syenite, which conducts at once into an awful room running north and south, sixty-one feet long,[1] twelve and a half

[1] More exactly, 731·3 inches long on the east side, 730·6 on the west, 152·4 on the north, and 149·7 on the south.

broad, and twenty high, all of polished granite; and with a square sepulchral well, pierced through a floor of brilliant crystalline alabaster, near the middle of its eastern side. Yet this is not a final or closed chamber, for there is a low doorway at the northern end, leading into, it may be a porch, or it may be a closet broken down at its eastern side, but there is at present too much drifted sand to allow one to distinguish which.

Sand is indeed now fast drifting into all parts of this temple-tomb, and the floors are everywhere more or less covered therewith; though wherever Alee Dobree scraped a hole, he showed the virgin purity of alabaster blocks beneath. Amongst other masses, too, of ruin encumbering the interior, were at one place a huge mass of red granite, and reclining against it a smaller one of white alabaster, or rather arragonite; as tender and refined in its construction, as the other was rough and strong,—an accidental simile of the Sun and Moon, as Milton's 'male and female light, which animate the world.'

The granite of the walls must have been everywhere smoothly polished: but a process is setting in now, of a skin-thickness of it exfoliating, and leaving the remainder masses sadly rough. Strange, too, appear to have been the actions of time, united with pressure, upon the massiest blocks of granite; as, for example, on the pillars and their upper cross-beams. The pillars, some fifteen feet high or more, and monoliths of course, are all square in transverse

section, some measuring thirty-nine by forty-one inches in breadth and thickness, others thirty-nine by fifty-six inches; and the beams, which may measure something similar taken joist-wise, must plainly have had to bear immense strain with the covering of twenty feet of earth above them for three or four thousand years. Yet none of them have broken in the middle; they have always, either the beams or the pillars, been decomposed or fissured at the point of contact: and then, on the bearing surface being no longer level, the supported block has fallen. Horizontal beams have evidently once extended from pillar to pillar along the whole length of the grand north and south galleries; while the chief of them yet remain in the shorter, but broader, western offset,—connecting the pillars there of each row lengthwise, and the first of each row eastward in the cross direction also.

No pillar, however, has fallen yet, or is to the eye even sensibly inclined. So good must be their foundation, so true must have been their original placing. But for what purpose, and when, could all this magnificent work in the costly material of the quarries of Syene, between five and six hundred miles from here, have been erected?

We pace the whole building inside and out, but neither on granite nor alabaster, nummulite limestone or Mokattam blocks (some of which appear here and there of small size and accurately cut, as a partial lining to the ruder masses of the former),

on no part of the building can the smallest trace of hieroglyphics, carving, or engraving be found ; and, as M. Renan truly says, 'not one ornament, not 'one sculpture, not one letter.' No Greek or Roman inscriptions either ; nothing but some chalkings of last year's 'travellers,'—whose broken champagne-bottles, half hidden in the deep sand under doorways, threaten to disembowel cruelly any venturesome man, who shall crawl snakelike through the low opening, to gaze on the ancient halls beyond.

This absence of the arts both of painting and sculpture, reminded one instantly of the interior of the Great Pyramid, as well as that of the second Pyramid ; and the eastern room, at first sight, with its granite walls, was thought to resemble the King's chamber in the former. But a very short examination of the 'joints,' proved a signal contrariety of building ; amounting to, either that Shafre's tomb was built out of the mere odds and ends of granite that were to spare after the completion of the Great Pyramid,—whence the strange diversity in thickness of courses, and change of thickness in one and the same course, with one stone curiously cornered into the substance of its neighbour :—or, that the one building had had nothing to do with the other. And this is the more probable conclusion ; for the style of architecture of Shafre's tomb is rather, and even eminently, that of the finishing of the lower part of the *second* Pyramid, with its granite-lined entrance passage, and rude surrounding limestone

masonry ; while, more eminently still, is the exterior of Shafre's tomb in the style of the so-called temple, on the eastern front of the same Pyramid.

The lining of that temple is gone, and no man has alluded to it ; but then we had evidently seen its smashings in the unnumbered fragments of red granite and white alabaster, lying about both inside and outside its cyclopean walls of limestone. We had seen, too, so many fragments of worked basalt, greenstone, and diorite, as to regard its neighbourhood as a quarry for such things. What then were they, or what purpose had they once served ?

Why this, is an indication of what they must have been, judging from King Shafre's tomb ; for in the square well of the eastern chamber, now one hundred and five inches deep to a water surface, and the water some seventy inches or more in farther depth,—there it was, that Mariette Bey discovered his celebrated statue of the ' Pyramid King,' now in the Museum of Boolak (see page 14),—together with a variety of other figures in diorite, basalt, and greenstone ; but all more or less broken up, ' as if ' precipitated into the well for destruction's sake, by ' the hands of revolutionists or the enemy.'

They were found, as I understand, under the level of the water ; and on looking into the well presently, a European would have hardly any other idea of such a shaft, than that it had been dug for procuring the needful fluid. Yet the shape is that of the sepulchral wells of old Egypt ; and even if there

be much water in the lower part now, representing the general level of the water in all the wells of the neighbourhood,—it need not have been there four thousand years ago; for, in that interval, the height of the bed of the Nile, with its yearly thin deposits in this latitude, has risen probably one hundred and seventy inches at least. Hence it is quite probable that there were formerly horizontal sepulchral chambers constructed at the root of this, at the time, dry well in Shafre's tomb; and that the spoilers ransacked the coffins, and broke all the larger statues there, where they stood, or lay.

But, even if it were so, such subterranean apartments were not the only places of sepulture in the building; for under Alee Dobree's guidance, we crawled through a series of low chambers close to the north wall, all massively constructed in polished granite; and then into others between the entrance passage and the western corridor. One of these, two hundred and eight inches long, one hundred and twelve high, and ninety-two broad,—had a granite roof; but its walls, all excepting a small lower course of granite, were of pure alabaster, one single block of which measured one hundred and ten inches long and sixty high.[1]

[1] The following sizes of special granite blocks were observed:—
A block of red granite over doorway of east room,
south end, ... = 138 in. × 38 × 47
Do., forming south part of west door, . . = 136 in. × 60 × 43
Do., in fifth course of east room, . . . = 120 in. × 59 × x.
The five courses of east room measure in depth, 59, 62, 42, 42, and 42 inches respectively.

We next visited the mass of covered building within the south-west corner of the general enclosure. There was a grand entrance there worked in polished granite, but the interior was quite taken up with masonry dividing its whole space into two storeys, and each of them into three gigantic pigeon-hole spaces,—every one measuring two hundred and thirty inches long, fifty-eight broad, and seventy to one hundred high. The divisions between these were massive in the extreme, and noble too, for the upper set had alabaster walls, while everything else was of polished red granite ; on retreating too, we observed that this whole section of the building, or rather these six grand recesses, were once closed up securely by weighty doors of stone,—whose pivot-holes, several inches in diameter, may be still seen in the upper and lower part of the doorway on either side.

These long air-tight or darkened cells, then, closed by ponderous doors, requiring immense exertions even to move them,—and whose pivot-holes by the way, while bearing full testimony to the weight they had to carry, indicate they were very rarely employed to assist in rotating these masses,—can hardly be looked on as anything but sepulchres of the dead, and more after the Syrian than the Egyptian manner. For the latter, gave each defunct king a house to himself ; while the former, had large chambers where one king went down after another to join the ghastly council of his predecessors ; who, thereupon, were poetically supposed to turn uneasily

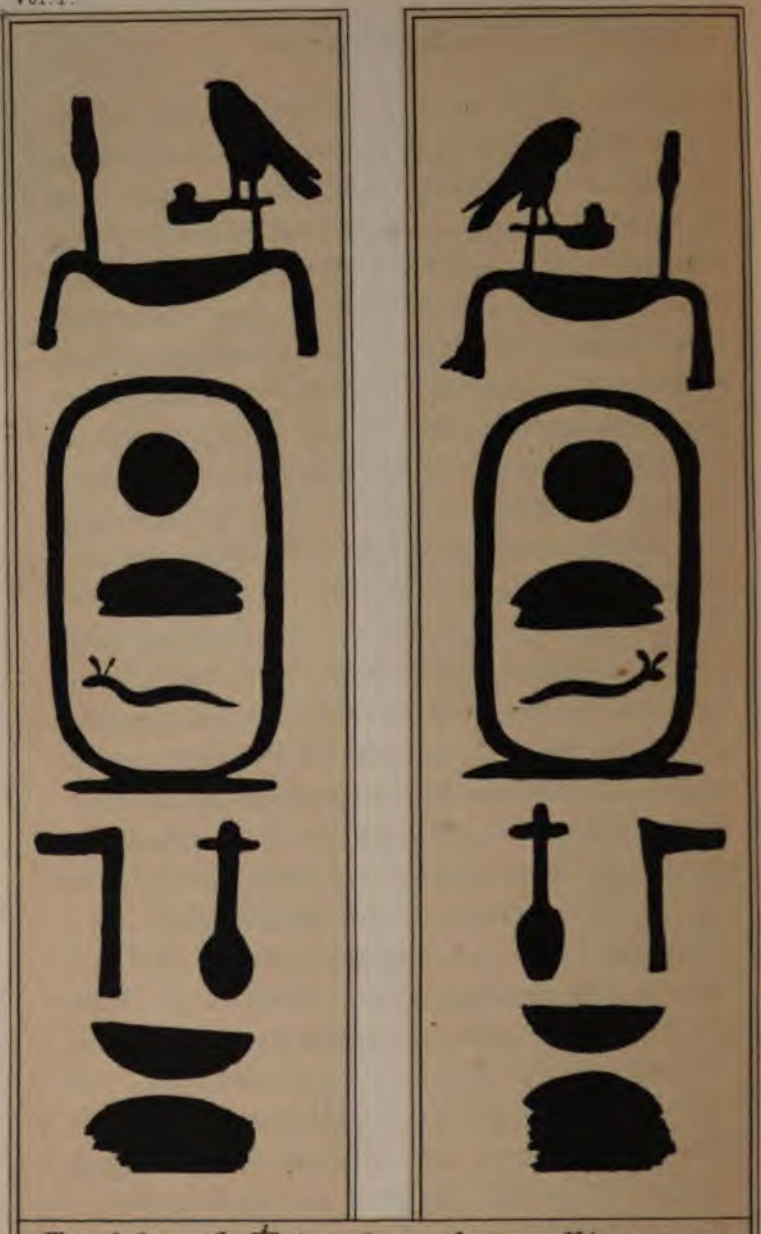
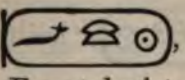


Photo-lithograph $\frac{1}{2\cdot5}$ the real size, from a rubbing on paper of the name on the base on either side of the feet of the statue in diorite of King Shafre, now in the Museum, at Boolak.

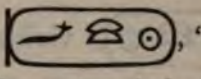
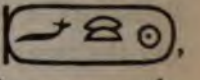
W. H. M'Farlane, Edin.r

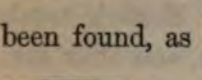
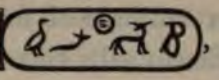
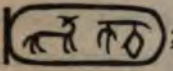
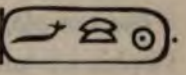
in their resting-places, and address each new-comer accordingly as his career in life had been. But there is nothing in any of these recesses now; and if Syrian tastes had anything to do in fashioning them, it must have been at an earlier period than any historically known inroad of that race into the valley of the Nile. For, not only does the mechanical style of the building generally connect it with the second Pyramid of Jeezeh,—but the diorite statue found in the well, has engraved on it a cartouche of one of the kings, of the fourth dynasty according to some, or of the fifth according to others, who make that dynasty simultaneous nearly with the fourth, in time, though successive in mere numerical nomenclature.

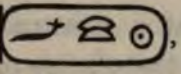
This cartouche  , variously translated by different Egyptologists, Shafre, Sephres, Chephren, and Chabryes, has been the subject of so much misapprehension,—that we applied to some valued English friends in Cairo; and, by the kindness of the ladies of the family (who went to the Boolak Museum for the purpose), are enabled to present our readers, on Plate VII., with a photo-lithographic copy of a 'paper pressing,' representing the two repetitions of the royal cartouche, as it exists on either side of the pedestal of the statue. In that Plate, accordingly, the cartouches appear 'nature-copied,' with all their heraldic accompani-

ments, and without either addition, subtraction, or alteration by modern human tastes or fancies.

These two close representations of each other are, moreover, as we understand, the sole traces of any hieroglyphics on the diorite figure; and will therefore doubtless be insisted on by all hierologists as proofs indicating, not only the king whom the statue represents, but as testifying also to the work having been constructed by his order and during his reign. For, had the statue been prepared subsequently by another king in favour of Shafre, then, according to all Egyptian precedent, the inscription would have taken especial and even religious care to say so.

There are those, however, who tell you, and Baron Bunsen is amongst the number, that King Shafre, or  , 'built the Great Pyramid,' 'in part, if not in whole;' and they found chiefly on confusions in the Greek accounts, which put sometimes the name of the principal king who built the *second Pyramid*, in place of the name of the *second king* employed on the Great Pyramid. But of the following local fact, ascertained in our own times, all men may rest most positively assured; viz., that the oval of Shafre, or  , has never yet been found anywhere in or upon the Great Pyramid. In the quarry-marks, indeed, on concealed surfaces of stones found in Howard

Vyse's excavations there,—some kings' names have been found, as  ,  , and  ; but these are by no means translatable, or have been attempted to be translated, into 'Shafre,' as we shall show farther on; and they are evidently very different from  .

Wiser, therefore, are they who attempt to connect the name of Shafre  , if he must be looked on as a 'Pyramid king' of some kind or other, with the *second Pyramid;* for, as no name whatever has been discovered there, in quarry-marks or otherwise,—the place is in so far still to let; while the extreme difference in the style of building between the upper or more perfect, and the lower or ruder portions of that monument,—indicates that the names of two different ages of kings may be expected some day to turn up there. Architectural resemblances, moreover, as we have already remarked, seem to be in favour of the designer of Shafre's tomb having probably had something to do with the basement of the second Pyramid.

But now there comes before us the most serious and important assertion of M. Renan, with respect to the great Sphinx, to examine; viz., the second of

those detailed on p. 333; for it is entirely founded upon mechanical features of King Shafre's tomb. M. Renan calls this edifice a temple, and after asking, 'To whom was it dedicated?' answers confidently, 'Without doubt to the Sphinx, or rather to 'the divinity represented by the Sphinx, *Horem-'hou*, or *Armachis*;' and his reason is this, viz., 'The temple, it is true, does not face directly to the 'Sphinx; but the passage of entry inclines with 'purpose towards the colossal monster. It is pro-'bable that a construction already existing had 'hindered the placing of the temple more directly 'in relation with the image of the god to whom it 'had been dedicated.'[1]

Now here, M. Renan has seized with his characteristic shrewdness, on a signal feature of importance in all the works of the Pyramid builders, viz., the angle of any entrance passage, whether in vertical or horizontal plane. And as we do not violently disagree with him, in considering the building which he calls Chephren's temple, and we Shafre's tomb, to be probably about as old as the Great Pyramid,—why, such a direction as he ascribes to the entrance passage,—must have the effect of proving the Sphinx to be older than the building containing such en-

[1] 'Qui l'a bâti? A qui était-il dédié? Il est permis de répondre à 'ces questions; c'est Chephren, le troisième roi de la quatrième 'dynastie, le successeur de Cheops, qui l'a fait élever.

'A qui le temple était-il dédié? Sans nul doute au Sphinx, ou mieux 'à la divinité, représentée par le sphinx, *Horem-hou* ou *Armachis*,— 'l'image du dieu auquel il était dédié.'—Ernest Renan, *Revue des Deux Mondes*, April 1865, pp. 675, 676.

trance passage; and therefore probably older also than the Great Pyramid. Hence, it only remains to examine whether the passage be really so inclined, —and then Sir Gardner Wilkinson's and Mr. Birch's very much later dates of Thothmes and 1460 B.C., for the invention of the Sphinx, are gone for ever.

Now, it so happens that we took several photographs from the East, looking over the entrance passage of Shafre's tomb, and including the monuments beyond towards the West. And having these glass pictures still in our possession, we can refresh our memory therewith, and say—that said entrance passage does in so far accord with M. Renan's theory, that it is *nearer* a direction of 'towards' the Sphinx, than would have been any passage going rectangularly forth from the western wall.

But in a case of the marvellous precision worked out in the angular directions of Pyramid entrance passages, it is not enough for any modern hypothesis to affirm, that it agrees within such wide limits as 'towards' whatever the ancient builders really pointed to. The test is, does it point to the same thing, and if not, by what amount does it miss the mark? Is it by something within the error of good modern observation, and therefore of ancient execution also? or does it deviate therefrom by an amount, which it would be a positive insult to a Pyramid architect, to suppose him incapable of taking account of?

Here M. Renan's theory evidently requires that

the passage shall point not only *towards* the Sphinx, but *to* it; and not only to it generally, but to it in such a manner as to indicate respect for the deity represented, viz., the great Horem-hou, or any other. The passage, therefore, should point not only to the Sphinx's face, but rather to the staircase of approach leading to the small temple between the two fore-paws, and just under the face. Does, then, the passage point in that manner?

We examine the faithful testimony of nature's own painting; and state that,—the passage does not incline far enough north, to hit that staircase; nor enough to come upon any part of the paws; nor enough to come upon the face; nor enough to come upon the shoulder; no, nor even to come upon any part of the body; but actually gives the entire Sphinx, one hundred and seventy-seven feet in length, the go-by completely,—passing on westward quite clear of the monster's last projection towards that quarter!

Oh M. Renan, M. Renan! why did you not either make a survey, or take photographs before you founded so much of history and comparative chronology, on the belief of a mechanical agreement which does not exist! But some one may imagine the case as yet only half proved; and therefore ask, 'If the inclined passage does not point to the 'Sphinx, is there anything else nearer to the 'direction in which it does point?'

We will try to satisfy so reasonable a querist.

One of the photographs is taken from a position admirably suited to settle the question, for one side of the passage forms a vertical line near the middle of the picture; and placing a neat ivory straight-edge on that line, and following its course into the distance,—behold, it enters precisely the central opening of the middle of the eastern side of that wondrous and often discussed temple on the eastern front of the second Pyramid; between which temple and Shafre's tomb, both M. Renan and ourselves have otherwise detected a community both of art and composition!

We returned home to East Tombs very happy from that visit to the gorgeous granite linings of King Shafre's apartments; and then found the ancient Ibraheem standing on a corner of the rock, overlooking some village children bringing the evening supply of water. Among them was a little girl of some nine or ten years old, very cheaply got up as to dress, in only two pieces of blue calico; she carried, moreover, such a mere cupful of water on her head, that her assistance in filling the great water-filters might easily have been dispensed with; but then, she was the daughter of poor parents, into whose hands the charitable ideas of Ibraheem wished some industrious pennies to fall.

There was an expression though on his countenance all the while, which indicated a feeling in his mind, that he was bound to improve the occa-

sion still further, for some one or other's edification, even though he should overthrow certain magnificent castles in the air. So, looking first down on the poor little mite of a child, and then partly turning towards ourselves in the dining-room tomb, where he knew so many Arab tales of wealth and grandeur had been laid off,—he ejaculated like a despairing preacher, but with large pity and much commiseration in his tone, 'There,—that's just the 'size, of Smyne's new bride!'

CHAPTER XIII.

ANTECHAMBER AND KING'S CHAMBER.

GREAT was the physical satisfaction after accomplishing all the measures required in the Grand Gallery, with its sloping floor, and the pit yawning at its bottom, so ready to receive whatever unfortunate thing should go helplessly down the too easy descent,—great indeed the satisfaction, to be walking thenceforward on a level; (this level beginning with the great step at the top of the Gallery, and then continuing by a horizontal floor to pass southward through a passage, lower indeed in height than any yet measured, but very short),—and so gain the antechamber; and from that, by another short and also level passage, to reach the King's chamber.

In this course, too, at a little space within the north end of the antechamber, we enter upon the *granite* constructions of the Pyramid, whatever they may mean; every single stone hitherto seen, whether outside the Pyramid or in, and whether in walls, roof, or floor, with the sole exception of the portcullis blocks at the beginning of the first ascending passage, having been of limestone. Now,

this change in the mineral of construction is a very plain and simple fact, touching which there ought to be no uncertainty whatever; yet such is the literature of the Great Pyramid, that not a few honest readers may be of a directly opposite belief; and even have some one or another book of repute to refer to, for the opinion which is in them. Thus, as to where granite is first to be met with, a thorough read scholar may prefer Baron Bunsen for his deep German learning,[1] against the world of British observers; and will put every such mere mechanical man down at once with the well-turned sentence, from pp. 164 and 165 in volume ii. of the noble *Egypt's Place in Universal History*,—declaring the whole Queen's chamber of the Great Pyramid, whose salt-bearing *limestone* we have already treated of, both from observation, touch, and taste, —'to be entirely built of granite.'

When the contradictions are so absolutely flat, any ordinary person who has seen with his own eyes,—is really puzzled to know what to do, or how to proceed decorously; especially when he finds the oligarchy ruling high scientific society is set dead against admitting, from any minor quarter, statements which may detract from the prestige due to a great fame, or established foreign name. For the present, then, we will merely suggest, that Baron

[1] 'Germans, who in all matters of research are immeasurably before 'the English: exhausting a subject.'—L. A. Brooke's *Life of Rev. F. W. Robertson*, vol. i. p. 321.

Bunsen, never having been in Egypt, cannot be taken for an original authority on the construction of any part of the Pyramid; while, as to the accounts which may be found in the works of some who *have* been there, they should not be held as representing more than very moderate weight, if their authors were at the Pyramid only once in their lives, and for a short part of a single day. But what shall be said, then, when a traveller, who was there for *two* days, is brought up with a positive contradiction of our long-continued observations? Well, such a reporter, let us confess freely, should be a little more trustworthy than him of one day only, but still not to be taken very much notice of in disputed or difficult cases,—unless, like Dr. Richardson, who published his two elegant volumes of Travels in 1822, he should acquire considerable popularity in higher quarters; and his visit to the Pyramids be otherwise alluded to as quite an event in their modern history, for the reason partly, that it was made in company with the 'Earl and Countess of Belmore, Consul-General Salt, etc. etc.'

Now, we do think there is something in this last reason; not only because every Consul-General in Egypt ought always to know something of the greatest monument of the country,—and Mr. Salt was, after that manner, a perfect prince amongst Consuls-General, dividing the attention of the antiquarian world for many years with Signor Belzoni himself,—but because the Doctor had the further

advantage of living much in the classic-minded and literary society of Earl, Countess, and other members of the noble family, whose honoured surname is Lowry-Correy ; and who are not only confessed by him in his Dedication and Preface to have given him some new and important ideas, but are unintentionally indicated in the course of the narrative, as having imparted intelligent thoughts very extensively, and nowhere with more point than in the chapter upon the Pyramids.

Many parts of that chapter, more especially those on the inferences to be drawn from the few fragmentary and most anomalous notices handed down by historians, touching the moral and political characters of the different Pyramid kings,—are excellent indeed (though unfortunately not further enlightened by John Taylor's original and deeper views on the subject), and doubtless came from the same superior soul who taught the Doctor afterwards, on the walls of Jerusalem, how to read the Book of Nehemiah. But when we come to one of the Doctor's pieces of direct observation on physical and scientific matters, where, of course, it is then the medical man, who speaks from his own professional knowledge, it is thus he writes of himself :—'The descriptions which 'it (his book) contains, were written when the 'place or object described was before his (the 'author's) eyes, and though he has consulted many 'authorities since, yet, in cases of difference, he has 'uniformly adhered to his own.' Turn we then to

this seldom fallible author's description of the interior structure of the Great Pyramid,—and we find him beginning to see granite immediately; for 'the 'entrance,' says he, 'is a small narrow passage, of 'about three and a half feet square; it is lined 'above and below, and on each side, with broad flat 'blocks of large-grained red granite, smooth and 'highly polished.'

In the first part of the passage, indeed, his attention was rather disconcerted by having to direct it medically upon another matter; viz., the best method, according to the Faculty, of descending one of those steep passages. 'Some,' writes he, 'take off their shoes, that they may apply their 'feet better to the floor, and be less in danger of 'sliding;' but that, he pronounces firmly to be 'a 'very bad plan; as it is likely to induce affections 'in the bowels, or to awaken a latent attack of 'gout, and other diseases to which there may be a 'predisposition.'

Again, before leaving the Pyramid, and after having had the experience of all the other passages and chambers, some of them truly granite-lined,—the party descended to the very lower end of the long entrance passage, to see the then recent discovery of M. Caviglia; viz., the large subterranean chamber of the Great Pyramid. And then, at that lower end of the long passage, which, according to Howard Vyse, Perring, Wilkinson, and others, is, from near to Al Mamoon's hole down to the bottom, simply cut

out of the solid nummulite rock, the too confident Doctor, writing of what was before him at that lower, as well as previously at the upper, end, says, —'This passage, as has already been mentioned, is 'lined on all the four sides by finely polished slabs 'of large-grained red granite of Assouan, commonly 'called Syenite; this must have been done at a 'great expense, the distance being between five and 'six hundred miles. The stones are remarkably 'well cut, and well fitted to each other.'

Yet, for all this anomalous granite finding, there is an abundance in the chapter well worth reading; and the following sentence has its peculiar value:— 'The whole of this memorable spot, the site of the 'Pyramids, and Sphinx, is filled with excavations, 'structures, and mausoleums, of the most interesting 'and instructive nature, so that many ages of men 'would not be sufficient to examine and describe 'them; *and the traveller who could bound his 'curiosity to explore their contents with accuracy, 'would perform a more instructive service to his 'fellow-creatures, and more gratifying to an in-'quisitive mind, than if he had galloped over 'thousands of miles, and only detailed the general 'aspect of the country that he passed over.*'

Had indeed, many travellers acted in this manner, the printed stock of knowledge touching the facts of the Great Pyramid, would have been vastly more accurate than it now is. At present, I will only state, that Howard Vyse, and Perring's large views

of the Pyramid,—views formed on months of long and intimate acquaintance with the interior,—are exactly in confirmation of my own, as to where the granite linings and constructions begin in roof, walls, and floor of antechamber.

Now this antechamber, though very small, say, eleven feet long, five broad, and twelve high, roughly, —is such a puzzle as to the nature and meaning of its contents, that I must have been there for two or three observing days,—mounted chiefly on a short ladder, which is necessary for the higher parts, —measuring, re-measuring, and testing again the notes of former measurings. The engravings of the great French work are here much to be commended, both for giving certain side-hollows in the floor, which I have seen in no other representation, and likewise for showing the southern end of the chamber, not with five vertical lines, as indicated by Greaves, Caviglia, and various other authors,— but as a space symmetrically divided through the chief part of its height, into *five* equal, vertical *spaces*, by *four* vertical lines; lines deep, hard, and clear, which run through the whole of that wall from its top in contact with the ceiling, to its bottom, as terminating in the passage roof, leading to the King's chamber.

Colonel Howard Vyse is also a trusty guide on those four lines, as he further is on the difference of height of the granite wainscot, twelve inches thick

on either side of the room; for he makes, agreeably with the French authorities, the western one the higher of the two, and garnished at the summit towards the southern end by three semi-cylindrical hollows; one of them being at the top of each of the broad, flat, or rectangular vertical grooves, in which men have said that three portcullises of stone slided, to defend the approach to the sacred chamber of the King. And this theory is, in so far, very tenable, because the eastern side has three opposite vertical grooves, of equal breadth and depth, though not quite the same height; and large slabs of granite *might* mechanically slide up and down there, across the room, very well. The southernmost block, too, would be actually in contact with the southern wall of the chamber, completely closing up therefore the mouth of the passage beyond; and, excepting the grooves, unless the stone had corresponding ridges, not allowing even a fly to pass in.

Hence that block would have made a *good* portcullis, and have been assisted in its duty by the next two, sliding in the adjoining grooves; each of the grooves being twenty-two inches broad, and separated by ribs of granite five inches thick; ribs, once left projecting from the wainscot, like pilasters, —but now nearly knocked away, bit by bit, to furnish specimens for 'travellers.' What however shall we say to the 'granite leaf,' which is still to be seen in yet a *fourth* pair of opposite grooves in the wainscot, measuring from the south, and the *first* pair, mea-

suring from the north? That pair of grooves at least, has still its granite blocks in hold, which the others have not, and are never even reported by any writers to have been seen in possession of; wherefore most travellers insist at once on the 'granite leaf' (that happy name of Professor Greaves for the sheet of stone hanging forty-three inches above the floor, and about the same amount below the roof),—they insist on this granite leaf, having formed a fourth portcullis.

Even Colonel Howard Vyse was of that opinion. And although he saw, as any one else may still most plainly see (the French drawings being, however, here not quite exact), that the suspended stone *never has* formed a portcullis; and for the simple reason that its lower edge has never been down below level of the *top* of the passage, because the stone grooves in the granite (and there partly limestone) wainscoting on either side, have never been cut, beginning from the top downwards, lower than that height;—still the Colonel maintains that it was an Egyptian tomb custom to lower portcullis blocks by cutting out the grooves below them as they stood, and so allowing the heavy blocks of stone, with the advance of the chiselling, to sink slowly down once and for ever. Wherefore, he argues,—the granite leaf was *intended* to have been made into a portcullis.

But then we may ask, not only how it came about that the granite leaf never *was* lowered like

the three other thicker and reputed portcullis blocks, whose grooves *are* cut down to the floor, and to a few inches lower still; but why, even if it was only *intended* to be lowered, why was it so beautifully and firmly *cemented* into its present elevated place, as we now find it to be; and by means of the more precious cement of the pure white order of the Pyramid? Why, too, is it full six inches less in thickness than the other three blocks? and why is there no semi-cylindrical hollow over the groove at its western end? All these are weighty questions; and then comes the more important one still, that even if that stone were to be lowered now, it would not make an effective portcullis; for its northern side, in place of being in contact with the northern wall of the antechamber, is actually twenty inches or more therefrom,—so that a man may with ease enter the room, whether such an attempt at a portcullis as the granite leaf, be down or up; and as its own height is only about a third part that of the room, the same man can always with equal ease either climb over or under it, at whatever possible height or distance between floor and ceiling it may have been left suspended! (See Plate XII. vol. ii.)

Now this was an idea, the possibility of which had occurred to me in Scotland, when considering the published views of the antechamber, and discussing them in the light of respect for the intelligence of the Pyramid architect; it was there-

fore not a little satisfactory to find, on actually visiting the place, that I *could* stand between the granite leaf and the northern wall of the ante-chamber; and could both creep under or climb over it, as it stood there firm as a rock, both cemented into its hollow, resting on firm granite, and in nothing whatever like a portcullis. But what then took me by surprise was, finding that even that granite leaf, though comparatively puny in size to all the principal stones about it, was yet not formed in one piece, but of two, one placed above the other; and the upper, with a very curious, and, for the Pyramid, perfectly unique, adornment of a semi-circular form, raised about one inch above the general surface, and bevelled off on either side and above,—forming thus a relievo object, seven inches broad and seven high at its inner outline, and five broad and five high at its outer surface.[1]

On the whole, it looked amazingly like a handle whereby to pull the upper half of the granite leaf upwards in its grooves, away from the lower half, and,—as was suggested to us,—perhaps disclose a small hollow space, containing the key of the whole Pyramid. The grooves, too, for sliding the block upward, are open, smooth, and ready for such a movement,—but the blocks themselves, as already stated, are cemented into their places; and then—I

[1] The duplicity of the granite leaf, as well as the existence of the raised ornament, though signally unrepresented in the beautiful French engravings, are well given in the large Pyramid views of Vyse and Perring, which I only became acquainted with on my return.

was bound to the Egyptian Government, not to 'break the Pyramid.' Had not M. Vassalis, too, told me, long before, 'When Mariette Bey comes down 'from Upper Egypt, he will lift all the great stones, 'and do any heavy work you require'? So, thinking on these things, and trusting all the promises made to us,—we went onwards with our candles and measuring-rods, into the King's chamber.

Now, if there is a place where a visitor should be cautioned as to his head, it is this last passage leading into the grand room of all; for, after straightening one's back in the antechamber for a time, the extreme stooping again to pass through a doorway only forty-three inches high is irksome; and, if seen at all by the faint candlelight in the thick air, the aperture does not seem really so low, for the granite just above its northern entrance is grievously fissured, making an angular top to the door of some twenty inches increased height. A huge notch it is, and which, with a modern doorway about a brick and a half thick, would enable any one to pass through with very little stooping; but, as this last Pyramid doorway is one hundred and twenty inches thick, and the broken-away part at the top only continues for a couple of dozen of inches or so,—the eager traveller, urging himself forward at only a half stoop, runs his head literally against a stone wall; and the Arabs, as they pick him up severely stunned, merely say, with some annoyance on their own

account, 'What did you do that for?' Hence the golden rule is, to keep on stooping most submissively and humbly, until all of a sudden the altered echoes assure you of your having arrived within the King's chamber,—where you may then arise freely enough as in a harbour of refuge and safety.

A rather difficult room to illuminate is the King's chamber, partly from its size, and partly from the darkness of the ancient red granite of floor, walls, and ceiling. With six candles you begin to see it, and a magnesium wire clears up the difficulty immensely, so long as its light lasts; showing the exquisite proportion of the rectangular chamber; whose polished *flat* ceiling, dazzling with sparkling crystals, bespeaks an imperial power in the methods of the architect to bid defiance to the mountain-like pressure of the Pyramid: and yet produce a room of simple geometrical figure, in place of the vaulted, groined, or other roofs with compound curvatures, usually to be met with, and even thought necessary in all modern buildings which support what is now considered a great weight,—though it may not amount to a tenth part of even one of the courses of the Great Pyramid.

My first task here, was to measure all the joints of stones in the floor; and the first event, very soon after beginning, was of course the arrival of travellers and Arabs. But now it was easy enough just to withdraw all the measuring apparatus into one corner, on hearing the premonitory symptoms,

and look on at what should occur. And this is generally the order of the phenomena which followed on such an occasion, these occasions seldom taking place less frequently than two or three times every day;—trio after trio of one traveller and two Arabs with short candles in their hands came stooping, waddling, and tumbling through the passage; and when fairly within the four grand walls of the chamber, began to cheer, shout, and hurrah with all their might, the Arabs shaking hands with the traveller, and assuring him he had done splendidly. Sometimes the earlier-arrived one gazes a little around, and an Arab may call his attention to the coffer,—to which he then gives a kick and asks, 'What 's that?' But more generally the trios merely accumulate in the middle of the room, renewing their hurrahs as the successive members of their party arrive; and then they form a ring, in the midst of which one or another dances a hornpipe, as they say, on 'old Cheops' gravestone,' while the poor coffer is banged for music,—and in five minutes they are all gone again.

The evanescence of these travellers' visits, when one was placed at their ultimate aim and object, was remarkable enough; and reminded us much of the sudden manner in which, according to the Danish Captain Norden, they used also to be terminated more than one hundred and twenty years ago,—even in cases too, where they had begun with rich promise of something important in the way of

research and discovery. In that day the countrymen of Niebuhr, the successors of the companions of Tycho Brahe, seemed to be much looked up to all over Europe as scientific explorers *par excellence*; and at least, they *began* nothing without displaying largely the decorum of high purpose and dignity of noble resolve. Thus, indeed, the gallant knight of the Danebrog writes, in 1740,—offering thereby a shining example to all young civil servants and juvenile cadets going out to India now: 'When 'you undertake,' says he, 'in the winter, to go and 'visit the Pyramids, you endeavour to form a com-'pany, as well to make the tour with agreeableness, 'as to be in a condition to observe everything in a 'better manner. Those that have been there, give 'an emulation to the stranger by their discourses, 'and assist him to make more exact researches, than 'he would do if he was alone.'

And the researches in the end, are found to culminate as follows:—'When you are in this saloon '(the King's chamber), you commonly make some 'discharges of a pistol, to give yourself the pleasure 'of hearing a noise that resembles thunder; *and as 'there is then no hope of discovering more than 'what others have already remarked, you resume 'the way by which you came, and return in the 'same manner as well as with the same difficulty.*'

This is indeed a sudden bringing up of a rather inglorious consummation; but then the poor travellers of that time, had gone through remarkable

difficulties before they had reached this *ultima thule* of Pyramid exploration. For, on referring to the plain and unvarnished narrative of the honest Norden, he describes the beginning of the attack on the Pyramid's dark and mysterious interior in these portentous words: 'After such necessary prelimi-'naries you must have the precaution to strip your-'self entirely, and undress even to your shirt, on 'account of the excessive heat that there constantly 'is in the Pyramids.'

'You enter in this condition, into the passage, . . . 'when you are arrived at the extremity, where the 'passage is forced, you find an opening, which has 'barely a foot and a half in height, and two feet in 'breadth. The traveller commonly lays himself on 'the ground; and the two Arabs that went before 'take each one of his legs, and drag him thus 'through this difficult passage, over sand and dust. 'Luckily this passage is not more than two ells in 'length; otherwise the trial would be insupportable 'to any one that was not accustomed to it.'

'After passing this strait, you find a large place,' now known as Khaliph Al Mamoon's hole, 'where 'you commonly take breath, and make use of some 'refreshments. This gives energy for penetrating 'into the second gallery, which is well worthy of 'observation; . . . at the end of this passage there 'is a resting-place;' and again, after surmounting the chief difficulties of ascending the Grand Gallery, 'you repose yourself a little at the end of the

'gallery, where you meet with a little platform;' while finally, after having 'done' the King's chamber, and with evident joy on his soul, the Captain writes the more cosmopolitan instruction: 'As 'soon as you are got out out of the Pyramid, you 'dress yourself; wrap yourself up well; and drink a 'good glass full of strong liquor; which preserves 'you from the pleurisy.'

After disposing of the joints of the floor, I commenced with those of the walls, and presently stumbled on a very remarkable feature, and one which, in a geometrical and mechanical examination, demanded extreme attention; it was, that the horizontal courses of granite forming the walls, whether composed of long or short stones, were always of the same height all round the room; and every successive course from floor to ceiling was of equal height with every other. Now, any one who knows the various sizes of blocks furnished by a granite quarry, must be aware,—that before a continued length of blocks of equal height, accurately to the tenth of an inch, can be procured for a length of five hundred and fifty feet,—there must have been immense expenditure as to both money and labour in trimming down stones above the size, and throwing away others that were found below it. In fact we may say immense waste, unless some very peculiar reason can be shown *requiring* such equality.

Now the Great Pyramid builders, of all men in

the world, were the most admirably economical, never going to more expense, for either material or workmanship, than the final ends they had in view did absolutely need; and they have shown again and again, in various parts of the structure, that when their ultimate object was merely a wall-surface, they looked only to securing that wall-surface good as a whole,—caring nothing for difference of size in the adjoining blocks; so long only, as they broke vertical joint in a satisfactory manner, looking to strength. Similarly, too, Colonel Howard Vyse, while describing the extraordinary perfection of the *pavement* which he discovered in front of the Pyramid, and the microscopic fineness of its joints,—adds, that the stones were not rectangular; and Mr. Perring's drawings show them very diverse therefrom indeed, though making a general sheet of pavement of unexampled excellence. When therefore those same ancient masons build a wall-surface, not merely with a view to its acting as such on the whole, but with special care to the exact equality in height of every course of stones, and these the most expensive and difficultly procurable of any building stones; when, too, they make four such walls, all exactly telling the same operose and costly tale, and describe it with all that perfection of needle-proof joints so much lauded by most authors,—we may be sure that there was some remarkable ultimate reason wrapped up in that feature. A feature, too, which we may safely maintain, was

inserted by the original builders of the Pyramid, and no other men whatever; and which speaks now in the universal language of mechanics,—as clearly and conclusively to all men, of all nations, understanding anything of good mechanical building,—as it did in the days of King Cheops to his own best trusted clerks of the mighty work.

When, moreover, we find that besides the equality of height in every course, their number is *five*,—the symbolical pyramid number; and that in fact there are between floor and ceiling four horizontal joint lines, but five of the equal granite spaces,—why, we immediately recollect, that that is precisely the principle, turned through 90°, of the remarkable set of *lines* on the southern wall of the antechamber: those mysterious lines, which form the last markings of any kind seen by the traveller before he makes his final low stooping, wherewith to pass through that concluding low passage we have already mentioned,—and after which, he rises an erect man in the midst of the King's chamber; finding himself there surrounded round and round on the east, west, north, and south, by the system of five equal granite spaces and four lines of separation between them.

Every traveller is environed by these things, but every traveller does not see them,—even though there was that sign over the doorway by which he entered, to call his attention to them. Worthy George Sandys, for instance, in 1610, writes of the King's chamber, which is to his mind 'very goodly;'

'its stones so great that eight floores it, eight roofes 'it, eight flagge the ends and sixteen the sides,— 'all of well-wrought Theban marble.' Our confident acquaintance, too, Dr. Richardson, declares[1] that the King's chamber 'is lined all round with broad 'flat stones of large red-grained granite, smooth 'and highly polished; *each stone ascends from 'floor to ceiling*;' that is, he would affirm there are no horizontal joints at all in these remarkable walls; whereas M. Fourmont, in 1755, positively states the walls of the King's chamber 'are com- 'posed of *six* tiers of stones.' So likewise Dr. Pococke, also M. Maillet, Consul-General of France from 1692 to 1708; nay, even our own more modern and very learned traveller, Dr. Clarke, in the fourth edition of his valuable Travels, in 1817, says (vol. v. p. 197), 'There are only *six* ranges of stone from 'the floor to the roof.' This, too, is after he has excessively admired that 'glorious room,' as Greaves styles it, 'where, as within some consecrated oratory, 'art may seem to have contended with nature;' and after also that he, Dr. Clarke, with his accus- tomed love of accuracy, tested the joints of the granite blocks 'on the sides of the King's chamber,' and having often before heard they were so close as to prevent the blade of a knife being inserted, 'actu- 'ally tried the experiment, and found it to be true.'

There is one joint, however, nay perhaps there are two, near the south-west corner, where one might

[1] Vol. i. p. 127.

perform the feat now,—partly owing to dilapidation, partly to the hammering of travellers for specimens all along these edges; but such a small proportional exception, no one need bring up against the able Doctor. What shall we say, however, to his *six* ranges of stones from floor to ceiling, in place of the actual five? His error *may* have been induced, in some degree, by a device of the builders, which prevented me also from at first perceiving a full equality amongst all the five courses; for the first of them, as I should have mentioned earlier, measures forty-two inches only in vertical height from the floor, while each of the others measures forty-seven inches from joint to joint.

But then no joint line of the walls appeared at the floor level; and on visiting the hole at the north-west corner of the floor (a hole by the way which existed just as now when Sandys paid his visit 250 years before),—behold the walls and floor of King's chamber are there shown to be on a totally different plan from each other, than what is observed in the walls and floor of the inclined entrance passage. For there, the floor is a broad sheet of stone extending far under the walls; while in the King's chamber, the floor is a limited platform rising *up between* the walls; and in this manner allowing the granite of the lowest wall course, to descend beneath the floor level; and it does so descend to the depth of five measured inches, and then rests on limestone. (Pl. XIII. vol. ii.)

There may be another meaning still connected with that five inches of concealed depth; but for the present we may be contented with its rendering the height of the lowest wall course equal to the other four; and pass on with M. Renan to admire the inimitable *chef-d'œuvre* which this 'interior 'chamber of the Great Pyramid' does in truth form,—'simple, without an ornament,—for the only 'beauty demanded, was perfection of execution.' But we cannot go further with him in also saying, 'Notwithstanding the astounding weight which the 'chamber carries, it has not bent a millimetre, the 'plumb-line does not accuse it of the smallest 'deviation;'[1] for in fact, besides the fissuring of the south-east wall and decayment of the floor blocks already noticed, I made on two several days long series of observations with Mr. Coventry's accurate clinometer, mounted on its extra 126-inch foot, upon each of the walls of the chamber successively; finding none of them perfectly vertical; but every one indicating, over and above some smaller anomalies, a slight tilt of the whole room down towards the south and west, by the quantity of six minutes of space.

Some might contend, that so small an angular deviation might be accounted for by geological changes, acting on the level both of the base of the Pyramid and all the crust of the earth forming the Libyan desert,—whose fossils too, show, that it has

[1] *Revue des Deux Mondes*, April 1865, p. 673.

been but recently raised above the sea; but such persons had better clear all four sides of the base of the Pyramid, and measure the errors of level there, free from any possible influence of flexures about the King's chamber.

From the walls we turned our attention to the royal chamber's sole contents, the mysterious coffer situated at its western end; and, 'sunk in the floor,' says the unfortunate Robert Richardson, M.D.,—but as completely standing above, that is, upon it, and free to be moved about thereon, as anything placed on a flat and smooth surface may well be.

On the coffer, of course, our measures both outside and inside were numerous; and a variety of methods were adopted to make up for the chipped-away edges of every surface. The outside of the vessel was then found to be by no means so perfectly accurate, as many would have expected; for the length was rather greater on one side than the other, and differed also according to the height at which the measure was made; all the sides too were slightly hollow, excepting the east side, which was closer to a true plane than our measuring apparatus would enable any one securely to find fault with.

The workmanship of the inside, both as to polish of surface and regularity of figure, was decidedly in advance of the outside, but yet not perfect: wherefore we were at some pains in getting measures

in some twenty different places, both for length, breadth, and depth, in order to arrive eventually at a good mean; and diagonal measures were taken as well, to test the rectangularity of the structure. In the matter of depth, there was some trouble at first, on account of the 'ledge cut out' already referred to;[1] but after having prepared a means of eliminating that, by filing two small blocks of the exact depth of such cut-out as shown at the north-east corner of the coffer,—the only point where the original top, and the secondary top formed by the cut-out, are seen together,—there was even found to be great ultimate advantage to the measurement from such a cut-out having once been made.

For, had our determinations for depth, for instance, been dependent on having the original top-level of the sides to refer to,—they could only have been made at one small corner of the whole coffer; seeing that everywhere else, the extremely and necessarily prominent nature of the ultimate top, has marked it out for the blows of 'travellers;' whose 'strong right hands,' as well as unsparing eyes, are shown by the destruction, almost everywhere, of that highest edge top. As ruthless, have they also shown themselves, of the whole upper south-eastern corner; for that is the part which presents itself most helplessly to the hammer, as each traveller, age after age, advances up to the coffer from the east, or entrance end of the room;

[1] Pages 85-90, chapter iv.

and seldom takes the trouble to go round by the narrow space on the west, or over the deep hole on the north. But all this time, the interior angle, or ledge, cut out for a lid, has generally escaped observation, or been naturally protected by its position; and so completely,—as happily to afford now some precious means of testing the equality of depth, and flatness of the coffer's bottom at many places.

This work was barely concluded, when both Alee Dobree and myself were equally surprised, to see Smyne enter the King's chamber, in a very unusual and excited manner. Alee Dobree first went to him as he leant against the wall near the northern air-channel mouth, and they had an agitated discussion in Arabic; after which they both came forward, and assured me that I was wanted immediately at East Tombs, though why, or for what purpose, I could by no means make out from them. Time, however, they indicated, was very precious, so we packed up immediately, and, candle in hand, descended as quickly as we might, the long Gallery incline, and first ascending passage.

Here one of the party, for a moment, loosed his hold of the small ladder with which I had been examining the upper courses of the walls of the King's chamber; and it was rather instructive to see what an angle of 26° can do. For the moment said ladder was no longer retained by human fingers on that slope, away it began to slide, quickening its pace

every moment, until, raising a cloud of white dust on its way, it shot along like a rocket, and presently came, with a cannon's report, against the granite portcullis; when, though made of hard wood, and of unusual strength, every one of our only recently purchased ladder's rounds, from one end to the other, in an instant became utterly loose and rickety.

Issuing suddenly at noon-day, from a long stay inside the Pyramid, is a gorgeously blinding sight under an Egyptian sun; for the white stones reflect such a world of living light, that one is literally overpowered. But on this occasion, I stopped neither for that, nor for the usual beating the white dust of the Pyramid's interior out of my clothes,—in a quiet and comfortably arranged sepulchre, well suited for the purpose, near the eighth Pyramid,—but hurried on to East Tombs; and there was much relieved in at once seeing Mrs. Piazzi perfectly well, and seated in the open-fronted dining-room tomb,—while the whole space between that and Ibraheem's kitchen was filled with Arab men, women, and children, from whom came only the deepest sounds of lamentation, mourning, and woe.

'Now, what is all this about?' I inquired; and prepared at once to have my feelings drawn forth alive, and torn to positive shreds by the perpetually occurring, heart-breaking affairs amongst these Arab villagers. But, before being able to explain precisely what it was,—I must beg the reader's leave to go back a few days in our proceedings, and describe

some events, which, though small, and distant at first, inevitably expanded in time, and drew our whole existence and everyday life most uneasily into their train.

The day after that one concluding our last chapter, for instance, my wife was sitting in the dining-room tomb, looking out over the plain of the cultivated valley,—once dark-brown after the inundation, but now so brightly green, that the poor date-palms (clipped too in Egyptian taste of their lower leaves, like a French elm-tree) looked black in comparison,—when, from the Pyramid village nearest in front, began to issue a largely attended funeral, slowly wending its melancholy dark length towards the burial-ground in the south; while its drums were beating in more than usually mournful manner, and the 'ululations' of the wailing women were more shrill and prolonged than ever. It was towards the evening hour, the sun sinking behind the hill, and the Pyramid casting its long shadow athwart the sandy plain, almost touching the Mokattam Hills, that glowed again with the rosy tints of the setting sun,—rendering this touching scene of the funeral, especially striking and memorable. Further, too, it was an unusual hour for the burial of the dead, that office being generally performed about nine in the morning.

Mrs. Piazzi therefore turned round to Smyne, who, with his arms behind his back, was watching the procession from a neighbouring prominence of

the East Tomb cliff, evidently looking on with intense excitement,—and asked him, 'Well, Smyne, 'who is dead now? is it another old man?' alluding to his other frequent explanations of Arab funerals.

But he now answered shortly: 'It's not a man; 'it's a woman.'

'And was she very old?'

'No; she was young.'

'And what made her die?'

'She was killed.'

'Killed! And how did that happen?'

'She was shot with a gun last night!'

Here was a revelation; and, of course, an immense number of questions were immediately to be asked, but Smyne had vanished. Ibraheem, however, was not far off, and Alec Dobree presently appeared to take his turn as a night-guard, so between the two, the following particulars were procured:—

The irrepressible Smyne had become so elated at the prospect of his second marriage to be, that he must needs give a dancing-party in the village to celebrate his good fortune. It was but on a small scale, for he himself was merely living in his mother's and stepfather's house as the eldest son in a large family, and he had apparently asked only his bachelor friends to the entertainment. But these, according to Arab custom, seated themselves in a circle in the yard outside the house; and, while two hired dancing-men performed in their midst, the company continued deftly clapping their hands,

raising and falling their heads in time, and swaying their bodies backwards and forwards,—all so lazily and yet so admirably according to Egyptian ideas of a ball,—that crowds of women and children gathered on the tops of the surrounding mud-walls and gazed down entranced with delight. So the entertainment continued to the wearying of none, not even the dancers, and to the pleasure of all; until,—in one moment, and before any one could be aware of what was going to be done,—a man, one of the invited, fired off his gun,—and the bullet which had been in it struck a damsel seated on the wall, entered under her chin, came out at the top of her head, and she fell down dead into the midst of the circle of guests.

On this unexpected calamity, every one fled, dancers, guests, and spectators; Smyne himself running foremost, and not stopping to look behind him until he had crossed the sand-plain, and reached both East Tombs and the protection of Ibraheem's kitchen. The man of the gun, however, and a friend of his, returned; carried the poor girl's body into the abandoned house of the Smyne family; and laying it, of all places, in Smyne's own room, departed to their homes,—meeting, though, in their way, the family of the deceased, roused by the rumours of death, and telling them where they would find the corpse.

This seemed a dark affair; and the more we inquired into it, the darker it became. What need was there for one man to fire off his gun in the middle of the innocent dance? Had he aimed

deliberately at the luckless girl? and who was she?

No need at all, they answered, to fire the gun, but they thought the man was not quite right in the head; and no one in the village knew whether he had intended what he had done, or not; or whether he had any reason, real or supposed, for acting in such a barbarous manner; and the girl was not known to have been sought or disputed for in marriage by any one present, and was not connected in any way with Smyne's recently successful rival. She was, on the contrary, a relation of Reis Atfee, and the intended wife of Alee Dobree's brother-in-law Abduwahad, who was therefore plunged into grief inconsolable. In fact, the villagers themselves were as much puzzled as we were; and disputed unceasingly over the matter, until they became divided into two great parties; and while these were each urging their own theories,—down came the Governor of Jeezeh upon them,—apprehended twelve men, and sent round patrols of soldiers, who took possession of all the guns both in that village, and in six others round about!

There had not been such a stroke of disarming policy in this part of the country, for an age; and the mystery hanging about the death, much assisted in making the Arabs submissive to the law, when enforced in the name of criminal justice. But still the parties in the village disputed; and mainly, as we learned, upon the probable complicity of Smyne,

who now passed every night at East Tombs; and if in that way securing his own safety, yet bringing so much danger to the other inhabitants there, that the two attentive Sheikhs, Abdul Samed and Murri, doubled the number of our guards; and came over themselves more than once in the course of the night, to make sure that the men were at their post.

Each morning brought further news of disputes at the village, and the arrest of more men by the Governor of Jeezeh,—until it was said that half the men of El Kafr were in prison. At last one further morning still, came the news which Smyne had so long been dreading, viz., that he too was wanted at Jeezeh. The soldiers consented to wait in the village, while stepfather, mother, brothers, and sisters went over to East Tombs to break the fact to him gently; on hearing which, he had started off to me inside the Pyramid in order that I might be induced to write him a 'letter' to take to Jeezeh. And thus it was that I reached East Tombs as before described; as fate had determined, too, almost immediately after Smyne's family party had been still further increased, by the arrival of his unsuspecting mother-in-law elect; who, poor wrinkled body, had come over from the other village, by a long previous appointment for that particular day, in order that she also might 'have a look' at her son-in-law to be, and receive ocular demonstration that he was everything a mother could desire, for the future happiness of her favourite child.

To heighten the scene and increase the confusion and dismay of these pitiable folk, three stalwart soldiers were now seen crossing the desert plain, evidently exhibiting impatience to pounce on their prey. Again, therefore, Smyne begged of me to write a letter.

'But what use can a letter from me be of?' I asked, 'what can I say?'

'Oh!' gasped forth Smyne, 'you can say that 'I slept here in the desert on the night of the 'murder.'

'That will be of no use,' I replied, 'when half 'the village saw you in the evening at your own 'party,—the very place where, and at the very time 'when, the gun was fired.'

'But then you can say,' returned he, 'that I have 'not got a gun.'

'No, indeed, I cannot,' I persisted, 'for I do not 'know anything about your possessions, further 'than that you have often boasted here that you 'had a gun, and that every true Arab has a gun.'

In short, poor Smyne, overcome by fright, did not improve his position at all by what he urged; but as his family were weeping and wailing as though he would be going to certain death, and with a bastinadoing to receive before it, if he was allowed to leave East Tombs without something in shape of a letter; and as, moreover, the worthy Reis Atfee, though much afflicted by the death of his relative, had also come over to strengthen the application of

the family, and declare his opinion that Smyne was a good man generally, and innocent in this particular,—and seeing that the soldiers were nearing our position,—there was no time to be lost in further debate. So I wrote at last, merely a character of Smyne, such as we had actually found him to be; read it in hearing of them all, disclaimed that it could have the power of preventing the Governor of Jeezeh putting the law into force to its fullest extent, upon whomsoever should be found guilty; and assured Smyne, that his only prospect of safety, was, to speak the truth openly, bravely, and to conceal nothing.

With which and other encouragements to act like a man, and fear neither the soldiers who were now longing for him, nor the prison he would be deposited in,—the letter was handed to Smyne; and in a more serious frame of mind than we had yet seen him endued with, he took his fated way across the sands direct to the ministers of justice; while his family followed after him in a confused and wailing line;—and we, quietness being once more restored to our dwelling, watched with no little anxiety the several members of the troubled party, until they all vanished from view behind the mud-walls of the northern El Kafr.

CHAPTER XIV.

PROGRESS OF THE SEASON.

For many days after poor Smyne had gone off to the inevitable jail at Jeezeh, there came to us each morning at East Tombs most perplexing rumours, following each other something after this fashion.

'The Governor of Jeezeh has had all the men up 'before him, but he cannot find out anything.'

Then, next day, 'The Governor of Jeezeh and the 'Kaimakan have both questioned every man, but 'they cannot find out anything more.' And the following day, 'The Governor of Jeezeh has gone to 'the Citadel to speak with the authorities there.'

An interval, and then, 'The Governor of Jeezeh 'has come back from the Citadel, and three Bashas 'with him; and they have examined all the men, 'but cannot find out anything.'

Then came a day when all that was reported amounted to this, 'that the Governor of Jeezeh 'does not know what to do next.'

But on the following morning came a man running excitedly at the top of his speed, with, 'It 's all 'found out now!'

'How did that come about?' cried every one, crowding round him.

'Why,' explained he, 'the Governor of Jeezeh 'flogged all the men, from the first down to the 'last; and then the wicked one confessed, and the 'murder was made plain.'

'Inshallah!' roared the people, 'but truly the 'Governor of Jeezeh is a wise man; and the Basha, a 'great one; and Mohammed the truest of prophets!'

Then proceeded descriptions of the mode of flogging practised in the jail of Jeezeh; and it appeared to be very severe, raising numerous ejaculations of pity from the bystanders in behalf of the unfortunate subjects, whether innocent or guilty.

The next following morning, however, a more veracious messenger appeared,—asseverating on his own knowledge 'that no one at all had been flogged; 'but that the man who had fired off the gun had 'voluntarily confessed so far; and now the Governor 'of Jeezeh is only puzzled in the endeavour to make 'out, whether the act was done with intent to 'murder or not.'

In fact the matter seemed, after so many days and such multifarious reports, to have reached no further than its original point in the village, and there to hang; while all the men who had been apprehended, being still retained in prison,—Smyne amongst the number,—our small household establishment at East Tombs was rather inconvenienced by this enforced absence of one of its most able-

bodied members. Yet Ibraheem, philanthropically anxious for the good of the impoverished Smyne family, begged my wife would not engage any one else in Smyne's place, but go on giving the wages of the absent one to the family at large; while he, Ibraheem, undertook to see that one or other member came over to do the work, to the best of his or her ability. Hence Smyne's little brothers were kept trotting backwards and forwards on all ordinary occasions; but when the washing-day came round, the day which even Smyne, despite all his boasted heroism, used invariably to fear,—declaring his arms were not strong enough for such heavy labour,—then the mother herself came over and washed; for a short space of time, too, as hard as any British washerwoman, though in a very different attitude indeed, and one not altogether describable.

Meanwhile, however, murmurings began to arise among the night-guards about their guns having been taken away; and even the Sheikh himself represented their case to us as being rather hard,—'for the Government obliged them to come out into 'the desert every night to guard us, and what had 'they to guard us with?—Nothing. In fact, the 'men were saying, that without their guns in their 'hands, they felt weak, and just like women!'

This was grievous indeed to an Arab; so we were obliged to obey the popular voice, and write a letter to the English Consul, asking him kindly to use his intervention to get the guns of at least the guardsmen

returned to them, in consideration of their Government employment. Mr. Consul Reade, too, quite in accordance with his frank and feeling nature, did take up the subject most promptly, and wrote to the Governor of Jeezeh suitably: when the Governor, on having the letter presented to him in full council, said, 'it was a very good letter,' and ordered the guns of the two Sheikhs and Alee Dobree to be given back to them, but no others. So then there was still much grumbling at East Tombs: and Reis Atfee came again and again to groan out disconsolate sentences as to its being a very bad affair; that no guns were left in the village; and how could he go out to shoot wild-ducks for the lady, when his gun was in the Governor of Jeezeh's strong room?

But to all these remarks, we offered only moral-philosophy forms of consolation; and were indeed, in our secret minds, extremely glad that an end had been put to that eternal firing of guns, that had gone on every night, and almost all night, in different parts of the plain, ever since the close of Ramadan, and up to the evening of Smyne's ill-starred dancing-party. The men of the night-guard, too, contrived to furnish themselves with some sort of weapons; and one big, long-armed man brought a huge-knobbed stick, with rusty headless nails driven purposely only about half way in, forming one of the most diabolical-looking weapons that ever a savage wielded; and the wretch described, gloatingly, what the effect was, when the jagged knob

was brought round with a great swing, which he showed us how he was in the habit of delivering upon a man's head in the dark,—playing havoc and destruction with that realm, wherein nature has enclosed reason and placed her on a throne, but whence a wild Arab is ever ready to let her out.

In fact various little indications were visible from time to time, to the effect, that if we had found the Arabs for the last three months a peaceable and so far innocent set,—the praise was less due to their own innate qualities, than to the strong Turkish government exercised over them; and which, all thanks to His Highness the Viceroy, through his officers Zeki Bey and the Governor of Jeezeh,—had let these lazzaroni of the Pyramids know so well beforehand the penalties they would incur (penalties only imaginable by a Turk, and which Turks would be sent out to inflict), if anything evil happened to us while at East Tombs,—that these gentry were on their best behaviour to us there.

Though now inhabiters of villages, it is not so very long since these men were roving Arabs of the desert; and there, they had their character thus painted by the Sieur du Mont, when travelling between Alexandria and Cairo in 1702;—'They are 'lean and black: their aspect is grim and terrible: 'they encamp in the Deserts, where they spend 'their whole lives; for when they have consumed 'the grass in one place they remove to another. 'They are perfect strangers to the knowledge of

'religion, and their only trade is to rob passengers; 'nevertheless, it must be acknowledged to their 'praise, that they kill none but Turks, and these 'only when they are disobliged by the Grand 'Signior.' Since that time, others have described the Bedouin Arabs, when entirely their own masters, as having eminently two sides to their characters: hence, they either receive a stranger hospitably, or murder him the instant they see him,—just as a straw may decide,—for it matters not to their conscience in the slightest degree which. Wherefore, had Egypt for governors any men less firm and less understanding Bedouin character than her present rulers,—the ancient valley would be more the prey of brigands than the worst regions of Southern Italy or modern Greece; and every English traveller, if not slaughtered at once for his mere clothes, would have to redeem himself from captivity at the cost of thousands of pounds, and many times over, during the course of one voyage from Cairo to Assonan.[1]

[1] During the summer of 1865, in those two professing Christian and highly-petted countries of Italy and Greece, English travellers actually *were* taken by brigands; and released only on making large payments. The Italian case has been described by Mr. Moens, its principal victim, in his interesting work, '*English Travellers and Italian Brigands*;' and we were not a little surprised to find, that the Government of King Victor Emmanuel so far encouraged brigandism, and its unhallowed profits,—eclipsing all that honest husbandmen can make,—among his subjects, and discouraged English travellers, as to let the ransom of £5100, *be* paid, and entirely at the cost of the travellers themselves. Had they not been able to pay,—and how many are the hard-working professional men amongst us, who could *not* at a moment's notice produce £5100,—their lives were to have been taken piecemeal: our own Government declining to help effectually.

But the Turks, though their methods look no methods at all in the eyes of Western Europeans, yet have ways and means of somehow or other producing the effects they require among country Arabs; ways too, which are far-reaching to a degree, and have successfully taught them during late years, for both the life and property of others, a respect that was quite unknown before. Unfortunately, though, forming such strange doctrine to these roving spirits,—that they require to have the lesson ever and anon repeated; or they will persuade themselves that it was only intended for an exceptional occasion, already passed away.

It was therefore rather fortunate for the chronicling of truth and fact, that such a philo-Arab as Mr. Lane should have had to record, on one of his visits to the Great Pyramid,—how he had to defend himself with fire-arms, when alone on the summit, from an Arab advancing on him with gun ready primed and cocked. And on another visit, how several young Arabs had discoursed on the beauty of some American ladies in a party from the United States, and wound up ingenuously with, 'Oh! the 'sword! the sword! if it were not for the Basha, 'we would have killed the men and taken the 'women captive.'

They even tried that ordinary trick on the great friend and out-and-out admirer of the 'modern 'Egyptians,' of getting him up into the dangerous position of the small passage leading to Davison's

chamber from the head of the Grand Gallery, and there demanding extra baksheesh. A great deal, too, of that sort of thing, we suspect, must go on still, whenever travellers' parties are *small;* for while we were at East Tombs, we heard, from actual subjects of them, of no less than three independent cases of a traveller being left alone and in the dark in the King's chamber,—because he would not bestow additional money, both to what he had already promised to give, and the Arabs agreed to receive, as proper payment. One of these instances was our own baker in Cairo; an enterprising, though very mild and quiet English tradesman, and a maker of remarkably good bread; but he, having on an occasion during our stay, come out to the Pyramids for a pic-nic, with a large party (as is the frequent custom with all the tradespeople of El Kahireh), and related to us, then in full security at East Tombs, his *first* sorry experience when he had performed the journey alone,—the group of Arabian children of Heth, who of course clustered around to sit in our doorway and listen to all the conversation,—these descendants of Heth smilingly acknowledged, that the story was perfectly true. And in fact, from Smyne's very intelligent manner, we rather suspected that he must have been one of the very company, who had threatened to bury the unfortunate baker alive in the dark interior of the Pyramid; and did leave him there for an hour and a half to his own unaided reflections.

A more peculiar case, however, happened before our eyes one day in March. All the large crowds of forenoon visitors had come and gone in the usual manner,—when, rather late one afternoon, was seen in the distance a very small party of Arabs and travellers moving about hither and thither in the most unaccountable manner, near the end of the northern causeway. Presently they seemed to catch sight of our tents, and made for them as straight as an arrow, the Europeans, of whom there were two only, and on foot, leading. Now it so happened that my wife and self were at the time outside photographing one of the tombs at the base of the cliff, and would much rather not have been interfered with by any stranger visitors; but as soon as the party reached the nearest rubbish mound to us, their leader called out most imploringly—

'Oh! is there any one here who can speak 'English?'

'Certainly there is, and more than one.'

'Oh! we are so glad to hear it,' responded the questioner, 'we've been so persecuted by these 'Arabs; and we were afraid they were going to 'kill us.'

We laughingly assured them of the needlessness of their fears, and having invited them to come a little nearer, through the heaps of ancient human bones that lay between,—the spokesman of the pair gave us a further account of their case in a perfect cataract of description. We had never heard so much English spoken before, in so small a space of

time, and yet not by an Englishman either. Who could he be? we thought; and his companion too, so silent by his side, and so different from him in every respect? But it all came out from the speaker in due course spontaneously.

'I'm only a poor pianoforte-maker,' said he, 'no-'thing beyond that. I am a Russian, and I am 'married and have a family in St. Petersburg, and 'was engaged there by a London house to go out to 'Calcutta, to repair pianofortes in India; and I'm 'going out now in one of the English steamers; and 'my friend here is an English navvie; he is being 'sent out by the English Government to work on 'railways in Ceylon; I never saw him before going 'on board the steamer, but we became great friends, 'and we go everywhere together, and we are living 'in a hotel in Cairo, until it is time to start for 'Suez. It's only a "second-class" hotel, but they 'charge us twelve shillings a day, and it quite ruins 'us; and I don't know where all the people who are 'there can come from or how they get their money, 'for every room is full, with at least half a dozen 'sleeping in it, and there are others always drinking 'and fighting in the passages. So my friend and I, we 'thought we must go and see the Pyramids before 'leaving Egypt; and we walked out all the way, and 'got on extremely well until we had just reached the 'edge of the sand-plain, and then these Arabs came 'down upon us, and would not let us go any way, 'where we wanted to go,—without paying them 'money; and I gave them all the silver I had,

'which was eighteenpence; but they said they must 'have ten shillings, or we should never be allowed 'to go near the Pyramid; and I offered to give 'them my silk handkerchief, but they said they 'must have gold, and they were beginning to 'threaten to take our lives for gold,—when all 'of a sudden we saw your tents, and made straight 'to them.'

Thus rolled on the rapid volume of the Russian's talk in English; while the Englishman, looking something like a very stout mate of a collier-brig, but dressed in brown in place of blue cloth, seemed quite content to let all the talking, even in his own mother tongue, be performed by the Russian, who certainly had the natural gift of language to a remarkable degree; while he, the Britisher, merely gave out an affirmative grunt now and then, twitching up his trousers, and remarking, 'Yes, just so;' or, 'They 're queer customers,' meaning the Arabs, but not allowing himself a sufficient number of words to express the whole sentence. But a man of immense bulk of muscle, was this navvie in his holiday attire, as the Arabs would doubtless have experienced, if they had actually got to the length of blows,—while the poor pianoforte-maker was as delicately put together, as the keys and sensitive strings of one of his own vibrating instruments.

So we explained to the Arabs that these were poor men, who could not give anything more than they had already given; and that they needed no guiding from any one else, for we would send Alee

Dobree to take them up to the Pyramid at our expense. This, accordingly, was done, and the indissoluble pair of friends, with diverse gifts, was further invited to a special tea, to be got up for them in East Tombs against their return. And they did return to it, and disposed of its items very energetically; the Russian talking eloquently and fervently all the time,—describing their pleasure, their thanks, and the gratification of having at last seen the Pyramids, and touched them; wherefore he had given the Arab his silk handkerchief after all; and he concluded with writing us a memorial note in the Russian character. While, as for Mr. Navvie, he might have been deeply impressed by what he had seen, and did look superb content; but cared not to utter his thoughts either in one word or two.

As they had a long walk before them, this faithful pair started off quickly after their refreshment,—but were hardly clear of the sand-hills in front of East Tombs, when all their previous knot of Arab persecutors, with big iron-shod sticks, started out from various places of hiding in pursuit of them. The poor pianoforte-maker fled at once, at a great pace, and in so doing, took a wrong track over the plain; but the navvie would not quicken his pace in the smallest degree for all the threatening cloud of tormentors; and so he followed on slowly and leisurely, a moving tower of strength behind his mentally and nervously gifted friend.[1] Hereupon,

[1] This pair formed quite an example in *petto*, of what we subsequently heard the American people had discovered towards the close of

Alee Dobree was instructed to call out to *those* Arabs 'to come back, for the lady was going to pay the 'usual fees for these two poor travellers, who could 'not pay for themselves.' So then, and not till then, the ruffian crew returned; and who should be chief among them, but the dreadful old Arab of our first day's acquaintance on Pyramid hill,—the sinister-visaged reprobate of the vertically-wrinkled forehead. My wife, however, produced the money, to be divided amongst the set; and I, further to insure their not following the two travellers, requested the honour of photographing the group then and there, under the base of Pyramid hill. They entered into the notion, too, rather interestedly; and it was a sight worth paying for, to see how the old sinner placed himself at the head of the party, and threw back his turbaned head in conceit, until his long pointed grey beard stood projecting outwards in front of him almost in a horizontal direction; and, but for the Basha, he was monarch of all he surveyed, either in the blue sky above, or the yellow earth beneath.

Some happier characteristics, however, there were about Alee Dobree; he could not indeed resist the temptation of at any time deserting his engagements in the chance of receiving baksheesh, for helping

their four years' war: 'Why,' said they then, when, after innumerable trials, they had got some most splendid working and soldier-like generals and officers; 'why! the war has actually brought to the 'surface, men who cannot talk: men who cannot put three words 'together in public, and could not say anything if set upon a stump!'

all newly arrived travellers up the Pyramid ; but, when he was employed by my wife, during Smyne's long confinement in prison, to go into Cairo on some of the ordinary shopping business, he brought everything at such low prices, and produced such full change in silver, for all the gold he had been intrusted with,—that she was perfectly astonished, after her experience of all her other messengers. The truth was, he had a soul above petty cheating, picking, and stealing after the Egyptian manner, in the small necessaries of life ; and we were inclined to attribute the solitary elevation of his character in this particular, to his descent by two generations from a great Sheikh of the Libyan desert.

This chieftain of a roving tribe, having found the sandy plain less and less capable of affording sustenance to his followers and their flocks, took advantage of the unsettled state of the country, subsequent to Bonaparte's expedition, and settled himself in one of the villages near the Pyramid ; identifying himself with its people, by marrying a daughter of their Sheikh, and contributing his live stock and herdsmen to cultivate their half desolate lands. A joint-stock proceeding which answered so well,—that one grandson, Abdul Samed, is the present Pyramid Sheikh of the northern El Kafr ; and another, Alee Dobree, is alone, of all the village population, allowed by the Government to retain his gun. A very curious machine, too, is that gun ; its barrel, a long thin tube bound about with metal thread ;

and, from the smallness of its bore, quite realizing what a superintendent of the electric telegraph had told us, of a grand fight he had been in near Suez, with a whole tribe of Arabs,—who had come down on the line there, and begun to cut up its stout iron wires to make ramrods, of all things, for their guns.

Meanwhile, the season was advancing with us apace; poor Alee, the sick man, yet trusty day-guard, had, early in March, frequently brought to my wife little presentation bunches of corn, fully grown, and beginning to ripen; while Alee Dobree, with rather more understanding of European tastes, brought nosegays of a small purple, sweet-scented Iris, growing in large quantities, but with most short-lived flowers, over all the grass land under the inundation level: the very originals probably were these Irises, of the ancient flowers after which 'Goshen' was once named in hieroglyphics, 'the land 'of flowers.' Or occasionally, he would show his appreciation of scientific notions, by bringing from the sand-hills a root of creeping grass, looking like a straw-coloured rope, about twenty feet long, and just ready to send out tufts of prickly leaves at every knot along its whole length.

These seasonable demonstrations were the result of the thermometer having progressively risen to daily maxima considerably above 70°, with minima seldom now below 56°; but when for two or three days the minimum had not been below 60°, and the maximum rising above 80°, had at last reached 88°

(in the shade of course), the next morning after that,—having gone out to procure dry-plate photographs in the plain north-east of the Pyramid,—behold every here and there a long cork-screw-like track through the sand, and continuing in one uniform wavy line as far as one could see.

'What is all this, Alee?' we asked.

'Oh, the snakes are out,' said he. 'They have 'been sleeping in the sand all the winter through; 'and now they are awakened by the heat, and are 'going about to see what they can get to eat.'

We pursued one of the lengthy cork-screw markings, which looked only just executed, hoping to see what sort of snake; but after following the trail several hundred feet, lo! all of a sudden it terminated, and the sand round about there, was pure, and markless of anything whatever corporeal having passed that way. Had the creature at that spot taken wings and become a flying dragon, or had it suddenly exploded into thin air? We dug with the pointed camera legs into the loose soil, but could not find anything more; so we concluded finally, that we must have followed its track backwards to where it had that morning risen to the surface of the sand, and then, obeying its leading instinct, had made straight for the cultivated fields in search either of water or frogs.

But in all directions, within three days, snake-tracks were to be seen; and some of them must have been rather stupidly directed too, for Alee

Dobree came one of these days looking quite mournful, 'There's a snake fallen into the well 'at King Shafre's tomb,' said he, 'and it's swim-'ming about and trying to keep its head above 'the water, but it will not be able to do so much 'longer:' and then next day he reported, 'There's 'a great snake tumbled into Campbell's tomb, and 'it will never be able to get out; it's certain to 'die.' No long time passed, moreover, without one and another snake being killed at East Tombs; but they seemed young, ignorant, and we hoped innocent things. At all events, when one night my wife was greatly alarmed at an apparition in the bedroom tomb, and Ibraheem handed in his charcoal tongs to me through the canvas door, I seized the creature therewith by the neck, and it proved merely to be a lizard,—for the lizards were also arisen from their dormant state; and if it was written nearly three thousand years ago of the lizard, 'It is a weak thing, and yet inhabits kings' 'palaces,' shall it not be found also in an ancient tomb?

The actual passage, indeed, in King Solomon's Proverbs, as rendered by the English authorized version, is (chap. xxx. 28),—

> 'The *spider* taketh hold with her hands,
> And is in kings' palaces,'

but Herder translates the original into—

> 'The lizard,—one may seize it with his hand,
> And yet it dwells in royal palaces,'

and a commentator has added, that the whole com-

parison of the 'four things that are little on the 'earth, but wiser than the wisest,' was perhaps made on account of the last, or the lizard; when an animal of that sort (which in warm climates lives in the walls,—runs up them as easily, and by means of the same sort of sucker-feet, as a fly up a pane of glass,—and is very annoying) made its appearance suddenly on the side of that chamber, wherein 'the sage Agur the son of Jakeh' was discoursing lofty sentiments, and inculcating modesty at the same time to his pupils desirous to be wise.

The poor lizard's portrait, though, depends much on the artist who paints it,—and Dr. Clarke wrote of the tribe: 'A singular species of lizard (in the hot 'weather in Cairo) made its appearance in every 'chamber, having circular membranes at the ex-'tremity of its feet, which gave it such tenacity, 'that it walked upon window-panes of glass, or 'upon the surfaces of pendant mirrors. This *re-'volting* sight was common to every apartment, 'whether in the houses of the rich or of the poor.'

But a Frenchman residing in the same city, when Professor Greaves was there,—seemed to have made pets of the harmless creatures, and even to have studied their amusement; for thus the Oxford astronomer describes what he saw,—'He (the 'Frenchman) had many four-legged serpents, black-'ish, with long knotty tails, ending in a point 'obtuse. These are something like the crocodile, 'but differ in the head, and tail, and skin. These

'serpents, when the weather is hot, would, upon 'musick, come out, and run upon him; but in the 'winter they lie as dead. Yet some of them will 'scramble a little and move. Of all musick they 'love the bagpipe best.'

With the increase of heat, too, on the Pyramid hill, ants began to abound more and more, but not to any repulsive degree; for there were no colonies of them working by thousands or millions; and the chief member of the family was a large, long-legged creature, usually solitary, but dashing about at a perpetual run, now here, now there, sometimes seizing on another ant and carrying him off all alive, sometimes on a bread-crumb, or sometimes on a date-husk; and though many times bigger than itself, yet lugging the burden along gallantly, and pushing or dragging it up the most impossible places; sometimes trying it one way and sometimes another, but never asking help from any companion, and always the more violently active the more ferociously hot and burning the day.

This was indeed an *ant*, to which the *sluggard* might look with advantage; and had only its exciting example been better pondered by modern Egyptians, a European traveller would not have had to write, that 'all of them (*i.e.*, natives of Egypt), 'excepting only the Arabs, have one grand and 'ruling idea: viz., to exist without exertion of 'any kind, and to pass whole days upon beds and 'cushions, — smoking and counting beads.' The

same author, too, though he confesses 'he does not 'know how it comes about, whether from climate, 'education, or government,'—yet is certain that 'this 'Egyptian genius for perseveringly doing nothing, 'can be perfectly well acquired by residing amongst 'the native inhabitants of Cairo; as proved,' he says, 'abundantly, from the appearance he saw 'exhibited day after day by Europeans, who have 'passed some years in the city.'

But in that damp and shaded conglomeration of ill-drained and unhealthy abodes, the inhabitants do not see anything of this paragon of industry and marvel of truly superhuman activity, the long-legged, self-helping, ant of the Pyramid.

Every available afternoon, though, in spite of the heat, we still went out for walks in some direction bearing upon Pyramid objects: and thus, on one occasion, ascended the steep hill, with the masonry-looking northern escarpment, that rises immediately south of the group of palm-trees, and upon which hill the southern causeway trends. Quite interesting enough in its display of fossil shells towards the summit, to repay a climb, was this hill; yet even more deserving of a visit, and a long-continued one, on account of the magnificent view it gives of the three great Pyramids, and almost all their field of sepulchres, at one glance; this grandly cumulative effect, arising from the general slope of all the Pyramid ground which takes place towards this

direction, combined with that slope,—richly tomb-covered,—being looked at from a considerable height.

From here, therefore,—and from this point alone of all other 'airts,' is it possible,—you scan the whole foreground of the scene, without missing anything, right up to the root of the Pyramid itself; and can thus form good comparative ideas of the sizes of the various tombs about. Then, the Sphinx is seen of its true magnitude; not as when a photographer puts up his camera close to it, and by exaggerating its angular subtense, makes the Great Pyramid appear only a small adjunct in the distance; but as merely one, amongst hosts of tombs and monuments near the base of the hill; and, in so far as there is any human face at all to the creature, looking, with its protruding mouth and sensual chin,—black too, in the shade of the western sun,—of even lower than negro organization. But the main effect to appreciate from this point, is the general ransacking that has been enacted of all the tombs of the Pyramid hill; for its whole slope has been so dug into and turned inside out by generations of resurrectionists, working continually and without shame in the light of day, that they have made the region in form to resemble a volcanic production; such as that remarkable one in Mexico described by Humboldt, where the whole plain is nothing but a collection of little craters or 'hornitoes,' with their central holes or pits, and then the rings of ejected heaped-up matter. (See Map, Plate II.)

A more important expedition was to some other hills, several miles farther to the south, and where Alee had reported many large shells were to be found. To this end, he produced, for my wife's riding, his own donkey ; a docile thing, remarkably clean-limbed and neat-footed, but only about half as large again as a Newfoundland dog ; with a sack tied over its back for a saddle, and no attempt whatever at bridle or halter; but it seemed to understand its duty in life wonderfully ; and it must fill in an Egyptian Arab's domestic circle something of the place forbidden to dogs,—besides being more actually useful. The rest of the party walked,—and either admired the distribution of fine sand, and coarse sand, *i.e.*, little pebbles neatly arranged in different tracts by the winds ; or, if active enough, caught some of the black and white beetles, which, instead of walking or crawling, ran with inconceivable rapidity over the ground,—until we reached a projecting portion of the low sloping desert hills, and commenced to ascend their stony flanks.

Gradually among the stones we began to see fragments of echini, and then casts of univalve spiry shells, and in a few minutes more, having arrived at a part where the crust of the ground had been broken up, partly artificially, partly naturally,—we found ourselves actually trampling on shells in all directions. The chief part of them were of a handsome cardium order, of various sizes up to three and four inches in diameter ; sometimes agglomerated

together loosely in masses of hundreds, at others lying about single, exquisite in form, and retaining much of their ancient gloss and pink colour, but all the ground about them formed of comminuted shells. We had been on many modern sea-beaches, but had never seen the hundredth part of the richness there in sea-shells, possessed by these dry desert hills, which are more than one hundred and twenty miles from the Mediterranean now; and yet the shells were so recent geologically, that one involuntarily compared them to the present productions of the sea, though knowing all the time that they were essentially fossil, probably of the pliocene age. Here and there were regions, where the delicate pink cardium gave way to large numbers of strong-built blue mussel-looking shells; and underneath the surface stratum,—which practically consisted of nothing but shells,—there was a depth of greenish sand, in which magnificent hard petrified echini were found, about five inches in diameter; each perfect, unless a chance blow of the pick alighting on it while still unseen in the sand, it was sent into shivers; but then displaying the structure of its *interior* with exquisite physiological ramifications.

What a scene of life and antiquity was all this, within sight of, but so much earlier than, the Great Pyramid! We wondered if its builders had paid any attention in their day, to those beautiful forms of an earlier period of the world's history. The tomb-decorators of that humanly primeval age,

and the general artists of subsequent Egyptian times, were certainly very fond of painting a *five-rayed* star; and on the upper surface of this echinus, is a grand five-rayed star, which was certainly depicted before those men lived.[1] Nay, more still, each linear ray of the echinus star is decorated on either side by organic markings, which look amazingly like the outlining of the pinion feathers in the decorating wings, which those industrious Mizraite idolaters attached to the arms of Isis, and many others of their lesser divinities.

Next day, there was a notable experiment to try, on the internal temperature of the Pyramid. To take a thermometer into the King's chamber,—is only to record an exceptional effect connected with its present forced and anomalous circumstances; but we hoped, by pouring water down the air-channels, from the outside, and then catching it as it came inside in the neighbourhood of the King's chamber, after passing along nearly two hundred feet of stone channel,—that something like the mean temperature of the higher part of the body of the Pyramid, would be obtained. Extra hands were therefore engaged to carry water at once from the plain, up to the foot of the Pyramid; these hands including not only several small Smynes, but Fatmeh, wife of Alee the day-guard, who was anxious to win some

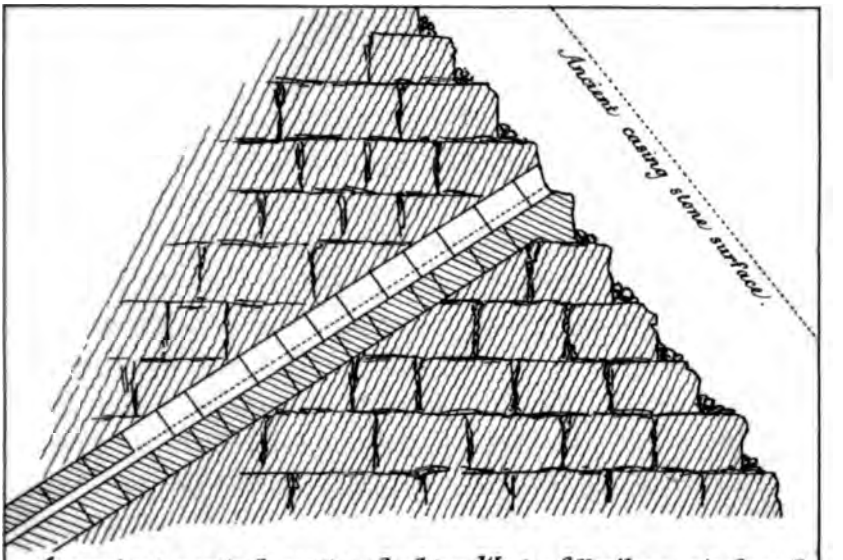
[1] In the Assyrian and Chaldean sculptures, stars of three, four, six, and eight rays are prominent; but I am not aware of any with five rays.

extra pay for her poor husband, and was kindly regarded by all the party therefor. The water having after that, been further carried from the Pyramid foot, upwards, by able-bodied men,—the arrangement was for them, at a certain time, per watch, to pour down six bucketsful, one after the other, into the mouth of the northern air-channel outside ; while I, having previously taken up my position inside, at the farthest point of Caviglia's forced passage, through the western wall of the antechamber,—was to await there the result, and test it with a variety of thermometers ; doubting all the time, though, whether some of them would not be swept away by the torrent to come, before its temperature could be well ascertained. (See Plates III. and IV.)

My wife, too, became so much interested in the affair, that, not content with remaining near the entrance, to give the signal for pouring down the water, she climbed up to make sure the buckets were emptied down at the exact second by watch ; being perhaps the first lady who has ever seen the air-channel mouth. A place of peculiar Great-Pyramid arrangement and economy,—but having this notable difficulty, that all over the middle of the northern face of the Pyramid, its component stones are so lamentably decayed and weathered away, from regular steps into an ugly slope,—that few travellers of any kind ever venture themselves there. Yet, with the assistance of the expert Alee Dobree, the Arab, on one side ; and on the other, a second

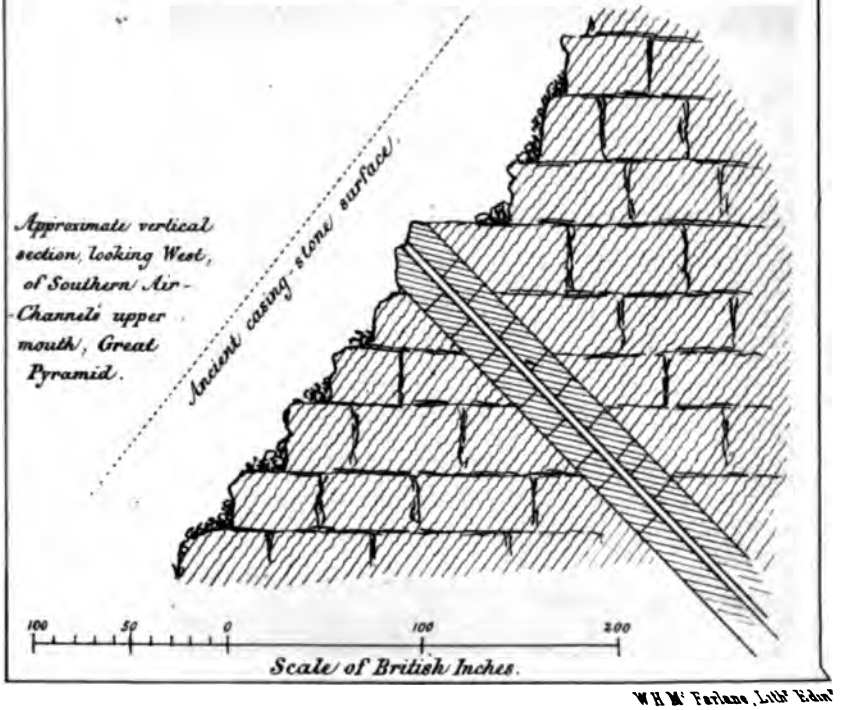
Alee,—or as they called him, Alee the Egyptian, or the Fellah, and laughed at him exceedingly on that account, but a man of Herculean build, understanding the climbing of a Pyramid from his infancy, and supporting or lifting another person's weight so gently, as if it were but a feather to him,—with the aid of these two, the lady now reached the elevated and dangerous situation in safety. And then, giving the time to the men from her watch, she saw each of the bucket-bearers creep down the first forced and enlarged part of that air-channel, a steep 33° slope, and discharge the contents of his bucket direct into the narrow mouth of the untouched portion of the channel lower down,—where it is a neatly cut square trough, carved (as far as one can see), through the substance of large, firm, and well-fitted blocks of good Mokattam stone. (See Plate VIII.)

Meanwhile, I was remaining inside, some two hundred feet lower down, and in the heart of the Pyramid,—at the very place where Colonel Howard Vyse, after his first clearing of the channel, had found that water passed down quickly from above; 'showing,' as he said, 'that there are no intervening rooms 'or cavities.' But on this occasion, not a drop came; and all that I had to observe, was the gradual increase of temperature in the confined and unventilated hole, recently formed in the course of the very ventilating channel of ancient times; an increase of temperature caused by both myself and three lighted candles, throwing out heat every



Approximate vertical section looking West of Northern air-channels upper mouth of Great Pyramid.

(The joints not put in from any measure.)

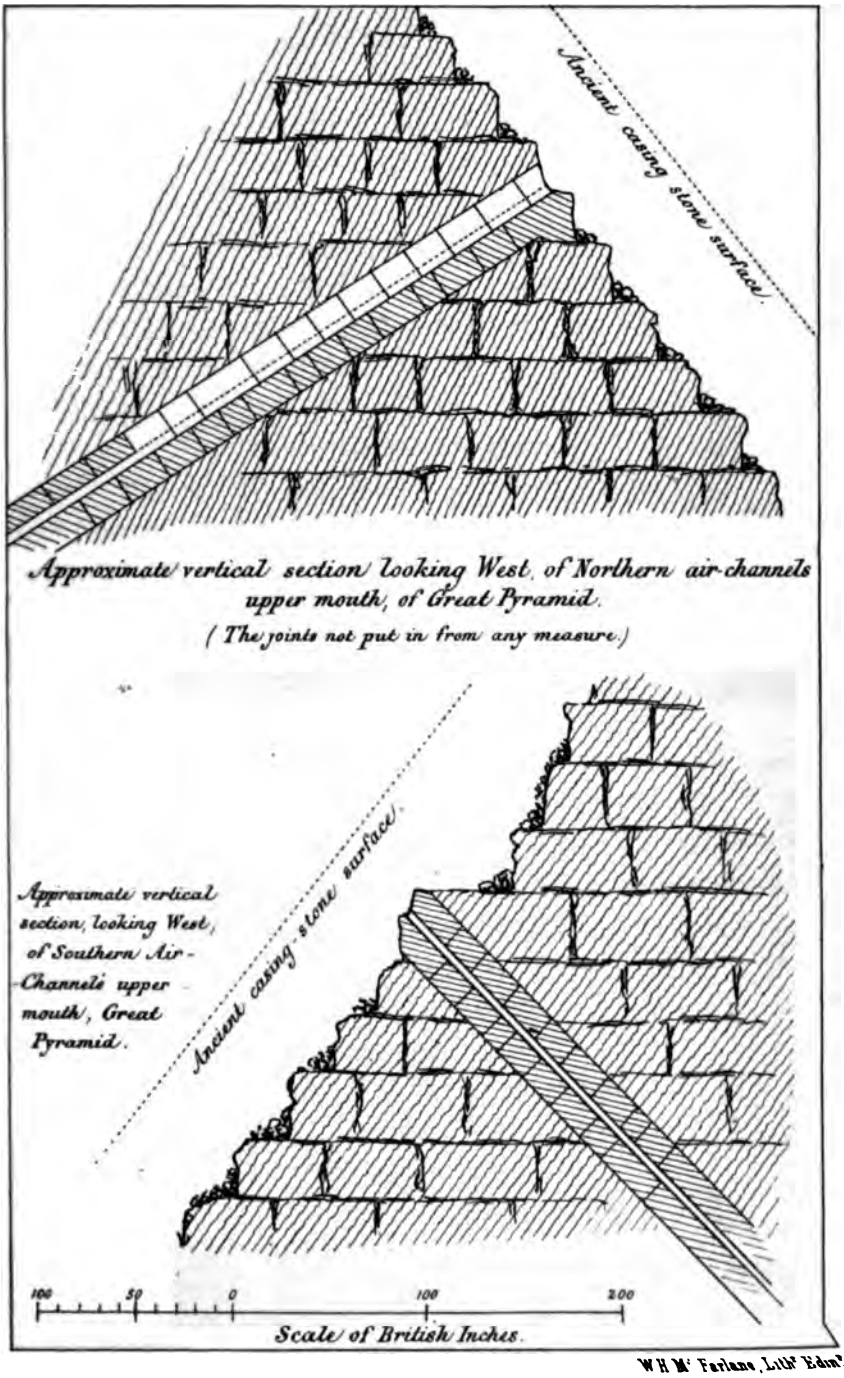


W.H.Mc Farlane, Lith. Edin.

moment, in that contracted space, surrounded with almost infinite non-conducting matter on every side, and no opportunity of radiating externally.

After two hours, the watching for a single trickling drop of water coming through, was given up; but the place was visited again that evening, and again the next morning, though with the same negative result. So we concluded that the north air-channel is at present hopelessly plugged up; and at some part or other, a long way down its tube.

Then we turned our attention to the south air-channel; and all the native portion of the party seemed to think their honour quite at stake, if they could not make water run through there. Old Ibraheem was continually coming to us with theories of his own, beginning with, 'Excuse me, sir, but if all 'the men were to pour *very* quickly one after the 'other,—that 's the way to make water run in this 'country.' He did not, however, think lightly of the practical accession afforded to our means of carrying water across the plain, in one of the large tin cans for lamp-oil: for this vessel having been at last exhausted of its original contents, and therefore, after being well cleaned out, brought into use as a water-carrier on this occasion,—was found to be immensely preferred by all the Egyptian children to any of the heavy, thick-sided, earthenware vessels of their own country's clumsy manufacture. Then, too, Alee Dobree borrowed the portable bath out of the bedroom tomb; and got it carried up the Pyramid



W. H. M.ᶜ Farlane, Lith.ʳ Edin.ʳ

side, and fixed in position just over the south air-channel mouth, so that it might be filled there by degrees, and form a local supply, ready for a sudden discharge. (See Plate VIII.)

One of the additional hands he had engaged for this purpose was his brother-in-law Abduwahad; but the poor youth, never at any time very bright or active, had gone half-demented ever since the unaccountable murder of his betrothed in the village: and now his craze seemed to be, because he was a trifle less dark-brown than his fellows, to fancy himself a white European. And therewith he would sit on the sunny side of the Pyramid, letting down his folding dress to expose now one shoulder and now another to view, in accordance with his ideas of the European manly manner. Perhaps, too, he was right in the fact, only a couple of thousand years after date; for when the city of Lyons was founded under Augustus Cæsar, the commander of the Roman legions in Gaul, L. Munatius Plancus, and the other generals and senators present on that memorable occasion, wore dresses which the ladies would *now* deem 'uncommonly low;' and the date of that event was, to an Egyptian, quite recent; in fact, an affair of only the other day.

But with the assistance of more able-bodied men, Alee Dobree got the portable bath filled at last in its elevated position, and then discharged down the very steep trough (46°, as a very enthusiastic traveller, Mr. Smyth of Lincolnshire, who visited us at

East Tombs in February, ascertained it to be by direct application of a small clinometer),—and about half an hour afterwards, water began to trickle slowly through the south air-channel's lower mouth, and to fall on the floor of the King's chamber. But it came so slowly, that it seemed unable to bring the temperature of the upper parts of the Pyramid along with it, and only gave out that which was shared by the stones closely adjoining the spot where the oozing forth took place.

However, that was a finishing off of what little we could do with the air-channels in their present wholly, or partially, stopped state: and we next turned to a case of angular measurement outside the Great Pyramid.

This new subject was, to ascertain the exact azimuthal angles of those large trenches on the east front of the Pyramid, which Reis Alee Shafei and his little men had been clearing out for us, near their terminations, as mentioned in chap. vi., p. 134. The *linear* measures of the trenches had been taken at that period sufficiently; but now came the *angles*, both as to each other and the astronomical meridian. Carefully, therefore, through the day, was the middle of every trench end marked, and a round pole set up there; for towards such a useful, but, at the time we left Scotland, totally unexpected purpose,—it so chanced that we had the eight ashen poles, of a peculiar build of tent, which

our friend R. M. Smith, Esq., of Edinburgh, having himself used in Iceland, pressed us to take the loan of for Egypt. We had brought it with us accordingly: but on Pyramid hill, where ancient tombs are so much better than tents, the canvas bundle was found most serviceable, simply in shape of a *bundle*, being then used as a seat for Sheikhs when they called upon us; and these grandly-robed men used to take to it very kindly, while their followers had to sit on the bare rock outside. While now, the lathe-turned wooden poles of the same tent, made more accurate signal-staves than anything else that all the ten nearest Egyptian villages could have furnished, even at the call of the Basha himself.

Towards four o'clock in the afternoon, or when the 'Asr' had arrived,—that division of time nearly midway between noon and sunset, when the Arabs, having got through all their afternoon siestas, ablutions, and prayers, are ready for another, but only a moderate turn of work,—we proceeded with the angular instrument to the central station among the trenches, to make the observations required; hoping too for comfort extraordinary, because that part of the ground would then be in the shadow of the great mass of the Pyramid, as thrown by the westering sun. (See Map in Plate II.)

Well, in the shadow it was; but that did not prevent the temperature going up to 92°, 93°, 94°; why, where is it going up to? we thought, and what is the meaning of this, that in proportion as the sun

goes down low in the sky, so does the temperature continually rise? The fact is, that one of the hot winds of the desert was then beginning to blow; and was bringing to us, not only the heat of a more southern parallel of latitude, but the physical circumstances of a region approximating to an earth without water; and *that*, in all Egyptian latitudes, is something very tremendous indeed, as well as happily not often endured.

In a natural-philosophy point of view, this want of water effect is a sufficiently interesting inquiry, and was first treated of very seriously by Principal Forbes in the Transactions of the Royal Society of Edinburgh; with the result of showing, that near the latitude of 45°, mean temperatures are the same, whether the relative proportion of land to sea, in the parallel, is large or small; but that, north of such a position, a large proportion of land is invariably accompanied by a lowering, and south of it, with a rising, of the mean temperature; and to such a notable degree, as to form a most powerful climatic influence on the earth as it is.

To take, however, only the case before us at the Great Pyramid,—and, supposing land and sea fairly and pleasantly divided all around and beyond it on every side,—the mean temperature of the year, and therefore a very fair representation of the particular temperature for March 23d, should be (*i.e.*, of the mean for the day and at the sea-level) about 69° Fahrenheit. Whence, then, comes,—though with a

semi-diurnal range of 8° or 9°, and even near the time of the sun going down,—that burning, red-hot day, of above 94°?

The wind, blowing from the south-west at the time, was bringing us the temperature of a more southern parallel; but even if it had brought us undiminished the temperature due to a position three hundred miles farther south,—that would only have raised the above 69° to 72°; or if of seven hundred miles south, only to 76·6°; and that would have required the wind to have been blowing in the southerly direction, for full three days, when it had actually only been so blowing for six hours, besides some other impossible circumstances. The mere latitude-angle variation therefore, of a purely solar climate of the *general* earth, was by no means sufficient to explain the temperature felt.

Let us now, however, try the effect of the only recently acknowledged principle of an excess of earth to sea in the parallels concerned,—and we find, that for the Pyramid latitude, the mean temperature may then be raised to 81°; at three hundred miles south to 86°; and at seven hundred miles south to 97°. And to these 'excessive quantities,' we may perhaps add, in such a region, 'at least;' for the observations on which the above results are founded, were by no means made in localities where the circumstances were so nearly those of an earth without water, as are unhappily many parts of the tract swept over by the Pyramid south-west wind. The

theory, indeed, admits of neighbouring parallels having sea to land in any proportion you like; when watery vapour is never far off, to modify the solar temperature in that happy manner so necessary to all life. But when for a great space to the east, the west, the north, and the south, there is nothing but one arid earth under the cloudless parallel of 25°, the very last atoms of moisture seem to be exhausted; and the atmosphere of such a region then becomes,—or without the acting of such regular and long-continued currents as the trade-winds, is always in danger of becoming,—a medium merely of dry, scorching, permanent gas; totally unfit, therefore, for man, quite irrespective of temperature,—though that does then range also dangerously high, and very much higher than ever experienced under the rainy equator.

From this point of view, then, we may quite well explain the relations of some travellers, from Bruce in Africa to Palgrave in Arabia, as to the simoom or poisoned wind; one of the efforts of nature, under a high unclouded sun, and in the midst of desert sands, to get rid, in a certain confined tract of air, of the last vestige of heavenly moisture. A fearful trial, is this simoom, for living man to have to pass through; there is not much velocity in the wind, no sand or dust in the air, yet[1] 'the horizon darkens 'to a deep violet hue, and seems to draw in like a 'curtain on every side;' for the gas, unpenetrated

[1] Palgrave's *Central Arabia*, vol. i. pp. 18, 19.

by watery vapour, is coloured; then 'a still heat, 'like that of red-hot iron slowly passing over the 'prostrate forms of men and beasts, is alone to be 'felt;' and when at last the ordinary trade-wind begins again to blow, and, interchanging many films of air from a distance, restores the moist element, and with it the light of day,—the survivors arise, 'half-dead with exhaustion, and looking more like 'corpses than living men.'

Quite similar as to the colour, is Bruce's account of the simoom, or dry gas air; for again and again 'when Idris cried with a loud voice, "Fall on your '"faces, for here is the simoom;"' the great traveller describes, 'and I saw from the south-east a 'haze come, in colour like the purple part of a rain-'bow: it was a kind of blush upon the air.' And though a moderate amount of drying of the atmosphere is very good as a disinfectant, this absolute drought, was as bad for the interior organs of living man, as taking oxygen in the concentrated form of nitric acid. Hence the attribution of a poisonous quality to the simoom; and,—while the merely mechanical disturbances of whirlwinds and moving pillars and clouds of sand were soon forgotten,—only a small mouthful of simoom which the great traveller took into his lungs, produced an effect which he did not get rid of until two years after, and then by dint of gentle stewing in the tepid baths of Poretta in Italy; while from his memory, it was never discharged,—resulting in his descriptions of his suffer-

ings, 'in passing through melancholy and dreary 'deserts, glowing with eternal sunbeams, and venti-'lated with poisonous winds,'—or, infested 'with all 'that is terrible to the feelings, prejudicial to the 'health, and fatal to the life of man.'

At the Pyramid, there was nothing so severe as this; but when near sunset, the thermometer appeared above 94°, and the bubble of the spirit-level was momentarily contracting from the expansion of its fluid, so that I was doubting every moment whether I should not take off the instrument, and bury it deep in the earth, or somewhere or other out of reach of this fearful and anomalous heat,—all of a sudden, the most delightfully cool fresh breeze blew on my face,—I darted to look at the thermometer, and lo! it had gone down to 91°, and the spirit-level was saved for that occasion.

Shortly after, too, we caught sight of the Polar star in the bright twilight sky; compared it with the signal-staves of the trenches again and again; and then packed up the instrument, and sent it quickly to East Tombs, by the various men who had been engaged for the portage,—but who had been, during the last half-hour, greatly divided in their minds as to whether to begin their evening prostrations towards Mecca then and there at the trenches, while observations were going on,—or, to wait until the day's work was completely over.

Alee Dobree, however, had remained rather behind the others; and as my wife and self were on

our way home, bringing up the rear,—we suddenly, on passing over a tomb-hill, came full upon him in single combat with an enormous cobra. The cobra, with expanded neck, had reared on his tail in most approved manner for striking, but Alee let fly at him with one of Mr. R. M. Smith's stout ashen tent-poles, in such vigorous manner, that the contest was over almost as soon as it was begun; and though the tail of the animal did move on being touched, when we came up,—Alee explained that that was only the residual life therein; the main life, that of the head, now smashed as flat as a pancake, having departed long ago.

The snake was such an unusually large one, that Alee carried it to East Tombs rather proudly on the end of the long stick; and we looked forward to photographing it next morning with measuring-rods placed alongside it, as an appropriate tribute to Mr. Joseph Sidebotham's method, and recommendation to all photographers. But when morning came, what was our annoyance to hear, that the ancient Ibraheem had carefully carried the carcase to a distance the previous night, and thrown it down a sepulchral pit some seventy feet deep.

'What had he done that for?'

'Excuse me,' he began, and then went on with a long series of stories about snakes; 'and how, if a 'great snake is killed, and its body remains in the 'neighbourhood,—the *wife of the snake* comes at 'night, and mortally bites every one all round

'about the place where her husband died.' And our prophet even went on to describe his own past experiences of the terrific nature of her, the wife of the snake's, inevitable revenge, and her marvellous subtilty against the children of men,—until we began to think that this was a land where, though 'Allah' is worshipped by day, the serpent is the power that is feared at night.

CHAPTER XV.

ASTRONOMICAL OBSERVATIONS.

From the first week in March, I had been practising every fine night at East Tombs the art of taking observations with a certain altitude and azimuth instrument of rather large size, known to us as the 'Playfair;' and the period of full moon—the glorious full moon too of an almost tropical region—had been chosen for this purpose, so that there might be light enough to assist in finding out how to manage one of the most powerful, but most complicatedly curious of so-called portable instruments ever employed in travelling astronomy.

Such a one had been brought to the Pyramids, because, not only was it the alone movable instrument possessed by the Royal Observatory of Edinburgh, and a first-rate one too,—but because there was that melancholy claim about it in the eyes of any earnest practical astronomer, of its having existed in the world for nearly two generations of men, or fifty-nine years, and never having been employed during all that interval in making a single recorded observation under the blue sky of heaven—not one

measure whether of the burning sun by day or the shining stars by night. In fact, it was a grievous case of a fine astronomical instrument going to its inevitable latter end of decay, without having fulfilled its mission.

Yet it was a splendid instrument, or had been deemed so once; for it had been procured from Troughton, without regard to expense, and presented to the great Playfair, as an engraved silver plate still records, by a number of admiring students in his class of Natural Philosophy in the University of Edinburgh, in the year 1806. Confessed, too, it was by all who then beheld it, to be an irreproachable astronomical circle; and certainly the chief ornament of the principal Scottish Natural Philosophy Museum for years and years. At Playfair's death, the instrument was conveyed over to the Astronomical Institution of Edinburgh, of which he had become the President during the latter years of his studious life; and in one corner of whose Observatory's enclosing walls on the Calton Hill, a classic monument to the great native mathematician of that age was soon after erected, in the fair, white sandstone of Modern Athens. Years passed, and the Astronomical Institution having succeeded in the grand object of its existence,—in not only building a large Observatory, but getting the Government to adopt it as 'The Royal Observatory of Scotland for all time 'future,'—closed its honourable and useful career, leaving the Playfair instrument, amongst other valu-

able property, to the care of Scotland's then newly-appointed Astronomer-Royal,—the late inimitable Professor Henderson.

Cared for by him the instrument was, and respected for its descent, but no actual use had ever turned up for it; and it was still, long after his premature and much-lamented demise, merely an ornamental furnishing of a chamber, to be idly, though admiringly, looked at,—until this proposed visit to the Great Pyramid in 1865 came to be agitated. But that was surely a noble occasion, and well worth the instrument's while to have waited for so long; because, if it could only procure for men good determinations of the astronomical requirements there, its latter age might then be passed in honoured repose.

Now hitherto, the instrument had always existed in one grand piece, or in a completely set-up state, as if ready for immediate observing; and it possessed a great mahogany case for itself as tall as a sideboard. But to prepare for travelling to Egypt, the whole construction was divided into three parts, each of which was furnished with a strong deal box suited to its figure, while the tripod stand formed a fourth package, and the levels, lamp, and other small matters a fifth. Thus packed, it had travelled as yet with perfect safety; and when duly put together upon its stand on the cliff ledge at East Tombs, displaying its large telescope, its two double circles of bright brass, silver divided, and reading off by glittering microscope micrometers for both vertical

and horizontal angles,—the Arabs were positively astounded, and talked earnestly to each other touching what other gorgeous things might yet be contained in some of the long boxes in the Howard Vyse instrument-room.

So much for the triumph, if that had ever been looked for by the maker, in the construction of the instrument; but then came the trial, when an observation had to be made, and every part was found to be curiously arranged, as if to consume the utmost amount of time, in overcoming the almost impossibility of there effecting what should be the simplest and most straightforward proceeding possible. The microscopes, of course, had long since been deranged, and having to be adjusted for focus, 'runs,' and position were found capable, on the slightest touch, of being made to deviate anywhere whatever; and, after an immense number of trials, having been brought by happy coincidences somewhat close in most of their elements, were then found to have no means of ascertaining what degree of the whole 360 was being observed. In despair at these and some other features, which began to illustrate why the instrument had existed in the world so long without ever having been used,—we remembered Dr. Pearson's old volumes on Practical Astronomy, and his orderly setting forth, how this species of astronomical circle was the one considered sixty years ago 'as proper 'for a gentleman, to enable him to determine the 'latitude of his country-seat,'—not only with due

accuracy, but, as was thought by some, of even more importance,—with conspicuous employment of all the most ingenious methods of correcting errors, and with many roundabout plans for securing the newest refinements then known to high astronomy.

Well! that description reopens the employments of scientific society in the times of our grandfathers —useful geographical employments, too, in their day; but which the spread of the Ordnance Survey has since then so completely rendered unnecessary, that their successors have to a man turned their back on such problems, and have taken either to equatorials and double-star observations; or, the smaller-handed amongst them, to photographic cameras, and all their attendant 'baths and processes.' Hence, at the Pyramid, with this fine instrument,—whose inventor, with rather over-kind officiousness, had originally intended it to occupy much time hanging heavy on the hands of a country squire, and not let his results come too easily or quickly,—some little instrumental adaptations had to be performed, until, on plain mechanical principles, the really magnificent power of the large telescope and the circle's microscope readings could be rendered available with a little more despatch.

Then, as intimated already, came serious observations of meridional stars for latitude; from dark in the evening until those smaller hours when, at that season of the year, the constellation of Scorpio rose, —a Cosmian colossus crawling straight up into the

eastern sky,—and formed the most strikingly life-like, yet tremendous-looking in such a latitude-parallel, of all the asterisms on the face of the heavens. In this manner, the latitude-position of East Tombs being obtained,—a simple pacing of the meridian distance between that spot and the centre of the Pyramid, gave the reduced latitude for the latter with all requisite accuracy, and a great saving of expense. But presently after, came observations which must be made at the Pyramid itself; such as to determine, not as had hitherto only been done by others, the direction of the rude outside masonry with the astronomical meridian,—but that of the central axis of the finished entrance-passage, in the state, or as referred to the very surfaces, left by the builders at the time of the building before history was born; and this was surely a problem worthy of the veteran Playfair circle, and of some exertion too.

So the place was surveyed, and as the regular tripod stand was perfectly out of the question on the upper edge of the passage's basement sheet of white stone,—descending as it did, steeply, but in steps, at a general angle of near 50° on the outside, and in a smooth, slippery slope of 26° on the inside, —the carpentry of the Howard Vyse Tomb was put into requisition to make, out of our dressing-tomb table with four equal legs, an instrument-stand with two long legs, one short one, many diagonal braces, radiating surface-grooves to keep the foot-screws from slipping, and many other observational require-

ments; in such proportions too, as not only just to stand on three nicks that were found cut into the stone, and in the vertical plane of the passage produced,—but to carry the instrument with its centre of vertical motion exactly on the level, at that point, of the very axis of the same passage.

All this, of course, required numerous trials to make it practically both what it should be for accuracy, and such as could be worked safely in the dark. But, having been at last brought to a respectable condition, together with a neat luminous signal, formed by a steady light shining through a microscopic hole in a thin bevelled board, fixed in the centre of the lower end of the passage,—we waited with anxiety for the concluding week of March; when the gain of sidereal, upon mean, time, as already hinted, should bring the greatest elongation of the Pole-star westward, to occur about sunset. For in that way we hoped to be enabled, both to make the determination of the azimuthal direction of the passage depend on the most unexceptionable position of the Polar star for that sort of observation,—and then have the instrument packed up and brought back in all its five boxes to East Tombs, while there might still be twilight enough in the sky, to enable the bearers to avoid the many sepulchral pits which were close on either side of the very rough and uncertain path. But that last March week was cloudy every evening, and we could do no more than practise making observations and

crawling round the instrument on the various slopes, so as to read off the microscopes on every side, without undue pressure on any part of the table-stand; which, though without any looseness, was certainly rather springy.

At last, however, on Monday, April 3d, the sky being clear once again, Alee Dobree brought over four men, all, it seemed, his own relations,—for he was something of a nepotist where gains were to be made,—and then, although I would have sent each box by two men carrying it by the handles, and caused them to make several journeys,—they asked, with a reference to another plan of their own, 'But who 'is to prevent the first boxes being stolen at the 'Pyramid when we are coming down for the others? 'That is not at all good,' they said, 'in the desert, 'where Bedouins may be watching your every 'motion from behind rocks, and waiting their op-'portunity; and besides, it would be too heavy 'work for the men's arms.' So this was the way they managed it,—they made one man's toga into a thick pad for the top of his head, and then two of his companions lifted one of the heavy boxes upon it, and told him to walk off; the others were very soon similarly burdened, and, following in Indian file, formed a sort of caravan of loaded men, who were groaning like camels, and declaring their heads were ready to break in. But for all that, they stepped along bravely, and never rested until they had reached the top of the rubbish mound at

the entrance passage's mouth, and deposited their burdens safely.

Then came my part of the play, in putting the instrument together upon its stand; testing its position with reference to the passage; going down to the lower end of said passage, to test the luminous signal's position similarly; and finally, observing. First, while daylight was still strong, and the Polar star invisible,—making angular measures for the vertical depression of the lamp-signal; and then, after measuring the horizontal angle also, turning the telescope to the computed place of the Pole-star, so as to catch the first glimpse of it which the momentarily failing light of the sun, in its rapid approach to the horizon, should allow. In this manner, several references were made, one after the other, from the lamp-signal low down towards the south, up to the Pole-star on the north, and *vice versâ*;—until we were sure there was no material error on the angular measure of things as then before us; and the caravan of head-loaded men was formed as before, to replace everything for the night within the only safe precincts throughout all that region; viz., the guard-defended East Tombs.

Next day, the men declared their heads were too sore for any more work of the same kind; but the day after, they were all marshalled again for a similar observing expedition,—this time to the entrance of the *second* Pyramid; and after all the

observations had been gone through, and duly computed, the next morning,—for the final results are not to be seen instantly by what is read off the instrument at the time,—we were surprised indeed, to find how closely the meridian had been hit by the ancient builders in both cases. Many persons had indeed talked in a general way, 'of the astonishing 'justness of the Great Pyramid's orientation;' and some had declared, 'it is perfect,' or, 'it coincides 'exactly with the four cardinal points,'—but they had made no positive instrumental observations as to the numerical amount of error or circumstances of the fact: and all they really meant by those grandly-turned phrases, was probably,—that the position was not more than a degree or two, from the truth, when they had expected to find it a whole handful of degrees out.

The only *measure* which I have been able to meet with, is by the Astronomer Nouet, one of the French *savants* of 1799; and he made the Pyramid, nineteen minutes of arc out; but considered that amount, for the occasion, a small quantity. He, however, only referred the star to the general trending of the outside of the Pyramid,—probably preferring to mount his 'repeating-circle-of-Borda,' on the safe and flat ground at the north-east foot of the Pyramid,—than to erect it on the dangerous knife-edge, formed by the basement-sheet of the entrance passage; or, perhaps, because he had not yet come to believe in the casing-stone theory of the outside of

the Pyramid; and had not appreciated, that nothing but those outside surfaces, which the builders of the Pyramid themselves left as such, are worthy of any attention from an accurate measurer. Nouet died early, but left quite proofs enough behind him of his gallant and impetuous spirit to show, that had he only seen a real scientific necessity for it, he would have run any risks, either to his repeating-circle or himself, in order to have got one really good measure,—not of a line formed merely the other day by vulgar-minded depredators, intent alone on demolishing and plundering,—but one which the Pyramid kings, on noble ends intent, had laid out with their own hands; and which had been waiting, during 'the forty centuries' appealed to by his own master, for some one or other to come and declare its ancient perfection; but had so long waited in vain. Hence, it was left to the Playfair instrument of the late Astronomical Institution of Edinburgh, and the year A.D. 1865, to prove beyond all doubt, that the error is not 19′, but only 5′!

Nay, indeed, there are indications that the 5′, or perhaps 4′ and a few seconds of space, though forming an actual outstanding difference between the direction of the Great Pyramid's entrance passage and the present astronomical meridian,—are not to be looked on altogether as an error; because, amongst other things, the passage of the second Pyramid is found to have almost exactly the same direction in space. The clambering up to that passage mouth

was even more difficult than at the Great Pyramid; and erecting the Playfair alt-azimuth upon its upper edge, was like hanging it on the brink of a precipice, and asking an observer to walk round and round it. But with the assistance of the Arabs it was done; and a lamp-signal being established below, at twelve hundred and fifty inches of measured distance along *there*, the *granite*-formed entrance passage,—a complete set of perfectly independent observations was obtained, for both the dip and azimuth of that passage. The former quantity then came out, though with a difference under the microscopes, yet nearer to the dip of the Great Pyramid passage than any other men's observations of *it*, hitherto published, have agreed among themselves; while the latter element, developed itself so excessively close,—will the reader allow me a few lines to try to give an illustrative idea of how close.

During the very time that these observations were going on, we received an interesting letter from an engineer in Scotland, a man of most varied experience, and discussing with considerable acumen the probabilities of correct workmanship being found in the Pyramid. Eastern workmen, he considered, are very clever, but have no ideas of rigorous mechanics, of straight-edges, and the uniform curves described by radii of definite length revolving round axles in firm bearings; hence they produce finely polished, but wavy and uneven surfaces. And ancient Greek workmen, he considered, had inimitably fine æsthe-

tic perceptions, were never wrong in a matter of taste, but were utterly deficient in the principles of manufacturing; wherefore it came that even the Athenians, under Pericles, could not make *two things alike*. Now this is what the moderns not only *can* do, but do even too well, *i.e.*, abundantly, for they carry it not only into manufactures, but the fine arts also: whence the corporation of a great English city, wishing to do the immense honour to their late eminent citizen, John Dalton, of erecting *two* statues to him within the limits of their burgh, —really thought they were doing so by putting up two casts from the same mould: and again, a Scottish architect, fatuously desirous of emulating the builders of ancient Greek temples,— repeated a certain lion's head no less than sixty times, without variation, round an important public edifice.

But the builders of the Pyramid are neither to be compared to the trinket-making Indians, nor to æsthetic Athenians; no, nor yet to the manufacturing moderns of Great Britain,—though undoubtedly approaching nearer them than either of the other varieties of workmen; for they of the Pyramid excelled in large mechanical work, and *could* also make two things alike when they chose; and if they seldom chose, it was because they did not see sufficient need of high order for attempting the feat oftener. To compare, however, their skill, when they did put it forth, with the best things the moderns have ever done in the same way,—is there any more

accurate class of modern workmen on the face of the earth than astronomical instrument-makers? and is there any structure wherein it should be easier to make two things alike, than two halves of the same astronomical circle? that is, to secure in a moderate-sized circular disk of brass, that from its 0° to 180° shall be equal to from 180° to 360°. That shall be the modern *chef-d'œuvre* against which we will compare the Pyramid builders' ancient work.

Now we tested, towards such an end, the azimuth circle of the Playfair instrument,—the high-priced manufacture of Troughton, the chief of all English instrument-makers,—tested it, too, very closely each evening by the manner in which the passages of the Great and second Pyramids were compared with the Pole-star; and found,—as of course will be found whenever an inquiry of the sort is pushed with sufficient accuracy,—that no man's work, not even Troughton's, is perfect; for there was a very sensible amount of difference in seconds of space between the two halves of his one and the same circle.

Amongst careful astronomers, such a result amounts only to the old, old story, which they all know far too much of. But what seemed new, and really surprising to meet with in fact, when pushing the case on further to the Pyramid, was,—that that amount of difference between the halves of Troughton's circle, expressed in angle, was greater than the angular difference between the azimuthal directions of the axes of the entrance passages of the

two ancient Pyramids, viz., the Great Pyramid and the second Pyramid; though removed as those buildings are by so many hundred feet from each other, and exposed to the brunts of the world for ages. So very nearly, then, had the ancient builders there, made *two things*, and two things of a very high nature and difficult order, *exactly alike*.

On the evening following the hazardous affair at the second Pyramid, we merely took the Playfair instrument and its corps of men to King Shafre's tomb; a short and nearly level road, and the place itself of comparatively almost puerile simplicity. The sepulchral room there was evidently very fairly in the meridian, and we wished to ascertain how near. Already we had been there one noon-day, watch in hand, and told Alee Dobree a quarter of an hour before it came to pass, 'Now, when the hands 'come to such and such a position, or when it will 'be noon exactly, as ascertained by observations of 'stars last night,—that great black shadow under the 'east wall will be gone, and you will see no shadow 'under either wall;' but he had replied, 'Oh no! 'it's impossible to have so much change in the 'shadow in so short a time; and, besides, the sun is 'not accurate, for,' he said, 'he knew quite well that 'the sun *rose* earlier, and very much earlier, in the 'day, at some parts of the year than others.'

Much astonished was I on this, as on many other occasions in Egypt, to find how little skilful the

natives are in making use of the sun as a time-keeper, compared with the less civilized inhabitants of Southern Africa. There, every half-wild Hottentot prefers his own look at the place of the sun, before any watch of any European; but in the long-civilized valley of the Nile, one man depends upon the words or orders of another as to what he is to believe about celestial phenomena; and human precept is thought vastly more of, than the laws of nature. A weakness, however, arising also from the said laws being so perversely employed by the general Egyptian mind; one of whose characteristic aberrations from primitive truth and modern science has always been, to prefer the risings and settings, to the meridional passages of heavenly bodies for time-keeping purposes. On this one day, however, Alee condescended to wait to see whether, what a local Dervish had told him, or what I now tried to explain, would prove correct; and he really seemed not a little struck when, at twelve o'clock, as predicted, no shadow appeared all along either east or west side of that remarkable tall-walled room of red granite. It was really a memorable sight; and in that country, where, if they keep any one particular time at all, it is apparent solar time, this well-chamber of King Shafre's tomb,—however many thousand years ago it was built,—enables a better observation for the instant of modern noon to be taken, than all their present time-finding means in

the wealthy and picturesque city of Masr El Kahireh.

Again, on another day, to get something like a permanent record of this architecturally-chronological fact, we had taken three photographs of the northern end of the room; one four minutes before, a second at, and a third four minutes after, the time of computed noon; obtaining thereby very sensible shadows under the east and west walls respectively, on the first and third occasions, and no shadow anywhere on the middle one. But photographs of minutes of time are not of so searching a character as actual astronomical observation; and when we came to prepare for establishing the Playfair instrument, on the middle of the northern, and a lamp-signal on the southern, end of the said sepulchral room, and measured the walls accurately therefor,—they proved to be twisted, and of unequal lengths; while the Pole-star observations made subsequently, showed a very notable defalcation from microscopic truth.

In fact, while there was nothing of the grandeur, there was also little of the exceeding accuracy, of Pyramid passages, about these walls of a mere tomb, approximately oriented though they may have been: and the chief result of the evening was, the relief to all our feelings, of observing on innocent level ground, where the ordinary tripod of the instrument could be used, and nothing was in danger of running off, or sliding away of itself.

Then, too, there were granite seats around for all the party, where, while I was making the observations, they did sit—watching the stars successively lighting up in the momentarily darkening indigo-blue sky; and the Arabs, one of whom had been in Syria, and compared this evening with the last, as being 'like a resting in a garden of pome-'granates after climbing among the rocks of 'Lebanon,'—inquired pathetically of my wife, if we should ever think of them after we had returned to our own country? and would we prove it by writing them a letter? for they would never go into Cairo without calling at —— and Co.'s, our agents there, to see if we really remembered them.

The next afternoon the men had to brace up their heads again for hard carrying-work, for we were determined then to take the powerful Playfair instrument, maugre its inconvenient size and weight, into the interior of the Great Pyramid; and there determine by its means, unrivalled hitherto over all that region of monuments, the real vertical angle, so much disputed, of both Grand Gallery and first ascending passage. For this purpose a new lamp-signal apparatus had been prepared, adapted to either, or both, the upper end of the Grand Gallery and lower end of first ascending passage,—the astronomical circle being placed nearly half-way between, on the very convenient flat floor leading to the Queen's chamber passage; and having its

horizontal axis nicely adjusted to the same vertical height above a joint, marking the base of the ramp line,—that the lamp-signal (looking very much in the telescope like an image of the planet Jupiter, but with still more flattening at the poles, on account of the angle of 26°, at which the really round hole was looked at), stood above the inclined floor, in the distance, either way. This was to be the last occasion of observing any lamp-signal in or about the Pyramid; so we had taken a deal of trouble in utilizing both our experience of the passages, and involuntarily growing skill in carpentry, in making an apparatus that could not be put out of order, and could not carry or show the light, except at one nicely-defined vertical height above the slope of the floor beneath it. (Plate I. vol. ii.)

Hence, partly, the observations made there, near the northern end of the Grand Gallery, were particularly satisfactory; and one of the Arabs present, who had contrived to worm himself into our employment, and whom we began to suspect of being in the private pay either of one Nubar Basha, the chief of a secret department in the Citadel, or of Mariette Bey, to see whether our real object was 'to break the Pyramid,'—if he reported facts correctly, would have given descriptions of how we treated each termination of the ascending interior passages, almost as if they had been the stars of heaven; while the instruments employed in the operation, were much more likely to suffer, than

inflict, injury on coming into contact with the Pyramid.

So we thought certainly after packing up, and in making our exit by the narrow way of the first ascending, now of course to us descending, passage. For, whether it was that the men were tired at the length of time they had had to wait in the dark and bad air, merely looking on at me reverse and re-reverse the telescope and microscopes on the distant light; or that they knew, when we were now, in a small-bored passage, all following each other like so many air and water bubbles in a narrow glass tube, that those in front were quite safe from being interfered with by an overseer from behind,—certain it is they began to drag, instead of carry, the instrument-boxes along the broken floor, with thundering knocks; and Alee Dobree, the Arab, when ordered to push past and stop all that noise, quite quailed before the superior strength of his ruder namesake, Alee the Egyptian. A perfect Hercules this man in build, with such positive 'heaps of muscles' in his deep bare thighs, as transcended even the statues of the Grecian hero; and, in the limited cross section of a Pyramid passage, forty-seven by forty-one inches only,—he became a concentrated mass of opposition and intensity of strength most difficult to deal with.

Meanwhile, as it had been the intention to conclude off this evening, with more observations of the Pole-star, combined with the outside of the entrance passage, (and what thanks and praises

would we not have given His Highness the Viceroy, had he, by boring a straight hole through the granite portcullis, enabled us to compare, not the directions of these petty cramped-up passages only, but the line of the *Grand Gallery* with the meridian of the northern heavens),—as this other work, we say, was to be accomplished before we quitted the Pyramid, and the unequal-legged table-stand had been already established over the top edge of the basement-sheet of the entrance slope,—my wife had found her way there about the evening hour, and had for some time the whole of that hollowed-out region of enormous and tilted, but intentionally tilted, cyclopean blocks of stone to herself. On one side, and half around her, the greatest mass of building ever erected by man; on the other, the desert hills extending away into the extreme north-western distance, towards the man-improved site of the now utterly ruined Pyramid of Aboo Roash; and, more towards the east, the sand-plains which cover, and the distant palm-groves which mark, the ruins where some Egyptologists place the site of ancient Cochome, a town that was of importance in the days of the early dynasties.

Presently she heard the most faint and far-off conceivable sounds as of nothing terrestrial, coming in fairy-like echoes by way of the entrance passage, out of the mysterious bowels of the mountain of masonried stone. By degrees these sounds increased in tone and character, until some human meaning

could be attached to them; and by and bye came one Arab after another out of the dark interior, bearing one or another box of the Playfair alt-azimuth, until the whole observing party had at last emerged to the light of day; by this time faint day, struggling with growing moonlight and gilded with the evening star.

Small occasion though now, to repeat the description of precisely how the comparison with the Polar point of the heavens was again made,—for the observations themselves will be found in our Second Volume. Neither is there much need to spend time over how, during the next day, we measured the length of every side of the base of the Great Pyramid; and also, with the portable sextant and artificial horizon, determined the angle of elevation of each flank, from the top of its central mound of rubbish;—unless it is to express something of the utter astonishment, combined with feeling of grief, wherewith we wondered how, when the real facts themselves seemed to admit of no more than a small handful of minutes of error,—how the best observer in the late learned Cairo Institute had obtained differences of three and four *degrees!* Concerning which, too, he had given me very kindly a copy of his actual observations, and I had them in my waistcoat-pocket to refer to at that very moment:—but otherwise, small occasion, we say, to delay over these matters, for they formed but rough work of very ordinary measuring kind, and

we were preparing meanwhile for a peculiar night on the summit of the Pyramid.

Never had I indulged in any of the rhapsodies of those scientific varieties of Egyptologists, who hold the Pyramids to be ancient astronomical observatories; and of all unlikely, impossible, and inconvenient parts of them, decide that the summit was where the work was carried on. But, as the summit of the Great Pyramid is in these latter days in which we live, more accessible than of yore, by reason of the once smooth slope of the casing stones having been removed,—I thought there would be no harm in ascending for a night with the Playfair alt-azimuth, and trying what observing up there might be like. There would at least, too, be one positive good obtained, viz., a salutary check on the latitude observations at East Tombs. For there, while we were at a notable distance from the Pyramid, and the hypercritical could object that its mass being on one side of us, and partly in the meridian direction,—*might* influence the plumb-bob or level, and spoil the latitude deduced; on the top of the Pyramid, on the other hand, we should be not only vertically above the centre of the base,—but have the whole mass beneath our feet, or in the only direction in which it cannot possibly have any disturbing effect on the angle of the plumb-line.

Monday morning, therefore, April 10th, was spent in interviews with the Pyramid Sheikhs, and

arranging special plans for the safety of all the property at East Tombs during our one night's absence, for my wife was to be of the summit party: and about two o'clock P.M., the first load of instrument-boxes was sent up, two men now to each box, to lift it up every stage of the Pyramid steps. At four o'clock, a second party started, including ourselves; and most of them clambered up to the summit platform as quickly as they could. I was latterly, however, rather behind the others, being anxious to measure the height of the Pyramid, by summing the individual height of every step; an operation, indeed, which had been performed most carefully by Bonaparte's architect, Le Père, and his colonel of engineers, Coutelle, also; but which it was quite within the limits of propriety to repeat.

Now these Great Pyramid *steps*, or things that are used in the present day as steps for travellers ascending,—the reader must by this time appreciate pretty well were never intended for steps originally; and for the very good reason that they were then considerably within the bulk of the masonry, whose outside was the smooth sloping surface of casing stones. That slope, however, removed,—and certain ranges of filling-in or backing-up stones also,—the rectangular corners of the horizontal layers of masonry forming the bulk of the Pyramid, are left outstanding: acting on the principle of steps, because each course must retreat a little inwards from the one below it, to make the general shape of

the Pyramid; but mightily different from steps for average-sized human beings in point of actual height; seeing that the best proportions of blocks wherewith to construct a cyclopean building to last for many thousand years, is one thing,—and the height a man can conveniently lift his feet, another.

The latter is indeed reckoned by architects at not much beyond seven inches; while the thicknesses of some of the Pyramid courses of masonry are at least seven times seven; a very inconveniently high step, if any one will actually try it. Hence, the almost necessity for Europeans to have Arab assistance in the climbing. But, as I required both to be independent, and at the same time able to ascend easily and comfortably, as suited to measuring carefully all the way,—I made myself a little mechanical help thereto. Alee Dobree had looked on rather critically, even cynically, at its commencement; and declared that, in the course of his long experience, he had seen travellers bring all sorts of portable stools with them, to try and divide the high steps; but none of such European contrivances, he declared, were found to answer in practice,—except to make the position more critical and dangerous; and their owners had invariably to end in getting the Arabs' assistance, just the same as all the rest of the world. He confessed, however, as the work proceeded, that he had never seen a 'stepping-board' exactly like mine; *i.e.*, about the height of a spade, and eight inches broad, with one hole near the middle for put-

ting a toe into for making the auxiliary step; and a second hole near the top, to serve as a convenient handle for drawing up the board by, after one should have mounted the unconscionable fifty-inch platforms; and the machine was not only employed, but found both very useful and perfectly sufficient; as well too in the descending as ascending.

Our ascent was from the north-east corner at once, which is not quite the usual path; but it equally and immediately put us into the train of thoughts which many travellers have described as occurring to them in their climb, and perhaps none have expressed better than Dr. Clarke. 'As we drew near,' says this scholarly writer, 'to its, the Great Pyramid's, 'base, the effect of its prodigious magnitude, and 'the amazement caused in viewing the enormous 'masses used in its construction, affected every one 'of us; but it was an impression of awe and fear, 'rather than of pleasure. In the observations of 'travellers who had preceded us, we had heard the 'Pyramids described as huge objects, which gave no 'satisfaction to the spectator, on account of their 'barbarous shape and formal appearance; yet, to 'us, it appeared hardly possible, that persons sus-'ceptible of any feeling of sublimity, could behold 'them unmoved. With what amazement did we 'survey the vast surface that was presented to us, 'when we arrived at this stupendous monument, 'which seemed to reach the clouds! Here and 'there, appeared some Arab guides upon the im-

'mense masses above us, like so many pigmies, 'waiting to show the way to the summit. Now and 'then we thought we heard voices, and listened; 'but it was the wind, in powerful gusts, sweeping 'the immense ranges of stone. Already, some of 'our party had begun the ascent, and were paus-'ing at the tremendous depth which they saw 'below. One of our military companions, after 'having surmounted the most difficult part of the 'undertaking, became giddy, in consequence of look-'ing down from the elevation he had attained; and, 'being compelled to abandon the project, he engaged 'an Arab to assist him in effecting his descent.'

But when the Doctor's party had reached the top, and found that the upper portion is very much easier than the lower, on account of the greatly decreased height of the steps, averaging there only twenty-two inches, 'an Arab was sent with a short 'note to the officer, urging him to make the attempt 'again;' and that method being ineffectual, the Doctor himself went down, 'and having, with some 'difficulty, prevailed on his friend to renew the 'effort, succeeded in conducting him to the top. 'He, the friend, expressed himself unwilling to re-'turn without having gratified his curiosity by a 'view from the summit, but confessed that the 'effect produced upon his mind, by the stupendous 'sight around him, was rather painful than pleasing, 'and had rendered him wholly unfit for the exertion 'it required,—confirming the truth of Mr. Burke's

'observations in his philosophical inquiry into the 'origin of our ideas of the sublime, as to the impres- 'sions to which men are liable, who, without the small- 'est personal danger, are exposed to the contempla- 'tion of objects exceedingly *vast* in their dimensions.'

Again, too, and with special reference to being very close to the Pyramid, where, besides a knowledge of its enormous size for a work of man, it subtends an angle of 180°, or half the sphere of view and sense, Dr. Clarke says, 'The mind, elevated 'by wonder, feels at once the force of an axiom, 'which, however disputed, experience confirms,— 'that in vastness, whatsoever be its nature, there 'dwells sublimity.' But, as the idea of the beautiful is said to be founded on pleasure, and that of the sublime on pain, so does Dr. Clarke argue again and again for the indescribable sublimity of the Great Pyramid, from the emotions of terror and feelings of awe, deepening to pain, so often produced on those who, with too irritable sensibilities, have approached it. 'Other individuals, however,' says he, 'have felt impressions widely different; and 'the ideas excited in their minds, have been that 'of the most dignified simplicity; of miraculous 'power; and of duration, so perpetual, that, if we 'were permitted to compare a result of human 'labour with the immortality which is of Almighty 'origin, we should say of this Pyramid, that it 'belongs to an Eternity, which was, and is, and is 'to come.' Or, in the solemn-meaning language

of the late Sir William Hamilton's (of Dublin) remarkable ode on 'Quaternions,' and forming their grandest practical realization on the surface of the earth,—the Great Pyramid may be considered as,—'the three of space, the one of time.'

Ascending is easier, both at the north-east and all the other *corners* of the Great Pyramid; not only because the corner slope of such a solid must be some ten degrees less steep than the middle of its side,—but because these corner lines are built of the hard Mokattam or Maasarah stone; and they have weathered so very much less than the general flank, built of local nummulitic rock, that, viewed by an extremely slanting light, the sides of the Great Pyramid seem to be growing somewhat *concave* towards the centre. As we approach the top, too, the cornering blocks are found to extend further into the courses, until these are at length composed entirely of the hard stones, well squared; and the whole summit of the Pyramid, through a considerable depth, is therefore capped and held together with its best constructive material.

Two hundred and one courses bring us to the terminal platform, about four hundred inches square; but as there are fragments of two other courses mounted upon that, we may say, with M. Le Pêre, Colonel Coutelle, and Mr. Lane, that there are two hundred and three courses in height existing still; while, if it be true that, in the time of Diodorus Siculus, the said platform measured only one hun-

dred and eight inches in the side, there may have been then five or six courses more. But even that size would only have brought it to the present condition of the top of the second Pyramid,—where there is much to be added both of internal masonry and outside casing; not to say anything of the grand and topmost stone, the head corner-stone of all, to restore the structure to its original completeness. For more exact particulars, however, and for some necessary corrections to the observed mere surface phenomena, see the numerical particulars, and discussion of the same, contained in Vols. II. and III.

By the time that the carrying men had set down their burdens and been discharged, leaving with us on the Pyramid's top, as 'upper' guards for the night, only Alec Dobree and Smyne,—for the latter had been at last freed from the Jeezeh prison, neither much better nor worse in character than he had gone in,—the sun was setting in a dense and lurid haze over the rocky desert table-land towards the north-west; a strong and rather cold wind was blowing from the same direction; and little time was to be lost in getting lamps lit, instrument mounted, boxes arranged into a secure compartment, and many other such necessary night-preparations made. Very soon after the accomplishment of this important work, the two guardsmen went fast asleep under their many-folded togas near one corner of the little platform; all the rest of which was then quite

free for my wife and self to walk over and gaze from, as the view towards any quarter might dictate.

To the south-west stood our nearest neighbour, about on a level with us, the summit of the second Pyramid. Tinged by the light of the sunset-sky on one side, and blanched by that of the rising moon on the other, that monument's venerable head rose high out of the mists of evening,—that hastened to fall on all the lower country, and leave the pair of primeval Pyramids, in isolated grandeur, to address each other with ease over the blue and deep abyss between them: an aerial gulf where, from time to time, a broad-pinioned eagle went floating securely along, but looking downwards on other things as much as we were looking down on him.

Over the eastern foot of the second Pyramid appeared the third, and beyond that similarly the fifth; from continued decrease of actual size, as well as the perspective of distance, a rapidly converging series; only just separable at last from the amphitheatre of sand-hills beyond, the advanced guard of the great south-western desert,—whose arid colours and serrated ridges of rock were traceable round westward and northward for more than 180°; barren, waterless, uninhabited and uninhabitable over its whole extent, and marked by nothing of human work, unless it were a ruined Pyramid on the extreme horizon, and just at the northern end of a stony table-land, bearing about 13° south of west.

Poor Dr. Leider had spoken to us when in Cairo

about that Pyramid, 'Oh, it is the most beautiful 'thing of everything to see,' exclaimed he; 'to see 'from the top of the Great Pyramid, just as the 'sun goes down, far away on the waste Libyan 'desert, one little pyramid all by itself, and exactly 'in the west!' A very curious thing it is too, *if really a pyramid;* for it is entirely removed from all the line of known Egyptian sepulchral pyramids, extending as they do from Aboo Roash to Sakkara and Dashoor, but skirting nearly the very brink of the cultivated valley closely all the way. Yet here is one Pyramid far removed from them, in the midst of a howling wilderness; in a stony tract so drear, that there are about it, not even locusts or wild-honey; no water but what is carried in skins; and no man stays his track in its neighbourhood, if he would live;—a scene, therefore, much more appropriate to one of the traditional pillars of Seth[1] (a saint-patriarch with all Shemitic religionists, but the abhorred Typhon[2] of the idolatrous Mizraites), on which the antediluvian wisdom was said to be inscribed for the benefit of posterity,—than to the necessary graveyard of a nation so comfortable and well-to-do in all the grosser luxuries of a peaceful and agricultural life, as were the early Egyptians of this 'Siriadic' land.[3]

[1] See Josephus, chapter ii. par. 3.

[2] 'Set, Suti, Suteck (Seth, Typhon)' of Dr. Lepsius, in his 'King's 'Book,' and represented as animal-headed, with upright, square-topped ears: the 'Ombte, Obte, Abtaut, Tithrambo, one of the characters of 'Typho, and the evil principle,' of Sir Gardner Wilkinson.

[3] Up to the present time I have not been able to gather any other

Here, close about the Great Pyramid, those men's graves are accumulated beyond counting, particularly on the western side, where they lie close set and regularly methodized, to economize ground; while the sand, which has made a clean sweep over that part of the hill, but lain nowhere very thickly,—shows the swelling tombs below, only half concealed by the long-drawn folds of their one, great, unwoven, winding-sheet. Eastward, the hill is again a collection of tombs; and now we distinguish the regular arrangement of all those sepulchral heaps we have been walking over, and amongst, so many months past in our progress from East Tombs to the Pyramid. Beyond, in that direction, lies the sand-flat; then the dark tract of that alluvial ground, which is the gift of the Nile and the essence of Egypt; then the Pyramid villages, with their groves of trees, now all broadened out from being seen at so great a vertical angle; and in the extreme distance, beyond the darkened plain, rise the faint grey forms of the Mokattam hills, projected on the moonlit sky. Smooth along their summits are they, but breaking down steeply towards the north, where the fretted city-line of domes and minarets can just be made out along the horizon edge; and a few tall chimneys too, for burning the

particulars about this Western Pyramid (?) than a Cairo *report*, that Dr. Lepsius is the only European who has visited it, and that its name is the Pyramid of Es Sedood. But in the maps contained in the learned Doctor's folio publication, the red line of his track of travel does *not* go anywhere westward of the Pyramids of Jeezeh.

black stone, brought now-a-days from the land of the Giaours, to the very spot where the Emperor Saladin used once to hold his court, and collect his lean and sun-dried warriors, to send on passionate campaigns against Richard Cœur-de-Lion.

Except the distant lights in the city, and a chance one in the villages, all is dark in the inhabited valley; for even when we look towards its more notable extension northward, as into the populous breadths of the Delta,—there are now no traces of water left on the surface to reflect the moonlight, and form bright shining eyes in the landscape: the whole spread of the inundation which, with its fertilizing waters, lately made the scene so charming and life-like, as viewed from the Pyramids, having departed completely; and the Nile itself being now retreated out of sight, low down within its deep clay banks; the reservoirs dried up; the canals exhausted; and the well-mouths jealously guarded. Egypt, in this apparently waterless condition, reminds one of some of its troubles of old; for when its water was gone, its wealth and health had departed likewise:—even as when Aaron was ordered to take his rod and stretch it forth 'upon 'the waters of Egypt, upon their streams, upon 'their rivers, and upon their ponds, and upon all 'their pools of water,' until they should be smitten that there be no more water; and that Pharaoh might know the Lord was against him—Pharaoh, 'the great dragon that lieth in the midst of his

'rivers, which has said, My river is mine own, and 'I have made it myself.'

'Why! who can that one man be,' remarked my wife aloud, 'who at this late hour is going past 'the northern foot of the Pyramid, into the desert, 'and driving a loaded camel and two donkeys be-'fore him?' Hardly had the remark taken fully the form of a question, when Alee Dobree, whose bad digestion would not allow him to sleep, answered, from under his dark-blue toga, 'Oh! that's a man 'the Government wants to get hold of, but they 'can never find him; he lives in the desert all day, 'and only comes near the villages at night for his 'supplies; he'll be a long way off before morning.'

Meanwhile the stars were abundantly appearing in the sky; for the moon's declination being south, the extinguishing tendency of its light, on other smaller lights, was by no means overpowering; leaving, in fact, on the *northern* side, quite enough of those invaluable stellar milestones of the sky, to enable us to contrast the present Pole-star in the Little Bear, with that other orb in Draco, which once held the same important reference-position when the Pyramid was in progress of building. Not only so, too, but we could trace in more than imagination, the place of the existing Rotation Pole of the sky, and fix its position in the circumference of that remarkable circle which it slowly describes in long ages round the Pole of the Ecliptic; and then, comparing our own Cynosure's place therein, with that of

a Draconis, as seen from the same Ecliptic centre, —we could at once perceive a something of the several thousand years during which the Pyramids must necessarily have existed, by the amount of *angle* passed through between the Pole-stars of the two epochs; of angle too, on that grandest of dials, (yet one easily to be seen by any man who knows how to look for it in the sky); a dial, the numbers on whose rim do not begin to repeat themselves, until after more than 25,800 years shall have elapsed.

Towards the *south*, on the other hand, were a glowing moon, the vivid scintillations of Sirius, the shapely stars in Orion, and the many-clustering splendours of Taurus; with Venus brilliant on one side, and Jupiter as bright on the other. Orbs of matchless beauty were these, glittering upon us from above through the blue luminous ether: while all the gross lower earth was then cut off from either sharing in, or lowering the character of, our view; that is, all such earth was removed, by our then position, out of sight,—except the circumscribed platform of the top of the Great Pyramid itself, and the neighbouring ghost-like summit of the second Pyramid.

We could almost at times fancy the latter congregation of head-stones *close* to us, in shape of a group of white-robed ancients, now a little nearer, now further, in the moonlight rays; and,—like the poetical philosophers of an ancient Greek chorus evoked by the genius of a mighty Sophocles,—

marching backwards and forwards with rhythmical pomp on our little space of stone,—teaching, instructing, advising, and elevating; improving the heavenly scene around to wayward, troubled mortals; or describing, in Tennyson's happy mixture of telescope-found particulars with ordinary-gaze generalities, the phenomena above and before us, as—

'Each sun, which from the centre flings
'Grand music and redundant fire,
'The burning belts, the mighty rings,
'The murmurous planet's rolling choir,
'The globe-filled arch that, cleaving air,
'Lost in its own effulgence sleeps,
'The lawless comets, as they glare
'And thunder through the sapphire deeps
'In wayward strength, are full of strange
'Astonishment and boundless change.'

But before we had enjoyed these thoughts and communings very long, a suspicious little white cloud began to form in the south; the north-west wind blew past, but could not stir it; it was a 'growing cloud,' well known in some peculiar states of the weather. I hastened, therefore, to get a few altitudes of the Pole-star, though it was not yet in the best position for latitude observations; and by the time I had finished, the whole star-bearing heavens had disappeared behind a nearly uniform milky surface of cloud, which gave little hope for all the rest of the night. About midnight the place of the moon was very closely watched, with the hope of trying to get some idea of the longitude, by means

of the difference of time in transiting the meridian by the moon and certain stars on her parallel; and the former *was* just visible crossing the field of the Playfair telescope, though with clouds between; but of all the stars there was only a glimpse of one, and that for about three seconds; yet it gave a tolerable idea notwithstanding of how very far we were cast of the meridian of dear old Greenwich.

Again, between two and three in the morning, there were a few openings in the clouds northward, and some more altitudes of the Pole-star were taken for comparing our latitude determination; but after that, the clouds extended everywhere from one horizon to the other, and there was little to do but to sit in turn on every side of the platform, and look down on graves, graves, graves. Burial-places, these graves of the rich and poor, and ransacked alike by their fellow-men; over whose evil deeds Nature herself, with her sighing winds, would willingly filter down the sands as a charitable veil; but the sinners will not cease from their sinning, and some fresh yawning chasm will even yet appear from day to day.

Most remarkable too looked that trio, away south-eastward, viz., Campbell's tomb, uncovered by Howard Vyse; the Great Sphinx; and King Shafre's tomb; the latter seen almost in contact with the monster's head, and remarkable for the deep and dark shadows among its colonnaded aisles. Attending to this circumstance, we could hardly but recall

to mind Dr. Clarke's description of what he saw from this very spot in 1801, or immediately after the French army had been making their excavations about the Sphinx; and think, that after all, King Shafre's tomb is not wholly a discovery of the last ten years, although neither the maps nor the views of either the great French work, of Howard Vyse and Perring, or Lepsius, allude to it in the smallest degree. 'Beyond the Sphinx,' says Dr. Clarke, 'we 'distinctly discovered, amidst the sandy waste, the 'remains and vestiges of a magnificent building, 'perhaps the Serapeum; a sort of chequered work 'appeared in the middle of the stones belonging to 'this ruined edifice. It is unnoticed by every author 'who has written on the Pyramids.'

The only question here is, What is meant by 'beyond the Sphinx,'—a few feet, or several miles? If the former, the Duke de Luynes and Mariette Bey were preceded by the man of Cambridge, and perhaps by Sir Gardner Wilkinson too; but if the latter distance was intended, and Dr. Clarke forces the passage to an enlarged meaning, by connecting what he saw with the Serapeum (or temple of Osiris and Apis, pronounced in one word), at Memphis, which is certainly many miles south of Jeezeh—the tables are turned.

Yet we doubt whether tombs of any sort, even of ancient kings, presented so remarkable an appearance, as seen in the faint lunar illumination of our night-view from the top of the Great Pyramid,—as

the three huge azimuth trenches on its eastern flank; awful gashes they seemed in the solid body of the earth; so deep down, too, within its rocky substance, that evidently, though the rasping teeth of time should eventually remove the whole of the Great Pyramid itself, and its place should know it no more,—those trenches would still remain, and with a marvellous lesson to all who can read in the language of angle!

Suddenly, about day-break or soon after, when, too, the thermometer had gone down to 49°,—the clouds quickly cleared away, the moon was seen setting red and disk-like just over the northern foot of that far-off western Pyramid (?), which we will venture to call, until a better claim be established, 'Dr. Leider's Pyramid,'—a round of azimuth angles was hastily taken; the sun's level rays began to strike in our eyes; and, in a moment more, 'the 'travellers' were upon us,—one party indeed arriving after another in almost endless succession.

Their attendant Arabs all came up to shake us very powerfully by the hand, as being old friends of theirs, and long since free of the Pyramid; but alas! to see the so-called 'travellers!' The same genus of men who used to cut such mad pranks within the four walls of the King's chamber below, and delighted to bang the coffer so mercilessly, and insult 'King Cheops' gravestone;' now, they were as quiet as mice; just looked faintly round for a

minute or two; turned pale on going near the edge of the platform; a weaker-stomached brother brought up his breakfast or last night's supper,—and then they were gone again; but only after expressing many fears, as to how they were ever to be able to make the descent. They might, therefore, have afterwards described their experiences most truly in the words of Dr. Veryard, A.D. 1701, who writes,—'We 'descended from the top of the Great Pyramid the 'same way, but with far greater hazard than when 'we came up; as well by reason of the bad way, as 'the *Terrour* with which the precipice struck us.' The Sieur du Mont has likewise hit off the feelings of many of these travellers, when he says, 'But he 'who can look to the bottom of the steps without 'amazement, may justly boast the strength of his 'head; for my part, I must confess I was struck 'with so much *horror* when I cast my eye down-'ward, that I was hardly sensible of any pleasure in 'viewing so great a variety of objects.'

An enthusiastic party of Americans was, however, capable of more work, though they did not stay up much longer. But in that short space of time, they had arranged themselves into a meeting on constitutional principles of Anglo-Saxon derivation, with a chairman, secretary, and audience; wherein a resolution was proposed, seconded, and carried unanimously, to the effect,—'that whereas this here pile 'whips everything in the way of building we've seen 'in all our grand tour through the used-up, worn-out

'world,—yet we calculate King Cheops, its builder, 'must have been such a horrid old tyrant and cruel 'oppressor of the people, that it is hereby resolved, 'by us free and independent citizens of the *Unyted* 'States,—that, "we *won't* give him a cheer."'

After which expression of most decided opinion, and offering the thanks of the meeting to their excellent chairman, for his well-balanced conduct and impartial attitude on his very elevated seat,—the gentlemen liquored up, the ladies, as they bashfully expressed it, 'consented just to take a swallow,' and the whole party disappeared down the steep slope of the Pyramid much more quickly than they had come up;—every man of them, though, with little Confederate flags picked out on the soles of their boots, so that they might have the pleasure of trampling on the hated ensign of the South wherever they went.

A Yankee notion this, with a vengeance; and it had been reckoned, we were afterwards informed, when first produced in Boston two or three years previously, to be not only 'considerable 'cute,' but 'decidedly *ahead* of anything that had ever been 'invented in the Old World in such a cause.' Yet Sir Gardner Wilkinson writes, at page 366, vol. iii. 3d edit., of his *Ancient Egyptians*, touching certain royal sandals from Thebes, that they 'were fre-'quently lined with cloth, on which the figure of 'a captive was painted; that humiliating position 'being considered suited to the enemies of their

'country, whom they hated and despised,—an idea 'agreeing perfectly with the expression which so 'often occurs in the hieroglyphic legends, accom- 'panying a king's name, when his valour and vic- 'tories are recorded on the sculptures: "You have '"trodden the impure Gentiles under your powerful '"feet."'

In still more ancient times too, than those of the above extract,—which probably applies to the eighteenth or nineteenth dynasties,—is it described of King Shofo, or Cheops, of the Great Pyramid itself, that he caused to be engraved on the public roads the figures of the gods of Egypt, 'in order that 'they might be trodden under foot both by man 'and beast.'

Yet why that primeval king wished them to be so trodden, has never been fully settled. The world, indeed, content to take his character from his enemies only, has for thousands of years gone readily enough into the damning sentence,—that it was because he, Cheops, was an *atheist;* and have even added latterly, that if the temples of Thebes are to be looked on as monuments of idolatry,—the Pyramids of Jeezeh, where no sculptured figures of any species, of either gods, saints, or demons, appear,—are to be held as demonstrations and durable records of the *infidelity* of the kings under whom they were built!

Yet the open-mouthed world has not been always right, on momentous questions of religious faith; and it may be, following the improvement inaugurated

by the late John Taylor, viz., the method of considering all the facts from a Christian point of view, that the real reason was,—that King Cheops, being no atheist, but on the contrary, a zealous, and Elijah-like worshipper of the one true God in spirit and in truth,—took every method which was open to him, for trying to wean his besotted subjects from their degrading animal-worship; and for showing them practically that their gods, in whom they trusted, were no gods.

This subject will, however, be brought up again in our third volume; and in the meanwhile, here, on the summit of the Great Pyramid, six men have just arrived from below, by appointment, to carry our instrument-boxes down.

'Don't throw that away,' said Alee the Egyptian,—the foremost, and by far the most stalwart, amongst these new-comers,—as I was emptying a brown fluid out of a black glass bottle, preparatory to packing up; so of course, I presented him immediately with the shining 'quarto' and all the remains of its contents.

'Why, what's that?' he exclaimed, with intense disgust, after trying a mouthful.

'Cold tea,' was the reply.

'Tea!' sneered this graceless follower of a false, though sober, prophet; 'and what sort of stuff do 'you call that, to give an Arab! A Pyramid Arab, 'and on the top of the Pyramid, made sure it was 'something strong.'

CHAPTER XVI.

MAGNESIUM PHOTOGRAPHY.

After safely descending the Great Pyramid, our Playfair astronomical circle,—its intended work completed,—was finally put away into its packing-boxes and screwed down, in readiness for returning home. The dry-plate photographic camera had been similarly disposed of, the dry plates having all been used; much of the measuring apparatus, including the Coventry clinometer, was likewise finished with, and packed up; in fact, there remained now little to do,—in the present state of the Pyramid, be it always understood, as to excavation and exposure,—beyond trying to procure photographs of crucial points of its interior by aid of the *magnesium* light.

Now this operation required the use of wet collodion; and though we had not fallen into the misfortune, confidently predicted for us by various acquaintances, as to the Khamaseen wind driving sand amongst the bottles of chemicals, until the glass stoppers would no longer fit into their places, —something else had made two samples of collodion ferment, and all the acetic acid very nearly to lose its acidity, or at all events its power either to change

the colour of litmus paper, or to keep silver baths and iron developers from fogging. Hence unnumbered failures in misty, streaky, and spotty pictures, as we were trying the apparatus day after day from the entrance of the Howard Vyse instrument-room. Perhaps too we should have got out of our difficulties sooner, had we been content to take an ordinary photographic camera, as prepared for the many,—instead of plunging into an attempt to organize something new, wherewith to fulfil various requirements not yet brought together in any one apparatus, but still often desired by not a few real travellers.

Thus the principles with which we had started were, that,—

1*st*, The pictures were to be taken on glasses as small as the ordinary microscope slides, which are only one inch broad; and can always be had of any optician neatly put up in little grooved boxes, to any amount in dozens, hundreds, or even thousands.

2*d*, Two pictures were to be taken perfectly simultaneously, in cameras whose distance apart could be varied from three to thirty inches or more.

3*d*, The exposure was to be limited with ease to any fraction of an hour, a minute, or a second.

And 4*th*, The sensitive plates were to be keepable, and in their best state, for nearly any length of time after sensitizing and before impressing; or after impressing and before developing.

The small size of these plates would evidently be a boon to many a wandering scientific man on the

score of portability, if there could be secured sufficient definition at the same time, to allow them afterwards to be enlarged by the copying camera,—say to the size of a plate for illustrating a quarto book,—and still possess detail and sharpness just beyond the power of the naked eye to penetrate fully; and this it turned out can be done, wherever the subject of the view is such as to allow the employment of those 'small stops' which are used in cameras of every kind, whenever fine definition is required; such size of stop being, from 1-20th to 1-50th of the focal length, whatever that may be.

Again, a small size of plate, though not necessarily so small as an inch in breadth, combined with the use of two separate plates, was expected, and has since been found, to be a perfect panacea for the cure of some radical difficulties connected with the preparation of accurate and effective stereographs on glass, for scientific purposes. For these latter purposes alone, we venture to say; because, as for the artistic men, they have long since shut themselves out from an important field, by having adopted the fascinating idea that, if the centres of the lenses of the two cameras wherewith the two members of a stereoscopic pair of photographs are taken,—be removed linearly *more* than two inches and seven-tenths apart,—they will give an entirely and absolutely false view. 'What is truth?' asked the old Roman more than a thousand years ago; and who has dared in all the interval to answer him posi-

tively ; until in the course of a recent year, a writer in a photographic journal said, roundly and simply, 'It is photography'? But he has since been improved on by another similar author, who has particularized truth, as, 'a photo-stereograph, taken with a bino-'cular camera, whose two objectives are 2·7 inches 'apart.'

This latter idea,—produced originally in the study, —as touching a limited question of linear stereoscopicity alone ; and altogether overlooking the grand pictorial difference, that no photograph whatever gives human-eye truth, when the latter sees by luminous and coloured, and the former is impressed by chemical rays producing only a monochromatic shading ; yet this idea travelled quickly among working photographers,—aided, we fear, by their knowing too well, how much easier is a binocular camera and a single glass plate to employ in the field, than two separate cameras placed at a greater distance apart. But the practical result has been, that the stereoscope, once so excessively popular, has gradually dropped into extreme neglect ; for, excepting when fore-ground objects are very close, these binocular-camera-born photographs give so little appreciable stereoscopicity, that some gazers ask, What more is to be seen by looking at two such pictures viewed in a troublesome machine, than at a single one unassisted? In fact, one large picture they then consider far more satisfactory.

Leaving the artistical photographers alone, then,

with the suicidal result they have themselves brought about to the public,—we looked at the matter only in connexion with the requirements of science, which simply demands to have as much knowledge of a subject as possible; and if the nature of a thing can be better ascertained by looking at it from either end of a base-line of thirty or three hundred inches, —than from one of two inches and seven-tenths only, —will immediately do so. Nay, when the world-admired stereographs of the moon, by Messrs. Bond, Whipple, and Rutherfurd, in America, and by Messrs. Hartnup, De La Rue, Fisher, and others in this country, have been the result of removing the two telescope-cameras to what is equivalent to *several thousand miles* apart,—why is an astronomer to be limited in choosing his camera separation-distance with any other of his subjects? To say that the moon is an object outside, and not belonging to the earth, while landscapes, and even interiors of great Pyramids, are upon and belong to it, and must be treated on a different principle,—would be to re-enact the supposed radical difference between things terrestrial and things celestial, which was the great obstacle to progress in ancient philosophy; and which no scientific man of the present day, who holds the advance of science dear to his heart, and repudiates perpetual motion, could tolerate for an instant.

If, in the case of the lunar stereograph, it has been found advantageous in giving a knowledge of the real form of the moon, to remove the two cameras

virtually some thousand leagues apart, because a mere separation of two inches and seven-tenths, subtending no sensible angle at the enormous distance of the moon, would give no stereoscopic effect,—so also will it be found desirable, in studying any large and distant terrestrial forms, to remove the two objectives by which they are viewed, to such a linear distance from each other, that they shall have at last a powerful angular command of what they are gazing upon; always attending, however, in every view, to the requirements of all the items which compose it, and reducing the separation of the lenses whenever a very near object is projected on the extreme distance; or, contriving to exclude any obtrusive foreground trifle, if the shape of a distant mass is the result desired to be attained. This, is for *scientific* purposes only, and the gathering up of knowledge in various ways; for the artistical man will be artistical still, and may be allowed to take photographs of the moon in a binocular telescope, if it please him so to do, and to look at them in a stereoscope, and see the lunar disk infallibly as flat as a pancake, or as the unassisted human, and animal eye also, without employment of the reasoning faculties, see it in the sky; and he may declare that that is 'truth.' He may also, of course, go on using a similarly 'Siamesed' pair of objectives, though with shorter focus, in depicting any scenes upon the earth for himself,—if he thereby satisfies his own conscience, and is unable to rise to the higher truth,

that every stereographic pair, when otherwise perfect photographically, is equally true to the angle under which it was taken; while some angles are much more instructive than others, and can only be obtained with distant objects by increasing the separation of the two cameras apart, very many times the amount of separation of an average pair of human eyes; which may be near, but is by no means always, that critical quantity of 2·7 inches.

For our own *scientific* objects therefore alone, and to satisfy *our* conscientious scruples therein, we had gone to the trouble of two separate cameras, to be fixed on each occasion of using, at any distance apart thought most appropriate to the subject in hand, and to the purpose it was being taken for. And then we expected certain facilities to follow, in afterwards combining the two separate views on one glass plate of suitable size for a transparent positive in the stereoscope, from the original negatives being so very small as the one inch square already described,—facilities that certainly could not have been commanded were the glasses more than, or even so much as, three inches broad.

To try to carry out these scientific-intended principles, therefore, if I dabbled in photography at all, was evidently something of a duty upon *me*, an astronomer; and not only had I already ordered a peculiar double apparatus to be applied to the cameras, so as to make the exposure of both simultaneous, and without either jar or disturbance to

definition, whether worked slowly or quickly,—but, a house-carpenter in Edinburgh, a very worthy and ingenious workman, had made me two vulcanite baths, with part of the front in plate-glass, so as to allow the picture to be impressed on the collodion-plate, while it was actually in the silver solution; and this proved an invaluable feature. *First*, because, from the small size of the plates, and the dryness of the desert air, they rapidly, almost instantly, deteriorated, when not under the surface of water; and, *secondly*, the outside surfaces of the plates were then free from those trickling drops of fluid, which so often spoil the finest definition, when they occur on the collodion side; and tend, when at the back of the glass, to add to the 'halation' or blurring sometimes produced there. This fault had been much discussed in the photographic journals during 1864, and several corrective methods were proposed; none, however, so complete as doing away with the reflection of the second surface of the glass by immersing it in a highly refractive liquid, contained in a vessel whose back was of a dense, dead black. All this is mentioned to the praise of the carpenter, Mr. John Air, who had had an immense deal of trouble, and shown remarkable skill, in preparing the apparatus to fulfil all the required conditions.

In the next place, and for scientific purposes also, I did really wish to try after more *quickness* than is usual in taking photographic pictures; for evidently, when we apply a telescope with cross wires,

we may immediately see, that one very powerful reason why nearly every so-called artistic photograph has the most unartistic possible of smooth, cloudless skies, is because the clouds are always in motion; in five seconds, nay, sometimes in one, they blurr themselves out of all natural shape or likeness, and in the two or three minutes of the dry processes, they have made a dozen different combinations, each of which would have been a little fortune for a painter to be able to reproduce, and not a trace of one of them has remained on the 'sensitive' plate. Who also has not been grieved by the dreadfully stuck-up portraits of men, who have been got to stand to represent figures in many a photographic landscape; or the phantom of a horse or dog, which stood by accident for half the time required admirably, and then moved off; or the bare and deserted appearance of a scene which was really thronging with human life during all the time the camera was at work upon it. Surely, no one would presume to say, in any of our fashionable photographic studios, that *that* bare and empty view of a really crowded street, on account of being a photograph, and whether binocularly taken or not, was 'truth, the *whole truth*, and nothing but the truth.'

Not a few photographers, have indeed of late taken to instantaneous attempts, more especially Mr. Skaife, with his uncouthly-named pistolgraph, though the most successful arrangement for quick purposes yet produced, and one deserving of much more

popular favour and professional attention than it has yet received. I suspect, however, that his chemicals must have been in better order than mine were at East Tombs ; for there was no need there, of a spring to work the exposing shutter with superhuman quickness. The said shutter had been arranged in a special manner, rotating on finely-turned centres, and a thumb and finger could always produce a quicker opening and closing of the sensitive plate, than the photographic action could follow, to make an effective picture, even with the largest available aperture. And here was the main limit to what could be done ; if the aperture exceeded a certain proportion to the focal length,—the resulting picture was so ill defined, notwithstanding that the lenses were double combinations by one of the first London makers,—that little could be distinguished clearly upon it, of either moving or stationary objects : and if it was below another proportion, good definition was obtained when the object stood still ; but if in motion, was more blurred by that, than by the larger aperture, though quicker performance on the former occasion.

Hence, while we found that an aperture of 1-20th the focal length, gave exceedingly neat definition of still objects over the whole one inch square of the glass,—equal, with our short focussed lenses, to about thirty degrees square of the landscape,—the several seconds necessary for its performance, limited it to inorganic, or at least stiffened, nature. An aperture of

1-10th, with an exposure of about a second, gave the delightful aspect of a plain, full of animated groups of human beings, if such were there; though, when examined by a magnifier, the figures were found pulled out by their motions during a second of time, into the most anomalous Chinese or Japanese-looking forms. But when an aperture of 1-5th was employed with an exposure of 1-10th of a second, the definition of the lens was not sensibly impaired by the average walking movement of men or horses, at the distance they usually were from us; this, however, was when the definition, with so large an aperture, was superfine nowhere, and only tolerable over about fifteen degrees in diameter of the middle of the glass; while the focus was extremely difficult to hit, with even a respectable approach to sharpness of result.

If any one else has a photographic lens which will give bearable definition over a moderate angular field, with a larger proportionate aperture than 1-5th,—he is a happy man; and will be able, other things being the same, either to take pictures more quickly than I did; or, putting in a smaller stop, to take them as quickly, but better defined. And I have *heard* of a lens which gave good pictures when the aperture was *equal* to its focal length, or which would have taken pictures in 1-25th part of the time that my apparatus did at its quickest,—but I have seen neither that lens nor its performances, and have had no means of estimating its owner's ideal of what good definition may, and ought to be.

To work, however, with an aperture of only 1-5th, and wet collodion, under a bright Egyptian sun, —imparted the beginning of great satisfaction. For then in all the experimental trials at the landscape view from East Tombs cliff, there was no occasion to ask any one to go and stand in such and such a position and be very still; but, as soon as a plate was ready, it was fired off; and if there was any one in the scene, either far or near, going or coming, in motion or stationary, he was sure to be taken. Wherefore it came, that the villages in such views were rendered populous and the fields tenanted; some groups of idlers, or perhaps very hard workers, were always near the Shadoof at the well; some one or other was sure to be just in the act of fording the canal; and one or two of the camels grazing on the dry plain, were in the act of lifting up their heads to peer about and look like camels; of course divers personages were to be seen footing it on the road from one village to the other, and three or four turbaned men were usually seated on the sand, discussing the burdens of Eyioob, or laying out their schemes for mammon.

These figures, however, from their distance, were mere specks on the glass; and it became an object therefore to take advantage of any passing groups nearer at hand, such as 'the travellers' going to, or coming back from, either the Great Pyramid or Sphinx. And as those gentry could not be regulated touching the times of their appearance or disap-

pearance,—then came the advantage of Mr. John Air's operating baths, which enabled the plate to be prepared, placed in the camera, and left there for an hour or two under a hot sun without any harm (unless perhaps a residual chemical action, requiring a trace of free iodine and bromine in the collodion to overcome).

So the camera having been duly loaded and pointed at some pictorially effective parts of the road up the hill, was left until Alee Dobree raised the cry of 'travellers;' whereupon I had to rush out of the tomb and twirl round the exposing shutter, at the instant when said travellers were passing the most striking of the rubbish-heaps. Or if by chance they might just at that moment, as they often did, run together into a confused crowd, then it was necessary to follow them by rotating the optic-box, until they opened out more picturesquely in the plain,—and then catch them all when they were least expecting it, or thinking about nothing so much as getting up their donkeys into a tolerable amble, much assisted by the 'Hooi! 'hooi! English fashion!' of the attendant native boys, when they begin plying their pointed sticks into the poor animals' hind-quarters.

In this way some respectable little groups were obtained, showing not only examples of the several kinds of travellers, but the manners of the Arabs, in surrounding them on their arrival, and running after them for baksheesh on their departure. Yet

we rather preferred the figures which went more legitimately past us by a country road that wound itself through an opening in the northern causeway, —and showed before our gaze, in the narrow gap which the tombs themselves circumscribed, the natives of the country wending along on their several affairs,—with a poetry of circumstance and abounding variety, that reminded one of the passing scenes in the mirror of the Lady of Shalott; and the restricted, as well as evanescent, view which she alone allowed herself of all the outer world and its busy throngs, 'as they went down to Camelot.'

'Sheep,' shouted Alee Dobree; and there was the shepherd in a flowing burnouse, walking pensively along, holding his long crook horizontally with both hands behind his shoulders, and humming a melancholy, dreary, monotonous, song,—his sheep in the meanwhile trotting as readily after him as so many attentive poodle-dogs, or as if he had been a very Orpheus indeed.

'Camels' was immediately after shouted forth, but there were no plates ready, and we could only simply look on at the procession of a whole Bedouin tribe, with all their wealth of camels; the women confined in basket-cages on the rearmost (very proud of the confinement too), and the whole length brought up by armed men, and young camels; mere youths of camels, with long thin legs, stepping delicately, and beginning to learn the method of carrying their heads floating on the air in front

of them, in the same touching and unapproachable manner as their fathers before them.

Another day, and we thought, 'Surely that pair 'of camels has been past very often.' 'Of course 'they have,' said Alee Dobree; 'they belong to 'Sheikh so-and-so, and he is carrying off stones 'from a tomb beyond the Sphinx to build another 'room to his house.[1] He has just married another 'wife, and is getting very rich with the price which 'his cucumbers bring now in Cairo; all that piece 'of land which you see over there, in square 'patches, green and black, all that is his; and he 'gets as much money now for every little basket 'of cucumbers, as his father used to receive for a 'whole camel-load. He is not one of the Pyramid 'Sheikhs; a Pyramid Sheikh would know better 'than to break the monuments; but that man is 'such a great Sheikh, no one else in the village can 'say a word to him.—Ah, there's the hawk again!'

So it was too, the same identical, big-headed, solemn-looking, hawk, which the sculptor of the fourth dynasty represented standing behind King Shafre's chair. But the camera was ready this time, so bang, though without loud noise and with less murder, it went,—and the royal bird, with

[1] We visited afterwards the particular tomb that had been plundered, and found it one where a few weeks previously we had immensely admired the internal walls composed of fair white limestone, in admirably cut blocks of very moderate size; but these were now all gone, and their site had become merely a shapeless hole in unmeaning rubbish.

finely outspread wings, was secured on both plates; though not sharply, for I had been rather slow in working the trigger, and the landscape part of the view appeared somewhat overdone.

Another pair of plates was, however, prepared, and we went to dinner; and there, while Ibraheem, —with all manner of gratified smilings of his brown-varnished face, and twinklings of his one powerful eye,—was receiving the compliments usually elicited by his performances; and was explaining on this occasion, that all his dishes of fried and otherwise cooked potatoes during the last few days had actually been furnished by *one* large tuber, which he himself had selected in the bazaar,—suddenly, 'camels' again was the cry. We looked, and through the cleft in the northern causeway came a travelling group, two camels largely loaded, one of them a grand shaggy fellow with a long mane depending from his neck, looking like the king of the camels; a knot of human beings, large and small, followed in close order, and a turbaned man on a little horse. On the whole, they formed too compact a mass for a picture, so I followed with the double-barrelled camera as they crept along the plain, hoping for a better grouping to occur; and, just as there was some tendency towards it, what must the patriarch camel do, but turn off at right angles to the line of march, to browse on a few blades of prickly grass that slightly enlivened the sand thereabout. So before he had quite doubled the group

upon itself, and stopped up all the lights between the figures, I was obliged to fire, photographically, and take them all as they were at that moment; remarking, though, upon how very inconsiderate of that camel, so free and easy in his proceedings.

'Ah!' said the ancient Ibraheem, 'he's the only 'one there who is at all free. That's a slave-gang 'you see, and they are going on to be sold in the 'city. They've left off having the slaves sold 'openly, but the trade goes on by night outside the 'city walls, just as much as ever. That man on 'the horse now, he is the owner, and he has brought 'all those black boys and girls from beyond Nubia; 'but when he comes near this part of Egypt, in-'stead of making straight for the city, he goes a 'long way into the desert behind the Pyramids, and 'then comes in just as you see now in the afternoon 'from quite another direction. He'll get to Jeezeh, 'too, just about dusk, and wait there until the rich 'merchants come to him out of Cairo, and they'll 'pay him plenty of money.'

For the sake of showing up the nefarious transaction, we could have wished that the resulting photographs had been better than they turned out. But they had fewer spots, and other faults than their predecessors, so we cut short our extraneous musings, and concluded that both camera and chemicals were now almost ready for the interior of the Great Pyramid; and it only remained to arrange for the lights, and make sure also that the apparatus would

travel. We were testing this point next day on the hillside, and found the first plate indifferent, the next worse, and the next after that with hardly anything upon it. Then we changed both collodion and developer, and got nothing at all. What can be the meaning of this? I thought; and putting my head into the operating-box, examined the several arrangements, to see if there was any visible screw loose there. While so doing, the sky, which had not been very bright throughout the afternoon, suddenly became darker, and cries of all inconceivable kinds began to arise from the villages in the plain.

On looking up, behold the whole air full of flying, or rather drifting, locusts. They positively darkened the upper regions like a snow-storm; and looked, as they drove along from north to south, like flakes of snow in shadow, partly floating and partly falling in front of the only bright light that remained and streamed in on the scene from the eastern horizon, tinged yellow, green, and red, or with most unactinic hues. Before I could pack up on the spot, the locusts were falling all about; and in an hour's time they almost covered the ground, so that wherever we went, they rose up in flocks, and came drifting against one's face with their prickly legs: and all night long they came flying into the East Tombs dining-room, looking by the fitful lamplight like so many illuminated skeletons.

Whether really they had been in such numbers in the upper air, as to have imparted their own green-

ish hue to the light, and so prevented successful photography, it were dangerous to say,—but in three days they were all gone again; that is, all but a stray one here and there, which had gone down into some of the deep sepulchral wells, and could not contrive, with all his flying, to fly out again. And then the villagers left off making their noisy cries, which had been intended to induce the great devourers to go to some other person's fields than theirs; just as the Hindoo seller of green stuff says, and dare not do more, to the sacred Brahminy bull of his village,—when the pampered beast is devouring everything that is laid out on the poor man's stall,—'Please, my lord, go to another shop.'

At last, on April the 17th, everything was thought ready for the long-expected magnesium-light photography inside the Pyramid, and Alee Dobree had brought over at sunrise a number of men for the carriage of the apparatus. So there was a great fetching forth out of the Howard Vyse instrument-room, of cameras, tripod-stands, measuring-rods, water-bottles, magnesium-lamps, ordinary lamps, and whatever else might be required; and arranging them into convenient loads. But while that was in progress, Alee Dobree reported that one of the men had gone.

'Where?'

'To the Pyramid! There are travellers come!'

'But did you not engage him regularly for this

'service to-day, and tell him that he would get his 'wages in the evening?'

'Oh yes,' said Alee Dobree, 'I told him all that; 'but what are wages for work, compared to bak- 'sheesh from travellers?' and even while he was speaking, two others of the engaged men made off without saying a word to any one. Then we looked forth, and beheld all the plain alive with parties of natives, as well as travellers. They had not been so numerous since the end of Ramadan; and presently the sage Ibraheem informed us, that this day was the feast of the beginning of El Khamaseen, or the festival of 'Shemm en-Neseem,' the smelling of the Zephyr; when the people of Cairo troop out by thousands to smell the air, and obtain great good therefrom. So we bowed to fate; gave sixpence to every man who had not gone off without leave; and then let them go and compete with the truants for serving all the travellers.

Now this El Khamaseen, or period of fifty days, is a time when certain unhealthy winds are supposed to blow,—so violent, so oppressive, and so dusty, as to be the terror of all Egyptians, both strong men and invalids, all the year through. And it had been Ibraheem's industrious care, to try to assure my wife for months past, that the Khamaseen winds were by no means so evil as usually described; that he had known some English gentlemen who lived in the desert all through the Khamaseen period; during which a stormy wind only blew occasionally for two

or three days, just as it had already blown with us once and again; and that there was no need, on Khamaseen account, for our breaking up the establishment at East Tombs, or ceasing to pay him wages as our cook and dragoman.

But when we asked why the people went out in such numbers to smell the air on the first day of the fifty,—he said that that was in remembrance of the plague in *former* years, for it was always worst towards the end of the Khamaseen. The people, therefore, went out, as anciently accustomed, on the 'Shemm en-Neseem,' to take the last enjoyment of the open air, and then shut themselves up in their houses, waiting patiently to see whom the angel of death would take, and whom he would leave alive. In the Coptic churches, the priests at this time read the burial-service over the whole congregation, and if any one dies between that ritual and the end of Khamaseen, such public reading is supposed to serve his needs, and is made to do so; for sometimes no priest, and but few of the congregation are left survivors. All that, however, Ibraheem declared to be only what the old men remembered; and plague, he averred, did not come to Egypt now. It has not been there, too, according to other testimony, for about a dozen years; but Cairenes and Alexandrians alike were at that very moment on the brink of an equally devastating appearance of cholera, and no man thought about it.

On the next morning our party was organized

again; and, with my wife in the company, we started at six A.M., hoping now to have all the interior of the Pyramid to ourselves. Successfully we reached its northern foot; got all the boxes and paraphernalia safely conveyed along and up the passages and Gallery into the King's chamber; placed measuring-bars around the coffer to give, at first, its *outside* proportions. Then erected the camera and operating-box at the other end of the room; poured out all the solutions; appointed who was to appear in the picture, and who to light the magnesium-wire when the nick of time should come; enjoined sombre silence and the utmost quiet on all of them, lest they should raise the fine white dust, which,—ever since the washing down performed by Reis Alee Shafei and his school of boys,—had been slowly returning; looked again into the cameras to see that they were both nicely focussed and truly directed; and then, stepping carefully lest I should break my own rules, began to pour the collodion on the first glass plate that had ever been prepared for photography within the Great Pyramid. But hardly had the collodion set, when my heart almost collapsed within me; for, could any one have believed it at that early hour! Yes! it is so indeed! The 'tra-'vellers' are upon us again! And the multifarious echoings coming up the Grand Gallery, testified that there were 'travellers' in numbers overwhelming.

'What is the use of going on now?' I could not but mournfully deplore to myself; 'the travellers

'will be in the room before a plate can be sensi-
'tized; and after they have once entered, there will
'be so much dust in the air that no faint reflected
'actinic rays will be able to penetrate through it,
'between the coffer and camera!'

Whether Sheikh Abdul Samed perceived my despair, I know not,—but he saw some of the exigencies of the occasion; and, as the noises coming up the Grand Gallery waxed louder and louder, he suddenly said—'He would try to arrange so, that only
'the travellers and none of the Arabs should enter
'the King's chamber, in order to the dust being
'raised as little as possible.'

I thanked him for the idea; and therewith he took all our people out with him to the great step at the beginning of the Grand Gallery; and while I sat grimly between the camera on one side and the operating-box on the other, to defend them from all comers,—my wife peeped out from the antechamber, to see how the Arabs would accomplish their benevolent intent.

Never, according to her subsequent report, had she seen, in the party that was now approaching, such a fearful conglomeration of human beings; the whole Grand Gallery was full of them; the travellers themselves were innumerable, and each of them with three Arabs carrying flaring candles. And 'Oh,' thought she, 'if they should stick fast
'in, and block up any of, the small passages when
'going out; and prevent us ever leaving these awful

'regions of majestic architecture, with their unpity-
'ing surfaces of solid stone,—where no human aid
'can possibly reach us, through their walls which are
'mountains thick, yet without any of the friendly
'rifts which nature would have inserted even in the
'severest of *her* dungeons!'

But the Arabs pondered over no such sentiments, though they had thought of a great deal more than they had told me; for the result at last came about,—that after I had sat between the two instruments for a long time, expecting every instant to have to point out to entering travellers how to avoid their spreading feet,—and had heard the innumerable echoes continually increasing for a while, up to an awful maximum of general din, almost as if Tippoo Saib's three hundred tigers had been let loose outside the entering passage,—presently the noise began positively to decrease, then to wax fainter, fainter, and fainter; fainter and more distant still, and then returned all our own party excepting the Sheikh, and said the travellers were gone.

'Gone! and how has that come about?' Why, all the time that some other persons had been merely indulging vain despair,—Alee Dobree and his friends had taken off their dark blue togas and spread them across the antechamber, so as to make the space behind, leading into the King's chamber, look as black as night. Then the Sheikh, gracefully seated on the grand step, like the Sultan himself, congratulated the leaders of the travellers' band as they

arrived, on having reached the most glorious part of the Pyramid.

'Well, but where,' they asked, 'is the chamber 'we have come to see, and every one tells us we 'should not leave the Pyramid without seeing?'

'The *beautiful* chamber,' answered the Sheikh, 'is below, and if the guides did not take you to it 'as you came up, they will doubtless do so as you 'return.'

'Well, but what's that place beyond there,' said some travellers, pointing to the antechamber, 'and 'what are all the people doing away there behind?'

'Oh! that place is only a dirty little hole,' replied the Sheikh, 'and there's a photographer or 'some fellow of that sort who is doing something 'or other there; and these poor starving people 'have come with him.'

'Well, if that's all,' exclaimed the spokesman of the travellers, 'we'll certainly go back and see the 'beautiful chamber below; but first we must burn a 'little magnesium here.' So therewith he explained to his companions, and one of them producing a strand of magnesium wire, and setting fire to it, displayed before their wondering eyes the enormous height of the Grand Gallery; the dignity of its seven mysterious overlappings of stone, and the inexplicable and dangerous angle running through the whole. Wherefore the boisterous shoutings in the further parts of the crowd ceased, and there was a deep reverberation of more solemn applause

again and again, as long as the light lasted, from every part of that huge collection of human beings.

'Oh! so immense it was,' said my wife afterwards; 'such a number of faces to be collected 'together; and all of them dreadful! whether in 'colour red, or brown, or livid white:—a surface of 'such faces before her as far as she could see, the 'whole way down the floor of the Grand Gallery; 'some, deadly pale in the oppressive heat, others 'fever-flushed with excitement, or toilsome labour, 'but all looking up at the mighty ceiling and the 'impressive walls composed of surpassing primeval 'symbols of structural language.'

After that, though, the travellers went away peaceably enough; and the Sheikh accompanied their band to make sure that the guides took them to the 'beautiful chamber,' *i.e.*, the Queen's chamber. And when some one there, thinking of accounts he had read as to the King's chamber, asked,—'Well, but where is the sarcophagus?' the turbaned chieftain replied, 'that all *small* antiques were now re-'moved to the Museum at Boolak.'

Perhaps it was as well that they did not inform me until it was all over, of this piece of organized hypocrisy, so speedily invented and so successfully carried out by pure Arab genius; but so it happened; and I was now fully occupied in preparing the photographic plates. How much magnesium should be burned in order to produce a photograph, was a question only to be settled by actual trial; I

suspected much more than what had been employed hitherto in portrait-taking in England; first, because a large surface, say fifteen feet by ten, had to be illuminated; and secondly, because that surface was excessively dark and unreflective. At the first attempt, therefore, we tried sixty grains,—burning it in the shape of hanging tapers in Mr. Brother's (of Manchester) very convenient shield-holders. A faint picture appeared. With another pair of plates, aperture 1-5th all the time, one hundred grains were consumed; and still the picture was faint. So then one hundred and twenty grains were tried with a third pair of plates; and hardly any impression was obtained! This bad result arose from the vapour of the burning magnesium diffusing itself throughout the room, in spite of all our efforts to condense it on surfaces of glass or porcelain. So by ten o'clock, finding the atmosphere of the King's chamber was so thick we could hardly see the further end,—we left the apparatus standing, and under special guardianship of two Arabs, who were to remain at the head of the Grand Gallery all day.

About three P.M. I returned, to find the top of the said Grand Gallery smelling fearfully of Arab men; and the room still smoky. A pair of plates was tried, but one of the white-robed Muslims looming through dense haze, was all that was pictured by an expenditure of another one hundred and twenty grains of magnesium. The ordinary candles, too, burned very palely; and we deeply deplored

once again, that the ancient ventilating channels had been surreptitiously stopped up within the last few years.

After two days' relaxation on outside works, we arranged for another photographing inside the Pyramid; and were gravely annoyed to find, when just ready to start, that all the men required for the carrying, had left us; yea, even our two engaged servants, Alee Dobree, and Smyne also. A proceeding really too bad of them on this occasion, for Ibraheem had gone on a special journey into Cairo, and during his absence they knew that much of our safety and comfort depended on them. But off they had gone notwithstanding, because, forsooth, some enormous crowds of steamer-passengers, whom they had never known anything about until they actually appeared, had come out to the Pyramids.

So there, in spite of all our large payments, and all our endeavours for months to sympathize with, and help, these people,—were my wife and self left entirely alone and undefended, except by poor Alee, the day-guard, who was too much of an invalid to walk many steps away! When, towards evening, Alee Dobree did at last return,—I endeavoured to set before him his want of truth in not adhering to his engagement; and his want of friendship in preferring utter strangers before us, who had known and cared for him so long; and should be leaving him for ever in a very few days more, after which he

might dance attendance on steamer-passengers or any other new-comers as much as he liked. He looked rather foolish at this, and still more so when I told him that he and his countrymen would never be free—would always be a nation of servants to the Turks, or some other masters, unless they could learn to appreciate truth and justice, and stand by what they had pledged their word to, even at a passing inconvenience, or loss to themselves. But then came his lamentable religion to his rescue, and he began peeling off his outer garments and droning out his usual set prayers towards Mecca, as if nothing had occurred, and no one was present.

He attended, however, in improved spirit next day, so that with him and three other men I was off to the Pyramid at 5.30 A.M.; finding the morning air on the road fresh and healthy, but the inside of the Pyramid still dusty and foul with the traces of yesterday's visitors. Three experimental pair of plates were tried with a new sort of magnesium-burner, and we returned to East Tombs in time to accompany my wife to our first and last party out, from the time of our reaching the victorious city of Kahireh in December, to leaving it again in May.

This unique piece of hospitality in Middle Egypt, came from Sheikh Abdul Samed. He had long spoken of his desire to ask us to dinner, and this was the day he had at last fixed us to.

We went over accordingly between twelve and

one o'clock to the village, rather a large party; for besides a young Scot recently arrived, and also invited, and of whom more anon, the portrait-taking camera had been applied for. The Sheikh, too, had apparently arranged with Ibraheem, that both he and Smyne were to do the waiting at table; while Alee Dobree undertook the part of *cicerone* and guide,—leading us by the shortest walk through the sands to the cultivated grounds,—and then and there duly mentioning whose were the particular patches of either corn or vegetables which we passed, or whose were the houses which loomed most conspicuously in the village before us. While he was explaining, too, why the men of his village did not care to increase their number of date-palms, because the taxes on them very nearly balanced the advantages derivable; and why they clipped them so very close of all their lower leaves, not only to have the materials for basket-work and household furniture of various kinds, but to prevent the 'life-giving 'Etesian winds' swaying the great woody fronds backwards and forwards, and damaging the bunches of fruit hanging down, in their season, amongst them,—while all this talk was going on, we passed one of the more popular wells near the side of the road; and, amongst other dignitaries seated by its brink, was Sheikh Murri, looking not particularly well pleased at the movement in progress.

Poor man, he had begun to be jealous some time since of our employing more of Abdul Samed's,

than of his, people; and now he thought the rival Sheikh had decidedly outflanked him in our favour by this invitation to his house. A cut, moreover, to Sheikh Murri, the unkindest of all; for *his* domestic affairs were sadly disarranged about that time, on account of his having *two* wives; and they had fought so fiercely together, that he had been obliged to divide his establishment, and keep one wife in Jeezeh and the other at his Pyramid village.

But on we went, along the northern side of El Kafr, past the public pond of clayey water, where geese were drinking in large numbers, and more Arabs congregated to gaze at the Sheikh's guests. And then, on our entering a door in a mud-wall, we were taken through a small yard,—where was huddled a great flock of white chickens hatched in the ovens at Jeezeh, and bought by the pound-weight in heaps; things that had never known, and never were to know, a mother-hen's loving care and experienced instructions; and looking, not so much like earthly chickens as a collection of naked souls on the bank of the Styx, shivering in the unkindly winds of a strange land, into which they had been brought they knew not how. Then up a flight of outside stairs, and then across a sort of upper court to a raised guest-chamber, with a very uneven floor,—that said little, indeed, for the qualities of palm-tree trunks for building purposes,—but furnished with a piece of Turkey carpet and cushions in one corner. Here they made us sit, and drink coffee in small

cups, which were almost filled with sugar before any of the brown fluid was poured in, and our host and his brethren drank in concert with us; but when the dinner appeared, they all vanished. A moderate affair it was, brought in upon the usual little table; rice and mutton chiefly, with oranges following; and symptoms that, small as was the spread, they had politely offered us the first partaking, and made their own dinner off it afterwards. Coffee then came in again, and the entertainment was over.

Meanwhile, however, the photographic camera was being established, and while I was taking the party of men collected on the terrace outside, the Sheikh brought his wife to exchange sentiments rather than words with Mrs. Piazzi. Sheikh Abdul Samed, to his honour be it spoken, and to the real comfort and satisfaction of his household be it understood, has only one, and has never had but one, wife; and she seems a woman of more than average Egyptian mind and feeling; her attire was costly, of embroidered cashmere, and her jewels were numerous and valuable. A portrait was to be taken of *her* also, with her children; but she seemed to have a strong objection to being placed for the purpose on the terrace, which could be commanded from many other houses, and was only at ease in the lower courtyard. Now that was rather unfortunate, for the light there was weaker than above; and even above, on that particular day, the photo-

graphic action had been strangely slow. No doubt the sun was shining,—but there was a yellow, diseased sort of look in the sky, and men talked to each other of Khamaseen winds, and red dust, clouds of locusts, and moving pillars of sand, until they got as truly wretched about the weather as an inhabitant of Edinburgh discussing the north-east gales which blow there in its cutting severity of spring-time. Certain it was, however, that instead of taking portraits, as I had hoped, in one or two seconds,—twenty, thirty, and even forty seconds of exposure were found too short. In fact, it was no day for taking portraits at all, especially of personages who could not be taught the absolute necessity of perfect stillness; and in the last attempt we made, a married daughter, also living in the house, dandled her baby up and down violently all the time, thinking if she could only keep it from crying, its picture would be beautiful for ever. Madame Abdul Samed, indeed, sat very steadily, though rather too modestly retired within a doorway; but the Sheikh's youngest son, strikingly and picturesquely attired in a little burnouse and a witch-like hood over his head, was the figure which told with most force and distinctness; yet no credit to him, the little miser, for he had just made unlawful gains to himself, and was fascinated with the sweetness of the look of a forbidden prize.

The child was pretty enough, fair for an Arab, with large almond eyes, an aquiline nose, thin

flexible lips, and a pointed chin. But then he was the Sheikh's youngest son, and on that account a spoiled favourite with the father; who used frequently to take him to the Pyramid and delight his own soul with his beauty for hours, when waiting for 'travellers' to appear. Once the Sheikh had brought his favourite to East Tombs on a morning visit, and the child was so bashful and coy he could hardly be brought forward to show his face from under the pointed hood; yet he was peering about furtively all the time; and the moment the visit was over, and the dining-room tomb vacant for a few minutes, he slily returned,—opened a packing-case where my wife kept her entomological collections in little glass bottles; took the whole of them, and having emptied all the contents on the floor, deposited the bottles one after the other deep down in a long and capacious pocket in his burnouse, and then followed his father up to the Pyramid, looking as innocent as a cherub. On Mrs. Piazzi's return, she was much dismayed to find all her specimens lying on the ground, the box open, and the bottles gone. She immediately called Ibraheem, and asked who could have been in the room. 'Oh,' exclaimed Ibraheem, 'I know, it must have been that wicked 'little boy;' and he at once followed on his track, and reported to the father what had taken place; when, on the young culprit's pockets being examined and found to contain all the stolen bottles, he received such a correction that he was not likely to

come to East Tombs again; 'no, never again,' repeated Ibraheem.

But the petting of the favourite child was soon resumed as before; and on this occasion of the dinner, my wife having taken some little presents to each of the children,—the 'general nuisance' set his heart immediately on getting for himself what had been given to his sister. And he took it, too; but my wife, being close by, insisted on its being restored; wherefore he declared he did not like her at all, and would not remain anywhere near her. But he managed his further goings out and comings in so adroitly, that by the time of my taking the last picture he had plundered his sister again of the coveted pair of scissors in morocco case; and was gloating in a perfect trance of ecstasy over the unholy acquisition, which he held low down between his knees, all the while the camera was at work; his little soul already dyed scarlet in a precocious love of mammon.

Having packed up the camera, and sent it back to East Tombs,—we took a walk with Alee Dobree through and about the village, before returning there ourselves; noting how the most conspicuous of the very few houses with an upper storey, and the only one fully white-washed, was that of a retired dragoman, who had made his fortune in boating excursions. The other houses had indeed something above them, for the roof was the storage place for their supplies, of that species of artificial

fuel mentioned in chap. ii. p. 24. And while the mud walls below, were as utterly devoid of architectural pretensions as mere mud walls can be, the owners really showed commendable taste in arranging their cakes of ammonia-composition, in a sort of serrated manner, which made them form quite a striking coronet around every house-top; and gave them something of the look of ancient Egyptian temples,—besides enabling one to judge of the wealth, or provident habits of the owner below. But the soil around the village was lamentable pot-clay, so dry and hard everywhere, except in occasional holes, that it was a wonder how the date-tree palms could live in it. There they stood, however, with their great columnar stems; through gaunt and serried colonnades of which, would appear most effective views, every now and then, of the desert, the desert hills, and the range of the Pyramids on the summit of the hills, far surpassing in actual height what they stood upon.

Proceeding onwards now to the west, the palm-trees fall behind, with the last trace of green, or even dark-brown earth, and the desert opens out with its 'melancholy gold' in front, and to the right and left, as far as one can see; the solitary Pyramids becoming more and more the kings of the deathly scene, and drawing all attention upon themselves. This is very much the view which Sandys was most struck with, and attempted to picture in A.D. 1627; and again, Howard Vyse in A.D. 1837.

The former, in his description, joins with all the rest of the world in abusing, what they so little understood; and therefore inveighs against 'those 'three Pyramides, the barbarous monuments of 'prodigality and vainglory;' yet, immediately after, he makes some of the very same confessions that many other authors have done, and which indicate strangely certain lingering traditions of higher motives. For otherwise, why should he write, 'By 'such shape, that of a Pyramis, the ancient did ex- 'presse the originall of all things, and that formlesse 'forme taking substance. For as a Pyramis begin- 'ning at a point, and the principall height by little 'and little dilateth into all parts; so Nature pro- 'ceeding from one undevideable fountaine (even 'God the sovereign essence), receiveth diversitie of 'forms; effused into severall kinds and multitudes 'of figures; uniting all in the supreme head, from 'whence all excellencies issue'?

But it was the 'unheroic eighteenth century,' which thought least of the Pyramids,—from Niebuhr, who flattered himself that, 'by employing a little 'natural philosophy, he had reduced their reputed 'wonder to very moderate dimensions,'—to Bruce, who was positively provoked that any one should still talk about them. 'Why,' exclaims he, 'the de- 'scription of them is in everybody's hands. En- 'gravings of them had been published in England, 'with plans of them upon a large scale, *two years* 'before I came to Egypt.'

The then last discovery was that of Davison's chamber; but the only thing extraordinary there, in Bruce's estimation, was, 'its having escaped dis-'covery so long;' or, if there was anything else also to be called extraordinary, it was, 'that for such a 'time as these Pyramids have been known, travellers 'were content rather to follow the report of the 'ancients, than to make use of their own eyes.'[1]

'Yet, it has been a constant belief,' says he, 'that 'the stones composing these Pyramids, have been 'brought from the Libyan mountains (according to 'Herodotus), though any one who will take the pains 'to remove the sand on the south side, will find the 'solid rock there hewn into steps. And in the roof 'of the large chamber, where the sarcophagus stands, 'as also in the top of the roof of the Gallery, as you 'go up into that chamber, you see large fragments of 'the rock, affording an unanswerable proof, that these 'Pyramids were once huge rocks, standing where 'they now are; that some of them, the most proper 'from their form, were chosen for the body of the 'Pyramid, and the others hewn into steps, to serve for 'the superstructure, and the exterior parts of them.'

The Pyramids themselves survived this atrocious libel by the great traveller of the age; but the opinions of polite society were quite destroyed, or sunk to such a depth of ignorance and error, that nothing less than the volcanic upthrowing and overturning of the French revolution, were required to

[1] Quarto edition in 1770, Bruce's Travels, vol. i. pp. 41, 42.

induce any one else to use *their* eyes, where Bruce had already employed *his:* or to read again their Herodotus, and find that the portion objected to, when properly translated, is to a very great extent perfectly true.

With the *savants* of Bonaparte's expedition, however, at the end of the eighteenth, and beginning of the nineteenth centuries,—came men who cared little for precedent or aristocratic names, but much for matters of fact, and the superior searching powers of modern science.

When they therefore arrived at the Pyramids, and began to observe for themselves in a more accurate manner than had ever been attempted before,—soon one discovery followed another, and high scientific ideas began to be entertained touching what other men had looked upon only as tombs. Thus too, the world might have arrived long since, at a full knowledge of the meaning of the most remarkable work of ancient men,—had not the British Government rushed in perfectly needlessly; confusing all those learned researches; and doing so, at an expense of many millions of money, as well as thousands of lives of Britain's sons who could ill be spared, and whose unaccomplished careers upon earth will never be made up to their nation.

'But was it needless,' does any one ask, 'to send 'out our great military expedition to Egypt under 'Sir Ralph Abercromby, when Britain was engaged 'in a life and death struggle with France, and there-

'fore bound to oppose that power in every possible 'manner, and especially to check each movement 'of her rising chieftain, Bonaparte?'

'Yes, perfectly needless,' we reply, after hearing local particulars, and feeling some of the climatic circumstances. Because, the two warlike ends quoted above, would have been served infinitely better by our not having sent out a single soldier, and merely letting matters in Egypt alone, and keeping them so. For how stood the case?—the French army was at the time completely cut off from its parent country by our command of the sea; its stores exhausted, its arms and uniforms all in ruin, daily harassed and thinned by more or less fighting with Turks, who were continually increasing in numbers as those of the French were decreasing; sickening also with a desire to return home that could not be gratified, and growing daily in hatred against the general who had brought them to such a country, and then deserted them. In fact, if they had been simply left there for many years more, the majority would have been killed or died off, and the few survivors,—become rabid anti-Bonapartists,—would have taken peaceful service in British ships, or accepted any sort of occupation to escape.

Even as it was, when we had been slaughtering them in battle, and they killing too many of our soldiers in return, and we engaged to take them back to their own country in our ships,—it is recorded by Dr. Clarke that the detachment of French troops,

ragged and miserable, sent on board his brother's man-of-war, the 'Braakel,' would do anything to ingratiate themselves with the British officers and men; and, amongst other voluntary demonstrations, got up a band, which used to play night and morning, 'God save the King,'—George of course; and all who could speak any English, *would* make a special point of giving the line, 'Send him victorious,' with extraordinary enthusiasm, for it was in fact their only hope of getting out of Egypt.[1]

Perfectly needless, therefore, even for its expressed purposes, which *may* be considered patriotic, but not very philanthropic, was the English Government's first murderous expedition to Egypt; and then it was besides, obstructive to the cause both of science and local social improvement. For the French army had been engaged all the time in giving the most important and deeply required lessons on respect for Europeans, to the overbearing Orientals of the most anarchical country on the face of the earth,—while their *savants* were unrolling the history of the land's primeval days.

[1] Respecting also the whole of the French army, 'a sincere desire to 'quit the country was evident on the part of the French soldiers,' writes Dr. Clarke, from what he saw of them previous to and at the capitulation of Alexandria; and he adds the particular anecdote of a Creole trumpeter, who had served under Bonaparte, and pretended to have been always about his person, coming up to a committee of the English officers, and saying, when he thought sufficient attention was not paid to him,—'If you should mention the name of l'Esprit to the 'little Corsican, you will find that I am pretty well known to him; 'and when I shall have arrived in Paris, I will make him explain why 'he left me in this cursed country here.'

England interfered with the progress of both these subjects, and took up neither of them herself. Not the scientific,—for though we did plunder the French of the 'antiques' they had collected; the doing so, while the objects were on Egyptian soil, and then carrying them off to London,—can only be considered as an unrighteous plundering of Egypt herself; as well as a fatal entangling of ourselves with a peculiar thing of spoil, which brings us no blessing from any nation, while it excites against us the most revengeful feelings even still of our nearest neighbour. And not the social problem either was served,—for our dismal defeat on the second English expedition to Egypt at Rosetta, with the beheading there of whole lines of English soldiers by Turkish scimitars, and the carrying away of others to slavery or forced Mohammedanism,—went far towards removing in Oriental minds that grand lesson which the French had given them, when they overthrew the more powerful cavalry of the Mamelukes, even at the very epoch of their greatest strength and impetuosity; and made their battle of the Pyramids both a watchword of triumph to the soldiers of European training, and a classic reference in military annals and the literature of war, for all future time.

Had the French army indeed occupied and ruled the country some time longer in their own manner, it is probable that the Osmanlees would have looked on Europeans with even august respect; and our

expedition to Rosetta in after years need not have taken place, or the losses our troops sustained there been incurred. What these were precisely, it is difficult now to estimate, as sufficiently evidenced by the following almost chance paragraph in Colonel Howard Vyse's first volume :—'Amongst other undertakings, 'a company of Greeks was employed in 1837 to 'weigh up a number of guns in the Bay of Aboukir, 'many of them English, and most probably lost in 'the unfortunate expedition under General Fraser, '*of which no detailed account was ever published.* 'It was probably thought by the Ministry then in 'power, that the result of the expedition to the Dar-'danelles was sufficient to gratify public curiosity.'

In one way or another, therefore, the prospects of Pyramid investigation, which had looked so bright at the opening of the nineteenth century, were shortly afterwards utterly extinguished, and remained for a while as black as night; considering, too, what country it was which had interfered with the progress of those studies, there appears but just retribution in all the severity and expense of their renewal falling upon an Englishman; though when the national burden for sins, both of commission and omission, against cosmopolitan science, was voluntarily borne by a single individual upon his own private resources,—it became for him an immortal honour.

Colonel Howard Vyse himself, indeed, we have

reason to believe, had no such very elevated thoughts about the importance of his proceedings; but merely listened conscientiously, as an honest man, to the promptings of a still small voice within him, which ever urged his soul to an admiration of whatever appeared to be in itself truly great; and, in calling on, involuntarily obliged, him to devote himself to its prosecution with an earnestness and generosity, which ever rose in proportion as popular favour had *not* hitherto manifested itself, or the justice of the world, according to his ideas, had *not* been done towards the object of his choice.

Arriving therefore in Egypt, more as a fashionable amusement-seeker than anything else, he begins to be impressed with the idea,—in spite of all that Bruce had written half a century before,—that the Pyramids had *not* had justice done them; and thus he reasons to himself as he looks towards the Pyramids of Jeezeh across the ever-flowing stream of the Nile, in a moonlight night's ride in November 1836 from Toorah, where he had been witnessing a review of troops, to Cairo:—

'They,' the Pyramids, 'are probably the most ancient buildings in existence, and are alike unrivalled in extent and the enormous proportions of their materials. Their origin is hidden in the abyss of time, so that even the period of their violation is unknown. And, notwithstanding the repeated aggressions of succeeding nations, they appear comparatively untouched, and have continued from age

'to age, through countless generations, the perpetual 'and mysterious records of an unknown and mighty 'people, whose memory has long since passed away, 'and whose very existence is alone established in 'these unrivalled monuments.'

A miraculous drop falls into the Nile, say the Mohammedans, on the night of the 17th of June, and causes the grand inundation of the year immediately thereafter to commence: and on the same principle we may suggest, that an invisible ray of immaterial thought must have descended into the Colonel's mind on that particular night of his lonely ride; and produced by its workings there all that subsequent flood of surpassing zeal, unbounded liberality, and untiring perseverance which developed themselves so abundantly in him during the following nine months,—as to constitute his labours at the Pyramids the grandest investigation into their nature which has ever yet been conducted by mortal man. And it was toward the end of that period, when local knowledge, joined to the natural gifts of his mind and the varied experiences of his life, entitle him to speak as one of first-rate Pyramid authority, that he writes touching this same view which we have just been alluding to,—or of the line of gigantic Pyramids, as seen from the sand-plains directly east of them, in the following terms:—

'The air of desolate grandeur, with which the 'ruined aqueducts stretch across the deserted Cam-'pagna, has been often remarked to be peculiarly

'appropriate to the *Roman* capital in its present 'state; but how trifling in extent and antiquity are 'those brick arches compared with the *Pyramids of* '*Jeezeh*,—which, of scarcely less duration than the 'rocks themselves, have existed "*on the utmost* '"*bounds of the everlasting hills*," from generation 'to generation, the wonder and admiration of all be- 'holders. From the simplicity of their forms they re- 'tain their original character of ponderous solidity, 'although whole towns and cities have been con- 'structed with materials taken from them; while 'from their vast expanse the finest aerial effects are 'produced, and they require repeated examination 'to enable any one to comprehend their awful and 'extraordinary proportions.

'They have, however, been often described by 'successive passing travellers, and extolled in vari- 'ous terms, according to the taste and feelings of 'each individual; but as they, the Pyramids, are 'unique and without comparison, no description can 'convey an adequate idea of them.'

Of course the worthy Colonel himself, notwithstanding his long experience, must suffer some of the same difficulty with all the rest of men, when trying to prepare set phrases and sentences wherewith to realize the whole scene of those truly world-wonder Pyramids at once; and his language flows more smoothly when, beginning to picture merely a small local effect in the course of his regular working operations, the grandeur of the subject

insensibly floats him away on its noble tide, in the following unintended and ingenuous manner :—

'The morning was cold and foggy, and at first 'every object, even the gigantic Pyramids, were 'totally obscured; but as the atmosphere cleared 'up, the scene from the Sphinx became singularly 'beautiful. The picturesque forms of the women 'and children carrying baskets of sand upon their 'heads on the undulating mounds near Campbell's 'tomb, the finely broken foreground extending to 'the rocks at the southern dyke, and the enormous 'masses of the ruined temple on the rising ground 'before the second Pyramid,—were in the finest 'breadth of light and shade. For a time, the lofty 'apex of the second Pyramid shone alone in the 'clear blue sky (like the top-gallant sails of a ship 'of war), far above the clouds that shrouded its 'mighty bulk, which by degrees slowly appeared in 'all its grandeur; and soon afterwards the southern 'front of the Great Pyramid, glittering with the 'morning sunbeams, was displayed in full majesty, 'as the light vapours melted away from its enormous 'space.

'Owing to the oblateness of their forms, the 'want of proper objects of comparison, the propor- 'tionate smallness of the stones with which they are 'built, and many other adventitious circumstances, 'the exaggerated and undefined expectations of 'travellers are often disappointed in the hasty sur- 'vey generally taken of these monuments; and they

'are consequently considered rude and misshapen 'masses of coarse masonry, without symmetry or 'beauty, and alone worthy of notice from their ex- 'traordinary size. A more deliberate examination, 'however, never fails to alter and correct those 'opinions; and it was universally acknowledged, 'by those who remained any length of time at the 'Pyramids, that the more carefully and frequently 'they are inspected,—the more extraordinary their 'grandeur appeared, and also the striking effects 'which, under the varying influence of the atmo- 'sphere, they continually presented. Pre-eminent 'in dimensions and antiquity over all other build- 'ings in the world, they are alike admirable for the 'excellence of their masonry, the skill and science 'displayed in their construction, and the imposing 'majesty of their simple forms.'

CHAPTER XVII.

CONCLUDING WEEK.

MONDAY the 24th of April opened the last week that we were to remain at the Pyramids, and opened it in most uncertain guise. We had, indeed,—all other work nearer at hand being well-nigh finished,—been contemplating a little journey to the Pyramid of Aboo Roash; and had already made acquaintance with the camel which was to take us, if we *should* go to that northern hill whence the view of the Jeezeh Pyramids is said to be peculiarly instructive, so promontory, if not island, like, appears there the eminence on which they are built. But what should we be able to bring back *photographically*, our thoughts suggested, in such unhappy weather as was then prevailing? for the whole air seemed stagnant, over-full of pale yellow miasma, with baleful sunlight shining through in streaks, and, even at its brightest, with a sickly white-lead hue; while the air-temperature was so high as 88° in the shade; and the drought, of all the severity that 20° difference of the wet and dry bulb thermometers could make it.

What, indeed, could we do closer at home (*i.e.*,

our home of East Tombs) in such weather? We took the camera up to the north-north-east azimuth trench, and in the dead white glare of the sun gave an exposure of twenty seconds with an aperture of 1-10th the focal length and a wet collodion plate, (or full seven times as long as should have been necessary on any ordinary day,) and yet obtained nothing at all; then increased the exposure to three minutes, and got something of the sky; and to five minutes, and obtained further indications of the surface-ground on either side of the trench; but the trench itself appeared as black as night or the bottomless pit, when the plate was looked at by reflected, and the sky flaming red when examined by transmitted, light.

If the sunlight of the outer world, then, has got so completely out of joint, let us retreat into the innermost depths of the Great Pyramid, where no rays of the disordered day can penetrate, and see what burning magnesium can do there. So away we went, through all the passages, and up into the King's chamber, carrying with us on this occasion a Manchester-made lamp, with three *spools* of flat wire, and mechanical arrangements for paying them out so as to burn uniformly just over a spirit-lamp flame; and may I never have such a machine to work again in such a situation! Of course, a Manchester man would have acquitted himself of the task an infinite deal better; but even he must have had some little trouble on finding the wooden cores of the spools

cracked with the droughty air of Egypt, and the vulcanized rubber springs—that were to have made, by lively vigorous pressure, one pair of smooth rollers move another,—converted into stiffened, dinted lumps of perfectly inert matter. Of course, by means of pressing the rollers into contact with one hand, and turning the endless screw-motion with the other, the three flat bands were made to pay out pretty well for a time, and kept up a tolerable light; but before a fourth part as many grains of magnesium had been consumed as we judged essential to take a picture, this desperately slow operation of burning the thin band, at *only* three ends at once, had gradually filled the chamber with white smoke; while presently, and worse still, a fragment of solder in one of the conducting-pipes giving way, the exit of that band in front was consequently stopped, and in five seconds afterwards the spools behind had released all the multitudinous coils, and their stiff and springy threads were in an interminable tangle. Such a place, too, the King's chamber of the Great Pyramid, wherein to have to sit down on the floor, and by the light of one or two miserable candles in the hot and stifling air, to adjust all the elastic and resisting turns of the metal-thread into regular sequence again on each of the three winders,—and our pair of photographic plates with their embryo pictures standing only half impressed all the time!

Well, this proved plainly enough that one thing remained to be accomplished before leaving the

Pyramid neighbourhood, and that was to organize some really effective plan for burning magnesium, suitable to the black surfaces and unventilated interior of the monument; for even the best of our results as yet, with the several forms of apparatus supplied on leaving England, had produced only the thinnest of negatives. With this view, therefore, we paced our way back to East Tombs, and then found the whole yellow-green air full of falling, rather than flying, locusts. They were coming now from the south-west, the direction whereto they had gone a fortnight before; which seemed to imply that they had been decidedly wrong in their geography, when they careered along so triumphantly in their late onslaught on those eternal realms of sand, and rock, and unmitigated sunshine.

What did they find there to eat? is a very natural question to ask; and any one who has attended to the botany of South Africa, at least within the limits of the Cape Colony, may be inclined to suspect that there would be a tolerable abundance of bulbous plants, producing occasional gorgeous flowers above the arid desert soil; for, have not many writers descanted again and again upon how beautifully the nature of a bulb is adapted to those sunburned regions around Hottentot's Holland, and the plains of Zwartland; the bulb being the bud of the plant, and protected from being scorched to death by being buried under so many inches of non-conducting earth?

All this is quite true, but may yet have its appropriate geographical limits; and these may be found to reside chiefly in a climate where, however hot the day, the night is cool, and however droughty the summer, the winter has its rains. Such, too, is the climate of South Africa, under the parallel of 33° latitude south of the equator: but at the Pyramids, under their latitude of 30° north (that is not only 3° nearer to a vertical sun, but in the *northern* hemisphere, where the parallels thereabout are almost 4·1° of temperature warmer, or where 30° north is to be held as equivalent to 26° south,—besides, the breadth of uninterrupted, air-drying land being greater in the proportion of five to one at least), in such a position then as that of the Pyramids, the surrounding country is necessarily *too much* of a scorched and burnt-up desert, to support a great deal, if any, of bulbous plant life. We certainly found not a single specimen, but did find three or four prickly and thorny bushes; one of which seemed, I do not know that it was actually so, to have the very petals of its flower developed in thorns; and a branch of it, brought home carefully at the end of a long piece of cord, and then tied up into a ring, with its efflorescence of a rose of spikes hanging upon one side of it, was instantly recognised by an American lady, who visited East Tombs in the course of her grand tour, in company with her husband, a venerable German prince,—and who was now finding, he said, that 'these American ladies

'will go everywhere,'—instantly recognised, by her sharp eyes and quick appreciation, as being the very representative of 'the crown of thorns.'

Yet Nature was always trying to do more; and in any hole or corner, and more particularly in the sunk area on the west of the second Pyramid, and on the floors of the azimuth trenches,—anywhere, in short, where the sun's rays were not quite so long continued as on the outside surface, and where a chance shower was intensified in its effects by drainage from round about,—there were two or three attempts at little herbaceous, though rather stringy, plants; and perhaps in a more favoured season than that in which we were there, they may make more considerable displays. But in the spring of 1865, the locusts found they had confessedly made a mistake in coming to this region, and were now trying back to greener lands.

On arriving, however, at East Tombs, uncertain as to what to attempt next,—behold, work of a new order was prepared to hand there: for the young Scot, Mr. Inglis by name, whom we mentioned as having dined in company with us at Sheikh Abdul Samed's,—had called to ask me to go with him to the Great Pyramid, and see, if possible, why he could *not* find more than two, out of its four, corner sockets; and this is how the matter came about.

Although enabled in one way or another to render a pretty good account of the sizes and angles

of almost all *details* of the Pyramid,—it had been a growing matter of regret with me, that we should return to Scotland without having been able to improve or advance the question of the size and shape of the Pyramid *as a whole;* and yet, we were condemned to that position, when the Viceroy declined to go to the expense of uncovering all four sides of the base, as requested to do in terms of Article A of the Memorial, on p. 8, chap. i. Such a piece of excavation was of course infinitely beyond my private means, on account of the length of the lines to be cleared, and the height of the hills of stone-rubbish to be cut through in the middle of every side; but, seeing that the depth of rubbish at each corner was very small, I had seriously considered, on arriving at the Pyramid, whether we should not at least endeavour to uncover those sockets or fiducial marks which the French discovered at the two ends of the north side of the base. But after looking at the ground again and again, I came to this conclusion; viz., that those two sockets could not be thoroughly understood, unless when seen along with both the other sockets, the pavement supposed to surround the Pyramid, and more especially with the line of the sides of the Pyramid, as shown by casing-stones *in situ*, like those of Colonel Howard Vyse. And that it would be useless, therefore, for anything approaching to final determinations, to uncover only one small part of the features by itself; while the mere act of so doing, might bring irreparable in-

jury upon that part; to the extent of its being no longer in existence, or able to contribute its testimony of exactness and accuracy, when at last the perfect time and the right man should have arrived.[1]

I would not therefore presume, merely for the sake of gratifying my own curiosity, and attempting, perhaps, some very bad and almost impossible measures over the intervening heaps of rubbish,—to run a risk of depriving a future explorer, conducting a much grander investigation, of one of his necessary references.

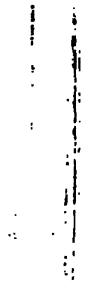
Thus, then, we had lived on there for three months and a half, in Spartan-like self-denial; when, in the middle of April, we were called on at East Tombs, by a gentleman who proved to be a well-known railway-embankment and canal-digging contractor in Glasgow, Mr. William Aiton, of Bath Street in that city, and last from some tangled business in connexion with the Suez Canal. Now Mr. Aiton had a theory of his own with regard to the manner of the building of the Great Pyramid, and announced his intention of sending out one of his engineering assistants immediately, with a party of men, to make the necessary measures to test his views. What these were precisely, I am not competent to say; but of course encouraged any one,

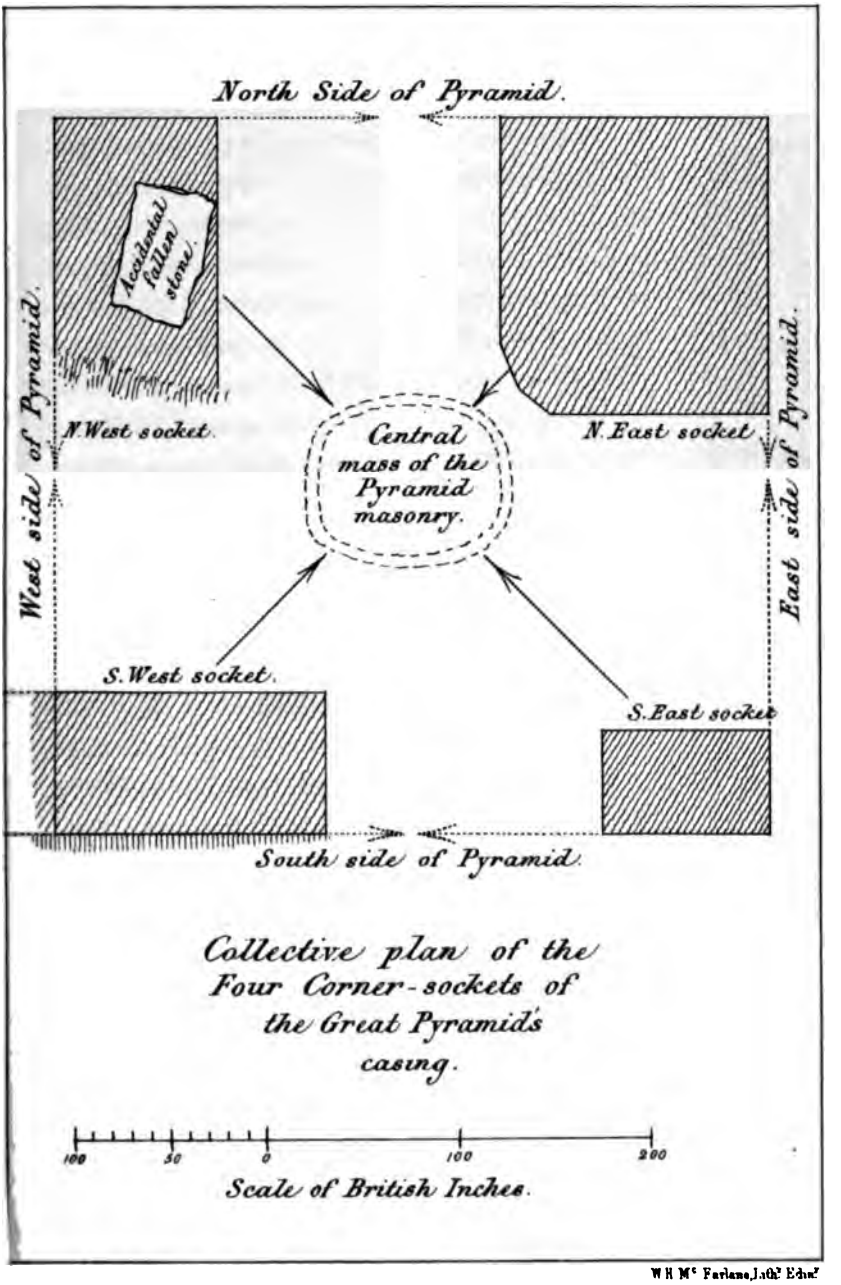
[1] Colonel Howard Vyse reports of the two casing stones, which he discovered, that, on finding them within a few weeks injured by specimen-seekers, he had them covered over by rubbish when he left the place; but that they had soon afterwards been uncovered and 'broken to pieces.'

who was at all inclined to test anything whatever about the Pyramid, through means of *measure*, on every account to pursue so excellent a plan; and as an inducement, showed a number of specimens of the casing-stone fragments which my wife and I had been picking up week after week,—and exhibited clearly the one peculiar and constant angle which pervaded them all. We likewise spoke much about the sockets, as a remaining proof in the present day, of the original size of the Pyramid; and when we confessed that we had not seen them yet, but only spoke of two positively, on the strength of the French *savants'* description of them in their great work on Egypt,—and *concluded* that there were also other two, from the manner in which they were alluded to in the Book of Job, as first explained by the late John Taylor,[1]—immediately Mr. Aiton's quick perception took hold of that fact, and he determined to do something therein.

He himself was indeed on the eve of going away on a tour in the Holy Land; but, two days after, his assistant, Mr. Inglis, arrived; and, obtaining our consent, established himself, with a party of Arab attendants, in the same lower storey of tombs which the Reis Alee Shafei and the youths of Sakkara had so long occupied in January. Extensive levellings from the sand-plain on one side, up the hill, round the Pyramid, and down again to the plain and the

[1] John Taylor's *Great Pyramid: Why was it built, and who built it?* p. 263.





Collective plan of the Four Corner-sockets of the Great Pyramid's casing.

W H M^c Farlane, Lith^r Edin^r

levelled, and the chisel-marks visible still. It gave one almost a feeling of awe to behold suddenly this ancient testimony brought to light from the soil beneath one's feet! How often had we not walked over that piece of ground; and, though fully believing all the French description, yet had been unable to realize it in its full force and accuracy-giving character, as of a thing existing still. Especially, too, was this the case, on account of the ground at that corner of the Pyramid having been so swept by daily winds, and occasionally washed by showers,—as to have been lowered and levelled down apparently to the very rock surface itself: making that, too, appear rough and rude, and as if forming a place such as only savages would erect a monument upon; while the present corner of the standing Pyramid close by, being also broken and mangled to a degree, causes it to look merely like the beginning of a Celtic cairn, or a piled heap of rough stones.

Small wonder, then, if a celebrated scientific man in England,—in fact the chief of her scientific men,—writing in 1864 on the subject of *standards of linear measure*, quoted 'the Pyramid of Cheops' as amongst the number of things in the world whose claims for being appealed to in such a question, have entirely departed; because, said he, that monument has worn away to such an extent as to be forty feet smaller in the length of a side of its base now, than it was in the time of Herodotus.

And so it may be, as to all of its substance which

is still above the surface of the ground. But as soon as Mr. Inglis's men began to dig,—the apparent gravelly rock was found to be only limestone-rubbish, somewhat cemented together naturally by a spontaneous action of the lime of which it is composed; and, at a foot or two beneath the surface of such *débris*, they came to the true stone-rock of the living hill. Nummulitic no doubt it was; but being entirely unweathered, and as if only recently levelled down to a flat area with saw or chisel, it exposed everywhere a white, compact surface; in the midst whereof, appeared the large sunk area for the corner-stone of the ancient casing; which casing's edge, and which alone, measured anciently the true size of the original building.

Here, then, was a witness,—a witness clothed in white, and almost twelve feet square,—to rise out of the ground in testimony against the modern English libel, which had made as little account of the discoveries of the French *savants*, as of the far-seeing methods of the Pyramid builders for perpetuating accuracy! One felt for the moment almost in the position of being brought into contact with those ancient men themselves, when the intervening veil of four thousand years was thus removed from one of the works of their hands; for it looked so recent, and was shown to be so admirably adapted both in fact and principle for maintaining a record of the exact size of the monument, if not to all time, at least down to this age in which we live!

The Arabs cleared out every particle of dust from the chiselled hollow, and Mr. Inglis examined it over its whole floor with a spirit-level. 'Why, I cannot 'find any error in it,' said he,—'that is, of level; 'but it is not quite square.'

'No, it is not quite square,' I repeated, 'inasmuch 'as two opposite sides are rather longer than the 'others; but have you measured the diagonals, 'which for some scientific purposes are more impor- 'tant than the sides?' And as he had not, I told Alee Dobree to bring the two one-hundred-inch measuring-rods, and lay them from corner to corner. Now these rods had been prepared during the past year in England, not only as convenient rods wherewith to perform measures, but in an expectation that some remarkable features about the Pyramid, though not on its outside and most prominent surfaces, would be found expressed in even *fives, tens,* or *hundreds,* of inches, and not in such odd numbers of inches and fractions of inches as the native Egyptian cubit of either past or present time is expressed in. So Alee Dobree laid the said rods along evenly from corner to corner, placing them with their planes vertical, so that they might go edgeways close up into the corners of the socket-walls; and then he exclaimed, 'Why, they just fit in quite tight, as if they 'were made for it.' And so it was, to the full astonishment of us all; though Alee Dobree continued to grow in surprise when he found that the two English-constructed fifty-inch rods, put in a line, ex-

tended exactly from the centre to the outer corner, also 'just as if made for it.'

From the north-east, we then adjourned with our rods to the south-east, corner, where Mr. Inglis's second socket had been opened. This socket had probably never been seen by man, except on two distant and remote occasions; *first*, when it was constructed at the building of the Pyramid, and immediately thereafter filled in, with its appropriate corner-casing, and foundation, stone; and *second*, when said stone was pulled out again, at the time of all the casing stones being removed by the early Arab Khaliphs one thousand years ago.

'It is not at all like the other socket,' said Mr. Inglis; 'being so much smaller in length and breadth; 'so decidedly an oblong rectangle in shape, and so 'much deeper; but there are chisel-marks clearly on 'the sides and bottom, and I have tested the floor, 'and found it to be beautifully level.'

But as he had not measured the diagonals also, Alee Dobree was called on to apply the one-hundred-inch rods from corner to corner, and one rod made each diagonal with practical effectiveness, for it jammed about half-way down the socket's sides, which were not exactly vertical. *There*, then, in these one-hundred-inch diagonals, was a link of connexion, and of a recondite, yet very important order, between the two externally most radically different socket-holes, viz., the north-east and south-east. But their architectural similarity to the same

thing, or rather to their original purpose, was proved still more, on measuring the vertical angle of the top of the Pyramid, as seen from each of them.

For us to have measured the socket's linear horizontal distance from the *lower* corner of the existing Pyramid-masonry, would have been of very little service indeed,—so excessive and unequal have been the modern breakings away there; but at the *summit* of the Pyramid, there is far less horizontal thickness removed; and, judging from the general squareness still preserved by the little plateau forming the present top, the amount removed must have been nearly equal on every side. Whence it came that, by moving one's station at either socket, from its nearer to its further corner, or *vice versâ*, a difference in the angle of altitude of the top of the Pyramid was obtained, of 15′ about at the smaller, and 30′ at the larger socket; showing, in so far, the power of the method; while the same identical whole angle, to the nearest minute nearly, was obtained at the outer corner of either socket.

Now the hard-working Mr. Inglis was unprovided with any angular measuring instrument, and had merely judged by the look and lay of the stones forming each foot of the Pyramid, whereabouts the corner-stone hole of the ancient exterior surface should be; and thought, *a priori*, that he had made an equally close hit in each of the four instances, as to where the Arabs should begin to dig. They did very soon, too, at every corner, come to a smooth

and levelled or artificially-prepared surface of the original rock of the hill; but at the north-west angle there was only a confusion of markings, and at the south-west something which was not understandable at all. Still they went on digging, and Mr. Inglis reported from time to time extraordinary indications at the south-west corner, and thought that that one would presently prove to be the very chief of the sockets of the Pyramid. But the indications invariably failed on being pushed a little further; the men dug hither and thither, discovered nothing more, and then wanted their contract-money 'for 'finding the sockets.' But one who had controlled large parties of navvies on the Clyde, was not going to yield prematurely to the clamour of a few Arabs; so Mr. Inglis came, as already mentioned, to East Tombs late on Monday afternoon, to see if I could throw any light on the reason why, they could *not* find the north-west and south-west sockets.

To the site of this latter one we first went; and, confident of the ancient truth of the Pyramid's figure, as well as having already tested the vertical angle of the top, as seen from the sockets which *had* been found,—I jumped, instrument in hand, into the fruitless hole the excavators had made,—but was instantly covered with a blinding cloud of limestone-dust which a newly sprung up wind kept in constant turmoil. The Arabs, however, immediately took off their long dark-blue winding-sheets of togas, and with them formed so famous a wall to

windward, that I was able at once to look through the sextant-horizon instrument again, upwards to the top of the Pyramid,—and, without any doubt, to say from its angle, 'You (Mr. Inglis and men) are too 'far out from the Pyramid here by eight or ten feet 'at least.' And then walking inwards from their hole, towards the present Pyramid stones, could say to the men as confidently, observing the angle of course as I went on,—'Here, vertically under this 'point, the socket must lie.'

They marked that spot accordingly, and then we adjourned to the north-west corner. It was somewhat strange, perhaps, that they should not have found that socket; for it is one which the French discovered and described in writing, though they did not picture it in their great work, as they did the north-east 'encastrement;' but the moment the hole which Mr. Inglis's Arabs had dug, was tested by the angle of the summit of the Pyramid, it was pronounced too far out by several feet. We walked inwards to the Pyramid, therefore, until the theoretical angle was obtained, and then found ourselves *vis-à-vis* to a huge block of nummulitic rock, rising sheer and vertical out of the ground. 'Oh, 'that,' had told us formerly some Cairo *savants*, 'is 'the rock of the hill, left by the builders to mark 'that corner of the Pyramid; and you will have 'no difficulty in making out the original size of 'the Pyramid there, with so clear a projecting 'mark formed in the solid.'

But there was no slope like that of the casing stones cut on the outside of this post of rock, and its stratification was presently found to be at right angles to that of the hill; so we unhesitatingly said, 'This is merely one of the great building blocks of 'the Pyramid, which has fallen out of the mass just 'opposite, and has tumbled accidentally into the 'very socket-hole; yes, into the very socket-hollow 'you are in search of; dig round about the block, 'and you will find the sides of the socket surround-'ing it.'

This was rather a bold announcement to make in opposition to the ideas of all the practical men on the spot, and on the strength only of the little cock-sparrow thing of a pocket-sextant and artificial horizon held in the hand; but the principles were clear, mechanical, and above-board, so it was done with confidence. A rather stormy meeting then followed between Mr. Inglis and his men, the agreement having been 'for finding the sockets,' and they wanting now more money when required to dig in a new locality; but when they found him firm as a rock in refusing to give them anything until the four sockets were veritably visible, the Sheikhs appealed to his humanity to leave off, for he was working their people too hard, and their strength was quite exhausted. Then, however, the Scottish Engineer told them,—I having meanwhile returned to East Tombs,—that '*Mr. Smyth* was so anxious to see all 'four of the sockets before he left

the Pyramids;' whereupon the Arab chief was graciously pleased to reply, 'Well, then, if that is 'the case, we will labour again to please *him*; and 'the digging shall be commenced at sunrise, with 'plenty of men to get it accomplished quickly.'

Next day, Tuesday April 24th, I had wandered away to take again the temperatures of various water-wells; and on my return, Mr. Inglis appeared announcing joyfully that the south-west socket had been found, and just in the place pointed out.

Then if that is the case, I could not but reply, you will assuredly find the north-west one also before long; and as it will then be the first known occasion in Egyptian history of the four lower corner sockets of the Great Pyramid being all seen open at once,—it becomes our duty to try to turn the occasion to some useful account in the way of measurement, *notwithstanding that there are the still unpierced hills of rubbish lying in the middle of every side*, and preventing any one socket-hole *seeing*, in the technical language of surveying, any other.

Mr. Inglis immediately volunteered 'that he was 'already preparing to take the differences of level 'of the floors of the several sockets, having a good 'levelling instrument and staff; and he also thought 'of measuring the rectilinear distance from socket 'to socket with a long tape-line.'

This tape-line he had used so much upon ordinary earth-work in contracting business, and had so

much faith both in it and his professional methods of using it in such a manner, as to give *horizontal* distances over any amount of *inclination* or roughness in the surface ground,—that I did not like to tell him scientific opinions respecting tape measures; especially, too, as the present state of the soil, so atrociously encumbered with broken stones, was perhaps not worthy of much higher means of accuracy. But having first taken the precaution of testing the entire length of his tape in sections over the 'reference scale' of all our Pyramid measuring-rods, and not found any error exceeding the easy elasticity of the tape itself,—I answered that I was quite happy to leave those two *linear* departments to his care, and would busy myself only with the *angular* measures that were called for.

To this end, although the Playfair altitude-azimuth instrument was already packed up complete for travelling back to Scotland, and our own time fixed now beyond alteration, by arrangements made through Consul Reade with the Egyptian Government, for leaving the Pyramids on Saturday morning first,—I determined to unpack said instrument again, and use its unrivalled powers, first, in measuring the vertical angle of the summit of the Pyramid from the outer corner of every socket; and, second, in determining the bearing of the lines joining two adjacent pair of sockets with the astronomical meridian. A troublesome matter this last would be, for it would require the heavy and unwieldy instru-

ment to be mounted near the summit of the hill of loose stones at the middle of a side of the Pyramid, with peculiar critical exactness, and the observations to be extended into twilight, if not into darkness; but Mr. Inglis spiritedly promised to assist in any way he could, and I began the unpacking accordingly.

A little code of signals being soon arranged, Mr. Inglis went off with his now special attendant, Alee the Egyptian, to ascend the Pyramid; and to hold out at a given time, first from the north-east, and second from the south-east, corner of the summit platform, an observing-signal in the direction of a diagonal of the Pyramid,—and at an agreed measured distance from the corner, so as to represent a probable thickness of casing stones and backing stones. Thereby not only giving me an accurate bisecting signal to observe from below, but enabling the angle read off from the instrument to be, without further correction, very nearly that of the original slope of the Pyramid, whatever that may have been,—whether what Mr. Taylor's theory would indicate, or any other. Soon after, Alee Dobree appearing with a number of his friends, we went up with all the boxes of the Playfair instrument and its stand, to the north-east socket; placing it on the levelled floor there, and, by means of a plumb-bob, accurately over a pencilled cross in the line of the diagonal of the Pyramid; but at such a distance inside the socket's corner, that the centre of the telescope's

motion was approximately in the expected line of the inclination of the corner angle of the Pyramid.

How the Arabs, beginning with Alee Dobree, did admire the plumb-bob. It was but one of the ordinary elliptical, brass-turned, surveyor's plumb-bobs; but they had never seen anything so neat and graceful before: so true in figure, so slender the thread from which it hung; so knowing the means of hiding the knot by the little screwed pipe within the substance of the ball; so quaint the name, which they repeated again and again to each other, until they had got it perfect; but beyond all, so exquisitely shaped in egg-form, the thing itself, that when they were told it was a symbol of truth and justice, they thought it also a better ideal of the traditional 'egg of creation,' than all the ostrich egg-shells that were hung up in their mosques by the dervishes!

More immediately, however, was I inclined to admire the circumstances of observing with an altitude-azimuth instrument on the floor of a Great Pyramid socket; for besides the astonishing firmness of the foundation, the truth of level was such, that on removing from the north-east, to the south-east, socket there was hardly more than half a turn of any one of the fine threaded foot-screws to be made, to put the instrument level within a second of space.

We were glad when the requisite number of observations, in reversed positions of the circle, enabled

us to signify to Mr. Inglis that his work aloft was finished, for it must have been a giddy employment for him to be looking down over the edge so long; and dangerous too, while in such a position, to have to hold out a long staff in the teeth of a violent wind. Yet he had so held it for the whole time required; and now, in order that he might come down the more quickly to help at the next part of the play,—his henchman, Alee the Egyptian, must needs bring him down, not by the north-east corner, but slantingly along the eastern face of the Pyramid, where the courses of nummulitic stone are weathered and rotten to a frightful degree. But the young Scot in his shoes, was fully equal to the Egyptian in bare feet; and, after safely effecting his descent went off immediately, just as if he had done nothing extraordinary at all, to plumb two tripod signals over the outer corners of the north-east and south-east sockets,—while I was putting up the Playfair circle on a little nick he had cut out during the day near the top of the eastern mound of rubbish.

When the full magnifying power of the telescope, however, was brought to bear, the said nick was found not to be near enough to a straight line between the two sockets; one or two other positions were accordingly tried in new nicks prepared *impromptu* among the stones; but the true position proved to be so evidently somewhere near the middle of a very steep part of the loose slope, as to require both great excavating to secure for the in-

strument a firm standing-place, and an extensive cutting of trenches north and south to see the signals. In fact, so much work, that when it was perceived that each stroke of the pick, under the high wind which was blowing, deluged both instrument and party in a cloud of white dust, while black clouds were gathering over the twilight sky, we gave up the observations for that night. But then, when the instrument was packed in its boxes ready for returning to East Tombs, one man was wanting; who was it?

Why, it was the melancholy, misfortune-stricken Abduwahad. He certainly had not displayed very great interest in our successive adjustings of the tripod of the Playfair instrument on the uneven foundation of broken blocks and limestone dust; and so had vaguely wandered away, somewhat of a privileged person, to where Mrs. Piazzi was watching our proceedings from the altar-like pedestal which Reis Alee Shafei had built near the general junction-point of the lines of all the azimuth trenches; and seating himself a little way off before her feet, he began to discourse, upon 'what a strong man was Mr. Inglis; 'and how he knew he was so strong by the way his 'arm swung backwards and forwards as he walked.' And then the poor creature remarked that it was very hot, and he was extraordinarily thirsty, and must therefore go down to old Ibraheem for a drink of water. But when the other men heard that that was the reason of his absence, they would listen to

no excuse for him! What! he, an Arab, and to feel thirsty when on particular duty! what was the good of an Arab if he could not sit in the desert when required all day long, and not think of thirst? To have given way at noonday would have been bad enough; but, after sunset! the thing was ridiculous, and his misfortunes must have overthrown his Arab nature altogether.

Next day, Wednesday the 25th of April, came the announcement that the fourth socket was found; so the plan of operations for the afternoon's observing was clear before us, except that there arose presently something like a riot amongst our Arab labourers; for they had found, they said, that Mr. Inglis was paying three shillings a day, while I had only paid two shillings; wherefore their clamours were loud that they had been cheated of what was their due, and of what must be repaid them for all the days they had been employed during three months past. Even Smyne, too, our regularly engaged servant, and the recipient of so many favours and undeserved indulgences, even he must go off to the new rising sun, and try to take service there, representing speciously that we could afford to give him up quite easily just now. On hearing of this secret manœuvre, which had not been successful, we of course taxed him with want of faith to his engagement with us; but then he asserted roundly that he had not wanted to leave us at all; that he was still going with us to Scotland whenever we left the

Pyramids; and he had only been seeking to get three shillings a day by digging for Mr. Inglis, without its at all interfering with his helping Ibraheem in our kitchen, as usual, but where the work, he averred, was so light that it could be done at any time.

Yet when it appeared presently from the course of operations, that Mr. Inglis had not permanently raised the price of a nominal day's easy employment, but only proposed to give the higher rate for a large amount of measured work performed on a special occasion,—the malcontents, who had never contemplated fatiguing themselves seriously for any one, were placed between two fires, and became very surly indeed. For we were not at all inclined to yield to their demands, and thereby make future explorations almost impossible to private investigators, by the ridiculously high price they would have to pay for the commonest labour,—a price, too, very probably, twelve times as high as the then prevailing agricultural wage of the region around.

At no more than the present rate, we fear that even the lordly purse of Colonel Howard Vyse would have failed long before he had accomplished half the investigations he desired to achieve; for in his time the pay of an Arab workman was 1 piastre = 2½d. per day; of a Reis or captain over the men, 2 piastres or = 5d. per day; and of a woman, or of children, from 1¼d. to 1¾d., 'according to their size.' All Egyptian prices have indeed changed marvellously since then wherever European travellers are con-

cerned, as the subjoined table of the rates paid by the Colonel in 1837, and by ourselves in 1865, will sufficiently attest ;[1] and all the more instructively, on considering Colonel Howard Vyse's statement that the prices at the former date, 'were greatly 'risen above those published by Sir Gardner Wil- 'kinson in 1835.'

But through all these changes, the manners and dispositions of the mass of the country working people must be still very nearly what they were ; for thus the Colonel condenses his experience, extending over many months of daily supervision, and dealings with thousands of them :—'The boys are 'well made and active, capable of great exertion,

[1] Names of Articles.	Prices Paid by					
	Howard Vyse in 1837.			C. Piazzi Smyth in 1865.		
	£	s.	d.	£	s.	d.
Flour, per 2·5 lbs.,	0	0	7·5	0	1	3
Beef, per 2·5 lbs.,	0	0	8	0	4	0
Mutton, per 2·5 lbs.,	0	0	5	0	2	6
A duck,	0	0	5·5	0	2	0
Pigeons, per pair,	0	0	2	0	1	3
A fowl,	0	0	7·5	0	2	0
Butter, per 1 lb.,	0	0	2·5	0	1	6
Eggs, 40, about	0	0	2·5	0	1	6
Potatoes, per 2·5 lbs.,	0	0	5	0	1	3
Macaroni, native, 2·5 lbs.,	0	0	7·5	0	1	3
Rice, per 2·5 lbs.,	0	0	7·5	0	1	6
Oranges, per dozen,	0	0	2·5	0	0	6
Limes, per dozen,	0	0	1	0	0	3
Apricots, dried, per 2·5 lbs.,	0	1	0	0	2	2
Charcoal, per mat,	0	4	2	0	8	4
Dragoman per month, besides food, baksheesh, etc.,		...		8	0	0
1st Arab servant, do.,		...		4	0	0
2d Arab servant, do.,		...		2	10	0

'and several of them are intelligent, and work ex-
'tremely well. But the men, with a few exceptions,
'are sullen, irrecoverably idle, deceitful, and totally
'insensible to good treatment, and therefore ap-
'parently incapable of amelioration;' or, as he writes in another place, 'a despotic government, 'together with their own idleness, dishonesty, and 'ignorance, has plunged them into a state of misery 'which Christianity and its attendant blessings can 'alone effectually relieve.'

At the very time, however, when this disputation was going on, and Alee Dobree was declaring that he could get no men from his village to carry the heavy instrument,—who should darken the doorway but Sheikh Murri, who had always, by some contrivance or other, been kept out of the way of employing his men in our service? So I immediately called him to witness Alee Dobree's declaration of inability to help us at this critical time; and inquired if he, Sheikh Murri, could send us any men, each of whom should receive two shillings a day certain, and in case of giving great satisfaction, three shillings a day.

'On my head and my eye,' indicated the Sheikh, and was immediately off and away up to the Pyramid, where he knew some of his people were at that time; and so speedily did he bring down a force of most rude and black-brown Egyptian 'fellaheen,' that the instruments were taken successfully, and within the appointed time, to the north-west

and south-west sockets successively; while Mr. Inglis at the top of the Pyramid held out the signal-stick from the corresponding angles there. Then we all adjourned to the central rubbish-heap of the eastern side, and succeeded in comparing the line of those two sockets with the Polar star; discovering too, the approximation to be so close, even so very much closer to the truth of nature than anything previously ascertained about the Pyramid as a whole, that we considered ourselves repaid over and above for all the extra labour of the past few days. Wherefore we went rejoicingly back to East Tombs; there, too, to find what had given us the pleasure of Sheikh Murri's visit at the fortunate moment when he looked in; and it was this:—The wary chief was not to be outdone in attentions to the strangers, when they were on the point of leaving, by his brother Sheikh of the northern village; hence, as unfortunate domestic circumstances, already alluded to, prevented him from entertaining at home, he had brought Mrs. Piazzi a present of a lamb—a live and flourishing lamb, half a year old, its ears dyed with saffron, its tail with hennah, and a few blue patches stained on its nose, to resemble those highly prized little tattooing marks about the lips and chin, which are thought essential to every Egyptian Arab damsel of perfect beauty, noble birth, and infinite charms, according to the ideas of the ancient land.

On Thursday morning, there was much field-

photography to accomplish; for, of course, the sockets must be photographed. The day was windy, and travellers came in crowds; but we established the operating-box in the bottom of the deep north-north-east azimuth trench, where no one found it out; (not even the wind, of which, several times in the day, some roaring little cyclones went over the top with their pillars of dust, but were harmless below;) and from whence, about every half-hour, I was able to issue with two new sensitive plates in the portable bath-carrying frames. Amongst several views too, that were then obtained, and are now most instructive to examine in a good achromatic stereoscope of high magnifying power,—was one we were particularly satisfied with; for it represented the north-east socket, with the two one-hundred-inch measuring-bars forming its south-east and north-west line of diagonal; and the two fifty-inch bars, its semi-diagonal towards the outer north-east corner; while, in each of the two small triangles of the floor so formed, sat one of the Pyramid-village Sheikhs, and in the large space behind, stood the youthful Thomas Inglis, the happy excavator of the whole.

Soon after mid-day, there came,—sent by Mr. Consul Reade's very kind and considerate attention,—the first clerk of the Consulate, to assure us personally that he had visited all the Egyptian authorities concerned, and found them every one in due training for sending their men and camels to us the

next evening, so as to be ready for the removal on Saturday morning. A most efficient head-clerk too, was this gentleman, speaking and writing several languages, both Western and Eastern; and at a rate of pay in these high-priced cotton times, which the home authorities would surely increase,—if they had real knowledge of the frightful advance in the prices of most necessaries in Cairo, to the families of humble servants of Government, struggling on upon the old fixed salaries of another age.

Towards evening, there were more observations for us with the Playfair altitude-azimuth instrument at the Great Pyramid. This time, on the rubbish-heap of its *northern* side, with the object of comparing the two sockets at each end there, with the Polar star; and then, through that high reference, contrasting the direction of the northern with that of the eastern side of the Pyramid; for therefrom, we should be able to determine the angle of the two sides of the base at the north-east corner; or, in other words, obtain an idea of the amount of error committed by the builders in one of the most radical proceedings connected with the original laying out of the whole Pyramid.

Mr. Inglis had been engaged during the day with Alee the Egyptian, in cutting a standing-place for the instrument in the eastern, as higher than the western, half of the northern rubbish-heap, so gashed has that once single mound been left by the Vyse

and Perring's proceedings of thirty years ago. And he was to help still further in the evening; for the over-frequent lifting of the too heavy instrument in and out of its boxes, these last few days, had sprained my right wrist, until it had become now close upon powerless; so *he* very obligingly undertook to do all the *lifting*, and leave me only the observing. Happily the sky was clear, on this the last evening which was possible to us; but all the circumstances were anxious, if not important; and both the Sheikhs, Murri and Abdul Samed, voluntarily gathered their many-folded robes around them, accompanied us to the observing place, and stayed there through all that followed.

It was a long and trying work; for, after erecting the signals (tripod camera-stands), over the socket corners, and the great Playfair circle on its stand upon the proposed shelf hewn out of the excessively steep slope at that part of the rubbish-heap,—it was found the instrument could not see the signals. Men were then sent with picks to cut into the western flank of the compound hill, and after much work there, the instrument station was found too far out from the Pyramid. But as it could not be taken inwards, on account of the rubbish-heap there rising like a wall, it was carried to the culminating top of that part, but then found to be too far in; in fact, the true place was right in the middle of the steepest part of the whole slope, where no one could cling on except with use of both hands and feet all

at once. So, with desperate resolve, the instrument was put into its boxes again; the Sheikhs carried them away for a little space; and all the men about began hacking and hewing at the bank of rubbish: composed of casing stone fragments all of it, but ground down mostly to impalpable white powder, which every gust of wind threw over us all, in blinding clouds.

Rapidly now was the time passing away; the sun had set, and twilight even perceptibly began to fade. So soon, therefore, as even something of a little recess in the cliff had been made to receive the projecting feet of the tripod,—the instrument was erected again, two men holding each box on the steep inclined neighbouring slope, while Mr. Inglis's strong arms lifted out each component part one after the other. Just space was there for pushing round the erected circle, and duly levelling it,—but lamps had now to be lit, for so dark was growing the air, that the microscopes could not otherwise be read.

We knew that we must be nearer the true position than before; and made a proper azimuth observation at once of the signal over the eastern socket, —then turned round to the west, but no signal could be seen there: evidently, too, it was masked by rather a distant ridge of the rubbish-heap which would require full half-an-hour to cut away, and by that time there would be the darkness of night. So Mr. Inglis, always ready in time of need, volunteered to go with his eighteen-foot surveying-rod,

and hold it vertically over the same outer point of the western socket, where was now the four-foot high tripod only.

'But what means have you got of holding it 'vertical?' said I, glancing involuntarily beyond him at the many stars already visible in the western sky, and thinking how difficult he would find it to note either level or plumb-bob.

'Is it not,' answered he, 'a point of professional 'requirement with us engineering surveyors to know, 'by sense and experience, how to hold a staff vertical, 'and to keep it so for any length of ordinary ob-'serving time?'

'Then by all means go,' was of course my response; and away he sped, making the dust of the rubbish-heaps fly at every step, while the Arabs distributed themselves about, above, and below, to keep him in sight, and give notice as soon as he had reached and stationed himself at the important signal-place. So at their shout, I looked through the telescope, but its field was sadly dark under the shade of the western horizon; and only just when on the very point of giving up all hope,—was at last the battered upper end of Mr. Inglis's well-known levelling-rod seen, standing fairly vertical, above the intervening rubbish-slope. Instantly it was observed, the angle noted, and the telescope turned again on the eastern signal,—but it could not be found. Has the instrument slipped? was the first fear. The telescope was, therefore, set to ex-

actly 180° from the staff on the west, but no east signal! 'It's blown down,' cried an Arab; and I turned back to the west signal, but now it was absolutely undiscernible in the darkness. Both our landmarks were therefore gone: but both had been truly observed, and the readings noted, so that if the steadiness of the instrument, on certainly no very steady foundation, could be depended on, we might still be saved. With such anxiety, however, as never had an observer before, did I go through the operations of turning the telescope to the Pole-star,—and, with the most unexceptionably delicate manipulation I was master of, make three complete observations, upon that celestial referring point, one after the other.

They did not show any other movement in their respective intervals, than that of the star itself according to the time, which was carefully noted on a pocket-chronometer daily tested for its error by observation; and on turning back to the notes of the two signal-measures, I saw that they were happily within a minute of space of being precisely opposite to each other,—so that really there was a chance, looking to the enormous optical power attached to the Playfair instrument, of our having obtained a very respectable measure after all. At the least, we had done whatever was then in our power, and that on the last night the Playfair alt-azimuth was destined to look at an Egyptian sky: so we announced to the people around that the work was all over,—but before packing up, told

them they should see the evening star as they had never seen it before. The telescope therefore being turned to the planet Venus, which was now glittering in the west upon a dark field of black blue sky, each man present looked through,—saw the elegant crescent of more than lunar dazzling light,—and, putting his hand respectfully to his head, averred that, 'God is great.'

But the most peculiar termination of the day was that witnessed by my wife, who had sat all this weary time in the recess on one side of the entrance passage of the Pyramid,—looking on in alarm and sympathy at our dangerous position and protracted proceedings. But presently, in the faint twilight, she saw the bats coming out of the Pyramid into the outer air; they came flying at full speed, and always in flocks; flock following flock for a quarter of an hour or twenty minutes without any cessation; so that the number of individuals must have been enormous, and well entitling the Great Pyramid to the appellation usually bestowed by the Arabs on the Northern Pyramid of Dashoor, of 'Haran el 'Wataweet,' or the Pyramid of the Bats. As fast, however, as these poor creatures came out to the fresh air, some luckless members of them were pounced on by large hawks,—hawks she thinks certainly, and not owls, though after sunset,—to whom it proved a perfect carnival of enjoyment.

Early next morning, Friday the 28th, the Playfair

instrument was repacked in its boxes for the last time; and we spent the greater part of the day inside the Pyramid, taking the final magnesium-photographs; for we had by this time made up some new tapers, which promised to meet the requirements of the place. There was a little extra work indeed towards the middle of the day, when the sun had cracked the glass tube of Mr. Inglis's levelling-instrument, and threatened to interfere with the progress of *his* department of the socket work; but there was fortunately a spare tube in Mr. Coventry's clinometer-box, which would fit into the place of the broken one very well; and would answer, if it could only be fastened there. So Alee Dobree was sent off to the neighbourhood of the third Pyramid to get some of the gypsum which lies about there abundantly; and on his return with a supply of the raw material, he set to work with great skill, as well as,—being anxious to show his mental superiority over the burly strength of Alee the Egyptian,—with exceeding spirit, to roast and then grind the crystals to powder, or to fine 'plaster-of-Paris,' in a certain very conveniently hollowed fragment of ancient red granite. This was indeed a fine old relic, which had been previously picked up on the hillside, and established as a seat at the entrance of the dining-room tomb: and yet, though looking very handsome there, it had not been much employed: for the ancient Ibraheem used to say, when he had come to make one of his long 'countings' of in-

numerable little kitchen expenses, and was just in the middle of some of his most serious arithmetic, —'Excuse me, madam, but I find this alabaster 'seat very cold.'

The native-made plaster, however, mixed famously with water, and formed an excellent cement for fastening the new glass bulb into the brass casing of the old one; so then, Mr. Inglis was free also to bear a hand during part of the time with the last magnesium experiments. The new tapers had from twenty-five to fifty threads or flat bands of about a foot long; not fastened close together, when they check each other's burning, and not perfectly loose at the sides, for then they often start out at right angles to the vertical pendant of the whole thing, as it is burning upwards after being lit below; but the bundle was, on the contrary, loosely confined within a rather open spiral cage of iron wire, and fastened with that to a hook inside an angular trough either of tin-plate or wood,—which served to reflect the light forward on the object to be delineated, and at the same time to prevent it shining into the object-glass eyes of the camera.

Of course, this plan made abundance of smoke; but that smoke went straight up to the ceiling first of all, and had not begun to diffuse itself by its peculiar corkscrew motions throughout the room, until long after the short lengths of magnesium wire had all burned themselves out; so that a light, equal to that of the consumption of a great length

of single wire, was obtained, but in a *short* time; and with the accompaniment of comparatively pure air in the visual direction, as well as a consequent strong picture. Only one photograph, however, was possible in each chamber; for by the time that a second pair of plates was prepared, the smoke of the fifty short lengths burnt all at once, had then spread itself through every part of the room. The full development though of this plan of increasing the number of simultaneously burning threads, but decreasing their length, was most nearly carried to its *ne plus ultra* by employing a quantity of grain magnesium, duly supplied by Mr. Mather and the Magnesium Metal Company of Salford, Manchester. For the burning of that preparation, assisted by a little saltpetre and mealed gunpowder, was so nearly instantaneous for the whole mass, as to enable the camera to take with equal ease both moving figures of ephemeral humanity, and the solid granite blocks of the eternal Pyramid.

On returning from this last experiment to East Tombs, behold all the camels arrived and encamped in the plain below,—while the Turkish officer in charge had already reported himself, and Ibraheem's coffee-manufactory was in full employ. So packing went on until dark: and then, on tea being placed upon the table, the two Pyramid Sheikhs arrived by express invitation: wherefore, after having partaken of the refreshing beverage as it is made in

Scotland, and heard our warmest thanks for the pains they had been at in our behalf for so many months past,—they received a variety of presents we had prepared for them: such as, a certain sum of gold, and then so many useful articles of our domestic establishment, now about to be broken up; and amongst which articles I was most happy to hand over to them,—and not to have been obliged to use any of it myself,—all our supply of gunpowder and lead.

Private arrangements were then made with the Sheikhs, as to bringing up next day all the men of both villages who had acted as guards to us. And when these two chieftains had moved off with their several parcels wrapped up in their voluminous sheets of dresses,—then were a cup of tea and some words of sympathy ready for Alee Dobree; who, with all his weaknesses for running off to serve travellers of any nation under the sun, came next to the Sheikhs, of the whole Pyramid village population, for general probity and trustworthiness; he had moreover a gentlemanly soul, some refined feelings, and considerable natural abilities. But when he was asked what he would like as a keepsake of a number of things about the tomb,—he stood quite silent for a time; and then, suddenly putting his fingers up to his eyes, rushed out into the night, to conceal his crying there.

The kitchen servants were, however, by no means so nice; for as soon as both Ibraheem and Smyne

heard that all the domestic chattels were to be given away to the villagers next day,—they were continually coming with requests, of 'Oh! might 'they not have just this one thing, or just that?' each small by itself, but repeated so often,—that at last we were obliged, in justice to the other recipients-elect, to make out a list of what these two who were on the spot, had got prematurely promised to themselves. And when Smyne came up again, for about the tenth time in one hour, for something more,—we inquired inquisitively why he was so anxious for *that* particular tin pot? 'Oh, 'because,' replied he, 'it is what they used to send 'me my dinner in every day when I was in prison 'at Jeezeh, and I came to love it so;' opening up thus to us some information we were not quite clear about before, touching both the employments which our kitchen utensils had been subjected to, and the prison system of the Egyptian Government, which throws the burden of feeding prisoners on their own relations.

On Saturday morning a second Turkish officer had arrived, to insure the correct performance of the camel service on the part of the Egyptian Government; and a cavass also appeared with a letter from Mr. Consul Reade, to give us all the authority of his office. So there was then, and thenceforward, a great clattering of swords upon the rocky staircase: while immense industrial exertions were going on in the Howard Vyse tomb,

with Mr. Inglis's assistance, in packing and screwing up all the twenty-seven boxes; for though many of their stores were already consumed, and some of their contents had been taken out and deposited in the dining-room tomb for a particular purpose presently to appear,—the place of those things was abundantly made up by natural specimens, especially of the geology of the region. We had indeed among them upwards of twenty specimens of casing stone fragments of the Great and second Pyramids; but these were broken off from nothing standing, and had been merely picked up by hand among the other loose fragments composing the soil daily trodden over by all men walking about the Pyramids; where too there are infinite numbers of such specimens still, and in the same maltreated position. Alee Dobree, certainly, wanted to press upon our acceptance some 'antiques' of his, such as an ancient Egyptian paint-box, a scribe's inkstand, a comb of 4000 years old, and one or two other such over curious things; but we declined them, on the principle of keeping rigorously and finally to our first statement expressed to the Egyptian Government, of having no desire to plunder the museum and saleable antiquities of the country, or accumulate virtuoso relics,—but only to make measures and examinations for the purposes of science.

At length, about eleven o'clock A.M., the boxes had all been screwed down and conveyed to the plain below,—where the loading of the camels began,

in the midst of a momentarily increasing crowd of Arabs from the villages around. Quite friendly were all the men; indeed most of them had brought their youngest sons with them, either to look on at this unusual event of their world, or perchance be in the way of receiving some waifs and stray trifles. But when the camels were at last loaded and sent off, then began, in Arab eyes, the solemn work of the day,—for the two Sheikhs were to present one after the other, in order to their receiving *baksheesh*, the men who had acted as our guards; first, Sheikh Murri, being the older of the two, was to introduce his best man, and then Sheikh Abdul Samed his best; then Sheikh Murri his second best, and Sheikh Abdul Samed the same; going down thus continually in the scale, until it was understood that those who were presented last, had been some of the troublesome hands whom the Sheikhs had had great difficulty in driving over to their duty on many occasions. Each man was to receive one pound sterling in English gold, and a something else in goods; but this something else, began with magnificent globe lamps, mounted in copper, with the best men; and gradually descended through saucepans and frying-pans, to merely miserable mouse-traps at last, for the bad subjects.

Before, however, more than three or four men had been paid, the cry that baksheesh,—nay, even yellow baksheesh, was being extensively given,—spread like wildfire; and the Arabs from below

stormed the cliff in such numbers as to upset all the studied arrangements of presentation. So the two powerful Sheikhs had to turn round and set to work, laying about them with their heavy sticks, and thus clearing all the staircase, by main force, of the whole of their countrymen, good and bad together; through which thorough-going means, order being again restored, the presentations recommenced, and continued uninterruptedly until the twenty-fourth night-guard had been duly decorated; and then, we called for old Hassan.

This seemed to make an immense sensation in the crowd; for he was considered so old and useless, that who of them would trouble themselves about him at all? and it was so long ago that he had acted as our day-guard, they thought we must completely have forgotten him. But now he was helped up the narrow way, and, besides a sovereign, had a roll of blanket given him. The latter too, he did not despise, but he seized on the money with such an agony of clutch, and his eyes brightened with so strange a fire, that, alas for perverted human nature! we feared we had done more harm to his soul, than good to his body. Lastly was summoned 'Alee 'the day-guard;' and very efficiently had that honest man performed his duties to us up to this, the final day; for though always so much of an invalid as seldom to be able to stand many minutes at a time, without a fit coming on,—he had never given any trouble (as the other stronger men so

abundantly had, ever since the murder in the village, about the want of guns to keep off imaginary Bedouins), and he had taken many a man's spell of night-guard, as well as his own period by day; so there was a sovereign for him, and a large bundle, besides the many smaller gifts he had been receiving from time to time.

Thus was concluded the most formal part of the proceedings. And a division of all the remaining dining and bedroom furniture having also been made, under my wife's auspices, in favour of those of the villagers who had served best;—at last the inevitable moment arrived for taking leave of Mr. Inglis; who, we feared, would find troubles accumulating when left the sole European at East Tombs; though he was full of fine enthusiasm for accomplishing the whole of his intended Pyramid work. So, after many adieus and much shaking of hands also with our Arab friends, we moved off for Cairo. A Turkish officer on a big horse led the way, while on either side of us rode the Sheikhs, mounted, with all their flowing robes, on most curiously little donkeys; Alee Dobree and Smyne accompanied us close on foot; while Ibraheem, the cavass, and the other Turkish officer brought up the rear.

With the exception of Ibraheem, whom we retained in our service until we left Cairo, and who also took charge of our instrument-boxes while in that city,—the formation and arrangement of the

rest of the Pyramid part of this train, was purely voluntary and perfectly spontaneous with the several individuals. But it was amusing to notice, that no sooner were we conveniently abreast of the Pyramid village, than the previously too much devotion-protesting Smyne, suddenly found that he must leave us to attend to 'urgent private affairs.' Yet the two Sheikhs, Murri and Abdul Samed, together with Alee Dobree, accompanied us the whole way into El Kahireh; and not only so, but the Sheikhs,—'most 'potent, grave, and reverend signors,' as they had generally appeared,—gave themselves a holiday there of three whole days, letting the Pyramid and travellers of all nations take care of themselves for the time; while Alee Dobree allowed himself yet two days more, as he had many purchases to make for his wife and son; and when he did take leave of us at last, it was with almost as much emotion as on the parting evening at East Tombs.

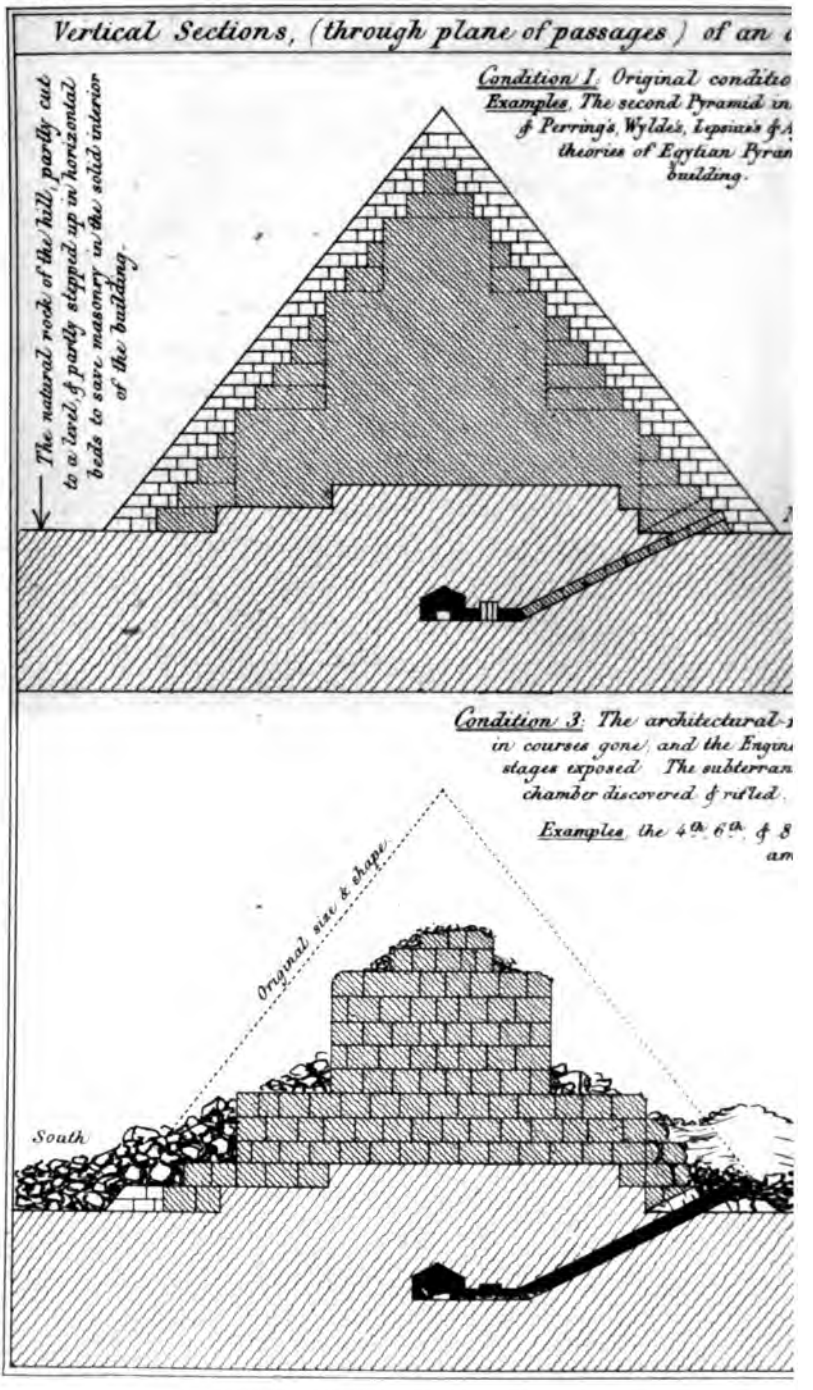
In a few days, however, he was in again with a letter from Mr. Inglis, who had been making some additional measures in his department of the Pyramid sockets. And when the ancient Ibraheem,—in full dragoman costume, and with his little son Mohammed (like another dragoman in miniature, and in his father's uniform of brown cloth, embroidered in black silk),—came to see us off a week afterwards by rail for Alexandria, he certified, unasked,—that the general impression of both Sheikhs and people at the Pyramid villages was, 'that they

'had not experienced anything so fully and finally 'satisfactory to them as the Scottish astronomer's 'visit, for nearly as long as they could remember.'

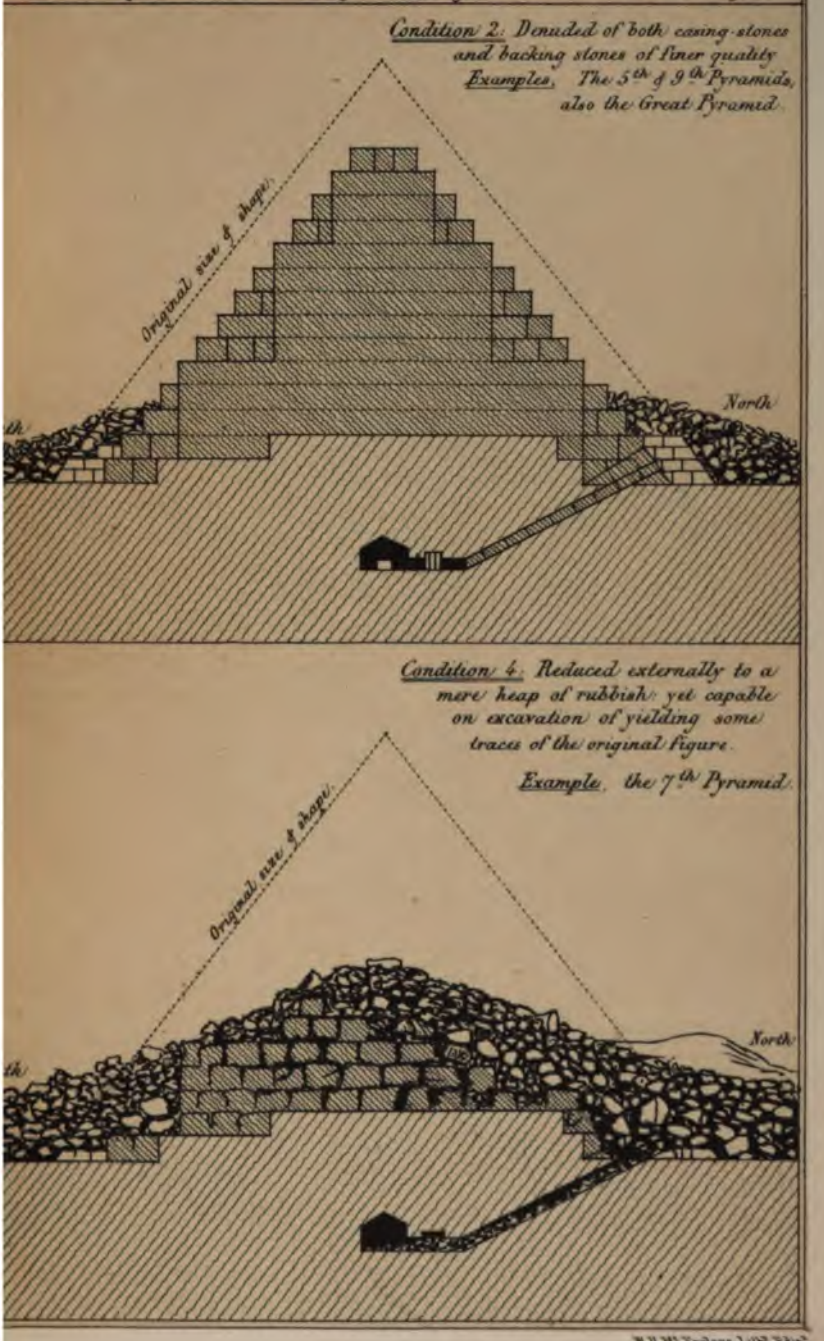
But a higher testimony came afterwards from the same worthy American missionary, the Rev. Mr. Lancing, who had been of so much service to us at the beginning of our Egyptian experiences: for he, in returning from a tour among the churches of the Faioum, visited East Tombs within a very few days after we had left; and having had much conversation with the natives,—reported subsequently, 'that there was a most perceptible improvement in 'the manners of the Pyramid Arabs; and he only 'hoped it might continue.'

END OF VOL. I.

EDINBURGH: T. CONSTABLE,
PRINTER TO THE QUEEN, AND TO THE UNIVERSITY.


Vertical Sections, (through plane of passages) of an
Condition 1: Original conditio
Examples. The second Pyramid in
& Perring's, Wylde's, Lepsius's & A
theories of Egytian Pyra
building.
The natural rock of the hill, partly cut
to a level, & partly stepped up in horizontal
beds to save masonry in the solid interior
of the building.
Condition 3: The architectural
in courses gone, and the Engin
stages exposed. The subterran
chamber discovered & ritled.
Examples the 4th 6th & 8
an
Original size & shape
South

Jeezeh Pyramid, showing its progressive mode of decay.



W. H. M. Packham, Lith. Edin.

LIFE AND WORK AT THE GREAT PYRAMID.

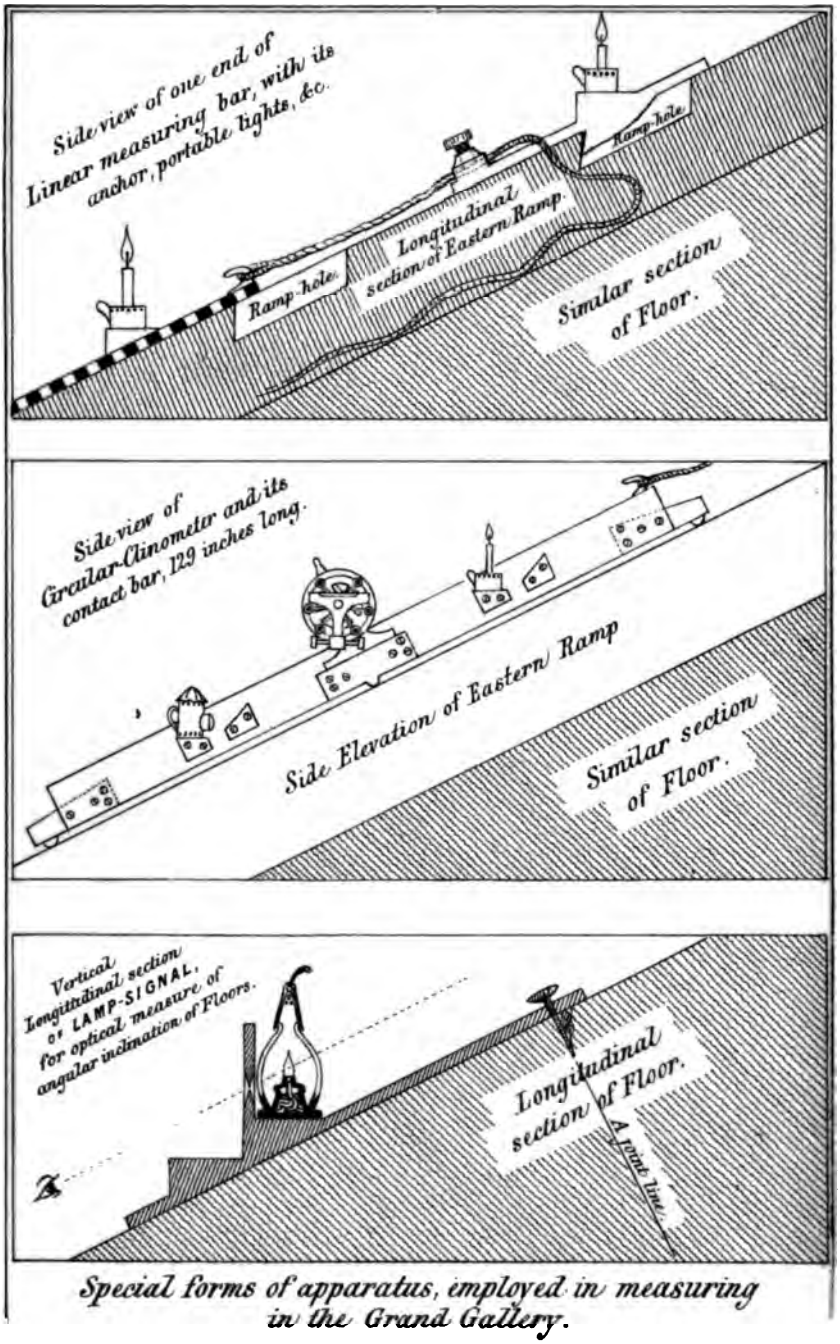
VOL. II.

EDINBURGH : PRINTED BY THOMAS CONSTABLE,

FOR

EDMONSTON AND DOUGLAS.

LONDON	HAMILTON, ADAMS, AND CO.
CAMBRIDGE	MACMILLAN AND CO.
DUBLIN	M'GLASHAN AND GILL.
GLASGOW	JAMES MACLEHOSE.



Special forms of apparatus, employed in measuring in the Grand Gallery.

W.K. M.ᶜ Farlane, Lith.ʳ Edin.ʳ

LIFE AND WORK

AT THE GREAT PYRAMID

DURING THE MONTHS OF JANUARY, FEBRUARY,
MARCH, AND APRIL, A.D. 1865;

WITH

A DISCUSSION OF THE FACTS ASCERTAINED.

BY C. PIAZZI SMYTH, F.R.SS.L. & E.

F.R.A.S., F.R.S.S.A.; HON. M. INST. ENGIN. SC., F.R. SOC., AND R.A.A.S. MUNICH AND PALERMO;
PROFESSOR OF PRACTICAL ASTRONOMY IN THE UNIVERSITY OF EDINBURGH,
AND ASTRONOMER-ROYAL FOR SCOTLAND.

IN THREE VOLUMES;

WITH ILLUSTRATIONS ON STONE AND WOOD.

VOL. II.

EDINBURGH:
EDMONSTON AND DOUGLAS.
1867.

QC99
S63
V.2

327325

CONTENTS OF VOLUME II.

NUMERICAL OBSERVATIONS.

SECTION I.

LINEAR MEASURES.

	PAGE
Introduction,	1
Entrance Passage to Great Pyramid,	11
First Ascending Passage,	44
Horizontal Passage to Queen's Chamber,	55
Queen's Chamber,	62
Grand Gallery,	68
Antechamber and its Passages,	93
King's Chamber,	101
The Coffer,	114
Azimuth Trenches,	125
Height and length of side of Base of Great Pyramid,	128
Sockets and Pavement of Great Pyramid,	134

SECTION II.

ANGULAR MEASURES, GEOMETRICAL.

Introduction,	139
Entrance Passage to Great Pyramid,	144
First Ascending Passage,	149
Horizontal Passage to Queen's Chamber,	152
Grand Gallery Angle,	154
King's Chamber Levels,	163

PAGE
Ventilating Channels' Angle, ... 164
Exterior Faces of Great Pyramid, ... 165
Casing-stone Fragments, ... 167
Vertical Corner Angles of Great Pyramid, ... 171
Horizontal do. do., ... 176

SECTION III.

ANGULAR MEASURES, ASTRONOMICAL.

Time Observations, ... 177
Latitude Observations at East Tombs, ... 180
Do. do. on Summit of Great Pyramid, . . 182
Round of Azimuths from top of Great Pyramid, . . . 184
Azimuth of Azimuth Trenches, ... 185
Azimuth of Entrance Passage of Great Pyramid, . . . 189
Azimuth of Great Pyramid Corner Socket Lines, . . . 193

SECTION IV.

HEAT MEASURES.

Introduction, ... 197
Well Temperatures near Cairo, ... 201
Well Temperatures near Great Pyramid, ... 203
Great Pyramid Temperatures, ... 206
Summit of Great Pyramid, ... 209
Meteorological Journal—January, ... 210
Do. do., February, ... 218
Do. do., March, ... 232
Do. do., April, ... 248
Cycle of a Day, ... 260
Meteorology of the Months, ... 262
Mean Daily Temperature, ... 265
Special Storm, ... 267

SECTION V.

MISCELLANEOUS AND COMMUNICATED MEASURES.

Measures of the Second Pyramid, ... 271
Photographs, ... 279

CONTENTS.

Specimens brought home, ...
Analyses of Great Pyramid materials by Dr. W. Wallace . .
Great Pyramid Measures by F. Ayrton, Esq., ...
Great Pyramid Measures by Messrs. Aiton and Inglis, . . .
French Measures of the Great Pyramid, ... 309
Howard Vyse's and Perring's Measures of Great Pyramid, . 322
E. W. Lane's Measures of the Great Pyramid, . . . 330
Greaves' Standard of Measure, ... 334
Length of the Cubit of Memphis, ... 337
Sir Isaac Newton's Dissertation on Cubits, reprinted, . . 341
Letters of the Freemasons, ... 367
Ethological Researches bearing on the Year of the Pleiades, by R. G. Haliburton, ... 370
The Festival of the Dead, ... 371
The same brought to Europe and Asia by a Migration of Races, ... 378
Addendum I., ... 404
Addendum II., ... 408
Addendum III., ... 414
Proofs from Astronomy and Chronology, that in relation to the Pleiades our Calendar now exactly corresponds with the Primitive Year, ... 424
Size and Figure of the Earth by the Ordnance Survey Officers, 449
Specific Gravity of the Earth, ... 452
On the Sacred Hebrew Standards of Weights and Measures, . 454
The Sacred Cubit, ... 454
Sacred Hebrew Capacity Standard, ... 460
The Molten Sea, ... 467

LIST OF ILLUSTRATIONS

IN VOLUME II.

(The following Plates, being mostly on very small scales, are capable of little more than giving first approximate ideas of the general nature of the subjects observed and measured. It is particularly requested, therefore, that no 'Pyramid measures' be taken from the Drawings; but that the numerical entries of the original measures, contained in this Volume, be always referred to, when exactness is required.)

No. of Plate.

I. SPECIAL FORMS OF APPARATUS EMPLOYED IN THE GRAND GALLERY, . Frontispiece.
Referred to at p. 75, 159.

Inserted at page

II. JOINTS OF FLOOR, WALLS, AND ROOF OF ENTRANCE PASSAGE OF GREAT PYRAMID, 15
Referred to at 11, 16, 33, 34.

III. ELEVATION AND SECTION OF NORTH END OF ENTRANCE PASSAGE OF GREAT PYRAMID, ... 37
Referred to at 11, 38.

IV. JUNCTION OF ASCENDING AND DESCENDING PASSAGES, ... 41
Referred to at 11, 41.

No. of Plate. Inserted at page

V. LOWER AND UPPER ENDS OF FIRST ASCENDING PASSAGE, ... 45
Referred to at p. 45, 53.

VI. AL MAMOON'S HOLE, AND CONNEXION OF MEASURES OF ENTRANCE AND FIRST ASCENDING PASSAGES, ... 53
Referred to at 53.

VII. SIDES OF QUEEN'S CHAMBER OPENED OUT, 65
Referred to at 66.

VIII. SECTIONS OF QUEEN'S CHAMBER, . . 67
Referred to at 56, 67.

IX. LOWER PART OF UPPER END OF GRAND GALLERY, ... 77
Referred to at 73, 78.

X. OVERLAPPINGS OF THE SIDE WALLS OF THE GRAND GALLERY, ... 89
Referred to at 56, 87, 91.

XI. FLOOR FROM GRAND GALLERY TO KING'S CHAMBER ENTRANCE, ... 93
Referred to at 92, 93.

XII. ANTECHAMBER DETAIL, ... 97
Referred to at 95, 98.

XIII. SIDES OF KING'S CHAMBER OPENED OUT, . 109
Referred to at 101, 110.

XIV. SECTIONS OF KING'S AND CONSTRUCTION CHAMBERS, ... 113
Referred to at 111, 112, 113.

No. of Plate. Page.

XV. AZIMUTH TRENCHES, EAST OF GREAT P
MID, ... 127

Referred to at p. 125, 127.

WOODCUTS.

No.

1. AN INSIDE MEASURING-BAR, . . . 3

2. CONNEXION OF FLOORS OF FIRST ASCENDING AND HORIZONTAL PASSAGES, . . . 60

3. NORTH END OF ENTRANCE PASSAGE FLOOR, . 190

VOL. II.

NUMERICAL OBSERVATIONS.

'In God's work of Creation, amidst the rich profusion 'and diversity which seem at first to defy all attempts at 'arrangement and classification, an unexpected beauty of 'order and regularity are discoverable on closer examina- 'tion, and all things, from the lowest to the highest, are 'found "TO BE ORDERED IN MEASURE AND NUMBER AND '"WEIGHT."'

'SCRIPTURE PARALLELISM,'
by the Rev. John Forbes.

SECTION I.—LINEAR MEASURES.

INTRODUCTION.

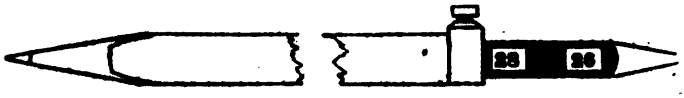
THESE linear measures are expressed throughout in terms of British inches and decimals of an inch; no other name of linear measure having been employed; and every measuring rod, bar, scale, or line having been specially prepared for this work, and graduated to show inches only, in numbers of either 5, or some multiple of 5. For coarse work, the rods had their inches painted alternately black and white, fractions being then read off by estimation, or by a portable inch-scale finely divided; while for closer work the bevelled edge of each scale was subdivided into tenths, and half-tenths, —which allowed a reading off with certainty to the merest hundredth of an inch, even under the necessarily imperfect candle illumination of the interior of the Pyramid; the readings being always taken in terms of decimal fractions of the whole inch, and never in tenths of the smallest divisional space on the scale, when that was other than a

tenth, or hundredth of an inch. One of the five-inch scales, by Mr. T. Cooke and Sons of York, was subdivided, and with great neatness, to every hundredth of an inch; allowing readings to be taken with a hand-magnifier to ·001 or ·002 of an inch. But this was found to be beyond the requirements of the Pyramid in its present state, and was only employed in the operations for comparing the lengths of the several bars or scales, actually employed in the measuring,—with a standard of acknowledged authority; and deducing thence the corrections to be employed, to reduce whatever lengths had been observed in terms of inches of the rods,—into true British standard inches; which are accordingly the inches in which all the following observations are, or are intended to be, expressed, when not otherwise specially noted.

The rods or scales employed were as follows, for any outside work, or forms :—

Name of Scale.	Material—when of wood, tipped with brass at each end.	Nominal			Edges bevelled	Divided to, on			True length in British inches when in Egypt.
		Length.	Breadth.	Thickness.		Fine edge.	Middle.	Thick edge.	
		inches.	inches.	inches.		inches.	inches.	inches.	
Cooke, 5	Ivory, . .	5	1·6	·15	one	·01	1·	0	4·995
Adie, 5	Ivory, . .	5	1·2	·1	two	·05	1·	·05	4·994
,, 12	Box-wood,	12	1·8	·34	one	·05	1·	·1	11·964
,, 25	Box-wood,	25	...	...	one	·05	1·	·1	24·907
,, 50	Maple-wood.	50	...	...	one	·05	1·	·1	49·987
50 A	Fir, painted,	50	2·3	·7	one	1·	1·	1·	50·008
50 B	Fir, painted,	50	2·3	·7	one	1·	1·	1·	49·995
100 A	Fir, painted,	100	3·0	·9	one	1·	1·	1·	100·016
100 B	Fir, painted,	100	3·0	·9	one	1·	1·	1·	100·031
500 tape	Steel tape,	500	...	...	0	1·	1·	1·	.....

For inside measures, as inside the coffer and inside the passages or rooms, for their breadth or height, a set of slider-scales was employed; made of mahogany, ended with brass, and the brass tipped with steel, shaved or bevelled off on every side to an acute angle, so as to offer no impediment to measuring diagonals inside a cube; and appearing generally of this figure:—



The thicker part of the arrangement is a hollow square tube, 1·25 inch square outside in cross section; in which slides the thinner part,—which is a solid mahogany rod, ·75 inch square in cross section, and can be clamped at any point by an appropriate screw. The slider alone is divided, so that it measures only the excess beyond the closed length, whence the name of each slider is derived. The divisions merely consist of whole inches, painted alternately black and white, and numbered. The sliding rod was made in every case as long as the hollow trunk permitted; but if the subject allowed, no slider was used with its sliding rod projecting very far. The lengths, however, of each slider, were taken at many different inches of protrusion of its inside sliding rod, as thus:—

SLIDER 25.

(Used chiefly for internal breadths, and depths of coffer.)

Nominal Lengths, inches.		Real Lengths in British inches.	Nominal Lengths, inches.		Real Lengths in British inches.
25	=	24·965	34	=	33·993
26	=	25·949	35	=	34·993
27	=	26·981	36	=	35·988
31	=	30·975	41	=	41·003

SLIDER 35.

(Used chiefly for the breadths and heights of passages, doorways, and ramp intervals; and its correction, for reducing a length given by its divisions to true British inches, has been considered = — ·152 inch.)

Nominal Length.		Real Length.	Nominal Length.		Real Length.
35	=	34·863	48	=	47·862
36	=	35·868	49	=	48·821
40	=	39·866	50	=	49·855
41	=	40·856	51	=	50·837
42	=	41·860	52	=	51·858
43	=	42·858	53	=	52·849
44	=	43·864	54	=	53·858
45	=	44·871	55	=	54·859
46	=	45·869	56	=	55·875
47	=	46·855	61	=	60·855

SLIDER 50.

(Correction to reduce a measure in its nominal inches to true British inches = + ·060 inch.)

Nominal Length.		True Length.	Nominal Length.		True Length.
50	=	50·044	61	=	61·060
51	=	51·068	66	=	66·055
52	=	52·067	71	=	71·066
53	=	53·072	76	=	76·055
54	=	54·048	81	=	81·055
55	=	55·077	86	=	86·045
56	=	56·060	91	=	91·068

SLIDER 70.

(Correction to reduce a measure in its nominal inches to true British inches = + ·130 inch, nearly.)

Nominal Length.		True Length.
70	=	70·057
71	=	71·107
76	=	76·121
77	=	77·135
78	=	78·127
81	=	81·123
86	=	86·129
91	=	91·122
96	=	96·121
And 90 inches of its slider alone	=	90·068

SLIDER 100.

Nominal Length.		True Length.
100	=	100·039
And 90 inches of its slider alone	=	90·068

SLIDER 400.

This was a variation on all the former sliders; and was composed of three hollow trunks of mahogany, sliding one within the other, and fixable at one point only by a stout brass pin; in the brass plate forming the base of the lower and thicker trunk, a strong steel peg was screwed (so that vertical heights might be measured truly on sloping floors); and from the top of the uppermost trunk there could be drawn forth,—by a string passing over a pulley, and capable of being either pulled from, or clamped, below,—a solid rod, marked with inches, and pointed at the end. After a particular measure on one

occasion in the grand gallery, this rod was laid down on a level floor, and tested by 100 B, with the following result :—

Nominal Length of Slider 400 at a particular point of its Slider part.			Tested Length, in terms of 100 B.	Real Length in British inches.
		inches.		
Steel peg .	=	10·00	.....	.....
First trunk	=	100·00	.....	.....
Second ,,	=	99·92	.....	.....
Third ,,	=	99·95	.....	.....
Sliding part at	=	40·3	.....	.....
		350·17	350·2	350·3

This, and the other smaller sliding scales, were all made by Mr. T. Cooke and Sons of York, and gave great satisfaction ; if too, there is a large constant error about some of them, as slider 35, it had been intimated to Mr. Cooke, that these rods were only intended to carry a measured length from the thing measured to a certain reference scale of higher order, which was alone to be held answerable for the truth of its figures.

REFERENCE SCALE.

The reference scale was itself, however, only an intermediary between the practical bars employed in measuring, and the standard scale (of which presently), and was thus composed :—

A flat bar, 105 inches long, 5 broad, and 0·5 thick, laid flat on the shallow floor of a very stout box, 115 inches long, 8 inches square at the ends, and composed of wood 1·3 inch thick, with deep

joint-like sides, to prevent gravity-flexure, and armed with thermometers at either end to show the temperature; the divisions were at every 5 inches; and there were gun-metal rectangles provided, one of which was fixed over the commencing division, and the other brought to touch one end of any rod, whose other end was touching the fixed metal surface; the excess of the place of the second rectangle beyond the last 5-inch division of the reference scale was then read off by means of the small ivory scale, divided to ·01 inch; and, by a magnifier, determined to ·001.

But the flat bar of the reference scale, which had been made out of an organ-pipe of the date of Queen Anne's reign, kindly procured for me by my friend Mr. Joseph Sidebotham, of Manchester, and reported by several of his friends to be almost matchless, when coated with copal varnish, for the construction of measuring-rods of invariable length, —had been unhappily treated to linseed-oil instead, by the optician into whose hands I had intrusted it; and this circumstance, joined perhaps to its having been cut out in the direction of a radial plane of the original tree, and to the heat and drought of Egypt,—set the bar twisting at such a rate in the plane of its breadth, great as that was, that in a short time it would no longer go into its box, and had to be discarded. In its place, however, I pencilled a scale on the inside bottom of the box, put in every fifth inch by means of a fine

cut with a penknife, and used these divisions ever afterwards as the reference scale; employing for the time an estimated value of their proportion to British inches.

Now, the 5-inch spaces of the reference scale had been intended, in any case, to be compared with a 5-inch stone standard, by means of a micrometer-microscope beam-compass; which, together with the said standard, had been prepared for me before leaving England by an optician there. But when he brought the combined apparatus to me in Liverpool, only on the eve of embarking, and it appeared made quite contrary to instructions, and very ineffective, —I handed it back to him to alter; and he promised so to alter it and send it out after me to Egypt within one month, on pain of paying a penalty of 10s. per day for every day's delay beyond the month; but I have not seen it from that time to this, though he states that he sent it to Alexandria three months after the appointed time.

Being driven, therefore, to make some extempore apology for a length-carrier when engaged at the Pyramid, I prepared a piece of ancient basalt; scratched with a diamond ring an approximate 5-inch length thereon; and compared every 5-inch space of the reference scale with this basalt standard, through means of the ivory scale divided to ·01 of an inch. In this manner the lengths of all the measures used about the Pyramid became known, in terms of the basalt standard; and were so deter-

mined three times, on February 20, March 22, and March 28, at temperatures varying from

BASALT STANDARD.

The basalt standard having been safely brought home, was compared, at the Royal Observatory, Edinburgh, on September 7, 22, and 23,—at mean temperatures of 59° and 60°,—with a standard yard-measure, constructed by Captain Kater in the year 1824, and presented by the Imperial Government to the Magistrates of Edinburgh; who kindly lent it to me for the purpose of making so necessary a comparison. This yard-standard had hitherto apparently never been used, being kept only as a reserve, and consists of a bar of brass, 1 inch square in cross section, with raised steel ends, 0·5 inch thick, and 1 inch broad and high; the distance between the inner surfaces of these raised ends being the standard 36 inches required. For the purposes of comparison, the Kater standard was not taken out of its box; but as it lay there, the length inside its uprights was taken off by one of the Pyramid slider scales, and by that transferred to the reference scale; whose values were in that manner ascertained, in terms of the inches of the Kater standard yard; and immediately afterwards by another operation, in terms of the inches of the reputed 5-inch basalt standard.

The inches of the basalt standard being thus

compared with those of the Kater standard, were found too short; or that the basalt reputed 5 inches were really only of the value of 4·994 inches of the Kater standard.

Now in the comparisons made at the Pyramid, I had suspected the basalt standard to be rather small, and had assumed its nominal length at 4·996; but after the above determination with the Kater yard, the values obtained at the Pyramid were all altered to a value of the basalt = 4·994; and these are the numbers which are given in preceding pages as the true length in British inches of the several scales employed at the Pyramid.

When all four sides of the base of the Pyramid shall be opened up at some future day, more accurate means of mensuration than the above, will have to be employed.

ENTRANCE PASSAGE OF GREAT PYRAMID.

JANUARY 28—FEBRUARY 11, 1865.

ENTRANCE PASSAGE.—(See Plates II. III. and IV.)

WEST *side of its* FLOOR; measures of the joints there, from beginning, or top, or north, end of said floor; and then from joint to joint.

Number of joint from top, or N.	Jan. 27, measured N. to S.	Jan. 27, measured S. to N.	Jan. 28, N. to S.	Jan. 29, N. to S.	Concluded Mean, from joint to joint.	Whole Distance from beginning of Passage-floor.	Character of Joint, etc.
	inches.	inches.	inches.	inches.	inches.	inches.	
0	0·0	0·0	0·0	...	0·0	0·0	Present beginning of basement sheet or floor is short of its original beginning.
1	54·2	54·0	54·2	...	54·1	54·1	Fair; *i.e.*, fairly close and fine.
2	47·9	48·0	48·0	...	48·0	102·1	Good.
3	58·9	59·0	58·9	...	58·9	161·0	Very good and close.
4	55·3	55·2	55·8	...	55·4	216·4	Very good and close.
5	65·7	65·8	65·7	...	65·7	282·1	Indifferent.
6	59·2	59·0	59·4	...	59·2	341·3	Long holes hereabout cut in middle of floor, and of a breadth to reach within six or eight inches of sides of passage.
7	66·0	66·3	66·2	...	66·2	407·5	Bad, and do. as to holes.
8	52·5	52·2	52·4	...	52·4	459·9	Bad, and do.
9	62·3	62·5	62·8	...	62·5	522·4	Bad, and do.
10	53·3	53·3	52·7	...	53·1	575·5	Bad, and do.
11	36·1	36·3	36·0	...	36·1	611·6	Bad, and do.
12	39·6	39·2	39·7	...	39·5	651·1	Bad, and do.
13	51·4	51·5	51·4	...	51·4	702·5	Bad, and do.
14	51·4	51·7	51·6	...	51·6	754·1	Bad, and do.
15	36·5	35·4	36·5	36·6	36·5	790·6	Hole 31 inches deep begins here, and shows floor-joints rectangularly transverse to axis of passage, through whole depth.
16	48·4	49·6	48·7	48·4	48·5	839·1	Bad.
17	40·2	39·8	40·0	40·0	40·0	879·1	Bad, as being broken.
18	24·7	...	24·8	24·8	24·8	903·9	Bad, and do.
19	35·1	60·0	35·2	35·2	35·2	939·1	Better.
20	...	...	63·7	63·5	63·6	1002·7	Diagonal! close, but with neighbouring cracks.
21	...	...	46·3	46·8	46·6	1049·3	Diagonal and close.
21′	133·3	...	22·±	20·±	21·±	1070·±	Sand-heap.
21″	44·±	...	48·±	50·±	49·±	1119·±	Al Mamoon's hole in west wall begins about this place.

ENTRANCE PASSAGE,

EAST *side of its* FLOOR; measures of the joints there, from beginning, or top, or north end of said floor, and then from joint to joint.

No. of joint from Top or North.	Measured on January 28th.	January 29th.	Concluded Mean, from Joint to Joint.	Whole Distance from beginning of Passage Floor.	Character of Joint, etc.
0	0·0	0·0	0·0	0·0	
1	54·6	54·6	54·6	54·6	Indifferent.
2	47·7	47·6	47·6	102·2	Better.
3	57·8	58·1	58·0	160·2	Good and fine, *i.e.*, thin.
4	55·0	54·9	55·0	215·2	Thin and fine, but partly concealed in a hole.
5	68·5	68·4	68·4	283·6	Indifferent.
6	59·0	58·8	58·9	342·5	Bad.
7	66·2	66·3	66·2	408·7	Bad and broken.
8	51·7	51·8	51·8	460·5	Much broken.
9	59·5	59·0	59·2	519·7	Broken, and not square across floor.
10	53·2	52·8	53·0	572·7	Broken, and not square across floor.
11	38·8	38·9	38·8	611·5	Very bad and broken.
12	40·4	40·3	40·4	651·9	Bad and broken.
13	50·8	51·0	50·9	702·8	Bad and broken.
14	53·0	52·5	52·8	755·6	Very bad, broken, and wide.
15	36·3	36·6	36·4	792·0	Better.
16	48·5	48·7	48·6	840·6	Very much broken.
17	40·0	40·1	40·0	880·6	Very broken.
18	24·7	24·6	24·6	905·2	Good originally, but since broken at edges.
19	35·1	35·4	35·2	940·4	Good; very hard stone between this and last joint.
20	57·0	57·0	57·0	997·4	*Diagonal* good, and in very hard stone, but with many neighbouring cracks.
21	36·0	36·4	36·2	1033·6	Diagonal, and do. do.
21′	35·±	30·	32·±	1066·±	Sand heap, adventitious, mixed with broken stones, blocks up entrance passage beyond and below this point.

ENTRANCE PASSAGE,

FLOOR OF.

West Side compared with *East* Side.

Number of joint from Top, or North.	Joint to joint on West side.	Do. on East side.	Whole distance from beginning of Passage Floor on West side.	Do. on East side.	Error of Rectangularity.
0	0·0	0·0	0·0	0·0	...
1	54·1	54·6	54·1	54·6	+ 0·5
2	48·0	47·6	102·1	102·2	+ 0·1
3	58·9	58·0	161·0	160·2	— 0·8
4	55·4	55·0	216·4	215·2	— 1·2
5	65·7	68·4	282·1	283·6	+ 1·5
6	59·2	58·9	341·3	342·5	+ 1·2
7	66·2	66·2	407·5	408·7	+ 1·2
8	52·4	51·8	459·9	460·5	+ 0·6
9	62·5	59·2	522·4	519·7	— 2·7
10	53·1	53·0	575·5	572·7	— 2·8
11	36·1	38·8	611·6	611·5	— 0·1
12	39·5	40·4	651·1	651·9	+ 0·8
13	51·4	50·9	702·5	702·8	+ 0·3
14	51·6	52·8	754·1	755·6	+ 1·5
15	36·5	36·4	790·6	792·0	+ 1·4
16	48·5	48·6	839·1	840·6	+ 1·5
17	40·0	40·0	879·1	880·6	+ 1·5
18	24·8	24·6	903·9	905·2	+ 1·3
19	35·2	35·2	939·1	940·4	+ 1·3
20	63·6	57·0	1002·7	997·4	— 5·3
21	46·6	36·2	1049·3	1033·6	— 15·7
21′	21·±	32·±	1070·±	1066·±	— 4·±
21″	49·±	...	1119·±	.....	...

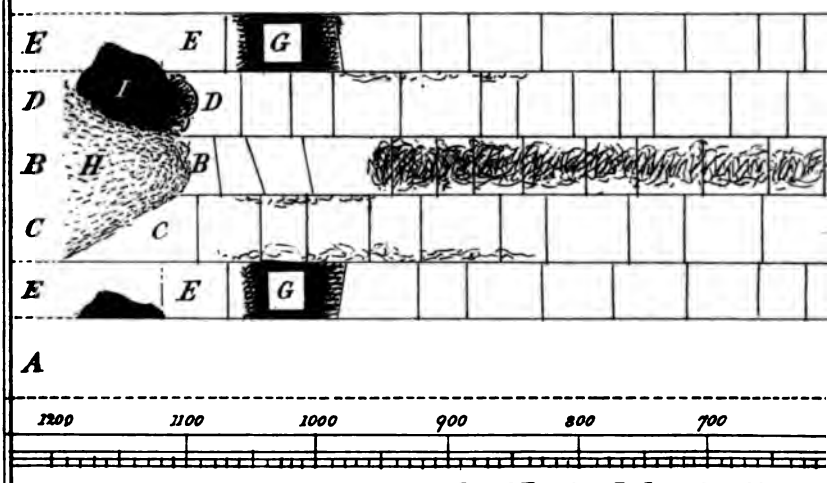
NOTES ON FLOOR OF ENTRANCE PASSAGE, TO ACCOMPANY THE MEASURES.

This floor is all in a limestone, close, compact, more or less hard in places, abrading a fine white dust, which rises in smoke-like clouds under the

feet from holes where it has accumulated. In parts *not* exposed to friction, this limestone has a tendency to decay into or acquire a rough, coarse surface, something like what granite might present, if coated over with thin, yellowish, lime-wash; but where under friction, as from the feet of countless travellers, it has approached a smooth, glossy, and marble-like appearance. There has been a slight wearing down of the floor over its whole breadth, as evident by its present level compared with the side joints.

To assist men, apparently, to ascend and descend on the originally smooth, sloping surface, occasional shallow, transverse holes or notches have been rudely cut in the floor at moderate distances apart. But much more rudely still, has the operation been performed towards the middle and lower end (of the here measured portion) of the passage, where the floor-stone is not so hard as near the beginning. For in such parts, these transverse holes, usually about two-thirds the breadth of the passage, have been lengthened out, preserving their breadth, until they meet and join each other longitudinally; and have then been deepened so as almost to form a sort of ditch, running along or through the central line of the passage floor; very rough and broken, but yet enabling the ascent and descent to be made with only little stooping. These floor-holes have attained the following vertical depths at the given distances from the North beginning of floor, viz.:—

Joints of floor, walls, and roof (rep
OF GREA
opened out on plane of t



Scale of British Inches for Size a

A, A, A, A, the Basement-sheet.

B, B, B, Line of floor, of passage.

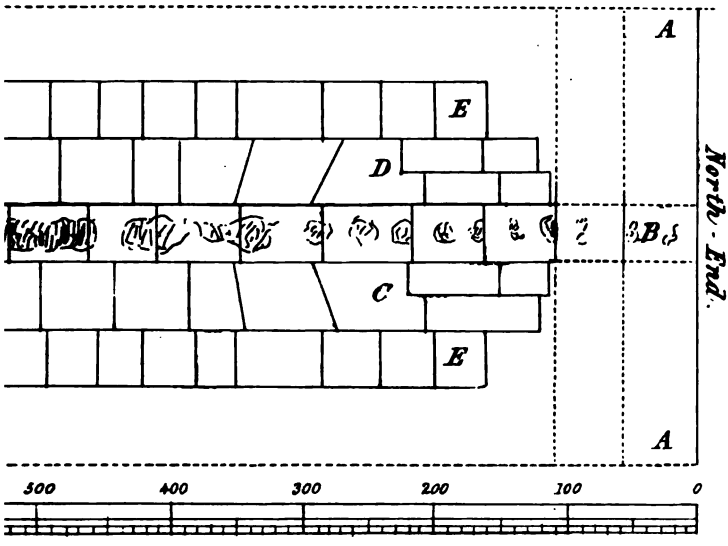
C, C, C, East-wall.

G, G, Granite portcullis, lower butt-end of, closing en

H, Heap of adventitious dust & rubbish brought in by

I, Caliph Al Mamoon's hole, where it broke into West-w
of getting round the Portcullis blocks, & into the Fir

vice) of Entrance Passage
PAMID
or basement sheet.



ce from North end of Floor.

, D, D, West-wall of passage.
E, & E.E, Roof of passage, repeated twice.

first ascending passage.

ntrance passage, and still serves travellers as a means
ing Passage.

W H M^c Farlane Lith^r Edin^r

At and about distance,	200,	depth of holes	= 4	more or less.
,,	300,		= 8	,,
,,	400,	,,	= 10	,,
,,	450,	,,	= 14	,,
,,	600,	,,	= 16	,,
,,	700,	,,	= 18	,,
,,	800,	,,	= 31	,,
,,	1000,	,,	= 0	,,

At the distance of about 1000 inches, the holes in the floor cease; and apparently because there, a very much harder stone is employed; so hard as to have defied both men and nature to injure it, and to have left for a short space the original floor surface almost unabraded and uninjured. Below, or beyond about 1100 inches of distance, the further floor is encumbered, and the whole passage down to the subterranean room of the Pyramid is stopped up by heaps of stones and sand, adventitiously or mischievously introduced by the Arabs in the course of the last few years; and effectively limiting now the amount of 'entrance passage' that can be carefully examined.

Only on the third occasion of measuring, did I perceive, that the piece of uninjured flooring, extending from 940· to 1065· of distance, is crossed by two joints. Rather obscured they are by neighbouring and parallel crackings, but true masonry joints nevertheless; very fine and thin, and placed notably diagonal to the axis of the passage. This position is such an anomaly to the other joints of the floor, and has been so very carefully and exactly performed,—made so close as not to catch a careless

eye, and yet so certainly as not to escape a scrutinizing one,—and constructed in such excessively hard stone, that, whatever was intended, it *has* lasted to the present time untouched, and uninjured,—that something must have been purposed to have been marked thereby. What could it be? By referring to the plan of the passage, Plate II. page 16, it will be seen that the lower butt-end of the granite portcullis leading to the upper parts of the Pyramid is just above the place; or rather the hole belonging to said lower butt-end of it, is; viz., that hole in the ceiling, out of which the so-called 'triangular' stone had dropped when Khaliph Al Mamoon was forcing his way into the Pyramid,—and disclosed to him, what Herodotus had never suspected, that there was an upper system of chambers and passages in this Pyramid, besides its subterranean ones.

The long and large holes in the entrance passage floor, though passed over by many describers, are thought by Perring and others,—to have been effected at a very early day, in order to let men get under the blocks of stone—with which they suppose the passage to have been filled up to its mouth by the original builders,—and so by getting under them, to be able to break them up and then drag them out piecemeal.

ENTRANCE PASSAGE,

ROOF OF.

West Side.

No. of joint.	First measure, joint to joint.	Second measure, do.	Mean.	Whole distance from beginning of *floor*, produced up to roof-level—*continued.*	Character of joint, etc., January 30, 1865.
0	0·0	0·0	0·0	162·2	Front surface of first roof stone is rather wavy and uncertain to measure.
1	38·2	38·2	38·2	200·4	Indifferently good.
2	40·7	40·8	40·8	241·2	Do. Roof stones have a dusty, pulverulent surface, and are 0·3
3	42·7	42·8	42·8	284·0	Bad. higher than joint of top of walls.
4	66·5	66·4	66·4	350·4	Bad.
5	30·6	30·8	30·7	381·1	Bad.
6	39·0	39·2	39·1	420·2	Good.
7	35·3	35·3	35·3	455·5	Indifferent.
8	35·4	35·4	35·4	490·9	Bad, stone showing a honey-comb surface-roughness.
9	61·8	62·0	61·9	552·8	Indifferent.
10	36·6	36·6	36·6	589·4	Fair.
11	36·6	36·5	36·6	626·0	Much broken on under side.
12	36·7	37·0	36·8	662·8	Bad.
13	55·4	55·4	55·4	718·2	Indifferent, stones rough-surfaced.
14	55·4	55·3	55·4	773·6	Fair and do.
15	54·6	54·7	54·6	828·2	Broken at under side.
16	55·6	55·6	55·6	883·8	
17	34·3	34·3	34·3	918·1	
18	59·0	59·1	59·0	977·1	Visible only in a hole in roof, in continuation of portcullis blocks of first ascending passage.
19	46·7	46·6	46·6	1023·7	At 5·7 preceding is a parallel crack. This, the nineteenth joint produced upwards, hits lower end of granite portcullis.
20	40·3	40·0	40·2	1063·9	Indifferent and broken.
21	48·0	48·0	48·0	1111·9	At beginning of Al Mamoon's hole on west side of passage.

ENTRANCE PASSAGE,

Roof of.

East Side.

No. of joint.	First measure from joint to joint.	Second measure do.	Mean.	Whole distance from beginning of *floor*, produced upwards to roof-level—*continued.*	Character of joint, etc., January 30, 1865.
0	0·0	0·0	0·0	162·3	Wavy and uneven cut off to roof stone.
1	38·6	38·8	38·7	201·0	Indifferent.
2	40·9	40·9	40·9	241·9	Bad and broken.
3	43·3	43·3	43·3	285·2	Indifferent.
4	66·2	65·8	66·0	351·2	Bad and wide.
5	30·3	30·5	30·4	381·6	Bad and wide; powdery, passing into a rough eaten-in surface.
6	39·3	39·6	39·4	421·0	Close.
7	35·4	35·3	35·4	456·4	Indifferent.
8	35·6	35·6	35·6	492·0	Bad.
9	61·8	61·9	61·8	553·8	Bad; stone very rough.
10	36·6	36·4	36·5	590·3	Good and close.
11	37·8	37·8	37·8	628·1	Indifferent.
12	36·7	36·7	36·7	664·8	Bad.
13	55·4	55·3	55·4	720·2	Wide.
14	53·1	53·0	53·0	773·2	Stone very rough and broken.
15	54·4	54·6	54·5	827·7	Much broken at lower edge.
16	58·5	58·6	58·6	886·3	
17	35·5	35·4	35·4	921·7	
18	60·0	60·3	60·2	981·9	Situated up in a hole, which is in continuation of portcullis blocks of first ascending passages, and in their inclined line.
19	46·0	46·4	46·2	1028·1	At 6·5 before this, a parallel crack. This joint produced in its own plane upwards, hits end of granite portcullis, three inches above its bottom.
20	38·5	38·8	38·6	1066·7	Beyond this point the ceiling is much broken in continuation of Al Mamoon's forced hole from the west.

ENTRANCE PASSAGE.

Roof of.

East and West Sides compared together.

Number of joint from Top, or North End.	Joint to joint on West side.	Do. on East side.	Whole distance from beginning of *Floor*, produced upwards to roof level, continued on West side.	Do. do. on East side.	Error of rectangularity.
0	0·0	0·0	162·2	162·3	+ 0·1
1	38·2	38·7	200·4	201·0	+ 0·6
2	40·8	40·9	241·2	241·9	+ 0·7
3	42·8	43·3	284·0	285·2	+ 1·2
4	66·4	66·0	350·4	351·2	+ 0·8
5	30·7	30·4	381·1	381·6	+ 0·5
6	39·1	39·4	420·2	421·0	+ 0·8
7	35·3	35·4	455·5	456·4	+ 0·9
8	35·4	35·6	490·9	492·0	+ 1·1
9	61·9	61·8	552·8	553·8	+ 1·0
10	36·6	36·5	589·4	590·3	+ 0·9
11	36·6	37·8	626·0	628·1	+ 2·1
12	36·8	36·7	662·8	664·8	+ 2·0
13	55·4	55·4	718·2	720·2	+ 2·0
14	55·4	53·0	773·6	773·2	— 0·4
15	54·6	54·5	828·2	827·7	— 0·5
16	55·6	58·6	883·8	886·3	+ 2·5
17	34·3	35·4	918·1	921·7	+ 3·6
18	59·0	60·2	977·1	981·9	+ 4·8
19	46·6	46·2	1023·7	1028·1	+ 4·4
20	40·2	38·6	1063·9	1066·7	+ 2·8
21	48·0	...	1111·9	.....	...

NOTES ON THE GENERAL CHARACTER OF ROOF OF ENTRANCE PASSAGE IN GREAT PYRAMID.

These blocks of stone do not seem of so hard and dense a quality as those of the side walls; and these again are inferior to the floor stones; which floor, therefore, seems to have been meant to stand work. The roof stones near upper end of passage

have a pulverulent surface, as from dry oxidation; lower down the passage they show the same rough decayed surface as the wall stones. Water sometimes runs down both the roof and side walls, as shown by dark stains.

The roof is first notably broken in upon, or broken out of, at, about, and in continuation of, the butt-end of granite portcullis of first ascending passage; and next it is broken in upon, and even more extensively and irregularly, lower down, partly opposite to, but more in continuation of, Khaliph Al Mamoon's hole in the west.

The parts broken out of the roof, under the portcullis, are rather more than would supply the now missing 'triangular' stone,—which, according to Sir Gardner Wilkinson and others, once completed the roof at that spot, and kept the portcullis out of sight; but they quite include the reasonableness of its once having existed.

The greater distances of nearly all the roof joints east, over west, as measured from commencement of basal sheet at its upper or north end, is probably due to the north escarpment of said basal sheet, in its present broken state, being rather difficult to trace; in fact, rather to error in point where measures were begun, than to all the roof joints being out of cross-level: the *differences* among them will, however, still serve to indicate the degree of closeness and accuracy aimed at, or attained, by the builders in that particular element.

ENTRANCE PASSAGE,

WALLS OF.

West Wall, *Lower* ends of Joints.

No. of wall-joint from top or North end.	Measured January 27. Joint to joint. Whole course. Upper course.	Measured January 27. Joint to joint. Whole course. Lower course.	January 27. Joint to joint. Whole course. Upper course.	January 27. Joint to joint. Whole course. Lower course.	January 30. Joint to joint. Whole course. Upper course.	January 30. Joint to joint. Whole course. Lower course.	Mean concluded. Whole course. Upper course.	Mean concluded. Whole course. Lower course.	Total distance from outside of basement. Whole course. Upper course.	Total distance from outside of basement. Whole course. Lower course.	Character of Joint, etc. Whole course. Upper course.	Character of Joint, etc. Whole course. Lower course.
0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	123·4	110·0	This first upper joint so fine as to have escaped observation on the two first measurements.	Good.
1	...	42·6	...	42·7	42·6	42·6	42·6	42·6	166·0	152·6		
2	100·5	55·0	100·0	55·0	58·0	55·2	58·0	55·0	224·0	207·6	Good.	Good.
3	82·4		82·1		.....		82·2		289·8		Vertical approximately.	
4	59·7		59·6		.....		59·6		349·4		Do.	
5	42·1		42·5		.....		42·3		391·7			
6	35·5		35·3		.....		35·4		427·1		Good.	
7	55·0		55·1		.....		55·0		482·1		Bad.	
8	45·0		45·1		.....		45·0		527·1		Indifferent.	
9	35·1		34·9		.....		35·0		562·1		Good.	
10	77·0		77·0		.....		77·0		639·1		Bad.	
11	42·1		42·2		.....		42·2		681·3		Bad.	
12	59·1		59·1		.....		59·1		740·4		Bad.	
13	26·6		26·4		.....		26·5		766·9		Bad.	
14	34·5		34·8		.....		34·6		801·5		Bad or indifferent.	
15	40·6		40·4		.....		40·5		842·0		Bad.	
16	29·1		29·1		.....		29·1		871·1		Indifferent.	
17	60·4		60·4		.....		60·4		931·5		Good.	
18	49·5		49·6		49·6		49·6		981·1		Good.	
19	29·7		.....		29.8		29·8		1010·9		Good, when produced upwards hits centre of lower end of granite portcullis.	
20	41·3		41·5		41·3		41·4		1052·3		Good.	
21	.....		54·5		56·0±		55·±		1107·±		Touched on by Khaliph Al Mamoon's hole.	
21′	.....		.....		70·±		70·±		1177·±		End of Al Mamoon's hole.	

ENTRANCE PASSAGE,

WALLS OF.

West Wall, *Upper* ends of Joints.

No. of wall-joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean, joint to joint.		Total distance from outside of basement, North end.		Character of Joint, etc. January 31, 1865.
	Whole course.		Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	0·0	0·0	0·0	0·0	0·0	0·0	122·4	110·0	
1	42·8	42·6	42·7	42·7	42·8	42·6	165·2	152·6	
2	58·2	55·3	58·3	54·9	58·2	55·1	223·4	207·7	
3	50·4		50·2		50·2		273·6		Vertical joint approximately.
4	65·7		65·2		65·4		339·0		Vertical do.
5	52·7		52·7		52·7		391·7		
6	35·3		35·3		35·3		427·0		
7	55·1		55·2		55·2		482·2		
8	45·3		45·2		45·2		527·4		
9	35·0		35·0		35·0		562·4		
10	77·0		77·1		77·0		639·4		
11	41·9		41·8		41·8		681·2		
12	59·4		59·4		59·4		740·6		
13	26·5		26·3		26·4		767·0		
14	34·8		34·8		34·8		801·8		
15	40·2		40·5		40·4		842·2		
16	29·3		29·4		29·4		871·6		
17	59·7 ?		60·3		60·2		931·8		In a fracture.
18	49·5		49·4		49·4		981·2		
19	30·3		.....		30·3		1011·5		This joint produced in its own line hits portcullis end.
20	40·8		.....		40·8		1052·3		Past, or to south of portcullis butt-end.

ENTRANCE PASSAGE,

WALLS OF.

West Wall, *Lower* and *Upper* ends of Joints compared together.

No. of vertical from top or North end.	Lower end: joint to joint.		Upper end: joint to joint.		Lower end: total distance from beginning of floor, North.		Upper end: total distance from beginning of floor, North.		Correction required to upper end.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	123·4	111·0	122·4	110·0	...	...
1	42·6	42·6	42·6	42·6	166·0	152·6	165·2	152·6	+0·8	0·0
2	58·0	55·0	58·2	55·1	224·0	207·6	223·4	207·7	+0·6	—0·1
3	82·2		50·2		289·8		273·6		+ 16·2	
4	59·6		65·4		349·4		339·0		+ 10·4	
5	42·3		52·7		391·7		391·7		0·0	
6	35·4		35·3		427·1		427·0		+ 0·1	
7	55·0		55·2		482·1		482·2		— 0·1	
8	45·0		45·2		527·1		527·4		— 0·3	
9	35·0		35·0		562·1		562·4		— 0·3	
10	77·0		77·0		639·1		639·4		— 0·3	
11	42·2		41·8		681·3		681·2		+ 0·1	
12	59·1		59·4		740·4		740·6		— 0·2	
13	26·5		26·4		766·9		767·0		— 0·1	
14	34·6		34·8		801·5		801·8		— 0·3	
15	40·5		40·4		842·0		842·2		— 0·2	
16	29·1		29·4		871·1		871·6		— 0·5	
17	60·4		60·2		931·5		931·8		— 0·3	
18	49·6		49·4		981·1		981·2		— 0·1	
19	29·8		30·3		1010·9		1011·5		— 0·6	
20	41·4		40·8		1052·3		1052·3		0·0	
21	55· ±		.....		1107·3		.....		.....	
21′	70·		.....		1177·3		.....		.....	

ENTRANCE PASSAGE,—Walls of.

East Wall, *Lower* ends of Joints.

No. of wall-joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean of joint to joint.		Total distance from outside of basement, North end.		January 30, 1865.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	0·0	0·0	124·8	110·2		
1	83·3	40·1	83·2	40·3	83·2	40·2	208·0	150·4	Fine and thin	Exquisitely fine; more remarkably still the longitudinal joint between the two courses.
2	...	68·9	...	68·8	...	68·8	...	219·2	...	Exquisitely fine.
3	70·8		70·9		70·8		290·0		True, but injured; vertical approximately.	
4	64·0		63·8		63·9		353·9		Bad and open; vertical approximately.	
5	33·6		33·3		33·4		387·3		Bad and open; wall-surface is rather glassy over an uneven grain, and is not of so hard a stone as the floor.	
6	54·9		54·9		54·9		442·2		Close.	
7	58·8		58·8		58·8		501·0		Bad and open.	
8	36·1		36·1		36·1		537·1		Close; wall-stone more injured and decayed.	
9	68·0		68·1		68·0		605·1		Close at top, open at bottom.	
10	53·7		53·8		53·8		658·9		Moderately close; stone surface very rough and decayed.	
11	58·1		58·3		58·2		717·1		Open; two big cracks between this and last joint.	
12	44·1		44·2		44·2		761·3		Closer at top than bottom.	
13	60·0		60·0		60·0		821·3		Indifferent.	
14	32·8		33·0		32·9		854·2		Indifferent; wall stones very rough.	
15	62·7		62·8		62·8		917·0		Close; from last joint to this one and the next two or three, there are extensive chips or fractures in the upper part of the wall stone.	
16	40·8		40·7		40·8		957·8		Close.	
17	42·4		42·7		42·6		1000·4		Indifferent.	
18	38·9		39·3		39·1		1039.5		Indifferent; stone much chipped both below and above.	
19	44·0		44·0		44·0		1083·5		Exceedingly broken.	
20	57·0		57·0		57·0		1140·5		Close, but exceedingly broken and opposite to Al Mamoon's hole on West side, *i.e.*, past its beginning by about 28 inches.	

ENTRANCE PASSAGE,

WALLS OF.

East Wall, *Upper* ends of joints.

No. of joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean, joint to joint.		Total distance from beginning of floor, North.		February 1st, 1865.
	Whole course.		Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	0·0	0·0	0·0	0·0	0·0	0·0	124·8	110·2	Front, or North surface of the upper of these two courses, begins 15 to 20 inches behind or to south of lower one; but neither have good and regular fronts, being greatly broken and injured.
1	82·9	40·0	82·8	40·0	82·8	40·0	207·6	150·2	
2	...	68·8	...	68·9	...	68·8	...	219·0	
3	70·7		70·6		70·6		278·2		Bad joint and difficult reading.
4	66·6		66·6		66·6		344·8		Do. do.
5	42·7		42·6		42·6		387·4		
6	54·8		54·8		54·8		442·2		
7	58·8		58·7		58·8		501·0		
8	36·6		36·4		36·5		537·5		
9	67·6		67·5		67·6		605·1		
10	53·8		53·7		53·8		658·9		
11	58·0		58·0		58·0		716·9		
12	44·2		44·2		44·2		761·1		
13	60·1		60·1		60·1		821·2		
14	32·8		32·9		32·8		854·0		
15	62·8		62·8		62·8		916·8		Close joint.
16	40·5		40·6		40·6		957·4		
17	42·5		42·5		42·5		999·9		This joint produced upwards hits top, or north side of lower butt-end of granite portcullis.
18	39·3		39·1		39·2		1039·1		
19	43·3		43·7		43·6		1082·7		Grievously broken, and lower part ending in sand.
20	.....		.....		.....		.....		

ENTRANCE PASSAGE,

Walls of.

East wall, *Lower* and *Upper* ends of joints compared.

No. of joint from top or North end.	*Lower* ends, joint to joint.		*Upper* ends, joint to joint.		*Lower* ends, total distance from beginning of floor, North.		*Upper* ends, total distance from beginning of floor, North.		Correction required to upper ends.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	124·8	110·2	124·8	110·2	...	...
1	83·2	40·2	82·8	40·0	208·0	150·4	207·6	150·2	+0·4	+0·2
2	...	68·8	...	68·8	...	219·2	...	219·0	...	+0·2
3	70·8		70·6		290·0		278·2		+11·8	
4	63·9		66·6		353·9		344·8		+ 9·1	
5	33·4		42·6		387·3		387·4		— 0·1	
6	54·9		54·8		442·2		442·2		0·0	
7	58·8		58·8		501·0		501·0		0·0	
8	36·1		36·5		537·1		537·5		— 0·4	
9	68·0		67·6		605·1		605·1		0·0	
10	53·8		53·8		658·9		658·9		0·0	
11	58·2		58·0		717·1		716·9		+ 0·2	
12	44·2		44·2		761·3		761·1		+ 0·2	
13	60·0		60·1		821·3		821·2		+ 0·1	
14	32·9		32·8		854·2		854·0		+ 0·2	
15	62·8		62·8		917·0		916·8		+ 0·2	
16	40·8		40·6		957·8		957·4		+ 0·4	
17	42·6		42·5		1000·4		999·9		+ 0·5	
18	39·1		39·2		1039·5		1039·1		+ 0·4	
19	44·0		43·6		1083·5		1082·7		+ 0·8	
20	57·0		.....		1140·5		.....		.....	
21	.....		.....		.....		.....		.....	

NOTES ON THE CHARACTER OF THE STONE SURFACE OF THE WEST AND EAST WALLS.

These walls of the entrance passage begin at the north or upper end in two courses to form its

height; but after 100 inches or more of distance southward, they are formed of larger blocks of the full height of the passage, and therefore in a single course only. All the joints between these stones are transverse or *perpendicular* to the axis of the passage, excepting only the third and fourth joints, which approximate to a *vertical* position.

A few inches below, or south of the fourth joint, and nearly similarly on either side of the passage, is still to be seen a line about ·98 broad and ·02 deep, drawn by a powerful hand, and with a hard tool, upon the stones, and in direction of a perpendicular to the line of the passage. The line finds itself on that particular stone, whose lower or southern end is perpendicular to the passage, while its upper and northern end is approaching to the vertical; and from its (the line's) position, would enable a set-off to be obtained for the unusual angle of the northern face more accurately than from the farther end of the stone, to which the line may be considered parallel,—but it is in fact rather truer in rectangularity than that, to the passage axis. The Pyramid guides had not noticed these lines on either side; and quite believed, on having them pointed out, that they might have been made by the original builders; while we ourselves afterwards found traces of similar lines on the junction surfaces of fragments of casing stones, and more notably on the south-west socket of the Pyramid excavated and exposed to view by Mr. Aiton in April.

The joints of the stones near the beginning of the passage are fine, thin, and true almost past belief; towards the middle of the passage they become coarse and wide, say 0·2 in breadth; but are closer again on approaching the neighbourhood of the portcullis block of the first ascending passage.

The surface of the walls is nowhere absolutely smooth: it shows indications, indeed, of having been once worked to a true plane, and then having, ages afterwards, suffered a corroding effect, which has partially honeycombed the surface; and this effect is chiefly visible far down inside the passage, where mechanical violence is most slightly felt. Wherever, on the contrary, the stone has been exposed to friction, it seems to harden under it, become smooth and marble-like, and resist the corroding and rough honeycombing influence seen elsewhere. Wherever, too, the stone has been fresh chipped or fractured, as it has been abundantly near the portcullis, the chipped surfaces are smooth, dense, and uniform.

ENTRANCE PASSAGE,

WALLS OF.

West Wall Joints, tested for rectangularity by a large Square.

No. of joint from top or North end.	Tail of square to South.		Tail of square to North.		Mean freed from error of square.		Notes, January 31, 1865.
	Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	...	...	...	...	...	...	Measures in first column made with tail of square to south, and going down passage; those, in second column, with tail to north.
1	+0·10	+0·30	—0·20	—0·09	—0·05	+0·10	
2	+0·20	0·00	—0·25	—0·02	—0·02	—0·01	
3	+14·±		+13·±		+14·±		Bad joint; the rectilineal line drawn and engraved in the stone behind this joint, or at about 355 inches or more from beginning of basement sheet (for it was not measured for distance) reads on the square +0·12 by a forward observation, and —0·12 by a backward observation, whence the mean shows no error of perpendicularity.
4	+ 9·±		+ 8·±		+ 9·±		
5	0·00		— 0·18		— 0·09		
6	0·00		— 0·03		— 0·02		
7	+ 0·12		— 0·05		+ 0·03		
8	+ 0·07		— 0·35		— 0·14		
9	+ 0·10		— 0·27		— 0·14		
10	0·00		— 0·20		— 0·10		
11	0·00		— 0·10		— 0·05		Joint open below.
12	0·00		— 0·30		— 0·15		Joint open at top.
13	— 0·03		— 0·25		— 0·14		
14	0·00		— 0·2±		— 0·10		Bad joint.
15	0·00		— 0·12		— 0·06		
16	— 0·10		— 0·20		— 0·15		Passage grows dark about and below this point.
17	+ 0·12		— 0·15		— 0·02		
18	+ 0·10		— 0·10		0·00		
19	0·00		— 0·1±		— 0·05		This joint produced upwards hits nearly on middle of lower butt-end of granite portcullis.
20	Sand heap.		— 0·2±		...		

ENTRANCE PASSAGE,

WALLS OF.

***East* Wall Joints, tested for rectangularity by a large Square.**

Number of joint from top or North end.	Tail of square to North.		Tail of square to South.		Mean, freed from error of square.		Notes, January 31, 1865.
	Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	...	...	...	...	...	...	
1	00·0	—0·07	—0·05	+0·10	—0·02	+0·02	
2	...	—0·10	...	+0·10	...	0·00	
3	+10·±		+10·±		+10·±		Bad joint, and measure at top in a hole.
4	+ 7·±		+ 8·±		+ 8·±		Bad joint; line on stone behind or south of this joint reads one way of the square +0·15, and the other way —0·23; giving for mean a —0·04.
5	— 0·45		— 0·08		— 0·26		
6	— 0·25		0·00		— 0·12		
7	— 0·25		+ 0·07		— 0·14		
8	— 0·30		— 0·12		— 0·21		
9	— 0·25		+ 0·10		— 0·12		
10	— 0·17		+ 0·01		— 0 08		
11	— 0·25		+ 0·03		— 0·12		Ends in a hole at top, and by a crack leads to a joint in roof.
12	— 0·20		+ 0·05		— 0·08		
13	— 0·22		+ 0·05		— 0·14		
14	— 0·25		+ 0·12		— 0·06		
15	— 0·10		+ 0·05		— 0·02		Best joint for many preceding ones. Upper edge of wall is chipped more than half way down.
16	— 0·25		+ 0·10		— 0·08		Getting rather dark for measuring.
17	— 0·20		+ 0·22		+ 0·01		This line produced hits near upper part of butt-end of portcullis.
18	— 0·25		Sand heap interferes.		.....		This line produced hits a little past, or to the south of butt-end of granite portcullis.
19	.....		.....		.....		

NOTES ON THE ABOVE OBSERVATIONS.

The square employed was made by myself at the Pyramid for the occasion, out of some of the well-planed flat deal bars contained as packing in the 100-inch linear box. The height of upright was 41", and length of bar, 50 inches. The base was all on one side of the upright, in the L manner; hence, when testing any particular joint, and reversing the square upon it, the tail-piece stood on different portions of the passage floor on each occasion, which might introduce some error from want of perfect straightness of floor surface; the shape, moreover, of the pieces of wood forming the base was such, as to prevent the upright applying quite so close to the wall in one way of using it as the other,—when the making of the observations accurately, became therefore rather more difficult.

I had hoped, on examining the square when first made up in the instrument-tomb, that it was true at the top of its upright to much less than 0·1, but by the time it had been carried up to the Pyramid, the observations show that it must have increased its error to 0·1 full, each way; making a difference between two sets of readings, with tail-piece reversed, of 0·20, which is probably a greater error than most of the joints themselves are really affected by, —always excepting the two *quasi*-vertical joints, whatever the reason of their being so made, may

have been. The large differences between the corrections for the said two joints, as measured with the square and as deduced from the linear measures, pages 16 and 19, are believed to be due to the measure of the square being taken at the top of its upright, or 41 inches from floor, while the linear measures were taken at the very top of the wall, or 47·3 inches above the same.

After making due note of those two anomalies, it will be perceived that there is a remarkably increased accuracy in the parallelism of the wall joints, as well as in their perpendicularity to the axis of the passage,—than what obtains with those of either floor, or roof; where errors, or variations exist as often to whole inches, as in the walls they do to tenths. This species of accuracy, too, is preserved throughout the whole measured length of both walls, notwithstanding that there is no effort apparent to make the blocks composing the walls either all of equal size, or to make them correspond in large and small on the two opposite sides.

ENTRANCE PASSAGE.

Relative lengths of stones in floor, walls, and roof, beginning with the highest or Northernmost.—(See Plate II.)

Floor, West side of.	West wall.				Roof.		East wall.				Floor, East side of.
	Bottom of.		Top of.				Top of.		Bottom of.		
	Whole course.		Whole course.				Whole course.		Whole course.		
	Bottom of lower course.	Top of lower course.	Bottom of upper course.	Top of upper course.	West side of.	East side of.	Top of upper course.	Bottom of upper course.	Top of lower course.	Bottom of lower course.	
54·1	...	...	...	...	...	...	...	...	...	...	54·6
48·0	...	...	...	...	...	...	...	...	...	...	47·6
58·9	42·6	42·6	42·6	42·8	38·2	38·7	82·8	83·2	40·0	40·2	58·0
55·4	55·0	55·1	58·0	58·2	40·8	40·9	...	...	68·8	68·8	55·0
65·7	82·2		50·2		42·8	43·3	70·6		70·8		68·4
59·2	59·6		65·4		66·4	66·0	66·6		63·9		58·9
66·2	42·3		52·7		30·9	30·4	42·6		33·4		66·2
52·4	35·4		35·3		39·1	39·4	54·8		54·9		51·8
62·5	55·0		55·2		35·3	35·4	58·8		58·8		59·2
53·1	45·0		45·2		35·4	35·6	36·5		36·1		53·0
36·1	35·0		35·0		61·9	61·8	67·6		68·0		38·8
39·5	77·0		77·0		36·6	36·5	53·8		53·8		40·4
51·4	42·2		41·8		36·6	37·8	58·0		58·2		50·9
51·6	59·1		59·4		36·8	36·7	44·2		44·2		52·8
36·5	26·5		26·4		55·4	55·4	60·1		60·0		36·4
48·5	34·6		34·8		55·4	53·0	32·8		32·9		48·6
40·0	40·5		40·4		54·6	54·5	62·8		62·8		40·0
24·8	29·1		29·4		55·6	58·6	40·6		40·8		24·6
35·2	60·4		60·2		34·3	35·4	42·5		42·6		35·2
63·6	49·6		49·4		59·0	60·2	39·2		39·1		57·0
46·6	29·8		30·3		46·6	46·2	43·6		44·0		36·2
21·±	41·4		40·8		40·2	38·6	.....		57·0		32·±
49·±	55·±		.....		48·0	...	.....		.....		...
...	70·±		.....		...	...	.....		.....		...

ENTRANCE PASSAGE.

Relative positions of joints in floor, walls, and roof, as indicated by their distance from beginning of basement sheet at its North end.—(See Plate II.)

Floor, West side of.	West wall.				Roof.		East wall.				Floor, East side of.
	Bottom of.		Top of.				Top of.		Bottom of.		
	Whole course.		Whole course.				Whole course.		Whole course.		
	Bottom of lower course.	Top of lower course.	Bottom of upper course	Top of upper course.	West side of.	East side of.	Top of upper course.	Bottom of upper course.	Top of lower course.	Bottom of lower course.	
0·0	...	...	...	...	...	...	...	...	...	...	0·0
54·1	...	...	...	...	...	...	...	...	...	...	54·6
102·1	111·0	110·0	123·4	122·4	...	...	124·8	124·8	110·2	110·2	102·2
161·0	152·6	152·6	166·0	165·2	162·2	162·3	207·6	208·0	150·2	150·4	160·2
216·4	207·6	207·7	224·0	223·4	200·4	201·0	...	...	219·0	219·2	215·2
282·1	289·8		273·6		241·2	241·9	278·2		290·0		283·6
341·3	349·4		339·0		284·0	285·2	344·8		353·9		342·5
407·5	391·7		391·7		350·4	351·2	387·4		387·3		408·7
459·9	427·1		427·0		381·1	381·6	442·2		442·2		460·5
522·4	482·1		482·2		420·2	421·0	501·0		501·0		519·7
575·5	527·1		527·4		455·5	456·4	537·5		537·1		572·7
611·6	562·1		562·4		490·9	492·0	605·1		605·1		611·5
651·1	639·1		639·4		552·8	553·8	658·9		658·9		651·9
702·5	681·3		681·2		589·4	590·3	716·9		717·1		702·8
754·1	740·4		740·6		626·0	628·1	761·1		761·3		755·6
790·6	766·9		767·0		662·8	664·8	821·5		821·3		792·0
839·1	801·5		801·8		718·2	720·2	854·0		854·2		840·6
879·1	842·0		842·2		773·6	773·2	916·8		917·0		880·6
903·9	871·1		871·6		828·2	827·7	957·4		957·8		905·2
939·1	931·5		931·8		883·8	886·3	999·9		1000·4		940·4
1002·7	981·1		981·2		918·1	921·7	1039·1		1039·5		997·4
1049·3	1010·9		1011·5		977·1	981·9	1082·7		1083·5		1033·6
1070·±	1052·3		1052·3		1023·7	1028·1	.....		1140·5		1066·±
1119·±	1107·3		.....		1063·9	1066·7	.....		.....		...
...	1177·3		.....		1111·9	...	.....		.....		...

ENTRANCE PASSAGE.

Relative view of errors of perpendicularity to axis of passage in the joints of floor, walls, and roof; the measures by the square being corrected for the less height of its upright, than the walls of the passage.

Floor.	West wall. By linear measure. Whole course. Lower course.	West wall. By linear measure. Whole course. Upper course.	West wall. By square. Whole course. Lower course.	West wall. By square. Whole course. Upper course.	Roof.	East wall. By linear measure. Whole course. Upper course.	East wall. By linear measure. Whole course. Lower course.	East wall. By square. Whole course. Upper course.	East wall. By square. Whole course. Lower course.	Notes.
+ 0·5	...	...	...	...	...	...	...	...	...	Of the two methods by which the wall joints have been tested, that by the square is considered the more accurate of the two, and capable of the more accuracy; as top and bottom of the joints were compared at the same instant, and noted to ·01 of an inch; while with the other method the readings for the top of the joints were taken one day, and for the bottom perhaps on another day, and they were only read off at any time to tenths of an inch; with a certain amount always of risk as to the measuring-rod slipping on the inclined floor, whose angle is greater than that of frictional repose. Yet it was important to exhibit the results of this method against the square on the *walls*, as it is the only method that was employed to test the joints of both roof and floor.
+ 0·1	...	...	...	...	...	...	...	...	...	
- 0·8	0·0	+0·8	+0·11	-0·06	+0·1	+0·4	+0·2	- 0·02	+0·02	
- 1·2	-0·1	+0·6	-0·01	- 0·02	+0·6	...	+0·2	...	0·00	
+ 1·5	+16·2		+16· ±		+0·7	+11·8		+11·3±		
+ 1·2	+10·4		+10·3±		+1·2	+ 9·1		+ 9· ±		
+ 1·2	0·0		- 0·10		+0·8	- 0·1		- 0·30		
+ 0·6	+ 0·1		- 0·02		+0·5	0·0		- 0·14		
- 2·7	- 0·1		+ 0·03		+0·8	0·0		- 0·16		
- 2·8	- 0·3		- 0·16		+0·9	- 0·4		- 0·24		
- 0·1	- 0·3		- 0·16		+1·1	0·0		- 0·14		
+ 0·8	- 0·3		- 0·11		+1·0	0·0		- 0·09		
+ 0·3	+ 0·1		- 0·06		+0·9	+ 0·2		- 0·14		
+ 1·5	- 0·2		- 0·17		+2·1	+ 0·2		- 0·09		
+ 1·4	- 0·1		- 0·16		+2·0	+ 0·1		- 0·16		
+ 1·5	- 0·3		- 0·11		+2·0	+ 0·2		- 0·07		
+ 1·5	- 0·2		- 0·07		-0·4	+ 0·2		- 0·02		
+ 1·3	- 0·5		- 0·17		-0·5	+ 0·4		- 0·09		
+ 1·3	- 0·3		- 0·02		+2·5	+ 0·5		+ 0·01		
- 5·3	- 0·1		0·00		+3·6	+ 0·4		.....		
-15·7	- 0·6		- 0·06		+4·8	+ 0·8		.....		
- 4·±	0·0		.....		+4·4	.....		.....		
...	.....		.....		+2·8	.....		.....		

ENTRANCE PASSAGE,

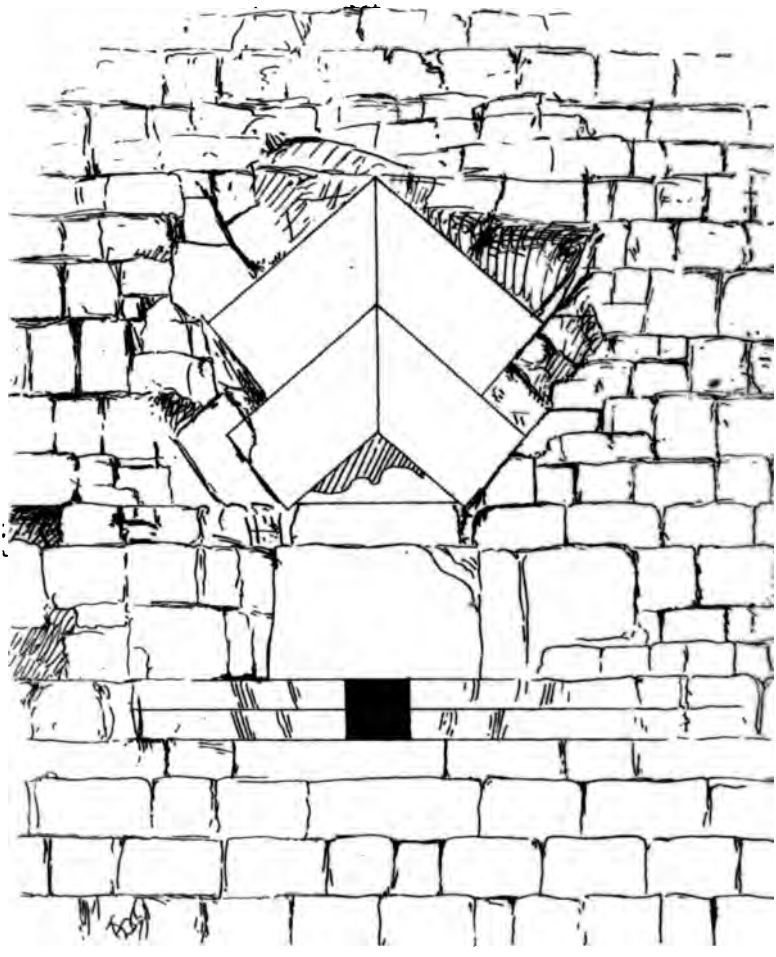
Breadth and Height of, measured with Slider 35·, and therefore corrected by—·14 to make it show British inches.

At or near floor joint, on West side.	*Breadth*, perpendicular to axis of passage.		Mean, or breadth near middle of walls.	*Height*, perpendicular to axis of passage.		Mean height.	Notes, February 1, 1865.
	Near bottom of walls.	Near top of walls.		West side of floor.	East side of floor.		
1	...	...	...	...	...	...	
2	...	...	...	...	...	...	
3	...	...	...	...	...	...	
4	41·61	41·63	41·62	47·24	47·27	47·26	The peculiar little holes of the rough decayed surface, always avoided. Passage has a *vertical* height here = 52·68.
5	...	...	...	...	...	...	
6	...	...	...	...	...	...	
7	41·51	41·41	41·46	47·23	47·30	47·26	
8	41·59	41·41	41·50	...	...	...	Supposed to be Professor Greaves' place of measure; the fifth joint might also answer his description of being 'opposite to a joint in the roof,' but there are wall joints on either side there, which would render the place inappropriate for his purpose.
9	...	...	...	...	...	...	
10	...	...	...	...	...	...	
11	41·59	41·51	41·55	47·30	47·32	47·31	Depth from roof, perpendicular to axis of passage, down to bottom of the broken holes in floor = 55·0, about.
12	...	...	...	...	...	...	
13	...	...	...	...	...	...	
14	...	...	...	...	...	...	Breadth measured purposely from hollow to hollow of the surface roughnesses on either wall = 41·91.
15	41·59	41·46	41·52	47·16	47·18	47·17	*Vertical* height of passage = 52·36; depth from roof, as before, to bottom of holes in floor, from 61· to 71· about this part.
16	...	...	...	...	...	...	
17	...	...	...	...	...	...	
18	...	...	...	...	...	...	
19	...	...	...	...	...	...	
20	...	...	...	...	...	...	
21	41·46	(chipped)	...	47·28	47·14	47·21	Top defined for height by plane of side roof joint.
	Mean of all,		41·53			47·24	

Elevation, looking South,

of North-end of Entrance passage of Great Pyramid,

slightly modified in perspective of lower parts.



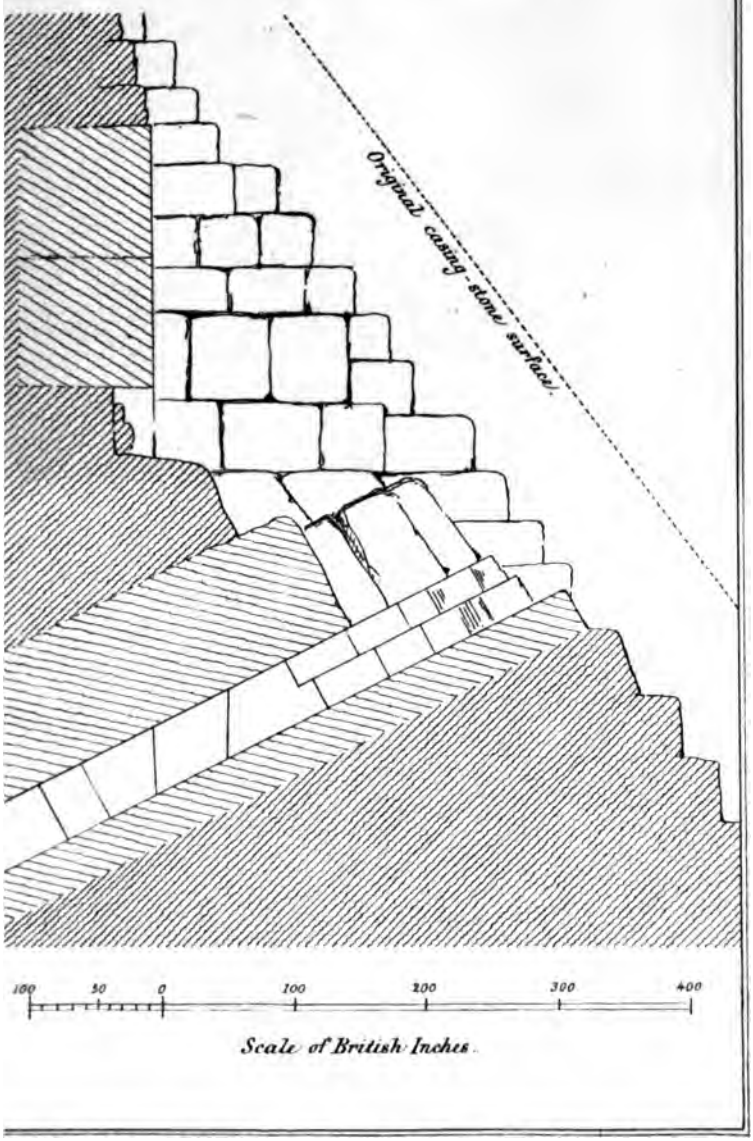
100 50 0 100 200 300 400

Scale of British Inches.

Vertical Section, looking West,

North end of Entrance passage of Great Pyramid,

chiefly to show joints of West wall.



Scale of British Inches.

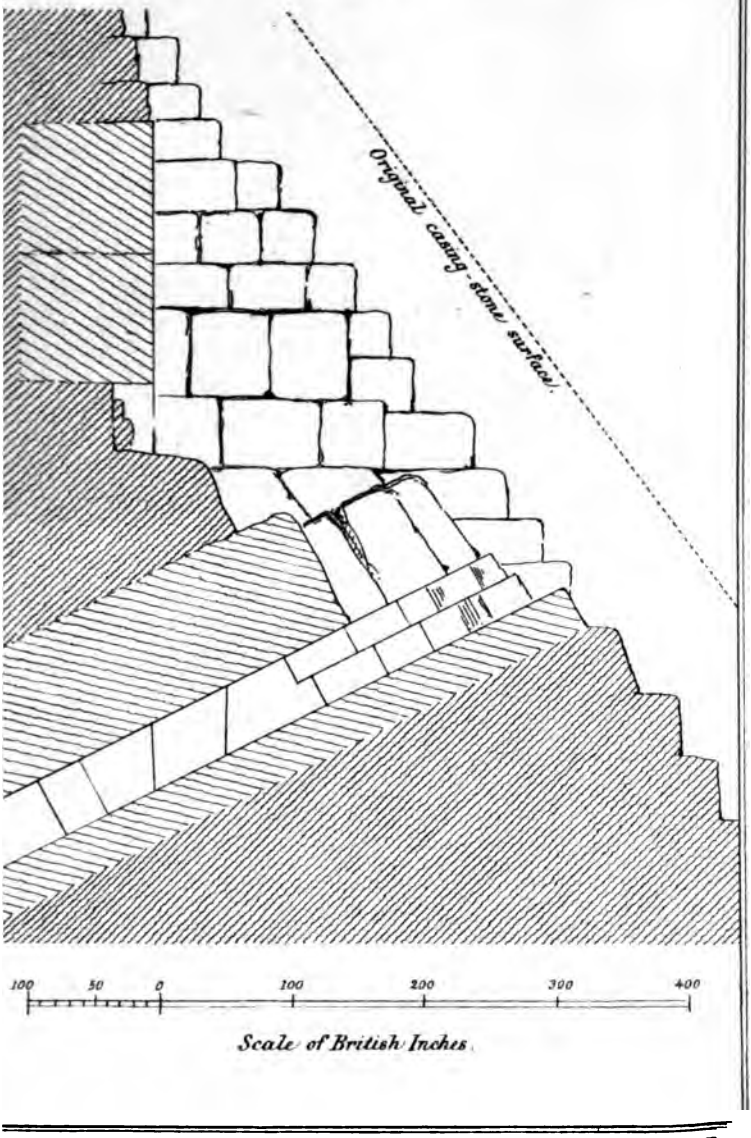
W H M^c Farlane, Lith^r Edin^r

Vol. II.

Vertical Section, looking West,

North end of Entrance passage of Great Pyramid,

chiefly to show joints of West wall.



Scale of British Inches.

W H.Mc Farlane, Lith.r E

ENTRANCE PASSAGE,

BEGINNING OF.

The present beginning of the entrance passage is an accident of dilapidation, and mischievous destruction; hence, the roof ends northward at one distance, the walls extend a little farther out in the same direction, and the floor a good deal farther out still; the latter, moreover, bears evident markings on its surface, of the walls, and therefore the passage, having once extended along its whole length to its extreme upper or northern end. But that upper or northern end of the floor, at present, is probably short by more than 100· inches of the original surface of the Pyramid at that place.

There is nothing, therefore, of great theoretical importance derivable from the measured length of the whole passage, as at present; though much may be deduced from attention to different parts: and no one with an ability to appreciate good work, can look, unmoved with admiration, at the extraordinarily truthful straight lines, and close fittings of the wall joints near and about the present entrance. This feeling, too, increases on examining further the proximate means by which permanence and solidity were given to that special masonry: for instance, though the passage itself is but 41·5 inches wide,—the flooring forming it, is close upon 400 inches wide, so that if that broad sheet, composed, too, of the hardest and whitest stone in all this part

of the building, was cross-levelled only tolerably at its own sides, the error on the sides of the passage must have been, to linear measure, microscopically small. And when the truth of the floor had been thus secured, the firmness of the rest of the passage was obtained by a manner of building, best represented by drawings, as below; where the front view dispenses with the very difficult representation of the characteristic dip of the passage southward at an angle of 26·3° nearly; but the side view, or longitudinal section, supplies that deficiency.—(See Plate III.)

The measurements on which the above sketches have been founded, are, in addition to those already detailed:—

Thickness of basement sheet,	=	29 to 30 inches.
,, roof-stone,	=	100
,, stone above roof-stone,	=	60 at outer end.
Height of triangular hollow under arch-stones,	=	55 inches.
Length of roof sides of said hollow,	=	84 ,,
Height of vertical line of the two lower arch-stones,	=	96 ,,
Depth of hollow from outer face of arch-stones,	=	33 ,,
Projection of stone above roof-stone, horizontally, or nearly so, beyond, or north of, face of arched stones,	=	46 ,,
Projection of roof-stone beyond, or north of, stone above it,	=	39 ,,
Breadth of floor-base,	=	398 ,,
,, roof-stone,	=	147 ,,
,, base of triangular hollow,	=	128 ,,

These measures about the so-called false portal are very rough; and the sketches have been partly filled in by reference to photographs. One or more pair of arched stones formerly existed northward of

the present set, as testified to by masonry below, in the form of abutments; but there is no visible indication that there are any more sets behind the present ones, going farther into the Pyramid; and, if there should be such, they go in upon a horizontal line, and therefore rapidly leave the neighbourhood of the entrance passage,—which descends, as it enters, at an angle 26·3°, nearly, below the horizon.

ENTRANCE PASSAGE,

SHAFT OF.

This was not examined farther than the heap of sand and stones fixed in it by the Arabs, at about 1200 inches from the north commencement.

This obstruction occurs just below Khaliph Al Mamoon's hole, which is to the west; the forced front entrance to said hole being from a point outside the Pyramid, about 300 (?) inches below the proper entrance, and 250 (?) inches west of it; very nearly, therefore, in the vertical central line of north face. On windy days a certain amount of ventilation goes on, between this forced passage and the entrance passage,—the incline of the latter giving it a certain amount of chimney power,—and their point of connexion being, where the bulbous inner end of the forced passage, or the Khaliph's hole, breaks into the western side of entrance passage. Shortly below that point, it is believed that the masonry of the

entrance passage ceases, all the lower part being excavated in the live rock of the hill.

The lower butt-end of granite portcullis of first ascending passage, as it appears in roof of entrance passage, is most noteworthy. It is visible now by a stone having fallen out of the roof at that part; the 'triangular stone' of Pyramid historians.

The shape of this stone, judging by the hole it has left, was underneath, or in plane of roof, about 100 inches long, and 41·5 inches broad, and rectangular; but in side elevation it must have been triangular, having the northern side about 60 in. long,
and the southern, ... 70 „
with the base, as before, about . . 100 „

The position of said granite portcullis or block, with regard to entrance passage, is also important, and requires more accurate measures.

If the position of its butt-end be demanded as referred to the floor of entrance passage, by lines transverse to the axis of that, then—

On Western side—	
Northern edge of butt-end of granite portcullis, from beginning of basement sheet, . . .	= 992·9
Southern edge, do., do., ...	= 1031·5
Mean,	= 1012·2
On Eastern side—	
Northern edge, do., do., ...	= 995·4
Southern edge, do., do., ...	= 1033·3
Mean,	= 1014·4
Mean of both, or centre of portcullis's lower butt-end, distant by transverse line to axis of entrance passage, from beginning of floor of same, ...	= 1013·3

But if the distance on floor at which the axial line of the portcullis block, or, which is the same thing, of the first ascending passage, if produced, will strike,—be demanded, the distance will be very much less; viz.:—

For the mean, ...	= 958·0
And distance at which said axial line strikes *axis* of entrance passage, measured transversely on floor, .	= 975·5
And distance at which roof of entrance passage is similarly struck, ...	= 993·3

These quantities were obtained for the means, by small special calculations of the following measures; but where the roughness of many of the broken surfaces prevented accuracy, and where a constant difference was found between the measures east and measures west.—(See Plate IV.)

The letters refer to the diagram following.

MEASURES CONNECTING PORTCULLIS BLOCK WITH ENTRANCE PASSAGE.

		Measures West.	Measures East.
a d, . . .	=	50·3	50·2
b e, . . .	=	32·8	32·3
c f, . . .	=	14·1	14·2
d g, . . .	=	29·8	29·7
e h, . . .	=	30·0	29·5
f i, . . .	=	30·0	29·8
g j, . . .	=	29·8	29·7
h k, . . .	=	28·7	28·9
i l, . . .	=	30·0	29·8

DISTANCES OF CERTAIN POINTS FROM BASEMENT BEGINNING.

		Measures West.	Measures East.
j, ...	=	927·3	928·2
k, first method, .	=	957·9	959·4
k, second ,, .	=	956·4	957·7
l, ...	=	985·6	987·2
h, first method, .	=	974·6	976·4
h, second ,, .	=	974·9	976·2
d, ...	=	963·0	964·8
e, ...	=	992·6	993·9
f, ...	=	1022·2	1023·0

SIZE OF LOWER END SURFACE OF PORTCULLIS BLOCK.

Breadth from east to west, across upper or north edge, ...	= 38·35 — ·15	= 38·20
Do. do. middle, . .	= 38·30 — ·15	= 38·15
Do. do. across lower or south edge, ...	= 38·22 — ·15	= 38·07
Mean,		38·14

Height or length on eastern side, February 9,	= 46·8 — ·20	= 46·6
,, ,, ,, 11,	= 47·1 — ·20	= 46·9
,, western side, ,, 9,	= 46·8 — ·20	= 46·6
,, ,, ,, 11,	= 47·0 — ·20	= 46·8
Mean,		46·72

Diagonal, east top to west bottom, .	= 59·8
,, west top to east bottom, .	= 59·6

The longitudinal surfaces of portcullis extending southwards and upwards from the above butt-end surface,—are partly visible on all four sides; and indicate, that the so-called granite portcullis is not a large sheet of granite sliding transversely to the

axis of passage, but is in form like a cork or stopper, rammed in along the axis, from above, and filling up all the bore of the passage.

The breadths and heights of butt-end being measured with the scale 'Adie 25,' have been corrected accordingly. They still show a small excess of length over the diagonals, measured with '50 A,' but that may be due to my having been misled by the rounding of the corners of the granite block. All the other and larger linear measures were taken with rod '100 A,' considered not to require any correction for such purposes as those which are here being inquired into.

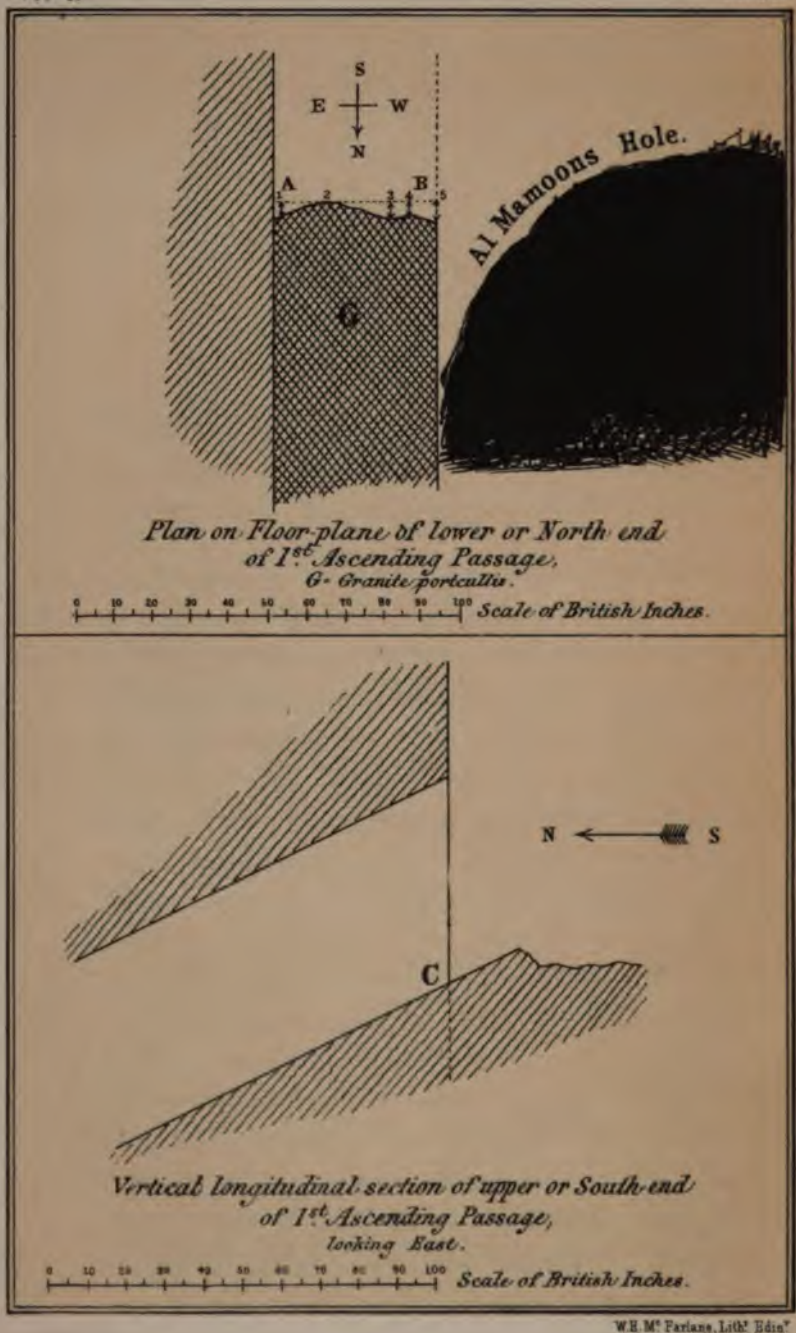
FIRST ASCENDING PASSAGE.

FEBRUARY 13-17, 1865.

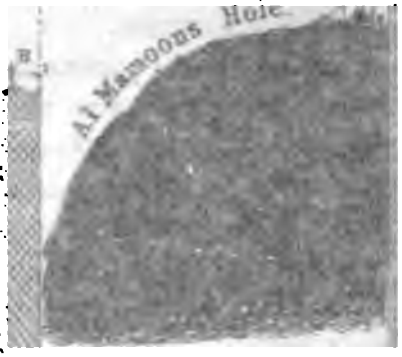
COMMENCEMENT OF MEASURES FOR LENGTH AT ITS PRESENT PRACTICAL LOWER END, OR JUST ABOVE THE UPPER END OF GRANITE PORTCULLIS.

THE floor of this passage is, if traced underneath its walls, much broader than passage itself; as is most easily to be seen on western side, where several feet in length, from portcullis upwards, of western wall have been broken away to admit of entrance into the passage by any one climbing upwards from Al Mamoon's hole: the original position of the removed wall is, however, still to be traced on the floor surface, and is conformable to the passage itself above or south, and to the breadth of the granite portcullis below, or north of, that place. (Plate v.)

The upper, or southern, face of the granite portcullis is very broken and uneven; it is, in fact, altogether a surface of fracture, and not the original end of the portcullis, which may have extended much farther upwards and southwards; while certain large fragments of granite, occasionally with parts of worked surfaces, still to be seen at the bottom of



W.H. M.c Farlane, Lith.r Edin.r


Al Mamoons Hole

Al Mamoon's hole just underneath,—may have been derived from some former breaking up of the southern end of portcullis.

The base of the present upper or southern end of portcullis terminates in the uneven manner represented in the sketch (Plate v.); where the corrections required to reduce actual surface to a straight line A B, drawn at right angles to axis of passage, and touching the most prominent part of the portcullis block, are, at the places marked

1	=	1·3 inch.
2	=	0·0 ,,
3	=	1·8 ,,
4	=	2·0 ,,
and 5	=	3·3 ,,

This line A B will be the reference for linear measures at the lower or northern end of first ascending passage.

TERMINATION OF MEASURES FOR LENGTH AT UPPER OR SOUTHERN END OF FIRST ASCENDING PASSAGE.

At upper or southern end, first ascending passage enters the Grand Gallery, *i.e.*, the *second* ascending passage,—by passing through a vertical wall which makes north end of said Gallery. Roof and walls of first ascending passage terminate flush with said north wall of Gallery, but the floor passes in, and extends into Gallery to a distance of from twenty to twenty-three inches, preserving its steep ascending angle; so that a vertical section of upper end of

first ascending passage, appears thus, when looking east.—(See Plate v.)

The floor of first ascending passage is, however, marked by a joint in continuation of vertical plane forming roof and walls, say at C, which will therefore be made the upper reference line for linear measures of the length of this passage.

SHAFT OF THE FIRST ASCENDING PASSAGE.

The stone of which the *floor* of this passage has been composed, is excessively hard, and has acquired, under friction of feet, a species of half-marble, half-flinty sort of polished surface; on which, a screw-driver would not make any visible line, when tried, to mark the end of the measuring-rod,—obliging a black-lead pencil to be used for that purpose. There are abundant cross notches cut in the floor, to keep feet from slipping; but the joints themselves are not very good, as a rule; though occasionally there were some so excessively close and fine through parts of their course, as to be quite invisible on either their western or eastern sides, as will be perceived in the columns of measures.

The *walls* and *roof* of the passage are composed of a very much softer stone, as Professor Greaves remarked in his day; and they are decayed and exfoliated away to a lamentable degree, chiefly towards the lower end, so as quite to give all that part of the passage a rounded and cavernous charac-

ter, which was not clearly mentioned by Professor Greaves, and is serious if it has occurred since his visit. Towards the upper end of the passage, the original surfaces of roof and walls begin to appear again; but a considerable portion of the roof is cracked longitudinally along the middle.

The walls show sometimes vertical, and sometimes perpendicular-to-passage, joints, and these are now and then confusedly interfered with by parts of horizontal courses of masonry. Altogether, there is smaller and less perfect masonry employed in the first ascending passage than in the entrance passage; giving the practical impression of the former being a mere necessary mean of communicating between the entrance passage and Grand Gallery, and having little or no symbolic importance in itself.

The measures were more troublesome than in entrance passage; for there, daylight generally served; but here, in first ascending passage, there is not a particle of daylight; candles had to be employed, and as they will not stand, but slip, and slide right away on the steep floor,—small angular brackets were fitted to the measuring-rod; so that when that was duly held fast by an attendant Arab, the candles and their illumination were preserved about us.

FIRST ASCENDING PASSAGE,

Floor of, on *West* Side; Measures for Length.

Numbers of joints from line A B at lower end.	Measures from joint to joint. Feb. 13.	Whole distance from line A B.	Measured by lengths of rod 100 A.	Notes on Characters of Joints, etc.
Line A B	0·0	0·0	...	
1	49·1	49·1	...	Bad joint.
2	42·2	91·3	...	
3	38·5	129·8	...	Very bad.
4	36·8	166·6	...	
5	37·0	203·6	...	Very bad, passage cavernous.
6	51·0	254·6	...	Bad.
7	55·0	309·6	...	Bad.
8	50·0	359·6	...	Passage very cavernous.
9	41·5	401·1	...	
10	62·0	463·1	...	
11	32·8	495·9	...	
12	49·4	545·3	...	
13	56·4	601·7	...	All the joints in this passage very difficult to identify and measure.
14	29·3	631·0	...	
15	38·0	669·0	...	
16	32·8	701·8	...	
17	52·2	754·0	...	
18	37·0	791·0	...	
19	36·5	827·5	...	Extremely close.
20	50·0	877·5	...	Extremely close.
21	30·2	907·7	...	
22	41·5	949·2	...	Extremely close.
23	...	...	...	No joint perceivable on this side; see east side.
24	86·2	1035·4	...	
25	48·3	1083·7	...	Bad.
26	30·8	1114·5	...	
27	...	...	...	No joint perceivable on this side; nor east side.
28	119·0	1233·5	...	Good.
29	57·5	1291·0	1291·2	This measure really taken on the *east* side.

FIRST ASCENDING PASSAGE,

Floor of, on East side; Measures for Length.

Numbers of joints from line A B at lower end.	Measures from joint to joint. Feb. 16.	Whole distance from line A B.	Measured by lengths of 100 inch rod, A.	Notes on Characters of Joints, etc.
Line A B	0·0	0·0	...	On a second examination, a joint was noticed at 5·5.
1	45·2	45·2	...	
2	36·4	81·6	...	
3	40·9	122·5	...	Very bad joint.
4	...	...	...	No joint perceivable on this side; see west side.
5	74·0	196·5	...	Bad; passage cavernous.
6	50·0	246·5	...	Bad.
7	53·3	299·8	...	Bad.
8	49·7	349·5	...	Bad.
9	50·0	399·5	...	Floor uneven and hollow to a degree.
10	62·5	462·0	...	
11	32·3	494·3	...	
12	50·2	544·5	...	
13	55·3	599·8	...	
14	...	...	...	No joint perceivable on this side; see west side. All these measures made by candlelight, as otherwise the passage is perfectly dark.
15	67·7	667·5	...	
16	33·0	700·5	...	
17	53·1	753·6	...	Good.
18	34·7	788·3	...	
19	37·4	825·7	...	
20	49·0	874·7	...	
21	31·7	906·4	...	
22	41·0	947·4	...	
23	53·0	1000·4	...	
24	33·5	1033·9	...	
25	48·8	1082·7	...	
26	30·7	1113·4	...	
27	58·5	1171·9	...	All the joints in this passage very difficult to identify and measure.
28	61·3	1233·2	...	
Line C = 29	57·8	1291·0	1291·4	

FIRST ASCENDING PASSAGE,

FLOOR OF.

West and *East* sides compared.

Numbers of joints from line A B, at lower or Northern end.	Sizes of the stones.		Whole distances from line A B.		Error of rectangularity.	Notes.
	On West side of floor.	On East side of floor.	On West side.	On East side.		
Line A B	0·0	0·0	0·0	0·0	...	
1	49·1	45·2	49·1	45·2	+ 3·9	
2	42·2	36·4	91·3	81·6	+ 9·7	
3	38·5	40·9	129·8	122·5	+ 7·3	
4	36·8	...	166·6	...	...	Joint so close as to be invisible on East side.
5	37·0	74·0	203·6	196·5	+ 7·1	
6	51·0	50·0	254·6	246·5	+ 8·1	
7	55·0	53·3	309·6	299·8	+ 9·8	
8	50·0	49·7	359·6	349·5	+ 10·1	
9	41·5	50·0	401·1	399·5	+ 1·6	
10	62·0	62·5	463·1	462·0	+ 1·1	
11	32·8	32·3	495·9	494·3	+ 1·6	
12	49·4	50·2	545·3	544·5	+ 0·8	
13	56·4	55·3	601·7	599·8	+ 1·9	
14	29·3	...	631·0	...	...	Joint invisible on East side.
15	38·0	67·7	669·0	667·5	+ 1·5	
16	32·8	33·0	701·8	700·5	+ 1·3	
17	52·2	53·1	754·0	753·6	+ 0·4	
18	37·0	34·7	791·0	788·3	+ 2·7	
19	36·5	37·4	827·5	825·7	+ 1·8	
20	50·0	49·0	877·5	874·7	+ 2·8	
21	30·2	31·7	907·7	906·4	+ 1·3	
22	41·5	41·0	949·2	947·4	+ 1·8	
23	...	53·0	...	1000·4	...	Joint invisible on West side.
24	86·2	33·5	1035·4	1033·9	+ 1·5	
25	48·3	48·8	1083·7	1082·7	+ 1·0	
26	30·8	30·7	1114·5	1113·4	+ 1·1	
27	...	58·5	...	1171·9	...	Joint invisible on West side.
28	119·0	61·3	1233·5	1233·2	+ 0·3	
29	57·5	57·8	1291·0	1291·0	0·0	

FIRST ASCENDING PASSAGE,

Breadth and Height of.

Observed with Slider 35, and therefore corrected by — 0·1.

At or near joints on floor, numbered from line A B upwards and southwards to line C.	Breadth.	Height perpendicular to axis of passage.	Notes, February 13, and February 16, 1865.
Line A B	41·6	47·3	These measures are rather of the portcullis block, close-fitting into the original passage at this point: and showing what that must have been.
Between line AB and joint 1	41·4	47·5	By old markings on floor and walls.
2	...	...	
3	...	50· ?	These excessive breadths and heights are caused by the extraordinary cavernous exfoliations of the stone; which have enlarged all the lower end and much of the middle of the passage, above its original size.
4	55· ?	53· ?	
5	60· ?	56· ?	
6	61· ?	59· ?	
7	60· ?	55· ?	
8	...	...	
9	58· ?	56· ?	
10	...	...	
11	55· ?	55· ?	
12	...	...	
13	...	...	
14	...	...	
15	...	...	
16	...	...	
17	...	...	
18	...	...	
19	...	...	
20	...	...	
21	...	...	Hereabouts the original surfaces of roof and walls begin to reappear; and with them the true measures; but roughly only by reason of cracks, and holes, and wear.
22	...	...	
23	...	...	
24	...	...	
25	...	47·7	Vertical height = 53·0 ±.
26	...	...	
27	...	47·7	All sorts of larger heights and breadths are possible by measuring in holes in the surfaces caused by wear and tear, but these have been carefully avoided.
28	42·2	47·5	
29	42·1	47·5	

PORTCULLIS.

This is composed of a series of blocks of red granite of shape of the passage, viz., 47·3 high (transverse to axis of passage), and 41·6 broad, and have been pushed down the passage from above; the lowest block being made with a 'taper,' and the lowest part of the passage similarly, to prevent the blocks going right through and into the entrance passage below. This tapered shape is proved by comparing the above measures for height and breadth of the top or south end of the portcullis with the similar measures for the lower end, see page 42 of entrance passage linear measures, viz.:—

Lower butt-end of portcullis, height (transverse to its passage) = 46·7
Do. do. breadth, ... = 38·1

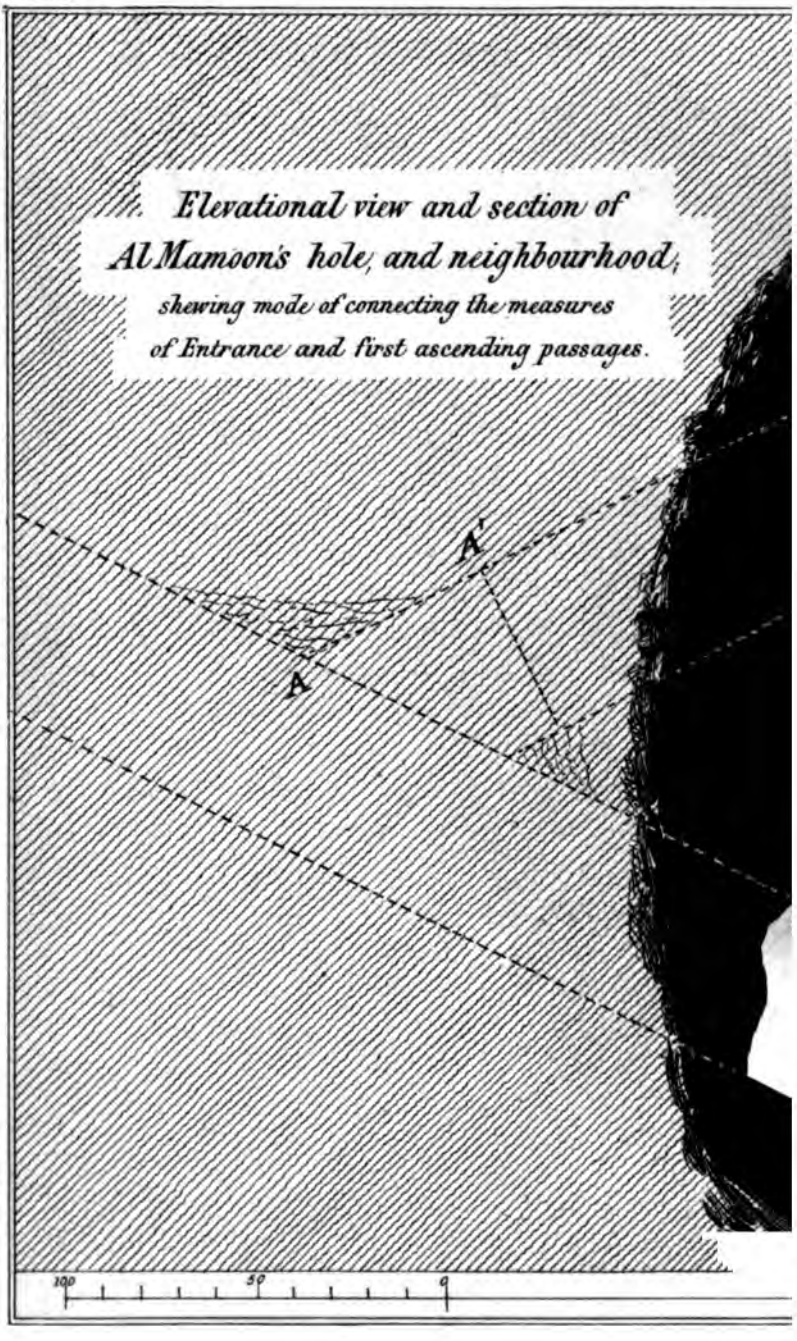
The length of the portcullis from lower butt-end up to the line A B, marking its upper or southern end on the floor = 178·8. See next section.

TOTAL LENGTH OF FIRST ASCENDING PASSAGE.

This may be considered as made up thus,—

1st, Shaft, or from line A B to line C, . .	= 1291·2
2d, Portcullis; or from line A B to lower butt-end,	= 178·8
and 3d, From middle of lower butt-end to axis of entrance passage in *h* (p. 41 and Plate IV.),	= 62·5
See also Plate VI.	1532·5

Of these three quantities, the second has not yet been proved; and it was so very difficult and roundabout to measure, that I do not attach much


Elevational view and section of
Al Mamoon's hole, and neighbourhood;
shewing mode of connecting the measures
of Entrance and first ascending passages.
A'
A
100
50
0

value to the numbers; but, such as they are, they were obtained as follows.

Standing in Al Mamoon's hole, towards its western side, you can see, looking eastward, a part of the upper or southern end of the portcullis; and also part of the entrance passage vertically under it; but you cannot drop a plumb-line from one to the other, for there is much projecting masonry between: neither can you see the whole length of portcullis, for the lower part thereof is buried still in solid surrounding masonry: and this state of things is shown in our large Plate VI., in elevation; and partly in plan, in the upper figure of Plate V.

The difficulty of the plumb-line was overcome, by making use of two,—one hung upon the portcullis itself, and the other from the end of a square, whose base was on the portcullis surface, and whose rectangular arm was so long, horizontally, as to carry the plumb-line clear of the obstructing matter below. It was then tolerably easy to bring the eye into the plane of the two plumb-lines, and see where that, being produced optically, would cut on the roof line of the entrance passage below, or at the point C.

Now, that point C, was measurable by rods from the point A, or at where the roof surface of the upper passage met the roof of the lower one; and such length A C, must be geometrically equal to A B, the angles of the passages being assumed equal and opposite. But A B being thus obtained, and found $= 180{\cdot}5$; we must evidently, in order to get the

portcullis itself, subtract A A′ = 50·2, or the distance of top of lower butt-end of portcullis from roof of entrance passage; and we must add on thereto at the other end, the length B B′, = 48·5, so as to reach on roof, a line transversely opposite that other line (A B) on the floor, of first ascending passage, which formed the origin there for measures of length.

We have then, finally, for the length of the portcullis, or A′ B′, 180·5 − 50·2 + 48·5 = 178·8.

Hence the length of first ascending passage, on its *floor*, from back of portcullis to line C (page 46) at top or south end of said passage,

= 1291·2 + 178·8 = 1470·0,

but from roof of entrance passage (see page 41),

= 1291·2 + 178·8 + 14·2 = 1484·2,

and from axis of entrance passage (see page 41),

= 1291·2 + 178·8 + 14·2 + 29·9 = 1514·1.

While from axis of entrance passage, as cut by *axis-line* of upper passage (see page 41 and Plate IV.),

= 1291·2 + 178·8 + 32·6 + 29·8 = 1532·4.

But, if *axis* of passage be thus adopted, there must be a further addition at the upper end; for a line produced upwards from the old line C (there on the floor), and perpendicularly to arm of passage, —will fall inwards or north of the doorway there; and by a quantity of about 12 inches, making thus, for full *axial length* of first ascending passage, from axis of entrance passage, to middle of doorway at south end of said first ascending passage,

= 1291·2 + 178·8 + 32·6 + 29·8 + 12·0 = 1544·4 inches.

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER.

THIS horizontal passage may be considered to begin at the north wall of the Grand Gallery; and, trending thence due south, has its first portion coincident with, or hidden in, said large Gallery; it then passes under the elevated floor of that Gallery, and, continuing on still horizontal (approximately) and southward, reaches the room called the Queen's chamber, entering it on its floor-level, and at the eastern side of its northern wall. But, in order that such coincidence of floors may take place at the entrance, the floor of the passage experiences a notable depression of nearly half the whole height of the passage, at about 1-7th of its whole length from the southern end. It is also to be noted, that the horizontal passage only begins *visibly* to be a passage, and of about the height and breadth of the 'entrance passage,' when it passes under floor of Grand Gallery; and this place occurs also at about 1-7th of the whole length, but from the north end, reference being had to the mean of the *two* northern ends or cut-offs of the Grand Gallery floor.

Further, it is particularly noteworthy, that in going from north to south in the horizontal passage,

saline incrustations are observable on walls and floor, beginning at about 150 to 200 of distance from north end, and increasing in amount farther southward; until at last both roof, walls, and floor are covered with a coating of them near an inch thick, brown outside, white inside, and of almost stony hardness, and they are termed by some authors, 'sparry excrescences.'

These saline incrustations are alluded to elsewhere in this volume, as well as in vols. i. and iii., for their chemical nature, mode of formation, and probable origin; here, they are merely mentioned as being impediments to applying linear measures direct to the original worked surface of the stone.

For the shape of this passage, near its commencement at north end, see Plate X.; also Plate VI. vol. i.; and for southern end, see Plate VIII. For the whole passage, on a very small scale, see Plate III. vol. i.

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER,—WALLS OF.

Floor Joints on *East* side, measured from North to South.

Number of joint.	Length from joint to joint.	Total length from North wall of Grand Gallery.	Notes, February 18, 1865.
North wall of Grand Gallery	0·0	0·0	
1	27·3	27·3	This joint about 4·5 in front, or to south of the cut-off of inclined floor of first ascending passage.
2	40·4	67·7	Bad joint.
3	45·0	112·7	Concluded from west side; east side being covered by hardened dirt.
4	58·2	170·9	Bad joint.
5	43·4	214·3	This is under roof; roof having begun at 199·4, where is the last or total cut-off of Grand Gallery floor.
6	16·9	231·2	At 236·0, is the first or southernmost, but only partial cut-off of Grand Gallery floor.
7	39·3	270·5	Wall joints at and beyond this part are all close, good, and true; vertical and horizontal, for they are in two layers or courses.
8	40·0	310·5	
9	44·1	354·6	From about 200· to this distance, and thence right on into the Queen's chamber, walls and roof are all composed of a species of limestone, hard, but having a species of saline incrustation on its surface, in sheets hard and brownish on the surface.
10	36·7	391·3	
11	18·4	409·7	
12	29·3	439·0	
13	31·5	470·5	
14	62·2	532·7	
15	44·2	576·9	
16	43·8	620·7	All these floor joints are more or less wide and bad; the stones, too, are small, and so narrow as to require two, sometimes three, to cross the passage
17	42·0	662·7	
18	48·0	710·7	
19	33·3	744·0	At 765 in centre of floor a cylindrical hole, 8·0 in diameter, and 3·0 deep.
20	39·7	783·7	Hereabouts begins a better floor, in large blocks all across.
21	83·8	867·5	
22	80·4	947·9	At 945·3 a hole in centre of floor, 4·0 diameter, and 4·5 deep.
23	79·3	1027·2	
24	68·3	1095·5	Wide joint.
25	79·0	1174·5	At 1122·5 a hole in middle of floor, 3·0 diameter, and filled with dirt.
26	49·4	1223·9	Stone broken longitudinally.
27	79·4	1303·3	At 1288·0 a hole in middle of floor, 2·5 diameter, and chipped about edges.
28	42·0	1345·3	At and from 1303·3 begins the lower level of passage floor.
29	50·0	1395·3	Wall joints hid by the excessive amount of hard, brown, stone-like, yet saline incrustation.
30	127·3	1522·6	This joint is 3·2 inches *inside* the Queen's chamber.
		— 3·2	
		1519·4	

The above measures for length being the mean of two sets, nowhere differing more than 0·3, and having been further tested for the whole length by a third measuring carried on by rod lengths of 100 inches, may be pretty safely depended on.

Hence whole length of horizontal passage, from north wall of Grand Gallery to north wall of Queen's chamber, ...	= 1519·4
One-seventh of the above, ...	= 217·1
South length of passage with low level, . .	= 216·1
North length without roof, measuring to *mean place* of the two cuts-off in Grand Gallery floor, .	= 217·8

BREADTH AND HEIGHT OF HORIZONTAL PASSAGE.

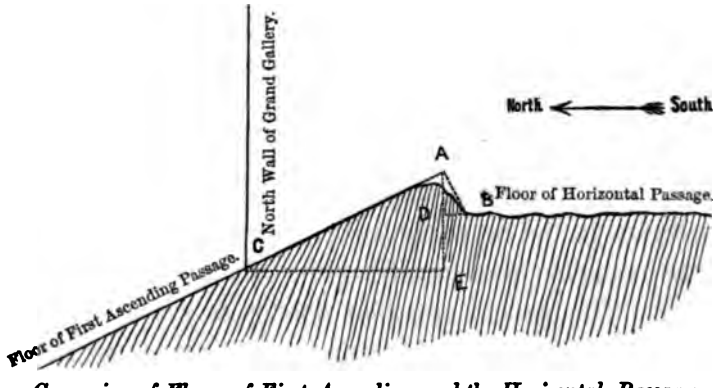
These measures, when below 50 inches, were taken with the '35 Slider' scale, and have had 0·14 subtracted from them for its correction; but when above that width, with the '50 Slider,' in which case the readings have not been corrected. Both roof, sides, and floor of this passage were so uniformly coated with more or less of the saline incrustation, that the measures are probably always less than the original truth by the thickness of such adventitious crust.

Place in passage, by distance from North wall of Grand Gallery.	Breadth, near the			Height, vertical, and also in this case perpendicular to axis of passage.			Notes, February 20.
	Bottom.	Middle.	Top.	East side.	Middle.	West side.	
220·	40·61	40·84	41·16	46·58	...	46·64	
760·	...	40·96	...	46·16	...	46·16	
1270·	41·06	...	41·16	46·36	...	46·26	
1310·	...	41·36	...	69·0	...	68·5	Lower level of floor here; stones much broken and badly placed over an excavated hole.
1516·	...	41·46	...	67·3	67·2	66·5	Roof stone is cracked over the entrance into Queen's chamber.

The original height of northern portion of above passage was not improbably 47·0 at least; the difference between 47·0 and the numbers above being due to the saline incrustations. But that height is what is measured off the floor of the passage; and that floor, although the saline matter were to be removed, is rough to a degree, and has even been assumed by Mr. Perring to be the casual surface of the mere course of core masonry of the whole Pyramid, which is nakedly exposed both here and in the floor of the Queen's chamber; and he alludes to the round holes (p. 57), as pivot-holes of the machines used in lifting the stones at the building. The present apparent floor is therefore not in a manner an *intended* feature; it was never worked true as a floor; and even if masons were to cut it

down now to the depth of six inches all along (a quantity by which it is in a manner too high, as presently to be shown) and polish it, the material would not be the finer and more precious Mokattam stone, which forms the floor of all the other passages. The bringing in, indeed, of layers of that species of stone to the thickness seen in some other parts, would nearly fill this horizontal passage up to its roof or ceiling, in fact, destroy it as a passage; and yet there is every appearance of roof, and walls perhaps also, being constructed in the fine stone, intended to be durable and be seen, or made some use of.

The floor is therefore eminently an anomaly in the horizontal passage; and if measured at its commencement, is shown to be six inches above the level of the line C, formerly referred to in measurements, on the floor of the first ascending passage; *i.e.*, that part of its floor which is in the plane of the north wall of the Grand Gallery.



Connexion of Floors of First Ascending, and the Horizontal, Passages.

The measurements were not very accurate, on account of the broken state of the upper corner of the protruding portion of ascending floor; but, slightly assisting the present forms, as shown by the dotted lines in the above diagram, the following measures were taken:—

A C, or inclined length, ...	= 23·2
A B, ...	= 4·7(?)
C B, or horizontal length, ...	= 21·5
D B, or vertical height of floor of horizontal passage above C on floor of first ascending passage, .	= 6·0

If this 6·0 be now added to vertical height of horizontal passage, formerly given, or 47·0, we have 53·0, or the same as the *vertical* measured height of south end of first ascending passage; and both top and bottom of horizontal passage will *then* be on the same levels as top and bottom of the other passage, or, which is the same thing, as the north doorway of Grand Gallery.

But southern, or depressed, end of floor of horizontal passage, together with the whole floor of Queen's chamber, is still 14·0 *below* the bottom of said north doorway of Grand Gallery.

QUEEN'S CHAMBER.

THE chamber known under this name, at the south end of the horizontal passage, has been long, and entirely, an enigma as to its objects or purposes: it is nearly square on the floor, with an angular roof; and the eastern wall has a large and sumptuously-constructed niche, of the Grand-Gallery walls description, but with a less number of overlappings (four only in place of seven), and it is not in the centre of its wall by a very notable distance. The material of walls, roof, and niche, is a fine white limestone; the floor is ragged and uneven, and apparently merely the general masonry of the Pyramid, so that the room is in fact without a floor-proper, and we are left to speculate where, in height, the upper surface of that would have reached. This peculiar condition of the chamber becomes all the more manifest on examining the structure of the walls; for they are not only not of the general masonry of the whole building, but are in advance both as to whiteness, beauty of the material, and closeness of the joints to the lining of any of the passages yet inspected. The joints are so close, that the edges of the two surfaces of worked stone,

and the filling of cement between, are comprisable often within the thickness of a hair. This fact was noted chiefly on the west wall, where, too, the presence of cement in the vertical as well as horizontal joints was duly noted. Elsewhere there is a difficulty in recognising the joints, on account of the half-glasy coating of saline matter. This substance must be regarded as a modern exudation of the stone, for some letters scratched on the north wall, with date 1824, have now a raised outline in the salty matter around and upon them. The saline matter was also seen filling a fissure apparently formed by injurious pressure in the west wall. In one or two places small portions of the original surface of the wall-stones appeared, and bore traces of having been once exquisitely smoothed and finished. The inclined roof-stones appear of a similar order, and extend 100 inches, more or less, into the wall or substance of the Pyramid, to give a firm bearing, as shown by two holes, just under the ceiling, worked by Colonel Howard Vyse and Mr. Perring. A large excavation hole has been made in the floor under the niche, and another at the back of it, by various parties, in former years; while on the south side of the room is a trifling nick recently cut into the wall, apparently for holding visitors' candles.

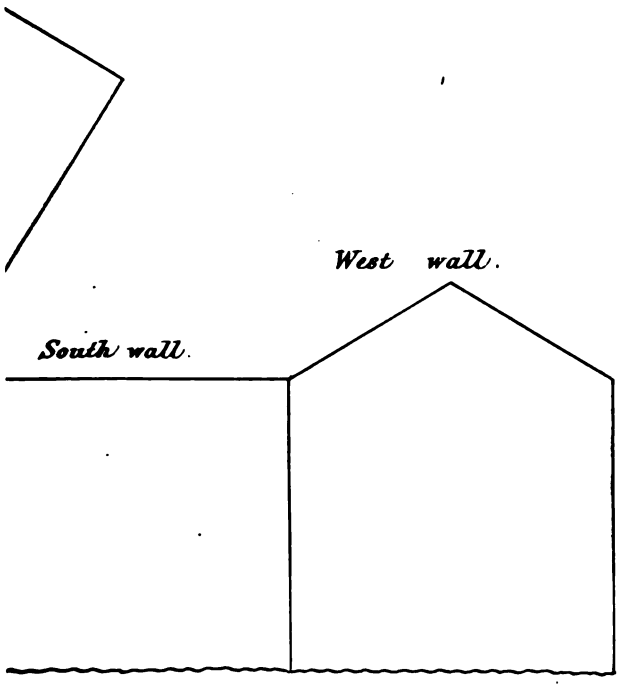
The following are the measures taken in this room, partly with the 100-inch rod, and partly with the great 400-inch slider, tested by the others, and not requiring greater corrections than theirs.

QUEEN'S CHAMBER,

FLOOR OF.

	First Measure.	Second Measure.	Mean.
East side, LENGTH of, . . =	204·7	206·5	205·6
South ,, ,, . . =	227·0	227·4	227·2
West ,, ,, . . =	206·3	205·6	206·0
North ,, ,, . . =	226·5	226·5	226·5
Mean of sides, E. and W., . =	...	...	205·8
,, N. and S., . =	...	...	226·7
East gable end, HEIGHT from floor, =	245.4	244·9	245·2
West, ,, ,, . =	244·2	...	244·2
Gable ridge, in middle of room, =	243·9	...	243·9
Mean, . .	...	...	244·4
North wall at E. end, height, . =	182· (?)	...	183·2
,, W. ,, . =	184·5		
South wall at E. end, ,, . =	181· (?)	...	181·5
,, W. ,, . =	182· (?)		
Mean, . .	...	...	182·4

Diagonals, LENGTH of measured.		Mean.
Floor, N.E. corner to S.W. corner, . . . =	302·9	303·2
,, N.W. ,, S.E. ,, . . . =	303·6	
North wall, low N.E. corner to high N.W. corner, =	293·5	292·2
,, ,, N.W. ,, N.E. ,, =	291·0	
South wall, low S.E. ,, S.W. ,, =	291·8	291·0
,, ,, S.W. ,, S.E. ,, =	290·1	
East wall, low S.E. ,, N.E. ,, =	275·5	275·4
,, ,, N.E. ,, S.E. ,, =	275·2	
West wall, low S.W. ,, N.W. ,, =	273·8	275·6
,, ,, N.W. ,, S.W. ,, =	277·3	



500 600 700 800

hes

n on plane of East-wall.

W H M. Farlane, Lith. Edin.

QUEEN'S CHAMBER.

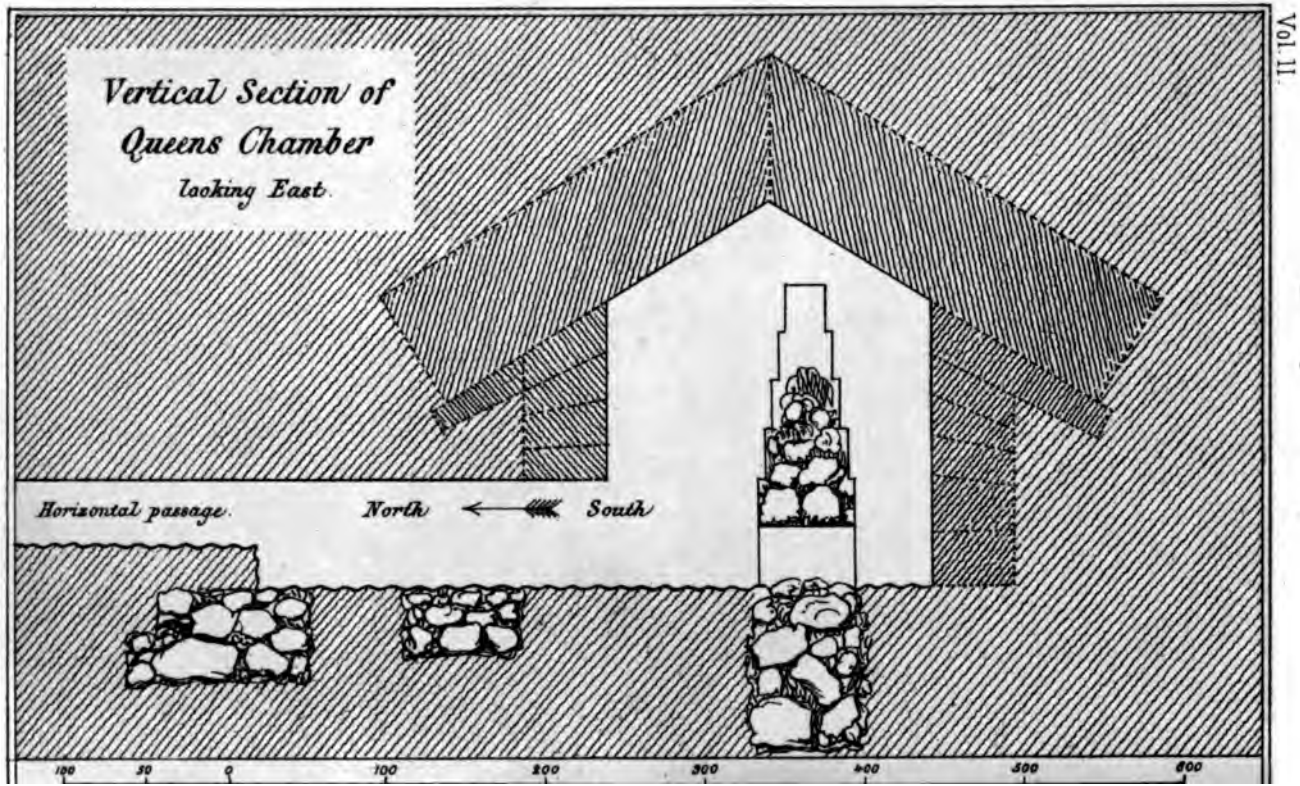
Floor, East and West sides, length, ...	= 205·
,, North and South ,, ,, ...	= 226·
Walls, North and South, length of, ...	= 226·
,, ,, height of, ...	= 183·
Walls, East and West, length of, ...	= 205·
,, ,, mean height of, or $\frac{183 + 244}{2}$	= 214·
Roofs, North and South, length of, ...	= 226·
,, ,, breadth, ...	= 119·
And angle of rise of each side of roof, computed from base = 102·5 and perpendicular = 61·0, . .	= 30·8°

Hence room opened out on plane of east side, may be represented as in Plate VII.

The mark on the western side of the door (in Plates VII. and VIII.) shows a shallow projection of the stone material.

Of the niche above represented, the following measures were taken on February 20; but are rude in the extreme towards the higher parts, as I had then no ladder to stand upon :—

Breadth of *a* to *f*, ...	= 61·3	
,, *b* to *g*, ...	= 52·3	
,, *c* to *h*, ...	= 43·3	(estimated.)
,, *d* to *i*, ...	= 34·3	(estimated.)
,, *e* to *j*, ...	= 25·3	(estimated.)
Horizontal distance, North wall to *a*, .	= 97·2	
,, South ,, *f*, .	= 46·6	
,, Centre of niche from continuation of East wall, or roof, . .	= 25·3	


Vertical Section of
Queens Chamber
looking East
Horizontal passage
North
South
100
50
0
100
200
300
400
500
600

Pl. 8.

W. H. M.c Farlane Lith.r Edin.r

	First measure.	Second measure.	Mean.
Height of portion *a* or *f*, . . =	66·7	66·7	66·7
„ „ *b* or *g*, . . =	31·6	31·5	31·6
„ „ *c* or *h*, . . =	28·3	29·0	28·7
„ „ *d* or *i*, . . =	28·5	30·2	29·4
„ „ *e* or *j*, . . =	29·7	29·0	29·4
Mean height of niche, . . =			185·6

Workmanship of niche, originally very good and true: the intended depth of it generally seems to have been 41 inches; but the stones which reach back to form this depth, penetrate some 35 inches still farther eastward into the masonry. A portion of the niche, just above a level bank or long shelf about 38 inches above the floor, reached much farther back still, say 100', with height of 40'; but all that part is now much disfigured by modern excavations. These are shown in the two following views of the Queen's chamber in Plate VIII.; where the arrangement of the roof and wall lining blocks is taken from Howard Vyse and Perring's views.

GRAND GALLERY.

FROM the larger space, and more numerous architectural features in the Grand Gallery over the simple passages, it requires much examination of the nature of each end, before attempting to measure the distance of one from the other. We shall also do well to look just now, only to the lower, or floor-ward portion of each end,—leaving everything with regard to the upper portions, whether of north or south ends, to a separate section for height.

Entering then the north end of Grand Gallery, by the first ascending passage, we enter there by a doorway 53·2 inches in vertical height (53·5, first measure, and 53·0, second measure), and 42·2 inches broad, *i.e.*, where not broader on account of manifest injury; and these measures are taken on the north wall of Grand Gallery, which is vertical for a certain height upwards from the floor.

The breadth of that wall, or end of Gallery, is about 82·0 (81·7 to 83·0) inches, and the lower storey of Grand Gallery progresses always at that breadth,—except in so far as its very lowest part is filled up on either side by the ramps or side-benches of stone; and these, for a vertical height of 23 inches, contract the breadth to about 42·0 inches, or the

same approximately as the first ascending passage and its doorway.

The floor of the Grand Gallery may be considered to begin, with the protruding (southward) portion of the floor of first ascending passage; and if continued thence would run along the base of the ramps the whole way, up to the upper or southern end of Grand Gallery.

But in such case there would be no communication to the Queen's chamber. A long part, therefore, 220 inches, of the inclined floor has been removed, and that space has been dug (in a manner) vertically down, preserving the breadth between the ramps as its measure of breadth, and continued downwards until it reaches the level of six inches above the base of north wall of Grand Gallery. (See fig. on page 60.)

Hence the first part of the floor of Grand Gallery *seems* to casual observation to be level; but the level part is no portion proper to the Gallery; and is so much as six inches too high for its beginning. This state of things may generally be apprehended from the diagrams of Plate VI. vol. i.; which are also constructed to give an idea of the five holes in the vertical sides of the chink leading to the Queen's chamber, and of the entrance to the well. The well (Plate v. vol. i.) is one of the most peculiar structures in the Pyramid, and forms a rather dangerous place of stumbling at the first entrance into the Grand Gallery: the square hole, however, in the floor, is

not that of the well itself, but only the beginning of a horizontal passage, some 28 inches deep, and 85 long, leading straight away west; and then and there only, plunging downwards to form the very well. Further, the hole spoken of as in the floor of Grand Gallery, is rather to one side of it, being within the limits of the western ramp, which has been broken away at the place, for the purpose. In fact there is every appearance that the entrance to the well was once completely closed, by the continuance of the ramp along the western side, similarly to what is now seen along the eastern. Under such circumstances, strangers would have passed through the Grand Gallery without suspecting any neighbouring well, or concealed passage of any kind; and it seems probable that it must have been opened by men ascending the well from its entrance below and bursting open its closed ramp-stone; when, thanks to the extraordinary strength of the cement employed in all the joints, a portion of the said stone was left sticking in the north-west corner of the Gallery, where it may still be seen, testifying to the once completion of the ramp.

The measures (February 18-22) on which the drawings of Plate v. vol. i., and Plate vi. vol. i., depend, are—

Entrance Passage,	Height vertical,	=	53·2
,,	Breadth,	=	42·2
Passage to Queen's chamber,	Height vertical,	=	46·7?
,, ,,	Breadth,	=	42·0

Grand Gallery, Breadth over ramps,	= 82·0
„ „ between ramps,	= 42·0
„ „ in 'dug-out' vertical depth leading to Queen's chamber,	= 42·0
North end of floor, Height of absolute cut-off,	= 39·7 and 39·8
„ „ Length on the incline to second cut-off,	= 40·5 and 40·3
„ „ Height of second cut-off,	= 9·0
„ „ Same on opposite side,	= 9·0
Horizontal distance from North wall of Grand Gallery to North end, or absolute cut-off of floor,	= 199·4
Inclined distance, computed from above for angle 26° 16′,	= 222·4
Inclined distance, given by summing small measures connected with the five holes on either side within the above length,	= 221·6

WELL, PARTICULARS OF.

Horizontal distance, North wall Grand Gallery, to beginning of hole in floor, measured near floor,	= 19·3
Inclined distance of the same to beginning of break-out near upper level of ramp,	= 25·5
Length North to South of hole in horizontal floor,	= 30·0
Inclined distance, North wall Grand Gallery to South end of break-out under ramp,	= 54·3
Distance horizontal from North wall Grand Gallery to North side of Well, produced Eastward,	= 21·3
Distance North side, to South side of Well mouth,	= 28·0
Distance East side, to West side of Well mouth,	= 28·0
Distance horizontal from North wall of Grand Gallery to centre of Well,	= 35·3
Depth within wall, from which ramp-stone to close Well mouth, has been broken out,	= 7·0
Horizontal length of Western passage to Well mouth, from East side of hole in floor to West side of Well,	= 84·5
Do. do. do. East do.,	= 56·0
Do. from East side of acting roof to West side of Well,	= 57·0
Depth of hole in floor,	= 27·0
Depth of roofed portion of horizontal passage to Well mouth,	= 27·0

Distance from North wall of Grand Gallery, to parallel of centre of Well mouth, measured horizontally on floor, = 34·3
The same distance computed from above, for the ramp incline, ... = 38·4
The same measured direct on broken indications, . . = 39·9
Ramps, vertical height, ... = 23·0
,, breadth (but for more particulars see a subsequent section), ... = 20·0

The five side holes *a*, *b*, *c*, *d*, *e* (see Plate VI. vol. i.), on east side, measure thus :—

	a.	*b.*	*c.*	*d.*	*e.*
Distance from North wall on incline of ramp of North side, .	72·5	115·7	148·7	172·7	197·4
Do. do., South side, .	80·7	132·5	157·7	182·4	207·1
Length or tallness of North side,	11·0	15·0	14·8	14·0	15·0
,, South side,	14·0	20· ?	17·4	17·0	18·0
Length, inclined, of upper side,	8·2	16·8	9·0	9·7	9·7
,, horizontal, of lower side,	8·2	16·0	8·4	8·8	9· ?
Height of lower side above apparent floor, ...	18·0	31·8	47·2	57·8	68·8
Do. do., above horizontal plane of North wall base, . .	24·0	37·8	53·2	63·8	74·8
Horizontal depth eastward, .	15·5	9·5	22·0	21·7	10·4

The holes are worked very rudely; and pick-marks are visible inwards; some of them have also been mischievously enlarged in part.

The sides of the holes all deviate from being truly vertical, and affect a slight tendency towards the position of being at right angles to incline, thus :—

With hole *d*, South side at its base requires correction to vertical = 1·1
and North ,, ,, ,, = 0·6
With hole *e*, South ,, ,, ,, = 1·0
and North ,, ,, ,, = 0·4

The five holes on the *west* side measure thus:—

	a.	*b.*	*c.*	*d.*	*e.*
Distance from North wall on incline of ramp of North side of hole,	72·5	116·3	147·3	171·3	196·6
Do. do., of South side of hole,	81·0	122·3	155·8	181·3	206·6
Length or tallness of North side,	10·0	16·0	14·5	14·0	14·0
„ South side,	13·0	21·0	18·0	20·0	18·0
Length, *inclined*, of upper side,	8·5	16·0	8·5	9·5	10·0
„ *horizontal*, of lower side,	8·6	16·5	9·4	9·0	9·5
Height of lower side above apparent floor,	18·0	32·0	45·5	58·0	69·4
Do. do., horizontal plane of North wall base,	24·0	38·0	51·5	64·0	75·4
Horizontal depth westward,	10·5	23·0	11·0	10·0	19·0

These holes are worked very rudely; pick-marks are visible internally; and large injuries to the adjacent stones, and edges of the holes externally, have been committed.

The sides of the holes deviate from true *vertical* directions, slightly towards being perpendicular to incline, so that with hole *b*, north side requires for correction to vertical = 0·4; and with hole *c*, its south side requires for correction to vertical = 1·0.

UPPER OR SOUTH END OF GRAND GALLERY.

(FEBRUARY 22.)

A principal feature at this part is the grand step, which stretches all across the Gallery, and interferes with the last part of the ramps. The step, once grandly severe, is now lamentably fissured in two places, and much broken away about the middle, as indicated in the several sketches of Plate IX.

The measures on which the plan, and elevations, both front, and for either side, in the Plate, are founded,—stand thus :—

Breadth of Grand Gallery, above South doorway, . .	= 82·2
,, of South doorway, ...	= 41·4
,, ,, in broken places Westward,	45 to 50·0
Height of doorway, on East side, ...	= 43·8
,, West side, ...	= 43·3
,, Mean, ...	= 43·6
Horizontal length of great step on East side, North to South, 60·7 to 61·0, ...	= 60·8
Do. do., on West side, ...	= 61·0
Vertical height of great step, at North end, East side, 35·8 and 35·9, ...	= 35·8
Do. do., West side, ...	= 36·2
Distance from joint 28 to South wall, along ramp line produced, and on East side, ...	= 81·4
Do. do., on West side, ...	= 81·8

These two last measures are important, because they have to be added to what will presently be measured along the whole Gallery, to give its full length: they are also rather difficult to determine, as well on account of the interference of the corner of the great step, as the error of rectangularity of the joints 28, and the one above it. But although the ramp itself ends north of the step, its joint line produced, reappears visibly above the step, and thence extends to the south wall of the Gallery. Some minor measures connected with this feature are thus:

EASTERN SIDE OF SOUTH END OF GRAND GALLERY.

Horizontal distance from South wall of reappearance of ramp joint, ...	= 33·2
Vertical height attained by it on the South wall, .	= 16·6
Hole in South-East corner, length, 21·5 and 21·2 .	= 21·4
,, ,, breadth, 6·2 and 6·0 .	= 6·1
,, ,, depth, 5·5 and 5·5 ? .	= 5·5

WESTERN SIDE OF SOUTH END OF GRAND GALLERY.

Horizontal distance from South wall of reappearance of ramp joint, ...	=	33·4
Vertical height attained by it on the South wall, .	=	17·0
Hole in South-West corner, length, 20·5 to 21·0 . .	=	20·8
„ „ breadth, 5·7 to 5·8 .	=	5·8
„ „ depth, 5·0 ? .	=	5·0?

but depth doubtful, on account of hard dust.

GRAND GALLERY, LENGTH OF, ALONG THE EAST SIDE.

(FEBRUARY 21, 22, 1865.)

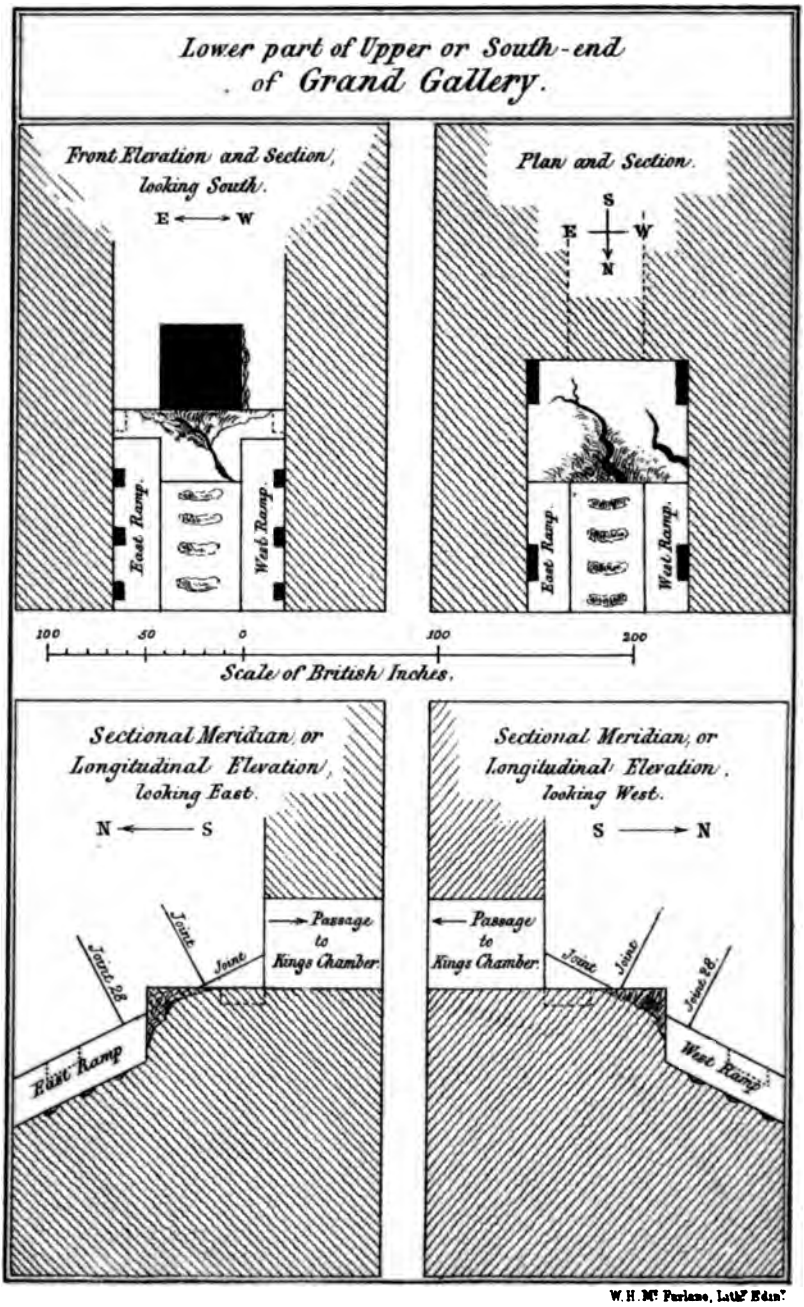
Measured with rod 100 A, carrying brackets for candles: at first the rod was held from slipping by hand, but was afterwards attached to a cord, drawn up and clamped at pleasure to a peculiar wooden anchor fixed in a ramp-hole above it. (See Frontispiece.)

The measurement was made on the wall-joints where they meet the ramp-top; these joints are generally good, and perpendicular to the incline; but some of them are unfortunately concealed by a hard, brown, stone-like salt incrustation (something similar to that in Queen's chamber, but usually thinner, harder, and darker externally); others, again, of the wall-joints are absorbed in certain stones inserted vertically, or nearly so, over every ramp-hole, excepting only the north hole and that next to it; and the joints of these inserted stones are not very good:—

GRAND GALLERY,

LENGTH of, upon *East* side (February 21, 22, 1865), along inclined Ramp-line.

Number of joint.	First Measure.	Second Measure.	Mean, or length from joint to joint.	Total length of each joint from North wall.	Remarks.
North wall,	0·0	0·0	0·0	0·0	
Joint 1	55·6	55·6	55·6	55·6	
2	75·5	75·5	75·5	131·1	Absorbed in vertical joint.
3	67·4	67·4	67·4	198·5	At 222·0, absolute or
4	40·7	40·7	40·7	239·2	final cut-off of floor.
5	...	79·5	79·5	318·7	At 262·6, partial cut-
6	(117·8)	38·3	38·3	357·0	off of floor.
7	92·6	92·6	92·6	449·6	
8	54·4	54·4	54·4	504·0	
9	...	...	...	...	Hid behind an inserted stone.
10	137·5	137·5	137·5	641·5	
11	62·3	62·3	62·3	703·8	
12	67·3	67·4	67·4	771·2	
13	95·4	95·4	95·4	866·6	
14	38·0	38·0	38·0	904·6	
15	177·5	177·5	177·5	1082·1	Ramp almost entirely broken away from 1087 to 1186.
16	39·0	39·0	39·0	1121·1	
17	62·1	61·9	62·0	1183·1	
18	49·0	49·0	49·0	1232·1	Ends in a hole.
19	43·4	43·6	43·5	1275·6	
20	52·6	52·8	52·7	1328·3	
21	87·5	87·7	87·6	1415·9	
22	36·7	36·6	36·6	1452·5	
23	43·0	43·0	43·0	1495·5	Absorbed in vertical joint.
24	80·2	80·2	80·2	1575·7	Do. do.
25	55·3	55·3	55·3	1631·0	Do. do.
26	65·7	65·8	65·8	1696·8	Do. do.
27	63·2	63·2	63·2	1760·0	
28	41·1	41·3	41·2	1801·2	
Step, .	...	...	12·7	1813·9	
South wall,	81·4—12·7	...	68·7	1882·6	Full length of Grand Gallery on East side.



W. H. M.ᶜ Farlane, Lith.ᵉ Edin.ʳ

GRAND GALLERY,

LENGTH of, upon *West* Side (February 21 and 22, 1865), along inclined Ramp-line.

Number of joint.	First Measure.	Second Measure.	Mean, or length from joint to joint.	Total length of each joint from North wall.	Remarks.
North wall,	0·0	0·0	0·0	0·0	
Joint 1	80·0	80·3	80·2	80·2	
2	52·8	52·8	52·8	133·0	Absorbed in vertical joint.
3	80·2	80·3	80·2	213·2	Do. do.
4	68·0	67·7	67·8	281·0	
5	54·6	54·6	54·6	335·6	Do. do.
6	44·0	44·1	44·0	379·6	
7	48·0	48·0	48·0	427·6	
8	43·7	43·7	43·7	471·3	Do. do.
9	56·7	56·8	56·8	528·1	
10	42·7	42·8	42·8	570·9	
11	96·8	96·8	96·8	667·7	
12	60·0	59·8	59·9	727·6	
13	76·5	76·7	76·6	804·2	
14	47·2	47·3	47·2	851·4	Close joint, almost concealed by hard, brown, salt incrustations.
15	64·4	64·3	64·4	915·8	
16	5(5)·8	51·7	51·7	967·5	Examined and proved error of first measure.
17	36·8	37·3	37·0	1004·5	
18	46·0	46·1	46·0	1050·5	
19	62·0	61·8	61·9	1112·4	
20	60·7	60·7	60·7	1173·1	Joint not quite perpendicular to incline.
21	96·7	96·5	96·6	1269·7	Ramp much broken from 1240 to 1317.
22	55·3	55·4	55·4	1325·1	
23	99·6	99·6	99·6	1424·7	Absorbed in vertical joint.
24	86·8	86·8	86·8	1511·5	Do. do.
25	93·4	93·9	93·6	1605·1	
26	90·5	90·8	90·6	1695·7	
27	56·8	56·6	56·7	1752·4	
28	48·7	48·8	48·8	1801·2	
Step, . .	...	...	14·4	1815·6	
South wall,	81·8—14·4	...	67·4	1883·0	Full length of Grand Gallery on West side.

Hence the total length of Grand Gallery from north wall, to south wall measured along surface of ramps—

= on Eastern side,	. . .	1882·6
„ Western „	. . .	1883·0
Mean,	. =	1882·8

And the partial length from north wall to beginning of great step—

= on Eastern side,	. . .	1813·9
„ Western „	. . .	1815·6
Mean,	. =	1814·8

RAMP HOLES IN GRAND GALLERY.

These holes are cut in the ramps, next the wall, rather rudely, and have their edges now much broken. (See Plate VI. vol. i., and Plate IX. vol. ii.)

Their upper and lower, or north and south sides, are cut nearly vertical, certainly far from at right angles to the general incline of the Gallery: the depth of the holes (vertical) varies from eight to eleven inches, probably as influenced by hardened dirt.

Their number,—*including* one at the south-east inside corner, and another at the south-west inside corner, of the upper horizontal surface of the great step at the upper and south end of the Gallery,—is, twenty-eight on either side.

Of these, all, except the two on the great step, and the *two* lowest or northernmost on *either* side (*i.e.*, four at the north end) have a piece of stone

let into the wall vertically over their middle; the height of such inserted piece being usually 18·, and breadth 13· ; while the depth or thickness in one particular case where a neighbouring fracture enables it to be seen, is about 10· inches.

The holes on either ramp are always opposite, or nearly so, to each other.

The following measures of the ramp-holes were only taken once, excepting a few checks; though the general nature, character, number, and position of the holes were observed again and again. As touching the number too, which has been variously stated by different persons as from twenty-five to twenty-eight,—the method of mensuration adopted on this occasion will, it is hoped, put any mistake in that feature within the power of any one looking over the figures, and assisting themselves by the general symmetry in size and distance observed throughout,—to correct for themselves.

GRAND GALLERY,

RAMP-HOLES on EAST side.

Number of, beginning at North end of Gallery.	Distance from North wall, of		Distance between adjacent sides of two holes.	Length of hole from North to South.	Breadth from East to West.	Depth, vertical.	Remarks.
	North side of hole.	South side of hole.					
At N. wall, 1	0·0	23·0	41·9	23·0	6·0	11·0	
2	64·9	84·6	41·8	19·7	6·7	11·0	
3	126·4	151·0	44·6	24·6	6·7	+ 7·0	
4	195·6	216·1	46·1	20·5	6·7	+ 7·0	
5	262·2	285·7	45·9	23·5	6·4	12·0	
6	331·6	352·4	48·0	20·8	6·7	+ 7·0	
7	400·4	422·9	45·7	22·5	6·8	...	
8	468·6	488·8	46·3	20·2	6·2	...	
9	535·1	557·5	46·0	22·4	6·4	...	
10	603·5	624·4	46·8	20·9	6·4	...	
11	671·2	693·2	47·0	22·0	6·7	...	
12	740·2	759·7	45·8	19·5	7·0	...	
13	805·5	828·8	47·4	23·3	6·7	...	
14	876·2	896·5	46·7	20·3	6·3	...	
15	943·2	966·7	45·5	23·5	6·8	...	
16	1012·2	1032·7	47·0	20·5	6·4	...	
17	1079·7	1101·2	48·5	21·5	...	...	Ramp nearly broken out from 1087 to 1186.
18	1149·7	1169·7	45·8	20·0	...	...	
19	1215·5	1239·3	45·7	23·8	...	...	
20	1285·0	1305·6	46·2	20·6	6·3	8·0	
21	1351·8	1375·8	46·0	24·0	6·3	8·0	
22	1421·8	1441·8	46·0	20·0	6·2	8·0	
23	1487·8	1511·8	45·7	24·0	6·0	8·0	
24	1557·5	1577·5	44·7	20·0	6·5	+7·0	
25	1622·2	1647·2	45·3	25·0	6·8	8·0	
26	1692·5	1712·9	45·3	20·4	6·3	8·5	
27	1758·2	1781·7	79·7	23·5	6·2	8·0	
On step, 28	1861·4	1882·6		21·2	6·0	+5·5	

GRAND GALLERY,

RAMP-HOLES on WEST side.

Number of hole from North wall of Gallery.	Distance from North wall of		Distance between adjacent sides of two holes.	Length from North to South.	Breadth from East to West.	Depth, vertical.	Remarks.
	North side of hole.	South side of hole.					
At N. wall, 1	0·0	23· ?		23· ?	6·0	(?)	Relics only of ramp.
2	65·0	86·5	42·0	21·5	5·7	9·0	
3	128·0	150·0	41·5	22·0	5·7	10·0	
4	196·6	216·3	46·6	19·7	6·0	9·5	
5	261·0	284·4	44·7	23·4	5·5	10·0	
6	333·5	355·0	49·1	21·5	6·2	11·0	
7	399·6	424·6	44·6	25·0	6·3	10·0	
8	468·9	489·9	44·3	21·0	6·3	11·0	
9	535·3	558·3	45·4	23·0	5·7	10·5	
10	603·0	623·1	44·7	20·1	5·8	10·0	
11	669·2	692·3	46·1	23·1	5·8	11·5	
12	739·3	759·8	47·0	20·5	6·3	10·5	
13	805·0	828·0	45·2	23·0	6·0	11·0	
14	873·0	893·2	45·0	20·2	6· ?	11·5	
15	943·6	966·1	50·4	22·5	5·9	8·0	
16	1010·8	1032·2	44·7	21·4	6·5	9·1	
17	1078·7	1102·2	46·5	23·5	6·3	7·5	
18	1148·0	1168·0	45·8	20·0	6·5	7·5	
19	1214·0	1236·4	46·0	22·4	6·3	8·3	
20	1282·4	1303·1	46·0	20·7	...	...	Ramp much broken from 1240 to 1317.
21	1349·7	1372·9	46·6	23·2	6·5	8·5	
22	1420·8	1441·5	47·9	20·7	6·2	7·5	
23	1486·2	1510·0	44·7	23·8	6·3	7·8	
24	1555·8	1577·0	45·8	21·0	6·4	7·5	
25	1622·5	1646·9	45·5	24·4	6·3	8·0	
26	1691·7	1712·5	44·8	20·8	5·5	7·0	
27	1758·7	1782·9	46·2	24·2	6·0	8·0	
On step, 28	1862·5	1883·0	79·6	20·5	5·8	5·±	

GRAND GALLERY,

Breadth of, between Ramps, and above Ramps.

At distance from North wall, nearly	Breadth between ramps.		Breadth just above ramps.
	First measure.	Second measure.	
At North wall,	.....	.....	81·7
76	41·6	41·5	.....
80	.....	.....	81·8
124	41·4	.....	.....
152	41·0	.....	.....
185	40·8	.....	.....
214	41·0	.....	.....
222	41·3	.....	.....
263	41·8	41·8	.....
300	.....	.....	82·0
315	42·2	.....	.....
400	42·4	.....	82·1
500	42·5	.....	.....
600	42·4	.....	82·8
900	42·4	42·2	82·9
1100	41·8	41·9	83·0
1300	42·3	.....	82·9
1600	42·6	42·4	82·9
1800	42·5	42·7	82·3
At South wall,	.....	.....	82·2

These measures show without doubt that the Grand Gallery is broader towards middle and upper or southern end than at the lower or northern end; and this prevails equally with the breadth between, and that above, the ramps. The much more notable contraction of the breadth higher up, caused by the *overlappings* of the walls, will be given further on.

GRAND GALLERY,

Ramps of, *Height* and *Breadth* of each.

Place of measurement, by distance from North wall of Gallery.	Ramp on East side of Gallery.			Ramp on West side of Gallery.		
	Breadth.	Height, at right-angles to incline.	Notes.	Breadth.	Height, at right-angles to incline.	Notes.
120	20·3	...	...	20·3	...	
300	20·2	20·9	...	19·6	21·3	
570	20·4	21·0	Walls chipped and injured where ramps join them.	19·9	20·6	
640	20·1	21·2	...	19·9	20·9	
1000	20·2	21·3	Both ramps much fissured and parted from walls. Floor also from ramps.	20·2	20·9	Through a considerable length this West side of floor is parted from ramp by a crevice 0·5 broad.
1400	20·3	21·3	...	20·3	21·3	
1430	20·1	21·3	...	20·3	21·2	
1500	20·0	20·9	...	19·8	20·9	
1740	20·4	20·6	...	20·1	20·5	
1800	19·3	20·3	...	19·8	20·6	
Mean,	20·14	21·03		20·04	20·93	

The above observations were taken with care, to avoid fractures of wall, or wearing of floor: matters that might easily have increased any of the above returns by 0·3 to 0·5, and sometimes even 1·0; without specially calling attention in themselves.

At each spot selected, generally for the goodness of the ramps at that part, the measurement was verified at the time as being certainly within 0·2 of the truth. This leaves, as may be noticed, a variation in the size of the ramps along the run of the Gallery

as a measured fact; and also that the height, taken perpendicular to the incline, is greater than the breadth, by the quantity very nearly of 1 inch.

Along nearly the whole distance from 400 to 1800 of western ramp, and occasionally along eastern ramp, there are longitudinal parallel scratches, forming almost a border or species of intended ornament following the direction of the ramp; they are inflicted upon and along its upright edge, close under the top, and towards axis of Gallery. But although the very same lines are traceable far, they do not extend the whole distance, being more or less gradually replaced by others; they may therefore, be merely the accidental scratches caused by rough and heavy bodies having once been slided along the sloping floor.

VERTICAL HEIGHT OF GRAND GALLERY.

(March 1-11, 1865.)

Measured with Slider-scale of 400.

This element of the Grand Gallery has always been a difficult one to travellers with limited apparatus, on account of its enormous proportions, and the tilt or incline of both floor and ceiling, together with the darkness, bad air, etc. But I had had specially prepared for the work, by Mr. Cooke, a trunk of 300 inches long (formed in three pieces, but fixed together inside the Pyramid); and furnished with an inside pointed slider of 100, capable of being pushed up from below from 0 to 90; while

the foot of the trunk was formed by a long steel peg, and levels were applied at the sides to test verticality. The mode of working was,—that two men held the apparatus vertical, or made it so by reference to the levels; I then pulled the string which raised the slider, until it touched the roof, and clamped; in which state the whole structure was lowered on the upward inclining floor, for me to read off the scale. The differences, at different parts of the length of the Gallery, are greater than I should have expected; and may be due partly to the roof being formed of slabs set at a tilt, each of them, to the general incline, like tiles.

The mean of the whole will, however, probably be pretty accurate; for there is no constant error of the apparatus amounting to a sensible quantity; seeing that one of the readings registering 350·2, being directly tested on the great rod by the known 100 B, was proved to be by that = 350·17.

The height sought to be measured, being the *vertical* height between *sloping floor* and *sloping roof*,—a large correction is needed at parts near the north end of Gallery, where the sloping floor has been cut away, and there is only the horizontal floor of Queen's chamber passage at a lower level to refer to. In such cases the elements of correction are, the distance from the north wall, and the angle of the Gallery assumed = 26° 18′.

GRAND GALLERY, *VERTICAL* HEIGHT OF.

Distance from North wall.	Measured on March 1.	Correction for level floor.	Measured on March 11.	Correction for level floor.	General results.	Notes.
20	...	...	344·2	...	344·2	On step of protruding passage floor.
30	350·2	— 8·8	...	...	341·4	8· South of step.
32	351·0	— 9·8	...	...	341·2	10· South of step.
77	...	...	366·4	— 32·0	334·4	On level floor.
125	...	...	394·2	— 55·8	338·4	On level floor.
270	...	...	343·7	...	343·7	On first six inches of true Grand Gallery inclined floor.
550	346·0	...	...	...	346·0	
620	...	...	336·0	...	336·0	
970	341·3	...	339·0	...	340·2	
1240	338·0	...	...	...	338·0	
1320	...	...	340·0	...	340·0	
1500	334·5	...	...	...	334·5	
1670	...	...	342·0	...	342·0	
1760	333·9	...	...	...	333·9	
1780	...	...	339·0	...	339·0	
Mean of height of Grand Gallery by 16 obs. =					339·5	*N.B.—Vertical height.*

ROOF OF GRAND GALLERY.

(MARCH 1, 1865.)

Examined the roof-stones of Grand Gallery, by a strong light from below, and made their number from north to south = 36.

Of these, the last nine towards the south are absolutely black with smoke; those preceding them towards the north, are only partially black. The stones are manifestly of unequal lengths, and the tile-angle at which they set to the general angle of the passage, is by no means constant; it was particularly marked at the fourth, seventh, and tenth

from the north. Looking up from below, the absolute cut-off of north end of Grand Gallery floor, was found to point to 4·3 of the roof-stones, measured from the north wall of Gallery.

GRAND GALLERY, OVERLAPPINGS OF, AT NORTH END.

Noticed with regard to these overlappings, that the first one of the side walls above the ramps, though making its due compression in the width of the north end wall, is *not* developed on that end as an end-overlapping; wherefore north wall goes up higher in plane of door than it otherwise would do.

Noticed also, that when the end-overlappings of north wall *are* developed, their under surfaces follow the general incline of the Gallery.

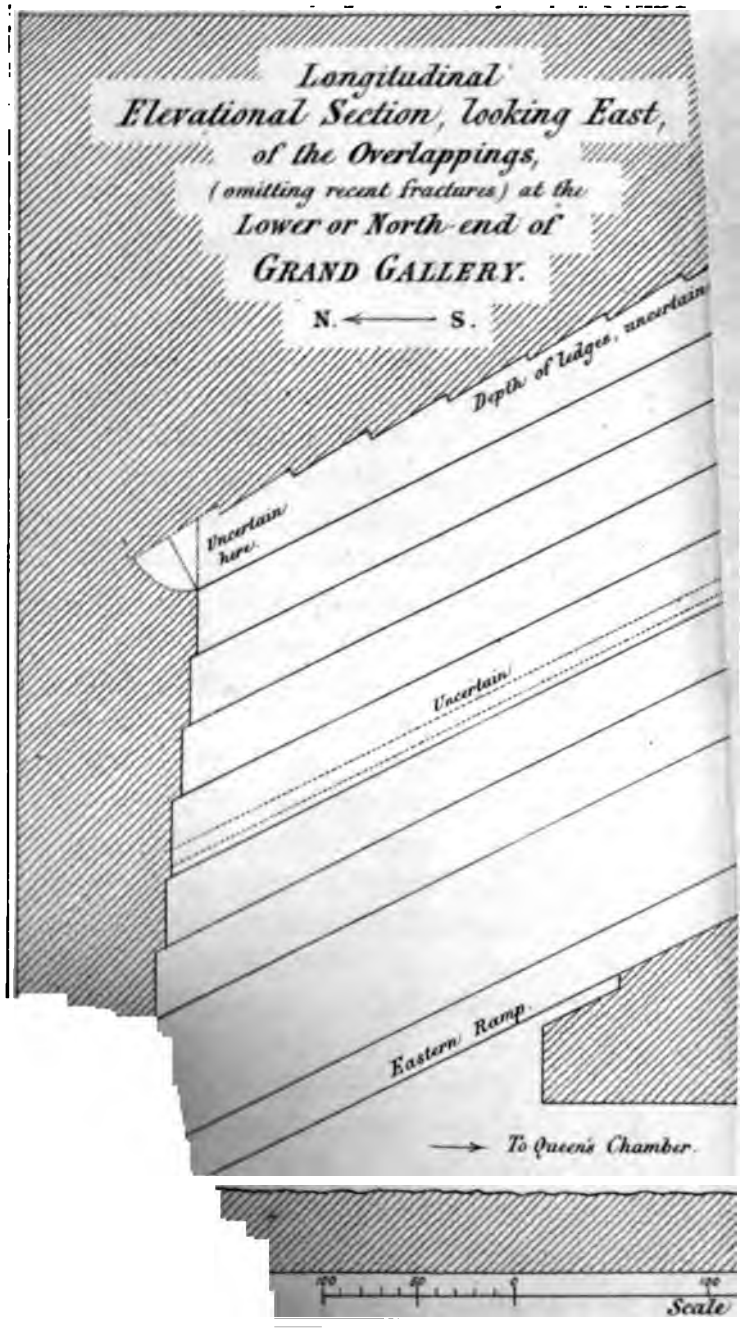
The shape of the wall at the highest overlapping of north end-wall, where there is evidently a large forced hole, I could not examine: the figure indicated in the diagram by dots, is from Perring's large views: also the groove above the third overlapping, measured from below. (See Plate X.)

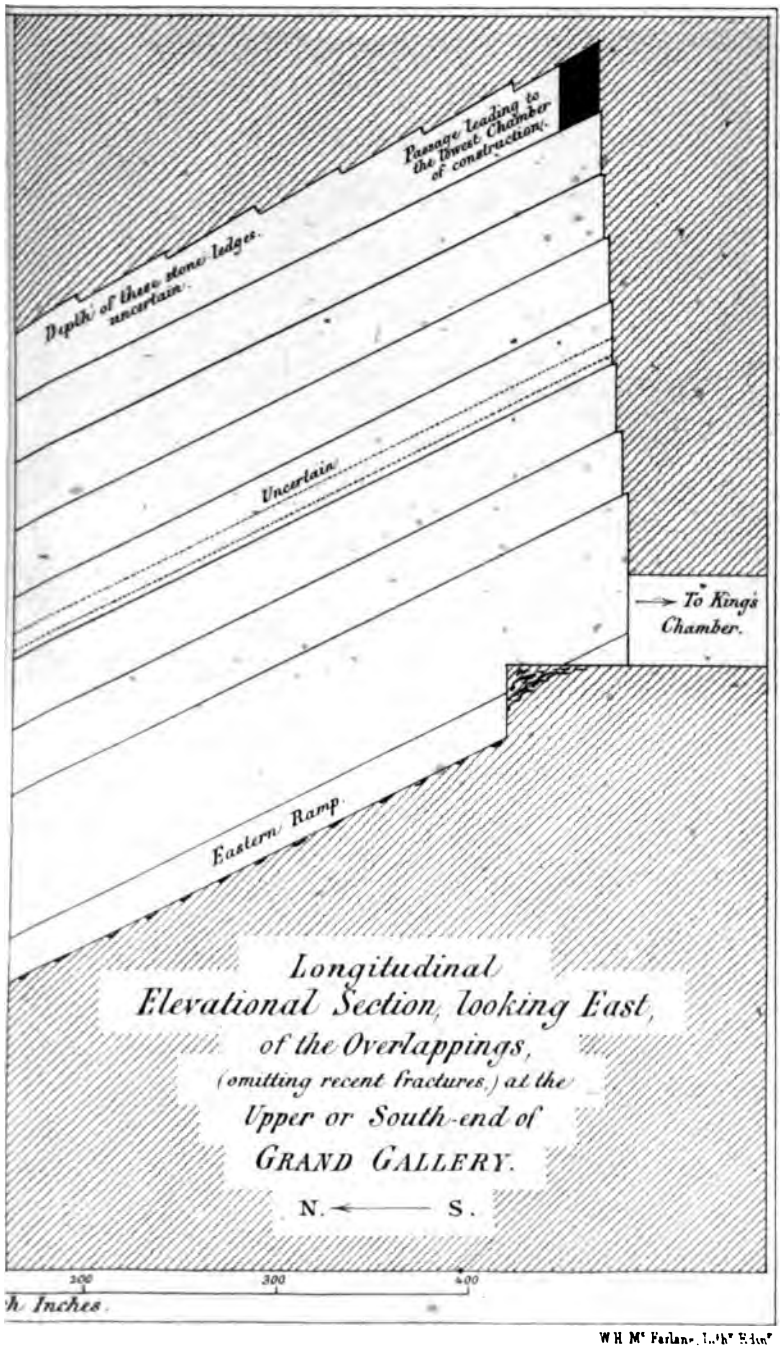
This groove on either side, did not catch my eye; but that may have arisen partly from much of the overlapping which it belongs to, having been recently broken away. Vyse and Perring say, 'For the long 'grooves running on each side the whole length of 'the passage, it is difficult to assign a use; they are 'roughly cut, and therefore could not have been 'used for a sliding platform, for which, at first 'sight, they appear adapted. Perhaps they were

'made to receive a scaffolding for the workmen 'employed in trimming off the sides of the passage.' To this I may add, that the groove is represented so near the bottom of its overlapping sheet, that there was little strength left, to support any weight; and as the grooved portion has to a great extent perished, without any strain being put upon it,—we cannot regard it as anything connected with scaffolding, but rather with some symbolic meaning.

The same authors, who had more opportunities than any other men, since the building of the Pyramid, to examine the upper parts of the Grand Gallery, and are therefore to be listened to with great respect for facts, say of its *roof*,—'it has been 'laid on a flat bed at the incline of the passage; but 'a settlement towards the lower end has given the 'roof-stones the angular direction shown in the 'figure.' I cannot altogether understand the mechanics of this paragraph, combined with the Pyramid method of forming the roofs of passages; generally by large stones spanning all across them, and far over the walls on either side: but I had no means of examining the roof closely, and can only speak by appearances judged of from the floor, as to each 'tile' corner of a roof-stone really throwing a shadow; and that there were thirty-six of them, in place of the thirty-one indicated by Howard Vyse and Perring, and thirty in the French work.

The further measures I was enabled to take from the floor, of the overlappings, are given below.


Longitudinal
Elevational Section, looking East,
of the Overlappings,
(omitting recent fractures) at the
Lower or North-end of
GRAND GALLERY.
N. ⟵ S.
Depth of Ledges uncertain
Uncertain here.
Uncertain
Eastern Ramp
To Queen's Chamber
100
50
0
100
Scale



W H Mc Farlane, Lith. Edin.

GRAND GALLERY,

***End-overlappings* of, at NORTH END and on NORTH WALL.**

Number of overlapping.	*Vertical* height above floor, following its incline.	Breadth of, from North to South.	Differences of Vertical heights.	Notes.
1st from floor,	94·4	0·0	...	The numbers in parentheses are concluded only from eye-estimate, checked by the whole height, previously measured.
			36·0	
2	130·4	5·5		
			36·3	
3	166·7	4·5		
			36·8	
4	203·5	(4·)		
			35·0	
5	(238·5)	(3·)		
			35·5	
6	(274·0)	(3·)		
			35·0	
7	(309·0)	(?)		A forced hole between 7 and roof.
Roof, .	344·0	...	...	The vertical height of Grand Gallery at that point.

***Side-overlappings at* NORTH END, but on EAST AND WEST WALLS, and measured at *right angles* to incline, from *ramp-surfaces* upwards.**

Number of overlapping.	East wall.		West wall.		Mean East and West.		
	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Differences of rectangular heights.
1st from ramps,	63·8	3·1	63·5	3·2	63·6	3·2	
							32·2
2	95·9	3·0	95·6	3·0	95·8	3·0	
							32·2
3	128·0	2·9	128·1	3·0	128·0	3·0	
							31·8
4	159·9	(3·)	159·8	(3·)	159·8	(3·)	
							32·2
5	(192·)	(3·)	(192·)	(3·)	(192·)	(3·)	
							32·0
6	(224·)	(3·)	(224·)	(3·)	(224·)	(3·)	
							31·0
7	(255·)	(3·)	(255·)	(3·)	(255·)	(3·)	
							31·0
Roof,	286·	...	286·0	...	286·0	...	

OVERLAPPINGS OF GRAND GALLERY AT SOUTHERN OR UPPER END.

This upper or southern end differs in many details from the northern end, as—

1*st*, The lowest side overlapping *is* developed on the end wall, together with all the rest.

2*d*, The under surfaces of all these overlappings are *level*, and not following the incline of the Gallery.

3*d*, The end wall is not vertical, but impends or hangs over the great step, *i.e.*, leans towards the north by a quantity of about 1°.

This circumstance may render the heights measured at this, the south end, always rather small; while, again, at the north end, the difficulty of eliminating fully the slope of the under-surfaces of the end-overlappings may have made them there rather too great. (See Plate X.)

GRAND GALLERY,

OVERLAPPINGS of, *at South or Upper end.*

Number of overlapping.	*Vertical* height above great step upper surface.	Breadth of overlapping from South to North, on South wall.	Reduction for surface of step to Gallery inclined floor, continued.	Vertical height above Grand Gallery floor, concluded.	Difference of vertical heights.
1st from floor of great step,	84·9	2·9	7·5	92·4	35·9
2	119·3	3·0	9·0	128·3	34·8
3	152·6	3·0	10·5	163·1	34·6
4	185·7	(3·0)	12·0	197·7	34·8
5	...	(3·0)	...	(232·)	35·0
6	...	(3·0)	...	(267·)	35·0
7	...	(3·0)	...	(302·)	35·0
Roof, .	...	...	...	337·±	

N.B.—The numbers in parentheses not directly measured.

GRAND GALLERY,

***Side-overlappings*, South end; but on *East and West walls*, and measured at RIGHT ANGLES to incline from ramp-surfaces upwards.**

Number of overlapping from ramp-surface up.	East wall.		West wall.		Mean East and West walls.		
	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Differences of Rectangular height.
1	63·0	3·	62·0*	3·	62·5	3·	32·3
2	95·5	3·	94·1	3·	94·8	3·	30·9
3	126·3†	3·	? ‡	3·	125·7	3·	31·7
4	157·9	...	157·0	...	157·4	(3·)	(31·6)
5	...	...	...	...	(189·)	(3·)	(32·0)
6	...	...	...	...	(221·)	(3·)	(31·0)
7	...	...	...	...	(252·)	(3·)	(32·0)
Roof,	...	...	...	...	284·	...	

* Large corner of overlapping much broken.

† Large piece of this overlapping, from its lower edge upwards, broken away; and extensive dripping marks, as of water escaping at the place, hang vertically down from it.

‡ After the first 100 inches or so from the south, so very long a portion of this overlapping is broken away, that no good measure can be obtained.

This is that overlapping, towards the lower side of which Howard Vyse and Perring have placed their longitudinal groove. Hence much decay has evidently taken place since their day. (See Plate x.)

ANTECHAMBER AND ITS PASSAGES.

(MARCH 14, 15, 1865.)

Floor, from North end of great step at the top of Grand Gallery, on through the antechamber and passage beyond, into King's chamber (see Plate XI.) :

The joints of this floor all go right across it from East to West wall ; the floor is horizontal.

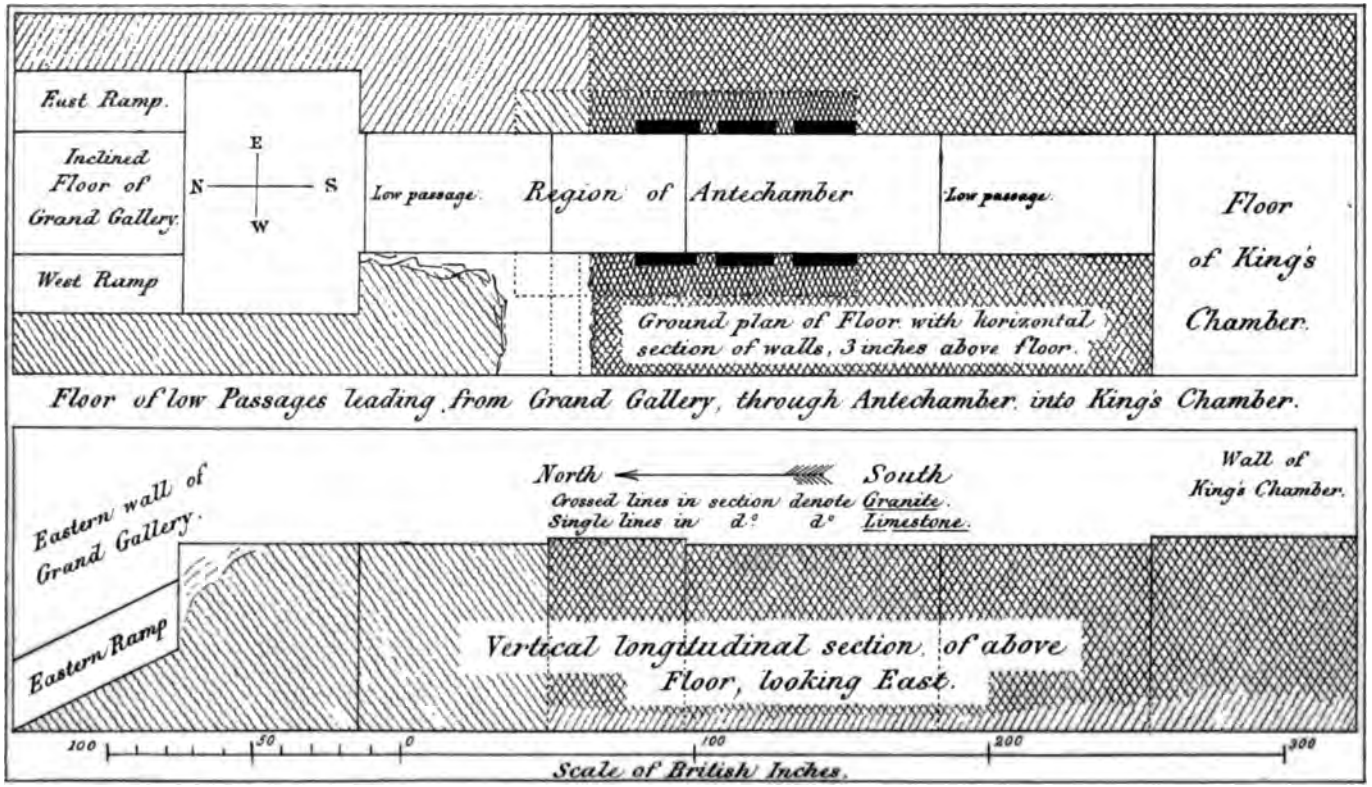
Floor-joints on EAST side.

No. of Joints on floor.	First measure.	Second measure.	Mean, or length from joint to joint.	Total horizontal distance from N. end of great step of Grand Gallery.	Notes.
1st or N. end of great step,	0·0	0·0	0·0	0·0	
2	62·2	62·3	62·2	62·2	
3	64·5	64·5	64·5	126·7	Limestone ends here, and granite begins.
4	47·3	47·2	47·2	173·9	
5	85·8	85·8	85·8	259·7	
6	70·6	70·5	70·6	330·3	

Floor-joints on WEST side.

No. of Joints on floor.	Length from joint to joint.	Total distance from N. end of great step.	Notes.
1st, or great step N. end.	0·0	0·0	
2	62·0	62·0	
3	64·6	126·6	Limestone up to this point, granite beyond it for the floor.
4	47·3	173·9	
5	85·8	259·7	
6	70·6	330·3	

The northernmost *granite* stone, as from 126·6 to 173·9 in the above passage, is about 0·3 in level *above* the two limestones preceding, and the two granite stones following it ; and the last of them is about 0·8 below the level of first stone of King's chamber floor.

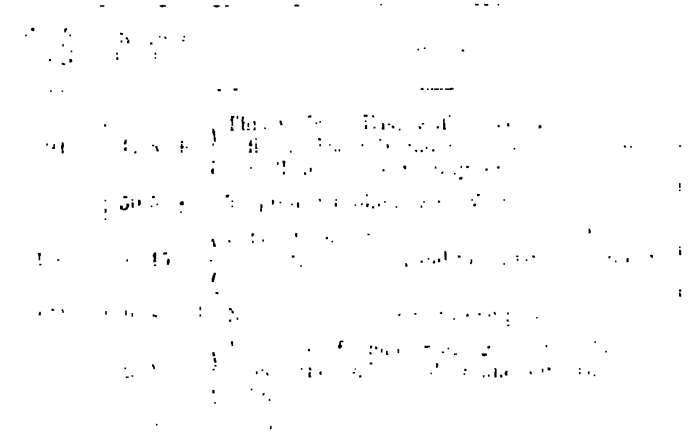


W. H. M.ª Farlane, Lith.ª Edin.ª

ANTECHAMBER AND ITS PASSAGE

FLOOR OF

Enlargements of, above floor, at different parts of the
North end of



ANTECHAMBER AND ITS PASSAGES,

FLOOR OF—*continued.*

BREADTHS of, above floor, at different parts of its length, from North end of great step of Grand Gallery.

Distance from great step.	Breadths measured.	Notes.
91	41·8 ±	This is from East wall to certain marks on floor, obscurely indicating where old West wall, now broken away, once stood.
...	50·5 ±	To present broken-away West wall.
136	41·45	Between the true ancient walls, both East and West, of granite, and under Greaves' granite leaf.
171	40·8	Normal part of floor, save chippings.
...	48·1	To sides of small rectangular trenches cut on either side of floor and into the walls high up.
214	41·2	Floor proper.
...	48·0	Floor extended by breadth of the small trenches three to four inches deep: this peculiar part of the floor is in the ante-chamber, and extends from 153·5 to 228·7, barring interruptions from pilasters now nearly broken away.
251	41·4	
321	41·4	

N.B.—The parts shaded in Plate XI. of this passage, with *crossed* lines, represent granite; and with *single* lines, limestone. The two walls and floor do not begin their respective granites in the same vertical plane; but all other features, as of joints, the broadened part of the floor, etc., are truly rectangular to axis of passage.

The numbers on which the particulars connected with the base of the walls are given in the above plan, are as follows :—

DISTANCE MEASURES NEAR BASE OF ANTECHAMBER PASSAGES.

	East side.			West side.		
	Distance from great step.		Longitudinal breadth of pilasters and of floor side holes.	Distance from great step.		Longitudinal breadth of pilasters and of floor side holes.
	First measure.	Second measure.		First measure.	Second measure.	
Beginning of the granite, .	136·6	136·0	...	134·0	134·3	
Beginning of cut-out in floor,	153·0	152·5		153·4	153·8	
			22·0			22·1
North edge of first pilaster,	175·2	174·5		175·4	176·0	
			5·8			5·6
South ,, ,,	181·0	180·5		181·0	182·0	
			21·4			21·
North edge of second pilaster,	202·5	202·0		202·4	203·±	
			5·8			5·6
South ,, ,,	208·3	208·0		208·0	209·±	
			21·1			20·4
End of cut-out in floor, .	229·3	229·±		229·8	230·0	
Beginning of King's chamber,	330·3	330·2	...	330·3	330·3	

Of Northern part of above passage, or near great step—
Height = 43·7, and breadth = 41·5.
And of Southern part of above passage, or near King's chamber—
Height = 43·6 to 43·8, and breadth = 41·4.

This very peculiar little antechamber, which finds itself rather north of the middle of the short horizontal passage leading from the Grand Gallery to the King's chamber,—has a much greater width than the passage, even in the part which is somewhat

increased by the breadth of the side depressions in the floor. But the full width of the antechamber does not appear in the plan previously given of the passage, except by certain dotted lines, because the lower two-thirds about, of the room are filled in, on the east and west sides, by a thick wainscoting of granite; hence the full width of the room is only clearly visible near the ceiling, and is then found to measure from

	65·9 to 66·2
while its length measures from North to South—	
near East side, ...	= 116·3
and near West side, ...	= 116·6
but along floor near East side, ...	= 116·2
the height of the room from floor to ceiling varying according to the more or less sunken position of the floor stones, ...	from 149·2 to 149·5
Circumference of walls, under ceiling, . . .	= 363·4

At a depth of 46·2 below ceiling on east side, and 37·5 on the west side, the above width of 65·2 is suddenly decreased to 41·4 and 42·0 by the sort of granite wainscot mentioned, rising from the floor up to the above-mentioned 46·2 and 37·5 from the ceiling. But the width is again increased to 48·1 in the parts extending between 39·0 and 116·0 from the north end of the room towards the south; for within these limits of space certain broad grooves were originally cut out, leaving only narrow pilasters between, which pilasters have since been nearly completely knocked away, chip after chip, by specimen-seekers.

The position of the antechamber in the course of

the passage may be obtained from the following numbers, amongst which are marked some of details which will be recognised in Plate XII.

MEASURES OF A PLAN, NEAR TOP-LEVEL OF ANTECHAMBER.

Parts measured.	East side.	West side.
North end of antechamber from North end of great step, ...	113·1	113·5
North side of slit containing granite leaf, .	132·6	133·0
North side of granite leaf, omitting boss, .	134·0	134·6
South side of granite leaf, ...	150·3	150·8
South side of slit containing granite leaf, .	150·3	150·8
South side of ridge containing granite leaf, .	153·9	153·8
South end of antechamber, ...	229·4	229·8
South end to a fractured edge, ...	236·?	230·0

Referring now to the large opening-out of all the sides of the antechamber, Plate XII., we may state :—

Of the *ceiling*, it is of granite, in three lengths, from North to South, measuring,

the 1st, ... = 41·5
2d, ... = 38·5
3d, ... = 36·5 nearly.

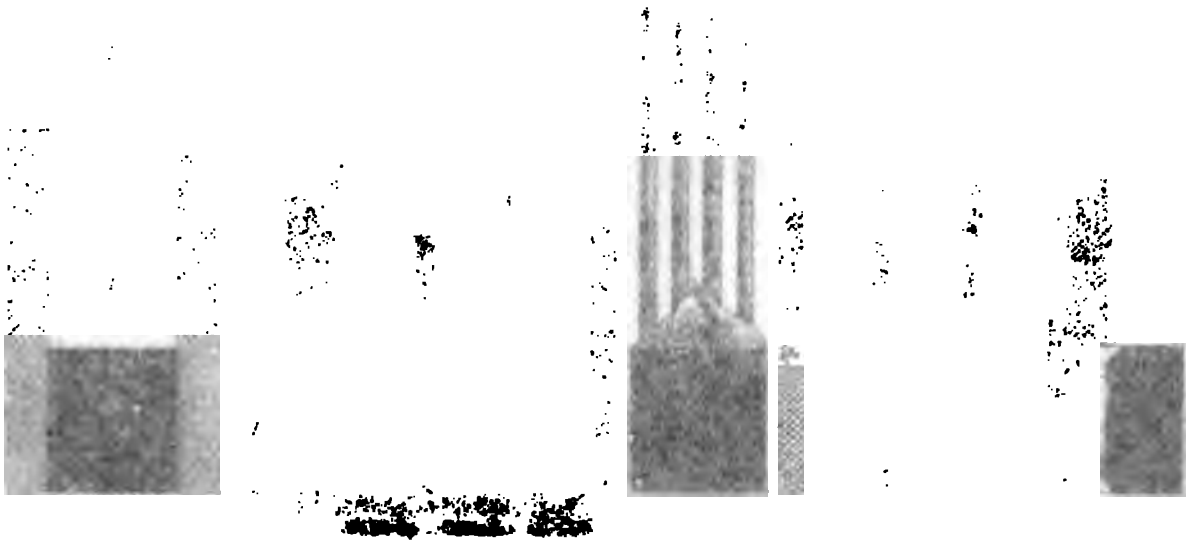
Of the *North wall*, it is of limestone, rough with pickmarks; and in three courses, measuring from the top,

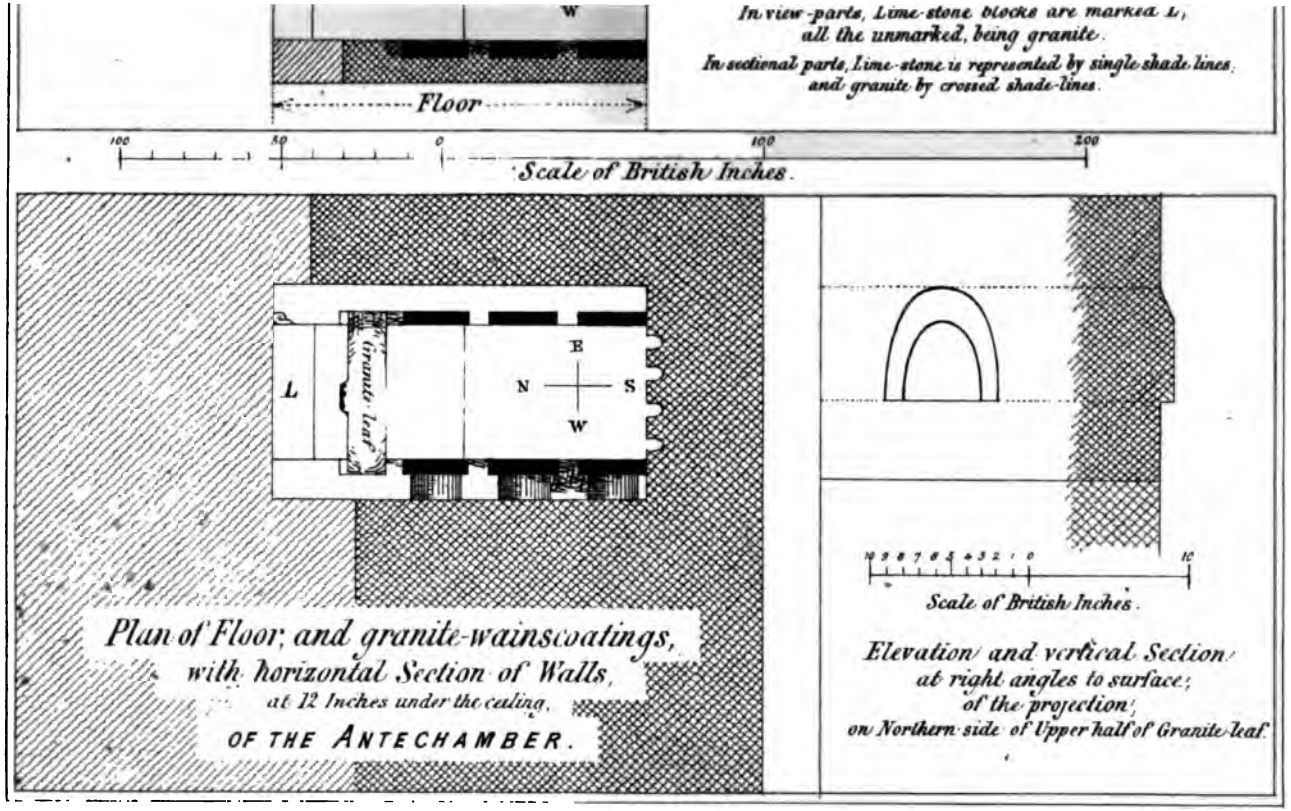
1st, ... = 29·0
2d, ... = 35·3
3d, ... = 41·5
Whole height from floor, ... = 149·3
Breadth at top, ... = 65·2
,, inside granite wainscot, . . . = 41·7
Depth from ceiling to granite wainscot on East side, = 46·2
,, ,, ,, West ,, = 37·5

Of the *South wall*, it is entirely of granite, except the topmost course, which is 12·0 deep of limestone,

Whole height from floor surface to ceiling, . = 149·4
,, bottom of side-hollows to do., = 152·5±
Breadth at top, ... = 65·2
Breadth elsewhere, ... = 48·1±

(*N.B.*—In this, different from its congener the North wall, where the breadth is 41·7 only.)





W H M^c Farlane Lith^r Edin^r

This south end wall is chiefly remarkable for the disputed '*four*' or '*five*' vertical lines of many authors.

They are actually and really four, (4) in number; and are deep, straight, vertical grooves, which subdivide the space from east to west side, at the level of any eye, symmetrically into five parts. (Plate XII.)

Their depth, = 2·8, and their breadths, taking them from east to west, are—

Near the top, = 3·6, 4·0, 4·0, and 4·0
And near the bottom, = 3·4, 3·8, 3·5, and 3·3

Their shape in cross-section being somewhat parabolic. Measured from east wall near top, and therefore above the granite wainscot, their central lines are distant therefrom 17·0, 27·4, 37·9, and 47·9 respectively, and near the bottom = 9·1, 19·6, 29·6, and 39·7 respectively.

The grooved granite stone is much fissured and broken away below. (See Plate XII.)

East wall, all composed of granite, except the small stones marked L :—

Whole height from floor to ceiling, ...	= 149·3
,, length from North to South, ...	= 116·3
Height of joint of first course, above floor surface, .	= 43·7
Height from first to second course, or top of granite wainscot, ...	= 59·4
Height from second to third course or ceiling, . .	= 46·2

The granite wainscoting of this wall is 12·0 thick from wall; but has four broad grooves cut back upon it, 4·0 deep. Of these, from the north,

The first is 16·5 broad,	and extends over from	19·5	to 36·0	from N. wall
second 22·0	,,	,, 39·6	to 61·6	,,
third 21·8	,,	,, 66·4	to 88·2	,,
and fourth 22·5	,,	,, 93·5	to 116·0	,,
or to South wall.				

The intervening spaces, or ribs, or pilasters, are 3·6, 5·0, and 5·3 broad respectively, but are now broken away for by far the greater part of their height. The first groove, however, is only cut to a depth of 59·4, or to bottom of granite leaf, which spans the room, leaving solid stone wainscot or wall under that; while the others all go down to about three inches under the floor.

West wall, all composed of granite, except the stone marked L.

Along the southern edge of the northernmost of the two granite stones, next under the ceiling,—is an appearance, partly of a bad joint edge and partly of a flattish curved beading; making a sensible difference from all the ordinary joints.

This west wall differs mainly from the east wall in having a higher wainscoting (higher by 8·7); and, in the tops of the three southern flat grooves (4· deep) having three semi-cylindrical hollows cut straight back to the wall, through the remaining 8·3 of thickness of the granite wainscot. These semi-cylindrical hollows have a radius of curvature = 9. The first flat vertical groove from the north descends only to the bottom of the granite leaf—

and is 17·1 broad,	and extends from	20·2	to	37·3	from N. wall
the second 21·7	,,	,,	41·0	to 62·7	,,
third 21·8	,,	,,	68·0	to 89·8	,,
fourth 21·3	,,	,,	95·2	to 116·5	,,

leaving the projecting ribs between them, in the few places where they at present exist, in breadth = 3·7, 5·3, and 5·4 respectively.

This west side wall is also noteworthy at present, on account of the forced passage made from its lower north-west corner, to meet north air-channel from King's chamber.

THE 'GRANITE LEAF.'

In the antechamber's first groove from the north, is to be seen Greaves' 'granite leaf,' or the 'portcullis' of many authors. It is, in thickness from north to south, on east side, = 15·4; and on west side, = 16·0; crossing the antechamber from east to west in two courses,—whereof the lower is from 27·5 to 28·0 high, and the upper from 18·0 on the east to 23·5 on the west, the upper surface of this upper stone being very rude and fractured. Further, the lower side of the whole granite leaf is 43·7 above the floor, and the upper side 57·0 nearly below the roof. (See Plate XII.)

I had concluded, before visiting Egypt, that this granite leaf could not be a portcullis; because, if lowered to the floor, it would not come near enough to the door to stop it up. Local examination proved this idea correct; for the space between north wall of antechamber and north surface of granite leaf is 21 inches, so that a man can easily stand between; and he could also easily clamber over said granite leaf, if lowered to the floor. But it has not been so lowered; and cannot be, without its grooves in the east and west walls being cut lower than they are by

43·7 inches, for it stands on firm granite and limestone at that height. The granite leaf is moreover cemented into its place, and wedged in after a fashion from the north, the groove being one inch broader than the stone. The groove, as visible above the granite leaf, up to the top of the granite wainscot, is remarkably well, truly, and smoothly, made in the solid granite.

So much care could hardly have been taken to introduce, once and for all, two stones which ever after were to have been fixtures; and the present appearances are certainly in favour of their being intended to slide upwards again, rather than downwards. For what purpose? Perhaps to disclose some secret; and it is well to call prominent notice to the raised ornament on the upper of the two stones forming the 'leaf;' it is something like one of the rudimentary handles on later sarcophagi, and a most unique thing certainly, throughout the whole of the Great Pyramid. It is of the following shape in elevation and vertical section; and is 7 inches broad, and 7 high, measured on its second surface, or that next the whole stone slab; and 5 inches high, and 5 broad, measured on its first or outer surface; 1 thick, and has its lowest line 5 inches above the joint between the lower and upper stone. It is further 16 from west wall and 18 from east at its boundaries, or 19·5 and 21·5 respectively at its centre. (See Plate XII.)

KING'S CHAMBER.

(March 11, 16, 18, 19, 20.)

GENERAL PROPORTIONS OF.

This fine room is entirely constructed in polished granite, and *appears* rectangular everywhere; the general measures of it are as follows; either by the 400-inch slider, or the 100 A and 100 B rods:—

Height of, floor to ceiling, granite both, but the floor-blocks sensibly disarranged from mutual level—

Near North-East angle of room,	=	230·8
,, middle of North side,	=	229·7
,, North-West angle,	=	229·2
,, South-West ,,	=	229·9
,, middle of South side,	=	229·5
,, South-East angle,	=	230·8
,, North-East angle, repeated,	=	230·8
Mean height,	=	230·1

The differences amongst the above measures are chiefly owing to the errors of floor-blocks, or effects of modern dilapidation.

Length of, or from East to West wall, along *South* side, near floor level—

First measure, on March 11,	=	412·6
Second ,, ,,	=	412·58
First ,, March 16,	=	412·5
Second ,, ,,	=	412·7
South side mean,	=	412·60

And along *North* side—	
First measure, on March 11, ...	= 412·4
Second ,, ,, ...	= 412·5
First ,, March 16, ...	= 412·5
North side mean,	= 412·5
Mean length for whole room,	= 412·55
Breadth, or from North to South wall—	
Near East side, first measure, ...	= 206·4
,, second ,, ...	= 206·2
East side mean,	= 206·3
Near West side, first measure, ...	= 206·3
Mean breadth for whole room,	= 206·3
Diagonals of Floor—	
From South-West to North-East corners, . .	= 462·0
,, North-West to South-East ,, . .	= 461·3
Mean measured diagonal floor,	= 461·7
And same computed from sides, 412·6 and 206·3, . . .	= 461·3
Diagonals of East wall—	
Low North-east corner to high South-East, . .	= 309·2
Low South-East corner to high North-East (subtracting 1·6 for hole in low South-East corner),	= 310·0
Mean diagonal for East wall,	= 309·6
And same computed from breadth and height, 206·3 and 230·1, .	= 309·0
Diagonals of West wall—	
Low South-West corner to high North-West, .	= 310·4
Subtract 1·0 for a sunk floor stone, . .	= 1·0
	309·4

Low North-West to high South-West cannot be measured by reason of deep hole in floor in low North-West corner.

The diagonals of the north and south walls were unfortunately rather too long to measure: there is however every probability, from angular measures subsequently taken, that they are as nearly rectangular and parallel, as are the east and west walls.

KING'S CHAMBER, FLOOR OF.

This floor, though once exquisitely level in polished granite, and greatly praised by Howard Vyse and others for its remarkably close joints,—is now much decomposed as to some stones being higher, some lower, than others, by a total quantity of more than an inch. An effect, one is inclined to think, resulting, possibly, from earthquake action subsequently to the large excavations in the neighbourhood of this room, carried on both by the Colonel and Signor Caviglia: and it is worth while to record here, that Mr. Sopwith, in his *Notes on Egypt*, mentions finding the house of the engineer of the railway between Alexandria and Cairo half ruinous, in December 1856, from a then recent shock of earthquake.

The blocks of the floor are notably arranged in six grand stripes crossing the length of the room: but they are not equal in breadth. The joints, measured in the usual manner, give the following results:— (See Plate XIII.)

JOINTS ALONG SOUTH SIDE.

Joint.	Lengths, joint to joint.	Total distances from East side.	Remarks.
East wall,	0·0	0·0	
	(29·5)	(29·5)	A half stone merely.
1	63·2	63·2	
2	67·9	131·1	
	(46·6)	(177·7)	A half stone again.
3	88·3	219·4	
4	67·6	287·0	
5	67·0	354·0	
West wall,	58·6	412·6	

KING'S CHAMBER,

FLOOR OF—*continued.*

JOINTS ALONG NORTH SIDE.

Joint.	Lengths from joint to joint.	Total Distances from East side.	Remarks.
East side,	0·0	0·0	
1	63·2	63·2	
2	68·0	131·2	
3	88·0	219·2	
4	67·8	287·0	Portions of the northern ends of these
5	66·9	353·9	last three rows of stones have been ex-
West wall,	58·6	412·5	tracted, leaving a hole.

JOINTS ALONG EAST SIDE OF THE SEVERAL NORTH AND SOUTH FLOOR-COURSES.

Name of Joint.	East side.	Second line of blocks West of East wall.	Third line of blocks West of East wall.	Fourth line of blocks West of East wall.	Fifth line of blocks West of East wall.	Sixth line of blocks West of East wall.
North side,	0·0	0·0	0·0	0·0	0·0	0·0
1	107·4	20·1	55·0	21·1	34·3	21·0
2	78·8	93·2	46·9	136·2	152·0	...
3	...	...	83·9	...	...	...
South side,	20·1	93·1	20·6	49·1	20·1	185·3
Sum, giving breadth of chamber,	206·3	206·4	206·4	206·4	206·4	206·3

The 'coffer' stands upon the open floor of this room, without apparently any mark to guide its placing, or anything to prevent its being pushed

about anywhere. It is nevertheless most probably still very near its original position, for its place is very similar to that of the sarcophagus *sunk* up to its top in the floor of the large chamber of the second Pyramid. But the place evidently has been *somewhat* disturbed, for the south end of coffer is tilted up on a stone, a black flint pebble of modern pushing in, and about 1·5 high; the coffer is also nearer the north wall than the south by 20 inches; and is further askew on the floor, so that north end of west side is nearer to west wall, than is the south end of same side, by 2·5 inches; the distances measured in direction of coffer's sides being thus :—

South-East corner, from	South	wall,	. . . .	=	68·6
South-West	,,	,,	,, ...	=	67·9
North-East	,,	North	,, ...	=	47·7
North-West	,,	,,	,, ...	=	48·6
North-West	,,	West	,, ...	=	53·8
South-West	,,	,,	,, ...	=	56·3

KING'S CHAMBER, WALLS OF, GENERALLY.

These walls, by many persons thought the chief triumph of the Pyramid-builders' architectural skill, from the fineness and evenness of the joints, are also symbolically remarkable in being composed of five horizontal courses which run round and round the room, of the same height everywhere, and all of them of equal height with each other to 0·1 of an inch,—with only the single interference, viz., that over the doorway, to make its roof very strong, there is an enormous block introduced, equal,

throughout its length of 122·7 inches, to exactly *two* of the courses.

The '*fiveness*' of these courses is all the more noteworthy, because, while it seems to have been called attention to by the builders, in the four deep lines which subdivide the space over the antechamber entrance to this room into *five* portions,—many travellers have written that the number of courses in the King's chamber is *six*. (See Plate XIII.)

Yet not only are they five only, but all the five are of equal height, viz., 47·0 inches; for though the lower course appears, on being measured off the floor, to be only 42·0 inches,—yet the hole which exists in the north-west corner of the floor, enables one to see there the construction of the walls, and to perceive and feel that the granite of the lowest wall-course goes down five inches under the level of the floor before it comes to a joint; and then rests on limestone, as shown in a sketch made at the place, and to be seen in one corner of Plate XIII.

To prove beyond all doubt that there are five, and not six courses, I wished to have measured the height of each course, and then compared the sum of their heights with the whole height previously given by the great measuring-rod; but not being able to reach the *upper* courses, I give *them* only by eye-estimation, placing them in brackets in the following table: but supplying everything else by direct measure: the *roughness* of the first-course measures being due to the disorganized state of the floor.

VERTICAL HEIGHTS OF WALL COURSES IN KING'S CHAMBER, AS MEASURED IN DIFFERENT DIRECTIONS SEEN FROM THE CENTRE OF ROOM.

Directions bearing from centre.	Height of first course from floor.	Height of second course from floor.	Height of third course from floor.	Height of fourth course from floor.	Height of fifth course from floor.	Sum of heights of courses.	Height of room in same part by a previous independent measure.
E.-N.-East,	42·1	47·0	47·1	(47·0)	(47·0)	230·2	230·8
East, . .	42·4	47·0	(47·0)	(47·0)	(47·0)	230·4	...
E.-S.-East, .	42·7	47·1	47·0	(47·0)	(47·0)	230·8	230·8
S.-S.-East, .	Wall much fissured through several courses.						...
South, .	41·1	47·0	(47·0)	(47·0)	(47·0)	229·1	229·5
S.-S.-West,	41·4	47·0	47·0	(47·0)	(47·0)	229·4	229·9
W.-S.-West,	41·6	47·0	47·0	(47·0)	(47·0)	229·6	
West, .	41·6	47·0	(47·0)	(47·0)	(47·0)	229·6	...
W.-N.-West,	41·2	46·9	47·0	(47·0)	(47·0)	229·1	229·2
N.-N.-West,	Hole in floor caused by removal of three blocks.						...
North, .	42·0	47·1	(47·0)	(47·0)	(47·0)	230·1	229·7
N.-N.-East,	42·3	47·0	47·0	(47·0)	(47·0)	230·3	230·8

The above table can leave no doubt of the number of courses being five, or a characteristic Pyramid number: and as respects their equality of height round every side of the room, that must have cost a great effort in many ways; for elsewhere in the Pyramid, and as more particularly seen in the granite lining of King Shafre's tomb, if the object was to build a wall surface merely, the architect simply built a good surface, and cared not what the sizes and even heights of two adjoining stones were, so long as the joints between them were close and true. The argument therefore follows, that something more than a good wall was wanted, or

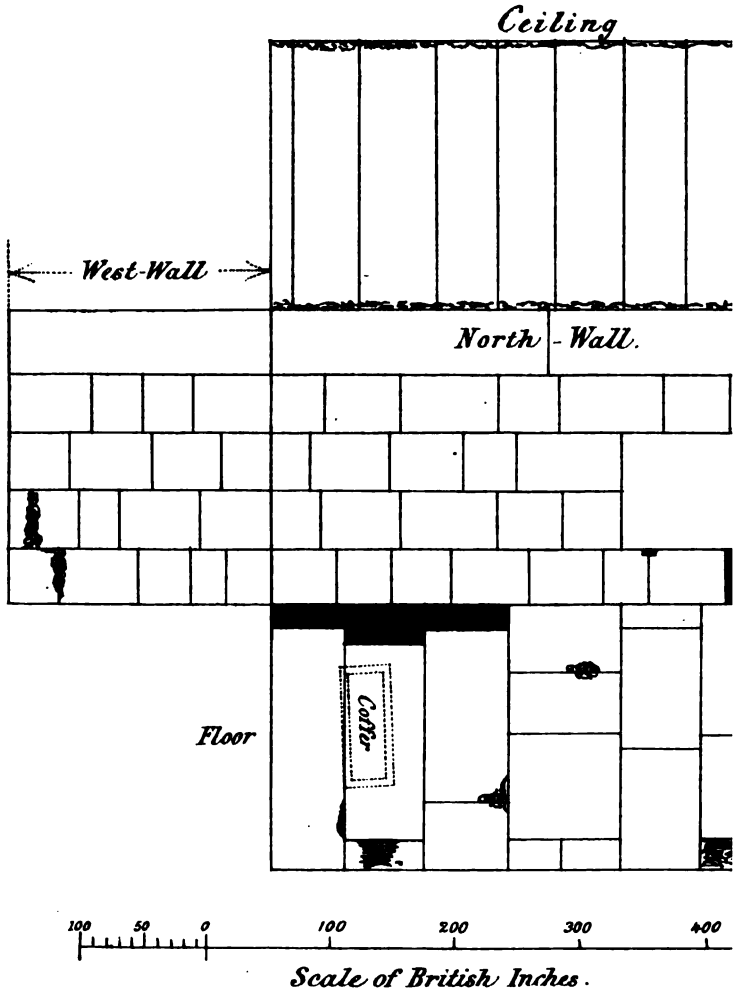
that something further was intended to be symbolized, by these *five* courses in the King's chamber.

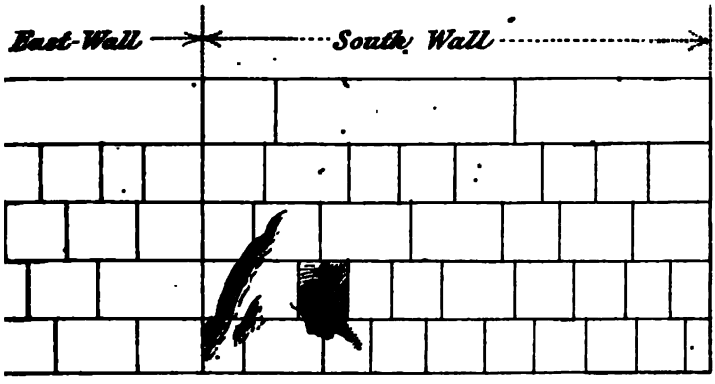
Each of the above five courses is formed in the run of its length, of many blocks, whose lengths are various; and apparently therefore, symbolically unimportant. I measured the lengths, however, in the three lower courses; and am enabled now, by the kindness of Mr. Aiton, to add the measures of all five, as taken soon after I had left by Mr. Aiton's assistant, Mr. Inglis. A comparison of his numbers with mine, through the three first courses, will indicate the possible limits of error where his stand alone: I have noted to my own, that the measures are very rude, and *not* worthy of competing in their united lengths for determining the whole length of any of the walls.

EAST WALL, VERTICAL JOINTS IN.

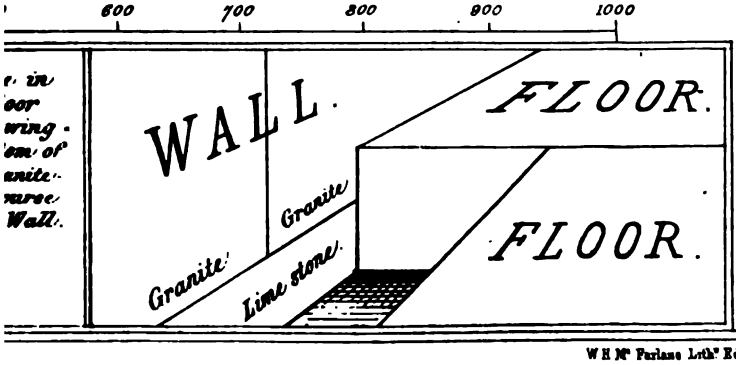
Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
North wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	16·8	15·9	16·8	71·6	72·0	71·6	52·7	52·9	52·7	43·0	43·0	..	..
2	30·5	31·0	47·3	56·8	55·9	128·4	(44·8	33·0)	97·5	37·9	80·9	..	..
3	44·0	44·0	91·3	..	..	..	(58·2	69·0)	155·7	48·0	128·9	..	..
4	65·4	65·0	156·7	..	..	..	..	..	..	35·0	163·9	..	..
South wall,	49·5	49·9	206·2	77·7	78·0	206·1	50·5	51·0	206·2	42·0	205·9	205·9	205·9

The brackets on two sets of numbers of the third course call attention to a case of certain blunder, either of mine, or Mr. Inglis's; but which,—it is now left to some third observer to determine.


Ceiling
West-Wall
North - Wall.
Floor
Coffer
100 50 0 100 200 300 400
Scale of British Inches.



THE SIDES OR WALLS, FLOOR & CEILING
OF KING'S CHAMBER
opened out on
plane of North-Wall.



W H M^c Farlane Lith^r Edin^r

West Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
South wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	36·0	36·0	36·0	14·7	15·0	14·7	47·8	48·0	47·8	65·0	65·0	..	..
2	61·7	61·9	97·7	37·6	37·0	52·3	67·4	67·9	115·2	41·0	106·0	..	..
3	42·0	42·0	139·7	34·9	35·0	87·2	58·3	58·1	173·5	41·0	147·0	..	..
4	32·3	31·9	172·0	69·0	69·0	156·2	..	..	..	..	..	..	..
North wall,	34·4	34·1	206·4	50·2	47·9	206·4	32·5	31·9	206·0	58·8	205·8	205·9	205·9

North Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
West wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	54·5	55·9	54·5	38·7	37·9	38·7	(36·0	48·5)	36·0	46·0	46·0	222·0	222·0
2	45·4	42·6	99·9	65·8	66·0	104·5	(63·6	51·4)	99·6	61·9	107·9	..	..
3	49·5	49·9	149·4	77·4	77·0	181·9	61·5	61·4	161·1	79·0	186·9	..	..
4	63·0	63·0	212·4	53·5	53·0	235·4	44·2	44·0	205·3	51·0	237·9	..	..
5	57·5	57·5	269·9	54·5	55·4	289·9	83·9	84·0	289·2	84·0	321·9	..	..
6	40·2	40·0	310·0	..	..	..	..	..	..	54·0	375·9	..	..
Door side or 7	62·0	61·4	372·1	..	..	..	..	..	..	..	..	..	..
East wall,	41·2	41·5	413·3	122·7	122·4	412·6	122·7	122·4	411·9	36·0	411·9	190·0	412·0

South Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
East wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	37·1	37.4	37·1	79·8	79·8	79·8	43·0	43·0	43·0	51·0	51·0	60·0	60·0
2	63·0	63·0	100·1	35·0	35·3	114·8	55·5	55·0	98·5	67·0	118·0	193·0	253·0
3	37·5	37·4	137·6	39·0	40·0	153·8	70·6	72·0	169·1	45·0	163·0	..	..
4	46·0	46·1	183·6	38·8	39·0	192·6	119·8	120·0	288·9	42·0	205·0	..	..
5	47·4	47·5	231·0	56·2	55·6	248·8	63·7	63·8	352·6	72·0	277·0	..	..
6	39·5	39·6	270·5	47·5	47·5	296·3	..	..	..	43·0	320·0	..	..
7	40·3	40·0	310·8	41·0	41·0	337·3	..	..	..	42·0	362·0	..	..
8	40·3	40·1	351·4	38·7	38·5	376·0	..	..	..	..	..	..	..
9	42·6	43·0	393·7	..	..	..	..	..	..	..	..	..	..
West wall,	19·1	18·0	412·8	36·2	35·3	412·2	59·0	58·0	411·6	49·9	411·9	159·0	412·0

REMARKS ON THE WALLS INDIVIDUALLY.

East Wall.

Good joints, and smooth surfaces of granite; no peculiarity except the unfortunate Russian-German inscription

Tcharikoff Nadlerberg
1845 $\frac{19}{31}$ Mai

smeared on in black oil-paint, and in letters six to twelve inches high.

West Wall.

This wall has joints in two courses near its southern end, low down, and therefore not far from the coffer,—seriously chipped by travellers for specimens.

North Wall.

This is chipped all round the corners of doorway, and round the air-hole.

This northern air-hole goes straight and rectilineally in, to a distance of more than 100 inches; after which it is stopped up with modern broken stones and sand.

On the north wall the measures of the mouth of the air-channel, which is rectangular, are as follows:—

East side of North air-hole distant from East end of room,	=	98·3
West ,, ,, ,,	=	106·6
Breadth of air-hole,	=	8·3
Height of top, from floor of room,	=	42·0
,, bottom on East side, from floor,	=	36·4
,, ,, West ,,	=	36·2
Tallness of air-hole,	=	5·7

South Wall.

Remarkable for fissures near east end, passing through several courses as they stand; there is much surface-fissuring also about the mouth of the air-channel. (See Plate XIII.)

This air-channel's mouth is a large, arch-roofed, tunnel-shaped thing; but at a distance inwards of from 50 to 100 inches it gradually decreases to much about the same size and proportions as the northern air-hole.

East side of South air-hole, at its broadest part, distant from East end of room, ...	=	91·4
East side of South air-hole, at level of first course, distant from East end of room, . . .	=	93·0
Breadth of the hole, at its broadest part, . .	=	17·5
,, at level of first course, . .	=	11·0
Tallness of hole, ...	=	23·1
Height from floor to top of hole, . . .	=	59·5
,, bottom of hole, . .	=	36·4

N.B.—The far-in, narrowed portion of this hole, seems to be beneath the level of the first wall course, similarly with the northern air-hole.

Ceiling.

The ceiling of the King's chamber is remarkably finished in appearance, being composed of polished granite, which crosses the room in lengths from north to south. In the run from east to west there are *nine* of these flat beams, but the two end beams have something more than the half of their breadth concealed; there are therefore in reality only *seven* full beams, and two portions of beams to form the ceil-

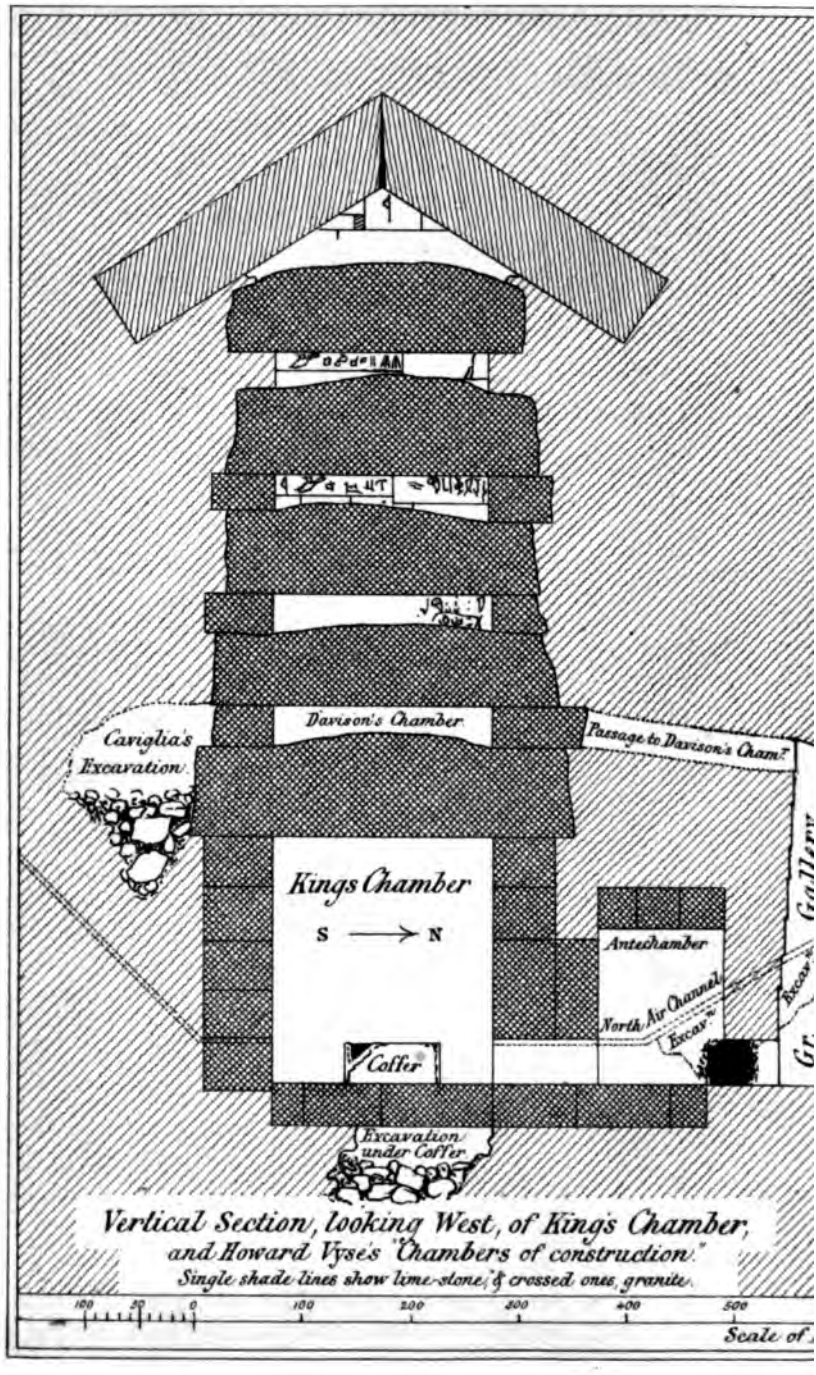
ing. The breadths, however, of the whole ones are not equal; and hence the number is probably not important symbolically. (See Plate XIV.)

I did not measure the breadth of these beams myself; but having compared Mr. Perring's drawings with Messrs. Aiton and Inglis's measures, and found a certain amount of resemblance, though not so close as it might be,—have deduced the following probable breadths, approximately :—

		Whole distances from East wall.
East wall of ceiling of King's chamber,	= 0·0	0·
East wall to Joint 1 ,, ,,	= 22· (?)	22· (?)
Joint 1 to 2 ,, ,,	= 50· (?)	72· (?)
,, 2 ,, 3 ,, ,,	= 52· (?)	124· (?)
,, 3 ,, 4 ,, ,,	= 53· (?)	177· (?)
,, 4 ,, 5 ,, ,,	= 49· (?)	226· (?)
,, 5 ,, 6 ,, ,,	= 46· (?)	272· (?)
,, 6 ,, 7 ,, ,,	= 61· (?)	333· (?)
,, 7 ,, 8 ,, ,,	= 57· (?)	390· (?)
,, 8 to West wall, ,, ,,	= 22· (?)	412·

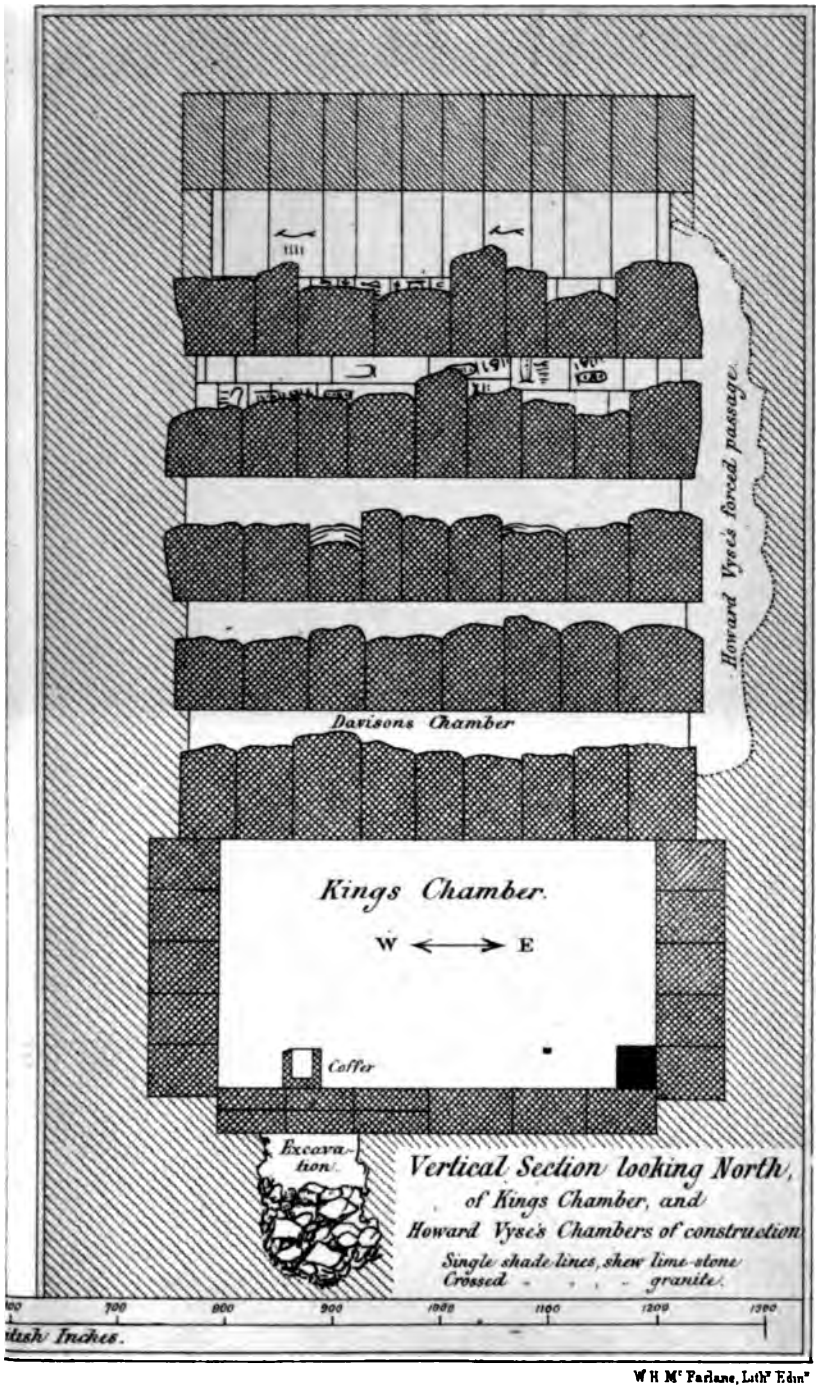
These beams, of course, cross the King's chamber in one entire length; and not only so, but extend over the thickness of the granite lining of the walls, or 60· inches on either side. As the beams are further of greater depth than breadth, in joist fashion, they form altogether some of the largest and heaviest stones known to exist in the whole Pyramid; and one of them at least, has a

Breadth of . . . 60· inches
Depth of . . . 80· ,,
And Length of . . . 326· ,,
The sum in cubic inches, amounting to 1,564,800.



Vertical Section, looking West, of Kings Chamber, and Howard Vyse's "Chambers of construction."

Single shade lines show lime-stone, & crossed ones, granite.



W H M^c Farlane, Lith^r Edin^r

Yet this mighty ceiling, as every one knows since Colonel Howard Vyse's admirable discovery, has above it, five successive ceilings, all designed to assist in taking off the extreme pressure of the upper part of the Pyramid on the lowest ceiling. I did not visit those upper chambers, being quite content with the Colonel's and Mr. Perring's measurements thereof; but inasmuch as they contain the dark and closed-up hollows, wherein the quarry-marks expressing the names of kings of the fourth dynasty have been found on some of the stones, and are necessary to understanding the mechanics of this room,—I subjoin two drawings of them, prepared from the Colonel's large publication. (See Plate XIV.)

The granite, in section is indicated by cross lines; limestone, by single lines. The quarry-marks are found only on limestone, and that from Mokattam. The lowest of the five chambers of construction had been known before Colonel Howard Vyse's time, being called indeed after an English consul, Davison, in the eighteenth century, as duly mentioned by the Colonel in his honest and faithful volumes.

THE COFFER.

MARCH 20-23, 25.

THIS vessel, the sole contents of the King's chamber, and termed, according to various writers, stone box, granite chest, lidless box, porphyry vase, sarcophagus, and coffer,—is composed, as to its material, of a blackish variety of red granite. And there is no difficulty in seeing this; for although the ancient polished sides have long since acquired a dark chocolate hue,—there are such numerous chips effected on all the edges in recent years, that the component crystals, quartz, mica, and felspar may be seen even brilliantly. (See Plate I. vol. i.)

The vessel is chipped around, or along, every line and edge of bottom, sides, and top; and at its south-east corner, the chippings extend to a breaking away of nearly half its height from the top downwards. It is, moreover, tilted up at its south end, by a black flint pebble, about 1·5 inch high, pushed in underneath the south-west corner. The vessel is therefore in a state of strain, aggravated by the depth to which the vertical sides have been broken down near one corner; and great care must be taken

in outside measures, not to be misled by the space between some parts of the bottom and the floor.

As for the under surface of the bottom, I felt it, near the south end, with my hand; and tried to look under it also, when a piece of magnesium wire was burning there,—without being sensible of any approach to hieroglyphics or engraving. But as to the inside, or upper, surface of the bottom, and the vertical sides of the vessel, both inside and out,—all the ancient surfaces there are polished smooth; they are also, all of them, simple, plain, and flat (sensibly to common observation); excepting only the top margin,—which is cut into, in a manner implying that a sarcophagus lid once fitted on, sliding into its place from the west, and fixable by three steady pins, entering holes on that side.

The west side of the coffer is therefore lowered all over its top surface, except at the north and south ends, by the amount of depth of such lid cut-out, or 1·72 inch; and the other, or east, north, and south sides, are, or should be, lowered to the same depth *on their inner edges*, and to a distance from inside to out, of about one-third the whole thickness. But the fulness of this arrangement cannot be seen now, because in some places, both ledge and top of sides are broken away together; and in others, though much of the inner angle of the ledge remains,—thanks to its protected position,—the upper and true surface of the side has all been chipped away. In fact it is only over a short length near

the north-east corner of the coffer, that the chippers have left any portion of the original top surface.

The whole question, therefore, of the full depth of the coffer, rests on that one small portion of the north-east wall, so to speak, of the coffer.

At the north-east corner only, is there an opportunity of measuring the vertical depth between the ancient top surface of a side, and the bottom surface of the *ledge*; and it was, by repeated measure, found = from 1·68 to 1·70 and 1·75; say mean = 1·72 inch.

The sides of the depression are vertical, or without any dovetailing: and the horizontal breadth of such cut-out,—measuring from within, to, or towards, the 'without' of the coffer,—and restoring the sides to their original completeness before the chipping away of the edges,—is—

On and near Western portion of Northern side,	=	1·65
,, Middle ,, ,,	=	1·62
,, Eastern ,, ,,	=	1·73
,, Northern part of Eastern side,	=	1·55
,, Middle and North-east ,,	=	1·60
,, Southern ,, ,,		*all broken.*
,, Eastern and Western parts of Southern side, . . .		*all broken.*

Along the western side are three fixing-pin holes, 1·2 deep, and 0·84 in diameter, save where they are broken larger, as is chiefly the case with the middle, and southern one. The three holes have their centres at the following distances from north end; viz., 16·0, 45·3, and 75·1 respectively.

It is inconceivable how the French Academicians

could have pictured the coffer, without noticing the ledge cut-out; unless they looked upon that, as a comparatively modern attempt to convert the original pure coffer, into a sarcophagus: and which they were therefore bound to overlook.

OUTSIDE OF COFFER: ITS FIGURE.

The planes forming the four external vertical sides of the coffer, are far from true; excepting the east one, whose errors are under 0·02; while the north, west, and south sides are so largely concave as to have central depressions of 0·3 and 0·5; or more particularly—

At North side, central hollow or depression of coffer's side (measured from a horizontal straight-edge touching the side at either end, and in a horizontal plane), or the quantity, *d*, near bottom,	=	0·45
,, middle of height,	=	0·20
,, top,	=	0·12
Mean,	=	0·26
At West side, *d*, near bottom,	=	0·35
,, ,, middle,	=	0·15
,, ,, top,	=	0·10
Mean,	=	0·20
At South side, *d*, near bottom,	=	0·28
,, ,, middle,	=	0·18
,, ,, top,	=	0·10
Mean,	=	0·19

Again, when the straight-edge is applied *vertically* to the sides,—east side comes out true, but the others concave—

On North side, the maxima of such depression, or $d' = 0{\cdot}20$ and $0{\cdot}28$
On West side, d', at South end, ... = $0{\cdot}00$
and d', at North end, ... = $0{\cdot}20$
And on South side, d', at different distances from East to West, ... = $0{\cdot}08$, $0{\cdot}12$, and $0{\cdot}04$

ITS SIZE, OUTSIDE.

The corners and edges of the coffer are so much chipped, that the steel claws I had had prepared for the sliding-rods to adapt them from inside to outside measures, were found not long enough to reach the original polished surfaces. A method was therefore adopted, of making up the sides with straight-edges projecting beyond the coffer at either end; and then measuring between such straight-edges, and on either side, or end, of the coffer.

LENGTH OF COFFER OUTSIDE, MEASURED WITH BAR 100 A.

	1st Measure.	2d Measure.	3d Measure.
On East side, near bottom, . .	90·5	90·3	90·5
,, 10 inches under top,	90·15	...	...
,, above top, . .	90·20	...	...
On West side, near bottom, . .	89·2	89·2	89·2
,, above top, . .	89·95	...	...
,, near top, . .	90·05	...	...
Mean, . . .	90·01	...	...

The above mean, however, represents only the mean length of the edges of the two sides, not of the whole coffer, on account of the concavity of the two external ends; wherefore, if we desire to state the mean length, for the mean of each end surface, we must subtract two-thirds of the mean

central concavity, as previously determined; *i.e.*, = 0·17 for the north end, and similarly 0·13 for the south end; wherefore, then, the mean length for mean of each end of coffer . . = 39·71

BREADTH OF COFFER, OUTSIDE.

	1st Measure.	2d Measure.	3d Measure.
At North end, near bottom, . .	39·05	39·1	39·2
,, near top, . .	38·7	...	...
,, over top, . .	38·67	...	...
At South end, near bottom, . .	38·8	38·7	...
,, near top, . .	38·6	...	...
,, over top, . .	38·5	...	...
Mean, . . .	38·72	...	...
Correction for curvature of West side, . .	·07	...	...
Mean breadth of mean sides,	38·65	...	...

HEIGHT OF COFFER, OUTSIDE.

Height of coffer outside, eliminating the stone under bottom, and the sarcophagus ledge of 1·72; *i.e.*, measuring from coffer-bottom to *extreme* top of sides, is—

At North end, eastern part of it, ...	=	41·3
Same repeated, ...	=	41·3
At North end, north-eastern part of it, . .	=	41·22
At other parts, no top left.		
Mean,		41·27

Correction for a supposed hollow curvature of under side of bottom; agreeably with three, out of the four, upright sides; and also agreeably with the construction of the under sides of the casing-stones, which rest on their circumferences, on account of a slight hollowing away of their central areas; not less than . .	=	·10
		41·17

SIDES, THICKNESS OF.

For this purpose two vertical straight-edges were placed opposite each other, in contact with the inside and outside surfaces of any flank of the coffer, and the distance across measured; finding at successive parts of the coffer circumference, bearing from centre—

South-south-west,	thickness,	=	6·0
South,	,,	=	6·0
South-south-east,	,,	=	5·95
East-south-east,	,,	=	5·85
East,	,,	=	5·95
East-north-east,	,,	=	6·10
North-north-east,	,,	=	5·95
North,	,,	=	5·98
North-north-west,	,,	=	6·10
West-north-west,	,,	=	5·95
West,	,,	=	6·10
West-south-west,	,,	=	5·95
	Mean thickness of vertical sides,	=	5·99

The above measures were repeated on March 28th, and proved sensibly true for this method of measurement over the top edge of the coffer; but if calipered lower down, it is extremely probable that a notably different thickness would have been found there.

BOTTOM OF THE COFFER, THICKNESS OF.

By difference of heights of two straight-edges of equal length, applied, one inside and one outside,—the outside one being further propped up where

required by a third straight-edge, inserted under the bottom,—there was found—

Under	South-west corner,	thickness of bottom,	.	.	=	7·0
,,	East side,	,,	,,	.	=	6·6
,,	East-north-east,	,,	,,	.	=	6·67
,,	East-north-east, again,	,,	,,	.	=	6·90
,,	North end,	,,	,,	.	=	6·90
,,	North-north-west,	,,	,,	.	=	6·85
,,	North-north-east,	,,	,,	.	=	6·80
,,	West-north-west,	,,	,,	.	=	7·20
,,	West,	,,	,,	.	=	6·90
,,	South-south-west,	,,	,,	.	=	7·15
Mean thickness of bottom around the edges (the thickness of bottom in the centre cannot at present be measured),					=	6·92

INTERNAL MEASURES.

The inside surfaces of the coffer, seem very true and flat over the greater part of their extent; but betray, on examination by straight-edges, a slight convergence at the bottom, towards the centre.

INSIDE LENGTH OF COFFER, BY SLIDER 70.

(Correction + 0·13 added to all the readings for length of Slider.)

Distance between East and West sides of the North and South ends.	Level at which observations were taken.			
	4 to 6 inches under top.	Middle of height.	6 to 7 above bottom.	0·6 above bottom.
Close to Eastern side, .	Broken at S.-E. corner.	78·08	77·93	77·68
At ¼d breadth from East, .	78·06	78·06	77·97	77·56
Halfway between E. and W.,	78·06	78·08	78·06	77·53
At ¾ds breadth from East, .	78·05	78·09	78·06	77·59
Close to west side, . .	78·03	78·06	78·01	77·57
Mean at each level, .	78·05	78·07	78·01	77·59
Mean of the whole, or inside length of coffer, . .	= 77·93			

INSIDE BREADTH OF COFFER.

(By Slider 25, not requiring any correction.)

Distance between North and South end, along the East and West sides.	Level at which observations were taken.				
	Near top.	Near middle.	6 to 7 above bottom.	0·6 above bottom.	0·6 Re-measured.
Close to North end, .	26·68	26·69	26·65	26·40	26·39
At ¼d length from N. end,	26·60	26·69	27·00	26·72	26·54
Near middle of length, .	26·64	26·80	27·10	27·05	27·05
At ¾ds length from N. end,	26·67	26·78	26·77	26·67	26·75
Close to South end, .	26·78	26·78	26·63	26·49	26·49
Mean at each level, .	26·67	26·75	26·83	26·67	...
Mean of the whole, or inside breadth of coffer, .	= 26·73				

INSIDE DEPTH OF COFFER.

The measure of this element is taken from the inside bottom of the coffer,—which is apparently smooth and flat,—up in the shortest line to the level of the original top-surface of the north, the east, and the south sides; and of the west side also, *presumably*, before it was cut down to the level of the ledge which runs round the inner edges of the north, east, and south sides.

Now, the depth of that ledge was before ascertained = 1·72 inches below the original top; a block of wood was therefore prepared of that thickness, and placed on the west side, to support one end of a straight-edge, whose other end rested on some part or parts of the original top, which is still preserved at and about the north-east corner.

[illegible] Depths from [illegible] top of North, East, and South sides.

(By Slider 25, not requiring any correction.)

Part of Length where observations were taken.	Part of Breadth where observations were taken.			
	Near East side.	Near middle.	Near West side.	Mean at each part of length.
0·6 south of inner N. end,	24·30	24·28	24·26	24·28
3·0 south of inner N. end,	24·44	24·36	24·35	24·38
5·0 Do. do.	24·42	24·41	24·28	24·37
10·6 Do. do.	24·40	24·38	24·28	24·35
24·0 Do. do.	24·36	24·38	24·26	24·33
Mean at each part of breadth,	24·38	24·36	24·29	24·34
General mean, or inside *depth* of coffer,	= 24·34			

COFFER, INSIDE MEASURES OF.

Diagonals.

Diagonals inside the north end; from either low corner at bottom, up to a measured height of 30·0, or the greatest height quite free from fractures; then—

from low North-east to 30· high North-west, = 39·71
and from low North-west to 30· high North-east, = 39·70

Diagonals inside west side; from either corner below, up to a height of 30 inches measured at the sides—

or from low South-west to 30· high North-west, = 83·19
and from low North-west to 30· high South-west, = 83·13

Cubical Diagonals.

From low South-west to 30· high North-east, = 87·13
„ South-east „ North-west, = 87·05
„ North-east „ South-west, = 87·06
„ North-west „ South-east, temporarily supplied, = 87·11

These diagonals give sensibly less than the mean lengths and breadths; on account, apparently, of the extreme points of the corners of the bottom not being perfectly worked out to the exact intersection of the general planes of the entire sides. But they seem abundantly sufficient to prove general rectangularity of figure, in the main part of the coffer's interior.

AZIMUTH TRENCHES.

JANUARY.

ON the east side of the Great Pyramid, several explorers have described certain *trenches* cut in the rock. Their notices, nevertheless, generally refer to a system of Pyramid *passages*, one entering the ground at a steep angle from the south, and another from the north; and meeting below the surface, in a vertical and meridian plane. These are therefore not trenches proper, or hypœthral cuts in the ground,—but tunnellings into its substance; on a very much smaller scale too, than the *trenches* of which we have now to speak,—and have denominated *azimuth* trenches.

These azimuth trenches, then, are a sort of large open ditches, spread about here and there on the surface of the hill, before the eastern face of the Great Pyramid; and not very noticeable, except for their relative angles in a horizontal plane; for these gave me the idea, at first sight, of being strangely similar to the dominant angles of the exterior of the Great Pyramid. (Plate XV.)

To ascertain whether this idea was true or not, I determined to measure all the angles rather carefully; and, as a necessary preliminary, proceeded to make myself acquainted with the forms of the

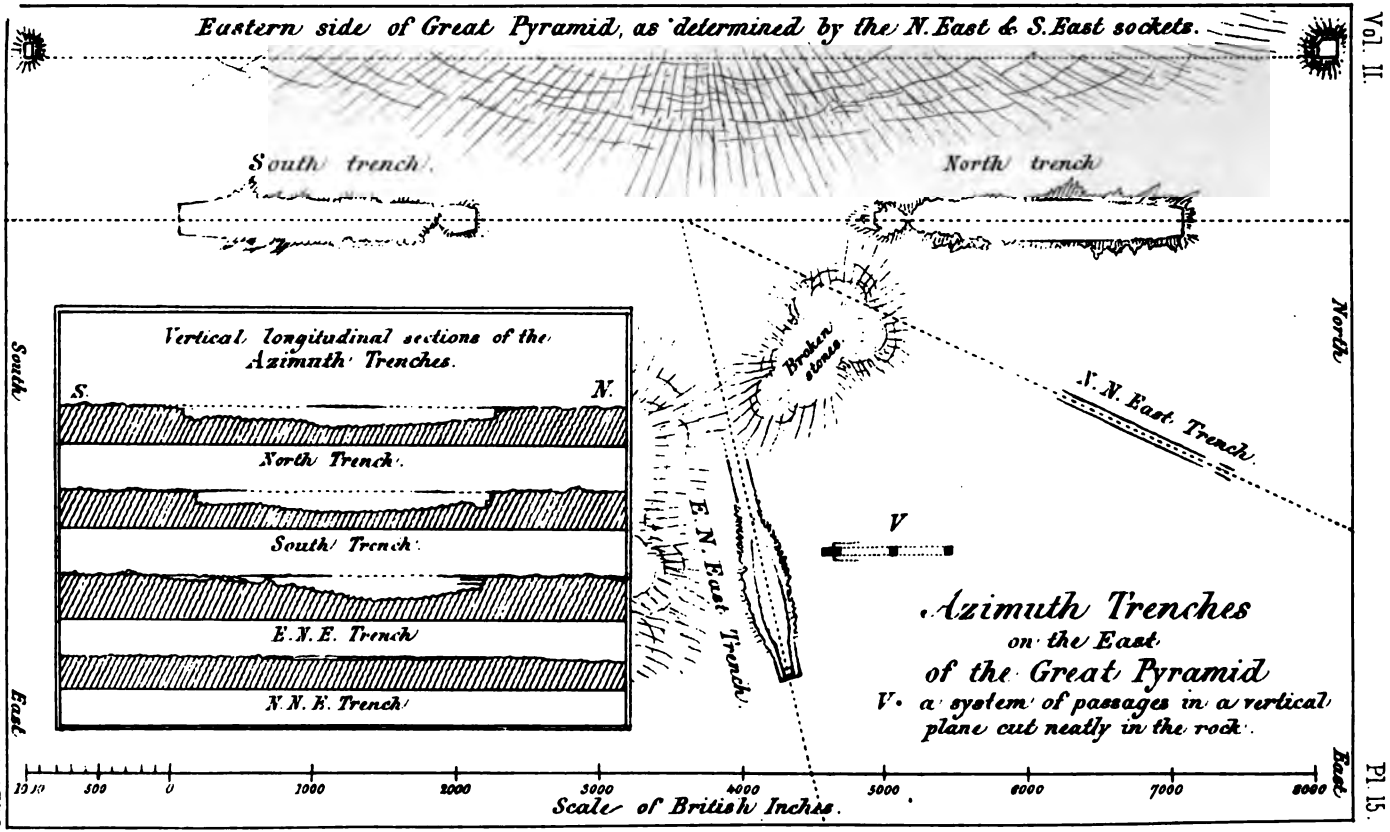
trenches, by approximate linear measures. The trenches are four in number, named the North, the South, the East-north-east, and the North-north-east; the latter being a very small one (in breadth and depth), and only to be thought of in connexion with the others when looking to its angular position on the ground. The trenches are shown on the accompanying Plate (XV.), where I have endeavoured to mark wherever there is a *worked* surface still existing; and the numerical dimensions are as follows :—

NORTH TRENCH.

Total axial length,	=	2138 inches.
Distance of its furthest end from central point C,	=	3492
Distance of same from North side of base of Pyramid, produced eastward, but uncertainly,	=	950 ?
Distance of longitudinal axis, from East side of Pyramid base, uncertainly,	=	1220 ?
Depth, at North end, worked surface,	=	70
,, near middle, worked surfaces,	=	110
,, about 200· short of South end,	=	100
Breadth, at North end, worked corners,	=	177
,, near middle,	=	280
,, South end, smaller than North, but uncertain.		

SOUTH TRENCH.

Total axial length,	=	2060
Distance of its furthest end from central point C,	=	3490
Distance of same from South side of base of Pyramid, produced east, but uncertainly,	=	1020 ?
Distance of longitudinal axis, from East side of Pyramid base, uncertainly,	=	1250 ?
Depth at South end, worked surface,	=	70
Depth at North end, first step, worked surface,	=	25
,, ,, second step, ,,	=	22 ?
Breadth, at South end, worked surface,	=	200
,, near middle, rough and worn,	=	280 ?
,, at North end, first step,	=	127
,, ,, second step,	=	106



W.H.M. Perlan. Lith. Edin.

EAST-NORTH-EAST TRENCH.

Total axial length uncertain, because no termination inwards to C, could be found, ...	=	1530 + x.
Distance of its furthest end from C, ...	=	3280
Depth, at outer or E.N.E. end, first step, worked surfaces, ...	=	40
„ „ second step, „	=	50
„ „ third step, „	=	60
Depth, near middle, ...	=	150
„ towards inner end, as far as traceable, but much filled with rubbish, ...	=	40
Breadth, at outer or E.N.E. end, first step, worked surfaces, ...	=	150
„ „ second step, .	=	44
„ „ third step, .	=	50
Breadth near middle, ...	=	250
Breadth, near inner end, between longitudinal worked surface, ...	=	165

NORTH-NORTH-EAST TRENCH.

Neither outer nor inner ends sharply defined.

Total length, of two marked portions, . . .	=	1280
Distance of furthest visible part from C, . .	=	4200
Breadth, at all parts, worked surfaces, 39· to 40·, say	=	40
Depth, at all parts, roughly, 10· to 12·, say .	=	12

The system of vertical *passages* is only inserted approximately on the plan of the trenches in Plate XV., as I did not *measure* their distance from other known objects. Their general appearance and nature are shown in fig. 4, of Plate II., in vol. iii. Compare also the map in Plate II. vol. i.

The bottoms of all the azimuth trenches were filled with more or less broken stones and rubbish, to an extent beyond my means of clearing out.

LINEAR MEASURES OF THE GREAT PYRAMID.

April 6, 10, 27, 1865.

HEIGHT, VERTICAL.

On the evening of April 10, in ascending the Great Pyramid, I measured in a rough manner the height of every course of stones; and repeated the measure next morning in descending. The two sets were not always quite so similar as they should have been, and the second gave 202 courses, while the former gave 201. Differences which may have arisen, both from the tracks up and down not being precisely the same; and because it was often difficult to say, from dilapidation, where any particular course began or ended: especially as the courses of masonry,—though generally running uniformly along all four sides, if not also through the whole Pyramid,—were in some particular places composed of two layers of stone, each of which might then be taken inadvertently as a single course; or again, two small courses rather ruined, might appear as one large one. There is, however, abundant proof, on looking over the numbers, that the courses are not of uniform or regular

decreasing or increasing thickness; and that they form little more than a core or substance upon which the ancient builders fastened the casing-stones with their fixing series, and *thereby* gave truth of figure to the whole Pyramid.

At the time of measuring, I merely made a guess at the depth of rubbish concealing the true foot of the Pyramid; but was able afterwards to correct it, when the socket of the corner-stone was uncovered at the north-east angle. And, reducing this to the supposed 'pavement' surface (see p. 136), we have the following numbers :—

MEASUREMENT OF VERTICAL HEIGHT OF GREAT PYRAMID.

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement	Every tenth course	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
Pavement	0·	0·	0·	0·	21	24	747		
1 & 2	79	79			22	23	770		
3	56	135			23	35	805		
4	48	183			24	33	838		
5	40	223			25	31	869		
6	40	263			26	38	907		
7	38	301			27	26	933		
8	39	340			28	28	961		
9	38	378			29	31	992		
10	36	414	414	414	30	30	1022	299	1022
11	34	448			31	26	1048		
12	33	481			32	28	1076		
13	30	511			33	28	1104		
14	30	541			34	24	1128		
15	28	569			35	24	1152		
16	30	599			36	50	1202		
17	28	627			37	41	1243		
18	26	653			38	39	1282		
19	32	685			39	38	1320		
20	38	723	309	723	40	34	1354	332	1354

MEASUREMENT OF HEIGHT OF GREAT PYRAMID—*continued.*

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
41	32	1386			81	22	2524		
42	32	1418			82	24	2548		
43	28	1446			83	24	2572		
44	32	1478			84	26	2598		
45	42	1520			85	26	2624		
46	37	1557			86	25	2649		
47	28	1585			87	25	2674		
48	35	1620			88	24	2698		
49	36	1656			89	24	2722		
50	30	1686	332	1686	90	25	2747	245	2747
51	28	1714			91	36	2783		
52	30	1744			92	33	2816		
53	26	1770			93	31	2847		
54	27	1797			94	28	2875		
55	24	1821			95	26	2901		
56	26	1847			96	25	2926		
57	22	1869			97	24	2950		
58	26	1895			98	24	2974		
59	27	1922			99	41	3015		
60	30	1952	266	1952	100	37	3052	305	3052
61	28	1980			101	34	3086		
62	26	2006			102	32	3118		
63	26	2032			103	30	3148		
64	26	2058			104	28	3176		
65	28	2086			105	27	3203		
66	26	2112			106	27	3230		
67	26	2138			107	26	3256		
68	34	2172			108	25	3281		
69	33	2205			109	29	3310		
70	31	2236	284	2236	110	25	3335	283	3335
71	28	2264			111	24	3359		
72	28	2292			112	24	3383		
73	27	2319			113	24	3407		
74	26	2345			114	23	3430		
75	31	2376			115	23	3453		
76	28	2404			116	23	3476		
77	26	2430			117	25	3501		
78	24	2454			118	23	3524		
79	24	2478			119	35	3559		
80	24	2502	266	2502	120	31	3590	255	3590

HEIGHT OF GREAT PYRAMID—*contd.*

						81	22	2524		
						82	23	2548		
						83	24	2572		
						84	26	2598		
						85	26	2624		
						86	25	2649		
						87	25	2674		
						88	24	2698		
						89	24	2722		
					1686	90	25	2747	245	2747
						91	26	[illegible]		
						92	31	2819		
						93	31	2847		
						94	28	2875		
						95	26	2901		
						96	25	2926		
						97	24	2950		
						98	24	2974		
						99	41	3015		
					1037	100	37	3052	307	3054
						101	34	3086		
						102	32	3118		
						103	30	3148		
						104	28	3176		
						105	27	3203		
						106	27	3230		
						107	26	3256		
						108	25	3281		
						109	29	3310		
					1796	110	25	3335	283	3337
						111	24	3359		
						112	24	3383		
						113	24	3407		
						114	23	3430		
						115	23	3453		
						116	23	3476		
						117	25	3501		
						118	23	3524		
						119	35	3559		
						120	31	3590	283	3590

MEASUREMENT OF HEIGHT OF GREAT PYRAMID—*continued.*

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
121	29	3619			161	21	4557		
122	28	3647			162	21	4578		
123	26	3673			163	24	4602		
124	26	3699			164	23	4625		
125	24	3723			165	25	4650		
126	24	3747			166	22	4672		
127	23	3770			167	22	4694		
128	23	3793			168	21	4715		
129	23	3816			169	21	4736		
130	23	3839	249	3839	170	20	4756	220	4756
131	27	3866			171	21	4777		
132	25	3891			172	20	4797		
133	23	3914			173	21	4818		
134	22	3936			174	21	4839		
135	22	3958			175	20	4859		
136	22	3980			176	21	4880		
137	25	4005			177	20	4900		
138	23	4028			178	20	4920		
139	25	4053			179	21	4941		
140	25	4078	239	4078	180	20	4961	205	4961
141	22	4100			181	26	4987		
142	22	4122			182	25	5012		
143	22	4144			183	23	5035		
144	22	4166			184	24	5059		
145	28	4194			185	22	5081		
146	27	4221			186	21	5102		
147	24	4245			187	21	5123		
148	22	4267			188	20	5143		
149	22	4289			189	21	5164		
150	21	4310	232	4310	190	21	5185	224	5185
151	26	4336			191	21	5206		
152	26	4362			192	21	5227		
153	25	4387			193	21	5248		
154	22	4409			194	20	5268		
155	21	4430			195	21	5289		
156	21	4451			196	22	5311		
157	21	4472			197	24	5335		
158	21	4493			198	22	5357		
159	21	4514			199	22	5379		
160	22	4536	226	4536	200	22	5401	216	5401
					201	22	5423		
					202	22	5445	44	5445

The course marked above 202, forms the present effective flat summit of the Pyramid; for though there are portions of two other and higher courses (one of 21 and the other of 19 inches) they are too fragmentary to allow any calculations to be made upon them, for approximating to the ancient height of the Pyramid.

But course 202 is complete, in so far as it forms a general square, and an equally good or bad termination to all the four present Pyramid sides, as now deprived of their casing-stones. Said course is built of good, hard, firm, rectangular blocks of Mokattam stone, browned with oxide of iron over the surface; but the original workmanship was only that of the core masonry, and the corners of the platform have been sadly broken in upon. When these were rudely made up, or supplied as to the missing stones, with measuring-rods,—each of the four sides measured something like 400 inches in length; and the diagonals 570 or 580; which implies a length of side = 406; but there were more obstructions in the way of the diagonal, than the side, measures.

Hence then, we conclude that the present height of Great Pyramid, from surface of pavement to top of present platform, or 202d course, = 5445 British inches; and that said platform is a square, of 400 inches in the side, nearly.

The peculiar shelf, or great cut-out in the north-east angle, known among the Arabs as 'half-way,'

is considerably more than half-way, or occurs with its floor at or near both the 105th course, and a height of 3203 inches; leaving therefore from thence to platform summit, 97 courses, and 2242 inches.

LENGTH OF SIDES OF PYRAMID BASE.

On April 6th, I attempted to measure the length of each side of the Pyramid's base with a 500-inch cord; and made each side between 8900 and 9000 inches in length; leaving an unknown quantity to be added on for the casing-stone thickness.

The above numbers, therefore, apply only to the internal core of masonry; and include an attempt to supply its lower corners, which are egregiously broken away, and rendered thereby absurdly blunt in figure. But the problem is next to impossibly difficult; both from the extent and abnormal character of the fractures, and the concealment of one end from the other, of each side of the base by the intervening heap of rubbish; that heap of rubbish too, not only altering the line vertically,—which would be its only effect if lying against a vertical wall,—but azimuthally also, on account of the sloping flank of a Pyramid.

In the third and fourth weeks, however, of April, Mr. Inglis, deputed by Mr. Aiton, having uncovered all four sockets of the Pyramid,—the sockets, as believed, of the corner stones of the ancient casing,—he was enabled to eliminate all uncertainties of thick-

ness of such once existing casing, and had only remaining the difficulties of the ground to contend with. Subject therefore still to those difficulties, —and they are excessive—Mr. Inglis handed me, on April 27, the following measures :—

		Inches.
Length of North side of base of Great Pyramid, from socket to socket (their outer corners), . . .	=	9120
Length of South do. do., . . .	=	9114
„ East do. do., . . .	=	9102
„ West do. do., . . .	=	9102
Mean,	=	9110

CORNER SOCKETS.

Now these corner-sockets of the Pyramid were, from my own measures, of the following sizes and shapes :—

North-east socket—

East side, length = 152· inches.
North „ = 137· „
South „ = 121·0 to a cut-off of 26· and then another of 21·
West „ = 157·0 to South side produced rudely.
Diagonal North-west to South-east = 200·0.
Semi-diagonal, centre to North-east corner = 100·0, + thickness of measuring-rods.
Depth, varying from 3 to 7 inches.
Distance of outer, or North-east corner of this North-east socket, from present North-east corner of Pyramid as standing now, = about 350 inches.

The above socket was once cut neatly in the firm live rock of the hill; and is still remarkably true in level, and smooth all over its floor; the sides are evidently injured by wear and tear, and are of unequal depth, besides their symptoms of erosion.

The diagonal, computed from the north and east sides, comes out 4·5 inches longer than that directly observed, which is probably owing to the greater wearing of the outer corner; for the diagonal was really so very close to 200 inches, that the two rods of 100 inches each in length would just extend along the straight line, when put in edgeways, but not when put in flatways. (See Plate of Sockets; or Plate IX. vol. i.; also Plate IV. vol. i.)

South-east socket—

East side in length, ... = 52· inches.
North ,, ... = 81·5 ,,
South ,, ... = 86· ,,
West ,, ... = 53· ,,
Diagonals, N.-E. to S.-W. corner, observed = 100, computed = 101·
,, S.-E. to N.-W. ,, ,, = 100, ,, = 97·
Depth somewhere from 12 to 20.
Distance of outer or South-east corner, from present South-east corner of Pyramid = 330.

This hole is cut in the rock, and its bottom is well and smoothly levelled; the sides are rather sloping and converging towards the bottom, so that the 100-inch rods, measuring both diagonals, jammed about halfway down; the upper surface of the rock was not cleared and was not distinct.

North-west socket—

North side in length, . . = 87
East ,, . . = 137 + x.
West ,, . . = 100 + x.
South ,, . . = not uncovered, or not visible.
Diagonals not to be measured, as well from South side not being discoverable, as from a large block of building-stone out of the Pyramid having chanced to fall into the middle of the area of the socket, and being, to us, immovable.

Depth about sides observed, from 4 to 11 inches.
Floor smoothly levelled.
Distance of outer or North-west corner of socket from present North-west corner of Pyramid = 350· about.

South-west socket—

North side in length, ... = 141·
East ,, ... = 72· + *x*.
West ,, ... = 74·3
South ,, ... = 142·

Diagonals not measured.
Depth of North-east sides from 2 to 3 inches.
But South side is high, above the rock surface outside, or South of it, by about 1 inch.
And West side is level with what is outside it, being merely marked by a line drawn with a blunt tool, similarly with the lines of rectangle in the entrance passage of the Great Pyramid.
Distance of outer or South-west corner of socket, from South-west corner of Pyramid, = 350·, about.
Floor well cut, smoothed, and levelled.

The floors of all the above sockets are exquisitely cut out in the rock, and levelled within their own area; but they are neither cut to the same depth in the rock near them, nor to a uniform general level; for according to Mr. Inglis's measures—

Taking the North-east socket floor for 0·0 in level.
South-east ,, is 13·6 inches low.
North-west ,, 4·2 ,, low.
and South-west ,, 5·6 ,, high.

THE PAVEMENT.

But the floors of no sockets can form the commencing surface, *i.e.*, the datum plane, or bench mark for level of the whole Pyramid, and for referring all heights to. That end is rather fulfilled by the upper surface of the *pavement* which Colonel Howard Vyse, when cutting down through the

middle of the northern rubbish-mound, discovered in front of that side of the building; and on which his casing-stones, *in situ*, stood, and from which the inclined side of the Pyramid rose. The pavement was there, about 400 inches broad and 21 thick; and was thence supposed to extend all round the Pyramid, with the same thickness and breadth; but when the same northern rubbish-mound was cut into again, in the middle of each half of it, east and west of its centre,—the pavement was only found there, about 120 inches broad, though broken, and thickness is not stated: nor has it been reported as having been seen anywhere else; while the very high pavements or pedestals of some authors, are pure inventions from ideas of modern architecture.

At the north-west socket, however, of which we took a photograph, there is, close to the east of it, something which looks like a portion of the pavement; it is only about ten inches thick, and stands up by that amount of height, above the floor of that socket. Hence, reducing all the sockets to such apparent pavement surface, we have—

North-east socket floor is		5·8,	below	pavement upper surface.
South-east	,,	19·4,	,,	,,
North-west	,,	10·0,	,,	,,
and South-west	,,	0·2,	,,	,,

numbers which are very descriptive of the general appearance of depth, to which each socket has been dug at its own corner.

SECTION II.—ANGULAR MEASURES, GEOMETRICAL.

INTRODUCTION.

THE principal instruments for measurement of angle were three in number, each of very diverse character to the others :—

First, A sextant-horizon instrument, for vertical angles. This consisted of an ordinary box-sextant by Troughton and Simms, reading by vernier to 1′; but attached to one end of a slab of wood,—the other end of which carried a 'spontaneous-horizon-point' made for me by Adie and Son of Edinburgh, according to my own invention in 1854. It was exhibited at the Paris Universal Exposition of 1855, and has the following qualities ; viz., that a level bubble, whose size can be adjusted, is seen in the field of view of the sextant, in place of the usual *horizon* reference of sea observations ; and the angular place of that level bubble with reference to the horizontal direction, is not altered by any amount of tilting either of sextant, or level, or both, within the range of the field of view, say 5°. Hence an

object to be observed has merely to be brought down, technically as with sextant observations of the sun, to the level bubble; and the observation is equally good, in whatever part of the field of view the bubble may be situated at the moment.

Such an instrument, therefore, giving vertical angles, true within its powers, and independent of level errors in its own position of several degrees, is important as a field instrument,—for it may be held in the hand, and so used with tolerable results for any altitude, from 0° to 90°. But in practice I used always to place it on a rough stand, with which it could be easily brought within half a degree of absolute level, and then remained steady thereat.

This instrument was in almost daily employ; being used for observations of the time both by the sun and stars when near the prime vertical; and for the latitude by meridian observations as a means of getting the combined index-error; also to determine the angles of ascent of all the Pyramid passages, as well as the slope of the Pyramid sides. The limits of error of an ordinary observation, I used to regard as from 3′ to 4′; and this quantity was partly due to the bad or broken silvering of the glasses, which prevented good definition of the reflected object,—and partly to a slow change of the index-correction of the whole instrument, caused probably by a change in the tin box holding the level, and altering either with time or heat, from 1° 21′ to 1° 8′ in the course of four months.

Second, A circular clinometer presented expressly for these observations at the Great Pyramid, by Andrew Coventry, Esq., of Moray Place, Edinburgh.

This instrument was constructed in the summer of 1864 by T. Cooke and Sons of York; and is probably unique for its excellence and power among all similar instruments for measuring mechanically the tilt of any given surface. It is generally constructed of gun-metal, with divisions on silver; the verniers being in form of a complete circle, with their surfaces in the same plane as that of the divided circle. The divisions are to every 10′, and the vernier readings to 10″; and there are six, or three pair of opposite, verniers, so that by comparing the mean of two with the mean of six, the errors of division, as well as those of eccentricity and motion of the centre, may be kept in check. The whole circle can likewise be shifted on a stout central screw, so as to bring any set of divisions whatever into a given direction. There is a powerful longitudinal level attached to the vernier circle, also a small cross level; and the frame of the instrument stands on three feet,—two of them being fixed feet, at either end of the frame, and in plane of the circle; and the third being a screw-foot, opposite the middle point of the other two feet, and intended to correct in level the cross position of the instrument, on whatever uneven foundation it might at any time be erected.

The circle is eight inches in diameter, and the two longitudinal feet thirteen inches apart; but in

use on the worn and rough stones of the Pyramid passages, it was mounted first on a very stout beam of mahogany, fifty inches long, and about six deep; and afterwards on a compound beam of deal and mahogany of greater depth, and 129 inches long, as will be more particularly described in connexion with the observations themselves. (See Plate I.)

The mahogany packing-box of the instrument had been fitted with a large thermometer; but at some time on the journey, the screws fastening the straps of the glass-tube to the metal scale, loosened; the glass-tube tumbled off, broke and scattered the contained mercury about the box, to the grievous injury of much of the silver-divided circle, as to visibility. With this one exception, the instrument answered admirably, and worked perfectly up to the full degree of accuracy of its 10″ readings, or rather much closer; and the misfortune above mentioned might have been avoided, had there been a wooden block beneath the metal scale, to receive the screws: for a metal screw in a metal socket shakes loose very easily. This was witnessed in a small way when the late Professor Playfair, as mentioned in Stevenson's large volume on the Bell Rock Light-house, found that every screw, of a telescope sent him from London by mail-coach, had shaken out. And in a large way, in the recent Government experiments of firing at iron-plate targets; for there, metal nuts and metal screws positively flew off from each other, all around any place where a ball struck;

while in another experiment where long metal screws were screwed into thick *wood* planks, the cannon-balls did every sort of mischief both to the iron plates, wooden backing, and even the screws themselves, but not one of these turned itself on its axis or got loose.

And third, An altitude-azimuth instrument by Troughton.

This had been a splendid instrument of its order, and was presented to the great Playfair, by students in his class of Natural Philosophy, in the year 1806. It is of the general figure rendered famous by Troughton, and his successor Simms, and measures as follows:—

Distance from foot-screw to foot-screw, . .	=	15·3 inches.
Diameter of azimuth circle, ...	=	14·0 ,,
,, vertical circle, ...	=	15·5 ,,
,, object-glass, ...	=	1·8 ,,
Focal length of telescope, ...	=	19·7 ,,
Magnifying power, with eye-piece generally employed, ...	=	25·0 ,,
Azimuth circle divided in direction of hands of a watch from 0 to 360.		
Vertical circle divided in quadrants.		
Both circles reading off by pairs of opposite microscope-micrometers to single seconds.		
Usual tripod-stand, solid, and high, . . .	=	32·4 ,,
Height from surface of stand to centre of horizontal axis, in mean position of foot-screws, .	=	19·9 ,,

Hence the optical and angle-reading power of this instrument were immense, wherever they could be brought to bear on any of the Pyramid slopes; and were not unworthy of accurate determinations of latitude as well.

ENTRANCE-PASSAGE ANGLE.

SEXTANT HORIZON INSTRUMENT.

February 9, 1865.—Fixed a bar horizontally across mouth of entrance passage, at a height of 23·7 inches from floor, measured perpendicularly to incline,—for a signal to be observed from below.

Placed sextant-horizon on a stand prepared yesterday, over the 'slide' part of the floor under portcullis: index-mirror axis 23·7 inches above floor, perpendicular to incline, and at a place 1036 inches south of and below basement-beginning; then, subtracting 1° 20′ for index-correction,—

1st measure of vertical angle of altitude of signal,	=	26° 24′
2d ,, ,,	=	26 28
3d ,, ,,	=	26 24
Readjusted instrument to a *vertical* height of 26·2 inches above floor.		
1st measure, ...	=	26 28
2d ,, ...	=	26 32
3d ,, ...	=	26 28
Mean, . . .	=	26° 27′

February 11.—Sextant-horizon again.

In place of former signal, put up a board 14·8 high, but with a perforated observing centre 23·7 inches perpendicularly above floor.

Placed instrument as before, at lower end of

passage, and subtracting for index-correction 1° 18′, we have—

First observation,	. . . . .	=	26° 27′
Second	,, ...	=	26 25
Third	,, ...	=	26 25
Fourth	,, ...	=	26 28
Fifth	,, ...	=	26 27
Sixth	,, ...	=	26 27
			26° 26·5′

Mean of both days, for angle of elevation of entrance passage as seen from below, under portcullis, = 26° 27′.

CIRCULAR CLINOMETER.

February 6.—This instrument was mounted on its 50-inch mahogany base, and taken down the west side of the entrance passage floor, step by step of its own length, so that the first or highest foot in the second observation was as near as possible on the spot occupied by the second and lowest foot at the first observation. In going down, or indeed up, the west side, the face of the instrument was necessarily looking east, and *vice versâ* when measuring along the east side of the passage floor. Hence a combination of all the observations on either side of the passage floor, enabled a fair approach to the index-correction to be obtained; it was large, viz., 35′ 22″, and therefore completely masked—in the progress of the work—what the final result was likely to be. Each observation is, however, now presented with the finally determined index-correction applied to it; that is, to the mean of the two opposite verniers A and D, which were always read and entered in the observing-book separately,

though they are hardly worthy of being now reproduced. The following readings of all six verniers at the parts of the circle which came into play for the readings west, and the readings east, will show the limits of errors of divisions, and prove them to be practically insensible. The degree readings of all the verniers except A, are purposely kept out of sight, as quite unnecessary in such a question.

Vernier A,		27°	3′	0″	Vernier A,	334°	3′ 0″
,, B,			3	10	,, B,		3 20
,, C,			3	50	,, C,		3 40
,, D,			4	10	,, D,		4 10
,, E,			3	50	,, E,		3 40
,, F,			2	50	,, F,		2 50
Mean of A and D,	=	27°	3′	35″	Mean of A and D, =	334°	3′ 35″
Mean of all,	=	27°	3′	28″	Mean of all, =	334°	3′ 27″

February 6.—For part of Passage Floor extending from 426 to 1035 Southward and below the basement-beginning North.

Distance of centre of clinometer from basement-beginning.	Circular clinometer.						Mean angle of floor.			Remarks.
	Angle at Western side of floor.			Angle at Eastern side of floor.						
426	26°	29′	28″	26°	30′	57″	26°	30′	12″	
475	26	29	43	26	31	37	26	30	40	
524	26	27	3	26	26	37	26	26	50	
574	26	32	13	26	33	37	26	32	55	
623	26	25	28	26	33	12	26	29	20	Bad standing for cross level.
672	26	29	3	26	31	7	26	30	5	
722	26	22	43	26	23	12	26	22	58	
771	26	32	8	26	24	37	26	28	22	
820	26	37	23	26	22	52	26	30	8	
870	26	16	48	26	19	57	26	18	22	
919	26	32	48	26	37	12	26	35	0	Next stones below this much broken.
1035	26	20	48	26	20	47	26	20	48	Under granite portcullis.
				Mean, =			26°	27′	58″	

February 7.—For the higher part of the Ascending Passage, or from 134 to 572, Southward from basement-beginning. Index correction = 35′ 42″, — applied to West, and + to East observations.

Distance of clinometer from basement-beginning, nearly.	Circular clinometer. Angle of dip Southward of floor, West side.	Circular clinometer. Angle of dip Southward of floor, East side.	Mean angle of floor.	Remarks.
134	26° 17′ 12″	26° 25′ 12″	26° 21′ 15″	
177	26 33 58	26 32 2	26 33 0	A hole on East side, below this.
227	26 27 53	26 23 27	26 25 40	
276	26 29 53	26 25 2	26 27 28	
325	26 22 18	26 23 57	26 23 8	
375	26 33 3	26 28 52	26 30 58	
424	26 26 33	26 30 57	26 28 45	
473	26 27 43	26 33 22	26 30 32	
523	26 26 23	26 33 42	26 30 2	
572	26 37 33	26 26 17	26 31 55	No place for cross foot below this, on the East side.
		Mean, =	26° 28′ 16″	

Mean of both sets by circular clinometer, = 26° 28′ 7″

OPTICAL MEASURE WITH PLAYFAIR ALT-AZIMUTH INSTRUMENT.

April 3.—The Playfair instrument was mounted over the beginning of the basement-sheet, northwards, by means of a stand specially prepared for the place by measure; and the centre of its vertical circle was placed in the line of axis of passage produced up northwards, as well as I could judge by eye, and referring to measures on either side.

The signal was the light of an oil-lamp, shining through a hole, 0·3 inch in diameter, and with

bevelled edges, in a board fixed over the slide under granite portcullis; and found by measure, to be 25·9 inches distant from floor, and 25·9 from roof; or on level of axis of passage at that place.

The depression, or angle of dip of this signal from the Playfair instrument, was then observed as follows:

Time of observation.	Face of circle turned to	Microscope A.	Microscope B.	Angle with index-error.	Mean angle.
h. m. 5·15 P.M.	East,	63° 27′ 51″	63° 27′ 56″	26° 32′ 6″	26° 25′ 41″
	West,	26 18 27	26 18 45	26 18 36	
Re-levelled,	West,	26 18 22	26 18 23	26 18 22	26 25 10
	East,	63 28 2	63 28 4	26 31 57	
6·5 P.M.	East,	63 27 58	63 28 5	26 31 58	26 25 10
	West,	26 18 18	26 18 25	26 18 22	
				Mean, =	26° 25′ 20″

This determination would probably be preferable to either of the two preceding, on account of the great calibre of the Playfair circle, had it not the drawback that the placing of the instrument in the line of the passage produced outwards, was a difficult matter, and perhaps not very accurately accomplished. Hence I am inclined to give equal weight to the mean determination of the several methods employed, which then stand as follows:—

ANGLE OF DIP OF ENTRANCE PASSAGE FROM NORTH TO SOUTH.

By sextant-horizon, ...	=	26°	27′ 0″
By circular clinometer, ...	=	26	28 7
And by Playfair altitude-azimuth, . . .	=	26	25 20
Mean, to nearest minute,	=	26°	27′ 0″

FIRST ASCENDING PASSAGE.

SEXTANT-HORIZON INSTRUMENT.

February 16.—This passage begins the perfectly dark parts of the Pyramid : a lamp-holder was therefore arranged, so that a dark lamp might illuminate the level-horizon bubble ; the signal was likewise an artificial light, *i.e.*, a candle shining through a hole in a board ; which board was wedged in to upper end of this passage, close to where it enters the Grand Gallery. Both hole in the board at upper, and index-mirror of sextant on a stand at lower end of passage just above the granite portcullis, were tested by measure to be 23·7 inches perpendicularly from inclined floor ; and the limits of error were thought to be $\pm$ 0·2 inch. Then subtracting 1° 12′ for index-correction, the following results were obtained, for angle of ascent of this passage from north to south :—

First measure,	=	26° 10′
Second ,,	=	26 5
Third ,,	=	26 4
Fourth ,,	=	26 5
Fifth ,,	=	26 5
Sixth ,,	=	26 5
Seventh ,,	=	26 4
Eighth ,,	=	26 4
Mean,	=	26° 5′

March 2.—Repeated the measures, with index-correction = 1° 11′, and found angle = 26° 6′.

April 7.—The floor of this first ascending passage was too much broken to employ the circular clinometer upon it with advantage. But upon this day, an important check upon the above measures was obtained, by observing the depression of the lower northern end, from the upper or southern end, of the passage, with the Playfair altitude-azimuth instrument.

The signal below, was a lamp shining through a small bevelled hole in an upright board, attached to a long plank foot, which butted against the upper end of the granite portcullis; while the Playfair instrument was mounted on its own strong tripod-stand on the level floor of the horizontal passage leading to the Queen's chamber, or 103 inches beyond the south end of the first ascending passage, measured in its own incline.

On carefully testing the positions of both instrument and signal when the angular observations were over,—the signal was found to be 0·3 inch too high, and the instrument 0·4 too low, as referred to the inclined floor-line of the passage; and as the distance from instrument to signal was 1395 inches, there is a correction of + 1′ 43″ to be applied to the observed dip; and it has been applied accordingly in the last column of the following table:—

Face of circle turned to	Microscope A.	Microscope B.	Angle with index-error.	Mean angle, corrected also for residual errors in position of instrument and signal.
West,	63° 48′ 0″	63° 49′ 0″	26° 11′ 30″	26° 6′ 40″
East,	25 58 2	25 58 47	25 58 24	
West,	63 48 2	63 48 48	26 11 35	26 6 41
East,	25 58 4	25 58 36	25 58 20	
West,	63 48 5	63 48 36	26 11 40	26 6 40
East,	25 58 5	25 58 23	25 58 14	
				26° 6′ 40″

Whence, angle of first ascending passage rising from North to South,

is, by sextant horizon, ...	=	26° 5′ 30″
And by Playfair alt-azimuth, ...	=	26 6 40
And mean	=	26° 6′ 0″

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER.

On March 3d the level of the floor of this passage (for the part extending from the north end towards the south, but only to the edge of the deep step, or 1303 inches in length), was tested with the sextant-horizon by means of reciprocal angles, with the result of finding a dip southward = 0° 7′.

On March 10th, the level was again tested, and by the circular clinometer on its long 126-inch foot; but as the floor is very rough and uneven,—no proper passage flooring at all,—it could only be brought to bear between the distances 200 and 1300, from the north end of the Grand Gallery: the results, corrected for index-error = 24′, were as follows :—

Clinometer length.	Instrument against West wall.	Instrument against East wall.	Mean angle of Passage.
	Dip.	Dip.	Southward dip.
1	South, 0° 19′	South, 0° 6′	0° 12′
2	,, 0 10	,, 0 26	0 18
3	,, 0 13	,, 0 16	0 14
4	,, 0 7	,, 0 6	0 6
5	,, 0 4	,, 0 2	0 3
6	,, 0 29	North, 0 2	0 14
7	North, 0 4	South, 0 23	0 10
Mean dip southward, . . =			0° 11

The two instruments seem tolerably confirmatory of each other; but when I tested afterwards the whole length of the passage, by looking along its ceiling from the Queen's chamber, to a scale set up by the north wall of the Grand Gallery, there was a dip northwards indicated, amounting to several inches, and equivalent to not less than 0° 8′. It is possible, however, that part of this apparent quantity, is owing to the ceiling bending down somewhat in the middle of its length.

GRAND GALLERY ANGLE.

SEXTANT-HORIZON.

March 3.—This instrument was placed on a stand previously prepared to suit the spot, and to stand partly on the sloping floor of top of first ascending passage, and partly on flat floor leading to Queen's chamber; the instrument was then nearly in the plane of the doorway, or north wall of the Grand Gallery; and its position as to height, was 28·5 inches above floor, and 24·5 below ceiling, of first ascending passage, or two inches vertically too high.

At the other or south end of Grand Gallery the signal was a candle shining through a 1·1-inch hole in a board; first naked and afterwards through oiled paper. The board was held by hand in plane of south wall, or in south doorway of Grand Gallery; and the board was cut to such a length that when resting on the floor there, the hole was 18 inches above the ground,—equivalent to 25·0 inches above the line of the Gallery floor, continued up to the south wall, or through the substance of the 'great step;' and 25·0 inches below roof of short

horizontal passage leading to antechamber: it was therefore in the concluded axis of that passage.

Above the first hole, by 3·5 inches, was a smaller one of 0·6 inch diameter, similarly illuminated. The mean of the two holes was therefore 1·75 inch too high; or 0·25 lower than it should have been, to be similar to the error of the instrument at the other end.

The observations then commenced as follows; but were only rendered fully satisfactory in the taking, when I had rigged up a cross plank and rope holdings, to prevent the otherwise inevitable sliding away of myself from the instrument, by reason of the steep slope of the passage.

	Top of level bubble.	Bottom of level bubble.	Centre of level bubble, —1° 10′ 56″ index-correction.
LOW LIGHT SIGNAL—			
First observation,	26° 56′	27° 55′	26° 14′ 34″
Second ,,	27 52	26 56	26 13 4
Third ,,	27 56	26 56	26 15 4
And single observation,	.....	.....	26 17 4
HIGH LIGHT SIGNAL—			
First observation,	27° 58′	27° 1′	26° 18′ 34″
Second ,,	27 5	27 54	26 18 34
Third ,,	27 1	27 57	26 18 4
And single observation,	.....	.....	26 22 4
Correction for mean place of signals,			+0° 0′ 30″
Mean angle of Grand Gallery, rising from North to South by sextant horizon, . =			26° 17′ 38″

The index-correction above given was determined by two series of star observations the same night, one of them giving $-1^\circ\ 11'\ 0''$ and the other $-1^\circ\ 10'\ 52''$.

CIRCULAR CLINOMETER.

March 9.—To prepare the instrument for this work, I made it a new and longer foot, cutting up its former mahogany 50-inch foot into three pieces, and fastening them to the lid of the long box of the reference-scale in such a manner, by means of powerful screws, that a joist-shaped stand was formed of the following size,—

Total length of foot, or beam,	=	129·0 inches.
Length between two longitudinal bearing points,	=	126·0
Breadth, total,	=	8·5
Breadth between the line of the two longitudinal bearing points and the middle bearing for cross level,	=	6·8
Vertical depth of beam through the 115·0 inches of its middle length,	=	7·5

To the above were further fastened four angular lamp-holding blocks, two of them acting when beam was used face west, and two face east; while the whole structure was prevented from slipping when on the incline, by a rope fastened to a wooden anchor, and placed in a ramp-hole above it. This arrangement was found to work well; the level and tangent screws were easy to turn, and the verniers to read off. (See Plate I., or Frontispiece.)

The observing method followed was, to take a

series of readings stepping up the east ramp, by steps the length of the clinometer foot, = 126 inches, wherever there was a fair ramp-surface for it to stand on; and then, having reached the top of the Gallery, the clinometer was taken into the King's chamber, turned round there, and next made to descend the western ramp of the Grand Gallery, also by steps.

When the ramp permitted, these steps were made exactly equal to the distance between the bearings of the clinometer foot, as before; but occasionally large deviations were obligatory, by reason of severe fractures of the ramp.

The ramp-surface is nowhere smooth, or nicely true; but is corrugated in a manner, from the decay of the stones; and has therefore inequalities which produce large differences in the angle. It is expected, however, that the mean of the whole observations east, will give the mean east inclination, so nearly, that compared with the similar mean inclination west (and trusting to the equality of the two ramps on the whole), the index-correction of the instrument may be obtained,—and also the angle of inclination of the Grand Gallery. It should, however, be remarked, that the index-error of the instrument is not the same as when last used in the entrance passage, in consequence of its now standing on a new foot.

GRAND GALLERY CLINOMETER ANGLE.

Stepping up *East* Ramp, March 9.—9 A.M. to Noon.

Distance of centre of clinometer from North wall of Grand Gallery, nearly	Clinometer readings. Vernier A.	Clinometer readings. Vernier B.	Mean reading, — 23′ 30″ index-correction.	Remarks.
inches.				
400	26° 37′ 50″	39′ 0″	26° 14′ 55″	Lowest foot of clinometer above sixth ramp-hole from North.
530	26 38 20	39 40	26 15 30	Up one length.
660	26 25 40	26 50	26 2 45	Up one length.
790	26 56 10	57 0	26 33 5	
920	26 46 0	47 0	26 23 0	Cross level of ramp much out, viz., dipping to East.
1005	26 26 40	27 50	26 3 45	Up about 80 only, on account of a great break in ramp.
1240	26 36 50	38 20	26 14 5	Skipped over the great break of ramp by ten inches.
1370	26 39 20	40 40	26 16 30	
1500	26 41 50	43 0	26 18 55	
1630	26 51 20	52 20	26 28 20	
1720	26 39 50	41 0	26 16 55	Advanced only 90 inches, or with upper foot near upper end of first inclined ramp-hole below great step.
Mean of East ramp, . =			26° 17′ 4″	

Stepping down *West* Ramp, March 9.—Noon to 3 P.M.

Distance of centre of clinometer from North wall of Grand Gallery, nearly	Clinometer readings. Vernier A.	Clinometer readings. Vernier B.	Mean reading, + 23′ 30″ index correction.	Remarks.
inches.				
1730	334″ 7′ 40″	8′ 50″	26° 15′ 15″	Upper end of clinometer halfway between South end of ramp, and first inclined ramp-hole.
1600	334 5 0	6 10	26 17 55	Down one step or length of the clinometer.
1470	334 2 50	4 10	26 20 0	
1370	334 7 30	8 40	26 15 25	Not down a full length on account of a broken ramp.
1170	333 47 40	48 50	26 35 15	Down more than a length past the broken ramp.
1040	334 0 10	1 20	26 22 45	
910	334 9 0	10 20	26 13 50	
780	334 20 40	21 50	26 2 15	
650	334 13 50	15 0	26 9 5	
520	334 3 0	4 20	26 19 50	
390	334 7 0	8 10	26 15 55	
Mean of West ramp, . =			26° 17′ 3″	

PLAYFAIR ALT-AZIMUTH INSTRUMENT.

April 7.—On this occasion there had been prepared carefully beforehand a lamp-signal apparatus, to be used either above or below instrument; and consisting of a plank 40· inches long, 10· broad, and 0·7 thick, carrying two solid angular shelves, and between them a board with a 0·3-inch hole, worked to an edge inside. (See Plate I.) The height of the centre of the hole above what the plank rested on, was 6·2 inches; and the hole was well illumined by a lamp placed in turn on either shelf,—when looked to, at an angle of 26° or 27° to the horizon, and from the opposite side to the illuminating lamp for the time being.

For measuring angle of Grand Gallery,—above apparatus was taken to upper end of Gallery, and pinned to the ledge of a chance hole in the floor, close in front of great step; front lamp being then of course removed, and hole in board illumined by back lamp; hole being then about 1755 inches from north wall of Grand Gallery, measured along the slope, but only 1652 inches from the place selected for the Playfair instrument. Said hole being further, 6·2 inches vertically above the floor, and the ramp 21·0 inches perpendicular, or 23·4 vertically high,—the hole may be assumed as 17·2 *inches vertically below upper surface of ramp in its parallel.*

The Playfair alt-azimuth instrument was then set.

up on the level floor leading to Queen's chamber, but at only 103· inches, nearly, within, or south of, north wall of Grand Gallery; and was first adjusted so as to have, it was believed, its centre of horizontal axis, 6·2 inches vertical, above the trace which is visible there on either side of the ancient floor-line produced, or base of ramps. But being dissatisfied with the difficulty of accurately performing the above adjustment,—I proceeded, after the angular observations were over, to test the position of the instrument with reference to the ramps in another manner. This was, to take the vertical depression of either pivot of horizontal axis, by measuring along a plumb-line, hanging from a straight-edge resting on the ramps on either side of the instrument, and so placed that the plumb-bob touched the end of the pivot. There was some trouble in getting the Arabs to hold the straight-edge steady on the steep slope, and the following various readings were obtained :—

Vertical depression of East pivot,	= 17·5,	of West pivot,	= 17·3
,,	,,	17·9,	,,	17·9
,,	,,	17·6,	,,	17·5
,,	,,	17·5,	,,	17·5
	Mean of all,	. .	= 17·6	

Hence instrument was after all too low by 0·4 inch, and its angle for the upper signal requires a correction = $-0'\ 50''$.

The angular observations began at 4 P.M., after careful levelling.

PLAYFAIR ALT-AZIMUTH INSTRUMENT IN GRAND GALLERY.

Reversals of circle.	Microscope A.	Microscope B.	Angle with index-error.	Mean angle corrected for index-error and position of instrument.
Zen. distance,	63°34′ 17″	63°35′ 3″	26°25′ 20″	26°17′ 51″
Altitude, . .	26 11 30	26 12 34	26 12 2	
Zen. distance,	63 34 8	63 35 6	26 25 23	26 18 4
Altitude, . .	26 12 4	26 12 46	26 12 25	
Zen. distance,	63 34 24	63 35 11	26 25 12	26 17 45
Altitude, . .	26 11 40	26 12 16	26 11 58	
Mean angle of elevation from North to South of floor of Grand Gallery, .			=	26°17′ 53″

Hence the three different methods of observation for the angle of Grand Gallery give—

Sextant-horizon, ...	=	26°	17′	38″
Circular clinometer, . . .	=	26	17	4
Playfair alt-azimuth, . . .	=	26	17	53

and giving them the respective weights of 1, 5, and 10, according to the calibre of the instrument, and care taken in the observation,—the final mean is

26° 17′ 37″.

KING'S CHAMBER LEVELS.

March 10.—The circular clinometer on its 126-inch foot, was employed to test on this day the levels of the short passage leading from Grand Gallery to King's chamber; and also the level of the floor of the latter room in two directions. But the stones composing these floors are so much risen in some places and sunk in others, that no accuracy of observation could be secured: and the full limit of the results seemed to be—that the north and south level both of said passage floor, and of King's chamber, and the east and west level of the latter,—are nowhere so much as half a degree in error.

The walls of the King's chamber were then tried, by rearing up the clinometer-foot vertically against them, and reversing it at each place; and their, the walls', surfaces were found much more smooth and appropriate to measure.

Similar observations were again made on the walls on March 29, the index-error of the clinometer having been in the meanwhile changed nearly five whole degrees; and three sets of complete observations were taken against every wall.

The final results for the mean surface of each wall, between the heights of 1 and 127 inches above the general floor, are as follows :—

	March 10.	March 29.	Mean.
E. wall, leans inwards at top, or to W.,	10′ 0″	9′ 50″	9′ 55″
W. wall, leans outwards at top, or to W.,	4 0	0 45	2 22
N. wall, leans inwards at top, or to S.,	8 0	11 44	9 52
S. wall, leans outwards at top, or to S.,	2 0	2 31	2 16
Mean of East and West walls, at top to West, .			6′ 8″
Mean of North and South walls, at top to South, .			6 4

Hence the *quasi*-vertical axis of the whole room is tilted at the top, towards the south-west; and the different observed amount of tiltings of east *versus* west, and north *versus* south walls, indicate that every wall inclines towards its opposite wall at the top; the east and west walls by the amount of 3′ 46″ each; and north and south walls by the amount of 3′ 48″ each.

VENTILATING CHANNELS.

THESE ventilating channels, or long and very small-bore passages, being found hopelessly stopped up somewhere in their length,—I made no other trial of their angles, than merely to put, or have put, a little pocket-clinometer on the floor of them, just within their upper mouths, on the outside of the Pyramid,—and take the angle there within a degree. This being close enough to indicate, whether the angles were the same as those of the larger inclined passages, viz., 26° to 27°; or whether they were nearer to what I had concluded from theory in my published book in 1864; viz., the north one = 33° 42′, and the south one = 45°.

The result of my measure in this rude manner, in January 1865, on the northern air-channel, at its outlet high up the Pyramid side, was, 32° 45′.

And the result of a similar measure on the southern air-channel, kindly performed at my request by an enterprising traveller, Mr. Smyth, from Lincolnshire, who visited the Pyramid in February 1865,—was, 46°.

EXTERIOR FACES OF GREAT PYRAMID.

April 7, 8.—Measured with sextant-horizon, the angles of ascent of Great and Second Pyramids; those of the former only, entered here; going consecutively to the top of the heap of rubbish lying against the middle of each side; and, after choosing some stone only slightly weathered, placing both eye and instrument in line of that and upper part of Pyramid foreshortened.

Tested each day the index-correction of instrument by reciprocal angles, observed in succession from two fixed stands, about 5000 inches asunder; and found it 1° 12′ on the 7th; and 1° 8′ on the 8th. Correcting the observations accordingly, we have for angle of ascent of each face of the Great Pyramid from the horizon:—

	April 7.	April 8.	Second observation.	Mean.
East face, . .	51° 46′	51° 44′	51° 49′	51° 46′
North face, .	51 39	...	..	51 39
West face, .	51 42	...	...	51 42
South face, .	51 55	51 59	51 49	51 54
Mean of all, giving weight to each observation,				51° 48′

These measures have no pretence to being closer than a handful of minutes, on account of the large weathering of the sides of the Pyramid, and the rudeness of the present denuded courses: but they will suffice to show that the 3°, 4°, and more of some travellers have no necessary place, touching the original unweathered Pyramid.

CASING-STONE FRAGMENTS.

After various preliminary trials, I had an apparatus made in March 1866, to measure the angles of the fragments of casing-stones brought home from the Great Pyramid in 1865. This apparatus was in the form of a double-pronged wooden compass, 25 inches long, 1·8 broad, and 1·1 in the collective thickness of its two moveable limbs. These were made in hard mahogany, and worked on a brass screw-bolt in the centre of their lengths; one limb, only 18 inches long, passing inside the other, which was therefore a double frame so far, but solid at either end. This machine having been opened, made to touch two sides of a casing-stone at their own angle, and clamped firm,—was then conveyed to a gun-metal circle 11·9 inches in diameter, and divided to every 20′ by Adie and Son,—to ascertain the angle. The screw-head of the compass-arms, entering a hole in centre of circle, gave a nearly concentric position; and the angle was then read off through small holes, in the central axis of each compass-arm at a radius of 5·7 inches. To correct residual error of eccentricity, the angle was read off on both ends of both arms, or on opposite sides

of the circle's centre; and to correct index-error of the instrument, the angle of the stone was taken twice,—once on the right, and once on the left, of the principal bar of the compass. Hence each reading now given, is the result of four independent readings and two measures of the angle; and is free, I trust, from all sensible instrumental defects.

Indeed, the apparatus proved itself superior in accuracy to the fragments which it had to measure; where, the almost constantly prevailing fault was found,—that the surface of the stone which had formed part of the horizontal course of masonry,—was more or less hollowed towards the central region: partly, from a purposed intention of the builders to cause the stones to rest on their edges only, not on their centres, which would make them unsteady; and partly, from the thin pointing of lime in the outer part of the joints, having tended to preserve the stone from decay along its angular edge, and to keep it high there; causing the measured angle, when straight-edges are applied to the *whole* surface indiscriminately, to give a too acute angle, by a quantity of a degree more or less. The original outer, or bevelled surfaces of the stones were nearly free from this defect; though three fragments from the northern rubbish-heap of the Pyramid had it rather severely, and indeed so evidently to the eye from their large decay, that they ought perhaps to have been thrown away at the place. But as they have been brought to this

country, I give their angles with those of every other fragment brought home, though not allowing them to mix in the mean.

Of nineteen fragments, seven came from the north side of the Great Pyramid, five from the east, two from the south, and five from the west.

And again, of the same nineteen,—fifteen were examples of the obtuse angle along the upper edge of every original casing-stone; and four of the acute angle at the lower edge. The angles observed in them run thus:—

OBSERVED ANGLES OF CASING-STONE FRAGMENTS.

Side of Great Pyramid found at	Number for reference.	Length of worked surface			Angle.	Mean for each side.
		In horizontal course.		In the outer bevelled slope.		
		General.	Trustworthy.			
		Inches.	Inches.	Inches.		
North,	1	3·	1·	1·	(127° 18′)	
„	2	4·	1·	3·	128 6	
„	5	4·	0·5	(?)	(126 50)	128° 6′
„	6	1·	0·5	3·	128 5	
„	7	3·	0·5	(?)	(127 15)	
East,	1	1·5	0·3	1·3	128 12	
„	2	1·	1·	2·	128 10	
„	3	6·	0·3	4·	128 6	128 5
„	4	1·	0·5	8·	128 6	
„	5	0·5	0·3	1·	127 50	
South,	1	1·	...	3·	127 40	127 54
„	2	4·	0·2	2·	128 9	
West,	1	3·	0·4	3·	128 4	
„	2	1·	0·7	3·	128 2	128 2
„	5	0·4	0·2	2·	128 0	
North,	3	2·	...	2·5	51 55	51 56
„	4	3·	1·	3·	51 56	
West,	3	3·	1·5	3·	51 26	51 42
„	4	4·	4·	6·	51 58	

Whence the mean of all the obtuse angles is 128° 2′, yielding trigonometrically 51° 58′ as their inference for the acute angle, or angle of slope of the sides of the Pyramid with the horizon; and the mean of the same acute angle, actually observed, is 51° 49′.

CORNER ANGLES OF GREAT PYRAMID.

ANGLES OF ALTITUDE OF CORNER-LINES OF GREAT PYRAMID.

April 25, 26, 1865.—These were measured with the Playfair altitude-azimuth, from the corner socket-holes of the casing, cut in the rock. The instrument therefore was powerful, the station marks below accurate, and if only there could have been obtained at the top of the Pyramid, a true memorial of its ancient surface, the observations would have been in the very highest degree important. But there is no such memorial there; and we must either supply on the present 400-inch-sided upper platform, a pole about 360 inches high to represent the masonry and summit casing-stones now removed; or, push out horizontally a signal from 100 to 150 inches to represent the *side casing*, now also removed.

Of the two methods, the latter was adopted—as containing the least amount of deduction from theory: and Mr. Inglis kindly undertook each day to ascend the Pyramid; and hold out as required, an observing-signal at a distance of, first 100 inches, and then 150 inches, from each corner of the summit-

platform in succession, and in the direction of a diagonal of the Pyramid.

In the meanwhile I marked off the Pyramid diagonal lines on the socket-floors below; and measuring from the outer corner of the socket, along that line a distance of 58·1 inches, marked that as the spot for erecting the Playfair instrument over, because then its centre was seen at an angle of altitude of 42° (the approximate vertical corner angle of the Pyramid), from said outer corner of socket floor. Hence, although the instrument stood near the middle of each floor, and high above it,—the angles may be considered as having been measured from the outer corner of the floor itself.

OBSERVATIONS AT NORTH-EAST SOCKET, OF THE 100-INCH DIAGONAL SIGNAL AT NORTH-EAST CORNER OF SUMMIT-PLATFORM OF GREAT PYRAMID.

Time.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 25, 4 P.M.	Alt., . .	41° 45′ 6″	41° 51′ 24″
	Zen. dist., .	48 2 12	
	Alt., . .	41 44 22	41 51 2
	Zen. dist., .	48 2 19	
Mean of both sets for a diagonal distance at top of 100 inches,		=	41° 51′ 13″

N.B.—A strong north-east wind blowing at summit of Pyramid, making the signal-staff difficult to hold steadily; wherefore bisection with telescope-wire was found often varying.

OBSERVATIONS AT SOUTH-EAST SOCKET, OF SIGNAL AT SOUTH-EAST CORNER OF SUMMIT-PLATFORM, AND DISTANCE IN DIAGONAL OF PYRAMID OF 100 INCHES *virtual*.

Time.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 25, 6 P.M.	Zen. dist.,	47° 58′ 16″	41° 54′ 55″
	Alt.,	41 48 6	
	Zen. dist.,	47 58 20	41 54 46
	Alt.,	41 47 51	
Mean for South-east corner and socket, =			41° 54′ 50″

The 100-inch distance above is called *virtual*, because it was actually 130 inches, but then the instrument below was pushed 30 inches outwards from its intended place of 58·1 inches inwards, on account of the small size of the floor of the south-east socket.

OBSERVATIONS AT THE NORTH-WEST SOCKET, ON TWO SIGNALS, ONE AT 100, AND THE OTHER AT 150 INCHES IN THE HORIZONTAL DIAGONAL FROM N.-W. CORNER OF SUMMIT-PLATFORM.

Time.	Signal.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 26, 4 P.M.	150	Zen. dist.,	47° 49′ 26″	
	100	Zen. dist.,	48 3 56	150 = 42° 2′ 56″
	150	Altitude,	41 55 16	100 = 41 48 40
	100	Altitude,	41 41 16	
Single reading of one microscope.	150	Zen. dist.,	47° 50′ 30″	
	100	Zen. dist.,	48 4 10	150 = 42° 2′ 30″
	150	Altitude,	41 55 30	100 = 41 48 45
	100	Altitude,	41 41 40	
Mean for 150 signal, =				42° 2′ 47″
Mean for 100 signal, =				41 48 42

OBSERVATIONS AT SOUTH-WEST SOCKET, ON TWO SIGNALS, ONE AT 100, AND THE OTHER AT 150 INCHES IN THE HORIZONTAL DIAGONAL FROM THE NORTH-WEST CORNER OF SUMMIT-PLATFORM.

Time.	Signal.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 26, 5 P.M.	150	Alt., .	41° 53′ 6″	.....
	100	Alt., .	41 39 46	150=42° 0′ 19″
	150	Zen. dist.,	47 52 28	100=41 46 53
	100	Zen. dist.,	48 6 0	.....
Single microscope.	150	Alt., .	41 54 0	.....
	100	Alt., .	41 40 20	150=42 0 55
	150	Zen. dist.,	47 52 10	100=41 47 5
	100	Zen. dist.,	48 6 10	.....
Concluded mean at South-west socket— For 150 signal, ... =				42° 0′ 31″
And for 100 signal, ... =				41 46 57

Hence, supplying places of the 150-inch signals to north-east and south-east sockets, from what was observed at the north-west and south-west sockets, we have—

As seen from Socket.	Angular altitude at top of Pyramid—	
	Of 100-inch corner signal.	Of 150-inch corner signal
North-east, . .	41° 51′ 13″	42° 5′ 3″
South-east, . . .	41 54 50	42 8 40
North-west, . .	41 48 42	42 2 47
South-west, . .	41 46 57	42 0 31

But the floors of the sockets are not on the same level; nor apparently intended to be so, by their builders,—from the different depths to which they are cut into the rock. It will be proper therefore to reduce the above angles of altitude, to what they would have marked, had they all been observed from a *uniform level* pavement extending round the whole Pyramid; and a portion of such a grand pavement is to be seen near the north-west socket, about ten inches or more above that socket's bottom.

Hence, reducing Mr. Inglis's levels of the socket-floors to above pavement (see page 137),—we find each of them to have been too low by the quantities stated in the *second* column of the following table. Wherefore, if the *third* column gives the 150-inch signal as observed from the actual socket-floors, the *fourth* gives it as it would have been observed from the uniform pavement. And the *fifth*, gives the angles from the same pavement, due to a decreased distance from 150 to 143 inches for the signal, in the direction of a horizontal diagonal from the corner of present summit-platform; (143 inches being equivalent, in the diagonal, to a side, horizontal thickness of casing and backing stones of 101· inches.)

Socket floor.	Below pavement surface.	150-inch signal from socket floor.	Same signal reduced to pavement surface.	A 143-inch signal from pavement surface.
	inches.			
North-east,	6·	42° 5′	42° 3′	42° 1′
South-east,	19·	42 9	42 3	42 1
North-west,	10·	42 3	42 0	41 58
South-west,	0·	42 1	42 1	41 59
			Mean, =	41° 59′ 45″

HORIZONTAL ANGLES AT THE CORNERS OF THE BASE.

These angles cannot be directly observed at present, because the rubbish-heap in the middle of every side interferes with any one socket seeing any other. But by comparing two sides *successively* with the Pole-star, as will be described in the next department of angular measures,—it was concluded, that the horizontal angle at the outer corner of the north-east socket, subtended between the outer corners of the south-east and north-west sockets, is 90° 0′ 44″.

This observation, however, was made under such remarkably disadvantageous conditions, and on the last observing evening we had,—that it eminently requires repetition under more favourable circumstances.

SECTION III.—ANGULAR MEASURES, ASTRONOMICAL.

TIME OBSERVATIONS.

ALL these observations were, with one or two exceptions, taken with the sextant-horizon; on account of the portability and expedition of that instrument: but its accuracy was usually considered somewhere, not nearer than 2′ or 3′; though by care it might be brought within 1′. Latitude observations by various stars were occasionally taken as a check on the index-error; and though the time was usually obtained from the sun, it was also sometimes found from star observations; which last occasions may be distinguished in the following table, by the hours against which the quantity for the day is entered.

The chronometer alluded to was my pocket-watch, compensated for temperature, and going, as will be observed from the column of error on mean solar time, very fairly,—considering the amount of motion

it was subjected to. The first column of errors on *apparent solar* time, was computed for the sake of having that sort of time certain for the meteorological observations; and the last, or the errors on *sidereal* time, for the sake of the astronomical observations with the Playfair alt-azimuth instrument; which, however, being only employed on the Pole-star, never required the time to be known with any very great degree of exactness.

In the first fortnight following January 24th, there was only one day on which weather prevented me from obtaining a time-observation of the sun; and the climate was so fine, that the series could have been kept up, probably for the whole four months, almost daily; but my time was too much limited by other work, to allow of doing more than what is given below :—

Time Observations at East Tombs in 1865.

Day.	Hour.	Chronometer's correction on time.		
		Apparent Solar.	Mean Solar.	Sidereal.
January	h.	m. s.	m. s.	h. m. s.
20	8 A.M.	− 7 49	+ 3 35	.....
22	8 ..	− 8 27	.....	.....
..	7 P.M.	.....	.....	− 3 48 36
23	7 ..	.....	.....	− 3 44 23
24	8 A.M.	− 9 17	+ 3 10	− 3 42 36
25	8 ..	− 9 27	+ 3 14	− 3 38 34
26	8 ..	− 9 28	+ 3 24	− 3 34 30
27	8 ..	− 9 52	+ 3 16	− 3 30 39
28	8 ..	− 10 1	+ 3 15	− 3 26 46
29	8 ..	− 10 23	+ 3 3	− 3 22 50
30	8 ..	− 10 29	+ 3 11	− 3 18 59
31	8 ..	− 10 42	+ 3 3	− 3 15 10
February				
1	7 ..	− 10 49	+ 3 4	− 3 11 11
2	7 ..	− 10 57	+ 3 3	− 3 7 15
4	7 ..	− 11 22	+ 2 52	− 2 59 35
5	7 ..	− 11 37	+ 2 42	− 2 55 58
6	7 ..	− 11 39	+ 2 44	− 2 51 49
8	7 ..	− 11 36	+ 2 53	− 2 43 36
11	7 ..	− 12 5	+ 2 26	− 2 32 26
14	7 ..	− 11 53	+ 2 33	− 2 20 24
17	7 ..	− 11 55	+ 2 20	− 2 8 50
19	8 ..	− 11 49	+ 2 16	− 2 0 56
21	7 ..	− 11 49	+ 2 4	− 1 53 19
28	7 ..	− 10 29	+ 2 19	− 1 25 29
March				
1	7 ..	− 10 31	+ 2 5	− 1 21 57
3	10 P.M.	.....	.....	− 1 11 20
7	7 A.M.	− 8 44	+ 2 32	− 0 57 45
11	10 P.M.	.....	.....	− 0 39 52
13	7 A.M.	− 7 51	+ 1 50	− 0 34 43
..	9.47 P.M.	.....	.....	− 0 32 20
18	8.41 ..	.....	.....	− 0 12 48
20	7 A.M.	− 5 56	+ 1 44	− 0 7 17
April				
1	8 ..	− 2 13	+ 1 46	+ 0 40 14
2	7.30 A.M.	− 1 58	+ 1 43	+ 0 44 2
3	8.30 ..	− 1 51	+ 1 31	+ 0 47 55
4	8.45 ..	− 1 36	+ 1 28	+ 0 51 52
6	8.0 ..	− 1 6	+ 1 23	+ 0 59 31
7	8.40 ..	− 0 36	+ 1 35	+ 1 3 47
..	8.50 P.M.	.....	.....	+ 1 5 40
8	9 A.M.	− 0 31	+ 1 22	+ 1 7 33
10	7.40 A.M.	+ 0 12	+ 1 33	+ 1 15 25
12	6.40 ..	+ 0 26	+ 1 16	+ 1 22 51
25	7.33 ..	+ 3 11	+ 1 4	+ 2 14 2
26	7.37 ..	+ 3 9	+ 0 52	+ 2 17 58
27	7.37 ..	+ 3 25	+ 0 59	+ 2 21 51

LATITUDE OBSERVATIONS.

MARCH 11—APRIL 10.

WITH THE PLAYFAIR ALT-AZIMUTH INSTRUMENT, MOUNTED ON A FIRM TRIPOD.

On March 11, at East Tombs,—Barometer = 30·06, and Thermometer = 68·6 at 14h. 0m. per watch,—the following observations were taken for Latitude :—

Nos. for reference.	Time by watch.	Quantity observed.	Microscope A.	Microscope B.	Means of microscopes, still affected by index-error.
	h. m. s.				
1	12 0 0	Alt.	28° 34′ 22″	28° 37′ 50″	28° 36′ 6″
2	12 15 45	Z. dist.	61 6 22	61 9 54	28 51 52
3	12 28 30	Alt.	28 30 8	28 33 38	28 31 53
4	13 56 10	Alt.	28 26 45	28 27 10	28 26 58
5	14 7 20	Z. dist.	61 14 36	61 14 46	28 45 19
6	14 24 30	Alt.	28 27 52	28 28 15	28 28 4
7	14 31 40	Z. dist.	61 13 12	61 13 34	28 46 37

STEPS OF COMPUTATION.

Nos. for reference.	True sidereal time.	Mean of microscopes.	Refraction.	Reduction to meridian.	Resulting latitude of station.
	h. m. s.				
1 and 3	11 34 45	28° 34′ 0″	...	...	...
2	11 36 15	28 51 52	...	...	...
Mean, .	11 35 30	28 42 56	−1′ 42″	+1° 17′ 29″	29° 58′ 43″
4	13 16 55	28 26 58	...	...	...
5	13 28 5	28 45 19	...	...	...
Mean, .	13 22 30	28 36 8	−1 42	+1 24 15	29 58 41
6	13 45 15	28 28 4	...	...	...
7	13 52 25	28 46 37	...	...	...
Mean, .	13 48 50	28 37 20	−1 42	+1 23 9	29 58 47

On March 18, at East Tombs,—Barometer = 30·20, and
Thermometer = 62·8 at 13h. 11m. per watch,
And „ = 62·5 at 13h. 30m. „ „,—
the following observations were taken for Latitude :—

Nos. for reference.	Time by watch.	Quantity observed.	Microscope A.	Microscope B	Means of microscopes, still affected by index-error.
	h. m. s.				
1	9 29 36	Alt.	29° 5′ 21″	29° 7′ 17″	29°. 6′ 19″
2	9 38 7	Z. dist.	60 37 24	60 39 0	29 21 48
3	13 3 20	Alt.	28 26 24	28 28 10	28 27 17
4	13 11 12	Z. dist.	61 13 52	61 15 42	28 45 13
5	13 29 20	Alt.	28 26 18	28 27 49	28 27 4
6	13 36 20	Z. dist.	61 13 55	61 15 27	28 45 19

STEPS OF COMPUTATION.

Nos. for reference.	Sidereal time.	Mean of microscopes.	Refraction.	Reduction to meridian.	Resulting latitude of station.
	h. m. s.				
1	9 16 58	29° 6′ 19″	...	...	...
2	9 25 29	29 21 48	...	...	...
Mean, .	9 21 14	29 14 4	−1′ 44″	+0° 46′ 23″	29° 58′ 43″
3	12 51 20	28 27 17	...	...	...
4	12 59 12	28 45 13	...	...	...
Mean, .	12 55 16	28 36 15	−1 46	+1 24 16	29 58 45
4	13 17 20	28 27 4	...	...	...
5	13 24 20	28 45 19	...	...	...
Mean, .	13 20 50	28 36 12	−1 46	+1 24 19	29 58 45

The meridional distance between the parallels of East Tombs and the centre of Great Pyramid, being paced,—was found equal nearly to 10,000 inches ; wherefore a correction of + 8″ is necessary to reduce the above latitude of East Tombs to that of Great Pyramid, Great Pyramid being north of East Tombs.

On April 10, 1865, on summit of Great Pyramid, Barometer concluded from East Tombs observation combined with height, = 29·75; correction of watch, or sidereal time, at

h.		h.	m.	s.
8 P.M.	= +	1	17	22
10 P.M.	= +	1	17	41
Midnight	= +	1	18	0
2 A.M.	= +	1	18	18

observed as follows with Playfair alt-azimuth instrument for latitude; instrument erected about 100 inches south of centre of summit-platform :—

Nos. for reference.	Time by watch.	Thermometer.	Quantity observed.	Microscope A.	Microscope B.	Mean of microscopes, still affected by index-error.
	h. m. s.	Fahr.				
1	8 37 10	...	Alt.	28° 57′ 23″	28° 57′ 5″	28° 57′ 14″
2	8 44 55	60·0°	Z. dist.	60 50 46	60 50 8	29 9 33
3	8 54 13	57·3	Alt.	28 52 56	28 52 16	28 52 36
4	9 7 20	56·0	Z. dist.	60 56 16	60 55 52	29 3 56
5	9 14 3	55·4	Alt.	28 48 0	28 47 24	28 47 42
6	12 25 4	54·3	Z. dist.	61 16 20	61 15 45	28 43 58
7	12 35 30	...	Alt.	28 30 28	28 29 46	28 30 7
8	12 46 42	53·9	Alt.	28 31 20	28 30 42	28 31 1
9	12 58 20	54·3	Z. dist.	61 13 36	61 13 2	28 46 41

STEPS OF COMPUTATION.

Nos. for reference.	Sidereal Time.	Refraction.	Reduction to meridian.	Latitude, with index-error.	Latitude.
	h. m s.				
1	9 54 38	− 1′ 42″	+0° 56′ 9″	29° 51′ 41″	29° 58′ 54″
2	10 2 25	− 1 42	+0 58 16	30 6 7	
3	10 11 44	− 1 43	+1 0 42	29 51 35	
4	10 24 52	− 1 33	+1 3 58	30 6 11	29 58 53
5	10 31 37	− 1 43	+1 5 32	29 51 31	29 58 51
6	13 43 7	− 1 45	+1 23 42	30 5 55	29 58 39
7	13 53 35	− 1 45	+1 23 0	29 51 22	
8	14 4 49	− 1 45	+1 22 5	29 51 21	29 58 37
9	14 16 28	− 1 45	+1 20 56	30 5 52	

Adding 8″ for geographical reduction to each of the East Tombs observations, we have then for the latitude of the Great Pyramid, the following series of results :—

March 11.	First set,	. . .	=	29° 58′	51″
	Second ,,	. . .	=	29 58	49
	Third ,,	. . .	=	29 58	55
,, 18.	First ,,	. . .	=	29 58	51
	Second ,,	. . .	=	29 58	53
	Third ,,	. . .	=	29 58	53
April 10.	First ,,	. . .	=	29 58	54
	Second ,,	. . .	=	29 58	53
	Third ,,	. . .	=	29 58	51
	Fourth ,,	. . .	=	29 58	39
	Fifth ,,	. . .	=	29 58	37

Considering that the strange anomaly of the two last must have been due to want of level adjustment, they deserve to have only half weight in taking the mean, in which case the final result for latitude north of Great Pyramid is

$$+ 29^\circ\ 58'\ 51''.$$

ROUND OF AZIMUTHS.

THIS round was taken very hastily, and only intended to be approximate; chiefly also to settle whether second Pyramid was in diagonal of Great Pyramid, and whether a certain supposed distant Pyramid in the desert, spoken of by Dr. Lieder, was really west of the Great Pyramid.

SUNRISE ON SUMMIT OF GREAT PYRAMID, WITH PLAYFAIR ALT-AZIMUTH INSTRUMENT.

APRIL 11.

South point of horizon (computed),	=	0°	0′
Second Pyramid summit,	=	43	20
Diagonal Great Pyramid,	=	44	55
Distant Pyramid (?), reputed west,	=	77	35
Full moon near setting, about	=	78	35
West point,	=	90	0
Pyramid of Aboo-Roash,	=	135	56
Delta of cultivated land, begins,	=	161	0
North end of meridian,	=	180	0
Delta of cultivated land, ends,	=	211	0
Dome of Mehemet Ali's mosque in Cairo,	=	245	38
Sun rising,	=	260	10
East point of horizon,	=	270	0
Pyramids of Sakkara, begin,	=	323	36
„ „ end,	=	326	25
A distant Pyramid, probably 'the False Pyramid,'	=	337	25
Dashoor, sharp and straight Pyramid,	=	339	51
Dashoor, re-entering angle Pyramid,	=	340	53
Distant ruins of Pyramids,	=	345	0
Some very distant,	=	355	0
South point,	=	360	0

AZIMUTH TRENCHES.

MARCH 21, 23.

WITH THE PLAYFAIR ALT-AZIMUTH INSTRUMENT.

THE observations of the 21st being only approximate as to signals, those of the 23d are alone preserved. The work began about 3 P.M. and finished at 8 P.M., in the shade of the Pyramid all the time from the sun; but exposed to a hot wind from the south-west, which made the temperature 94·2° at 5.18 P.M., and 91·0° at 6.0 P.M., and contracted the size of the level-bubble fearfully.

The azimuth trenches here observed upon, are described in the linear measures, p. 126.

The first step was, to place the Playfair instrument midway between the north and south trenches; and in the line of their mutual axes, as indicated by poles carefully planted at their outer ends. That done, the two inclined trenches, viz., the east-north-east and north-north-east, were looked at, and found not to converge precisely on the instrument, but on a point about 100 inches west; so that the correct line to have taken with the north and south trenches would have been,—not their central axes, as I had done,—but a parallel line 100 inches west of that;

in fact nearly the west side of their *ends*. Instead, however, of moving the instrument and signals to that new western position, I preferred to move the instrument in the axial line of the north and south trenches. First northward, until it reached the intersecting point of the north-north-east trench, as shown by poles at its either end; and again southward, for the intersection of the east-north-east trench: separate observations of the north and south poles being made at each station. Hence we have for the crude observations—

AT CENTRAL STATION FOR NORTH-NORTH-EAST TRENCH.

Time.	Signals at	Mean of two opposite microscopes.
h. m.		
5 30 P.M.	North end of North trench, . .	30° 21′
	Axis of North-north-east trench, .	54 52
	South end of South trench, . .	210 18
	North end of North trench, . .	30 21

AND AT CENTRAL STATION FOR EAST-NORTH EAST TRENCH.

Time.	Signals at	Mean of two opposite microscopes.
h. m.		
6 0 P.M.	North end of North trench, .	337° 22′ 49″
	Axis of East-north-east trench, .	53 48 26
	South end of South trench, . .	157 22 21
	North end of North trench, .	337 22 32
6 43 ..	Pole-star, ...	336 4 36
6 51 ..	,, ...	336 4 24
6 58 ..	,, ...	336 4 20
7 2 ..	,, ...	336 4 18
7 8 ..	,, ...	336 4 24

Hence azimuth angle of north-north-east trench, from north end of axis of north and south trenches, towards the east, is

$$54^\circ\ 52' - 30^\circ\ 19'\ 30'' = 24^\circ\ 32'\ 30''$$

and azimuth of east-north-east trench from north end of axis of north and south trenches,

$$= 413^\circ\ 48'\ 26'' - 337^\circ\ 22'\ 34'' = 76^\circ\ 25'\ 52''$$

But the east-north-east and north-north-east trenches being more accurately cut, or better preserved than the others,—should have their azimuths compared also with the line of the sockets defining the east side of the Pyramid's base, which may be accomplished thus,—

The Pole-star readings taken above, include the greatest elongation west for that evening, computed at $1^\circ\ 37'\ 30''$; therefore $336^\circ\ 4'\ 18'' + 1^\circ\ 37'\ 30'' = 337^\circ\ 41'\ 48''$; or place of celestial pole, when north end of axial line of north and south trenches reads $337^\circ\ 22'\ 34''$. And, as the circle readings increase in going round west, north, east,—said axial line of north and south trenches is at its north end, $19'\ 14''$ west of the north point on the horizon.

But, by observations presently to appear,—the line of the sockets on the east side of Great Pyramid, deviates at its northern end $4'\ 44''$ west of the true north point. Whence, line of north and south trenches points $14'\ 30''$ west at its north end, of the similar trending of socket line: and the *inclined* trenches have a less inclination from socket line, than from north and south trenches line; thus—

Azimuth angle of	From North end of		Mean.
	North and South trench line.	Socket line on East side of Great Pyramid.	
N.N.E. trench, . .	24° 32′ 30″	24° 18′ 0″	24° 25′ 15″
E.N.E. trench, . .	76 25 52	76 11 22	76 18 37
E.N.E. — N.N.E. trench, ...			51° 53′ 22″
$\frac{76° 25′ 52″}{2} - 90$, ...			51 47 4
$\frac{76° 11′ 22″}{2} - 90$, ...			51 54 19
		Mean, =	51° 51′ 35″

AZIMUTH OF ENTRANCE-PASSAGE OF GREAT PYRAMID.

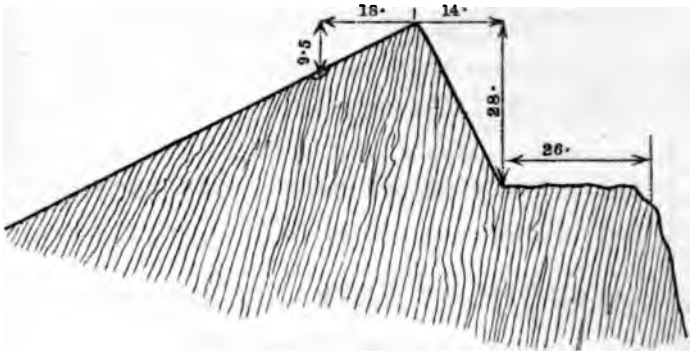
April 3, 7, 1865.

The signal observed on April 3d was a lamp, placed on a box upon the sand-heap under the granite portcullis, about 1000 inches down the entrance passage; and viewed through a 0·3-inch hole, with bevelled edges, in a board fastened to same box; the hole being placed by measure—

25·9	inches from	floor.
25·9	,,	roof.
21·4	,,	east wall.
and 21·4	,,	west wall.

The lamp flame was behind or southward, and rather below this hole,—in order to make said hole appear well illuminated when viewed from above and northward; *i.e.*, from the position of the instrument, at the top of passage, or rather of the basement sheet,—as this extends beyond either walls or roof.

A vertical meridian section of the upper end of the basement sheet appears thus—



A special tripod-stand was therefore prepared for the Playfair alt-azimuth instrument, having two legs 29 inches long, and one 10·5 inches long, with a breadth of 33 inches at the top. And, by shifting that stand about, it was finally so placed, that the centre of the telescope of the Playfair instrument, was considered to be in the line of the axis of the entrance passage produced outwards,—to within 0·2 inch. The following observations were then obtained for the azimuth, after others for the dip of the passage had been secured :—

Time per watch.	Object observed.	Microscope A.	Microscope B.	Mean of both azimuthal microscopes.
April 3.				
h. m. s.				
6 13 0 P.M.	Signal lamp in passage,	57° 38′ 50″	39′ 34″	57° 39′ 12″
6 23 50	Polaris,	236 7 33	7 42	236 7 38
6 32 10	.....	236 7 26	7 40	236 7 33
6 41 15	.....	236 8 14	8 24	236 8 19
	Signal lamp,	57 38 58	39 38	57 39 18
6 53 0 P.M.	Signal lamp,	237 38 46	39 56	237 39 51
7 7 5	Polaris, .	56 9 40	10 7	56 9 54
7 15 0	Signal lamp,	237 39 + x.	...	.....

the following being the steps of computation :—

Illumined end of telescope axis.	Object observed.	Azimuth angle.	Reduction to a North meridian.	Pole of passage and pole of sky.
East ? h. m. s. 7 21 37 Sid. time	Lamp signal, south	57° 39′ 15″	180° 0′ 0″	237° 39′ 15″
	Polaris, .	236 7 50	1 37 20	237 45 10
West ? h. m. s. 7 56 42 Sid. time	Lamp-signal	237 39 51	180 0 0	57 39 51
	Polaris, .	56 9 54	1 35 11	57 45 5

Hence in one way of the illuminated end of the telescope axis, the north pole of the Pyramid entrance passage is 5′ 55″, and in the other 5′ 14″, west of the pole of the sky; or, on the mean = 5′ 34″ west.

April 7, 6 P.M.—On this day a new lamp-signal was duly centred in the entrance passage, under the granite portcullis, and observed with the Playfair alt-azimuth from above and northward as before,—

Time by watch.	Object observed.	Microscope A.	Microscope B.	Mean of both azimuthal microscopes.
	Lamp-signal,	177° 36′ 21″	36′ 46″	177° 36′ 34″
h. m. s.	Telescope reversed, .	357 36 52	37 36	357 37 14
6 48 0	Polaris, .	356 5 30	6 18	356 5 54
6 54 20	.....	176 6 18	6 32	176 6 25
7 1 40	.....	356 7 0	7 34	356 7 17
	Lamp-signal,	357 36 56	37 36	357 37 16

the following being the steps of computation,

separating the observations with illumined end of axis east or west :—

Sidereal time.	Object.	Azimuth angle.	Reduction to North meridian.	Pole of passage, and Pole of sky.
h. m. s.	Lamp South,	177° 36′ 34″	180° 0′ 0″	357° 36′ 34″
7 53 20	Polaris,	356 5 54	1 35 30	357 41 24
8 7 0	...	356 7 17	1 34 8	357 41 25
	Lamp South,	357 37 15	180 0 0	177 37 15
7 59 40	Polaris,	176 6 25	1 34 54	177 41 19

Hence, in the two ways of the telescope, the pole of the passage is shown to be west of the pole of the sky, by 4′ 50″, and 4′ 4″ ; mean = 4′ 27″.

But result of April 3d, said 5′ 34″ ; therefore mean of both days = 5′ 0′, for azimuthal deviations of pole of entrance passage west of pole of sky.

AZIMUTH OF PYRAMID CORNER SOCKETS.

EAST SIDE OF GREAT PYRAMID.

April 26, 27, 1865.—After preliminary trials on April 25, the Playfair instrument was taken on the 26th to a nick cut out in side of rubbish-heap on eastern flank of Great Pyramid, and made there to observe, azimuthally, signals which had been duly centred over the outer corners of the north-east and south-east basal sockets,—a similar observation being afterwards made of the Polar star. After several trials and adjustments of the stand, to bring it into the vertical plane between the two signals, the instrument was well levelled, and the following observations were taken; the change of readings by 180° for the same object, showing when the telescope was reversed, and the opposite half of the azimuthal circle brought into play :—

Time per watch.	Object observed.	Microscope A.	Microscope B.	Mean of both azimuthal microscopes.
	South socket,	350° 6′ 52″	6′ 64″	350° 6′ 58″
	North ,,	170 8 26	8 31	170 8 28
	South ,,	170 7 20	7 24	170 7 22
h. m. s.	North ,,	350 9 14	9 0	350 9 7
6 50 45	Polaris, .	168 49 10	49 10	168 49 10
6 56 25	...	348 50 0	50 14	348 50 7
7 1 30	...	168 51 28	51 20	168 51 24

Applying then the correction + 2h. 20m. 0s. to reduce the watch time to sidereal time,—and computing for the time thus found, or 2h. 9m. 51s. after the greatest elongation west, that the reduction of the Pole star to the north meridian was = + 1° 22′ 29″,—the polar pointing, or trending of the line of the two socket corners on east side of Pyramid, is, 4′ 44″ west of the polar point of the sky, referred to the north horizon.

NORTH SIDE OF GREAT PYRAMID.

At 4h. 30m. P.M. placed the Playfair alt-azimuth instrument on eastern half of northern rubbish-heap, where a nick had been prepared during the day,—expected in the vertical plane joining the outer corners of north-east and north-west sockets. The position was very difficult to attain in any way, on account of the steepness and looseness of the rubbish-heap, which owes its present compound shape and extra steepness of slope—to the excavations made by Colonel Howard Vyse on the original rubbish-heap; for that heap was previously of the same simple form, as those still to be seen on the other three sides of the Pyramid. The wind was violent, and the air often so filled with sand and lime-stone-dust, that I could seldom open my eyes with impunity, though holding them as close as I could to the telescope or microscope eyepiece. My right hand, by continual overtasking during the several last days, had become so sprained, that the Playfair

instrument had to be lifted for me by Mr. Inglis, in placing it on its stand. He likewise adjusted the observing signals over the outer corners of the two sockets; at the north-east socket, a camera-stand; and at the north-west socket, finally, an 18-inch rod, which he held vertical by hand.

Not until close upon seven o'clock, when daylight had almost entirely vanished, had we obtained a place where the instrument was sufficiently in the line of the two signals, and could see them both,—so extensive and troublesome were found the necessary diggings into the side of the steep hill of loose rubbish and dust.

At length, after various trials, the instrument and its stand were erected in a new hole; hastily levelled; and the following observations obtained with single microscope—

	West signal,	= 256° 35′,	and	East signal,	76° 37′
Again,	,,	= 256 37	and	,,	76 37

Now these notes show a discrepance of 2′ somewhere, and though I turned to the west signal immediately, the growing darkness prevented my seeing it again; while the east signal, on being looked for, was found to have been blown down in the interval. Directing therefore immediately to Polaris, the following observations were taken:—

	h.	m.	s.			
At	7	2	0	per watch, azimuth of Polaris,	. =	165°20′ 0″
	7	4	50	,, ,,	. =	165 21 0
	7	6	30	,, ,,	. =	165 21 30
Means, =	7	4	37,	or 9 h. 28 m. 12 s. sidereal time,	=	165°20′ 50″

The reduction to the meridian for the above sidereal time, or 2h. 21m. 50s. after time of greatest elongation of Polaris west, = 1° 19′ 40″: making reading for celestial pole = 166° 40′ 30″ referred to north horizon.

And if we take a mean of the signal measures just as they stand, adding 90° to the degree-reading for the west end,—we obtain 166° 36′ 30″, for the azimuth of the polar direction of the Pyramid deduced from its north side, as defined by the terminal sockets' outer corners there,—indicating that such line, is

4′ 0″ West of celestial pole.

I need hardly remark that this observation requires repetition, and would have been repeated by me, but that another night was not possible.

SECTION IV.—HEAT MEASURES.

INTRODUCTION.

THE instruments employed in these measures, including the meteorological, were—

1. An aneroid barometer, by T. Cooke and Son; compared by J. Hartnup, Esq., Director of the Liverpool Observatory, through 0·692-inch of barometer range, and through 25·5° of temperature, with the result—that it is correct to ·001-inch at 83·0° temperature; but has a thermal correction of 0·00243-inch for one degree of Fahrenheit, + above, and − below the temperature of 83·0°.

2. Thermometer, 'Casella 0,' a mercurial travelling thermometer, scale engraved on glass tube, compared at the Liverpool Observatory on June 1, 1865, and found by three observations to be 0·1° too high, at or near 62°.

Therefore the correction to be applied to its readings is − 0·1°.

3. Thermometer, 'Casella 1500,' a mercurial, Phillips'-maximum thermometer, scale engraved on glass tube, and found to have top of *unbroken*

mercurial column, 10·1° distant from top of broken part,—when this is being driven along slowly by expansion.

Adding therefore 10·1° to any reading of the column part, its readings are then found 0·3° too high; hence the correction for such readings is −0·3°, at or near 62°.

4. Thermometer, 'Casella 1499,' a mercurial, Phillips'-maximum. Column correction = + 9·6°; with which added, the final correction on the Liverpool standard is − 0·2°, at or near 62°.

5. Thermometer, 'Casella 1834,' a spirit minimum thermometer, for whose corrections see Meteorological Journal.

6. Ayrton's Fastre's dry-bulb; a mercurial thermometer, scale Centigrade, and engraved on the glass tube; it reads too high, and requires a correction to its readings of −1·1° Fahrenheit.

7. Ayrton's Fastre's wet-bulb; a mercurial thermometer, Centigrade scale engraved on the glass tube; it reads too high, and requires a correction to its readings of − 0·9° Fahrenheit. Both of these thermometers were of exquisite manufacture, and were kindly lent me by Mr. Ayrton for Pyramid observations.

METEOROLOGICAL STATION.

This was established in our dining-room tomb, at East Tombs. Said tomb was very shallow in depth

and large in opening,—not very different from two-thirds of a sphere, worked out in the middle of the cliff, and towards the east-north-east. The sun only shone into it early in the morning, for a short time; and then the thermometer-box, of mahogany, with louvre-boarded sides, was always carefully placed in the shade. Every facility was given through the day, for the wind to blow freely on the thermometer bulbs; but I am afraid that at night, the minimum thermometer may possibly have been rather too well protected by the roof of the tomb or cavern; for, on the only night when we had simultaneous observations on the summit of the Pyramid and at East Tombs,—the depression of temperature at the former was much more than it should have been for the height; or, assuming the summit observations true, the minimum temperature at East Tombs was abnormally high.

Otherwise the station was a respectable one for its purposes, and in locality may be described as follows:—

EAST TOMBS METEOROLOGICAL STATION.

Latitude,	=	29° 58′ 45″ North.	
Longitude, approximate,	=	2h. 5m. East of Greenwich.	
Height, above the sea,	=	1600	inches.
,, well-water,	=	800	,,
,, neighbouring plain,	=	520	,,
Depth, below neighbouring hill-top,	=	250	,,
,, Great Pyramid pavement,	=	980	,,
,, King's chamber floor,	=	2668	,,
,, outcrop of air-channels,	=	4210	,,
,, present Pyramid summit,	=	6420	,,

Distance direct from Red Sea, ...	=	87 miles.
„ „ Mediterranean, . . .	=	110 „
Distance from Mediterranean along the course of the Nile, ...	=	150 „
Distance from cultivated land, about, . .	=	0·5 „
Distance from Great Pyramid, about, . .	=	0·2 „

See also Map in Plate II. vol. i.

WELL TEMPERATURES NEAR CAIRO.

The wells, the temperature of whose water is here alluded to, are frequent in and about the city of Cairo,—sometimes single, and sometimes in a cluster of three,—but always fitted up with a sakeeah or water-raising apparatus turned by bullock, donkey, or other animal power,—and consisting chiefly of a vertical wheel, raising one side of an endless band garnished with earthen water-pots. The observations for temperature, were usually made in the stream of water flowing out of the basin into which the water-pots emptied their supply. But if the machine was not at work at the moment, I raised the water for myself with a glass tumbler and string,—measuring only the third or fourth tumblerful drawn up; and no temperature-difference between the two methods at the same well, could be detected,—though there was much difference, and apparently constant, between one well and another. The reason of this variation I could not make out, for there was very little difference generally in the depth of the wells; the country was flat on the surface; and it was to be presumed that all the wells drew upon the same subterranean sheet of water.

Wells near Cairo.

Date.	Hour.	Name of Well.	Temperature of		Depth of Well approximately.
			Air.	Water.	
1864.	h. m.				inches.
Dec. 21.	9 15 A.M.	White well, Boolak road,	61·0°	71·2°	400
,, ,,	9 30 ,,	Coppersmith's well, do., .	58·5	70·0	500
,, ,,	11 30 ,,	,, ,,	68·0	70·1	...
,, 28.	3 0 P.M.	East side of Usbekeeah, .	67·0	68·0	400
,, 29.	9 30 A.M.	At Casr Nuzha, . .	60·1	67·3	350
,, ,,	10 30 ,,	Beyond Casr Nuzha, .	66·5	69·9	400
,, 30.	9 30 A.M.	White well, . . .	64·0	71·0	400
,, ,,	9 50 ,,	Coppersmith's well, .	63·0	70·2	500
,, 31.	4 30 P.M.	Coppersmith's well, .	64·0	69·6	500
1865.					
Jan. 4.	6 55 A.M.	White well, . . .	49·0	71·0	400
May 3.	8 0 ,,	At Casr Nuzha, . .	68·0	69·4	350
,, ,,	8 15 ,,	Beyond Casr Nuzha, .	68·0	70·8	400

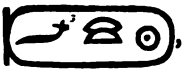
Open water in the Nile, near middle of Stream.

Date.	Hour.	Where.	Temperature of	
			Air.	Water.
1864.	h. m.			
Dec. 31.	4 0 P.M.	Between Boolak and Gezireh, . . .	65·0°	58·3
1865.				
Jan. 2.	6 55 A.M.	,, ,,	64·0	58·8

WELL TEMPERATURES NEAR THE PYRAMID.

Date.	Hour.	Name of Well.	Temperature.		Depth to surface of water.
			Air.	Water.	
1865.	h. m.				inches.
Jan. 26.	4 0 P.M.	King Shafre's well, .	69·5°	63·5°	105
„ „	4 10 „	„ „ .	68·5	63·3	...
Feb. 15.	11 10 A.M.	King Shafre's well; this temperature appears low, but has noted under it in the observing-book that it was *exactly* measured.	68·0	61·0	...
April 23.	4 50 P.M.	King Shafre's well, .	88·2	66·2	105
„ „	4 55 „	Sand near well, = 89,	...	66·7	...
„ „	5 15 „	Abdallah's well in field,	...	66·9	130?
„ „	„ „	A similar well, a few feet further North, .	...	68·0	...
„ „	„ „	Another, . . .	...	69·3	...
„ „	„ „	Another, . . .	...	69·7	...
„ „	„ „	Another, . . .	...	71·1	...
„ „	„ „	Another, . . .	...	70·2	...
„ „	„ „	Another, . . .	...	69·3	...
„ „	„ „	Another, . . .	...	68·8	...
„ „	„ „	Another, . . .	...	70·3	...
„ „	6 0 „	Abdallah's well returned to,	...	67·3	...
„ „	6 34 P.M.	King Shafre's well, .	...	66·8	105

Of these wells near the Pyramid, the most remarkable one by far is that called King Shafre's, being a square, masonried, sepulchral-looking shaft, —105 inches deep from the alabaster floor to the water-surface, and with a depth of water of 70 inches below that again,—in the eastern room of

the recently-discovered and excavated building called King Shafre's Palace or Tomb, south-east of the Sphinx; and in which well, was found by Mariette Bey, the broken, life-sized statue of King Shafre  , in diorite. Hence this well has really some claim to show, what the temperature of a water-well in the Great Pyramid *would* be.

All the rest of the wells noted under this heading, were agricultural wells in the alluvial flat east of the Pyramid hills. With reference to the observations of April 23, the following note appears in the observing-book:—

April 23.—No wind; dull hazy evening: sun coloured of an unwholesome primrose yellow; locusts appearing from the south-west. The water to be examined was drawn always from the wells in a small tin kettle at the end of a rope; and only after said kettle had been kept plunging in and out for some minutes, and then depressed for as long, to near bottom of well. The temperature was taken both by *fall and rise*; that is, the air being warmer than the water, the thermometer was plunged into the fluid, and kept in until it ceased to fall; then being taken out, evaporation lowered the bulb below its previous lowest, — in which state it was again plunged into the water, and rose up to, or very nearly to, what it had reached at first when descending from the warmer air.

The reason of the different temperatures of the

waters of the different wells in the alluvial plain, we could not discover at the time, or since: for their construction and situation seemed all so very similar; viz., circular holes eight to twelve feet broad, and fifteen to twenty deep, lined about their lower parts with Indian-corn stalks. The last four northward wells were being worked by the villagers with the shadoof: the first five, were not being worked in any way. In some of the extreme cases of anomalous temperatures, the kettleful of water experimented on was emptied upon the ground, and a new haul taken,—but in no case was the numerical result of the first experiment thereby sensibly altered, for *that* well.

GREAT PYRAMID TEMPERATURES.

Date.	Time.	Subject.	Dry bulb.	Wet bulb.
1865. January 19.	h. h. m. 10 to 10 35 A.M.	In dust under coffer in King's chamber,	75·0°	...
,,	,, ,,	In air, at intervals of five minutes, by Mr. Ayrton's Fastre's thermometers, corrected for index-errors, .	75·7 75·4 75·2	65·8° 65·8 65·8
,,	,, ,,	In dust on floor in Queen's chamber,	74·3	...
,,	,, ,,	Again, . . .	74·3	...

N.B.—Temperature of Queen's lower than that of King's chamber, though latter is more elevated.

Date.	Time.	Subject.	Temperature by Casella 0.
1865. January 26.	h. m. 10 27 A.M.	Floor of King's chamber in temperature, . .	75·5° Fah.
,,	10 44 A.M.	Floor of Queen's chamber in temperature, . .	74·3° Fah.

Temperature of Queen's, again lower than of King's, chamber.

Date.	Time.	Subject.	Temperature by Caselia 0.
1865.	h. m.		
March 20.	10 50 A.M.	South air-channel in King's chamber, .	75·2°
„	1 0 P.M.	Do. do.	75·2
March 21.	10 37 A.M.	North air-channel in King's chamber, .	75·0
„	0 0 P.M.	Do. do.	75·0
March 23.	9 0 A.M.	North air-channel in King's chamber, .	75·0
„	11 0 A.M.	Do. do.	75·0
March 25.	9 30 A.M.	In dust at descent into well from Grand Gallery, . . .	73·2
„	9 50 A.M.	In dust in hole of floor of Queen's chamber, . .	74·5
„	10 13 A.M.	In dust of well-mouth of Grand Gallery repeated, . . .	73·2
„	10 45 A.M.	South air-channel in King's chamber, .	75·1
„	10 57 A.M.	North air-channel in King's chamber, .	74·9
„	11 25 A.M.	Do., but meanwhile two travellers and their Arabs had entered and gone again, . . .	75·3
„	0 15 P.M.	Still in same place, .	75·2
„	0 20 P.M.	In further part of north air-channel, outside King's chamber, where it is entered by a forced passage from the antechamber, .	74·7
March 29.	10 A.M. to 1 P.M.	In King's chamber, .	75·0

NORTH AIR-CHANNEL.

On March 30, 1865, had six buckets of water poured in quickly one after the other at top of

north air-channel,—where it crops out on the exterior of the Pyramid,—expecting that they would run through, carrying the mean-temperature with them,—and down to the excavated cross-passage, which meets said air-channel from north end of ante-chamber. But no water came through; the shaft being evidently plugged up somewhere,—as it was in Colonel Howard Vyse's day, before he cleared it. Meanwhile I was waiting at said cross-passage with a candle, two thermometers, and a tin mug,—and observed the following rise of temperature in the air of that confined locality, evidently from the effect of my own, and the candle's, heat. At—

h.	m.					
9	15	A.M., temperature by Casella	0 = 74·6°,	by spirit min. Th. =		74·6°
9	30	,,	,,	75·0	,,	75·0
9	45	,,	,,	77·8	,,	...
10	0	,,	,,	78·2	,,	...
10	15	,,	,,	78·1	,,	77·0
10	30	,,	,,	77·6	,,	77·5
10	45	,,	,,	77·8	,,	77·4
11	0	,,	,,	76·8	,,	76·8
11	15	,,	,,	77·8	,,	77·5
11	30	,,	,,	77·6	,,	77·4
11	45	,,	,,	77·2	,,	76·8

SOUTH AIR-CHANNEL.

On April 1, at 10.45 A.M., six buckets of water were poured down the open, upper, outer end of south air-channel; and in half an hour afterwards it began to trickle, but only to trickle, through the south air-channel mouth in the King's chamber, and on to the floor. At 11h. 27m. A.M., I began to

catch it, as it thus came out of the mouth of the hole, in a one-ounce glass; and tested the temperatures of successive fillings, as follows—

First,	. . . . .	= 74·5°
Second,	. . . . .	= 73·5
Third,	. . . . .	= 74·2
Fourth,	. . . . .	= 74·5

When the thermometer, wet with any previous experiment, was held in the air while the glass cup was refilling, its column went down to 72° and 71°, pretty quickly; and with more time would go down as low as 66·3°. But this was an effect of evaporation; and the true temperature of the water, which went on trickling for more than half an hour through the air-channel hole—was close to 74·5°, as shown by the thermometer immersed in it, and kept there, on each occasion, upwards of one minute.

SUMMIT OF GREAT PYRAMID.

April 10, 1865.—Observed the following temperatures by 'Casella 0,' placed temporarily in windy, but shaded from sky, places,—

At 8 45 P.M.	appar. solar time,	temperature,	=	60·0° Fahr.
8 54	,,	,,	=	57·3 ,,
9 8	,,	,,	=	56·0 ,,
9 14	,,	,,	=	55·4 ,,
April 11, 0 25 A.M.	,,	,,	=	54·3 ,,
0 47	,,	,,	=	53·9 ,,
0 58	,,	,,	=	54·3 ,,
Day-break,	,,	,,	=	50·0 ,,
Sunrise,	,,	,,	=	49·0 ,,
N.B.—Spirit minimum at day-break was at			=	51·0 ,,

METEOROLOGICAL JOURNAL AT EAST TOMBS,

January 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic feet of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☽ 14th,	11 A.M.	30·25	58·4	57·6	51·4	(55·5)	...	3·4
	1 P.M.	30·20	59·9	59·8	53·0	...	...	3·6
	2 ,,	30·18	62·1	62·0	53·6	...	...	3·5
	3 ,,	30·16	60·4	60·0	51·9	62·3	59·2	3·2
	4 ,,	30·16	61·6	62·0	51·1	...	(6·1)	3·0
	7 ,,	30·15	60·6	60·0	52·6	...	...	3·4
☉ 15th,	8 A.M.	30·13	57·9	57·3	51·1	(57·0)	...	3·3
	10 ,,	30·11	61·9	61·5	55·6	...	...	4·1
	0 P.M.	30·10	66·9	66·5	55·6	...	...	3·5
	3 ,,	30·06	64·1	63·5	55·6	67·3	61·6	3·8
	7 ,,	30·10	61·1	60·3	56·1	...	(11·5)	4·3
☾ 16th,	8 A.M.	30·14	56·0	55·5	51·3	(54·7)	...	3·6
	10 ,,	30·18	59·3	59·2	53·6	...	...	3·8
	0 P.M.	30·13	62·3	62·0	53·6	...	...	3·5
	3 ,,	30·12	63·3	63·0	51·8	...	...	3·0
	7 ,,	30·15	61·0	60·8	54·9	67·5	59·3 (16·4)	4·0
♂ 17th,	7 A.M.	30·21	48·4	48·2	43·8	(47·5)	...	2·7
	9 ,,	30·24	57·3	57·0	50·0	...	...	3·2
	0 P.M.	30·17	64·3	63·2	54·0	...	...	3·4
	3 ,,	30·16	64·3	64·0	55·0	...	...	3·6
	7 ,,	30·18	60·3	60·0	51·6	65·5	58·0 (15·0)	3·2

GREAT PYRAMID HILL, IN THE YEAR 1865.

and Moisture.		Clouds.		Wind.		
Computed						
Humidity relative Sat. = 100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	Remarks.
	Grains.					
81	2·1	3	Cirro-cumuli,	2	N.	Heavy smoky haze over Cairo.
82	2·2	6	Cirrus, . .	1	N.	
56	2·7	5	Cirrus and cirro-cumuli,	0	0	
56	2·6	4	Cirrus, . .	1	N.	
49	3·2	6	Cirrus, . .	1	N.	Ibraheem and Smyne near Thermometer-box.
58	2·5	10	Cirro-strati, .	0	0	
82	2·0	10	Cirro-strati and nimbus,	0	0	Blue, hazy, half fog half rain effect in distance.
66	2·1	10	Cirro-strati and cirrus,	0	0	Slight shower of rain about 9 A.M.
48	3·8	7	Cirro-strati, .	0	0	
57	2·8	10	Cirro-strati and cirrus,	1	N.W.	Clouds look very watery.
72	1·7	10	Nimbus, .	8	N.W.	Occasional rain dropping.
72	1·4	0	0	0	0	
68	1·8	0	0	1	N.	Smoke hanging over Cairo.
56	2·8	0	0	0	0	Smoke still hangs over Cairo.
46	3·5	0	0	0	0	
68	2·0	0	0	0	0	A few stars shining brightly.
70	1·2	5	Cirrus, . .	0	0	
60	2·1	5	Cirrus, . .	0	0	☉ rose by compass S. 65 E. over S. end of Masara Hill. Visited Sphinx, and found it looking straight East, ridge of its back also East and West.
50	3·3	3	Cirrus, . .	2	S.	
54	3·1	0	0	1	S.	
56	2·7	0	0	0	0	Bright star-light.

JANUARY 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 18th,	7 A.M.	30·21	55·1	54·3	46·2	(53·5)	...	2·5
	8 ,,	30·21	57·6	57·3	48·3	...	...	2·7
	9 ,,	30·21	57·9	57·5	48·4	...	...	2·7
	0 P.M.	30·14	65·1	65·0	53·6	...	...	3·2
	7 ,,	30·14	63·3	62·8	54·6	66·0	60·6 (10·8)	3·6
♃ 19th,	8 A.M.	30·21	59·1	58·5	48·6	(56·9)	...	2·7
	0 P.M.	30·18	66·3	66·0	53·8	...	...	3·1
	3 ,,	30·19	70·1	70·0	54·6	...	...	3·0
	7 ,,	30·24	65·5	65·2	54·2	70·0	63·0 (14·0)	3·3
♀ 20th,	7 A.M.	30·25	55·6	55·5	47·6	(55·0)	...	2·8
	10 ,,	30·26	64·2	63·3	53·6	...	...	3·3
	0 P.M.	30·21	70·9	69·8	53·4	...	...	2·7
	3 ,,	30·15	72·9	72·4	55·1	...	...	2·9
	7 ,,	30·19	63·5	63·2	56·0	73·0	64·3 (17·5)	4·0
♄ 21st,	7 A.M.	30·15	56·3	56·3	52·8	...	...	4·0
	9 ,,	30·18	57·1	57·0	53·8	(56·0)	...	4·1
	0 P.M.	30·12	63·1	63·0	58·6	...	...	4·8
	3 ,,	30·10	66·1	65·5	60·4	...	...	4·9
	7 ,,	30·11	63·5	63·1	60·4	66·3	61·4 (9·9)	5·3
⊙ 22d,	8 A.M.	30·15	58·3	58·1	55·8	(56·9)	...	4·6
	9 ,,	30·17	60·0	59·3	57·0	...	...	4·7
	0 P.M.	30·13	64·4	64·0	58·6	...	...	4·6
	3 ,,	30·10	68·7	68·2	59·0	...	...	4·1
	7 ,,	30·13	64·3	63·8	57·6	69·5	62·8 (13·5)	4·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
52	2·4	1	Cirrus, . .	1	S.	Smoke and haze level over Cairo; the green plain also with much mist lying upon it.
52	2·6	1	Cirrus, . .	1	S.	
52	2·6	1	Cirrus and cirro-strati,	1	S.	
46	3·6	5	Cirrus and cirro-cumuli,	0	0	
56	2·9	10	Cirro-cumuli,	1	N.	Visited the third Pyramid, and at 3 P.M. was in the interior of the Great Pyramid.
48	2·9	0	0	0	0	Haze level over Cairo.
44	4·0	0	0	1	S.	Took Aneroid levels at Great Pyramid. (See Journal.)
37	5·0	0	0	1	N.W.	Smoke haze clearing away over Cairo before North-west wind.
47	3·6	0	0	1	N.E.	
56	2·2	0	0	0	0	Dense level haze over Cairo, and along Nile.
49	3·3	0	0	1	N.	The same dense haze continues.
33	5·6	0	0	3	N.E.	Haze clearing away.
32	5·8	1	Cirrus, . .	4	N.E.	Haze almost gone.
61	2·6	3	Cirrus, . .	2	N.E.	A few stars shining.
78	1·0	4	Cirrus and fog,	0	0	Heavy fog before sunrise, and still over central line of Nile valley.
79	1·1	10	Fog, . .	0	0	Fog driving from North to South.
75	1·6	8	Cirro-cumuli,	1	N.	Fog almost concealing the last green of the valley.
70	2·1	9	Cirro-cumuli,	1	N.	The plain visible, but fog over Cairo and Nile valley. At 4 P.M. Maasara Hill visible.
82	1·2	4	Cirrus, . .	2	N.	Stars shining out.
84	0·9	10	Cirro-strati, .	1	N.E.	
82	1·1	10	Cirro-strati, .	2	N.E.	Haze fog in distance.
68	2·1	0	0	3	N.E.	Haze all gone. ☉ shines brightly.
53	3·6	0	0	3	N.E.	
64	2·3	1	Cirrus, . .	1	N.	

January 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 23d,	8 A.M.	30·14	55·3	55·2	54·1	...	...	4·5
	9 ,,	30·15	59·1	59·0	57·1	(55·0)	...	4·9
	0 P.M.	30·13	65·1	65·0	60·6	...	...	5·1
	3 ,,	30·08	67·7	67·5	61·6	...	...	5·0
	8 ,,	30·13	62·8	62·4	58·0	68·5	62·2 (12·7)	4·6
☽ 24th,	7 A.M.	30·16	59·6	59·2	56·1	...	...	4·5
	8 ,,	30·17	57·3	57·0	55·5	...	...	4·6
	9 ,,	30·19	60·1	59·8	57·2	(56·7)	...	4·8
	0 P.M.	30·16	65·1	65·0	56·8	...	...	4·0
	3 P.M.	30·12	65·3	65·0	55·6	...	...	3·6
	5·5,,	30·11	63·3	63·0	53·6	65·3	59·8	3·4
	8 ,,	30·12	62·3	61·6	53·7	...	(10·9)	3·5
☿ 25th,	7 A.M.	30·15	52·6	52·4	48·5	...	...	3·3
	9 ,,	30·16	60·1	60·0	50·8	(52·2)	...	3·1
	0 P.M.	30·12	67·1	66·5	54·6	...	...	3·2
	3 ,,	30·10	66·0	65·6	56·6	...	...	3·8
	7 ,,	30·13	63·6	63·2	56·0	67·2	58·7 (15·1)	3·9
♃ 26th,	7 A.M.	30·11	52·3	52·6	49·5	...	...	3·6
	9 ,,	30·13	61·1	61·0	53·8	(52·0)	...	3·6
	0 P.M.	30·08	66·3	66·2	56·2	...	...	3·7
	3 ,,	30·08	68·3	68·2	57·1	...	...	3·7
	7 ,,	30·10	65·3	64·8	58·0	68·5	61·8 (13·3)	4·3
♀ 27th,	7 A.M.	30·16	59·0	58·6	55·6	...	...	4·5
	9 ,,	30·18	65·1	64·8	59·6	(58·5)	...	4·8

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
92	0·4	10	Fog, . .	3	N.	Dense fog.
85	0·7	8	Cirrus, . .	2	N.	Fog decreasing.
76	1·7	6	Cirrus, . .	2	N.	
68	2·4	5	Cirro-strati, .	4	N.	
73	1·7	2	Cirrus, , .	2	N.	
80	1·2	3	Fog, . .	1	N.	Fog over Nile valley to ground.
88	0·6	10	Fog, . .	0	0	Fog over hill, and heavy on central Nile valley.
88	1·0	10	Fog, . .	0	0	Fog beginning to lift up.
58	2·9	5	Cumulus and cirro-strati,	1	N.	Fog disappeared.
52	3·2	2	Cirrus, . .	1	N.	Very bright, with light cirrus clouds flying about.
52	3·1	4	Cirrus, . .	1	N.	Brilliant rosy sky after sunset.
56	2·8	2	Cirrus, . .	1	N.	
74	1·2	3	Cirro-cumuli,	0	0	
53	2·8	2	Cirro-cumuli,	2	S.	Haze gathering over Cairo.
44	4·1	3	Cirro-cumuli,	2	S.	Haze increasing in density over Cairo.
54	3·2	5	Upper cirro-cumuli and lower cirro-strati, .	1	N.	Remarkably clear towards South and West.
61	2·6	7	Cirro-strati, .	0	0	
82	0·8	2	Cirrus, . .	0	0	
61	2·4	0	0	0	0	Aneroid levels taken today between East Tombs and interior of Pyramid.
52	3·4	1	Cirrus and cumulus, .	0	0	
48	3·9	2	Cirro-strati, .	2	N.	Gust of wind blew sand into East Tombs.
62	2·6	8	Cirro-strati, .	2	W.	
80	1·1	2	Cirro-cumuli,	0	0	Thin mist over line of Nile.
71	2·0	1	Cirro-cumuli,	0	0	

JANUARY 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 27th,	0 P.M.	30·16	66·1	65·5	59·6	...	...	4·7
	3 ,,	30·13	66·6	66·0	57·0	...	...	3·8
	7 ,,	30·17	63·6	63·0	56·0	67·3	62·0 (10·5)	3·9
♄ 28th,	7 A.M.	30·19	55·8	55·4	50·6	...	...	3·5
	8 ,,	30·20	57·8	57·2	52·5	(55·2)	...	3·7
	9 ,,	30·21	61·3	60·4	55·0	...	...	4·0
	10 ,,	30·22	64·3	64·1	56·6	...	...	4·0
	11 ,,	30·20	66·6	65·8	56·6	...	...	3·8
	0 P.M.	30·16	67·1	66·2	57·4	...	...	3·9
	1 ,,	30·13	67·3	67·0	58·6	...	...	4·2
	2 ,,	30·13	66·5	65·8	58·0	...	...	4·2
	3 ,,	30·12	67·3	67·0	58·5	...	...	4·2
	4 ,,	30·12	68·4	68·2	58·8	69·0	61·6	4·1
	5 ,,	30·12	66·6	66·5	58·4	...	(14·9)	4·3
	6 ,,	30·13	66·0	65·5	57·7	...	...	4·1
	7 ,,	30·15	64·7	64·4	57·2	...	...	4·1
	8 ,,	30·16	63·2	62·5	55·6	...	...	3·9
	9 ,,	30·16	62·0	62·1	55·8	...	...	4·1
	10 ,,	30·16	60·0	59·7	54·3	...	...	3·9
	11 ,,	30·17	60·2	59·8	54·6	...	...	4·0
⊙ 29th,	5 A.M.	30·16	53·5	53·2	50·0	(53·0)	...	3·6
	7 ,,	30·18	55·3	55·0	50·0	...	...	3·4
	8 ,,	30·19	59·3	58·3	53·8	...	...	3·9
	9 ,,	30·20	62·1	61·8	54·6	...	...	3·8
	0 P.M.	30·16	68·6	67·8	58·5	...	...	4·0
	3 ,,	30·13	71·1	71·0	59·6	...	...	4·1
	7 ,,	30·15	64·0	63·8	55·6	73·0	62·8 (20·4)	3·8
☾ 30th,	7 A.M.	30·11	54·1	53·4	48·5	(52·3)	...	3·1
	9 ,,	30·13	60·1	59·8	56·6	...	...	4·6
	0 P.M.	30·09	66·3	66·0	59·1	...	...	4·5
	3 ,,	30·04	70·3	70·0	56·1	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
66	2·4	5	Cirro-cumuli,	2	N.	
54	3·3	3	Cumulus, .	1	N.	
61	2·6	0	0	0	0	
69	1·5	0	0	0	0	Low thin white haze over all the Nile land.
69	1·6	0	0	0	0	Said haze clearing, and leaving smoke stratum over Cairo.
66	2·1	0	0	1	S.	
60	2·6	0	0	0	0	Smoke from chimneys in Cairo rising straight up.
53	3·4	0	0	1	S.	
53	3·4	0	0	1	S.	Dense smoke-haze over Cairo.
57	3·1	2	Cirro-strati, .	0	0	
58	3·0	1	Cumulus, .	0	0	
57	3·1	1	Cumulus, .	0	0	
54	3·5	0	0	0	0	
60	2·9	0	0	1	N.	Smoke-haze blowing off Cairo to the South.
59	2·9	0	0	0	0	
61	2·6	0	0	0	0	Stars very bright.
61	2·6	0	0	0	0	
66	2·1	0	0	2	N.	
68	1·9	0	0	2	N.	
68	1·9	0	0	2	N.	
77	1·0	0	0	1	N.	
68	1·6	0	0	0	0	Low level haze over line of Nile.
69	1·8	0	0	0	0	
60	2·4	0	0	0	0	
52	3·6	0	0	1	N.E.	
49	4·2	0	0	2	N.E.	
57	2·8	0	0	3	N.E.	
66	1·6	3	Cirrus, . .	0	0	Dense white haze over Nile line.
79	1·2	2	Cirrus, . .	0	0	
63	2·6	1	Cirrus, . .	0	0	Smoke from chimneys in Cairo rising straight.
41	4·8	1	Cirro-cumuli,	0	0	Smoke from two great chimneys in Cairo blowing *towards* each other.

JANUARY 1865.		Air Pressure at Station.	Air-Shade Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Thermo.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 30th,	8 P.M.	30·05	65·4	65·1	54·6	70·4	62·3 (16·2)	3·4
♂ 31st,	7 A.M.	29·97	57·0	56·8	49·4	(56·1)	...	3·1
	9 ,,	29·98	66·8	66·0	55·8	...	...	3·6
	0 P.M.	29·95	69·3	69·0	56·8	...	...	3·5
	3 ,,	29·89	76·2	76·0	58·1	...	...	3·3
	7 ,,	29·90	71·1	70·8	56·7	76·8	66·4 (20·5)	3·3
FEBRUARY								
☿ 1st,	7 A.M.	29·98	57·4	57·1	48·2	(56·0)	...	2·7
	9 ,,	29·98	66·1	65·8	53·6	...	...	3·1
	0 P.M.	29·97	69·1	69·0	55·8	...	...	3·4
	3 ,,	29·86	69·6	69·5	55·6	...	...	3·3
	7 ,,	29·84	64·2	63·7	52·0	76·5	66·0 (21·0)	3·0
♃ 2d,	7 A.M.	29·87	55·0	54·8	48·5	...	...	3·0
	9 ,,	29·88	63·3	63·0	53·1	(55·0)	...	3·3
	0 P.M.	29·84	67·1	66·5	54·1	...	...	3·1
	3 ,,	29·77	68·1	67·3	55·1	...	...	3·2
	7 ,,	29·71	64·3	64·0	51·5	68·1	62·1	2·9
	9 ,,	29·70	...	...	...	...	(12·0)	...
♀ 3d,	6 A.M.	29·69	57·3	57·3	50·0	...	...	3·2
	7 ,,	29·70	58·5	58·2	50·9	(57·2)	...	3·2
	8 ,,	29·71	58·6	58·3	51·2	...	...	3·3
	9 ,,	29·74	61·4	61·0	52·0	...	...	3·2
	10 ,,	29·75	...	...	...	...	...	...
	11 ,,	29·77	63·5	63·0	53·5	...	...	3·4
	0 P.M.	29·76	65·1	64·8	54·0	...	...	3·3
	1 ,,	29·76	64·6	64·1	53·6	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
49	3·5	0	0	0	0	A visitor prevented 7 P.M. observation.
59	2·1	1	Cirro-strati, .	0	0	Dense but distant cloud-bank on N.E. horizon.
49	3·7	0	0	1	S.	
46	4·3	0	0	3	S.	
34	6·5	0	0	5	S.	
40	5·0	0	0	4	S.	Moon and stars very bright, and making sharp shadows on the desert sand.
53	2·6	0	0	0	0	Rather hazy horizon.
44	3·9	0	0	3	S.	
43	4·5	1	Cirrus, . .	2	S.	Maximum probably in error, by + 6°.
41	4·7	9	Cirro-strati and nimbus,	5	S.	Clouds, cirro-strati, and nimbus.
44	3·7	3	Cirrus, . .	5	S.S.W.	Atmosphere becoming more clear.
62	1·9	5	Cirrus and cirro-cumuli,	4	S.	Dry sand haze on Eastern side of Nile.
51	3·2	1	Cirrus, . .	13	S.	Cairo enveloped in a sand haze; occasional drifting of sand in the desert.
43	4·2	2	Cirrus and cirro-cumuli,	15	S.S.W.	Everything in our tombs getting covered with fine sand.
43	4·3	3	Cirro-strati, .	20	S.S.W.	Sand haze all round.
43	3·8	4	Cirrus, . .	15	S.W.	A sand storm.
...	...	7	Cirro-strati, .	15	S.W.	
60	2·1	1	Cirro-strati, .	14	S.W.	Sand haze obscuring all the distance.
59	2·3	3	Cirrus and nimbus, .	20	S.W.	Colouring very pale.
60	2·2	4	Cirro-strati, .	20	S.W.	Sand in constant motion.
53	2·9	5	Cirrus and nimbus, .	20	S.W.	
...	...	7	Sand haze, .	20	S.W.	
52	3·2	10	Sand haze, .	20	S.W.	Sun shining pale through the sand haze.
48	3·5	10	Sand haze, .	20	S.W.	Pyramids very indistinct through the hazy air.
48	3·5	10	Sand haze, .	20	S.W.	Sand haze evidently thicker, and air darker.

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 3d,	2 ,,	29·76	65·6	65·0	55·0	...	...	3·4
	3 ,,	29·77	65·4	65·0	54·6	...	...	3·4
	5 ,,	29·82	65·4	65·0	54·6	...	...	3·4
	7 ,,	29·89	65·0	64·3	55·5	66·3	61·5	3·6
	9 ,,	29·93	63·0	62·5	54·7	...	(9·6)	3·6
♄ 4th,	6 A.M.	30·01	56·7	56·2	50·0	...	...	3·2
	7 ,,	30·02	58·2	57·8	51·8	(56·2)	...	3·5
	9 ,,	30·04	64·8	64·5	56·1	...	...	3·8
	0 P.M.	30·04	68·1	67·8	56·2	...	...	3·5
	3 ,,	30·00	69·1	69·0	56·4	...	...	3·5
	7 P.M.	30·04	64·1	64·0	54·6	69·2	61·6	3·5
	9 ,,	30·05	63·2	63·0	53·5	...	(15·3)	3·4
☉ 5th,	6 A.M.	30·12	52·0	52·0	45·0	(51·6)	...	2·6
	7 ,,	30·13	54·5	54·0	47·8	...	...	2·9
	9 ,,	30·17	62·3	62·0	51·6	...	...	3·0
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·08	73·1	72·7	57·9	...	...	3·5
	7 ,,	30·11	67·0	66·8	56·5	73·6	63·7 (19·8)	3·7
☾ 6th,	6 A.M.	30·12	56·5	56·1	50·5	(56·0)	...	3·4
	7 ,,	30·13	57·8	57·2	50·2	...	...	3·2
	8 ,,	30·14	61·3	60·5	52·6	...	...	3·4
	9 ,,	30·14	64·1	64·0	54·0	...	...	3·4
	10 ,,	30·13	68·3	68·0	54·4	...	...	3·1
	11 ,,	30·10	70·3	70·0	54·8	...	...	3·0
	0 P.M.	30·09	73·3	73·0	56·4	...	...	3·2
	1 ,,	30·06	74·3	74·0	56·6	...	...	3·1
	2 ,,	30·05	75·3	75·0	57·0	...	...	3·1
	3 ,,	30·03	75·5	75·0	56·9	...	...	3·1
	4 ,,	30·02	74·8	74·5	56·8	...	...	3·1
	5 ,,	30·02	72·3	72·0	56·4	...	...	3·2
	6 ,,	30·03	71·0	70·4	55·3	76·0	67·5 (17·0)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Hmmidity relative lat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
49	3·5	10	Sand haze, .	20	S.W.	Visitors entering.
49	3·5	10	Sand haze, .	15	S.W.	
49	3·5	9	Stratus, .	10	W.S.W.	Break in the clouds.
53	3·2	8	Cirro-strati, .	7	W.	A little blue sky.
58	2·8	5	Cirro-strati, .	10	W.	
62	1·9	1	Cirro-strati, .	6	W.	Distant banks of cirro-strati on East horizon, air clear of sand, and Eastern hills clearly visible.
64	1·9	1	Cirro-strati, .	4	W.	
56	2·9	0	0	3	W.	Haze coming over Cairo and the Nile.
46	4·0	2	Cirro-cumuli, .	3	W.	Haze decreasing.
45	4·4	1	Cirro-strati, .	2	W.	Haze merely on horizon.
53	3·1	0	0	0	0	Moon and stars very bright.
52	3·1	0	0	0	0	
59	1·8	0	0	2	S.W.	
61	1·9	0	0	2	S.W.	
48	3·3	0	0	3	S.	
...	...	...	.....	...	...	Absent from East Tombs at noon.
40	5·4	3	Cirrus, . .	4	S.W.	
50	3·6	3	Cirrus, . .	2	S.W.	
66	1·8	2	Cirrus, . .	0	0	
59	2·2	2	Cirrus, . .	0	0	
56	2·7	3	Cirrus, . .	0	0	
51	3·2	4	Cirrus, . .	2	S.	
40	4·5	1	Cirrus, . .	2	S.	
37	5·1	1	Cirrus, . .	2	S.	
35	5·7	1	Cirrus, . .	2	S.	
34	6·1	1	Cirrus, . .	2	S.	
32	6·4	3	Cirrus, . .	1	S.	
32	6·5	7	Cirrus and cirro-cumuli,	2	S.	
33	6·3	7	Cirrus and cirro-cumuli,	0	0	
37	5·4	7	Cirro-strati and cirro-cumuli, .	1	S.	
37	5·2	10	Cirro-strati, .	0	0	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 6th,	7 P.M.	30·02	70·0	69·8	54·8	...	...	3·1
	8 ,,	30·02	68·7	68·3	54·0	...	...	3·0
	9 ,,	30·03	68·0	67·4	54·0	...	...	3·0
	10 ,,	30·04	67·4	66·8	53·7	...	...	3·0
	11 ,,	30·02	67·3	67·0	53·9	...	...	3·0
	0 A.M.	30·02	66·8	66·2	53·6	...	...	3·0
♂ 7th,	6 A.M.	29·99	62·6	...	49·5	...	...	2·5
	9 ,,	30·01	66·1	66·0	54·6	(62·0)	...	3.1
	0 P.M.	30·01	72·1	72·0	61·6	...	...	4·6
	3 ,,	29·98	72·5	71·9	58·7	...	...	3·7
	7 ,,	29·99	63·1	62·5	49·5	72·5	65·5 (14·0)	2·5
☿ 8th,	7 A.M.	30·11	55·5	54·8	45·6	(55·0)	...	2·4
	9 ,,	30·13	63·5	62·5	51·0	...	...	2·8
	0 P.M.	30·08	67·3	66·6	51·6	...	...	2·6
	3 ,,	30·04	67·4	67·0	52·6	...	...	2·8
	7 ,,	30·04	60·4	60·0	48·6	68·0	61·0 (14·1)	2·6
♃ 9th,	7 A.M.	30·06	52·8	52·0	43·3	...	...	2·2
	9 ,,	30·07	61·1	60·8	47·4	(52·8)	...	2·3
	0 P.M.	30·04	68·1	67·6	50·1	...	...	2·3
	3 ,,	30·02	68·4	68·0	51·6	...	...	2·6
	7 ,,	30·08	62·1	62·0	49·6	68·0	59·8 (16·4)	2·6
♀ 10th,	7 A.M.	30·19	51·8	51·0	44·6	...	...	2·5
	9 ,,	30·25	58·4	57·6	47·9	(50·3)	...	2·6
	0 P.M.	30·21	66·1	65·5	53·4	...	...	3·1
	3 ,,	30·16	65·3	65·1	50·6	...	...	2·6
	7 ,,	30·16	63·1	62·5	49·6	66·5	58·2 (16·6)	2·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
38	4·9	8	Cirro-strati, .	1	S.	
38	4·7	4	Cirro-cumuli, .	1	S.	
40	4·5	5	Cirrus, . .	1	S.	
41	4·4	9	Cirrus and cirro-strati,	1	S.	
42	4·3	9	Cirrus and cirro-strati,	1	S.	
42	4·2	9	Cirro-cumuli, .	0	0	
41	3·8	3	Cirro-strati and cirro-cumuli, .	2	S.	
44	3·9	1	Cirro-strati, .	2	S.	Error of 5° in dry-bulb.
52	4·0	0	0	4	W.	Haze enveloping Cairo and Nile valley.
43	5·0	0	0	2	N.W.	Haze less dense than at noon.
39	3·9	0	0	1	N.W.	Haze much decreased, stars shining.
49	2·6	0	0	0	0	Haze on horizon.
43	3·7	0	0	0	0	Haze coming over the valley.
35	4·8	0	0	1	S.	Haze continues in the distance.
38	4·6	0	0	1	S.W.	Still hazy over the valley.
44	3·3	0	0	0	0	Haze decreased; very bright moonlight.
49	2·3	0	0	0	0	Hazy under sun.
39	3·7	0	0	2	S.	Very cold morning, haze over Cairo and Nile valley.
31	5·2	0	0	3	S.	Sand haze and sand-drift for about an hour.
33	5·1	1	Cirrus, . .	2	S.W.	
43	3·6	0	0	1	W.	
58	1·8	0	0	0	0	Hazy and dull-coloured eastward.
48	2·8	3	Cirro-cumuli,	3	S.	
43	4·0	0	0	2	S.W.	Haze much increased since 9 A.M.
37	4·3	1	Cirrus, . .	2	S.W.	Haze decreased.
40	3·9	0	0	1	S.	Clear moonlight night.

FEBRUARY 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☽ 11th,	6 A.M.	30·19	49·8	49·6	40·4	(49·5)	...	1·9
	7 ,,	30·20	51·6	51·0	43·0	...	...	2·2
	8 ,,	30·20	56·8	56·2	45·2	...	...	2·2
	9 ,,	30·19	60·8	60·6	46·6	...	...	2·2
	10 ,,	30·19	62·3	62·2	47·0	...	...	2·2
	11 ,,	30·15	64·8	64·6	48·0	...	...	2·2
	0 P.M.	30·11	66·1	66·0	49·0	...	...	2·3
	1 ,,	30·08	66·8	66·7	49·2	...	...	2·2
	2 ,,	30·05	67·9	67·4	50·5	...	...	2·4
	3 ,,	30·03	68·4	68·2	51·0	...	...	2·5
	4 ,,	...	...	...	...	...	...	...
	5 ,,	...	...	...	...	...	...	...
	6 ,,	30·01	64·0	63·8	50·0	68·5	59·4	2·6
	7 ,,	30·02	63·1	63·0	50·0	...	(18·3)	2·6
	8 ,,	30·04	59·7	59·5	49·6	...	...	2·8
	9 ,,	30·03	59·8	59·4	49·0	...	...	2·7
	10 ,,	30·01	59·6	59·2	47·6	...	...	2·5
☉ 12th,	6 A.M.	30·07	58·3	58·0	47·5	...	...	2·6
	9 ,,	30·06	60·3	60·0	48·1	(51·0)	...	2·5
	0 P.M.	30·12	65·4	65·0	50·8	...	...	2·6
	3 ,,	30·10	65·2	64·3	50·8	...	...	2·6
	7 ,,	30·15	61·4	61·0	47·8	66·5	57·7 (17·7)	2·3
☾ 13th,	6 A.M.	30·22	47·0	46·8	39·6	...	...	2·0
	7 ,,	30·23	50·8	50·4	41·0	(46·5)	...	1·9
	9 ,,	30·27	59·0	58·8	42·8	...	...	1·8
	0 P.M.	30·25	64·4	64·2	48·1	...	...	2·2
	3 ,,	30·22	64·6	64·5	53·4	...	...	3·2
	7 ,,	30·27	62·1	61·8	45·8	65·2	57·1 (16·2)	2·0
☽ 14th,	6 A.M.	30·35	52·7	52·3	46·5	...	...	2·8
	9 ,,	30·38	59·9	59·7	51·6	(51·5)	...	3·3
	0 P.M.	30·36	64·0	63·8	52·6	...	...	3·1
	3 ,,	30·31	65·1	65·0	50·8	...	...	2·6
	7 ,,	30·34	62·1	62·0	50·1	65·3	58·6	2·7
	9 ,,	30·36	59·4	59·2	52·0	...	(13·4)	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
midity lative 3.=100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
47	2·2	0	0	0	0	Fine clear morning.
52	2·1	0	0	0	0	
42	2·9	0	0	2	S.	
37	3·8	0	0	1	S.	
34	4·1	0	0	2	S.	
31	4·6	0	0	3	S.	
32	4·7	0	0	3	S.	
31	5·0	0	0	3	S.	
31	5·1	0	0	2	S.	
32	5·1	0	0	2	S.	
...	...	...	...	...	...	Out photographing at King Shafre's tomb.
...	...	...	...	...	...	
39	4·0	0	0	2	S.	Remarkably clear night.
41	3·8	4	Cirrus, . .	1	S.	Full moon shining brightly.
49	2·9	3	Cirrus, . .	0	0	
47	3·0	1	Cirrus, . .	1	S.	
43	3·3	0	0	2	S.	
47	2·9	10	Fog, . .	5	W.	
42	3·4	10	Fog, . .	4	W.	
38	4·3	0	0	3	W.	Fog gone from the desert, but still hangs over Cairo.
38	4·2	0	0	5	W.	Horizon hazy.
40	3·7	8	Fog, . .	4	W.	
54	1·7	0	0	1	N.	Haze along horizon.
47	2·3	0	0	1	N.	
31	3·8	1	Cirrus, . .	1	N.	
32	4·5	0	0	2	N.W.	
47	3·5	0	0	3	W.	
31	4·2	0	0	3	W.	
64	1·6	0	0	0	0	
56	2·5	0	0	0	0	
47	3·5	0	0	1	S.W.	
38	4·2	0	0	1	W.	
44	3·5	0	0	1	N.	Stars very bright.
59	2·2	0	0	1	N.N.E.	

February 1865.		Air Pressure at Station.	Air Shade-Temperatu					Compu
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight Vapour cable i of Ai
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grain
15th,	6 A.M.	30·33	53·0	52·6	48·2	...	...	3·2
	7 ,,	30·34	55·6	55·0	51·0	(52·3)	...	3·6
	9 ,,	30·37	62·4	61·9	53·5	...	...	3·5
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·25	66·8	66·4	55·1	...	...	3·4
	7 ,,	30·24	65·3	64·8	54·8	67·0	59·9	3·4
	9 ,,	30·23	63·3	63·0	54·0	...	(14·2)	3·5
♃ 16th,	6 A.M.	30·20	54·1	53·5	46·9	...	...	2·8
	7 ,,	30·21	58·4	57·8	51·4	(53·3)	...	3·4
	9 ,,	30·23	63·1	62·9	53·6	...	...	3·4
	0 P.M.	30·17	71·1	70·9	55·4	...	...	3·1
	3 ,,	30·10	73·2	72·9	55·6	...	...	3·0
	7 ,,	30·10	69·2	69·0	54·6	73·3	65·3 (16·8)	3·1
	10 ,,	30·11	67·5	67·2	54·8	...	...	3·2
♀ 17th,	6 A.M.	30·05	61·5	61·2	51·0	...	...	3·0
	7 ,,	30·06	61·5	61·3	51·0	(60·5)	...	3·0
	9 ,,	30·07	65·3	65·1	52·4	...	...	3·0
	0 P.M.	30·02	74·1	74·0	54·8	...	...	2·8
	3 ,,	29·95	74·5	74·1	55·0	...	...	2·8
	7 ,,	29·99	71·2	71·0	54·6	75·2	68·1	2·9
	9 ,,	30·02	65·5	65·2	56·6	...	(14·2)	3·9
♄ 18th,	7 A.M.	30·05	61·7	61·5	57·5	...	...	4·6
	9 ,,	30·08	66·0	65·8	59·1	(61·6)	...	4·5
	0 P.M.	30·03	70·2	70·0	59·6	...	...	4·2
	3 ,,	29·97	70·7	70·5	57·6	...	...	3·6

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
70	1·3	0	0	0	0	
72	1·3	0	0	0	0	Level smoke over Cairo. Clear morning.
55	2·8	0	0	0	0	
...	...	...	...	...	...	Photographing, and observing the ⊙ for true noon, and measuring levels in King Shafre's tomb.
46	3·9	0	0	2	N.E.	
50	3·4	0	0	1	N.E.	
54	3·0	0	0	1	N.E.	
58	2·0	3	Cirrus and cirro-cumuli,	0	0	
61	2·1	3	Cirrus and cirro-cumuli,	0	0	
53	3·0	3	Cirrus and cirro-cumuli,	0	0	
37	5·2	1	Cirrus, . .	0	0	
33	5·9	3	Cirrus and cirro-cumuli,	0	0	
39	4·7	5	Cirrus and cirro-cumuli,	0	0	
44	4·2	6	Cirrus and cirro-cumuli,	0	0	
48	3·2	10	Cirrus and cirro-strati,	0	0	
48	3·2	8	Cirrus and cirro-strati,	0	0	
43	3·9	8	Cirro-cumuli, .	3	S.E.	
30	6·4	5	Cirro-cumuli, .	3	S.	
30	6·5	2	Cirro-cumuli and cumulus,	2	W.	Appearance of thunder and lightning.
35	5·4	0	0	1	W.	
55	3·0	0	0	1	W.	
76	1·5	4	Cirro-strati, .	0	0	
64	2·5	8	Cirro-strati, .	0	0	
51	3·9	1	Cirro-strati, .	0	0	
44	4·6	1	Cirro-cumuli, .	1	N.	Clear over Cairo and Mokattam Hills.

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♄ 18th,	7 P.M.	29·99	68·2	68·0	56·6	...	...	3·6
	9 ,,	30·01	65·8	65·5	58·2	72·2	66·4 (11·6)	4·3
☉ 19th,	7 A.M.	29·93	62·6	62·3	57·5	(59·7)	...	4·5
	9 ,,	29·97	66·7	66·3	60·2	...	...	4·8
	0 P.M.	29·95	69·2	68·8	59·7	...	...	4·3
	3 ,,	29·92	69·6	69·4	57·6	...	...	3·7
	7 ,,	30·00	65·3	65·0	52·8	70·6	63·0	3·0
	9 ,,	30·02	64·1	63·4	53·0	...	(15·2)	3·2
☾ 20th,	6 A.M.	30·07	52·4	51·8	46·0	...	...	2·8
	7 ,,	30·08	56·4	55·5	49·5	(51·3)	...	3·2
	8 ,,	30·08	58·3	57·8	49·8	...	...	3·0
	9 ,,	30·09	60·6	60·4	51·0	...	...	3·0
	10 ,,	30·12	62·1	61·9	51·6	...	...	3·0
	11 ,,	30·11	63·3	63·0	52·6	...	...	3·2
	0 P.M.	30·09	64·8	64·5	52·5	...	...	3·0
	1 ,,	30·08	65·1	64·9	52·1	...	...	2·9
	2 ,,	30·08	66·0	65·5	53·2	...	...	3·0
	3 ,,	30·08	65·5	65·2	52·6	...	...	3·0
	4 ,,	30·11	63·8	63·5	52·1	...	...	3·0
	5 ,,	30·12	63·2	63·0	52·8	67·4	60·2 (14·5)	3·2
	6 ,,	30·13	62·4	62·2	52·6	...	...	3·2
	7 ,,	30·15	62·9	62·4	53·1	...	...	3·3
	8 ,,	30·17	62·5	62·2	53·0	...	...	3·4
	9 ,,	30·18	61·3	60·6	53·0	...	...	3·5
	10 ,,	30·19	61·0	60·4	53·8	...	...	3·7
♂ 21st,	6 A.M.	30·25	55·1	54·8	48·4	...	...	3·0
	7 ,,	30·27	57·2	56·7	50·6	...	...	3·3
	9 ,,	30·30	64·6	64·3	54·0	(54·5)	...	3·3
	0 P.M.	30·24	67·3	67·0	54·2	...	...	3·1
	3 ,,	30·22	67·5	67·2	54·1	...	...	3·1
	7 ,,	30·26	65·3	65·0	53·9	69·0	61·8 (14·5)	3·2

and Moisture.		Clouds.		Wind.		Remarks.
Computed		Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.					
	Grains.					
47	4·0	0	0	0	0	Stars very bright.
61	2·7	0	0	2	N.W.	
72	1·8	4	Cirrus and cirro-cumuli,	2	S.W.	
66	2·4	3	Cirrus and cirro-cumuli,	5	S.W.	A little gust of wind from N.E., and two showers of rain during the night.
54	3·6	2	Cirro-cumuli, .	1	S.W.	
47	4·2	3	Cirro-cumuli, .	4	W.	
44	3·8	0	0	3	W.	Fog over the level valley of the Nile.
48	3·4	2	Stratus, . .	2	W.	
62	1·7	3	Cirro-strati, .	0	0	Heavy bank of cirro-strati eastward.
61	1·9	2	Cirrus, . .	3	S.	
55	2·4	2	Cirrus, . .	2	S.	
52	2·9	8	Cirrus, . .	10	W.	Sand-drift and dense haze.
48	3·2	6	Cirrus, . .	10	W.	
49	3·3	6	Cirrus, . .	8	W.	Less of sand-drift, but haze very dense.
44	3·7	10	Fog, . .	8	W.	Haze still more dense.
42	3·9	10	Fog, . .	9	W.	
43	4·0	10	Fog, . .	12	W.	Haze and fog.
43	3·9	10	Fog, . .	15	W.	Haze and fog increasing, with little whirlwinds of sand.
45	3·5	10	Fog, . .	10	W.	Foggy haze.
50	3·2	10	Fog, . .	12	W.	Fog haze becoming more and more dense.
51	3·0	10	Fog, . .	7	W.	
52	3·0	10	Fog, . .	3	W.	
52	3·0	7	Cirro-strati. .	3	W.	A few stars shining over head.
57	2·6	3	Cirro-strati, .	2	W.	
61	2·3	9	Cirro-strati, .	1	W.	
62	1·9	1	Cirro-strati, .	0	0	
63	1·9	1	Cirro-strati, .	0	0	
49	3·4	1	Cirrus, . .	1	N.W.	
43	4·2	2	Cirro-strati, .	1	N.W.	
42	4·3	4	Cirro-strati, .	0	0	
47	3·6	0	0	2	W.	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 22d,	6 A.M.	30·21	56·5	56·3	47·0	...	...	2·6
	9 ,,	30·20	63·5	63·2	49·1	(54·5)	...	2·4
	0 P.M.	30·14	71·1	71·0	52·6	...	...	2·6
	3 ,,	30·05	73·8	73·4	53·5	...	...	2·5
	7 ,,	30·03	70·1	70·0	55·6	74·0	66·2	3·2
	10 ,,	30·07	68·0	67·5	53·0	...	(15·5)	2·8
♃ 23d,	6 A.M.	30·15	63·0	62·5	56·8	...	...	4·2
	7 ,,	30·15	64·3	64·1	57·0	(62·5)	...	4·1
	9 ,,	30·22	67·2	67·0	59·1	...	...	4·4
	0 P.M.	30·23	69·2	69·0	55·6	...	...	3·3
	3 ,,	30·21	62·1	62·0	54·1	...	...	3·6
	7 ,,	30·27	60·1	60·0	51·6	69·5	62·0 (15·0)	3·2
♀ 24th,	6 A.M.	30·29	48·0	47·2	42·8	...	...	2·6
	9 ,,	30·32	54·3	54·1	45·1	(46·5)	...	2·4
	0 P.M.	30·30	62·2	62·0	48·4	...	...	2·4
	3 ,,	30·26	62·1	61·8	49·7	...	...	2·6
	7 ,,	30·27	59·1	59·0	49·6	62·5	55·2	2·9
	9 ,,	30·27	57·5	57·2	48·6	...	(14·7)	2·8
♄ 25th,	7 A.M.	30·22	52·5	52·1	44·5	...	...	2·4
	9 ,,	30·24	55·1	55·0	46·6	(49·0)	...	2·6
	0 P.M.	30·22	58·5	58·3	46·6	...	...	2·4
	3 ,,	30·16	61·1	60·9	49·0	...	...	2·6
	7 ,,	30·13	58·0	57·8	47·1	61·4	55·6	2·5
	9 ,,	30·16	54·5	54·3	46·0	...	(11·6)	2·6
☉ 26th,	8 A.M.	30·23	55·2	55·0	47·6	(50·5)	...	2·8
	9 ,,	30·25	57·7	57·3	49·0	...	...	2·9
	0 P.M.	30·22	62·4	62·0	51·0	...	...	2·9
	3 ,,	30·19	62·5	62·0	49·6	...	...	2·6
	7 ,,	30·24	60·0	59·8	51·5	63·0	57·4 (11·2)	3·2
	10 ,,	30·29	57·8	57·5	51·0	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
50	2·6	4	Cirrus and cirro-strati,	0	0	
37	4·1	2	Cirro-strati, .	15	S.	
31	5·8	4	Cirro-strati, .	20	S.	Sand drift; haze over Cairo.
28	6·5	3	Cirrus and cirro-cumuli,	12	S.	
40	4·8	4	Cirro-cumuli,	12	S.	
37	4·7	5	Cirrus, . .	1	S.	
66	2·2	4	Cirro-strati, .	0	0	A very little rain fell during the night.
62	2·5	5	Cirro-cumuli,	0	0	
60	3·0	8	Cirro-strati, .	0	0	
42	4·5	9	Cirro-cumuli,	0	0	
58	2·6	9	Cirro-strati and nimbus,	0	0	A few drops of rain now falling.
56	2·6	8	Cirro-strati and nimbus,	0	0	
66	1·2	2	Cirrus, . .	0	0	
50	2·4	3	Cirro-strati, .	3	S.	
39	3·8	1	Cirrus, . .	12	S.W.	
43	3·6	2	Cirrus, . .	10	W.	
51	2·7	2	Cirrus, . .	6	N.W.	Stars very bright.
53	2·5	0	0	0	0	
54	2·0	9	Cirro-strati, .	0	0	
54	2·3	9	Cirro-strati, .	1	W.	
43	3·1	9	Cirro-strati, .	1	W.	
44	3·4	1	Cirro-cumuli,	1	W.	
46	2·9	0	0	0	0	
54	2·2	0	0	0	0	
58	2·1	0	0	6	W.	Strong wind blew during the night.
54	2·4	0	0	4	W.	
46	3·4	4	Cirrus, . .	2	W.	
41	3·7	5	Cirrus and cirro-cumuli,	2	W.	
56	2·6	9	Cirro-strati and cumulus,	2	W.	
62	2·0	7	Cirro-strati, .	1	W.	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 27th,	7 A.M.	30·27	53·6	53·0	48·0	...	...	3·0
	9 ,,	30·29	64·2	64·0	50·7	(53·0)	...	2·7
	0 P.M.	30·23	66·3	66·0	51·1	...	...	2·6
	3 ,,	30·16	63·3	63·0	51·1	...	...	2·8
	7 ,,	30·16	61·2	61·0	49·6	66·3	58·0 (14·7)	2·7
♂ 28th	7 A.M.	30·10	53·4	52·8	46·5	(50·2)	...	2·8
	8 ,,	30·11	56·4	55·7	47·5	...	...	2·7
	9 ,,	30·12	59·2	59·0	49·0	...	...	2·8
	10 ,,	30·10	64·0	63·8	50·5	...	...	2·7
	0 P.M.	30·09	66·0	65·9	51·6	...	...	2·7
	3 ,,	30·05	67·8	67·0	52·4	...	...	2·7
	7 ,,	30·10	64·1	63·5	49·6	68·2	60·0	2·5
	10 ,,	30·13	61·3	61·0	49·8	...	(16·5)	2·7
March ☿ 1st,	6 A.M.	30·20	54·0	53·4	49·4	...	...	3·4
	7 ,,	30·23	57·2	56·4	52·1	(53·2)	...	3·7
	8 ,,	30·25	59·2	58·6	52·6	...	...	3·6
	9 ,,	30·27	62·1	61·5	54·1	...	...	3·6
	10 ,,	30·26	63·2	62·6	55·1	...	...	3·7
	11 ,,	30·24	65·1	64·8	55·6	...	...	3·7
	0 P.M.	30·24	66·0	65·6	55·8	...	...	3·6
	1 ,,	30·21	65·6	65·2	54·8	...	...	3·4
	2 ,,	30·18	66·7	66·2	54·0	...	...	3·1
	3 ,,	30·18	66·1	65·7	53·5	67·3	60·2	3·1
	4 ,,	30·18	65·1	64·5	53·1	...	(14·2)	3·1
	5 ,,	30·20	64·3	64·0	52·6	...	...	3·1
	6 ,,	30·22	63·0	62·5	52·4	...	...	3·1
	7 ,,	30·24	62·0	61·5	51·3	...	...	3·0
	8 ,,	30·26	61·1	60·5	52·6	...	...	3·4
	9 ,,	30·27	60·1	59·6	51·6	...	...	3·2
	10 ,,	30·28	59·0	58·8	51·6	...	...	3·4
♃ 2d,	6 A.M.	30·31	53·5	53·0	48·4	...	...	3·2
	7 ,,	30·32	54·8	54·0	49·6	(53·0)	...	3·3
	8 ,,	30·33	58·6	58·1	52·3	...	...	3·6

and Moisture.		Clouds.		Wind.		Remarks.
Computed.						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
66	1·6	3	Cirrus, . .	0	0	Thin haze and stratus on Nile valley.
41	3·9	5	Cirrus, . .	0	0	
37	4·5	5	Cirrus, . .	2	N.E.	
44	3·6	2	Cirrus, . .	1	N.E.	
45	3·3	0	0	0	0	Bright stars and new moon.
60	1·8	0	0	0	0	Eastern hills clear and dark.
53	2·4	0	0	0	0	
48	2·9	1	Cirrus, . .	2	S.	
40	3·9	0	0	2	S.	
39	4·3	0	0	0	0	
36	4·8	2	Cirro-strati, .	3	S.	
38	4·1	0	0	2	S.	
46	3·3	0	0	1	S.	
71	1·3	0	0	1	S.	
70	1·5	0	0	0	0	
63	2·0	2	Cirrus, . .	0	0	
58	2·6	2	Cirrus, . .	0	0	
59	2·7	4	Cirro-cumuli, .	2	S.	
53	3·2	8	Cirro-strati and cumulus,	2	S.	
51	3·4	7	Cirro-strati and cumulus,	3	S.	
49	3·5	8	Cirro-strati and cumulus,	4	W.	
43	4·1	7	Cumulus, .	5	N.W.	
43	3·9	5	Cumulus, .	5	W.N.W.	
45	3·7	6	Cirro-cumuli,	4	W.N.W.	
46	3·6	6	Cirro-strati, .	5	W.N.W.	
49	3·3	4	Cirro-strati, .	4	N.W.	
48	3·2	2	Cirrus, . .	3	W.	
56	2·6	0	0	1	W.	
56	2·6	0	0	2	W.	
59	2·2	0	0	3	N.W.	
68	1·4	2	Cirrus, . .	0	0	
68	1·5	4	Cirrus, . .	0	0	
65	1·9	3	Cirrus, . .	0	0	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♃ 2d,	9 A.M.	30·34	61·2	60·9	54·1	...	...	3·7
	0 P.M.	30·29	64·3	64·0	55·6	...	...	3·8
	2 ,,	30·25	65·4	65·0	54·0	...	...	3·3
	3 ,,	...	...	...	...	...	...	...
	7 ,,	30·28	62·4	61·8	53·2	67·4	60·4	3·4
	9 ,,	30·30	61·1	60·8	53·0	...	(13·9)	3·5
♀ 3d,	6 A.M.	30·27	55·0	54·8	49·6	...	...	3.3
	7 ,,	30·28	55·8	55·1	50·3	...	...	3·4
	9 ,,	30·28	62·8	62·5	52·1	(54·0)	...	3·0
	0 P.M.	30·21	68·4	68·0	53·6	...	...	2·9
	2 ,,	30·17	68·6	68·4	54·1	...	...	3·0
	3 ,,	...	...	...	...	...	...	...
	7 ,,	30·20	63·4	63·0	51·5	68·5	61·2	2·9
	11 ,,	30·23	61·2	60·5	51·0	...	(14·7)	3·0
♄ 4th,	7 A.M.	30·23	55·3	55·0	45·6	(53·6)	...	2·4
	9 ,,	...	...	...	...	...	...	...
	10 ,,	30·23	65·0	64·6	52·1	...	...	2·9
	0 P.M.	30·19	69·3	69·0	54·6	...	...	3·1
	3 ,,	30·13	69·0	68·6	54·7	...	...	3·1
	7 ,,	30·14	65·9	65·4	53·6	69·6	62·4	3·1
	11 ,,	30·18	61·2	60·4	54·5	...	(14·3)	3·8
☉ 5th,	7 A.M.	30·16	60·1	59·6	54·1	(57·0)	...	3·8
	9 ,,	30·17	64·6	64·4	55·2	...	...	3·6
	0 P.M.	30·13	70·8	70·5	56·7	...	...	3·4
	3 ,,	...	...	...	...	...	...	...
	4 ,,	30·06	70·7	70·2	56·2	71·8	64·7	3·3
	7 ,,	30·06	68·0	67·7	53·5	...	(14·3)	2·9
	9 ,,	30·05	64·6	64·2	53·0	...	...	3·1
☾ 6th,	6 A.M.	30·17	58·9	58·3	50·6	...	...	3·1
	9 ,,	30·20	65·5	65·1	52·6	58·0	...	3·0

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
62	2·3	2	Cirrus, . .	0	0	
56	2·9	6	Cirro-cumuli, .	0	0	
47	3·6	5	Cirro-cumuli,	0	0	
...	...	...	...	...	...	Absent at the second Pyramid at 3 P.M.
55	2·9	6	Cirro-strati, .	0	0	
58	2·5	3	Cirro-strati, .	0	0	
68	1·6	3	Cirrus and cirro-strati, .	0	0	
68	1·6	0	0	0	0	
48	3·3	0	0	0	0	
38	4·7	0	0	2	S.	
38	4·7	0	0	0	0	Occasional little whirlwinds sending up the sand.
...	...	...	...	...	...	Absent at 3 P.M. visiting the Fossil-shell hill, about three miles distant.
45	3·6	0	0	0	0	
49	3·1	0	0	0	0	
50	2·5	0	0	0	0	Light haze over Nile valley, hill tops clear.
...	...	...	...	...	...	Neglected 9 o'clock observation.
42	3·9	0	0	0	0	
39	4·8	1	Cirro-strati, .	2	S.	
40	4·7	0	0	0	0	
44	3·8	2	Cirro-strati, .	0	0	Sky very deep blue, and stars very bright.
64	2·2	5	Cirro-strati, .	4	N.W.	
66	2·0	2	Cirrus and cirro-strati,	0	0	Low level haze over the Nile.
54	3·1	1	Cirrus, . .	1	S.	
42	4·9	1	Cirrus, . .	0	0	
...	...	...	...	...	...	Absent at 3 P.M.
40	4·9	1	Cirrus, . .	2	S.	
38	4·6	0	0	5	S.W.	
46	3·6	0	0	5	S.W.	
56	2·4	0	0	0	0	
43	3·9	0	0	0	0	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 6th,	0 P.M.	30·21	68·3	68·0	52·6	...	...	2·7
	3 ,,	30·18	67·8	67·2	52·0	72·0	64·5 (15·2)	2·6
	7 ,,	30·24	64·2	63·4	53·5	...	...	3·3
	9 ,,	30·28	60·5	60·1	52·0	...	...	3·2
♂ 7th,	6 A.M.	30·33	56·5	56·2	50·5	...	...	3·4
	7 ,,	30·35	60·0	59·0	53·2	...	...	3·6
	9 ,,	30·39	65·1	64·8	55·6	56·0	...	3·7
	0 P.M.	30·35	68·1	67·9	55·1	...	...	3·2
	3 ,,	0·32	67·2	67·0	54·6	72·0	63·3 (17·3)	3·2
	7 ,,	0·35	63·2	63·0	52·6	...		3·2
	10 ,,	0·39	59·5	59·0	52·0	...	...	3·4
☿ 8th,	6 A.M.	30·35	54·5	54·0	49·6	...	...	3·4
	8 ,,	30·35	59·5	59·0	53·5	53·4	...	3·8
	9 ,,	30·35	62·2	62·0	53·8	...	...	3·5
	10 ,,	30·34	63·9	63·5	54·3	...	...	3·5
	11 ,,	30·32	64·8	64·3	54·2	...	...	3·4
	0 P.M.	30·26	66·3	66·0	54·8	...	...	3·3
	1 ,,	30·24	68·8	68·6	54·1	...	...	3·0
	2 ,,	30·22	68·5	68·0	53·8	69·2	61·0 (16·5)	3·0
	3 ,,	30·19	68·3	68·0	53·2	...		2·8
	4 ,,	30·17	68·2	67·8	54·3	...	...	3·1
	5 ,,	30·17	67·4	67·1	53·6	...	...	3·0
	6 ,,	30·15	66·3	66·0	53·8	...	...	3·1
	7 ,,	30·17	64·3	63·9	52·4	...	...	3·0
	8 ,,	30·17	63·2	63·0	51·6	...	...	2·9
	9 ,,	30·18	60·1	59·5	52·5	...	...	3·4
	10 ,,	30·18	59·8	59·5	53·0	...	...	3·6
♃ 9th,	6 A.M.	30·13	52·8	52·4	49·0	...	...	3·4

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
35	4·9	0	0	0	0	
35	4·8	0	0	2	W.	
49	3·4	0	0	2	N.W.	A brilliant shooting star passed from S.W. to N.E. at 7 h. 13 m. P.M.
56	2·6	0	0	2	N.W.	
66	1·8	0	0	1	N.	
63	2·2	0	0	0	0	
53	3·2	2	Cirrus, . .	0	0	
43	4·3	3	Cirrus and cirro-cumuli,	2	N.	
44	4·1	4	Cirrus and cirro-cumuli,	5	N.	
49	3·3	0	0	4	N.	
59	2·2	0	0	5	N.W.	
70	1·4	0	0	0	0	Haze over Cairo and Nile valley.
66	1·9	0	0	1	N.E.	
57	2·7	0	0	5	E.	Haze quite blown away.
54	3·1	0	0	10	E.	The sand, which for weeks past has been permanently ribbed N.E. and S.W., is this morning flattening itself into a broad general jangle.
49	3·4	0	0	10	E.	
46	3·8	0	0	10	E.	
38	4·7	0	0	8	E.	Occasional severe gusts of wind.
38	4·7	0	0	8	N.E.	Wind still coming in gusts.
37	4·8	0	0	6	N.E.	Gusts of wind less strong.
40	4·5	0	0	7	N.E.	
41	4·4	0	0	7	N.E.	
44	4·0	0	0	8	N.E.	
45	3·6	0	0	8	N.E.	
45	3·5	0	0	8	N.E.	
60	2·4	0	0	7	N.E.	
63	2·1	0	0	7	N.E.	
76	1·1	0	0	2	N.	Distant hills remarkably clear.

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♃ 9th,	9 A.M.	30·12	62·3	62·0	54·6	52·0	...	3·8
	0 P.M.	30·08	71·5	71·3	55·1	...	...	3·0
	3 ,,	30·03	72·5	72·2	55·4	73·3	63·8	3·0
	7 ,,	30·06	69·1	68·6	53·6	...	(18·9)	2·9
	10 ,,	30·10	65·5	65·2	56·0	...	...	3·8
♀ 10th,	7 A.M.	30·15	62·1	61·8	56·6	56·9	...	4·3
	9 ,,	30·17	64·8	64·5	58·1	...	...	4·4
	0 P.M.	30·15	71·5	71·2	65·9	...	...	6·0
	3 ,,	30·10	74·1	74·0	59·3	74·5	66·4	3·7
	7 ,,	30·11	71·2	70·7	58·0	...	(16·1)	3·7
	10 ,,	30·13	68·5	68·0	57·6	...	...	3·8
♄ 11th,	7 A.M.	30·17	62·3	62·0	52·0	60·0	...	3·1
	9 ,,	30·19	68·0	67·5	56·5	...	...	3·6
	0 P.M.	30·13	80·5	80·0	58·5	...	...	3·0
	3 ,,	30·08	80·5	80·2	58·5	81·0	71·9	3·0
	7 ,,	30·07	75·4	75·0	55·6	...	(18·2)	2·8
	10 ,,	30·10	71·2	70·8	56·0	...	...	3·2
	0 A.M.	30·08	68·5	68·2	53·0	...	...	2·8
☉ 12th,	8 A.M.	30·06	73·0	72·5	54·4	65·5	...	2·8
	9 ,,	30·06	76·2	75·4	57·0	...	...	3·1
	0 P.M.	30·00	86·8	86·0	60·4	...	...	2·7
	3 ,,	29·97	87·5	87·1	60·1	88·0	75·5 (24·8)	2·4
	6 ,,	30·07	75·0	74·6	62·0	...	...	4·3
	9 ,,	30·17	67·5	67·4	58·8	...	...	4·3
	10 ,,	30·20	67·2	66·7	59·0	...	...	4·4
☾ 13th,	6 A.M.	30·23	61·2	60·8	56·5	...	...	4·4
	7 ,,	30·24	62·8	62·3	56·8	...	...	4·3
	9 ,,	30·28	66·5	66·2	58·1	61·0	...	4·2
	0 P.M.	30·24	71·1	71·0	58·6	...	...	3·8
	4 ,,	30·16	72·4	72·3	58·6	...	..	3·7
	7 ,,	30·18	67·6	67·2	57·0	72·5	65·8	3·7
	10 ,,	30·18	65·0	64·8	55·0	...	(13·5)	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. =100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
59	2·5	0	0	0	0	Smoke haze over Cairo.
35	5·4	0	0	0	0	
34	5·7	0	0	0	0	
37	4·9	0	0	0	0	
53	3·2	0	0	1	N.E.	
70	2·0	0	0	0	0	Fog haze over Nile valley, tops of the hills clear.
64	2·4	0	0	0	0	
71	2·4	0	0	0	0	
41	5·4	0	0	2	N.E.	
44	4·7	0	0	0	0	
49	3·8	0	0	0	0	
49	3·2	8	Cirrus, . .	0	0	Level haze over the Nile valley, hill tops clear.
48	3·9	8	Cirro-strati, .	0	0	
28	8·1	2	Cirrus, . .	0	0	Haze quite cleared away.
28	8·1	1	Cirrus, . .	0	0	
30	6·7	0	0	0	0	
38	5·2	0	0	1	W.	
36	4·8	3	Cirrus, . .	1	W.	
31	6·0	1	Cirrus, . .	0	0	
32	6·7	1	Cirrus, . .	0	0	
19	10·4	0	0	15	S.	Sand flying along in haze dust.
17	10·8	2	Cirrus, . .	10	S.	Sand-drift ceased, atmosphere clear.
46	5·1	10	Sand fog, .	12	N.W.	From 4.30 P.M. a severe gale from N.W., with sand drift.
57	3·1	8	Haze, . .	5	N.	
59	3·0	4	Cirrus, . .	2	N.	
74	1·6	3	Cirrus, . .	2	N.	Hazy horizon.
68	2·1	2	Cirrus, . .	3	N.	
59	3·0	0	0	5	N.	
46	4·5	0	0	3	N.	
43	4·9	0	0	5	N.	Absent at 3 P.M.
50	3·7	2	Cirrus, . .	2	N.	
51	3·3	3	Cirrus, . .	3	N.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♂ 14th,	7 A.M.	30·12	59·7	59·5	54·4	57·0	...	4·0
	9 ,,	30·14	66·3	66·0	58·6	...	...	4·4
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·08	71·1	71·0	62·8	...	...	5·0
	4 ,,	30·06	72·3	72·0	63·1	72·5	66·5	5·0
	7 ,,	30·08	71·4	71·0	63·5	...	(12·0)	5·2
	9 ,,	30·09	69·7	69·3	61·4	...	...	4·8
☿ 15th,	7 A.M.	30.08	67·1	66·8	58·6	64·0	...	4·3
	9 ,,	30·08	72·2	72·0	62·1	...	...	4·7
	0 P.M.	30·04	80·2	80·0	64·0	...	...	4·3
	3 ,,	29·97	84·0	83·4	64·2	...	...	4·0
	7 ,,	29·98	80·6	80·0	63·6	84·3	75·2	4·2
	10 ,,	30·00	78·0	77·8	63·5	...	(18·3)	4·4
♃ 16th,	7 A.M.	29·95	78·2	78·0	64·1	68·0	...	4·5
	9 ,,	29·96	81·1	80·8	62·2	...	...	3·8
	0 P.M.	29·91	93·0	92·5	65·9	...	...	3·7
	3 ,,	29·85	94·3	94·0	66·0	...	...	3·7
	4 ,,	29·78	93·6	93·1	65·2	...	...	3·4
	5 ,,	29·79	92·0	91·7	64·6	...	...	3·3
	7 ,,	29·88	89·6	89·2	65·0	96·1	83·5	3·7
	11 ,,	29·90	88·0	87·5	65·0	...	(25·3)	3·8
♀ 17th,	6 A.M.	29·97	74·5	74·0	62·5	...	...	4·5
	7 ,,	30·00	75·8	75·2	63·0	73·7	...	4·5
	8 ,,	30·04	77·8	77·2	63·5	...	...	4·4
	9 ,,	30·04	77·3	76·7	64·0	...	...	4·6
	10 ,,	30·04	77·4	76·8	64·6	...	...	4·7
	11 ,,	30·03	79·8	79·0	66·0	...	...	4·9
	0 P.M.	30·02	79·4	78·8	65·0	...	...	4·7
	1 ,,	29·99	80·2	79·7	64·2	...	...	4·3
	2 ,,	29·98	80·6	80·0	64·5	...	...	4·4
	3 ,,	29·98	80·7	80·1	65·5	...	...	4·7

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
70	1·8	1	Cirrus, . .	5	N.	Haze over Nile valley.
62	2·7	1	Cirrus, . .	5	N.W.	Sand in plain now ribbed in direction transverse to the N.W.
...	...	...	...	...	...	Absent in the interior of the Pyramid.
60	3·3	5	Cirro-strati and nimbus,	0	0	Rain in Cairo wind towards E. of S., a few drops fell in the desert.
56	3·6	7	Cirro-strati, .	0	0	
62	3·2	9	Cirro-strati, .	0	0	
59	3·2	9	Cirro-strati, .	0	0	
58	3·0	2	Cirrus, . .	0	0	Low level haze on Nile valley; hill tops clear.
54	3·8	1	Cirrus, . .	0	0	
39	6·8	1	Cirrus, . .	0	0	
32	8·4	7	Cirrus, . .	0	0	
37	7·0	3	Cirrus, . .	0	0	
42	5·9	4	Cirro-cumuli,	0	0	
44	5·8	8	Cirro-cumuli,	0	0	
33	7·6	9	Cirro-strati and nimbus,	1	S.	
21	12·4	10	Sand haze, .	4	S.	Sand-drift since 10 A.M., air quite filled with sand.
21	13·2	10	Sand haze, .	15	S.	Sand-drift increasing in density and quantity.
19	12·4	10	Sand haze, .	15	S.	
18	12·2	10	Sand haze, .	10	S.	
26	10·9	8	Haze, . .	5	S.	
27	10·2	10	Haze, . .	5	S.	
48	4·8	4	Haze, . .	5	W.	
47	5·1	3	Cirrus and haze,	4	W.	
44	5·9	4	Cirrus and haze,	4	N.W.	
46	5·5	7	Cirrus and haze,	2	N.	
48	5·4	10	Haze, . .	2	N.	
45	6·0	7	Cirrus and haze,	2	N.	
43	6·1	7	Cirrus and haze,	2	N.	
39	6·7	7	Cirrus and haze,	3	N.W.	
39	6·8	9	Cirrus and haze,	5	N.W.	
41	6·5	10	Haze, . .	5	N.W.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Thermm.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic feet of air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 17th,	4 P.M.	30·00	80·0	79·5	65·7	81·1	75·0	4·6
	5 ,,	30·03	77·6	77·1	64·6	...	(12·3)	4·7
	6 ,,	30·06	76·0	75·5	63·8	...	...	4·7
	7 ,,	...	...	...	...	...	...	...
	8 ,,	30·12	73·6	73·2	60·0	...	...	3·9
	9 ,,	30·12	72·3	72·0	59·2	...	...	3·8
	10 ,,	30·13	71·0	70·8	58·6	...	...	3·8
	11 ,,	30·12	70·3	69·8	58·2	...	...	3·8
♄ 18th,	7 A.M.	30·20	65·3	65·0	57·1	64·0	...	4·0
	9 ,,	30·23	70·1	70·0	59·9	...	...	4·3
	0 P.M.	30·19	73·2	73·0	60·1	...	...	4·0
	3 ,,	30·15	74·6	74·3	58·6	75·0	68·3	3·5
	7 ,,	30·18	68·0	67·6	55·6	...	(13·4)	3·4
☉ 19th,	8 A.M.	30·22	67·9	67·5	57·6	59·2	...	3·9
	9 ,,	30·22	69·2	69·0	58·6	...	...	4·0
	0 P.M.	30·18	70·3	70·0	58·1	...	...	3·8
	3 ,,	30·13	71·4	71·0	59·2	...	...	3·9
	7 ,,	30·17	67·0	66·7	55·5	72·6	66·1	3·4
	9 ,,	30·21	63·5	63·2	56·0	...	(13·0)	4·0
☾ 20th,	6 A.M.	30·28	61·2	60·8	54·6	...	...	3·9
	9 ,,	30·32	68·0	67·7	57·6	60·0	...	3·9
	0 P.M.	30·27	70·3	70·0	58·0	...	...	3·8
	3 ,,	30·24	71·2	71·0	58·6	...	...	3·8
	7 ,,	30·29	66·8	66·3	56·5	71·4	64·8	3·7
	9 ,,	30·33'	64·0	63·8	54·6	...	(13·2)	3·5
♂ 21st,	6 A.M.	30·35	57·5	56·9	52·0	...	...	3·6
	7 ,,	30·36	60·5	60·0	53·6	56·5	...	3·7
	8 ,,	30·37	62·3	62·0	55·6	...	...	4·0
	9 ,,	30·38	65·1	64·9	55·9	...	...	3·8
	10 ,,	30·36	67·3	67·0	55·6	...	...	3·4
	11 ,,	30·34	69·1	68·8	56·6	...	...	3·5
	0 P.M.	30·30	70·2	70·0	57·4	...	...	3·6
	1 ,,	30·29	71·8	71·2	56·9	...	...	3·3
	2 ,,	30·27	73·3	73·0	57·2	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
43	6·2	10	Haze, . .	5	N.W.	
48	5·5	10	Haze, . .	4	N.W.	A few drops of rain.
48	5·0	9	Cirrus and haze,	4	N.W.	
...	...	...	...	...	...	
44	5·0	9	Cirro-strati, .	2	N by E	
45	4·8	9	Cirro-strati, .	2	N.N.E.	
46	4·5	8	Cirro-strati, .	2	N.N.E.	
47	4·3	6	Cirro-strati, .	3	N.N.E.	
58	2·9	9	Haze, . .	0	0	Dense haze over Nile valley.
52	3·8	0	0	2	N.	
45	4·9	0	0	3	N.	
38	5·8	0	0	2	N.	
45	4·1	0	0	2	N.W.	
51	3·6	3	Cirrus, . .	0	0	Haze on horizon.
51	3·8	2	Cirrus, . .	1	N.	
46	4·3	5	Cirro-strati, .	3	N.	
47	4·5	3	Cirro-strati, .	2	N.	
48	3·8	0	0	1	N.	
61	2·6	0	0	2	N.	
64	2·2	0	0	0	0	
51	3·6	0	0	0	0	
46	4·3	0	0	2	N.	
45	4·5	0	0	3	N.E.	
52	3·5	0	0	0	0	
53	3·1	0	0	3	N.N.E.	
68	1·6	0	0	1	N.E.	Haze over the line of the Nile.
62	2·2	0	0	1	N.E.	Haze all along the east horizon.
64	2·3	0	0	1	N.E.	
54	3·1	0	0	5	N.E.	
47	3·9	0	0	10	N.E.	
46	4·3	0	0	15	N.E.	
45	4·5	0	0	10	N.E.	
39	5·2	0	0	10	N.E.	
37	5·6	0	0	9	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♂ 21st,	3 P.M.	30·25	73·0	72·5	57·0	...	...	3·3
	4 ,,	30·24	73·2	72·8	56·5	...	...	3·2
	5 ,,	30·24	73·5	73·1	56·1	74·0	63·9	3·1
	6 ,,	30·27	71·3	71·0	54·6	...	(20·2)	2·9
	7 ,,	30·27	69·7	69·3	56·8	...	...	3·5
	8 ,,	30·28	67·4	67·2	55·5	...	...	3·4
	9 ,,	30·30	64·5	64·3	56·3	...	...	3·9
	10 ,,	30·31	63·3	63·0	56·2	...	...	4·0
☿ 22d,	8 A.M.	30·24	59·9	59·5	54·6	51·0	...	4·0
	9 ,,	30·23	64·1	63·8	56·0	...	...	3·9
	0 P.M.	30·27	74·0	73·7	59·7	...	...	3·8
	3 ,,	30·11	80·1	79·5	68·6	...	...	5·7
	7 ,,	30·07	74·0	73·5	63·5	80·6	68·8	4·8
	9 ,,	30·06	69·0	68·5	60·2	...	(23·6)	4·5
♃ 23d,	7 A.M.	29·96	68·1	67·8	53·6	63·0	...	2·9
	9 ,,	29·96	78·4	78·0	56·6	...	...	2·8
	0 P.M.	29·94	91·8	91·6	61·6	...	...	2·5
	3 ,,	29·85	92·5	91·8	61·5	...	...	2·3
	7 ,,	29·82	84·5	84·0	61·6	92·5	80·4	3·4
	9 ,,	29·89	80·8	80·6	60·0	...	(24·2)	3·3
♀ 24th,	7 A.M.	29·90	77·4	77·0	56·1	73·6	...	2·8
	9 ,,	29·93	85·5	85·0	60·1	...	...	3·0
	0 ,,	29·92	87·8	87·4	63·1	...	...	3·3
	3 ,,	29·89	87·8	87·2	65·3	...	...	3·9
	7 ,,	30·02	75·0	74·6	63·2	...	...	4·7
	9 ,,	30·08	71·4	70·8	63·2	89·4	78·8 (21·1)	5·1
♄ 25th,	7 A.M.	30·05	65·5	64·8	59·4	(63·0)	...	4·7
	9 ,,	30·07	69·1	69·0	60·1	...	...	4·4
	0 P.M.	30·07	75·8	75·5	60·1	...	...	3·7
	3.5 ,,	29·99	77·1	76·7	59·0	...	...	3·4
	7 ,,	30·02	70·7	70·2	58·6	77·8	70·7	3·8
	9 ,,	30·05	67·5	67·0	56·2	...	(14·2)	3·6

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
37	5·5	0	0	9	N.E.	
36	5·7	2	Cirrus, . .	10	N.E.	
34	5·9	3	Cirrus, . .	10	N.E.	
35	5·5	9	Cirro-strati, .	6	N.W.	Query wind's direction.
44	4·4	5	Cirrus, . .	6	N.E.	
46	4·0	0	0	6	N.E.	
58	2·8	2	Cirrus, . .	6	N.E.	
63	2·4	3	Cirrus, . .	6	N.E.	
70	1·8	1	Cirrus, . .	2	N.E.	Haze over the line of the Nile.
59	2·7	1	Cirrus, . .	2	N.E.	
42	5·3	0	0	3	N.E.	
52	5·4	0	0	3	N.E.	
54	4·2	2	Cirrus, . .	2	N.E.	
57	3·3	3	Cirrus, . .	0	0	
38	4·6	1	Cirrus, . .	0	0	Haze over the line of the Nile; hill-tops remarkably clear.
27	7·6	0	0	2	S.W.	
14	13·0	9	Cirrus, . .	8	S.W.	Sand-drift, and sand haze in the distance like mist
12	13·8	7	Cirrus, . .	12	S.	Sand-drift abating.
27	9·2	4	Cirrus, . .	0	0	
30	7·9	3	Cirrus, . .	0	0	
28	7·3	0	0	0	0	Haze on the horizon.
24	10·0	0	0	0	0	
24	10·5	0	0	0	0	Haze all round, but clear at the Pyramids.
29	10·0	0	0	10	N.W.	
50	4·7	0	0	12	N.W.	
61	3·3	4	Cirrus, . .	7	N.W.	
68	2·2	2	Cirrus, . .	2	N.E.	Dense haze.
56	3·4	8	Cirrus, . .	12	N.E.	
39	5·9	10	Haze, . .	20	N.E.	
34	6·6	10	Haze, . .	20	N.E.	Sand-drift.
47	4·4	10	Haze, . .	20	N.E.	
48	3·8	10	Haze, . .	15	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☉ 26th,	8 A.M.	29·99	65·4	64·9	59·3	(64·1)	...	4·6
	9 ,,	30·02	69·8	69·2	61·5	...	...	4·8
	0 P.M.	29·98	75·1	74·8	64·1	...	...	4·9
	3 ,,	29·97	76·8	76·3	63·0	77·0	69·5	4·4
	7 ,,	30·01	72·4	72·0	62·2	...	(15·0)	4·7
☾ 27th,	8 A.M.	30·18	64·0	63·5	58·2	(60·0)	...	4·6
	9 ,,	30·18	66·6	66·2	60·2	...	...	4·8
	0 P.M.	30·16	76·4	76·0	60·1	...	...	3·7
	3 ,,	30·12	79·4	79·0	58·6	80·0	69·2	3·1
	7 ,,	30·16	72·8	72·4	57·6	...	(21·5)	3·5
♂ 28th,	7 A.M.	30·26	61·5	61·0	54·8	(57·0)	...	3·9
	9 ,,	30·28	65·6	65·2	57·6	...	...	4·1
	0 P.M.	30·20	71·4	71·0	58·6	...	...	3·8
	3 ,,	30·13	74·2	73·9	56·6	75·0	65·9	3·1
	7 ,,	30·14	70·0	69·5	56·6	...	(18·2)	3·4
☿ 29th,	7 A.M.	30·19	60·5	60·0	54·1	(56·5)	...	3·8
	9 ,,	30·17	66·5	66·0	56·6	...	...	3·8
	0 P.M.	30·13	74·3	74·0	57·1	...	...	3·2
	3 ,,	30·04	79·2	79·0	56·4	...	...	2·7
	7 ,,	30·05	74·3	73·8	57·6	80·0	70·6	3·3
	9 ,,	30·09	71·6	71·1	55·7	...	(18·8)	3·1
♃ 30th,	7 A.M.	30·06	67·5	67·0	53·1	(66·0)	...	2·9
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·08	82·3	81·5	64·0	...	...	4·0
	3 ,,	30·03	83·3	82·8	63·8	...	...	3·9
	7 ,,	30·12	72·5	72·2	63·5	83·4	74·2 (18·4)	5·1
♀ 31st,	6 A.M.	30·13	65·1	64·8	60·2	...	...	5·0
	7 ,,	30·15	66·1	65·8	61·2	64·0	...	5·2

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
68	2·2	9	Nimbus and cirro-cumuli,	10	N.N.W.	
59	3·2	9	Cirro-strati, .	10	N N.W.	
52	4·5	9	Nimbus and cirro-cumuli,	10	N.N.W.	
44	5·5	0	0	7	N.	
54	3·9	0	0	5	N.	
68	2·0	9	Cirro-strati, .	0	0	Haze over Nile valley, and hills obscured.
67	2·4	3	Cirro-strati, .	2	N.	
37	6·1	0	0	15	N.E.	
29	7·6	0	0	20	N.E.	
39	5·3	0	0	8	N.N.W.	
64	2·2	0	0	0	0	Light haze all round, but clear on the Pyramid hill.
59	2·8	2	Cirro-cumuli, .	2	N.E.	
45	4·6	0	0	0	0	
34	6·1	0	0	2	N.E.	
43	4·6	0	0	0	0	
64	2·1	6	Cirrus, . .	0	0	Light haze over Nile valley.
53	3·4	2	Cirro-strati, .	4	N.E.	
35	6·0	6	Cirrus, . .	3	N.E.	
25	7·9	8	Cirro-strati, .	2	E.	
36	5·9	3	Cirrus, . .	4	W.	
36	5·3	0	0	5	W.	
39	4·5	8	Cirro-strati, .	0	0	
...	...	...	...	...	...	Absent at the Pyramid.
34	7·7	8	Cirro-strati, .	0	0	
33	8·2	6	Cirro-strati, .	0	0	
58	3·6	13	Cirrus and cirro-strati,	18	N.W.	
74	1·8	10	Nimbus and cirro-strati,	4	N.E.	
74	1·9	10	Nimbus and cirro-strati,	3	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Thermm.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 31st,	8 A.M.	30·15	67·1	66·6	62·0	...	...	5·3
	9 ,,	30·16	68·8	68·4	62·6	...	...	5·3
	10 ,,	30·16	71·6	71·2	63·5	...	...	5·2
	11 ,,	30·14	72·4	71·8	63·5	...	...	5·1
	0 P.M.	30·12	74·3	73·8	63·1	...	...	4·7
	1 ,,	30·10	75·3	74·9	63·5	...	...	4·7
	2 ,,	30·10	74·6	74·2	62·8	...	...	4·6
	3 ,,	30·04	75·2	75·0	61·1	...	...	4·0
	4 ,,	30·08	74·2	73·8	60·0	...	...	3·9
	5 ,,	30·08	72·9	72·6	60·1	...	...	4·0
	6 ,,	30·07	71·4	71·0	59·6	75·8	69·4 (12·8)	4·0
	7 ,,	30·08	70·3	70·0	57·6	...		3·6
	8 ,,	30·09	69·3	69·0	58·5	...	...	4·0
April ♄ 1st,	7 A.M.	30·01	64·3	64·0	59·1	(62·0)	...	4·8
	9 ,,	29·98	69·0	68·3	61·2	...	...	4·8
	0 P.M.	29·89	81·0	80·6	64·8	...	...	4·4
	3 ,,	29·86	84·6	84·3	65·1	...	...	4·2
	7 ,,	29·97	73·0	72·4	64·0	85·2	74·4 (21·5)	5·1
	9 ,,	30·02	71·0	70·6	62·5	...	...	4·9
☉ 2d,	8 A.M.	30·21	70·1	69·7	61·2	(65·4)	...	4·6
	9 ,,	30·23	71·2	70·4	60·0	...	...	4·2
	0 P.M.	30·24	72·3	71·7	57·6	...	...	3·5
	3 ,,	30·24	73·4	73·0	58·6	...	...	3·6
	7 ,,	30·26	68·2	67·8	54·6	74·0	68·4 (11·3)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
72	2·0	9	Nimbus and cirro-strati,	3	N.E.	
67	2·4	9	Cirro-strati, .	10	N.E.	
61	3·2	9	Cirro-strati, .	12	N.E.	
58	3·5	8	Cirro-strati, .	7	N.E.	
51	4·5	9	Cirro-strati, .	8	N.E.	
50	4·8	10	Cirro-strati, .	15	N.E.	
49	4·7	9	Cirro-strati, .	15	N.E.	
43	5·4	9	Cirro-strati, .	20	N.E.	
43	5·3	7	Cirrus and cirro-strati,	18	N.E.	
46	4·7	7	Cirrus and cirro-strati,	20	N.E.	
48	4·3	8	Cirrus and cirro-strati,	12	N.E.	Clouds moving from s.w.
45	4·4	7	Cirro-cumuli,	10	N.E.	
51	3·9	10	Cirro-strati, .	10	N.E.	
71	1·9	9	Cirrus and cirro-strati,	3	N.E.	
61	3·0	9	Cirro-cumuli and cirro-strati, .	7	N.E.	
39	6·9	8	Cirro-cumuli and cirro-strati,	0	0	
33	8·5	9	Cirro-cumuli,	8	N.	
58	3·7	7	Cirrus and cirro-cumuli,	7	N.	
59	3·4	3	Cirrus, . .	5	W.	
58	3·4	8	Cirrus and cirro-cumuli,	10	N.W.	
50	4·2	8	Cirro-strati, .	12	N.W.	Whirls of sand-drift.
40	5·1	10	Cirro-strati, .	2	W.	
40	5·3	4	Cirro-strati, .	0	0	
41	4·4	7	Cirrus and cirro-cumuli,	4	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Thermo.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
⊙ 2d,	8 P.M.	30·32	66·2	65·7	54·6	...	...	3·3
☾ 3d,	8 A.M.	30·42	65·4	65·0	54·1	(60·0)	...	3·3
	9 „	30·44	70·0	69·4	56·5	...	...	3·4
	0 P.M.	30·43	72·5	72·2	55·6	...	...	3·0
	3 „	30·48	73·0	72·6	56·6	...	...	3·2
	7 „	...	...	...	...	...	...	...
	9 „	30·47	66·0	65·3	57·0	73·4	66·2 (14·4)	3·9
♂ 4th,	7 A.M.	30·49	63·0	62·5	55·8	(58·0)	...	3·9
	9 „	30·50	66·2	65·3	56·4	...	...	3·8
	0 P.M.	30·47	69·7	69·5	56·6	...	...	3·4
	3 „	30·40	71·6	71·4	57·6	...	...	3·5
	7 „	30·43	68·0	67·6	56·0	72·2	64·1 (16·2)	3·5
☿ 5th,	8 A.M.	30·45	61·8	61·4	53·6	(54·0)	...	3·5
	9 „	30·46	64·4	64·0	54·3	...	...	3·4
	0 P.M.	30·41	69·4	69·0	56·8	...	...	3·5
	3 „	30·31	72·0	71·6	58·0	...	...	3·6
	8 „	30·35	66·7	66·3	57·2	72·0	63·6 (16·7)	3·9
♃ 6th,	7 A.M.	30·38	61·6	61·2	54·1	(56·6)	...	3·7
	9 „	30·40	64·4	64·0	54·6	...	...	3·5
	0 P.M.	30·35	70·4	70·0	56·9	...	...	3·4
	3 „	30·28	73·0	72·6	57·6	73·5	65·8 (15·5)	3·4
	7 „	...	...	...	...	...		...
	9 „	30·35	64·4	63·8	54·8	...	...	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour required to saturate a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
46	3·8	6	Cirrus, . .	3	N.	The chief consequences of the rise of the barometer, which might have been marked in other countries by a cessation of rain, have developed themselves here in an increase of the wet and dry bulbs' difference, and an increase of the transparency of the air, and vividness of solar illumination.
47	3·6	3	Cirrus, . .	2	W.	
42	4·6	2	Cirrus, . .	4	W.	
34	5·6	3	Cirrus, . .	2	W.	
36	5·6	5	Cirrus, . .	5	W.	
...	...	...	...	...	...	Absent at the Pyramid.
56	3·1	3	Cirrus, . .	10	N.W.	Cirrus and a halo round the moon.
62	2·5	0	0	1	N.	Dense haze over Nile valley.
53	3·3	7	Cumulus, .	12	E.N.E.	
44	4·5	1	Cumulus, .	15	E.N.E.	
42	4·9	3	Cirrus, . .	7	N.E.	
46	4·0	1	Cirrus, . .	12	N.E.	Between 5 and 6 o'clock a long cloud of locusts, like a fall of snow in a strong wind, went past from N. to S.
57	2·6	1	Cirrus, . .	6	N.E.	
51	3·3	2	Cirrus, . .	12	N.E.	
45	4·4	3	Cirrus, . .	15	N.E.	
42	4·9	1	Cirrus, . .	7	N.E.	A few locusts seen flying variously from 1 to 2 P.M.
55	3·3	0	0	12	N.	
60	2·4	8	Cirro-strati and cirro-cumuli, .	2	N.	
52	3·2	8	Cirro-cumuli,	10	N.	
43	4·7	0	0	10	N.	
39	5·4	0	0	5	N.	
...	...	...	...	...	...	Absent at the second Pyramid.
53	3·2	2	Cirro-strati, .	4	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 7th,	7 A.M.	30·30	63·4	63·0	58·1	(59·5)	...	4·6
	9 ,,	30·32	68·0	67·6	59·2	...	...	4·3
	0 P.M.	30·27	72·6	72·2	58·6	...	...	3·7
	3 ,,	30·19	79·1	78·8	58·6	...	...	3·1
	7 ,,	...	...	...	...	...	...	...
	9 ,,	30·26	66·3	66·0	60·8	79·2	66·9 (14·6)	5·0
♄ 8th,	7 A.M.	30·22	65·3	65·0	57·6	(59·8)	...	4·2
	9 ,,	30·22	69·8	69·3	58·1	...	...	3·8
	0 P.M.	30·17	74·0	73·4	56·5	...	...	3·1
	3 ,,	30·12	74·9	74·6	56·1	...	...	2·9
	7 ,,	30·12	69·8	69·5	55·6	75·3	67·0 (16·7)	3·2
☉ 9th,	8 A.M.	30·26	62·4	62·0	58·1	(57·5)	...	4·7
	9 ,,	30·25	64·3	64·0	57·6	...	...	4·3
	0 P.M.	30·20	69·0	68·5	55·3	...	...	3·3
	3 ,,	30·16	71·8	71·5	54·6	...	...	2·8
	8 ,,	30·25	64·5	63·0	53·0	°71·8	64·3 (15·0)	3·2
☾ 10th,	7 A.M.	30·31	62·2	61·9	56·6	(56·0)	...	4·3
	9 ,,	30·31	65·0	64·3	53·2	...	...	3·1
	0 P.M.	30·29	68·1	67·8	54·6	...	...	3·1
	3 ,,	30·22	70·3	70·0	54·6	72·3	64·4 (15·8)	3·0
	4 ,,	...	...	...	...	...	...	...
♂ 11th,	7 A.M.	...	...	...	...	...	...	...
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·23	71·4	71·0	57·6	...	...	3·5
	3 ,,	30·17	71·0	70·3	60·6	...	...	4·3
	7 ,,	30·20	66·3	65·4	58·7	...	...	4·4
☿ 12th,	7 A.M.	30·31	63·4	62·5	56·5	(57·4)	...	4·1
	9 ,,	30·35	67·3	67·0	57·6	...	...	4·0
	0 P.M.	30·33	70·6	70·2	58·6	...	...	3·9

and Moisture.		Clouds.		Wind.		Remarks.
Computed		Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.					
	Grains.					
71	1·9	0	0	0	0	Haze over Nile valley.
57	3·2	4	Cumulus, .	0	0	
43	5·0	0	0	0	0	
29	7·5	0	0	1	N.	
...	...	...	...	...	...	Absent at the Great Pyramid.
71	2·1	0	0	0	0	
60	2·7	0	0	0	0	
48	4·1	0	0	0	0	
34	6·0	0	0	0	0	
31	6·4	2	Cirrus, . .	0	0	
40	4·7	0	0	7	N.E.	
76	1·6	1	Cirrus, . .	2	N.E.	
64	2·3	5	Cirrus, . .	6	N.E.	
42	4·5	1	Cirrus, . .	8	N.E.	
34	5·6	1	Cirrus, . .	3	N.E.	
46	3·6	0	0	10	N.E.	
69	2·0	0	0	0	0	Whirlwinds of sand frequent over Cairo and in the Nile valley.
46	3·7	5	Cumulus, .	2	N.E.	
42	4·4	4	Cumulus, .	2	N.E.	
37	5·1	6	Cumulus, .	3	N.E.	
...	...	...	...	...	...	Start at 4 P.M. to spend the night on the top of the Great Pyramid.
...	...	...	...	...	...	Thermometer on the top of the Great Pyramid at the lowest, 49°.
...	...	...	...	...	...	Began to descend the Great Pyramid at 9 A.M.
42	4·8	5	Cumulus, .	0	0	
52	4·0	8	Cumulus, .	2	W.	Min. Ther. not set at East Tombs, but found at 56°, temperature had not been lower there.
62	2·7	8	Cumulus and nimbus, .	0	0	A little rain fell between 6 and 7 P.M.
63	2·4	0	0	0	0	
53	3·4	2	Cumulus, .	0	0	
47	4·3	6	Cumulus, .	0	0	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 12th,	3 P.M.	30·31	71·5	71·1	57·4	...	...	3·5
	7 ,,	30·35	67·6	67·2	56·1	72·5	64·6 (15·9)	3·6
♃ 13th,	7 A.M.	30·47	64·0	63·5	56·6	(55·8)	...	4·1
	9 ,,	30·48	67·3	67·0	57·6	...	...	4·0
	0 P.M.	30·45	70·5	70·0	56·6	...	...	3·4
	3 ,,	30·39	71·5	71·3	56·1	...	...	3·2
	8 ,,	30·40	68·0	67·5	57·0	72·4	64·2	3·7
	9 ,,	30·45	65·0	64·5	54·3	...	(16·5)	3·4
♀ 14th,	6 A.M.	30·45	58·2	57·5	52·0	...	...	3·6
	7 ,,	30·46	60·5	60·0	54·1	(56·0)	...	3·8
	8 ,,	30·46	63·7	63·0	55·2	...	...	3·7
	9 ,,	30·45	66·1	65·6	55·6	...	...	3·6
	10 ,,	30·44	68·1	67·8	56·4	...	...	3·6
	11 ,,	30·43	69·4	69·0	56·6	...	...	3·5
	0 P.M.	30·39	71·4	71·0	57·1	...	...	3·4
	1 ,,	30·36	72·5	72·0	58·6	...	...	3·7
	2 ,,	30·34	73·3	73·0	56·8	...	...	3·2
	3 ,,	30·31	73·0	72·3	56·5	74·0	65·6	3·2
	4 ,,	30·30	72·6	72·0	55·8	...	(16·7)	3·1
	5 ,,	30·29	72·1	71·8	55·6	...	...	3·0
	6 ,,	30·32	70·3	70·0	57·1	...	...	3·5
	7 ,,	30·34	68·0	67·5	58·5	...	...	4·1
	8 ,,	30·37	65·8	65·4	57·6	...	...	4·1
	9 ,,	30·38	64·6	64·2	58·0	...	...	4·4
♄ 15th,	7 A.M.	30·37	63·3	63·0	57·6	(58·6)	...	4·4
	9 ,,	30·37	68.0	67·4	57·6	...	...	3·9
	0 P.M.	30·32	74·0	73·6	58·0	...	...	3·4
	3 ,,	30·27	76·0	75·5	58·9	...	...	3·5
	7 ,,	30·30	68·0	67·3	59·2	76·2	67·4	4·3
	9 ,,	30·35	66·5	66·0	57·5	...	(17·5)	4·0
☉ 16th,	8 A.M.	30·37	66·0	65·4	58·5	(58·8)	...	4·4
	9 ,,	30·38	67·1	66·8	59·6	...	...	4·6
	0 P.M.	30·33	73·6	73·2	60·6	...	...	4·1
	3 ,,	30·35	76·0	75·8	58·6	...	...	3·4
	7 ,,	30·30	71·0	70·5	59·0	76·2	67·7 (17·0)	3·9

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
41	4·9	7	Cumulus, .	0	0	
48	3·9	4	Cirro-strati, .	2	N.	
61	2·5	0	0	0	0	Light haze on the horizon; very lovely effect.
53	3·4	2	Cumulus, .	2	S.	
42	4·8	1	Cumulus, .	1	N.	
37	5·2	1	Cumulus, .	8	N.	
49	3·8	1	Cirrus, . .	10	N.E.	
49	3·4	3	Cirrus, . .	7	N.E.	
66	1·9	4	Cirro-strati, .	1	N.E.	
64	2·1	2	Cirro-strati, .	5	N.E.	
57	2·8	4	Cirrus, . .	4	N.E.	
49	3·5	3	Cirrus, . .	5	N.E.	
47	4·0	5	Cirrus, . .	7	N.	
45	4·4	2	Cirrus, . .	7	N.	
40	5·0	2	Cirrus, . .	9	N.	
43	5·0	1	Cirrus, . .	12	N.	
36	5·7	2	Cirrus, . .	12	N.	
36	5·6	5	Cirrus, , .	12	N.	
34	5·6	1	Cirrus, . .	15	N.	
35	5·5	1	Cirrus, . .	15	N.	
44	4·6	2	Cirrus, . .	20	N.	
54	3·3	0	0	10	N.	
58	2·9	0	0	10	N.	
65	2·3	0	0	10	N.	
69	2·0	0	0	0	0	Haze over Nile valley.
51	3·6	0	0	7	N.	
37	5·7	0	0	4	N.	
36	6·2	5	Cumulus, .	2	N.	
51	3·2	0	0	5	N.	
56	3·2	0	0	3	N.	
62	2·6	6	Cirro-strati, .	0	0	Haze over Nile valley.
62	2·8	6	Cumulus, .	0	0	
46	4·9	2	Cumulus, .	0	0	
35	6·3	2	Cirrus, . .	2	N.	
47	4·4	5	Cumulus, .	12	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 17th,	7 A.M.	30·34	65·5	65·0	57·6	(59·5)	...	4·1
	9 ,,	30·33	68·8	68·3	57·6	...	...	3·8
	0 P.M.	30·28	74·0	73·5	56·1	...	...	3·0
	3 ,,	30·21	75·8	75·4	57·0	...	...	3·1
	7 ,,	30·20	72·6	72·2	58·5	78·8	69·0	3·6
	8 ,,	30·22	70·0	69·5	57·5	...	(19·6)	3·6
♂ 18th,	5 A.M.	30·22	60·2	59·5	55·4	(59·0)	...	4·2
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·21	74·3	73·7	58·8	...	...	3·5
	3 ,,	30·15	76·5	76·0	56·6	...	...	3·0
	8 ,,	30·25	70·0	69·7	58·5	76·6	68·6 (15·9)	3·9
☿ 19th,	7 A.M.	30·36	65·1	64·8	58·6	(62·5)	...	4·5
	9 ,,	30·38	68·0	67·5	60·0	...	...	4·5
	0 ,,	30·35	74·1	73·8	60·2	...	...	3·9
	4 ,,	30·28	75·4	75·0	56·6	...	...	3·0
	8 ,,	30·33	70·6	70·2	57·3	76·0	68·6	3·5
	10 ,,	30·39	67·0	66·5	57·7	...	(14·8)	4·0
♃ 20th,	6 A.M.	30·36	61·8	61·3	56·5	(60·0)	...	4·3
	10 ,,	30·37	69·0	68·5	58·1	...	...	3·9
	0 P.M.	30·33	72·4	72·0	57·0	...	...	3·3
	3 ,,	30·26	72·0	71·7	56·7	...	...	3·2
	8 ,,	30·31	66·7	66·4	56·5	72·7	65·2 (15·1)	3·7
♀ 21st,	6 A.M.	30·34	58·0	57·3	51·0	(55·2)	...	3·3
	7 ,,	30·34	60·0	59·5	52·1	...	...	3·3
	8 ,,	30·33	62·5	62·0	52·6	...	...	3·2
	9 ,,	30·33	65·1	64·8	52·8	...	...	3·0
	10 ,,	30·33	67·1	65·8	53·6	...	...	3·0
	11 ,,	30·29	68·4	67·6	54·2	...	...	3·0
	0 P.M.	30·27	70·0	69·5	54·6	...	...	3·0
	1 ,,	30·25	71·4	71·0	55·4	...	...	3·0
	2 ,,	30·23	71·6	71·2	56·1	...	...	3·2
	3 ,,	30·21	71·4	70·9	57·5	...	...	3·5
	4 ,,	30·21	71·5	70·8	57·5	...	...	3·5
	5 ,,	30·21	71·0	70·5	55·1	72·5	64·6	3·0
	6 ,,	30·24	69·6	69·1	55·0	...	(17·1)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
59	2·8	0	0	0	0	Haze on horizon.
48	3·9	0	0	0	0	
33	6·1	0	0	0	0	
31	6·5	2	Cirrus, . .	0	0	
42	5·0	0	0	0	0	
46	4·4	0	0	0	0	
72	1·6	0	0	0	0	Preparing to start for the interior of the Great Pyramid.
...	...	...	...	...	...	
39	5·7	0	0	0	0	Returned to East Tombs at 11.30 A.M.
31	6·9	0	0	0	0	
48	4·1	0	0	0	0	
66	2·4	10	Cumulo-strati,	0	0	
60	3·0	8	Cumulo-strati,	0	0	
43	5·2	4	Cumulo-strati,	0	0	
32	6·5	0	0	0	0	
44	4·6	3	Cirrus, . .	7	W.	
55	3·3	3	Cirrus, . .	5	W.	
70	1·9	10	Cumulo-strati,	2	N.	
50	3·9	6	Cumulo-strati,	4	N.	
38	5·3	4	Cirrus, . .	6	N.	
38	5·3	0	0	8	N.E.	
52	3·5	0	0	15	N.E.	
61	2·1	0	0	2	N.E.	
58	2·5	0	0	1	N.E.	
51	3·1	0	0	2	N.E.	
45	3·8	0	0	10	N.E.	Whirlwinds of sand frequent.
42	4·3	0	0	15	N.E.	
39	4·6	0	0	20	N.E.	
37	5·0	0	0	20	N.E.	
36	5·3	0	0	20	N.E.	
38	5·3	0	0	20	N.E.	
42	4·9	0	0	18	N.E.	
42	4·9	0	0	15	N.E.	
36	5·3	0	0	13	N.E.	
39	4·8	2	Cirrus, . .	12	N.E.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour in cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 21st,	7.4 P.M.	30·29	67·4	67·0	54·2	...	...	3·1
	8 ,,	30·32	65·5	65·0	54·2	...	...	3·3
	9 ,,	30·35	63·6	62·8	53·1	...	...	3·3
♄ 22d,	8 A.M.	30·32	64·6	64·2	54·6	(55·5)	...	3·5
	9 ,,	30·34	66·6	66·2	54·6	...	...	3·3
	6 P.M.	30·28	74·0	73·8	56·1	...	...	3·0
	7 ,,	30·28	71·0	70·4	57·2	74·5	65·0 (19·1)	3·5
☉ 23d,	7 A.M.	30·28	62·0	61·5	56·0	55·4	...	4·1
	9 ,,	30·28	71·6	71·2	59·0	...	...	3·8
	4 P.M.	30·10	83·5	82·8	62·0	84·2	71·4 (25·5)	3·6
☾ 24th,	6 A.M.	30·05	72·6	72·2	59·6	(62·0)	...	3·9
	9 ,,	30·08	85·5	85·0	63·6	...	...	3·7
	0 P.M.	30·06	88·5	88·0	67·6	...	...	4·4
	3 ,,	30·03	88·5	88·0	68·1	89·0	75·5 (27·0)	4·6
♂ 25th,	8 A.M.	30·26	67·3	66·9	58·6	(62·0)	...	4·2
	0 P.M.	30·23	75·6	75·2	59·6	...	...	3·7
	3 ,,	30·17	79·0	78·5	61·0	79·0	70·2 (17·5)	3·7
☿ 26th,	7 A.M.	30·34	64·5	64·0	57·6	(61·0)	...	4·3
	9 ,,	30·34	69·5	69·0	59·0	...	...	4·0
	3 P.M.	30·32	80·2	80·0	61·8	...	...	3·7
	9 ,,	30·34	72·7	72·0	61·0	81·0	71·0 (20·0)	4·3
♃ 27th,	7 A.M.	30·40	64·6	64·1	57·6	(61·0)	...	4·3
	0 P.M.	30·36	77·0	76·5	59·6	...	...	3·5
	9 ,,	30·40	70·3	70·0	59·1	80·5	70·8 (19.5)	4·0
♀ 28th,	7 A.M.	30·46	66·1	65·8	58·0	(61·0)	...	4·2
	3 P.M.	30·33	78·1	77·8	57·6	...	...	3·0

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
42	4·3	3	0	12	N.E.	
47	3·6	0	0	12	N.E.	
50	3·3	0	0	10	N.E.	
52	3·3	0	0	6	N.E.	
45	3·9	0	0	10	N.E.	
33	6·1	4	Cirrus, . .	8	E.N.E.	
42	4·8	5	Cirrus, . .	12	E.N.E.	
67	2·1	0	0	5	N.E.	Hazy sky, white about sun.
46	4·6	0	0	2	N.E.	
30	8·6	4	Cirrus, . .	0	0	Hazy.
45	4·8	0	0	0	0	Hazy sky, and white about sun.
29	9·3	0	0	0	0	
32	9·8	0	0	0	0	Atmospheric light bad.
33	9·6	0	0	0	0	
57	3·1	1	Cirrus, . .	4	N.E.	Haze all about.
38	5·9	0	0	6	N.E.	Atmospheric light improved.
35	6·9	0	0	4	N.E.	
63	2·4	0	0	0	0	Haze over Nile valley.
52	3·8	2	Cirrus, . .	3	N.E.	
34	7·3	2	Cirrus, . .	4	N.E.	Atmospheric light good.
49	4·4	0	0	15	N.E.	
63	2·5	1	Cirrus, . .	2	N.E.	Haze over Nile valley.
35	6·5	0	0	4	N.E.	
49	4·1	0	0	4	N.E.	
60	2·8	0	0	2	N.E.	Haze over Nile valley.
29	7·3	0	0	1	N.E.	Air all day pleasant and balmy.

CYCLE OF A DAY.

From the hourly observations of the various meteorological elements, taken throughout a day, generally once a week,—mean representations for every hour observed, have been deduced for each month; and from such monthly means, the means for the whole four months have been obtained and inserted in the following table prepared for each hour throughout the twenty-four. Some of the hours—as those from 11 P.M. to 5 A.M.—have been supplied by an interpolating curve prepared from the rest of the observations.

The complete day thus instrumentally described at twenty-four equidistant points along its circumference, will represent an average day in Egypt, between February and March; a period at and about which many travellers and invalids may desire to know the vicissitudes they will have to undergo; or, by referring their own observations there at the instant to a normal statement, to ascertain when any of the Egyptian meteorological elements are in an abnormal condition, and some changes of weather, possibly a severe sand-storm, may be looked for.

N.B.—The mean barometrical height is not to be looked on with much confidence, as the instrument employed, experienced an injury on the return,

preventing its due comparison with a standard barometer.

METEOROLOGY OF A MEAN DAY AT EAST TOMBS, PYRAMID HILL, DURING THE MONTHS OF JANUARY, FEBRUARY, MARCH, AND APRIL (THE HOURS FROM 11 P.M. TO 5 A.M. INCLUSIVE, BEING SUPPLIED FROM AN INTERPOLATING CURVE).

Hour.	Barometrical Pressure.	Correction to Mean of 24 hours.	Temperature in shade, (Fahr.)	Correction to Mean of 24 hours.	Temperature of evaporation.	Correction to Mean of 24 hours.	Difference between dry and wet bulb.	Computed			
								Elasticity of vapour.	Weight of vapour in cubic foot of air.	Weight of vapour required to saturate the same.	Relative humidity, saturation =100.
	Inches.	Inches.						Inches.	Grains.	Grains.	
0 A.M.	30·18	0	59·8°	+ 3.6°	52·6°	+ 1.2°	7·2°	0·31	3·5	2·2	62·
1 ,,	3·18	0	58·5	4·9	51·8	2.0	6·7	·31	3·4	2·0	62·
2 ,,	·17	+ .01	57·2	6.2	51·0	2.8	6·2	·30	3·4	1·9	64·
3 ,,	·17	+ .01	56·2	7.2	50·0	3.8	6·2	·29	3·3	1·8	64·
4 ,,	·18	.0	55·6	7.8	49·4	4·4	6·2	·28	3·2	1·8	64·
5 ,,	·20	− .02	55·3	8.1	49·2	4.6	6·1	·28	3·1	1·8	65·
6 ,,	·22	− .04	56·5	6.9	50·2	3.6	6·3	·29	3·3	1·8	64·
7 ,,	·23	− .05	58·6	4·8	51·9	1.9	6·7	·31	3·5	2·0	63·
8 ,,	·23	− .05	61·2	+ 2.2	53·3	+ 0.5	7·9	·31	3·5	2·5	58·
9 ,,	·23	− .05	64·0	− 0.6	54·5	− 0.7	9·5	·32	3·5	3·1	53·
10 ,,	·23	− .05	66·2	− 2.8	55·3	− 1.5	10·9	·31	3·4	3·6	48·
11 ,,	·22	− .04	68·0	− 4.6	55·7	− 1.9	12·3	·31	3·4	4·1	45·
0 P.M.	·19	− .01	69·3	− 5.9	56·3	− 2.5	13·0	·31	3·4	4·7	42·
1 ,,	·16	+ .02	70·1	− 6.7	56·7	− 2.9	13·4	·31	3·4	4·6	42·
2 ,,	·14	.04	70·3	− 6.9	56·6	− 2.8	13.7	·31	3·4	4·7	41·
3 ,,	·11	.07	70·5	− 7.1	56·8	− 3.0	13·7	·31	3·4	4·8	42·
4 ,,	·11	.07	70·3	− 6.9	56·6	− 2.8	13·7	·31	3·4	4·8	41·
5 ,,	·11	.07	69·1	− 5.7	56·1	− 2.3	13·0	·31	3·4	4·4	44·
6 ,,	·13	.05	67·8	− 4.4	55·8	− 2.0	12·0	·32	3·5	4·0	46·
7 ,,	·16	+ .02	66·4	− 3.0	55·6	− 1.8	10·8	·32	3·5	3·6	48·
8 ,,	·18	.0	64·8	− 1.4	54·8	− 1.0	10·0	·32	3·5	3·3	51·
9 ,,	·19	− .01	63·4	0.0	54·7	− 0.9	8·7	·32	3·5	2·9	55·
10 ,,	·19	− .01	62·2	+ 1.2	54·1	− 0.3	8·1	·32	3·6	2·6	58·
11 ,,	·19	− .01	61·0	+ 2.4	53·4	+ 0.4	7·6	·32	3·6	2·4	60·
Mean of 24 hours,	Inches. 30·28	...	63·4°	...	53·8°	...	9·6°	...	...	...	...

METEOROLOGY OF THE MONTHS.

In the following table, both the means and extremes from all the daily meteorological observations are entered for each month separately, and successively, to show the weather history for the time.

The chief anomaly will then be seen to consist in the extra heat and drought of the month of March. For heat, the temperature of 96·1° Fahrenheit, sufficiently realizes that element; while for drought, the most instructive return to look at, is probably that of 'the weight of vapour required to 'saturate a cubic foot of air,'—for such return expresses so closely, in its variations, the actual effects experienced on the human skin. Now in Scotland, the mean amount required in the same month of March, was 0·5 grain; and in June, the dryest month of the whole year, it was 1·1 grain; but at East Tombs, Great Pyramid hill, in March, the the mean quantity required there was 3·8 grains; and the maximum quantity, on one special occasion, was no less than 13·8 grains.

Hence there are peculiar effects produced by Egyptian heat, on account of its accompanying dryness: while even in the element of heat alone, it may be interesting to point out, as respecting medical climatology, that the coldest months, or January and February, at the Great Pyramid, were

3° warmer than the warmest months,—July and September of the same year,—proved to be in Scotland. But to enable the reader to judge more particularly of the differences between the two climates, a table of the Scottish meteorology is introduced on page 264.

EAST TOMBS, LAT. 29° 59′ N.

METEOROLOGICAL ABSTRACT OF EACH MONTH OBSERVED IN 1865.

Subjects.		Jan.	Feb.	March.	April.
General.	Particular.				
		Inches.	Inches.	Inches.	Inches.
Barometrical Pressure,	Mean height,	30·13	30·11	30·14	30·29
	Greatest height on any occasion,	30·26	30·38	30·39	30·50
	Least height on any occasion,	29·89	29·69	29·78	29·86
	Extreme monthly range,	0·37	0·69	0·61	0·64
	Mean semi-daily range,	0·05	0·07	0·08	0·08
		° Fah.	° Fah.	° Fah.	° Fah.
Temperature in shade,	Mean temperature,	61·2	61·4	68·5	67·5
	Highest temperature on any occasion,	76·8	76·5	96·1	89·0
	Lowest temperature on any occasion,	47·5	46·5	51·0	54·0
	Extreme monthly range,	29·3	30·0	45·1	35·0
	Mean semi-daily range,	6·9	7·5	8·5	8·7
Moisture in shade,	Mean weight of vapour, in grains,	3·7	3·0	3·8	3·8
	Mean humidity relative,	60·0	49·0	50·0	49·0
	Mean required vapour, in grains,	2·4	3·1	3·8	3·7
	Greatest weight vapour on any occasion, in grs.,	5·3	4·8	6·0	5·1
	Greatest humidity ,,	92·0	76·0	76·0	76·0
	Least required vapour ,, in grs.,	0·4	1·2	1·1	1·5
	Least weight of vapour on any occasion, in grs.,	2·7	1·8	2·3	2·9
	Least humidity ,,	32·0	28·0	12·0	29·0
	Greatest required vapour ,, in grs.,	5·8	6·6	13·8	9·8
Cloud,	Quantity of 0—10,	3·6	2·9	3·0	2·4
Wind,	Mean velocity in miles per hour,	1·6	4·6	5·2	5·4
	Mean direction,	N.	S.W.	N.	N.N.E.
Rain,	Number of days on which it fell,	1	1	1	0
	Depth fallen; insensible,	0	0	0	0

SCOTLAND, LAT. 56° 30′ N.

ELEVATION ABOVE SEA = 3072 INCHES.

METEOROLOGICAL ABSTRACT OF EACH MONTH, FROM THE SCHEDULES OF THE METEOROLOGICAL SOCIETY OF SCOTLAND IN 1865.

Subjects.		Jan.	Feb.	March.	April.
General.	Particular.				
		Inches.	Inches.	Inches.	Inches.
Barometrical Pressure,	Mean height, reduced to the sea level,	29·41	29·80	29·89	30·11
	Greatest height on any occasion?	30·27	30·66	30·48	30·45
	Least height on any occasion?	28·55	28·94	29·30	29·77
	Extreme monthly range,	1·71	1·72	1·18	0·68
	Mean semi-daily range,	...	...	...	...
		° Fah.	° Fah.	° Fah.	° Fah.
Temperature in shade,	Mean temperature,*	34·6	33·9	37·3	46·5
	Highest temperature on any occasion,	57·5	52·1	58·8	77·0
	Lowest temperature on any occasion,	−4·0	−1·1	14·7	23·0
	Extreme monthly range,	34·7	33·9	28·6	39·4
	Mean semi-daily range,	4·6	4·6	5·4	8·0
Moisture in shade,	Mean weight of vapour, grains,	2·1	2·1	2·1	3·0
	Mean humidity relative,	87·0	88·0	85·0	83·0
	Mean required vapour, grains,	0·2	0·2	0·5	0·6
Cloud,	Quantity of 0—10,	6·2	7·1	6·4	5·9
Wind,	Mean velocity in miles per hour?	20·0	16·0	18·0	15·0
	Mean direction,	W.	S.E.	N.W.	S.W.
Rain,	Number of days on which it fell,	17	14	15	8
	Depth in inches,	3·73	2·91	2·05	0·94

	June.	July.	August.	Sept.
	° Fah.	° Fah.	° Fah.	° Fah.
* The mean temperatures of the four warmest months of the year 1865 were as follows :—	57·1	58·4	56·1	58·0
And the mean weight of vapour in cubic foot of air, in grains,	4·1	4·4	4·4	4·5
Mean humidity relative,	81·0	82·0	87·0	86·0
And mean required vapour to saturate a cubic foot of air, in grains,	1·1	1·0	0·6	0·7

MEAN DAILY TEMPERATURE, IN THE SHADE.

In extracting the numbers for this return from the Meteorological Journal, first, as given by the self-registering thermometers only,—the simple precaution has been observed, of comparing each day's maximum temperature—not with the low temperature of the previous night alone, or the following night—but with the mean of the two nights. The range thus obtained has been divided by two, in order to present the quantity, the simple addition or subtraction of which will at once give either the maximum or minimum temperature.

Day of Month.	January.		February.		March.		April.	
	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.
1	...	...	66·0°	10·5°	60·2°	7·1°	74·4°	10·8°
2	...	...	62·1	6·0	60·4	7·0	68·4	5·6
3	...	...	61·5	4·8	61·2	7·4	66·2	7·2
4	...	...	61·6	7·6	62·4	7·2	64·1	8·1
5	...	...	63·7	9·9	64·7	7·2	63·6	8·4
6	...	...	67·5	8·5	64·5	7·6	65·8	7·8
7	...	...	65·5	7·0	63·3	8·6	66·9	7·3
8	...	...	61·0	7·0	61·0	8·2	67·0	8·4
9	...	...	59·8	8·2	63·8	9·4	64·3	7·5
10	...	...	58·2	8·3	66·4	8·0	64·4	7·9
11	...	...	59·4	9·2	71·9	9·1	...	...
12	...	...	57·7	8·8	75·6	12·4	64·6	7·9
13	...	...	57·1	8·1	65·8	6·8	64·2	8·2
14	59·2°	3·1°	58·6	6·7	66·5	6·0	65·6	8·4
15	61·6	5·8	59·9	7·1	75·2	9·2	67·4	8·8
16	59·3	8·2	65·3	8·4	83·5	12·6	67·7	8·5
17	58·0	7·5	68·1	7·1	75·0	6·2	69·0	9·8
18	60·6	5·4	66·4	5·8	68·3	6·7	68·6	8·0
19	63·0	7·0	63·0	7·6	66·1	6·5	68·6	7·4
20	64·3	8·8	60·2	7·2	64·8	6·6	65·2	7·6
21	61·4	5·0	61·8	7·2	63·9	10·1	64·0	8·6
22	62·8	6·8	66·2	7·8	68·8	11·8	65·0	9·6
23	62·2	6·4	62·0	7·5	80·4	12·1	71·4	12·8
24	59·8	5·4	55·2	7·4	78·8	10·6	75·5	13·5
25	58·7	7·6	55·6	5·8	70·7	7·1	70·2	8·8
26	61·8	6·6	57·4	5·6	69·5	7·5	71·9	10·0
27	62·0	5·2	58·0	7·4	69·2	10·8	70·8	9·8
28	61·6	7·4	60·0	8·2	65·9	9·1	...	...
29	62·8	10·2	...	...	70·6	9·4	...	...
30	62·3	8·1	...	...	74·2	9·2	...	...
31	66·4	10·4	...	...	69·4	6·4	...	...
	61·2°	6·9°	61·4°	7·5°	68·5°	8·5°	67·5°	8·7°

The mean temperature for the whole of the four months observed in, appears to be from the preceding returns = 64·6°. But there are some causes which may make this result rather too high; first, that the minimum thermometer being of alcohol, and large-bulbed, is more sluggish than the mercurial maximum, and does not equally give the extremes of its curve; and second, that the stone shelf in the dining-room tomb, where the minimum was placed at night, was perhaps rather farther within solid stone protections than it ought to have been, with due regard to fine scientific requirements: points which were better attended to with the ordinary observations of temperature at the instant. There is the further uncertainty too with this method, that it is by no means necessary that the mean of the two extremes of the daily curve, should give the mean for the whole day; and in fact Mr. Glaisher has shown long since that it does not.

Hence the result from the maximum and minimum thermometers, observed every day,—though the popular system,—is probably not so good as that from the simple thermometers observed hourly, about once a week, throughout the same four months; and this latter method gives 63·4.°

Assigning the latter number, therefore, double weight,—perhaps it ought to have more,—the mean of the whole meteorological observations on the atmosphere, for the mean temperature at East Tombs during the months of January, February, March, and April, of the year 1865, = 63·8° Fahr.

SPECIAL STORM.

THE severest storm experienced at the Pyramids during the first four months of 1865, was undoubtedly that which culminated on February 3, at 4h A.M. The barometer steadily decreased during four days from 30·16 to 29·69, and then as steadily rose from that point to 30·17 in the course of the three following days. During the sinking of the barometer, the wind veered from south gradually to south-west, and during the rising from south-west to west, the maximum velocity occurring soon after the maximum fall of the barometer. Not a drop of rain fell, but during three days the sky was dark and obscured with sand, which seemed to fill all the air; and the difference between wet and dry-bulb thermometers was occasionally 10°, at a shade-temperature of 65°.

The importance of this storm is not to be judged on European principles by the amount of rain, which was nothing, because the region is a 'rainless region;' nor is it to be judged from the whole fall of the barometer, which was not more than 0·47 inch, because the latitude parallel is one of small barometrical variation; but it is to be compared only with the other weather phenomena of its own

locality, and especially is it to be weighed by the long period of uninterrupted fall, and then the almost equally long period of uninterrupted rise of the barometer, lasting altogether for a whole week, —and indicating a wide-spread and truly grand disturbance of the atmosphere. Seeing too, that such disturbances are always of a dynamical or locomotive order, we may ask whence did this storm come to Egypt?

From the southern parts of the North Atlantic, is the first idea; and one still to be tested; for though the admirable daily bulletins of the Imperial Observatory of Paris show little or nothing of it, they may not extend their weather-maps far enough southward, for the earlier history of the storm; as they certainly do not far enough eastward to represent Egypt. The range of those maps is indeed essentially West European, though they have a little of North-west Africa, and some parts of Russia, within their bounds. Still, as most admirable things of their kind, and quite unique,—their indications deserve to be chronicled on the present occasion, though they are only negative: and stand thus:—

During the several last days of January, no noticeable phenomena disturbing the weather.

On February 1, 8h. A.M., a most serious-looking set of concentric barometric circles over England first, and then Europe; lowest descent of mercurial column = 28·6 inches.

On February 2, 8h. A.M., more moderate baro-

metric curves, but in nearly similar positions; lowest barometrical height = 29·1 inches; greatest height anywhere, at Gibraltar, and = 30·1 inches. But eastward of Sicily a new, separate, and distinct, centre of barometrical depression is indicated, having for its lowest reading, 29·3 inches.

On February 3, 8h. A.M., less marked curves of the European system, whose centre and lowest point is over France, and reads 29·1 inches. The East-Sicilian system is gone.

On February 4th, 8h. A.M., the weather calm and settled, and all European barometric heights very uniform.

Hence arises the conclusion, that the Egyptian storm was not felt in West Europe; though the centre of barometrical depression, indicated on the morning of February 2 as being eastward of Sicily, may have been connected with it,—when pursuing a path something like east-north-east, or moving against the trade-wind current; and in latitudes between 35° and 25° north, when near 15° of longitude east of Greenwich.

But what of the storm when farther east, supposing such to be its track?

The following observations bearing on this point have been kindly furnished by the Meteorological Society of Scotland from their observer at Jerusalem; and indicate, as well as single daily observations may be expected to do, that the storm culminated there on February 3; was marked by

larger and longer continued barometric depression than in Egypt; had similar south-west wind, though of no great strength, accompanying its central position; and was distinguished by nearly two inches of rain, with much thunder and lightning:—

METEOROLOGICAL SOCIETY OF SCOTLAND.

STATION—JERUSALEM.

Latitude, 31° 46′ 45″ N.

Longitude, 35° 13′ East.

Distance from sea = 35 miles.

Height, station above sea = 2400 feet = Bar. corr. + 2·536 inches.

Observer—DR. THOMAS CHAPLIN.

Time of observation = 9 h. A.M.

Date, 1865.	Barometer.	Max. Th.	Min. Th.	Dry-bulb.	Wet-bulb.	Wind.		Rain, inches.	Clouds.	Notes.
						Force.	Direction.		0—10.	
JAN.	Inches.	Fahr.	Fahr.	Fahr.	Fahr.					
29	27·532	56·9°	42·5°	52·°	49·5°	1	E.	...	0	
30	·492	60·0	44·0	56·	50·0	0	N.E.	...	0	
31	·397	66·5	49·5	54·9	47·0	0	E.	...	10	
FEB.										
1	·322	69·5	50·5	56·0	47·5	1	N.W.	...	0	
2	27·137	67·5	43·5	44·2	41·8	1	S.W.	...	7	
3	26·972*	53·1	44·0	48·0	44·2	3	S.W.	·050	7	Rain began at 3.30 P.M.; much lightning and thunder.
4	27·247	51·5	44·0	46·1	46·1	3	S.W.	1·775	10	Numbers of the clouds entered from description partly.—(C. P. S.)
5	·362	56·0	45·0	55·8	47·1	3	S.W.	...	0	
6	·472	58·5	49·0	53·2	51·5	0	N.W.	...	5	
7	·422	61·6	50·0	54·9	48·0	0	N.W.	...	10	

* No other case below 27· inches, all through January and February.

SECTION V.—MISCELLANEOUS AND COMMUNICATED MEASURES.

MEASURES OF THE SECOND PYRAMID.

ANGLE of elevation of each side of the casing near the summit of the second Pyramid, measured approximately from below; *i.e.*, with the sextant horizon from the top of the rubbish-mound in the middle of each side, on April 7 and 8 :—

Angle of East face of casing,	. . . . .	=	52° 57′
,, South ,,	. . . . .	=	52 52
,, West ,,	. . . . .	=	52 49
,, North ,,	. . . . .	=	52 42
	Mean,	=	52° 50′

SARCOPHAGUS OF SECOND PYRAMID.

Situated near the western end of the grand chamber, which is close to the centre of the base of the Pyramid. Length of this chamber runs east and west; roof, angular; walls, of limestone, apparently excavated in rock of hill, and salt-incrusted.

Floor near sarcophagus, is of granite, much broken up (by Mr. Perring, in his search for an under chamber). Sarcophagus of red granite, with its length placed north and south; sunk originally in floor up to level of brim, quite or nearly; measures, excluding at present particular consideration of the grooves for a lid,—thus on March 2 and 14,—

SARCOPHAGUS OF SECOND PYRAMID.

Part observed at	Outside.			Inside.		
	Length.	Breadth.	Height.	Length.	Breadth.	Depth.
	Inches.					
General, ... =	103·5	41·8	38·0	...	...	...
Lowered part of West side, etc., . . =	...	...	36·4	...	...	...
West side, . . =	...	...	...	84·6	...	...
East side, . . . =	...	...	...	84·6	...	...
North end, . . =	...	...	...	...	26·7	...
South end, . . =	...	...	...	...	26·7	...
North-East corner, . =	...	...	...	...	...	29·4
Part of West side by reason of groove ledge, =	...	...	...	...	...	27·8

Transverse thickness of West side, all along, . = 7·6 inches.
,, East ,, below ledge, . = 7·6 ,,
,, North end, below ledge, . = 9·3 ,,
,, South end, ,, . = 9·4 ,,

Had once a cover, still to be seen, which fitted on by sliding from the west, like a sliding-lid of a box. The grooves for such a sliding-lid are cut inside the top of the east side, and north and south ends; while the west side is entirely lowered—to the depth of the groove—all across and along its (the west side's)

upper surface,—except a small portion at each end, beyond the limits of the side grooves there.

Vertical depth of this groove,	.	.	.	=	1·6 inch.
Horizontal breadth of its base on East side,	.	.	.	=	0·45 „
Do. on South end, South-east corner,		.	.	=	1·1 „
Do. do. South-west „	.	.	.	=	1·7 „
Do. on North end, North-east „	.	.	.	=	1·1 „
Do. do. North-west „	.	.	.	=	1·9 „

The outer sides of the grooves overhang towards the top and to the centre of the sarcophagus; so that they may be described as being acute-angled or dovetailed, and, as such, would prevent the cover being pulled off upwards. It was further prevented from being pulled off horizontally westward, by having holes in the top of the west side, into which sliding-pins fell out of the bottom of the lid, when this was pushed on into its right place. There are two of these holes only, each about 1 inch broad, circular, and 1 deep, in the middle of the western side as regards breadth, and 6 inches within the inside ends of the interior of the sarcophagus as regards length.

The lid or cover was found lying amongst the broken stones of the floor; it is very thick; the full length and breadth of the whole vessel; and with a portion only of the under side chiselled into shape, to enter the grooves at the top of the sarcophagus sides. The lid measured 103·7 inches long; 42 inches broad; 8·2 inches thick to the cut-out part, to suit ledge or grooves; and 9·8 inches thick elsewhere.

The temperature of the room was found to be thus, by Casella 0 :—

h.	m.			
At 5	0	P.M.	=	75·0° Fahr.
5	10	,,	=	74·5 ,,
5	20	,,	=	74·6 ,,
5	30	,,	=	74·6 ,,

ENTRANCE PASSAGE OF SECOND PYRAMID.

This entrance passage, on the northern face of the second Pyramid, is merely lined with red granite; or formed of four sets of granite plates thrust into this very rude general masonry. Of these, the plates or blocks forming the roof and floor, are 112 inches broad, and 35 to 50 inches thick; while the plates forming the walls are much smaller blocks placed in between these large flat ones to keep them apart, and are each 35 inches broad, 47·3 inches high or thick, and 41·7 inches apart the one from the other at their internal faces, to form the breadth of the passage; which passage is therefore 41·7 inches broad, and 47·3 inches high transversely to the line of the floor.

Or, by a second measure—

	Inches.
Vertical height of said passage,	= 52·3
Height at right angles to incline,	= 47·2 and 47·4
Breadth at top,	= 41·7
,, bottom,	= 41·6
Distance of beginning of roof is south of the North end of basement,	= 70·0
West wall end from ditto,	= 50·0
East wall end from ditto,	= 8·0

The ends of the granite blocks on the east side and below, are not quite clear of the side rubbish.

ANGLE OF INCLINATION OF ENTRANCE PASSAGE OF SECOND PYRAMID.

On April 5, the Playfair altitude-azimuth instrument was erected over basement beginning, or north end of this passage; and a lamp-signal was placed near bottom, or south end of the same, on a heap of rubbish, about 1250 inches from the instrument, measured on the passage's incline.

Before beginning the angular measures, the lamp-signal was examined and found to be sensibly in the centre of the passage, as regards roof and floor, and east and west wall. The Playfair instrument was also found to be correct between the east and west walls of the passage, but somewhat out in height; an error not measured quite so accurately as it ought to have been, but believed to amount very nearly to 0·8-inch too high; or that the horizontal axis of the vertical circle was 27·0 inches vertically above the floor of the passage, and 25·5 inches vertically below the roof produced optically to the instrument's position.

While taking some of these measures near the top of the passage inside, there was an involuntary testimony to the angle of the floor of the passage being greater than the angle of repose for wood resting on granite, with some sand sprinkled on it too,—by the measuring-rod sliding away of its own accord, and not stopping till it had got to the bottom of the whole passage.

DIP OF ENTRANCE PASSAGE, TO THE SOUTH.

Reversals of circle.	Microscope A.	Microscope B.	Angle with index-error.	Mean angle, corrected for index-error, and position of instrument, as below.
Direct, .	26° 25′ 48″	26′ 2″	26° 25′ 55″	26° 30′ 18″
Complement,	63 20 44	21 5	63 20 55	
Direct, .	26 25 38	25 53	26 25 46	26 30 16
Complement,	63 20 38	20 62	63 20 50	
Direct, .	26 25 44	25 61	26 25 53	26 30 18
Complement,	63 20 41	20 62	63 20 52	
			Mean, =	26° 30′ 17″

The corrections applied for the circle being 0·8-inch too high, on a signal 1250 inches distant, being $-2'\ 12''$.

AZIMUTH OF ENTRANCE PASSAGE OF SECOND PYRAMID.

Set telescope to Solar focus; lamp-signal, then, a disk of 5′ in diameter, but with a bisectible luminous centre. Relevelled.

Time by watch.	Object observed.	Microscope A.	Microscope B.	Mean of azimuthal microscopes.
h. m. s.				
5 55 0 P.M.	Lamp-signal, .	57° 39′ 59″	40′ 18″	57° 40′ 9″
,, ,,	Again, reversing,	237 40 27	40 34	237 40 30
,, ,,	Again, reversing,	57 39 57	40 32	57 40 14
6 14 0 ,,	Polaris, near w. elongation,	236 8 34	8 39	236 8 36
6 21 30 ,,	Do., reversing telescope, .	56 8 12	8 42	56 8 27
6 29 7 ,,	Do., reversing telescope, .	236 8 48	8 55	236 8 52
6 36 0 ,,	Lamp-signal, .	237 40 42	40 39	237 40 40

The following being the steps of computation :—

Lamp-signal, according to telescope reversal, . =	57° 40′ 9″ and 57 40 14	or 237° 40′ 30″ 237 40 40
Lamp-signal, Mean places of, . . . =	57° 40′ 12″	and 237° 40′ 35″
h. m. s. Polaris at 7 11 22 sid. time, ,, 7 18 52 ,, ,, 7 26 29 ,,	236° 8′ 36″ 236 8 52	..... 56° 8′ 27″ and 360 0 0
Mean, = 7 18 54 sid. time, =	236° 8′ 44″	or 416° 8′ 27″
Add elongation of star West of Pole computed for time as above, . =	+1 37 25	+1 37 25
Place of Pole, or North end of Meridian, . . =	237° 46′ 9″	and 417° 45′ 52″
But lamp-readings + 180°, ... =	237° 40′ 12″	and 417° 40′ 35″
Therefore difference shows Pole of Pyramid *West* of Pole of sky by =	+ 5′ 57″	and + 5′ 17″
	Mean, = + 5′ 37″.	

CASING-STONE FRAGMENTS, OF SECOND PYRAMID.

This fragment was picked up amongst the rubbish of the western side of the second Pyramid, and contains portions of three worked surfaces, viz., the base, the bevelled outside, and a vertical side-joint.

The angle of the base with the bevelled surface being measured with the reversing caliper apparatus and circle on March 7, 1866, in Edinburgh,—gave 52° 45′; and on May 10, 1866, without looking at the former return, 52° 52′; mean = 52° 48′.

The angle of the base with the upright side-joint surface was found = 90° 5′; and the angle of the bevelled surface with the same side-joint was found = 91° 10′; the increase of this angle over the other of 90° nearly, being very marked.

PHOTOGRAPHS.

NEGATIVES.

THESE photographs were all taken with a view solely to procuring aids in scientific inquiry. Hence they were numerous; often rather peculiar, both in their subjects and stations (though the camera was never *tilted*, but on the contrary levelled by spirit-level), and were always on glass plates. The impressions were moreover '*thin*,' photographically,—as rendering them more suitable to copying and enlarging by a copying camera afterwards,—and small in size, for the sake of portability; one-half of them being taken on dry plates about three inches square, with a lens 4·8 inches in focus; and the other half on wet plates, of the unusually small size of 1 inch square,[1] with a lens by Mr. Dallmeyer, of London, 1·8 inches in solar focus. These smaller pictures were the work of an apparatus specially arranged by myself for the occasion, and with a view to

[1] i.e., the impressed pictures were of that size; the glass plates themselves being three inches long and one broad, or the usual-sized slides for microscopes.

securing several practical advantages as detailed in vol. i. chap. xvi.: but though successful in its objects, I do not burden these pages with an account of it, as the apparatus itself was exhibited (for me) by Mr. J. Nicol, and described by him extremely well, before the Edinburgh Photographical Society on May 16th, 1866; besides being reported in the *British Journal of Photography* (No. 318) for June 8th, of the same year.

POSITIVES.

From the above-mentioned negatives,—of which there are, large and small, twelve boxes,—I prepared, with a copying camera, after returning home, a considerable number of positive copies. Occasionally, of the whole subject; but usually some special portion only, of the original negative, was picked out, and magnified to such an extent as to fill the size of glass plate selected for the positives,—and in that way, exhibit sundry features of structural importance or theoretic interest, in a more striking and easily understandable manner than would otherwise have been possible.

On this principle there were first prepared, copies of sixty subjects,—on glass plates 7·75 by 4·25 inches,—with some idea of converting them into book plates: but the expense of so doing was soon found to be vastly beyond my limited means,—however desirable it might be otherwise, for Pyramid litera-

ture to receive so large an accession of accurate pictorial representation.[1]

Afterwards a series of copies was commenced on glass plates 6·75 by 3·25 inches,—as being more suitable to optical examination, micrometric measure, and public exhibition by the oxyhydrogen light,—and carried out to the extent of 166 subjects.

Finally, a series has been commenced on glass plates suitable for the stereoscope. Only fourteen subjects of this series have been realized as yet, and it will probably not extend to more than fifty, as only a portion of the original negatives were taken appropriately in duplicate. In preparing these proofs for the stereoscope, a standard was adopted at the beginning, and will be preserved throughout, of keeping the centres of the two pictures forming a stereoscopic pair 2·7 inches apart. With this distance, no prismatic power is required with the lenses of the stereoscope to enable an average pair of eyes to produce combination of the two subjects without strain on the optic nerves; and it has been possible, therefore, to employ, in some special stereoscopes recently manufactured on purpose, simple achromatic lenses, with much greater magnifying power than is usual; and with such an increased

[1] Of the above collection, thirty were lent to Mr. Mather, of the Magnesium Metal Company, to exhibit at his 'stall' at a conversazione of the British Association for the Promotion of Science, at Birmingham, in 1865; so that they have not been altogether useless to the public; and the rest have been chiefly given away to private friends, interested in the subject of the Pyramid.

extent of realization of the mechanics composing the scene photographed, as to induce a regret now, that *every* subject was not taken in a stereoscopic manner.[1]

Still, such as they are, with numerous imperfections on their heads, the collection has been of invaluable service to me,—in keeping up the memory of the scenes; in furthering some examinations which had only been begun when upon the spot; and in commencing others which had not attracted my attention at the time, but yet had had their elements pictured with accuracy, in views which had been photographed for some other very different purpose. This is indeed one of the special uses of photography to a scientific traveller, viz., that it maps down not only what is required and understood, but everything else far and near, whether appreciated or not; but all with equal fulness, sharpness, and accuracy: wherefore all scientific men, and travellers more especially, are indebted indeed to Fox Talbot and Daguerre for this remarkable instrument of help in their investigations,—and which their fathers knew not.

Deriving so much benefit then myself from having these photographs at my hand when writing the present work, and wishing to make others partakers of the same advantage,—I was much disappointed

[1] Six of the above-mentioned stereographs were exhibited in as many stereoscopes at the meeting of the Royal Society, Edinburgh, April 2, 1866, on occasion of a notice of the recent measures at the Great Pyramid being given at the request of the Council.

to find, as already mentioned, that the expense of preparing good and large-sized paper prints from them for publication, was too expensive for me to contemplate. But I have since then lent many of the lantern series for public exhibition by the oxy-hydrogen light; so that audiences of 800 individuals and upwards at a time, have seen them, and have had each of the original 1-inch square pictures magnified so as to cover square screens from 100 to 300 inches long in the side; or nearly to fill the end of a large hall.

In this manner thirty-six different pictures were shown in Manchester by Mr. Mather in November 1865, to his friends interested in the production of magnesium metal; thirty-six by Mr. Joseph Sidebotham in December, to the Photographic Section of the Philosophical Society in the same city; thirty-six at the Royal Scottish Society of Arts in Edinburgh, on April 23, 1866; forty-eight to a popular meeting of the Edinburgh Photographic Society on May 7; eighteen to an ordinary meeting of the same Society on May 16; fifty to a public conversazione in the Museum of Science and Art in Edinburgh in November; fifty during the same month at a public meeting in the City Hall, Glasgow, in aid of Scottish Church extension in Alexandria, in November also; fifty at Stirling in December, and fifty at Alloa in the same month, before local scientific societies; fifty at Montrose, in aid of working men's lectures, on January 5, 1867;

fifty in the City Hall, Glasgow, in aid of the Alexandrian scheme again, on January 11; and fifty in the Queen's Rooms of the same city, on January 15; while two more exhibitions are promised in Edinburgh in March before the Philosophical Institution.

On all these occasions, excepting only the two first, the pictures were placed in charge of, and exhibited by, Messrs. Nicol and Slight, of the Edinburgh Photographic Society; who performed their part most efficiently.

Nevertheless, as some of the plates, from being exposed so frequently in close proximity to a powerful oxyhydrogen light, are now beginning to show symptoms of 'roasting,'—it may be inexpedient to exhibit them again in public. I close this department, therefore, with a list which—though containing merely the names and described subjects of the plates—may yet allow of an idea being formed touching the accession to the means of obtaining a knowledge of the Pyramids, furnished on this occasion by photography.

GREAT PYRAMID PHOTOGRAPHS—*in six boxes.*

1. Three Pyramids of Jeezeh from Southern uplands.
2. Two greater Pyramids of Jeezeh from Southern uplands, with Fossil Shells in foreground.
3. Fossil Shells in foreground of No. 2, magnified.
4. Fossil Shells in the more immediate foreground of No. 2, magnified.

5. Bird's-eye View of Great Pyramid and its Sepulchral Hill from an eminence Southward.
6. Great Pyramid, and East Tombs Cliff from Eastern Sand-plain.
7. Great Pyramid and Northern Causeway, from the East.
8. Great Pyramid from the East Tombs Cliff.
9. Great Pyramid from the South-east; a Snake-track in foreground.
10. Great and Second Pyramids, from the Sand-plain North-east.
11. Great Pyramid and the Ancient Rubbish-heaps from the Sand-plain to the North-east.
12. Great and Second Pyramids from Sand-plain on the North.
13. Great Pyramid and Monuments from the South-east.
14. Great Pyramid from hills to the North-west.
15. Great Pyramid, old and recent Rubbish-heaps, and distant Egyptian cultivated fields, from the North-west.
16. Ancient Rubbish-heaps North of Great Pyramid, from the North-west.
17. Masonry of Southern and part Western sides of Great Pyramid.
18. Howard Vyse's Hole, in South face of Great Pyramid.
19. North-east corner of Great Pyramid and Hill.
20. Stone Ranges of Great Pyramid at North-east corner.
21. Slickensides marked Rock, below North-east corner of Great Pyramid.
22. Stone Ranges of Great Pyramid at South-west corner.
23. Masonry of North-east corner of Great Pyramid.
24. Masonry of North-east corner of Great Pyramid, from close by.
25. Large Fragment of a Casing-stone discovered by Alee Dobree in side of Northern Rubbish-heap, February 1865.
26. Nummulite Limestone, South-west corner of Great Pyramid.
27. The North Azimuth Trench, on East side of Great Pyramid.
28. The South Azimuth Trench.
29. The North-north-east Azimuth Trench.
30. East-north-east Azimuth Trench, looking outwards, Figures seated.

31. East-north-east Azimuth Trench, looking outwards, Figures standing.
32. East-north-east Azimuth Trench, looking inwards, Figure in shade.
33. East-north-east Azimuth Trench, looking inwards, Figure in sunlight.
34. Upper part of Great Pyramid from East-north-east Azimuth Trench.
35. Heap of Rubbish on Western side of Great Pyramid, rich in fragments of ancient Casing-stones.
36. South-east corner of Great Pyramid, with parts of Second and Third Pyramids.
37. Terminal Socket of Great Pyramid Casing at North-east corner, uncovered April 1865, by Messrs. Aiton and Inglis.
38. Another edition of No. 37.
39. Socket at North-east corner of Great Pyramid, and Stones of Pyramid.
40. Socket at North-west corner of Great Pyramid, with a building stone found accidentally tumbled within it.
41. South-east corner Socket of Great Pyramid.
42. South-west corner Socket of Great Pyramid.
43. Entrance into North face of Great Pyramid: oblique view.
44. Closer view of No. 43.
45. Entrance into Great Pyramid from the North.
46. Closer view of No. 45.
47. Still closer view of No. 45.
48. View on the Pyramid side, representing one flank of general hole leading down to Entrance Passage of Great Pyramid, showing the finer Mokattam stone composing its walls and floor.
49. Closer view of No. 48.
50. Straightness and fineness of the Joints on one side of the Entrance Passage into the Great Pyramid.
51. Mouth of Entrance Passage into Great Pyramid.
52. Stone above roof of Entrance Passage into Great Pyramid.
53. All the Pyramids of Jeezeh from the South-west.
54. Closer view of No. 53.

55. Still closer view of the tops in No. 53.
56. The Granite Coffer in the King's Chamber of Great Pyramid, by magnesium light.
57. Another edition of the same.
58. Do. do.
59. Do. do.
60. Do. do.
61. Upper North-east corner of Coffer, by magnesium light.
62. Broken South-east corner of Coffer, by magnesium light.
63. Fissures locally formed in South-east corner of King's Chamber, Great Pyramid, by magnesium light.
64. Broken Ramp-stone near Well-mouth, in Grand Gallery of Great Pyramid, by magnesium light.
65. Magnesium and Mealed Gunpowder in North end of Grand Gallery, Great Pyramid.
66. Base of Niche in Queen's Chamber of Great Pyramid, by magnesium light.

SECOND PYRAMID PHOTOGRAPHS—*in two boxes.*

1. Bird's-eye View of Second Pyramid from Southern hill-top.
2. Second and Third Pyramids, from the North-east.
3. Second Pyramid from the North.
4. Second Pyramid from the East-north-east.
5. Second Pyramid from the East.
6. Second Pyramid with Clouds.
7. Second Pyramid and Groups.
8. North-west corner of Second Pyramid, and Third Pyramid.
9. View Northward from North-face heap of Second Pyramid.
10. Northern Enclosure of Second Pyramid: Great Pyramid in distance.
11. Figures on North Enclosure of Second Pyramid.
12. True and False Entrances into North side of Second Pyramid.
13. Western Enclosure of Second Pyramid.
14. Hieroglyphics on West Enclosure of Second Pyramid.

15. Close view of Entrance Passage of Second Pyramid.
16. Ruined Blocks near South face of Second Pyramid.
17. Summit-casing of Second Pyramid.

THIRD PYRAMID—*one box.*

1. Third Pyramid with Clouds.
2. Third Pyramid from North-east: White Stone Coffin in foreground.
3. Third Pyramid of Jeezeh, from the South-east. *N.B.*—Sand-ribbings in the foreground.
4. South-east corner and Southern side of Third Pyramid.
5. Fallen Blocks of Granite-casing on Southern side of Third Pyramid.
6. Fallen Blocks of Granite-casing on Western side of Third Pyramid.
7. Granite Casing-stones *in situ* on North side of Third Pyramid.

SPHINX—*one box.*

1. Head of Sphinx and Sand-hills.
2. Head of Sphinx and Figure from East Tombs.
3. Head of Sphinx and Shafre's Tomb.
4. Near view of Sphinx, Third Pyramid in distance.
5. Near view of Sphinx and Sand-hills.
6. Sphinx from the West.

KING SHAFRE'S TOMB—*two boxes.*

1. King Shafre's Tomb, Sphinx, and Great Pyramid, from South-east.
2. King Shafre's Tomb, Sphinx, and Great Pyramid, from South-east, rather nearer than in No. 1.
3. King Shafre's Tomb, and Second Pyramid.
4. Entrance Passage into King Shafre's Tomb, and Temple before Second Pyramid.

5. King Shafre's Tomb, and Third Pyramid.
6. Western Entrance into King Shafre's Tomb, nearly blocked up by running sand.
7. Entrance Passage into King Shafre's Tomb, inside.
8. Interior Colonnade of King Shafre's Tomb, No. 1.
9. Interior Colonnade of King Shafre's Tomb, No. 2.
10. Interior Colonnade of King Shafre's Tomb, No. 3.
11. Interior Colonnade of King Shafre's Tomb, No. 4.
12. Well Room in King Shafre's Tomb.
13. No. 1 of Sepulchral Chamber in King Shafre's Tomb, tested for orientation, by Sun's shadow, four minutes before noon, apparent solar time.
14. No. 2 of Sepulchral Chamber, tested as in No. 13, at noon.
15. No. 3 of Sepulchral Chamber, tested as in No. 14, four minutes after noon.
16. Red Granite and White Arragonite in King Shafre's Tomb.
17. Closer view of No. 16.

TOMBS NEAR THE PYRAMIDS—*three boxes.*

1. East Tombs Cliff from North-east.
2. East Tombs Cliff from Eastern plain.
3. Day-guards' Tent at East Tombs, No. 1.
4. Day-guards' Tent at East Tombs, No. 2.
5. Day-guards' Tent at East Tombs, No. 3.
6. Day-guards' Tent at East Tombs, No. 4.
7. Base of Cliff at East Tombs, No. 1.
8. Base of Cliff at East Tombs, No. 2.
9. Base of Cliff at East Tombs, No. 3.
10. Interior of Tombs revealed, by breaking away of front of Cliff.
11. Tombs in East Face of Pyramid Hill.
12. Hieroglyphics on a Tomb Door-jamb.
13. Tomb Door and Arab at base of Cliff at East Tombs.
14. Group of Arabs at East Tombs.

15. Tombs on East Face of Pyramid Hill.
16. Tomb Entrance on East Face of Pyramid Hill.
17. No. 16 closer.
18. Tomb Mouth with bones, at East Tombs, Pyramid Hill.
19. Part of No. 18 magnified.
20. Part of No. 18, further magnified.
21. Stone-coffin Figure on Pyramid Hill.
22. Discussion over the Stone-coffin Figure on Pyramid Hill.
23. Utterly broken Tombs on Pyramid Hill.
24. Sarcophagus at bottom of Campbell's Tomb, viewed from above.
25. Shadow of Pyramid extending over Egyptian plain.
26. Sunset Shadow of Pyramid.
27. Ruined Tombs and Hills near the Sphinx.
28. Travellers' Road up East Face of Pyramid Hill.
29. Square Sepulchral Well on Pyramid Hill.

PORTRAITS AT THE PYRAMID—*one box.*

1. Mrs. C. P. S. at East Tombs.
2. Ibraheem,—cook, dragoman, and head-servant.
3. Ibraheem, enjoying his *otium cum dig.*, after the service is over.
4. Alee Dobree on Guard at East Tombs, and dreaming of his own house and date-trees.
5. Alee Dobree annoyed that he was not allowed to desert to a party of Travellers one day, and receive baksheesh.
6. Sheikh Abdul Samud of the northern Pyramid village.
7. Smyne, Ibraheem's help, at East Tombs.
8. Alee, the Day-guard at East Tombs.
9. The Lamb presented by Sheikh Murri.
10. Sheikh Murri, of the southern Pyramid village.
11. Arab Group on roof of Sheikh Abdul Samud's house.
12. Madame Abdul Samud and Family.

PYRAMID MOVING FIGURES—*one box.*

1. Village with Figures on the Sands, south of Pyramid Hill.
2. The Cultivated Land of Egypt from the Sand-plain.
3. The principal Pyramid Village, and the Eastern or Mokattam Hills in the distance.
4. The Northern Pyramid Village.
5. Travellers ascending the Hill towards the Great Pyramid, accompanied by Arabs.
6. No. 5 magnified.
7. Hawk on the wing.
8. The Slave-merchant.
9. Line of Camels.
10. Travellers returning from seeing the Pyramid.
11. Distant view of Pyramids of Abooseer, south from Jeezeh.
12. The Last Man.

NUMBER OF LANTERN PHOTOGRAPHS.

Great Pyramid, ...	66
Second Pyramid, ...	17
Third Pyramid, ...	7
Sphinx, ...	6
King Shafre's Tomb, ...	17
Tombs near the Pyramids, ...	29
Portraits at the Pyramids, ...	12
Pyramid Moving Figures, ...	12
Total, =	166

PHOTOGRAPHS PREPARED IN DUPLICATE FOR THE STEREOSCOPE.

1. North-east Socket of Great Pyramid, and Corner of Masonry.
2. North-east Socket and its Excavators.
3. North-west Socket of Great Pyramid, and part of Pavement.
4. South-east Socket of Great Pyramid.

5. Upper part of Great Pyramid, viewed from East-north-east Azimuth Trenches.
6. North Azimuth Trench.
7. Outer end of East-north-east Azimuth Trench.
8. Same repeated.
9. Inner end of East-north-east Azimuth Trench.
10. Coffer in King's Chamber, by magnesium light.
11. Upper North-east corner of Coffer, by magnesium light.
12. Upper South-east corner of Coffer, by magnesium light.
13. Lower part of Niche in Queen's Chamber, by magnesium light.
14. Second and Third Pyramids, with South-east corner of Great Pyramid.

Out of about fifty general subjects.

SPECIMENS BROUGHT HOME.

THESE were almost entirely hand-specimens of the rocks; for if some of them were parts of monuments, they were ancient fragments of them only, trampled under foot for ages, and now picked up off the ground merely to illustrate the material; and show what has been brought to the region by man, and what by nature. The series was as follows:—

1. Nummulite Limestones of the Pyramid Hill.
2. Fossils of various kinds, Gypsum, and Sand, from the neighbourhood of the Second Pyramid, Third Pyramid, and Sphinx.
3. Rock of Fossil-shells from the top of the hill to the south of the Pyramid Hill.
4. Fossil-shells, Echini, etc., from hills about three miles farther south.
5. Nineteen fragments of Casing-stones of the Great Pyramid, picked up out of the rubbish at its foot.
6. One ditto of the Second Pyramid.
7. Cakes of Salt from the Horizontal Passage in the Great Pyramid.
8. Salt Incrustations and a piece of stone from a fissure in the West Wall of the Queen's Chamber.
9. Fragments of Diorite picked up on the northern edge of Pyramid Hill.

10. Fragments of Basalt, Granite, and Arragonite picked up at various parts of the Hill.
11. Fragments of Pottery, Glass-beads, etc., in the rubbish outside many Tombs.
12. Jasper-pebbles, Quartz-pebbles (loose and in their matrix rock), together with portions of Petrified Wood from the neighbouring hills of the Libyan Desert.
13. Various Insects of the Region, including a large, brown, round-bodied Beetle from the Interior of the Great Pyramid, pronounced by W. R. M'Nab, Esq., Jun., to be without eyes, and to be 'a species of *heteromera*, apparently new, but not yet sufficiently examined.'

Examples of all the geological specimens, together with sixteen of the casing-stone fragments, have been presented to the Royal Society, Edinburgh, and are deposited in their Museum.

ANALYSIS OF PYRAMID MATERIALS, by WILLIAM WALLACE, Ph.D., Chemical Laboratory, Mechanics' Institution, 38 Bath Street, Glasgow.

THE following particulars are extracted from two letters by Dr. Wallace in 1866, dated February 2 and March 29, respectively,—after receiving some Pyramid specimens from the author.

1. Granite; small fragments picked up here and there about the Pyramid hill; a darker and duller red granite than that of Scotland, but apparently much more durable under an Egyptian climate.

This appears to be a syenitic granite containing very little mica, and therefore less likely to be affected by extreme changes of temperature than such granites, as the Peterhead. I have taken the specific gravity of various specimens for comparison, using pieces of half a pound to one pound.

From Pyramid neighbourhood,	=	2·731
,, Peterhead (red),	=	2·646
,, Ross of Mull (bright red),	=	2·646
,, Summit of Ben Cruachan (red),	=	2·612

2. Basalt, picked up loose on Pyramid hill. Specific gravity of the following specimens:—

Large-grained basalt,	=	2·863
Medium size grained basalt,	=	2·919
Fine-grained basalt,	=	2·785

I have some doubt about the fine-grained specimen being basalt, and I am not quite satisfied that any of them are basalt. The two first of the above specimens contain a mineral which appears to be glassy felspar, and I am somewhat inclined to think they are syenitic.

3. Diorite? This stone, of which you state the earliest Egyptian statue is made, appears to me to be a hornblendic quartzite. It consists chiefly of quartz (at least the pieces you sent me), but there is some hornblende and also pearl-spar, clearly pointing out, I think, that it is a metamorphic rock, rather than an igneous one. It is extremely hard —having in fact the hardness of quartz,—and I really cannot suggest the probable means by which it was fashioned into a work of art. Specific gravity = 2·755.

4. Gypsum, picked up loose near the third Pyramid. We have here two specimens, one of selenite and the other of fibrous gypsum. These both consist of hydrated sulphate of lime, $CaO, SO_3 + 2\ HO$, very pure.

5. 'Alabaster or arragonite,' from the interior of King Shafre's tomb, and the neighbourhood of the 'temple' on the east of the second Pyramid. Two pieces, one massive, the other crystalline, both consist of *carbonate of lime* without any sulphate (therefore probably arragonite, and decidedly not alabaster). The crystalline specimen is, I think, calc-spar; it is too soft for arragonite.

6. Mortar. The white mortar referred to in your note does not appear to have been sent. The pink mortar is exactly the same as that I formerly analysed (see *Chemical News* for April 21st, 1865), consisting chiefly of hydrated sulphate of lime, with a little carbonate.

7. Casing-stone fragments picked up in the rubbish around the Great Pyramid.

I have estimated with great care the specific gravity of this—allowing for absorption while in the water, etc., and find it to be 2·0907; weight of a cubic foot = 130·3 lbs. This is not lighter than I would expect such a stone to be. It is a limestone, and contains silica and alumina, 8·489; carbonate of magnesia, 5·697; the remainder, 85·83, being carbonate of lime. It contains also a minute quantity (not estimated) of oxide of iron, which accounts for the brown coating upon the exterior surface of the casing-stones.

(On being struck sharply by a hammer, a fœtid odour, like that of sulphuretted hydrogen, is elicited; as Dr. Clarke noticed in 1801.—C. P. S.)

8. Stone of the walls of the Queen's chamber with saline incrustations. I selected a piece of this stone containing no visible salt, and found in it 5·90 per cent. of salt, chiefly common salt.

9. Nummulite rock of the Pyramid hill, nearly white.

This is a limestone containing 0·4 per cent. of common salt, and 1·95 per cent. of sulphate of lime,

also 0·15 per cent. of carbonate of magnesia; ·20 per cent. of organic matter; 1·00 per cent. of silica, and 2·4 per cent. of alumina, phosphoric acid and oxide of iron. The remainder is carbonate of lime, 93·9 per cent.

The darker coloured nummulite rock contains a little more organic matter and oxide of iron.

10. Rock of hill south of Pyramid hill.

This is also a limestone containing 5·03 sulphate of lime, and 0·23 per cent. of common salt; also 2·58 carbonate of magnesia; 1·2 organic matter; 4·8 silica and clays; the remainder being carbonate of lime, with a little oxide of iron.

11. Rock near second Pyramid, in loose blocks near its foot, with special fossils.

This is also, like the others, a limestone, but contains no common salt—or only the most minute trace, and very little sulphate of lime (0·8 per cent.); silica and clay, 3·40; organic matter, 0·44; oxide of iron, phosphoric acid, and a little alumina dissolved from the clay, 4·4 per cent. The remainder is carbonate of lime, with a little carbonate of magnesia not estimated.

W. W.

PYRAMID MEASURES BY F. AYRTON, Esq.

ANGLES of inclination of corner lines of Great Pyramid, taken from the top with a theodolite—

North-East angle of Pyramid,		1st	observation,		=	41°	19′	20″
,,	,,	2d	,,		=	41	34	40
,,	,,	3d	,,		=	41	11	0
North-West angle	,,	.	.	. .	=	41	39	40
South-West angle	,,	.	.	. .	=	41	41	0
South-East angle	,,	.	.	. .	=	41	40	0
Mean of North-West, South-West, and South-East angles,					=	41°	40′	13″
Mean of the six observations,					=	41°	30′	57″
Mean of second observation of North-East angle, and of North-West, South-West, and South-East angles,					=	41°	38′	50″

Note to the three observations of the North-east angle.—The disaccordance arises from the great irregularity of the angular projections of the stones at this corner. It is very difficult not only here, but at all the angles, to select those points down the angular line, which may best coincide with the intersections of the general planes of the adjacent sides —themselves hardly planes.

ANGLES OF FACES OF THE GREAT PYRAMID.

North face:	theodolite in the centre on top, .	=	52°	42′ 20″
,,	theodolite in another place on top,	=	51	51 40
,,	theodolite in a third place on top,	=	51	53 0
West face:	in centre of top, ...	=	54	44 20
South face:	,, ...	=	55	58 0
East face:	,, 1st observation,	=	52	38 40
,,	,, 2d ,,	=	54	44 40
,,	,, Mean, . .	=	53	46 40
	Mean of all the facial observations,	=	53°	31′ 49″

(*F. Ayrton*, in October 1841.)—East face of Pyramid, probably the least worn, in its present state has angle of inclination = 53° 46′ 40″.

(*Howard Vyse*, in 1837.)—Casing-stone angle = 51° 50′ and 51° 52′.

Supposing altitude of Pyramid to have been 11-16ths of base; then angle of elevation at foot would be 53° 58′ 28″;

Or, supposing altitude of Pyramid 2-3ds of base, then angle of elevation at foot would be 53° 7′ 48″;

Or, supposing altitude of Pyramid 5-8ths of base, then angle of elevation of foot would be 51° 20′ 25″;

Or, supposing angle of elevation of foot of Pyramid to have been twice the angle of inclination of the entrance passage, and this to have been the angle given by the incline formed by two horizontal and one vertical, then such foot angle of Pyramid should be 53° 7′ 48″.

Inclination of entrance-passage by Howard Vyse,	=	26°	40′ 18″
Do. observed by F. Ayrton, with a theodolite at top of passage, and a lamp placed at bottom close to subterranean chamber,	=	26	41 0
Do. computed on supposition of being the incline formed by two horizontal and one vertical, ...	=	26	33 54

INCLINATION OF GRAND GALLERY (ASCENDING PASSAGE).

Measured by M. Jomard in 1800,	. . .	=	25°	55′ 30″
,, Howard Vyse in 1837,	. .	=	26	18 0
,, F. Ayrton in 1841—				
by measurement of a base and perpendicular,	. . .	=	25	17 36
by measurement of a hypothenuse and perpendicular,	. .	=	25	42 53

The combinations from linear proportions are very curious, particularly the result of double the angle of the sloping passage, derived from two horizontal to one perpendicular equalling the angle of inclination of the face of a Pyramid, whose height is 2-3ds of its base (length of side of base). I am persuaded that this view of the subject deserves consideration.[1] (Signed) F. AYRTON.

CAIRO, *4th January* 1865.

[1] The above is little more than a hastily written memorandum, or short extract, out of a lengthy paper on the subject commenced by its author many years ago, but apparently never completely finished. Yet in as far as it goes, that paper, of which I was kindly allowed a reading, shows so perfect a comprehension of all the methods and details of mathematical mensuration, and such unflinching honesty, that Pyramid literature has lost much from the memoir not having yet been published. Pyramid literature, however, I would suggest, rather than our knowledge of the ancient form of the Pyramid; for the subject having been pursued perhaps too exclusively as a problem of pure science, the author has been led into several errors of conclusion, by applying his measures to decayed and therefore altered parts of the surfaces. Hence his largely erroneous angle of the faces of the Pyramid as measured from the top; and they are self-proved to be erroneous as applied to the whole *face or side*, when the angle of such side is computed from the observed angles at the *corner-lines* of the Pyramid; where the measures, too, are more accordant with each other on account of the greater hardness of the stone there, and the less amount of degradation and disrepair.—C. P. S.

PYRAMID MEASURES BY MESSRS. AITON AND INGLIS.

THESE measures were taken by Mr. Inglis in April and May 1865, at the Great Pyramid, according to instructions from Mr. Aiton, his employer; and they were afterwards drawn out in Mr. Aiton's office in Glasgow, I believe by Mr. Inglis, in form of a series of plans and sections arranged on one long roll of tracing-cloth,—a copy of which was kindly given to me by Mr. Aiton in November of the same year. The measures taken, are mostly entered on the cloth against their respective subjects, and in feet and inches, which are here reduced to inches in the following extracts, from such numerical entries:—

Whole height of Pyramid = 5481 British inches above (as I, C. P. S., suspect) the floor of the north-eastern socket; whence, reduced to the Pyramid pavement, the quantity becomes 5475 British inches.

SPECIAL HYPSOMETRIC DATA.

Names of Subjects.	From level of general alluvial plane.	From Pyramid pavement, assumed.
	British inches.	
Floor of King's Chamber, . . .	+ 3360	+ 1714
Floor of horizontal passage, . . .	+ 2537	+ 891
Floor of Queen's Chamber, . . .	+ 2504	+ 858
Junction of floors of entrance-passage, and of 1st ascending passage, produced, .	+ 1806	+ 160
Floor of North-East socket, . . .	+ 1640	− 6
Floor of South-East socket, . . .	+ 1627	− 19
Sand plain, variously, ...	+ 246	− 1400
Alluvial plain, ...	0	− 1646
Well-water in alluvial plain, . . .	− 120	− 1766

THE FIRST FIFTY COURSES FROM BASE OF PYRAMID, THEIR HEIGHTS IN INCHES.

Number of course from base.	Height in inches at South-west angle of Pyramid.	Height in inches at North-east angle of Pyramid.	Number of course from base.	South-west.	North-east.
1	...	...	26	32	33
2	45	28	27	32	32
3	54	51	28	31	...
4	45	57	29	29	34
5	45	46	30	29	14
6	...	11(+32)?	31	28	58
7	76	33	32	28	29
8	46	40	33	28	...
9	34	39	34	27	57
10	40	41	35	26	28
11	31	34	36	27(+25)?	52
12	32	35	37	24(+26)?	28(+22)?
13	27	38	38	24(+25)?	49
14	32	35	39	41	43
15	30	27	40	25	38
16	28	...	41	...	36
17	29	57	42	49	34
18	28	27	43	46	...
19	31	31	44	32	64
20	39	53	45	31	29
21	...(+37)?	37	46	21	33
22	37	38	47	41	41
23	10	24	48	41	38
24	35	23	49	38	26
25	33	34	50	28	36
Corrected sums,	844	871	26 – 50	834	854
Mean,	858		1 – 50	1678	1725
				1702	

Some of the courses, in the drawing from which the above numbers are derived, are entered in pairs, as the 6th and 7th of the south-western angle, and the united height given at the 7th only. Others I fear are not entered quite correctly, for, on

comparing them with my own measures, and with photographs,—it would appear that course 21 of the south-west angle is missed out; course 6 of the north-east angle, is in large error; while courses 36, 37, and 38 at the south-west angle, and course 37 at the north-east angle of the Pyramid, have altogether failed to notice (so far as these small figures are concerned, for the drawing itself seems more accurate) the very remarkable and sudden increase which in reality takes place there, in the thickness of the Pyramid courses. Wherefore, correcting for these several errors, as indicated, — we have the heights of the first twenty-five and first fifty courses of the Pyramid, at the south-west and north-east angles, as given at the foot of the columns above.

In the original drawing alluded to, the figures for the heights of all the rest of the courses up to the top of the Pyramid are given,—but as the anomalies seem to increase in ascending, I have not attempted to investigate them further.

KING'S CHAMBER.

The measures by Mr. Inglis of the sizes and numbers of the stones composing the walls and ceiling of this chamber, appear to have been his final and most complete work at the Great Pyramid; and do him much credit, besides giving a completer account of them than has ever been published before. The following particulars are derived from the numbers entered by him on each stone, in his large and architectural drawing:—

NORTH WALL;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
	Inches.	Inches.	Inches.	Inches.	Inches.
East wall, . .	0·0	0·0	0·0	0·0	0·0
First from East wall,	41·5	122·4*	122·4*	36·0	190·0
Second ,,	61·4	55·4	84·0	54·0	222·0
Third ,,	40·0	53·0	44·0	84·0	...
Fourth ,,	57·5	77·0	61·4	51·0	...
Fifth ,,	63·0	66·0	51·4†	79·0	...
Sixth ,,	49·9	37·9	48·5†	61·9	...
Seventh ,,	42·6	...	...	46·0	...
Eighth, or West side,	55·9	...	...	...	...
Sum, or length of room on North side, =	411·8	411·7	411·7	411·9	412·0

SOUTH WALL;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
	Inches.	Inches.	Inches.	Inches.	Inches.
East wall, . .	0·0	0·0	0·0	0·0	0·0
First from East wall,	37·4	79·8	43·0	51·0	60·0
Second ,,	63·0	35·3	55·0	67·0	193·0
Third ,,	37·4	40·0	72·0	45·0	159·0
Fourth ,,	46·1	39·0	120·0	42·0	...
Fifth ,,	47·5	55·6	63·8	72·0	...
Sixth ,,	39·6	47·5	58·1	43·0	...
Seventh ,,	40·0	41·0	...	42·0	...
Eighth ,,	40·1	38·5	...	49·9	...
Ninth ,,	43·0	35·3	...	...	...
Tenth, or West wall,	18·0	...	...	...	...
Sum, or length of room on the South side, . . . =	412·1	412·0	411·9	411·9	412·0

* The same block of stone here serves or fills up both these courses, making thereby a strong roof to entrance passage.

† These two blocks in my measures are 63·6 and 36·0 inches long.—(C. P. S.)

East Wall;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next to floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
	Inches.	Inches.	Inches.	Inches.	Inches.
South wall, . .	0·0	0·0	0·0	0·0	0·0
First from South wall,	49·9	78·0	51·0	42·0	205·9
Second ,,	65·0	55·9	69·0*	35·0	...
Third ,,	44·0	72·0	33·0*	48·0	...
Fourth ,,	31·0	...	52·9	37·9	...
Fifth, or North wall,	16·0	...	...	43·0	...
Sum, or breadth of room at East end, =	205·9	205·9	205·9	205·9	205·9

West Wall;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next floor.	Second course.	Third course.	Fourth course.	Fifth course.
	Inches.	Inches.	Inches.	Inches.	Inches.
North wall, . .	0·0	0·0	0·0	0·0	0·0
First from North wall,	34·1	49·9	31·9	58·8	205·9
Second ,,	31·9	69·0	58·1	41·0	...
Third ,,	42·0	35·0	67·9	41·0	...
Fourth ,,	61·9	37·0	48·0	65·0	...
Fifth, or South wall,	36·0	15·0	...	...	...
Sum, or breadth of room at West end, =	205·9	205·9	205·9	205·8	205·9

* These blocks appear in my measures as 58·2 and 44·8 inches respectively.—(C. P. S.)

Ceiling.

Formed of stone beams crossing from south to north wall in single lengths.

	Inches.
Breadth at West end, ...	= 205·9
And at East end, ...	= 205·9
Length of mean, ...	= 411·8

The length being thus made up of the breadths of the several beams,—

	Inches.
From West wall to first joint, ...	= 23·0
From first joint to second joint, ...	= 60·0
From second joint to third joint, ...	= 57·0
From third joint to fourth joint, ...	= 45·0
From fourth joint to fifth joint, ...	= 55·0
From fifth joint to sixth joint, ...	= 51·8
From sixth joint to seventh joint, ...	= 53·0
From seventh joint to eighth joint, ...	= 46·0
From eighth joint to ninth joint, ...	= 21·0
Sum, or length of ceiling, ...	= 411·8

Height of the Walls in the King's Chamber, and of the Courses composing them.

Courses.	East wall.		Courses.	West wall.	
	North side of.	South side of.		North side of.	South side of.
	Inches.	Inches.		Inches.	Inches.
First, or floor course,	41·6	41·6	First, or floor course,	40·9	40·9
Second course, .	48·0	48·0	Second course, .	46·1	46·1
Third course, .	46·0	46·8	Third course, .	45·6	45·6
Fourth course, .	48·0	47·2	Fourth course, .	48·0	48·0
Fifth, or top course,	47·0	47·0	Fifth, or top course,	48·0	48·0
Sum, or height of King's Chamber,	230·6	230·6	Sum, or height of King's Chamber,	228·6	228·6

Courses.	North wall.		Courses.	South wall.	
	West end of.	East end of.		West end of.	East end of.
	Inches.	Inches.		Inches.	Inches.
First, or floor course,	41·6	42·0	First, or floor course,	41·4	41·8
Second course, .	47·2	$\frac{94\cdot2}{2}$	Second course, .	46·8	46·0
Third course, .	46·8	$\frac{94\cdot2}{2}$	Third course, .	47·0	48·0
Fourth course, .	48·0	46·8	Fourth course, .	46·6	46·8
Fifth, or top course,	45·5	46·1	Fifth, or top course,	47·4	45·6
Sum, or height of King's Chamber,	229·1	229·1	Sum, or height of King's Chamber,	229·2	228·2

FRENCH MEASURE OF THE GREAT PYRAMID'S HEIGHT, IN 1800 A.D.

THE French *savants* of 1799 appear to have paid special attention to linear measures, particularly those of the Pyramid's height, both trigonometrically and by means of measuring each successive step, with a rectangular measuring-staff appropriately arranged. This latter mode of mensuration was performed firstly by MM. Jomard and Cecile before, and secondly by M. Le Père and Colonel Coutelle after, the discovery of the 'sockets;' hence the measures of the former are deficient at the starting-point, and I have replaced their imperfect idea of the two first courses at the ground in the following table by the same quantity derived from the second pair of observers. This pair seem to have begun their measures, not from the bed or floor of the socket, but from its inner edge, rather more than eight inches above the same, and therefore practically identical with the 'pavement' surface which I have assumed as the datum-plane of Great Pyramid hypsometry.

From the *pavement* then below, the French step-measures extend up to the topmost stones on the summit of the Pyramid; but as these topmost stones consist of two small fragments only of courses, one on the other,—I have thought that M. Nouet the astronomer had more reason in terminating his trigonometrical measures for height, at the 'platform' of the summit. Hence to make the points measured between, similar in all cases, I have cut off the two uppermost registered courses, which are the fragments before alluded to, from both the sets of step-measures,—which then terminate above, also with the *platform*.

This platform is easily recognisable as being about 400 inches long in the sides, and being the 202d course from the pavement upwards. The eminent French authorities indeed mark it the 201st; but then they make only one course of really the two lower ones, without apparently having good reason. They have, for instance, actually entered them in two several portions, as in the column of Le Père and Coutelle, but yet have summed them up together as a single course only,—*because* the upper one is part of the solid and standing rock of the hill, and they imagined that it indicated a high base to have originally extended all round the Pyramid. But Colonel Howard Vyse has since shown that no such high base ever existed; and my own photographs of the north-east corner of the Pyramid show a second higher ledge of the same standing rock further

inside than the shelf above alluded to; and in such a position of level with regard to the courses of masonry proper,—some of which are outside it,—as to show that it does not rule their number or heights. In addition to which, other photographs show, by the remains of coarse mortar outside the lower ledge of rock, that there were stones of Pyramid masonry courses outside that also, rendering its service in the structure solely to supply some of the *interior* bulk of building.

Hence there appears abundant reason, from the Pyramid itself, for giving force to the apparent separation which the French philosophers did see, in the whole height of their nominal lowest course; and for calling it now with certainty, 'two.' Whence also, the height from the pavement below to the platform above,—which in their own immortal work appears as 201 courses,—is represented in the following English edition of the same as 202 courses: though with the same total height.

But while modern photographs lead me to make this correction on the work of those eminent *savants*, they have led me also to bear testimony to the remarkable accuracy of their measures of heights of the courses, for a great extent up the Pyramid's side; and it would be most satisfactory to their *excelsior* spirits, could they behold those apparent anomalies which they chronicled so faithfully at the 36th, 37th, and other courses, completely borne out in one of the recent Nature-painted views of the Pyramid. In

fact, their measures of the courses of the Pyramid are extraordinarily good, and stand far before all others which have ever been made, either before or since, my own included: all honour to them therefore. And yet, for practical purposes, it is necessary also to mention that in the pages of their measures in *Antiquités Memoires*, vol. i., there are no less than four errors of a whole metre, or near it, each in Le Père and Coutelle's measures as given in metres; errors, however, not of theirs in the measures, but of M. Jomard in reducing the old French feet and inches actually employed to metres; or perhaps they are only printer's errors, except that two of them are repeated in the large engraved section of the Pyramid at Plate XIV. of their largest sized plates (vol. v.); and the only published Pyramid section I know of, which has attempted to give pictorially the true height of every course.

The errors alluded to are contained in pages 533 and 534 of *Antiquités Memoires*, vol. i.; and the corrections required to the figures printed there, are—

Courses as now numbered from the pavement upwards.	
No. 37, . . .	+ 1·0 metres.
„ 101, . . .	− 1·0 „
„ 170, . . .	− 0·9 „
And 186 and 187 combined, .	+ 1·0 „

In my own reductions of Le Père and Coutelle's measures from metres to British inches, I have taken the liberty of dividing the several cases which

he gives of only one measure for two small steps,—so that *every* step may be represented by figures; a proceeding which does not alter the whole height, while it makes errors of the above quoted nature easier to detect. At the same time, having only carried such reduction to the nearest inch, at every one of 202 steps, there arises a small difference between M. Jomard's and my summing up; and as he went to many more decimal places than I did, I prefer to take his final sums for the whole height; wherefore these are given at the end of the columns.

Touching the degree of trust to be placed on these measures, it will be interesting to all who respect the name of M. Fourier, to know, that he considered the mode employed,—that is, by the separate observations of 202 steps,—and gave it as his view of the probable error of the final result, as dependent on the error likely to be committed at each step,—that it would be bounded by *the known limit of error of one measure, multiplied by the square root* (*not the simple number*) *of the number of similar operations.*

Whence M. Jomard concludes the limits of error of his own observations dependent on having made each measure to a closeness of '6 lines' only, to be under 8 inches. But Le Père and Coutelle, he thinks, should have smaller limits of error, as they apparently measured to single lines.

If, however, in one place, from two step mea-

sures and one trigonometrical measure, the French *savant* thus gives the vertical height from pavement to platform at summit, or 202 courses of the Pyramid

= 5437 British inches,

we should caution our readers that he sometimes cuts off from this, the 72 inches of the first two courses from the ground; but on the erroneous theoretical idea we have already exposed, of the inclined surface of the ancient Pyramid having only begun at that upper level.

FRENCH MEASURES OF GREAT PYRAMID'S VERTICAL HEIGHT.

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.			Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.		Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.
1 }	72?			20			21	21			24		
2 }				52			22	24			24		
3	56			56			23	36			35		
4	43			53			24	32			33		
5	45			41			25	33	(146)	(859)	33	(149)	(877)
6	41			38			26	36			33		
7	39			39			27	24			30		
8	41			42			28	31			28		
9	39			36			29	30			29		
10	36	412	412	41	418	418	30	28	295	1008	29	298	1026
11	33			31			31	27			28		
12	31			35			32	27			31		
13	28			33			33	27			27		
14	29			26			34	24			26		
15	29			28			35	27			26		
16	29			31			36	49			50		
17	26			29			37	42			42		
18	27			28			38	37			37		
19	32			31			39	36			36		
20	37	301	713	38	310	728	40	33	329	1337	33	336	1362

FRENCH MEASURES OF GREAT PYRAMID'S VERTICAL HEIGHT—*continued.*

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.			No. of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.		Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.
41	33			33			81	24			24		
42	30			31			82	24			23		
43	30			28			83	24			23		
44	33			34			84	23			25		
45	42			39			85	28			25		
46	39			38			86	21			22		
47	27			27			87	27			24		
48	35			34			88	22			24		
49	36			37			89	33			26		
50	33	338	1675	33	334	1696	90	22	248	2724	29	245	2746
51	29			27			91	35			29		
52	24			27			92	35			36		
53	26			25			93	33			33		
54	26			25			94	30			29		
55	23			26			95	27			25		
56	25			26			96	26			25		
57	24			25			97	24			24		
58	25			25			98	24			23		
59	27			27			99	41			41		
60	29	258	1933	29	262	1958	100	38	313	3037	39	304	3050
61	28			27			101	35			35		
62	27			27			102	33			34		
63	25			25			103	29			28		
64	26			26			104	29			28		
65	27			26			105	27			27		
66	26			26			106	27			26		
67	24			26			107	26			26		
68	33			33			108	25			27		
69	32			31			109	29			27		
70	30	278	2211	32	279	2237	110	27	287	3324	25	283	3333
71	28			29			111	24			25		
72	27			27			112	24			23		
73	27			27			113	24			23		
74	26			28			114	24			23		
75	31			28			115	23			23		
76	30			27			116	22			24		
77	24			27			117	26			24		
78	24			24			118	23			29		
79	24			23			119	35			29		
80	24	265	2476	24	264	2501	120	33	258	3582	32	255	3588

FRENCH MEASURES OF GREAT PYRAMID'S VERTICAL HEIGHT—*continued.*

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.			Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.		Br.in.	Br.in.	Br.in.	Br.in.	Br.in	Br.in
121	30			30			165	25			24		
122	29			30			166	23			21		
123	27			26			167	21			21		
124	27			26			168	20			21		
125	24			26			169	20			19		
126	23			23			170	20	218	4746	19	214	4745
127	24			23			171	21			20		
128	24			23			172	20			20		
129	23			23			173	21			20		
130	22	253	3835	24	254	3842	174	20			20		
131	26			24			175	20			20		
132	25			24			176	21			20		
133	24			24			177	21			20		
134	22			22			178	20			20		
135	22			22			179	21			20		
136	21			22			180	21	206	4952	20	200	4945
137	24			22			181	26			26		
138	22			22			182	24			25		
139	27			26			183	24			24		
140	26	239	4074	26	234	4076	184	23			23		
141	22			22			185	22			22		
142	21			22			186	21			21		
143	22			22			187	21			21		
144	22			22			188	20			20		
145	30			30			189	21			20		
146	23			26			190	21	223	5175	20	222	5167
147	24			23			191	20			20		
148	22			22			192	20			20		
149	21			22			193	20			21		
150	22	229	4303	22	233	4309	194	21			20		
151	27			25			195	21			20		
152	25			25			196	21			22		
153	24			23			197	23			22		
154	22			23			198	24			23		
155	21			21			199	22			23		
156	22			21			200	22	214	5389	21	212	5379
157	21			21			201	23			23		
158	21			21			202	22	45		22	45	
159	21			21						5434			5424
160	21	225	4528	21	222	4531							
161	21			21			Fragmentary.						
162	21			22									
163	24			22			203	21			22		
164	23			24			204	21	42		22	44	

Summed up in metres in the French work, and reduced to British inches here—

MM. Jomard and Cecile, .	=	138·30	metres.	
+ Neglected portion at bottom,	=	·77	,,	
− two top fragmentary courses,	=	1·08	,,	
		137·99	,, =	5433 Br. in.
Le Père and Colonel Coutelle,	=	139·17	metres.	
− two fragments, . . .	=	1·13	,,	
		138·04	,, =	5435 Br. in.

M. Nouet, astronomer, measures height of 'Platform' at top of Pyramid, and finds it from ground = 137·53 m. = 5415 in.; but his 'ground' is supposed to be 28 inches above the socket-edge or pavement *afterwards* discovered, therefore 5415 + 28 = 5443 British inches.

SOCKETS, DISCOVERY OF.

The discovery by the French *savants* of two, out of the four, corner sockets of the Great Pyramid, was so entirely original with them, and has proved of such infinite importance since in all studies of the Pyramid, either in theory or practice, that the two following extracts chronicling the circumstances may not be considered out of place:—

'In the month Pluviôse, year 9 (January 1801), 'MM. Le Père and Coutelle, in excavating at the 'foot of the Pyramid, towards the two angles of 'the northern side, found an esplanade which is

'the ancient "*sol*" or ground-plot of the monument;
'*i.e.*, of the pedestal, "*socle*," on which it reposes.
'Upon this esplanade, and in front of the apparent
'extremities (of the building) they further dis-
'covered two sockets, "*encastrements*," almost
'square, cut in the rock. They recognised that
'these sockets were well on a level, and their
'angles sharp, and perfectly rectangular. It was
'from one angle to the other, and on the outside,
'that they took the measure of the base, and on
'the line which joins them, with a minute atten-
'tion, and most exact methods:—finding its length
'716 feet 6 inches French, or 232·747 metres,'
=9163·45 British inches.—M. JOMARD, *Antiquités Memoires*, p. 513, vol. i.

'While we were occupied with these operations,
'other workmen laboured at the north-east angle
'of this (the Great) Pyramid to discover its true
'base. At two metres and three-quarters, about, of
'distance from the nucleus or of the present base,
'we found the part of the rock in which the stone
'of the angle of the casing had been inlaid "*in-*
'"*crustée.*" The rock is still perfectly flattened
'"*dressé*" and cut out to the depth of 207 milli-
'metres, over a space of 3·9 by 3·4 metres.'—M. COUTELLE, *Antiquités Memoires*, p. 46, vol. ii.

ENGRAVINGS.

The great French work on Egypt is very notable for the large number of engravings of atlas size

which it contains, touching the Pyramids of Jeezeh, there called usually of Memphis. In execution, these engravings are magnificent, forming examples of the 'line manner,' or true work of the graver, such as the present generation seldom sees. Some faults have however crept in, as thus:—In Plate IX. vol. v. of *Antiquités Planches* of the smaller size of atlas, there is a grand view of the Great and second Pyramids from the north,—with a sun, just below the horizon, radiating from thence magnificently over all the sky,—but in an azimuth which is due *south*, or where the Egypt of our days most assuredly never sees the sun at so low an altitude.

In Plate XIV. of vol. v. of the larger size of atlas, there is a section of the Great Pyramid, very recommendable as the only one known, at least by me, where every course of the masonry has been put in by measure; yet is the interior unfortunately faulty. Thus (1.) the entrance passage *terminates* below, at its junction with the first ascending passage.

(2.) The portcullis of the said first ascending passage has slipped down *into the entrance passage*, thereby blocking it up.

(3.) The well is far from true, being too straight and vertical in its entire; and its entrance hole from Grand Gallery is of a wrong shape; *i.e.*, square and door-like, whereas its top, is really inclined suitably with the ramp-lines, so that it would be concealed

were the ramp completed, or the ancient stone, now broken out, put back into its place.

(4.) The floors of the Queen's chamber and horizontal passage are erroneously represented all on one level, *i.e.*, not showing the deep step towards the southern end.

(5.) The Grand Gallery roof is made with distinct inverted steps, but having only *thirty* of them, instead of thirty-six.

(6.) The *south-east* socket of the Pyramid is shown as well as the north-east; but the only other socket which the French *savants* discovered, besides the north-east one, was that at the north-west corner. Since then, viz., in 1865, Messrs. Aiton and Inglis found by excavating that a south-east socket really existed. But, that the French had not seen it, is pretty plain from their having drawn it of the *same* size as the north-east socket, while its meridian length is really only one-third of that.

In another Plate, the faults of not showing the granite leaf of the antechamber to be composed of two pieces, and one of them garnished with a certain projecting portion,—are to be noticed; also, and still more importantly, the total neglect of the *ledge* on the coffer in the King's chamber. But many other features are well given, and with splendid treatment as works of the draughtsman.

HYPSOMETRICAL REFERENCE OF THE GREAT PYRAMID, BY M. JOMARD, IN 'DÉSCRIPTION DE L'ÉGYPTE,' 'ANTIQUITÉS DÉSCRIPTIONS, VOL. II. p. 62.

'Les opérations du nivellement des deux mers, 'l'un des ouvrages les plus importans des ingénieurs 'de l'expédition Française, ont été rattachées, 'd'après une idée très-judicieuse de M. Le Père 'aîné, directeur de ce travail, au sol de la Grande 'Pyramide, qui servira ainsi de repère invariable à 'toutes les observations future sur le niveau des 'crues du Nil, sur l'exhaussement du lit du fleuve 'et celui de la vallée. Ce point de départ est le 'sol de l'encastrement du socle de la Pyramide, à 'l'angle nord-est: il est élevé de 42·88 mètres' (1688 British inches) 'au-dessus de la coudée supé-'rieure du meqyâs ou nilomètre de Roudah: de '42 mètres' (1654 British inches) 'au-dessus de la 'vallée et des hautes eaux moyennes (de 1798 à '1801); et de 49·97 mètres' (1967 British inches) 'au-dessus des basses eaux moyennes pour la même 'époque. Ces données précieuses ne doivent pas 'être perdues de vue.'

Compare vol. iii. p. 77: adding to the numbers above given, six inches, to reduce them from the floor of the north-east socket, to the upper surface of the general pavement surrounding the Great Pyramid. See vol. ii. p. 137.

PYRAMID MEASURES BY COLONEL HOWARD VYSE AND MR. PERRING.

No series of authorities on Pyramid measurement would be complete, without the combined work of the two authors above mentioned. We have indeed been obliged to point out in more than one instance, such as that of the height of the present Pyramid, that their numbers are by no means always so correct as they might be; but we believe them to be perfectly honest, as published by Colonel Howard Vyse, either in his octavo volumes of *Operations carried on at the Pyramids of Jeezeh in* 1837, or his folio atlas of *The Pyramids of Jeezeh*, published soon after; and they furnish besides, the greatest body of measures of different portions of the Pyramid ever collected by any single party, and contain some items with regard to which there are no other authorities. The publication, too, since then, by Chevalier Bunsen, of some of these measures, as unfortunately altered by Mr. Perring to suit a theoretical view of his own, makes a republication of the original numbers important for the credit both of Mr. Perring and Colonel Howard

Vyse, as *measurers*; and their numbers of feet and inches being here reduced to inches only, renders their results more immediately comparable with our own.

WHOLE PYRAMID.

	British inches.
Ancient base-side, length of, ...	= 9168·
Present base-side, ,, ...	= 8952·
Ancient height, vertical, computed by angle 51° 50′, .	= 5769·
Present height, vertical, ...	= 5409·
Ancient height, inclined, ...	= 7332·
Present height, inclined, ...	= 6819·
Angle of casing-stones, between 51° 50′, and 51° 52′ + x seconds.	

ENTRANCE.

Vertical height from base to bottom of entrance, . .	= 588·
Distance of the centre of this entrance eastward from the centre of the Pyramid, ...	= 294·
Breadth of passage, ...	= 41·5
Height of passage, perpendicular to incline, . . .	= 47·0
Angle of this entrance passage, = 26° 41′.	

LENGTH OF ENTRANCE PASSAGE.

From present dilapidated beginning of roof to the junction with first ascending passage, ...	= 758·
Thence to the forced passage, ...	= 214·
Thence to the well, ...	= 2582·
Thence to the subterranean horizontal passage, . .	= 296·
Or, present length inclined, of whole entrance passage, .	= 3850·
But, ancient length must be increased for an extent of more than 276 inches broken away at the beginning with the exterior of the building, and is therefore more nearly, ...	= 4126·

SUBTERRANEAN HORIZONTAL PASSAGE.

Breadth, ...	= 33·
Height, ...	= 36·
Length, ...	= 324·

SUBTERRANEAN CHAMBER.

	British inches.
Cut out of rock of hill *in situ*.	
Length, East to West, ...	= 552·
Breadth, North to South, ...	= 325·
Ceiling flat, floor uneven from the excavation not having been completed: depth from ceiling to deepest part of floor, ...	= 138·
Northern side distant from the central vertical axis of the Pyramid, northwards, ...	= 96·
Eastern side is distant from the same axis eastwards, .	= 311·
Depth of ceiling below base of Pyramid, ...	= 1088·

SUBTERRANEAN PASSAGE TO THE SOUTHWARD.

Length, ...	= 633·
Breadth, ...	= 31·
Height, ...	= 29·

SUBTERRANEAN SHAFT OR HALF-WELL.

This was situated near the eastern end of this chamber, in the deepest part of the floor, so far as excavated; it was described as very rude, evidently unfinished, and about in depth, ...	= 150·

See further particulars of it at the end of the list.

FIRST ASCENDING PASSAGE.

Length, from lower end of granite portcullis blocks to the Grand Gallery, including the space of 177 inches at present occupied by said blocks, ...	= 1492·
Height, perpendicular to incline, ...	= 47·
Breadth, ...	= 41·5

Angle of inclination = 26° 18′.

GRAND GALLERY, OR SECOND ASCENDING PASSAGE.

Height, vertical, ...	= 336·
Length from North end to step at South end, . .	= 1810·
Further length from step to passage leading to King's chamber, ...	= 62·
Total length of Grand Gallery, ...	= 1872·
Breadth between ramps, ...	= 41·5

		British inches.
Breadth of each ramp, ...	=	20·5
Height (vertical) of ramp, ...	=	24·

ANTECHAMBER NEIGHBOURHOOD.

Length of passage, horizontal, leading through antechamber, from Grand Gallery into King's Chamber, .	=	265·
Height of said passage, ...	=	44·
Breadth of ditto, ...	=	41·5
Height of portcullis, ...	=	169·

KING'S CHAMBER.

Length from East to West, ...	=	411·
Breadth from North to South, ...	=	205·
Height, floor to ceiling, ...	=	229·
Height from base of Pyramid to floor of chamber, .	=	1665·
Northern side distant from centre of Pyramid to southward, ...	=	195·
Eastern side distant from same eastwards, ...	=	315·

There is supposed to be a difference of a quarter of an inch in one of the sides of the chamber, which is probably an inflection in the stone.

NORTHERN AND SOUTHERN AIR-CHANNELS.

Inclined height of upper ends from base of Pyramid, .	=	3972·
Distance of lower ends from East side of King's Chamber, westwards, ...	=	97·
Height of same from floor of chamber, ...	=	36·
Dimensions of same, in height, ...	=	6·
,, breadth, ...	=	8·
Length of northern air-channel from King's Chamber to outward part of Pyramid, ...	=	2796·
Dimensions of average section, in height, ...	=	9·5
,, ,, breadth, ...	=	9·
Length of southern air-channel from King's Chamber to outward part of Pyramid, ...	=	2091·
Dimensions of average section, height, ...	=	9·1
,, ,, breadth, ...	=	8·9

The mouth of the southern air-channel has been forced and enlarged; but was probably originally of the same size as the other.

SARCOPHAGUS OR 'COFFER' IN THE KING'S CHAMBER.

		British inches.
Outside of coffer, length, ...	=	90·5
,, breadth, ...	=	39·
,, height, ...	=	41·
Inside of coffer, length, ...	=	78·
,, breadth, ...	=	26·5
,, depth, ...	=	34·5

CHAMBERS OF CONSTRUCTION.

Length of passage leading to Davison's Chamber out of south-east corner of top of Grand Gallery, . . .	=	297·

DAVISON'S CHAMBER, DISCOVERED BY MR. DAVISON IN 1764.

Length, East to West, ...	=	460·
Breadth, North to South, ...	=	205·
Height, varies between	=	30· to 42·

WELLINGTON'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length, East to West, ...	=	462·
Breadth, North to South, ...	=	204·
Height, varies between	=	26· to 44·

NELSON'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length, East to West, ...	=	465·
Breadth, North to South, ...	=	200·
Height, varies between	=	24· to 58·

ARBUTHNOT'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length from East to West, ...	=	448·
Breadth from North to South, ...	=	196·
Height, varies between	=	16· to 53·

CAMPBELL'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

	British inches.
Length from East to West,	= 454·
Breadth from North to South,	= 246·
Height, in centre of angular roof, varies between	= 70· to 103·
Whole height from floor of King's Chamber to roof of Campbell's Chamber,	= 831·

PASSAGE LEADING TO QUEEN'S CHAMBER.

Length from North end of Grand Gallery to beginning of low passage,	= 199·
Length from the low passage to the step,	= 1104·
Length from step to Queen's Chamber,	= 215·
Total length of this passage from North wall of Grand Gallery,	= 1518·
Breadth of passage,	= 41·5
Height of passage, in 'low' part before the step,	= 46·
,, beyond the 'step,'	= 68·

QUEEN'S CHAMBER.

Length, East to West,	= 225·
Breadth, North to South,	= 204·
Height to commencement of roof,	= 177·
Extreme height to upper angle of roof,	= 243·
Recess in eastern side, width at bottom,	= 61·
,, whole height,	= 183·
,, depth to forced passage,	= 41·
,, width at top,	= 23·5?
,, distance of central vertical axis from same feature of East wall of room,	= 26·0?
Distance from western side of chamber to centre of Pyramid,	= 90·
Distance from southern side of chamber to centre of Pyramid,	= 34·
Whole height from base of Pyramid to floor of this chamber,	= 808·

WELL; i.e., Upper or Dry Well.

	British inches.
Depth of upper and vertical part of shaft, . . .	= 313·
Thence to grotto, ...	= 389·
From grotto to bottom, ...	= 1596·
Total depth, ...	= 2298·
Square in section, with length of one side, . . .	= 28·
Height of top of natural rock above base of Pyramid, .	= 264·

Note.—As the mouth of the well has been forced through the masonry, Mr. Perring supposes it was not part of the original design; but, if the upper inclined passage was filled with solid masonry, it was the only way in which the workmen could go out after they had closed up the passage from the upper end of it.

The platform on the top of the Pyramid is about 396 inches square; above this are four or five stones belonging to the upper layers.

CONCLUDED AREA AND WEIGHT.

	Acres.	roods.	poles.
Former extent of base, ... =	13	1	22
Present extent of base, ... =	12	3	3

Supposing the natural rock to average 96 inches over the extent of base, and deducting the space occupied by chambers and passages, the original quantity of masonry would be, in cubic feet, = 89,028,000

Or in tons, ... = 6,848,000

And the present quantity, in cubic feet, . . = 82,111,000

And in tons, ... = 6,316,000

The space occupied by chambers and passages being only 56,000 cubic feet, or 1-1590th of the whole mass.

MISCELLANEOUS DETAILS.

	British inches.
Pavement at centre of North front, width, . . .	= 402·
Thickness of its stones, ...	= 21·
Width of same pavement at excavations near middle of each half of North front, . . . =	from 132· to 144·
Horizontal distance of outer surface of bevelled casing-stones at foot of North front, from the rectangular masonry behind them, ... =	about 108·

MR. PERRING'S ACCOUNT OF THE SHAFT SUNK IN THE SUBTERRANEOUS CHAMBER, DURING THE YEAR 1838.

Base of Great Pyramid above Nile in 1838 A.D., . .	= 1647·
Rise of Nile bed in 4000 years, estimated . . .	= 120·
Sum, or base above Nile in 2162 B.C., ...	= 1767·

	British inches.
Base of Great Pyramid to ceiling of subterraneous chamber, =	1088·
Height of said apartment, ... =	138·
Probable height of any undiscovered chamber below, . =	120·
	1346·
Balance to former sum, ... =	421·
	1767·

Shaft in floor of subterraneous room was sunk from that depth, or 1226 inches below base, 432 inches further, or to 1658 inches below base, without meeting anything else than solid and dry rock.

(To have met with *wet* rock, this shaft ought to have been driven fully 120 inches further down, or to 1780 inches below the Pyramid pavement. See Hypsometric table in our vol. iii. p. 82.—C. P. S.)

PYRAMID MEASURES BY MR. E. W. LANE.

THE unrivalled accuracy and loving conscientiousness with which the talented Mr. E. W. Lane described 'the Modern Egyptians,' leaves amongst further regrets for his too early death, that his researches among the monuments of ancient Egypt are fewer than they would otherwise probably have been. The only fragments of his labours in this direction, that I am acquainted with, are all of a high order, viz. :—

First, A large view of the Great Pyramid from its north-eastern corner, contained in Colonel Howard Vyse's atlas of the Jeezeh Pyramids.

Second, His arrangement of the ancient Egyptian dynasties and interpretation of the traditions of Osiris, contained in the article 'Egypt,' by his nephew, in the last edition of the *Encyclopædia Britannica*.

And, *third*, some measures of the Great Pyramid which appear in his sister, Mrs. Poole's, *Englishwoman in Egypt*, published between 1842-45.

These measures I have extracted as follows, thinking it only due to his excellence, skill, and general accuracy that he should appear among Great Pyramid authorities; though, had he lived longer, and published the measures himself, he might have revised some few of the numbers first.

GREAT PYRAMID GENERALLY.

	British inches.
Height of Pyramid base above plain, approximately, .	= 1800·
Present height of Pyramid from base to summit, . .	= 5472·
Number of courses of masonry, base to summit, = 203	
Length of side of platform at summit, ...	= 396·
(Do. in time of Pliny (70 A.D.), . . = 170 British inches.)	
(Do. in time of Diodorus Siculus (60 B.C.), = 108 ,,)	
Present length of every or any side of the base, . .	= 8796·

N.B.—A socket 144 inches square, alluded to as being 144 inches *outside* the parts above measured, and showing the ancient size of the Pyramid.

ENTRANCE PASSAGE.

'Over' the sixteenth course from bottom, or high, .	= 600·
Distant eastward of middle vertical plane of North side, more than, ...	= 240·
Angle of dip southward, = 26° 30′.	
Height of, at right angles to incline, ...	= 48·
Width, ...	= 42·
Granite portcullis block, distance of from beginning of roof of entrance passage, ...	= 840·
Almamoon's hole, distant from the same, ...	= 960·

N.B.—This passage, so far, well built, of good Mokattam stone, and with fine joints.

FIRST ASCENDING PASSAGE.

Length of, from South, or upper end of portcullis, .	= 1308·
Add projection of into floor of Grand Gallery, . .	= 18·
Total length from above, to above-mentioned points, .	= 1326·

N.B.—Sides and roofing very rough.

QUEEN'S CHAMBER.

	British inches.
Visible beginning of passage leading to, from projection of floor of first ascending passage, ...	= 183·
Length thence to deeper part, ...	= 1116·
Further length of that deeper part, ...	= 213·
Total length from North wall of Grand Gallery, . .	= 1530·
Height of deeper part, ...	= 67·
Width of same, ...	= 41·
Height of shallower part, ...	= 47·
Width of same, ...	= 41·
Queen's Chamber, length, ...	= 228·
,, breadth, ...	= 204·
,, height to commencement of roof, .	= 162·
,, height to point of roof, . . .	= 246·

GRAND GALLERY.

Height of grand step therein near North end, . .	= 87·
Same, including a small cut-off above, ...	= 95·
Angle of ascent, = 26° 30′.	
Ramps, square in section, length of one side, . .	= 20·5
Width of Grand Gallery above the ramps, . . .	= 82·
Whole length of Grand Gallery, ...	= 1896·
Upper and southern step, horizontal length, to be taken off above, ...	= 61·
,, its height, ...	= 35·

ANTECHAMBER AND PASSAGES.

Horizontal passage from Grand Gallery to antechamber—	
Length, ...	= 53·
Height, ...	= 43·5
Width, ...	= 41·5
Antechamber, length, ...	= 116·
,, breadth near top, nearly . . .	= 83·
Granite leaf, in *two* pieces, each in thickness, . .	= 15·
Horizontal passage, antechamber to King's chamber—	
Length, ...	= 101·
Height, ...	= 43·5
Breadth, ...	= 41·5
Total length, Grand Gallery to King's Chamber, . .	= 270·

KING'S CHAMBER.

	British inches.
Length of, ...	= 412·5
Breadth of, ...	= 206·25
Height of, ...	= 230·25

Number of courses in walls of, = 6 (?)

WELL AND SUBTERRANEAN CHAMBER.

The lower parts of both the well and the entrance passage leading to the subterranean chamber, are characteristically described for their *irregularities*.

GREAVES' STANDARD OF MEASURE.

PROFESSOR GREAVES of Oxford (A.D. 1638) was so eminently in advance of his age in metrological researches, that much interest has been expressed at various times, and for various purposes, to learn,—if it were possible,—the length of the measuring-rod which he used, in terms of a modern known standard. But the rod itself having been lost,—though the case which once held it, is said to be preserved still in Oxford,—the comparison has not been possible directly; indirectly, however, Greaves' intentional method by successive measures of stated parts of the Great Pyramid, can be brought into use through the agency of our own measures.

His principle he describes in vol. i. of his *Pyramidographia*, by Dr. Birch, page 126; and at page 346, towards the end of his Denarius dissertation, he supplies the following data for his own measures:—

(1.) 'The first and most easterly of the three 'great Pyramids of Egypt hath on the north side a 'square descent; when you are entered a little past 'the mouth of it, there is a joint or line, made by 'the meeting of two smooth and polished stones over 'your head, which are parallel to those under your

'feet; the breadth at that joint or line is 3·463 of 'the English feet;' or × 12 = 41·56 Greaves' inches.

(2.) 'Within the Pyramid, and about the midst 'of it, there is a fair room or chamber, the top of 'which is flat, and covered with nine massy stones; 'in it there stands a hollow tomb of one entire 'marble stone; the length of the south side of this 'room, at the joint or line where the first and 'second rows of stone meet, is 34·380 feet;' or × 12 = 412·56 Greaves' inches.

(3.) 'The breadth of west side of the same room, 'at the joint or line where the first and second row 'of stones meet, is 17·190 feet;' or × 12 = 206·28 Greaves' inches.

(4.) 'The hollow, or inner part of the marble 'tomb near the top, on the west side of it, is in 'length 6·488 feet;' or × 12 = 77·86 Greaves' inches.

(5.) 'The hollow or inner part of the marble 'tomb near the top of it, on the north side, is in 'breadth 2·218 feet;' or × 12 = 26·62 Greaves' inches.

Now the first of these specified places may be identified in our table of heights and breadths of entrance passage, page 36, = 41·50 inches.

The second, or length of the south side of the King's chamber, 42 inches above the floor, is from our measure on the floor of 412·60, reduced for the angular inclination of the walls + 412·56 inches.

The third, or west side of the room, similarly corrected, is 206·26 inches. (See p. 102.)

The fourth, or inside length of the coffer near the top on the west side, = 78·03 inches. (See p. 121.)

And the fifth, or inside breadth of the coffer near the top on the north side, = 26·68 inches.

Hence we have the following double series :—

	Greaves. Inches.		C. Piazzi Smyth. Inches.
(1.)	41·56	=	41·50
(2.)	412·56	=	412·56
(3.)	206·28	=	206·26
(4.)	77·86	=	78·03
(5.)	26·62	=	26·68
Sum, . .	764·88	=	765·03

One would think from the above numbers that four and five had been measured with a different rod from the others either by Professor Greaves or myself; but I am not aware of any error of the sort in my own observations; and the coffer, which they belong to, has always been a puzzling object to passing travellers. There seems, therefore, at present to be no opportunity of doing anything else than taking the sum of each series; and thereupon declaring, that 764·88 of Greaves' inches are equal to 765·03 of the present British imperial inches; or in fact that Greaves' measuring-rod was based on a standard foot much closer to the truth, than most persons have hitherto deemed possible or likely.

LENGTH OF THE CUBIT OF MEMPHIS.

FROM a comparison of Professor Greaves' measures of various parts of the Great Pyramid, Sir Isaac Newton deduced a value in British inches for the length of the cubit of the ancient city of Memphis, or of ancient Egypt generally; and arrived thereby at a quantity very fairly close to that which has been subsequently determined on perfectly different grounds by later investigators: few of whom, however, appear to expect a precision of more than two or three tenths of an inch.

The method on which Sir Isaac Newton proceeded was based on the assumption,—that if the Great Pyramid was built by Egyptian workmen, there was a probability that even numbers of whole lengths of their favourite linear standard—or the Memphian cubit,—would be employed by them, for practical convenience, in laying off the chief lengths, breadths, and heights throughout the structure.

This principle seems to contain *some* truth, but is not always to be implicitly depended on; for many circumstances connected with either use or art, may require fractional, and very intricate fractional, portions of a cubit to be introduced into some parts of a building, even *because* whole

cubits are introduced into another. Further also, if the length of the part measured, be very great, and the difficulties of measurement notable,—as in the side of the base of the entire Pyramid,—the errors of observation may exceed the length of any possible fraction of the cubit; and some number of whole cubits can then be placed by the modern observer with perfect ease, but not propriety, within the limits of his several observations, and claimed as being the length originally intended.

To keep therefore on the safe side, I have confined myself, in a similar inquiry based on my own measures, to interior features of the Pyramid only; and to cases in which, both the whole lengths were small, as of 2, 4, or more cubits,—if cubits existed at all;—and the error of observation was probably under a tenth of an inch.

The final mean of the whole set of determinations obtained in this manner = 20·73 British inches, as the length of the cubit employed by the masons engaged in the Great Pyramid building, or, that of the ancient city of Memphis; and which cubit need not, and actually is not, by any means the same as the cubit typified in the more concealed and symbolized metrological system of the Great Pyramid.

The above length for the Memphis and Great Pyramid cubit comes very near the mean of Sir Isaac Newton's, Sir Gardner Wilkinson's, Mr. Perring's, and other determinations—hitherto considered, = 20·70 inches; but the nearness is accidental only, for our individual results are found anywhere

between 20·10 and 21·35 British inches; and some of theirs are almost as wide. The best of them, indeed, are usually between 20·6 and 20·8 British inches; thus a preserved cubit recently found in pulling down a building at Thebes, supposed to date about 1000 B.C., is mentioned by Sir Gardner Wilkinson, as equal to two ordinary cubits, each of 20·65 inches long; and he makes the cubit-marks of the Elephantine Nilometer, dating from the Roman Emperors, = 20·63 inches, but mentions a French determination of the same = 20·73 inches; and likewise notices a stone with 10-14ths of a cubit built into the wall at Elephantine, and part apparently of an older Nilometer, where the cubit was = 21·0 British inches. The cubit of the Nilometer at Cairo is given by the same author at 21·4 English inches, but attributed to no earlier authority than an Arab Caliph about A.D. 860.

The differences amongst our own results are partly due to dilapidation effects, but are partly dependent also on variations introduced by the builders, or actual errors in their work: as when the breadth of the Grand Gallery varies in different parts of its length, irregularly, anywhere between 81·7 and 83·0 inches. Another source of error is more uncertain, as where two parts taken by Sir Isaac Newton and most other writers as certainly intended to be the same in measure, are found to be positively different. An example of this is presented in the breadth and height of the ramps, assumed by Sir Isaac to be equal, but found by my

measures to be (on the mean of a number of places, but nowhere very uniformly), nearly an inch different, without a probable uncertainty of more than 1-10th of an inch. (See p. 83.)

All the results are given without exception in the table below; and may probably be held to indicate, that it was no principal object with the architect of the Great Pyramid, to memorialize the exact length of the cubit of Memphis in that manner: while they may further show, that the cubit of Memphis is an entirely different length from, and is never to be confounded with, the cubit of the symbolical Great Pyramid system, and the sacred cubit of the Israelites, which are both = 25·025 British inches nearly.

Parts of the Great Pyramid measured.	Measured length in British inches.	Assumed to contain of cubits of Memphis, the following numbers.	Consequent length of the ancient cubit of Memphis in British inches.
Breadth of entrance passage, .	41·5	2	20·75
Breadth of North doorway in Grand Gallery, . . .	42·2	2	21·10
Breadth of Grand Gallery, . .	81·7	4	20·43
	83·0		20·75
Breadth between ramps, . .	40·8	2	20·40
	42·7		21·35
Breadth of South doorway of Grand Gallery, . .	41·4	2	20·70
Mean breadth of East and West ramps, ...	20·1	1	20·10
Mean height at right angles to incline of do., do., . .	21·0	1	21·00
King's Chamber, length, . .	412·6	20	20·63
,, breadth, . .	206·3	10	20·63
,, height, . .	230·1	11	20·91
Mean, ...	...	...	20·73

SIR ISAAC NEWTON'S DISSERTATION ON CUBITS.

'A DISSERTATION upon the *Sacred Cubit* of the 'Jews (Hebrews rather, or Israelites) and the 'Cubits of the several Nations; in which, from 'the Dimensions of the greatest *Egyptian* Pyra- 'mid, as taken by Mr. *John Greaves*, the antient 'Cubit of *Memphis* is determined.

'*Translated from the* Latin *of Sir* Isaac Newton, '*not yet published.*' And now extracted from 'MISCELLANEOUS WORKS of Mr. *John Greaves*, 'Professor of Astronomy in the University of '*Oxford:* many of which are now first published. 'Vol. II. Published by THOMAS BIRCH, M.A., 'F.R.S., and Member of the Society of Anti- 'quaries, London.—1737.'

'To the description of the Temple belongs the 'knowledge of the *Sacred Cubit;* to the understand- 'ing of which, the knowledge of the Cubits of the 'different nations will be conducive.

'The *Roman* and *Greek Cubits*[1] were a Foot and

[1] 'Vitruvius lib. 3. Hero in Isagoge. Hesychius. Suidas in voci- 'bus πλέθρον & πους. Columella lib. 5, de Re Rustică, qui cubitum 'nominat *semipedem*, quasi *pedis* & *semis*. Vid. & Frontin. de Limit. 'Agrorum; & Isidor. Hispalensem, lib. 15, c. 15. Authors are agreed 'upon these Cubits, amongst whom *Agricola* and Mr. *Greaves* are espe- 'cially to be consulted.'

'a half, and, like the *Sacred Cubit*, consisted of six 'Palms, and twenty four *Digits*. For the *Roman* and 'Greek Feet contain'd four *Palms*, and sixteen *Digits*. 'The *Roman* Foot was likewise divided into twelve '*Unciæ* or *Pollices*, and was equal to $\frac{967}{1000}$ of the '*English* Foot, as Mr. *Greaves*, who examined dili-'gently the antient monuments in *Italy*, and consi-'der'd the arguments of former writers, as *Philander*, '*Agricola*, *Pœtus*, *Villalpandus*, *Snellius*, and others, 'has determined with the greatest accuracy of all 'other authors. The *Roman Cubit* is therefore '$1\frac{4595}{10000}$ of the *English Foot*.

'Of the *Greek Feet*, the *Attic* was most eminent. 'Modern writers represent it as equal to a *Roman* Foot 'and a *Semuncia* of that Foot; because the *Greek* '*Stadium* consisted of six hundred *Greek Feet*; 'and a *Roman Milliare*, or Mile, of a thousand of 'the greater *Roman Passus*, or five thousand Feet; 'and antiently eight *Greek Stadia* were equal to a '*Roman Milliare*. But it is probable, that the 'nearest round numbers were used here; and if we 'say, that the antients sometimes made the *Stadium* 'equal to an hundred and twenty-five *Passus*, that 'proportion might be deduced, not from a compari-'son of the Feet with one another, but from the fore-'going proportion of the *Stadium* to the *Milliare*, 'express'd very near the truth in round numbers. 'This conjecture is confirm'd by reflecting, that '*Polybius*, cited by *Strabo*, receded from this vulgar 'computation, and represented the *Milliare* as equal

'to 8 *Stadia*, and one-third part; by which means 'the *Attic* Foot will be equal to the *Roman*. The 'former computation is favour'd by the *Ptolemaic* 'Foot, which is equal to a *Roman* Foot and a '*Semuncia*, if the latter Foot was deriv'd from the '*Attic*. The latter computation is countenanc'd by 'the Porphyry pillar dug up at *Rome*, with this in-'scription, ΠΟΔ· Θ. that is, *nine Feet*; for the Foot 'of this pillar, as measured by *Philander*, exceeded 'the *Roman* foot only a ninth part of an *Uncia*. 'This difference shews the Foot not to be *Roman*, 'and the inscription proves it to be the *Greek* Foot. 'But whether it was the *Attic* Foot, let others de-'termine. Till something more certain shall appear, 'we shall assume nothing, but that the *Attic* Foot 'was neither less than the *Roman*, nor greater than 'the *Roman* above a *Semuncia*. This being granted, 'we shall have the magnitude of the *Attic* Cubit to 'pretty great exactness.

'The *Derah*, or *Arabian* Cubit[1] consisted in like 'manner of six *Palms*, and 24 digits; and, in my 'opinion, was very near equal to the *Roman* or *Attic* 'Cubit. For it was a fifth part of the Royal Cubit 'of *Ægypt*; that is, as will immediately be shewn, 'four simple Cubits of *Ægypt*, which are now equal 'to five *Roman* ones.

'Three *Arabian* Miles were likewise equal to the '*Persian Parasanga*, that is, to thirty *Attic Stadia*,

[1] '*Abulfedæ* Geograph. Arab. and *Muhammed Ibn Mesoud*, quoted 'by Mr. *Greaves*.'

'and consisted of 1000 *Orgyiæ*, or *Arabian* Paces, 'that is, 4000 Cubits; by which means the *Arabian* 'Cubit will be equal to the *Attic*. For the wander- 'ing *Arabians* at first serving in war under the 'Romans, and afterwards founding an empire in 'Syria, learned from the conquered people the 'money, weights, and measures of the *Romans* and 'Greeks. We shall pass over this Cubit therefore, 'and proceed to those which are more antient.

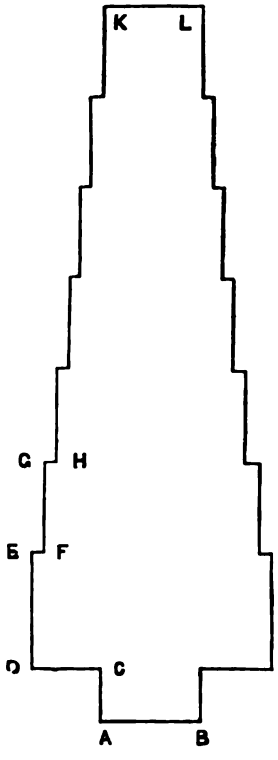
'From the Pyramids of *Ægypt* accurately mea- 'sured by Mr. *John Greaves*, I collect the length of 'the antient *Cubit* of *Memphis* in this manner. 'The side of the first Pyramid was 693 *English* feet. 'It is very probable, that at first the measure of it 'was determined by some round number of *Ægyp- 'tian* Cubits. *Ibn Abd Alhokm*, quoted by Mr. 'Greaves, tells us, that the measure of each side was 'an 100 Royal Cubits of the antient times. But it 'is probable, that the *Ægyptians* learn'd, from the 'Orgyiæ of the Greeks, their measure of four Cubits 'of *Memphis*, and gave it the name of the *Royal* 'Cubit. Thus the side of the Pyramid will be 400 'simple Cubits, or four *Arourœ*; and the *Cubit* of 'Memphis will be equal to $1\frac{732}{1000}$ of the *English* 'Foot.

'That the Pyramid was built by the Cubit of this 'magnitude, appears from several dimensions of it. 'The square passage leading into it of polished 'marble was in breadth and height $3\frac{463}{1000}$ of the 'English Foot; that is, two of the above-mentioned

'*Cubits* of *Memphis*. And of the same breadth and 'height were the four other galleries. In the middle 'of the Pyramid was a chamber most exquisitely 'form'd of polished marble, containing the monu-'ment of the king. The length of this chamber was '$34\frac{38}{100}$ *English* Feet, and the breadth $17\frac{19}{100}$; that 'is, it was 20 Cubits long, and 10 Cubits broad, the 'Cubit being supposed to be $1\frac{718}{1000}$ of the *English* 'Foot. The difference between this measure and 'the former is $\frac{135}{10000}$, or one-thirtieth of a Foot, 'that is, about one-seventh of an Inch; an error of 'no importance, if we consider the much greater 'irregularities observ'd by Mr. *Greaves* in the best 'buildings of the *Romans*. The roof of this chamber 'consisted of nine oblong and parallel stones; the 'seven middle ones of which were of the same 'breadth, but the two outermost were less by half 'in breadth than the rest; and the breadth of them 'all together was equal to the length of the chamber, 'or to 20 Cubits; so that the length of the middle 'stones was two Cubits and an half. The marble 'gallery, which led into this chamber, was six feet 'and 87 of 100 parts of a foot; that is, 4 Cubits of 'the chamber, in breadth. In the middle of this 'gallery was a way of polished marble, $3\frac{433}{1000}$ feet; 'that is, 2 Cubits broad; and on both sides the 'way were two banks, like benches, of polish'd 'marble likewise, $1\frac{717}{1000}$ feet broad, and $1\frac{717}{1000}$ feet 'deep; that is, in breadth and depth one Cubit. 'Who will therefore imagine, that so many dimen-

'sions not at all depending upon each other, should 'correspond by mere chance with the length of the 'Cubit assigned by us?

'Besides, the division of this Cubit into 6 *Palms* 'is evident from the dimensions of the Pyramid. 'For the height of the gallery, according to Mr. '*Greaves*, was about 26 Feet, that is, 15 Cubits. 'Subtract the height of the benches, and the remain- 'ing height will be 14 Cubits. This was divided 'into seven parts, according 'to the 7 ranges of the 'stones in the walls of the 'gallery; and every upper 'range projected over the 'lower about three inches, 'as is represented in the 'annexed figure; where *A B* 'expresses the breadth of 'the way, *A C D* the bank 'or bench, *D E* the height 'of the first range of stone, '*E F* the projection of the 'second range, and *F G* the 'height of it; *G H* the pro- 'jection of the third range, 'and *H I* the height of it; 'and so on to the roof *K L*, 'which answers to the way '*A B*. The height therefore 'of every range of stone was two Cubits; and the



'6 projections *E F*, *G H*, &c., answering to one 'Cubit, were *Palmares*.

'There are likewise, in the king's monument 'above-mentioned, specimens of the division of the 'Cubit. For since the Cubit *D C* is $1\frac{717}{1000}$ of a 'Foot, and consequently the *Palm* $\frac{286}{1000}$ of a Foot, 'ten *Palms* will be $2\frac{86}{100}$ Feet; seven *Palms* and 'three Digits will be $2\frac{217}{1000}$ Feet; and twenty-five '*Palms* and two Digits will be $7\frac{293}{1000}$ Feet. Now 'Mr. *Greaves* found the measure of the height of 'the monument within to be $2\frac{860}{1000}$ Feet, the breadth 'within to be $2\frac{218}{1000}$ Feet, and the length of the 'exterior superficies to be 7 Feet, 3 Inches and an 'half; that is, $7\frac{293}{1000}$ Feet. The height of the 'monument within was therefore 10 *Palms*, the 'breadth within 7 *Palms* and 3 Digits, and the 'length of the exterior superficies 25 *Palms* and 2 'Digits, without any sensible error. The height and 'breadth of the exterior superficies was 3 Feet, 3 'Inches and 3 quarters; that is, 11 *Palms* and 2 'Digits and a quarter, if Mr. *Greaves* has been suf-'ficiently exact in setting down the dimensions 'of it.

'There are also other specimens of this Cubit; 'as particularly that the whole length of that gal-'lery, with the hypothenuse of a rectangular triangle, 'whose base was 15 Feet, and height about 5 or 6, 'or perhaps 7 Feet, being measured by a cord, was '154 Feet. Subtract the hypothenuse, and there 'will remain the length of the gallery, 138 Feet;

'that is, 20 times the breadth, or 20 *Royal Cubits*. 'Two other galleries were likewise measured, and 'found to be in length 110 Feet, that is, sixteen '*Royal Cubits*; and another Chamber was in 'breadth about 17 Feet, that is, 10 Cubits; and 'an *Anticameretta*, or *Anticloset*, was in length 7 'Feet, in breadth about 3½ Feet; that is, 4 Cubits 'long, and about 2 Cubits broad. And it is my 'opinion, that the Pyramid was built throughout 'after the measure of this Cubit.

'If any person shall hereafter exhibit in this 'manner the dimensions of the remains of the old 'buildings of the *Babylonians* and other nations, it 'will not be difficult to determine from thence the 'antient Cubits of those countries. In the mean 'time I shall produce one instance, which occurs, as 'a specimen of this calculation. Mr. *Purchas*[1] in- 'forms us, that there is still extant between the 'antient *Babylon* and *Bagdad*, a vast rude struc- 'ture of brick; the bricks of which his friend Mr. '*Allen* found to be one Foot long, eight Inches 'broad, and six Inches thick; he means Inches of 'the *English* Foot. These proportions shew, that 'the bricks were regularly formed, and consequently, 'that in the making of them regard was had to some 'particular measure used by the *Babylonians*, which 'was of great use, to enable the workmen from the 'number of bricks to determine immediately the 'dimensions of the walls with respect to the length,

[1] 'Pilgrimage, par. 1. lib. 1. c. 11.'

'breadth, and thickness, and *vice versâ* to compute 'the number of the bricks necessary to the building 'of the wall agreed upon. As the *Babylonians* 'therefore measured their buildings by Cubits, it 'follows, that the bricks according to their length, 'breadth, and thickness conjunctly must compose 'the measure of the Cubit. Now two bricks accord-'ing to their length, three according to their breadth, 'and four according to their thickness, form the 'same measure; and consequently the measure is 'that of a Cubit. A *Babylonian* Cubit is therefore 'equal to two *English* Feet; and the component 'parts intimate the division of this Cubit into six '*Palms*, so that the dimensions of the bricks may be 'express'd in round numbers of *Palms*; the length 'by 3 *Palms*, the breadth by 2, and the thickness by '1½. This Cubit may perhaps be determined here-'after with more exactness by a greater variety of 'observations.

'The magnitude of the *Persian Cubit*, I think, 'may be determin'd from their *Parasanga*. For 'it is to be considered, that the greater measures, 'which exceeded the human members, us'd to be 'deduced from the lesser by multiplication, in which 'multiplication the *denary* and sometimes the '*binary* numbers were employ'd. Thus the *Roman*[1] '*Calamus* or *Pertica* consisted of ten Feet; the '*Scrupulum* of ten Feet in length, and ten in

[1] 'Vide Hygin. de Limitib. constituend. & Siculum Flaccum de 'Condit. Agrorum.'

'breadth; the *Versus* of an hundred Feet in length, 'and an hundred in breadth; the *Clima* (a measure 'deriv'd from the *Greeks*, as the name shews) of 'ten *Orgyiæ* in length, and ten in breadth; the '*Actus* of two *Climata* in length, and two in 'breadth; the *Jugerum* of two square *Actus* in 'length; the *Decumanus* of ten *Actus* in length, 'and ten in breadth; the *Centuria* of ten *Decumani* 'in length, and ten in breadth, within *Italy*; but 'without, of twice that number; the *Saltus* of an 'hundred *Decumani* in length, and an hundred in 'breadth; the *Milliare*, or Mile, of a thousand '*Passus* in length; and the *Iter Diei*, or *Day's* '*Journey*, of twice ten *Milliaria*. The *Greek* Reed, 'called Ἄκαινα, consisted of ten Feet; the *Clima* 'of ten Feet in length, and ten in breadth; the '*Plethrum* of an hundred Feet in length and breadth; 'the *Stadium* of an hundred *Orgyiæ* in length; and 'the *Iter Diei*, according to *Herodotus*, of two hun-'dred *Stadia*. And in the province of *Cyrene*, in 'the lands which *Ptolemy* a *Greek* king of *Ægypt* 'left to the *Roman* people, the[1] *Plinthides* consisted 'of fifty *Limites* in length, and fifty in breadth; 'and each side of those square *Limites* were ten '*Stadia*.

'It appears also from several instances, that as 'the western nations proceeded from the Foot mul-'tiplied by ten, so the eastern did from the Cubit multiplied in the same manner. Thus among the

[1] 'Hygin. de Limit. constit.'

'*Jews*, a nation us'd to the feeding of cattle, the '*Kibrath Terræ* or pasture-land, sufficient, I think, 'for a flock under one shepherd, was determined by 'the space of a thousand Cubits, and a Sabbath-day's 'Journey by that of two thousand Cubits. And 'thus among the *Ægyptians*, the *Aroura* consisted 'of an hundred Cubits in length, and an hundred in 'breadth. And because the *Ægyptians* every year 'after the inundation of the *Nile* divided their lands 'into *Arourœ*, the Reed ought, for the greater expe-'dition in measuring, to consist of ten Cubits, that 'by the repetition of ten they might make an '*Aroura*. And for the like reason the greater 'measures, into which those lands were divided, 'ought to consist of tens and hundreds of *Arourœ*.

'The greater measures therefore of the antient 'nations consisted of the round numbers of those 'lesser measures from which they were derived; and 'consequently the *Schœni* of the *Ægyptians* and 'other eastern nations, and the *Parasangæ* of the '*Persians*, consisted of round numbers of Cubits. 'Now the least *Schœnus* of the *Ægyptians*, by the 'testimony of *Artemidorus* and *Strabo*, was equal 'to thirty *Greek Stadia*; and the *Parasanga*, by 'the testimony of *Herodotus*, *Xenophon*, *Hesychius*, '*Suidas*, *Agathias*, and others cited by *Strabo*, was 'likewise equal to thirty *Stadia*; and the round 'number of Cubits, to which so many *Stadia* were 'equal, are ten thousand. That *Schœnus* therefore 'consisted of 10,000 *Cubits* of *Memphis*, and the

'*Parasanga* of as many *Persian* Cubits; and 10,000 'of the Cubits of both kinds were equal to 30 '*Stadia*.

'The calculation of the *Ægyptian* Cubit is con- 'firmed by the present Cubit of the *Ægyptians* used 'in the city of *Grand Cairo*, which Mr. *Greaves* 'found to be $1\frac{824}{1000}$ of the *English* Foot. This 'Cubit approaches nearer to the antient Cubit of '*Memphis*, than to the lesser Cubits of the *Greeks*, '*Romans*, and *Arabians* who reigned in *Ægypt*; 'and therefore it seems to be derived from that of '*Memphis*. But it is greater than that. And what 'wonder is it, that a measure should be somewhat 'increased in the space of above 3000 years? The 'measures of Feet and Cubits now far exceed the 'proportion of human members; and yet Mr. '*Greaves* shews from the *Ægyptian* monuments, 'that the human stature was the same above 3000 'years ago, as it is now. The measures therefore 'are increased, the reasons of which may be assigned. 'The instruments, which use to be preserved as 'standards of measures, by contracting rust are in- 'creased. Iron beaten by the hammer may insen- 'sibly relax in a long space of time. Artificers 'likewise, in making instruments, choose to err in 'the excess of the materials; and when by filing 'they attain any measure, which they think suffi- 'cient, they stop, knowing that they can soon cor- 'rect that little excess by filing, if their master 'should complain of it; but that they cannot

'remedy a defect. Let us suppose therefore, that 'all measures have increased by degrees, especially 'in the first ages, when less care was taken of 'them; and the Cubit of *Memphis*, about the time 'of the *Roman* Empire, will be a mean between 'the antient and the modern Cubit, but will ap- 'proach nearer to the modern. The antient Cubit 'was $1\frac{719}{1000}$ of the *English* Foot, and the modern 'is $1\frac{824}{1000}$ of the *English* Foot. The mean there- 'fore between them will be about $1\frac{78}{100}$, or $1\frac{79}{100}$ 'of a Foot. Now 10000 of such mean or middle 'Cubits make, as they ought, about 30 *Attic* '*Stadia*.

'The former calculation of the *Persian* Cubit is 'confirmed by the *Arish*, or modern *Persian* Cubit, 'which (being doubled, as I suppose) Mr. *Greaves* 'found by measuring to be $3\frac{1987}{1000}$ of the *English* 'foot. If half of this was the simple Cubit, and it 'increased from the time of the *Greek* and *Roman* 'Empire after the manner of the Cubit of *Memphis*, 'it must antiently have been about $1\frac{57}{100}$ of the *Eng-* '*lish* Foot. *Herodotus* stiles this Cubit, compared 'with the Cubits of the *Greeks* and neighbouring 'nations, the *middling Cubit*; and tells us, that the 'royal *Persian* Cubit was larger than it by 3 Digits. 'If we understand by them, Digits of the middling 'Cubit, which was more known to the *Greeks*, the 'royal Cubit will be to the middling Cubit, as 27 to '24; and since the middling Cubit is $1\frac{57}{100}$ of the '*English* Foot, the royal Cubit will be about $1\frac{676}{1000}\frac{1}{4}$.

'Now 10000 of such Cubits make, as they ought, 'about 30 *Attic Stadia*.

'The preceding computations are likewise con- 'firm'd by a certain general reason, by comparing 'the Feet and Cubits used at first in every nation 'according to the proportion of the members of a 'man, from which they were taken. For the Foot 'of a man is to the *Cubit* or lower part of the Arm 'of the same man as about 5 to 9, as I my self have 'measur'd, and any person may easily find by his 'own body. And the oldest Feet, of which any ac- 'count has been transmitted to us, are the *Roman*, 'the *Ptolemaic*, and the *Drusian* Foot at *Tongeren* 'in *Germany*, the last of which is equal to $13\frac{1}{2}$ '*Unciæ* of the *Roman* Foot. And to these three 'Feet, according to the proportion of 5 to 9, answer 'the three Cubits, $1\frac{7406}{10000}$, of the *English* Foot, '$1\frac{8056}{10000}$, of the *English* Foot, and $1\frac{9582}{10000}$, of the '*English* Foot; and of about these magnitudes are 'the antient Cubits determined by us above, viz., 'those of *Memphis*, *Babylon*, and *Persia*; to which 'add that of *Samos*, which *Herodotus* represents as 'equal to the Cubit of *Memphis*. The *Greek* and '*Roman* Cubits, which were secondary measures, 'adapted to the measures of the Feet before received, 'ought not to come under consideration here.

'The Cubits of the Eastern Nations, with which 'the *Jews* were surrounded, being determined in 'this manner, we may from hence form a conjecture 'concerning the magnitude of the *Jewish* Cubit.

'The vulgar *Jewish* Cubit ought not to be greater 'than them all, nor the sacred Cubit less than them 'all. The opinion of *Villalpandus* and others there- 'fore is to be rejected, who represent the vulgar 'Cubit as equal to two *Roman* Feet and an half; 'and I think them likewise mistaken, who make the 'sacred Cubit and *Attic* Cubit equal. That the 'sacred Cubit was very large, appears from the '*Jewish Calamus* or Reed, which contained but six 'of these Cubits; and from the antiquity of this 'Cubit, since *Noah* measured the Ark with it. How- 'ever, it is not to be magnified in such a manner, 'that the vulgar Cubit (which in the time of *Moses* 'was called the *Cubit of a man, Deut.* iii. 11.) should 'much exceed the Cubit of a tall man. But we shall 'circumscribe these Cubits in narrower limits in the 'following manner.

'We learn from the *Talmudists* and *Josephus*, 'that the *Jews* used the measure of four sacred *Palms* 'instead of the *Greek* Cubit. The *Greek* Cubit there- 'fore approached nearer to 4 *Jewish Palms* than to '5 or 3; that is, it was less than $4\frac{1}{2}$ *Palms*, and 'greater than $3\frac{1}{2}$. Hence it follows, that the sacred 'Cubit of 6 Palms was less than $2\frac{4}{7}$ *Attic* Feet, and 'greater than 2 *Attic* Feet.

'The stature of the human body, according to the '*Talmudists*,[1] contains about 3 Cubits from the feet 'to the head; and if the feet be raised, and the arms

[1] 'This proportion is expressly set down in *Mishnaioth*, Tract. de '*Ghaburim*, cap. 4. ה in Comment.'

'be lifted up, it will add one Cubit more, and con-
'tain 4 Cubits. Now the ordinary stature of men,
'when they are bare-foot, is greater than 5 *Roman*
'Feet, and less than 6 *Roman* Feet, and may be
'best fix'd at 5 Feet and an half. Take the third part
'of this, and the vulgar Cubit will be more than 20
'*Unciæ*, and less than 24 *Unciæ* of the *Roman* Foot;
'and consequently the sacred Cubit will be more than
'24 *Unciæ*, and less than 28$\frac{4}{5}$ *Unciæ* of the same Foot.

'*Josephus* writes, that the Pillars of the great
'court were as large as could be embraced by three
'men with their arms join'd. The *Orgyia* or Fathom
'of a man is commonly supposed equal to the stature
'of the same man, but in reality exceeds it about
'one Palm of the *Roman* Foot. The common
'people use the nearest round numbers; in this
'case the true numbers are to be employed; add
'therefore a Palm to the measures of the stature of
'a man above express'd, and the sum being tripled,
'15$\frac{3}{4}$ *Roman* Feet will be greater, and 18$\frac{3}{4}$ less than
'the circumference of the pillar.

'Now that circumference, according to the *Tal-*
'*mudists* and *Josephus*, was, as above, 8 Cubits, at
'least in the inner court. Taking therefore about an
'eighth part of the preceding numbers, the sacred
'Cubit will be greater than two *Roman* Feet, and
'less than two and a third. We have taken here
'the pillars of both courts, that is, in thickness, tho'
'not in height. It is certain, that the pillars of the
'inner court were not thicker than those of the outer

'court; and therefore the latter computation must 'necessarily be admitted.

'A Sabbath-day's journey, by the unanimous 'consent of the *Talmudists* and all the *Jews*, was 'two thousand Cubits. Hence the *Chaldee* inter- 'preter upon *Ruth* i. 6. says, "We are commanded '"to observe the Sabbath and good days, so as not '"to go above two thousand Cubits." The *Jews* 'describing this journey, instead of Cubits, some- 'times substitute Paces. *Erasmus*, in his notes 'upon *Acts* i. 12. writes thus concerning the Sab- 'bath-day's Journey: *The Evangelist means the* '*space of two thousand Paces. It was not lawful* '*for the Jews to travel farther on the Sabbath-day.* '*This is asserted by St.* Jerome, *writing to* Algasia, '*in his tenth question*, viz. *that the* Jews *religiously* '*observed not to walk on the Sabbath-day above* '*two thousand Paces, agreeably to the appointment* '*of* Akiba, Simeon [*the Just*] *and* Hillel, *Rabbins*, '*whom they use to call our masters.* Thus writes '*Erasmus*, who reads *passus* in St. *Jerome*, and not '*pedes*, as it is corruptly in the printed editions of 'that father. And hence in *Numb.* xxxv. 4. instead 'of *a thousand Cubits*, the *Latin* interpreter substi- 'tutes *a thousand Paces.* But we must take care 'not to understand by them the *Roman* or *Greek* 'Paces; for in *Sebbolch Lecheth, Tract.* 22. *cap. de* '*Sabbat.* those Paces are thus described: Samuel '*travell'd thro' the valley, and knew not the limit* '*of the Sabbath. A Sabbath-day's journey is two*

'*thousand middling Paces.* As if he had said, a 'Sabbath-day's journey is a journey of two thou-'sand paces of a man travelling upon a sabbath, 'not with speed, as in the *Roman* Paces, not too 'slowly, but moderately, in the manner of those 'who travel on the sabbath-day. Now men of a 'middling stature, in walking in this manner, go 'every step more than two *Roman* Feet, and less 'than two and a third. And within these limits 'was the sacred Cubit circumscribed.

'The *Talmudists* write, that the height of the 'steps, by which they ascended to the inner 'court, was half a Cubit, and their retractions half 'a Cubit. They mean the sacred Cubit; and we 'see that *Josephus's* computation, with regard to 'the height of these steps, corresponds with them. 'Now *Vitruvius* determines, that the height of 'steps ought not to be more than 10 *Roman Unciæ*, 'and the retractions not less than 18 *Unciæ;* whence, 'since the *Jews* make the height equal to the retrac-'tions, we must suppose that they took a middle pro-'portion, and that the height, as well as the retrac-'tions, made about 12, or at most 13 *Roman Unciæ*. 'The middle proportion between 10 and 18 is about '$13\frac{5}{12}$. And I should be inclined to maintain, that 'this height was not at all exceeded, lest it might 'have been difficult to ascend the steps. The sacred 'Cubit therefore was less than 27 *Roman Unciæ*, but 'not less than 24 *Unciæ*, in order that the retrac-'tions of the steps might not be too much lessen'd.

'The Cubit being thus circumscribed within cer-
'tain limits, and the erroneous opinions of other
'writers being thus refuted, we may now assign the
'more exact measure of it with greater assurance;
'and this we shall do by the following argument.

'It is agreeable to reason to suppose, that the
'*Jews*, when they passed out of *Chaldea*, carried
'with them into *Syria* the Cubit which they had
'received from their ancestors. This is confirmed
'both by the dimensions of *Noah's* ark preserv'd by
'tradition in this Cubit, and by the agreement of
'this Cubit with the two Cubits, which the *Tal-*
'*mudists* say were engrav'd on the sides of the city
'*Susan* during the empire of the *Persians*, and that
'one of them exceeded the sacred Cubit half a Digit,
'the other a whole Digit. *Susan* was a city of
'*Babylon*, and consequently these Cubits were *Chal-*
'*daic*. We may conceive one of them to be the
'Cubit of the royal city *Susan*, the other that of
'the city of *Babylon*. The sacred Cubit therefore
'agreed with the Cubits of divers provinces of
'*Babylon* as far as they agreed with each other;
'and the difference was so small, that all of them
'might be derived in different countries from the
'same primitive Cubit, the *Jewish* Cubit being less
'enlarged after sacred things began to be deter-
'mined by it. This therefore was the proper and
'principal Cubit of the *Jews*. But that people
'afterwards going down into *Ægypt*, and living for
'above two hundred years under the dominion of

'the *Egyptians*, and enduring an hard service 'under them, especially in building, where the 'measures came daily under consideration; they 'must necessarily learn the *Egyptian* Cubit. 'Hence came the double Cubit of the *Jews*, viz. 'that of their own country, and the adventitious 'one, which, from its being used upon ordinary occa- 'sions only, was esteemed vulgar and profane. This 'hypothesis is confirmed by the proportion of the 'Cubits to each other. For the *Babylonian* Cubit 'of two *English* Feet is to the Cubit of *Memphis* 'of $1\frac{719}{1000}$ of the *English* Foot, as 6 to $5\frac{157}{1000}$, that 'is, as the sacred Cubit to the vulgar Cubit very 'near. The small fraction of $\frac{157}{1000}$ might arise 'from either the difference of the *Babylonian* 'Cubits, or the greater antiquity of the *Babylonian* 'building, than of the pyramid, or the dimension 'of the brick, expressed not in the exact, but the 'nearest round numbers.

'Suppose the thickness of the brick to be $6\frac{3}{16}$ '*English* inches, the breadth $8\frac{1}{4}$ inches, and the 'length $12\frac{3}{8}$ inches; and a Cubit double that 'length will be to the Cubit of *Memphis* as 6 to 5. 'I am inclined therefore to think, that the Cubit of '*Memphis*, at the time when the *Jews* went down 'into *Egypt*, was equal to 5 *Palms* of the *Chaldæo-* 'Hebraic Cubit; and that the *Jews* thus determin- 'ing the magnitude of that Cubit by five *Palms* of 'the proper Cubit, the *Palms* of *Memphis* became 'at last neglected, and the doub[illegible] only

'a simple *Palm*, remained among the *Jews*. Besides, 'as it is reasonable to suppose, that the profane and 'adventitious Cubit agreed with the Cubits of the 'nations round about, viz. those of *Memphis*, *Samos*, 'and *Persia*; so it appears from the following argu-'ment, that this Cubit was the same with that of '*Memphis*. The different measures of the Cubit of '*Memphis*, taken from different parts of the Pyra-'mid, were $1\frac{717}{1000}$, $1\frac{719}{1000}$, and $1\frac{732}{1000}$ of the *English* 'Foot. To these measures in the proportion of the 'sacred Cubit to the vulgar *Jewish* Cubit are the 'measures $2\frac{694}{10000}$, $2\frac{698}{10000}$, and $2\frac{784}{10000}$ of the *Eng-'lish* Foot, which in *Unciæ* of the *Roman* Foot are '$25\frac{57}{100}$, $25\frac{60}{100}$, and $25\frac{72}{100}$, and consequently 'fall in the middle of those limits, with which we 'have before circumscribed the sacred Cubit, and 'which were 24 and 27 *Unciæ* of the *Roman* Foot. 'Thus therefore, by means of these limits, those 'measures agree with the sacred Cubit, and conse-'quently the measures of the Cubit of *Memphis* 'agree with the vulgar Cubit. Supposing therefore 'that the *Jews* learned the Cubit of *Memphis* in '*Ægypt*, and that it was their vulgar Cubit, and 'consequently that in the time of *Moses*, and soon 'after, when, as Mr. *Greaves* contends, the Pyramids 'were built, the vulgar Cubit was of the same mag-'nitude with that of *Memphis*; the sacred Cubit in 'those times was not less than $25\frac{57}{100}$, nor greater 'than $25\frac{72}{100}$ *Unciæ* of the *Roman* Foot. Those, 'who shall hereafter examine the Pyramid, by mea-

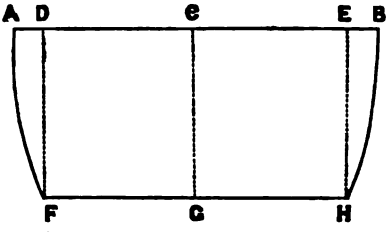
'suring and comparing together with great accuracy 'more dimensions of the stones in it, will be able to 'determine with greater exactness the true measure 'of the Cubit of *Memphis*, and from thence like-'wise of the sacred Cubit. In the mean time for 'the precise determination of the Cubit of *Memphis*, 'I should choose to pitch upon the length of the 'chamber in the middle of the Pyramid, where the 'king's monument stood, being very large, and built 'with admirable skill; which length was the twen-'tieth part of the length of the whole Pyramid, and 'contained 20 Cubits, and which was very carefully 'measured by Mr. *Greaves*, as he informs us him-'self. And from hence I would infer, that the 'sacred Cubit of *Moses* was equal to 25 *Uncia* of 'the *Roman* Foot, and $\frac{6}{10}$ of an *Uncia;* or, what is 'equivalent, that it had the same proportion to two '*Roman* Feet as 16 to 15.

'*Mersennus* in his treatise *de Mensuris, Prop.* 1. '*Cor.* 4. writes thus: *I find that the Cubit, (upon* '*which a learned* Jewish *writer, which I received* '*by the favour of the illustrious* Hugenius, *Knight* '*of the order of St. Michael, supposes the dimen-*'*sions of the temple were formed,) answers to* $23\frac{1}{4}$ '*of our inches, so that it wants* $\frac{3}{4}$ *of an inch of two* '*of our Feet, and contains two* Roman *Feet, and* '*two Digits and a Grain, which is* $\frac{1}{4}$ *of a Digit.* 'The *Paris* Foot, with which *Mersennus* compared 'this Cubit, is equal to $1\frac{68}{1000}$ of the *English* Foot, 'according to Mr. *Greaves;* and consequently is to

'the *Roman* Foot as 1068 to 967. In the same 'proportion reciprocally are $23\frac{1}{4}$ and $25\frac{68}{100}$. That 'Cubit therefore is equal to $25\frac{68}{100}$ *Unciæ* of the '*Roman* Foot, and consequently falls within the 'middle of the limits $25\frac{57}{100}$ and $25\frac{79}{100}$, with which 'we have just circumscribed the sacred Cubit; so 'that I suspect this Cubit was taken from some 'authentic model preserved in a secret manner from 'the knowledge of the Christians. Lest any person 'should be surprised, that the Cubit, which we have 'concluded to have been in the time of *Moses* '$25\frac{60}{100}$ inches, should not have increased more in 'three thousand years; he may observe, that the '*Palms* used in building at *Rome*, which was 'antiently 9 *Unciæ* of the *Roman* Foot, is now 'equal to $\frac{732}{1000}$ parts of the *English* Foot, that is, '$9\frac{1}{12}$ *Unciæ*, and consequently that in fifteen hun-'dred years it has increased but $\frac{1}{12}$ of an *Uncia*, 'though it was not preserved in a religious manner.

'Some compute the Cubit from *Solomon's* brazen 'sea. Lest any objection should be raised from 'thence, I shall briefly remark, that the bottom of 'that sea ought not to be represented spherical, as 'it generally is, but flat, in such a manner that all 'the water might run out for the use of the priests, 'and the vessel might stand commodiously upon 'the backs of the oxen, and the oxen not hinder 'the priests from coming to the cocks. However I 'would not represent it under a cylindrical figure. 'The following one will be more beautiful. Let

'the line *A B*, of ten Cubits, be bisected in *C*; and
'taking upon it *A D*, *E B*, of a Cubit each, erect
'the perpendiculars
'*D F*, *C G*, *E H*,
'each of them of
'five Cubits, and
'with the semiaxes
'*A D*, *D F*, and *B E*,



'*E H*, describe the quadrants of the ellipses *A F*,
'*B H*, and drawing the right line *F H*, the figure
'*A F G H B* convolved round the axis *C G*, will
'describe the external superficies of the vessel,
'whose cavity, if it be an hand-breadth thick, will
'contain about (?) thousand baths, supposing that a
'bath was equal to twelve *Roman Congii* (as *Agri-*
'*cola* and others maintain) and that seven *Congii*
'and an half will fill a Cubic *Roman* Foot, as Mr.
'*Greaves* found by the *Farnesian Congius*. It is
'said likewise, that this sea contained three thou-
'sand baths; whence some affirm, that there were
'two kinds of baths. Others understand a dry mea-
'sure, whose *Cumulus* equalled half the contents;
'others suspect a various reading; others imagine,
'that the sea contained two thousand baths for daily
'use, but, when full, could receive three thousand
'baths. I shall not attempt to determine the dispute.

'This is what I thought proper to lay down at
'present with regard to the magnitude of this Cubit.
'Hereafter perhaps those, who shall view the sacred
'mount, and the monuments of the *Chaldeans*, by

'taking accurately the various dimensions of the 'stones, bricks, foundations, and walls, and compar- 'ing them together, will discover something more 'certain and exact.

'The *Roman* Cubit therefore consists of 18 *Unciæ*, 'and the sacred Cubit of $25\frac{3}{5}$ *Unciæ* of the *Roman* 'Foot; and consequently those Cubits are to each 'other in round numbers as 2 to 3 very near. And 'this proportion is used by *Josephus*, out of regard 'to the greater expedition in computing the bulk of 'the buildings. For writing to the *Romans*,[1] he 'everywhere puts three *Roman* Cubits for about 'two sacred Cubits, except in some of the most 'eminent dimensions of the temple, properly so 'called, and set down in scripture, in which case he 'thought proper to retain the sacred Cubit. This 'will appear by comparing the Cubits of *Josephus* 'with the sacred Cubits of the *Talmudists*, in the 'following table :—

	Josephus's Cubits.	Sacred Cubit.	*Talmud* Cubits.	*Vulgar* Cubits.
'The height of the wall *Chajil* { without,	40	$26\frac{2}{3}$	...	...
{ within,	25	$16\frac{2}{3}$	...	...
'Difference answering to the 19 steps,	15	10	...	...
'Height of those 19 steps,	15	10	$9\frac{1}{2}$	...
'Height of the *Septum cancellatum*,	3	2	...	2
'Height } of the gates,	30	20	20	...
'Breadth }	15	10	10	...
'Height of the altar,	15	10	10	...
'Breadth of the altar,	50	$33\frac{1}{2}$	32	...
'Height of the temple within,	60	40	40	...
'Circumference of the pillars,	12	8	8	...

[1] 'Josephus in Prologo Belli Judaici.'

'Thus likewise, where *Josephus* in a round num-
'ber makes the *Exhedras* thirty Cubits, we must
'write twenty sacred Cubits, or more exactly twenty-
'two; and the like reduction is necessary in all the
'other numbers of *Josephus*.'

LETTERS OF THE FREEMASONS.

I.

(1866.)

'SIR,—I have been reading your work on the 'Pyramid,[1] and have been very much amused. 'Had you been a Freemason, or studied the rites 'and ceremonies of the ancient mysteries, you 'would have had no difficulty in understanding 'what the Pyramids were built for. They were 'simply places for initiating the neophytes in—and 'as the mysteries in every country were *funereal*, 'the use of the sarcophagus is easily explained. 'Should you care to investigate this hypothesis—if 'what is certain can be called a hypothesis—you 'may read to advantage the Rev. Dr. Collier's '*History of Initiation*, and Faber's *Mysteries of* '*the Cabiri*, and *Pagan Idolatry*.

'Freemasonry was the original of the "Mysteries." 'A pure society was in existence on the plains of 'Shinar (before the dispersion) in which Divine 'truths were taught by means of symbols. After 'the dispersion the same symbols were used all 'over the world, but the true *interpretation* of 'them was gradually lost; except amongst the

[1] *Our Inheritance in the Great Pyramid.*

'*Essenes*. If you read Josephus's account of that 'sect, you will be greatly entertained, and you will 'find evidence of the fact that they were Free-'masons. The initiated *easily* understand his 'allusions: the "profane" do not.—I am, yours 'truly,' (Signed) 'OXONIENSIS.'

'*P.S.*—Extract from Greaves (*Pyram.* vol. ii. 'p. 34):—

'"The places of initiation were indifferently a '"*pyramid*, a pagoda, or a labyrinth, furnished '"with vaulted rooms, etc."'

'"Pits or wells were occasionally used in the '"the mysteries."—Faber's *Pagan Idolatry*, vol. iii. 'p. 187, etc. etc.

'The Pyramids, Cave of Elephanta, etc., the 'Round Towers of Ireland (built by pupils of Zoro-'aster) were all places of initiation.'

II.

'HALIFAX, *Nov.* 21*st*, 1866.

'MY DEAR SIR,—Do you remember my borrow-'ing a Manual of Freemasonry from you, and being 'greatly surprised at finding certain symbols that 'had attracted my attention previously, and my 'predicting to you that the day would come when 'my studies would throw a new light on the history 'of the Pyramids? I told you when the prediction 'was fulfilled I would remind you of it.

'I forget the correct date, but it was soon after

'you and I left Poplar Grove. Important dis-
'coveries have recently been made in Egypt, which
'render our conversation at that time of interest.
'—I am, yours truly,

(Signed) 'R. G. HALIBURTON.

'Please write on the other leaf and return this
'with your reply—as I wish to use them both.

'JOHN M'GREGOR, Esq., Halifax.'

(Mr. *Haliburton* is *not* a Freemason.)

III.

'HALIFAX, *Nov.* 21*st*, 1866.

'DEAR SIR,—I have a very distinct recollection
'of my lending you a Manual of Freemasonry, and
'of the conversation to which you refer, which took
'place in 1853.

'My Manual was burned with your library
'January 1st, 1856.

'I am glad to find that your expectations have
'been realized in so singular a manner.—I am,
'yours faithfully,

(Signed) 'JOHN M'GREGOR.

'To R. G. HALIBURTON, Esq.,
'Barrister, Halifax.'

EXTRACTS FROM ETHOLOGICAL RESEARCHES BEARING ON THE YEAR OF THE PLEIADES.

By R. G. HALIBURTON, F.S.A., F.R.S.N.A., Barrister, of Halifax, Nova Scotia. 1863.

ON returning from Egypt in 1865, I (C. P. S.) had much besought Mr. Haliburton to prepare a condensed account of his researches regarding the Pleiades year, for publication in this country: and, as he kindly informed me by letters from time to time,—he both began such a paper, or book, and had nearly completed it, when recent political troubles and commercial excitements interrupted the course of his work. The interruption, we may well hope, is temporary only; but meanwhile he seems to be losing a fitting opportunity for establishing his claims to priority in a very unusual line of research, and one which has been found to have much connexion with the Great Pyramid.

Hence at the last moment for closing this volume, and when I have had to give up all expectation of receiving Mr. Haliburton's new, and special paper in time, I have thought the next best thing to be done, alike for the public, the cause, and himself, would be

to publish a considerable section of his privately printed work of 1863, in the following pages.

Such a course will neither represent the whole of his discoveries, nor will it give the full amount of priority of date, to which he may justly lay claim ; for the letters on pp. 368 and 369, will be found to refer to years much earlier than 1863. Nor again will such a course perform the more delicate operation of separating some few of his earlier and cruder notions, which neither himself, nor others might care to uphold now ; but until he himself comes out with something later and fuller,—these extracts may assist in attaching his name to the subject,—and will at least show how much I have been indebted to him, for some of the original ideas, which have been lately recognised to exist in the Pyramid.

Without further apology, therefore, I beg to submit the following portions of what he had written, long before I went to Egypt.

'THE FESTIVAL OF THE DEAD.

'BY R. G. HALIBURTON, F.S.A.

'In European Calendars, the last day of October, 'and the first and second days of November, are 'designated as the festivals of All Halloween, All 'Saints, and All Souls.

'Though they have hitherto never attracted any

'special attention, and have not been supposed to 'have been connected with each other, they origin-'ally constituted but one commemoration of three 'days' duration, known among almost all nations 'as "the Festival of the Dead," or the "Feast of '"Ancestors."

'It is now, or was formerly, observed at or near 'the beginning of November by the Peruvians, the 'Hindoos, the Pacific Islanders, the people of the 'Tonga Islands, the Australians, the ancient Per-'sians, the ancient Egyptians, and the northern 'nations of Europe, and continued for three days 'among the Japanese, the Hindoos, the Australians, 'the ancient Romans, and the ancient Egyptians.

'Halloween is known among the Highlanders by 'a name meaning the consolation of the spirits of 'the dead, and is with them, as with the Cinghalese, 'the Pacific Islanders, and almost every race among 'whom the festival is observed, connected with a 'harvest home, or, south of the equator, with a first 'fruits celebration. An old writer asks why do we 'suppose that the spirits of the dead are more abroad 'on Halloween than at any other time of the year? 'and so convinced are the Irish peasantry of the 'fact, that they discreetly prefer remaining at home 'on that ill-omened night. The Halloween torches 'of the Irish, the Halloween bonfires of the Scotch, 'the Coel Coeth fires of the Welsh, and the Tindle 'fires of Cornwall, lighted at Halloween, are clearly 'memorials of a custom found almost everywhere

'at the celebration of the festival of the dead. The 'origin of the lanthorn festival has never yet been 'conjectured. It will be found, I believe, to have 'originated in the wide-spread custom of lighting 'bonfires at this festival.

'The church of De Sens, in France, was endowed 'by its founder in the days of Charlemagne, for the 'purpose of having mass said for the dead, and the 'graveyard visited on All Halloween. Wherever 'the Roman Catholic Church exists, solemn mass for '*all souls* is said on the second day of November; 'on that day the gay Parisians, exchanging the 'boulevard for the cemetery, lunch at the graves of 'their relatives, and hold unconsciously their "feast '"of ancestors," on the very same day that savages 'in far distant quarters of the globe observe in a 'similar manner their festival of the dead.

'Even the Church of England, which rejects *All 'Souls*, as based on a belief in purgatory, and as being 'a creation of Popery, devoutly clings to All Saints, 'which is clearly a relic of primeval heathenism.

'On All Souls day, the English peasant goes '*a-souling*, begging for "a soul cake for all Christen '"souls." He has very little suspicion that he is 'preserving a heathen rite, the meaning of which is 'not to be found in the Book of Common Prayer, 'but (as I shall hereafter show) is to be discovered 'in the sacred books of India, in which country the 'consecrated cake is still offered, as it has been for 'thousands of years in the autumn, to the souls of

'deceased ancestors. But, though the festival of 'the dead is so generally observed in November, 'there are some exceptions. Thus it was observed 'in February by the Greeks, the Romans, the Per-'sians, and the Algonquins of America, and in 'August by the Japanese and Chinese. The traces 'of its being observed in May are very few, and 'those of its being held at any other times of the 'year are of exceedingly rare occurrence. Before, 'therefore, I can attempt to treat of the festival of 'the dead, or refer to its origin and history, and the 'influence it has exerted on ancient mythology, it 'is necessary to confine this paper simply to ques-'tions connected with the calendar, and the times 'when the festival is found to be observed. It is 'important to trace the ancient November festival 'to the primeval year, which must have fixed it in 'that month among races south, as well as north of 'the equator. This year, I believe I have succeeded 'in discovering; and, as it appears to have ori-'ginated in, or at least only now exists in, the 'southern hemisphere, I have designated it as 'the Primitive Southern year. It is also necessary 'to show that the festival of the dead, occurring in 'February or August, indicates a change having 'taken place, and a more recent year, commencing 'in February, having been substituted. As we only 'find this year north of the equator (so far as I have 'been able to learn), I have designated it as the 'Primitive Northern year.

'Wherever the festival occurs in November, it is, 'or at least originally was, the new year's festival 'of the primitive southern year. Where it is held 'in February, it is, or once was, the commemoration of the commencement of the northern year.

'As the mode of investigation pursued on this 'point materially adds to the credibility of my con- 'clusions, I may be pardoned for referring to it.

'The startling fact that "this feast was cele- '"brated among the ancient Peruvians at the same '"period, and on the same day that Christians '"solemnize the commemoration of the dead (2d '"November)," at once drew my attention to the 'question, *how was this uniformity in the time of 'observance preserved, not only in far distant 'quarters of the globe, but also through that vast 'lapse of time since the Peruvian, and the Indo- 'European first inherited this primeval festival 'from a common source?*

'It was plain that this singular uniformity could 'never have been preserved by means of the defec- 'tive solar year in vogue among ancient nations. 'How then could this result have been produced? 'It was apparent that the festival must have been 'regulated by some visible sign, or mark, that 'nature had supplied, such as the rising of some 'constellation.

'Remembering the ancient traditions as to the 'Pleiades, I naturally turned my attention to them. 'Professor How kindly offered to ascertain from an

'excellent astronomer whether the Pleiades could 'have ever risen in November in Asia or Europe. I 'was fortunately, however, able to save that gentle- 'man the calculation. On turning to Bailly's *Astro- 'nomie Indienne*, I found him state that the most 'ancient year, as regulated by the calendar of the 'Brahmins of Tirvalore, began in November, and I 'was much gratified at finding that, in that calendar, 'the month of November is called Cartiguey, *i.e.*, 'the month of the Pleiades,—a circumstance which, 'M. Bailly says, would seem to indicate that that 'constellation by its rising or setting in that month, 'must have regulated the commencement of the 'ancient year in November.

'But here a fresh difficulty arose as respects the 'calendar. To suppose that the Pleiades rose in 'that month, and commenced the year in the autumn, 'was not only opposed to ancient traditions respect- 'ing them, and to their name as the Stars of Spring '(*Vergiliæ*), but also to their actual movements, at 'the present day at least.

'We could not assume that great astronomical 'changes could ever have produced this result. How 'then could we account for the anomaly? I dis- 'covered the clue in extending my researches to the 'southern hemisphere, where I found the festival 'of the dead to occur in November, and to be the 'vernal new year's festival of a year commencing 'in November, and regulated by the rising of the 'Pleiades *in the evening*.

'Before concluding this prefatory paper, it may 'be as well to state that the whole subject, both as 'regards the primitive new year festival of the 'dead and the primitive year, has altogether 'escaped the observation of the learned. De 'Rougemont, in his *Peuple Primitif*, published at 'Paris in 1856, has, out of three volumes, not de-'voted as many pages to "Les Fêtes des Morts," 'though they are unquestionably the most remark-'able memorials we possess of *Le peuple Primitif*. 'Festivals connected with the seasons, he says, can-'not now be investigated, from our ignorance of the 'primitive calendar; and he therefore only selects 'those that took place at the time of the vernal 'equinox and the summer solstice, *i.e.*, associated 'with a solar year, and hence of a comparatively 'recent date, and subsequent to those of the two 'primitive calendars to which I have referred.

'The primitive year of two seasons, commencing 'in November, and the connexion of the Pleiades 'with the primeval calendar, are not even referred 'to in the latest work on the astronomy of the 'ancients, published last year in Paris. Though 'very many remarkable facts in the history of the 'calendar and of our race, to which the study of the 'festival of the dead has afforded me a clue, are 'referred to by Greswell in his learned works on 'the Calendars of the Ancients, he has attempted to 'explain them by resorting to the miracles in the 'Bible—as to the sun having stood still or gone

'back on certain occasions—events which he con-
'tends must not only have disturbed, but have even
'left their impress on the calendars of the ancients.
'But they are, I believe, capable of a more common-
'place solution.

'THE FESTIVAL OF THE DEAD BROUGHT TO EUROPE
'AND ASIA BY A MIGRATION OF RACES FROM THE
'SOUTHERN HEMISPHERE.

'"Who can restrain the sweet influences of the
'"Pleiades?" we are asked in the book of Job, the
'most ancient production of sacred or profane
'literature. "The lights in the firmaments of the
'"heavens," "for signs and for seasons, and for days,
'"and for years," are supposed to have reference to
'that constellation, as well as to the sun and moon,
'for in early ages neither the sun nor the moon
'could have indicated the length of the year, or its
'division into seasons. The extreme veneration of
'remote antiquity for the Pleiades, or *Ver*giliæ, for
'having marked the seasons, and the beginning of
'spring, are amongst the most venerable traditions
'of our race, and are now only realized among
'Australian savages, who still worship the Pleiades
'as announcing spring, "and as being very good to
'"the blacks;" and at their culmination hold a
'great new year's corroboree in November, in
'honour of the *Mormodellick*, as they call that time-

'honoured constellation. The name given to these 'stars by the Romans, *Vergiliæ*, is plainly con- 'nected with the strange tradition of Northern 'natives, of the Pleiades having marked the com- 'mencement of spring. They are popularly known, 'from France to India, by the same name—a cir- 'cumstance which proves, says M. Bailly, that our 'first knowledge of these stars was derived from 'the most ancient nations of Asia.

'The question naturally suggests itself, Whence 'arose this veneration for a constellation, that 'among us, at least, is no longer reverenced? 'When and where can they have marked the begin- 'ning of spring, and what were those "sweet in- '"fluences," referred to in the book of Job, and still 'celebrated by Australian savages?

'So far from rising in Europe or Asia in the 'spring, they first appear in June, a summer month. 'How could the *Ver*giliæ, then, have acquired their 'name, as the stars of spring? It is plain that 'they could not have marked a vernal commence- 'ment of the year, *as the most ancient year com- 'menced in the autumn*, and among most ancient 'nations we find traces of a traditionary or civil 'year commencing in the autumn.

'We also find traces of a very singular year of 'six months, the very existence of which Sir Corne- 'wall Lewis has somewhat hastily questioned. '"These abnormal years," he tells us, "are desig- '"nated by Censorinus as involved in the darkness

'"of remote antiquity." Dupuis suggests that we 'must turn to the Pleiades, as well as to other con-'stellations, to account for these "abnormal years," 'as well as for the ancient year commencing in the 'autumn,—"pour expliquer les fictions relatives à '"ce commencement d'année, soit chez les Juifs, soit '"chez les autres peuples, qui ont eu le commence-'"ment d'année en automne. Tels étaient ceux qui '"avaient des années de six mois." In confirma-'tion of this conjecture, I have found that in the 'Arabian calendar of lunar mansions, which is made 'up of two divisions, one belonging to summer, and 'the other to winter,—one of the mansions is 'designated by the name of the Pleiades. Let us 'see if this suggestion will prove equally correct 'respecting the autumnal year; and let us endea-'vour to find in that constellation a clue to the re-'markable circumstance of the festival of the dead 'having been observed in Hindostan, Peru, Ceylon, 'Egypt, and Europe, in November.

'I may here state that the classical nations of 'antiquity, with whom the influence of the Pleiades 'was rather a matter of tradition than of practical 'use, when they spoke of the rising of the Pleiades, 'referred to the heliacal rising of the constellation 'in the morning, *i.e.*, the time, when at dawn, the 'stars were first visible—

> "The grey dawn and the Pleiades
> Shedding sweet influence."

'This took place in the middle of May, 2000

'years ago, and marked the beginning of summer 'in the south of Europe and Asia. But we must 'conclude either that the Pleiades must have once, 'in some other manner than by their heliacal 'rising, indicated the beginning of spring, or else 'that there must have been, by a long lapse of 'years, a change in their movements, that rendered 'their rising inconsistent with their very name as 'the stars of spring. It must, however, have been 'nearly 5000 years since the heliacal rising of the 'Pleiades occurred at the beginning of April, and 'even then it could not have indicated the com-'mencement of seed-time in the south of Asia and 'of Europe, or marked the beginning of spring. 'Their name, the *Hesperides*, too, would seem to 'connect them with the evening rather than the 'morning. But if, at such a remote era, the Plei-'ades regulated the seasons by their heliacal rising 'at that time of the year, they must have left their 'impress on primitive calendars, and traces of the 'connexion of the calendar with the heliacal rising 'of the Pleiades, would still be found among many 'races, either in their names for March or April, or 'at least in their traditions as to the time when 'their year once commenced. But this is not the 'case. There are no traces of a primitive year in 'general use in remote antiquity, commencing in 'March, April, or May; the only apparent exception 'being the solar year, regulated by the vernal equi-'nox, which was of comparatively recent invention.

'But on examining the calendars of ancient 'races, we find in Persia, India, Egypt, and Peru, 'that the month in which our first of November 'festival would fall, bears in its very name a singu-'lar impress of its former connexion, either with 'the Pleiades or the festival of the dead.

'In the most ancient calendar in India, the year 'commenced in the month of November, which 'bears the name of Cartiguey, *i.e.*, the Pleiades; a 'constellation which, Bailly suggests, must by its 'rising or setting at that time, once have regulated 'the primitive year. We find also that, in the 'month of October the Hindoos, like ourselves, have 'three days which are connected with the festival 'of the dead.

'In the ancient Egyptian calendar the same re-'semblance can be traced between the name of the 'Pleiades, which among the Hebrews and Chaldeans 'is Athor-aye, with that of the Egyptian month of 'November, which is Athor. The Arab name for 'the Pleiades, Atauria, also suggests a resemblance.

'In November took place the primeval festival of 'the dead, clad in a veil of Egyptian mythology. 'In the Isia, the solemn mourning for the god Osiris, '"the Lord of Tombs," lasted for *three* days, and 'began at sunset, like the Lemuria of the Romans, 'and the festival of the dead among the Persians 'and other nations.

'The singular custom of counting the day from 'the sunset of the preceding day, or the nocti-

'diurnal system, was so universal, that Greswell 'refers to it as a conclusive proof of the unity of 'origin of our race. The Bible tells us "the even- '"ing and the morning were the first day." Our 'words "fortnight" and "se'nnight," are traces of 'this primitive custom. But the first day of our 'festival of the dead, is a still stronger illustration, 'as it is called Hallow*eve*. The origin of this custom 'has not been explained by Greswell. Volmer 'connects it with the word *Athor*, which means '"the night;" and which he therefore supposes re- 'presented the first evening of creation. But the 'most important night, not only in that month, but 'in the whole Egyptian year, was that of the 17th 'of Athyr, when the three days of mourning for 'Osiris (*i.e.*, the festival of the dead) began with an '*All Halloweve*. Hence the origin of this wide- 'spread noctidiurnal system is to be found in what- 'ever caused the festival of the dead to commence 'at sunset, or with a Hallow*een*.

'Let us turn to the primitive races of the south- 'ern hemisphere to find a solution :—

'1*st*, For the festival of the dead being connected 'with an agricultural celebration. 2*d*, For its being 'held in November. 3*d*, For its commencing with 'a Halloweve. 4*th*, For the primitive year com- 'mencing in November. 5*th*, For the Pleiades 'being connected with that month. 6*th*, For their 'being reverenced as the *Ver*giliæ and Hesperides, 'the stars of the spring and the evening. 7*th*, For

'the "abnormal year" of six months, found north 'of the equator.

'We find that, among these southern races, when 'the Pleiades are in the evening first visible at the 'horizon, which is at the beginning of November, 'they mark the beginning of the year, and the 'vernal new year's festival, a feast consecrated to 'first fruits, and to the dead. As long as at evening 'they continue visible, they mark a season called '*the Pleiades above*. When they cease to be visible 'in the evening, the second season commences of '*the Pleiades below*: these seasons nearly equally 'dividing the year. Hence we can understand 'why tradition has connected the Pleiades with 'November, as the first month of the year, has pre-'served their name as the stars of the evening and 'of the spring, and has caused the festival of the 'dead to commence in the evening, or with a Hal-'loween. We can also understand how the year of 'six months arose, that has so puzzled astronomers.

'In the voluminous report on the Aborigines, by 'a Committee of the Legislative Council of Victoria, 'Session 1858-9, we find W. Hull, Esquire, J.P., 'a gentleman who has written a work on the Ab-'origines, stating "their grand corroborees are held '"only in the spring, when the Pleiades are gene-'"rally most distinct; and their corroboree is a '"worship of the Pleiades as a constellation, which '"*announces spring*. Their monthly corroboree is '"in honour of the moon" (p. 9).

'In another place Mr. Hull says, "Referring again
'"to their worship of the stars, I may mention that
'"one night I showed Robert Cunningham the
'"Pleiades, and he said 'they were the children of
'"'the moon, and very good to the black fellows,'
'"—a remark that recalls to our mind 'the sweet
'"'influences of the Pleiades.'"

'C. J. Tyers, Esq., Commissioner of Crown Lands,
'Alberton (p. 79), says in confirmation of the fore-
'going,—"Regarding their religious practices very
'"little is known, so little that Europeans generally
'"believe them to be devoid of any. Yet they do,
'"according to their manner, worship the hosts
'"of heaven, and believe particular constellations
'"rule natural causes. For such they have names;
'"and *sing and dance to gain the favour of the*
'"*Pleiades* (Mormodellick), the constellation wor-
'"shipped by one body as the giver of rain." Now
'the Pleiades are most distinct at the beginning of
'the spring month of November, when they appear
'at the horizon in the evening, and are visible all
'night. Hence their vernal festival of the Pleiades
'takes place in honour of the Vergiliæ, the stars of
'spring, at the beginning of November, the very
'month called in the calendar of the Brahmins of
'Tirvalore, the month of the Pleiades, and among
'the ancient Egyptians connected with the name of
'that constellation.

'But we are told by another gentleman examined
'by the committee, that all the corroborees of the

'natives are connected with a worship of the dead, 'and *last three days*. If this be the case, is it not 'somewhat startling to find that Australian savages, 'at or near the time of Halloween, All Saints, and 'All Souls, also consecrate three days to the 'memory of the dead, as a vernal new year's cele- 'bration, regulated by the time-honoured Pleiades, '—and, like the northern festival of the dead, be- 'ginning in the evening, or with a Halloween?

'In the Tonga Islands, which belong to the Fee- 'jee group, the festival of Inachi, a vernal first 'fruits celebration, and also a commemoration of 'the dead, takes place towards the end of October, 'and commences at sunset.

'"The Society Islanders," Ellis tells us, "divided '"the year into two seasons of the Pleiades or '"Matarii. The first they called the *Matarii i nia*, '"or the *Pleiades above*. It commenced when, in '"the evening these stars appeared at or near the '"horizon" (*i.e.*, at or near the beginning of No- 'vember), and the half-year during which, imme- 'diately after sunset, they were seen above the 'horizon, was called *Matarii i nia*. The other 'seasons commenced when at sunset these stars are 'invisible, and continued until at that hour they 'appeared again above the horizon. This season 'was called *Matarii i raro, i.e.*, "*the Pleiades* '"*below*." The Pleiades are visible at the horizon 'in the evenings at the beginning of November. 'They then culminate near midnight, and are

'visible till morning. Ellis says that this year 'began in May; but it is evident that what he calls 'the first season, "the Pleiades above," commenced 'at or near the beginning of November, and the 'second division must have begun towards the end 'of April, or early in May. If they appear at the 'horizon in the evening, on the 5th November, they 'continue visible at that time till the 24th April fol- 'lowing. But, not only was the month of November 'connected with the rising of the Pleiades, but also 'with a festival of the dead, and a first fruits cele- 'bration, as among the people of the Tonga Islands.

'"The most singular of their stated festivals was '"the ripening or completing of the year. Vast '"numbers of both sexes attended it; the women, '"however, were not allowed to enter the sacred '"enclosure. A sumptuous banquet was then held. '"The ceremony was viewed as a *national acknow-* '"*ledgment to the gods.* When the prayers were '"finished, and the banquet ended, a usage prevailed '"*resembling much the Popish custom of mass for* '"*souls in purgatory.* Each one returned to his '"home or family marae, there to offer special prayers '"for the spirits of departed relatives." Ellis does 'not tell us to what mode of dividing the year he 'refers (for they appear to have had three); but, as 'the feast of Alo Alo in the Tonga Islands, as well 'as the festival of the Pleiades in Australia, took 'place in November, we may assume that this was 'the new year's festival of the season of the Pleiades.

'Let us turn from the Islands of the Pacific to 'Peru, and there we find the primitive calendar 'of two seasons marked by a new year's festival of 'the dead, occurring in November, and celebrated 'at precisely the same time as in Europe and 'Polynesia.

'The month in which it occurs, says Rivero, "is '"called Aya-marca, from *Aya*, a corpse, and '"*marca*, carrying in arms, because they celebrated '"the solemn festival of the dead, with tears, lugu-'"brious songs, and plaintive music; and it was '"customary to visit the tombs of relations, and to '"leave in them food and drink. *It is worthy of* '"*remark that the feast was celebrated among the* '"*ancient Peruvians at the same period, and on* '"*the same day, that Christians solemnize the com-*'"*memoration of the dead* (2d November)."

'Finding the festival held at the beginning of 'November, I felt convinced that it never could 'have been fixed in that month by a solar year, 'such as was in use in Peru, but that it must have 'been originally the new year's festival of the year 'or seasons of the Pleiades, that must have once 'been in use in that country. Subsequent investi-'gations bore out the conclusion.

'Rivero tells us that in November took place the 'termination of the year and of seed-time. Garci-'lasso bears distinct testimony to the existence of a 'traditionary year of seasons.

'"Yet, for all this sottish stupidity, the Incas

'"had observed that the sun accomplished its
'"course in the space of a year, which they called
'"*huata*; though the commonalty *divided it only*
'"*by its seasons*, reckoning their year to end or be
'"finished with their harvest" (*i.e.*, in May).

'Here we have the year ending with the months
'of November and May, a plain proof that the
'Southern year of the Pleiades ending in November
'and May, must have existed there before the Incas
'invented or introduced the solar year, and must
'have been the seasons referred to by Garcilasso.
'As the festival of the dead is, however, the new
'year's festival of the year of the Pleiades, we may
'assume that it must have, in Peru, originally
'marked the commencement of the year at the
'beginning of November. Wherever the festival of
'the dead occurs in November, even among nations
'now far north of the equator, the same inference
'may, I believe, be adduced. The race by whom it
'is preserved must have once regulated that festival
'in November, by the rising of the Pleiades, like
'the Australians.

'In Persia, we find a singular light thrown on the
'calendar by the festival of agriculture and of death
'celebrated south of the equator. In the ancient
'calendar, November was consecrated to the angel
'who presided over agriculture and death. We have
'seen that the month in which this festival occurred
'in Peru, was called "the month of carrying corpses."
'The month of November was formerly called in

'Persia Mordad, the month of the angel of death. 'In spite of the calendar having been changed, the 'festival of the dead took place at the same time as 'in Peru, as a new year's festival (although the year 'no longer commenced then). It is called by some 'writers the *Nouruz of the Magi*, because the Magi 'still adhered to the primitive new year's festival. 'It commenced in the evening with a Halloween, 'which was regarded as peculiarly sacred. Unde 'hujus diei *Vespera* quibusdam Persarum, peculiari 'nomine signatur Phristâph. Bonfires are lighted 'at this festival as they are in Britain, and in most 'portions of the globe, at this season of the year.

'In Ceylon, Sir Emerson Tennent says, a festival 'is held that is a species of a harvest home and a 'commemoration of the dead. It must, however, be 'rather a first fruits celebration, like that of nations 'south of the equator, as the harvest is over in May 'or June. This festival of agriculture and of death 'takes place at the beginning of November.

'We now turn to Mexico, and there we find that 'the great festival of the Mexican cycle was held on 'the 17th of November, and was regulated by the 'Pleiades. It began at sunset; and *at midnight* as 'that constellation approached the *zenith*, a human 'victim, Prescott says, was offered up to avert the 'dread calamity which they believed impended over 'the human race. This belief was so remarkable 'that I cannot omit a reference to it here. They 'had a tradition that at that time the world had

'been previously destroyed; and they dreaded lest 'a similar catastrophe would, at the end of a cycle, 'annihilate the human race.

'Now it is most remarkable to find that the Egyp- 'tians, with their Isia, or new year's festival of agri- 'culture, and of the dead, that took place on the '17th day of November, associated traditions as to 'the deluge, and it is still more surprising to find 'that the 17th day of November is the very day on 'which, the Bible tells us, the deluge took place.[1]

'Greswell has devoted several chapters, and much 'learning, to the 17th day of November (Athor), to 'show how remarkable a landmark it has always 'been, through a long lapse of centuries, for the cor- 'rections of the Egyptian calendar, and he derives 'from it some curious arguments in support of his 'views. De Rougemont and other writers have

[1] 'While the above was going through the press, as I was convinced 'that the memory of the deluge had been thus preserved among the 'Hebrews, Egyptians, Greeks, and Mexicans, in the traditions con- 'nected with the new year's festival, and that the date of the com- 'mencement of the deluge, the 17th day of the first month, of the 'primitive year, was not of an historical but of an astronomical 'character, I most closely examined the Mosaical account of the 'deluge, and found my conjecture singularly verified. The deluge 'commenced on the 17th of the second month of the Jewish year (*i.e.*, 'November); the ark rested on Mount Ararat on the 17th day of the '7th month; and the dove returned with the olive branch on the 17th 'day of the 11th month. Though the connexion of this with the 'traditions and calendars of heathen races is somewhat startling, I am 'convinced that should the study of *Ethology* afford a clue to the 'primeval origin of pagan idolatry, it will at the same time conclu- 'sively prove how entirely different and distinct must have been the 'source from which the Hebrews derived the great truths and princi- 'ples of our religion.'

'referred to this day, but have thrown no light upon 'it. They seem, however, not to have observed that 'even among the Persians the same day was pecu- 'liarly venerated. Hyde says that in the ancient 'Persian calendar the 17th day of November was 'held so sacred, that all favours asked of rulers were 'granted on that day; but why it was so venerated 'he does not attempt to conjecture. Even tradition 'has been unable to preserve the history of this day; 'that must be sought for in the very earliest ages 'of the world, or among the rudest existing types of 'man. In the mysteries of Isis, the goddess of 'agriculture and of death, the funereal part of the 'ceremonies, the lamentations and search for Osiris 'commenced on the 17th and ended on the 19th. 'There was also a Julian year of the Egyptians, 'which commenced, Greswell says, on the 18th of 'November.

'Herodotus tells us, that Isis is the same as the 'Greek goddess Ceres, who, with her daughter Pro- 'serpine, presided over agriculture and the dead.

'Among the Greeks, besides existing in other 'ceremonies, the primeval festival of the dead 'appears under a veil of mythology in all the 'ancient mysteries, but above all in the greatest of 'them, the Eleusinian. The Attic Anthesteria and 'the Roman Feralia were funereal celebrations, and 'held on the 17th, 18th, and 19th of February. 'We may therefore assume, that as the lesser Eleu- 'sinian mysteries, which were sacred to Proserpine

'alone, were celebrated in that month, they were 'held on these ill-omened days.

'The Macedonians retained the primitive year 'beginning in November. It is peculiarly interest- 'ing to note that with the festival of the dead, the 'tradition as to the deluge was also transferred by 'the Athenians to the 17th day of February. Even 'in some other months, the 17th seems to have been 'a conspicuous day in the Greek calendar. In Per- 'sia, in every month, there were three days of fast- 'ing and sadness; but as the 17th and 18th days 'were *dies nefasti*, on which no work was done, we 'may assume that the 19th was the *ultima dies* '*placandis manibus*, and that the 17th, 18th, and '19th were the days of mourning. In Europe, 'Asia, and Africa, we find days in every month 'consecrated to the memory of the dead.

'Let us now look south of the equator for an ex- 'planation: 1*st*, Why the 17th, 18th, and 19th of 'the month were so funereal. 2*d*, Why the primi- 'tive year of the Egyptians and of other races, and 'their funereal mysteries, once began on the 17th 'day of the month. 3*d*, Why, not only at every 'new year's festival, but even monthly, the dead 'were commemorated.

'Almost all savage races, like all nations of re- 'mote antiquity, regulate their months by the new 'or the full moon, and hold festivals of a funereal 'character at the time of the new moon, or when 'the nights are darkest.

'The Australians not only hold an annual corro-
'boree of the Pleiades, but also a monthly corro-
'boree of the moon, apparently connected with a
'dread of ghosts, or a worship of the dead. They
'regulate their months by the full moon. The
'Hindoos offer in every lunar month, on Mahacala,
'the day of the conjunction, and defined as "the
'"day of the nearest approach to the sun," "obse-
'"quies to the manes of the *pitris*, or certain pro-
'"genitors of the human race, to whom the *darker*
'"fortnight is *peculiarly sacred*." Sir William
'Jones also says, referring to a Hindoo work, "Many
'"subtle points are discussed by my author con-
'"cerning *the junction of two*, or even *three lunar*
'"*days in forming one fast* or *festival*."

'The Chinese, the Africans, the Caribs, and other
'races of America, the Greeks, the Romans, and
'almost all ancient nations, kept a commemoration
'of the dead in the dark nights of the moon.

'Here we have an explanation for a monthly
'commemoration of the dead, but why were the
'17th, 18th, and 19th days of each month, among
'some races, especially of a funereal character?
'Ellis tells us that the Society Islanders regard the
'17th, 18th, and 19th nights of the moon, as sea-
'sons "when spirits wander more than at any other
'"time," a plain proof that even among the Pacific
'Islanders, three days, in every month, must have
'been consecrated to the dead, as to this day, it
'is still believed in Britain, that on Halloween,

'when the festival of the dead once commenced,
'"the spirits of the dead wander more than at any
'"other time of the year." "This is a night when
'"devils, witches, and other mischief-making be-
'"ings, are all abroad on their baleful midnight
'"errands."

'But the question arises, How came the beginning
'of the year to be, among some nations, on the 17th
'day of the month? The explanation, I think, is
'plain. The Chinese, the Hebrews, and other races,
'regulated the beginning of the year at the time of
'the new moon, *i.e.*, at the time of the festival held
'in the dark nights of the moon. With many
'races, the 17th, 18th, and 19th days after the full
'or the new moon, were evidently regarded as pecu-
'liarly sacred to the dead, and were the monthly
'days of rest or the monthly *sabbath* of heathen
'races.

'Our own mode of regulating Easter, will serve
'to explain the commencement of the ancient year.
'The Common Prayer-book says: "Easter-day is
'"always the first Sunday after the full moon which
'"happens upon or next after the 21st day of
'"March." But the Hebrews probably substituted
'four sabbaths in place of one monthly time of rest,
'and used the vernal equinox, instead of the rising
'of the Pleiades, to regulate their Passover. Let
'us substitute the monthly festival of the dead for
'the word Sabbath, and the rising of the Pleiades
'for March 21, and we read, "New Year's day is

'"always the monthly sabbath, which happens upon
'"or next after the culmination of the Pleiades at
'"midnight." But as this would occur near the
'month of November, we can understand that when
'the months ceased to be lunar, and their festivals
'"moveable," the new year's festival would, for some
'time at least, continue to be held on the 17th day
'of the first month, and that the 17th, 18th, and
'19th days of every month would still appear in
'ancient calendars as funereal days. We can also
'understand that a traditionary veneration for the
'17th day of the month, especially of November,
'would long continue, like some old sea-margin, to
'show the changes which time had effected; and
'that the new year's festival of the dead, preserved
'in the mysteries of Isis, would long be held on the
'17th, 18th, and 19th nights of the first month of
'the primitive year, though no longer those dark
'nights of the moon, in which the spirits of the
'dead are wont to wander forth from their Maraes
'and their temples to receive the offerings of their
'trembling worshippers.

'Among the Romans we find a trace of a partial
'observance of the festival of the dead in November.
'They seem however to have borrowed their Feralia
'or festival of the dead, from the Athenian Anthe-
'steria, as they were both held on the 17th, 18th,
'and 19th of February. The more ancient institu-
'tion was the Lemuria, or festival of the ghosts,
'celebrated in May—a month, therefore, so unlucky

'that no marriage took place in it. Ovid and Gres-
'well both agree as to the antiquity of the Lemuria.
'It is evident that this festival, transferred from
'November to May, was originally regulated by the
'heliacal rising of the Pleiades in the morning.
'Yet the offering to the spirits took place at mid-
'night, a time when that constellation was invi-
'sible. What can have made that hour so peculiarly
'marked?

"Non hæc Pleiades faciunt, nec aquosus Orion."[1]

'Greswell connects this circumstance with the
'November festival of the Aztecs, which *com-*
'*menced in the evening*, and in which *midnight*
'was the hour of sacrifice. From this he infers
'that the calamity commemorated was the event of
'the sun going back ten degrees in the days of
'Hezekiah. His remarks as to the Aztec festival
'supply a clue to the fact that the Lemuria must
'have been moved from November to May, from
'the month when the Pleiades rose in the evening
'and culminated at midnight, to May, when they
'were invisible till early dawn.

'Before concluding this necessarily superficial
'sketch of this primeval new year's festival, a
'subject respecting which scores of volumes might
'be written, I must turn to Britain to see if we have
'among us any traces of this primitive year, or
'seasons of the Pleiades. That it did exist among

[1] 'Propertius II. 16. 51.'

'the Celtic race, has long been known to those who 'have studied its history and customs. Wylde says, '"the first great division of the year was into '"summer and winter, Samradh and Geimradh, '"the former beginning in May or Bealtine, and the '"latter in November, the Samhfhuim, summer end. '"On the first of May took place the great Druid '"festival of Beal or Bel, and at the beginning of '"November, All Halloweven;" and it is strange 'that both the eve of May day, and Halloween, are 'ill-omened nights, on which prudent persons in 'Ireland, from fear of encountering fairies and 'ghosts, avoid being out after dark.

'Classical writers of antiquity tell us that in 'Britain, Ceres and Proserpine were worshipped in 'the same manner as in the mysteries of the Cabiri. 'Now we have seen that Proserpine and her mother 'Ceres, are really the same deities, both being con-'nected with agriculture and the dead. In Sicily, 'Ceres was worshipped in May, and Proserpine in 'the autumn.[1] The latter was called Core, or the 'damsel. Are there any traces of her still in 'Britain? It is manifest that the May queen, and

[1] 'The marriage of Proserpine, who was "in autumn wed," must 'have been almost simultaneously celebrated with that of the Core of 'the South. But the myth of the appearance and disappearance of 'Proserpine merely typified the appearance and disappearance of the 'Pleiades. For three days at the Thesmophoria Ceres mourns for her 'daughter, who for six months is visible on earth, and for the rest of 'the year is compelled to reign with Pluto in hell. Dupuis shows 'clearly that the story had some reference to Taurus. But as Ceres

'the Kernbaby of the harvest home, are either relics 'of this deity, or the origin of the myth. But we 'have evidence that they are as old, if not older, 'than Proserpine herself. In the Tonga Islands, at 'a first fruits celebration, a child presides as a sort 'of Southern queen of the spring, a November 'queen, if I may give her a new title.

'The Tow Tow, a species of first fruits celebration, 'takes place "at the time when the yams are ap- '"proaching maturity, *in the early part of Novem-* '"*ber*," when prayers are offered up to A'lo A'lo, 'the god of weather. Mariner, in describing it, 'says, "A deputation of nine or ten men from the '"priests of A'lo A'lo, all dressed in mats, with green '"leaves round their necks, arrives with a female '"child, to represent *the wife of A'lo A'lo.*" They 'offer up a prayer for a fruitful season to the god, 'and then divide the provisions collected for the 'occasion. One pile being assigned to A'lo A'lo, 'and to other gods. Mariner tells us that "she is '"selected from the chiefs of the higher ranks, and '"*is about eight or ten years old;* during the eighty '"days of this ceremony, she resides at the conse- '"crated house of A'lo Al'o, where, a day before the

'was comforted by *Hesperus*, and by *certain stars* seen by her *in the* 'evening, the appearance of Proserpine must originally have meant the 'beginning of "the Pleiades above," which commenced when those 'stars were first visible at the horizon in the evening. In Novem- 'ber the great festival of the Pleiades is still celebrated by the Aus- 'tralians. The fact that there was a temple in Sicily in which Ceres, 'Proserpine, and the Pleiades were jointly worshipped, confirms my 'view of this strange myth.'

'"ceremony, a cava party is held, at which she
'"presides, as well as at a feast which follows. She
'"has nothing to do on the actual days of the cere-
'"mony, except to come with the deputation and
'"to sit with them." Here, then, we have, south of
'the equator, a "queen of the May," or a *Kernbaby*,
'whichever we may call her. But in China, Core,
'or the damsel, assumes more distinctly the funereal
'character of Proserpine. At the festival of the
'dead, a child presides, who receives the offerings
'made to deceased ancestors. In the South, she is
'the wife of A'lo, the god of weather, but in Grecian
'mythology, she is "in autumn wed" to Pluto, the god
'of the dead; and in Egyptian fables, she is doomed,
'at the November festival of the new year, to mourn
'Osiris, the God of Agriculture and "the Lord of
'Tombs." It would be strange, if, in the half-naked
'little Feejee savage, the wife of A'lo, we should find
'a clue to her, who was "the ancient goddess" in
'the days of the Patriarchs, and whose statues bore
'the inscription, "I am all that has been, that shall
'"be; and none among mortals has hitherto taken
'"off my veil."

'Such then, north of the equator, are the scat-
'tered fragments of, what we can only regard as the
'wreck of the primitive Southern year, and of its
'new year's festival of first fruits, and the dead.
'I have endeavoured to collect together these *disjecta*
'*membra*, diffused and hitherto lost in vague myths,

'confused calendars, uncertain traditions, and ob-
'solete customs. Yet, in the New, as well as in the
'Old World, civilized and savage races gaze with
'equal wonder on the memorials, that everywhere
'exist, of the observance of this festival by primeval
'man. In the large deposits of ashes, and of the
'remains of food, found in vast burial tumuli in
'Australia, America, and Asia, the graves of races
'long extinct, we have significant evidence of this
'new year's commemoration dating back to the most
'remote ages; while even at the burial cave at
'Aurignac, to which an antiquity of not less than
'8000 (?) years is assigned by some authorities, we
'have the same memorials of the feasts and fires of
'this ancient festival. Its memory has long been
'forgotten. Preserved only in the rites of heathen
'races, or merely lingering, among civilized nations,
'in the customs and superstitions of the peasantry,
'this festival has never been considered worthy of
'the attention of the historian or of the ethnologist;
'and this paper is the first attempt that has been
'made to throw any light on its history or its
'origin.

'I have restricted my remarks to such points as
'connect it with a year commencing in November,
'a branch in itself far too extensive for the space at
'my disposal. My next paper will show the light
'which this festival, occurring in February, throws
'on the primitive northern year; and my third will
'be devoted to a far more interesting and easier

'branch of inquiry, as to the prime origin of this 'festival of the dead, and the influence it has ex- 'erted on the idolatry, the mythology, and the 'religious rites of all ancient nations,—an influence 'even still discernible in the customs and modes of 'thought of civilized nations.

'That, from Australia to Britain, we have all in- 'herited this primitive year and its new year's 'festival, from a common source, is plainly manifest. 'Was it carried south by northern nations; or, has 'there been a migration of southern races to northern 'latitudes?

'That the "Feast of Ancestors," which still lingers 'in our All Halloween, All Saints, and All Souls, is 'the same as the *Inachi* of the south, and was 'originally the new year's festival of a primitive 'year commencing in November, is a matter, which 'can, I believe, be established beyond any question; 'but in what part of the world it first originated, is 'necessarily, with me, a matter of vague conjecture 'only, especially with the limited materials I possess 'respecting the festivals of southern races. The 'fact, that the year of the Pleiades, as well as the 'ancient reverence for that constellation, only now 'exists south of the equator, is, however in itself 'very significant.'

Mr. Haliburton is at some pains in pages which follow, to show that the Pleiades year, and probably the human race too, originated in the isles of the Southern ocean, and came thence by ship to the Northern hemisphere of the world. And he considers this less extravagant as a scientific theory, than for another author to recur to a

miracle affecting the seasons by six months,—in order to explain why, when we know that the Pleiades culminate at midnight in November, or the autumn of the Northern hemisphere,—they should yet have names and traditions connecting them with spring. But there is an easier method still of explaining the anomaly.

For, *first*, the Latin name of the Pleiades, or 'Vergiliæ,'—though by the classics connected with *Ver*, spring, is shown by the author of *Mazzaroth, or the Constellations*, on going to the roots of the words in languages earlier than the classics, to have nothing to do with 'spring,'—but with 'a turning round a centre.'

And *second*, many of the accompaniments of spring in high latitudes are found to affect the autumn in low latitudes, though keeping in the Northern hemisphere all the time. Thus, in the latter parallels, especially in very dry situations,—it is only when the sun goes low down to the south, and rains commence in autumn,—that the grass begins to grow, sheep to get fat, and small farmers venture to kill an ox, and feed on beef. Nay, even with some of the trees of these countries, the droughts of spring and summer are their period of almost deadly rest; and the winter their time of vigorous growth: so that, while the Usbekeeah square in Cairo was in magnificent vegetation when we were there in December 1864,—its numerous Locust acacia trees were nearly denuded of leaves, and were waving little more than 'iron boughs,' in the hot sand-winds, when we returned there in the beginning of May 1865.

This one difficulty, too, of *some* Northern *May*, or spring, accompaniments being compatible with the month of *November* in Egypt, Arabia, Shinar, and India, having been got rid of,—all the other traditionary notices and nominal distinctions of the Pleiades year are eminently suitable to its occurrence, for men of the Northern hemisphere, in the autumn, as regards all the circumstances of the *Sun*. For, as Mr. Haliburton well shows, while the primitive day began with sunset, and 'the evening and the morning,' not 'the morning 'and evening,' were 'the first day,'—so did the year begin with the autumnal decadence, or annual-evening declension of the sun; and the autumn night of the Pleiades culminating at midnight, in November,—or, for 4000 years ago say rather in September,—became 'the 'mother night of the year.'

There are, moreover, besides the above, some very simple facts connected with a certain *relative* alteration of sidereal chronology by the amount of six months, which seem fully able to explain the origin of many of the strange traditions from very early times, as to an actual alteration of the seasons having once taken place rather suddenly. But that subject will be treated of again in chapter viii. and Division III. of volume iii.

ADDENDUM I.

'The necessity of compressing the subject into 'such narrow limits, has rendered the following 'additional remarks unavoidable, in justice to a 'branch of inquiry, of which I feel I have given a 'most imperfect outline.

'Since the publication of the foregoing paper on 'the Festival of the Dead, Mr. William Gossip, the 'Secretary of the Nova Scotian Institute, has drawn 'my attention to the Rev. William Chalmers' re-'marks as to the existence of the year of the 'Pleiades among the Dayaks of Borneo. The facts 'mentioned by him, in addition to others which I 'have recently discovered respecting the Fiji and 'the Sandwich Islands, almost settle the point, that 'the identity in the November festival of the south 'with that of northern nations, cannot possibly be 'accidental; and confirm my conjecture as to the 'probability of the year of the Pleiades, and the 'new year's festival of first fruits and of the dead, 'being found to exist throughout the islands of the 'Pacific, and of the Indian Archipelago.

'We have seen that, north of the equator, in 'Hindostan, Persia, and Egypt, November was con-'nected by its very name, either with the Pleiades, 'or with the festival of first fruits and of the dead. 'The Bœotians designated it the month of Ceres. 'Even many of the northern nations of Europe,

'though they appear to have, thousands of years 'ago, transferred "the mother night," and the begin-'ning of the year, from Halloween to Yule, retained 'traces of the ancient year, not only in the festivals 'of All Halloween, All Saints, and All Souls, but 'also in the very name of November, which was 'called among the Anglo-Saxons, the Dutch, the 'Danes, and the Swedes, the *month of blood* or of '*sacrifice*.

'South of the equator we have seen that the 'month of November is also connected either with 'the Pleiades or with the new year's festival of agri-'culture and of the dead. In Peru it was called '"the month of carrying corpses." In Australia, in 'November takes place the festival of the Pleiades: 'at which time is held, in the Tonga or Friendly 'Islands, the feast of Alo Alo, the God of Agricul-'ture, who is wedded to the little damsel, the 'November Queen of the Spring.

'The Fiji Islands, though peopled by a Melane-'sian race, almost form part of the Friendly Islands, 'and the manners and customs of the inhabitants 'of the two groups are strikingly similar, and in 'many respects resemble those of the natives of 'Australia, from which those islands are not far 'distant.

'Among the Fijians, the Australians, and the 'Friendly Islanders, we find, connected with No-'vember, the rude outlines and elements of almost 'all the myths and traditions associated by northern

'nations with that month, most of which have 'hitherto never been satisfactorily explained.

'No solution has yet been found for that strange 'myth of the Egyptians, almost the basis of their 'religion, viz., that in November Osiris, the God 'of Agriculture and "the Lord of Tombs" comes 'from the world of spirits, and is restored to his 'sorrowing spouse. Nor has any explanation been 'given for the Autumn festival among the Greeks, 'in which the rape of Proserpine, or the marriage 'of that Goddess "in autumn wed" to the God of 'Hell, was celebrated at the time of the acronycal 'rising of the Pleiades. No clue has been supplied 'to the belief of the ancient Persians, that winter 'comes up from hell at the beginning of Novem-'ber, "the month of Death" (Morâd), which is also 'known among the Arabs as Rajeb ("the Month of 'Fear").

'The festival of Kali the goddess of death, and 'the spouse of Siva, "the destroyer," takes place in 'Hindostan in November (the month of the Plei-'ades). Both of them, like Osiris, "the Lord of '"Tombs," are honoured as "delighters in ceme-'"teries," the goddess, like the wife of Alo Alo, 'being represented by a little girl. The explana-'tion of these myths will be found in the new year's 'festival of first fruits and of the dead, among the 'races of the far South.

'The Fijians, like the ancient Greeks and the 'Egyptians, believe that *in November a god comes*

'*up from the infernal regions.* He is named Ra-
'tumaimbulu, and is, like Osiris, Kali, and Proser-
'pine, a deity presiding over agriculture—and "a
'"god of great importance in Fiji, as he causes the
'"fruit trees to blossom, and on him depends the
'"fruitfulness, or otherwise, of the seasons. There
'"is a month in the year, about November, called
'"Vula i Ratumaimbulu (the month of Ratumaim-
'"bulu). *In this month the god comes from Bulu,*
'"*the world of spirits,* to make the bread-fruit and
'"other fruit-trees blossom and yield fruit. He
'"seems to be a god of peace, and cannot endure
'"any noise or disturbance, and his feelings in this
'"respect are most scrupulously regarded by the
'"natives. They, therefore, live very quietly dur-
'"ing this month, it *being tapu to go to war or to*
'"*sail about, or plant, or build houses, or do most*
'"*kinds of work,* lest Ratumaimbulu should be
'"offended, and depart again to Bulu, leaving his
'"important work unfinished."

'As the Fiji Islands are adjacent to the Friendly
'or Tonga Islands, and the natives of both groups
'strongly resemble each other in their customs and
'observances, there can be but little doubt that Alo
'Alo, the God of Agriculture of the Friendly Islands,
'whose festival takes place in November, is the same
'as the Fiji god, and like him is assumed to come
'in that month from the world of spirits, which is
'called by the Fijians *Bulu,* and in the Friendly
'Islands *Bulotu.* For the same reasons we may

'assume that a vernal queen, like the little damsel 'who presides at the festival of Alo Alo, also wel- 'comes the Fiji god, on his arriving in that month 'from the land of spirits—as Isis welcomed Osiris, 'and Proserpine wedded Pluto in November.'

ADDENDUM II.

'Such, then, are some of the conclusions to which 'the study of *Ethology* has led me.

'There, are, however, further proofs, deducible 'from chronology and astronomy, which, though 'less interesting to the general reader, are most im- 'portant in confirming the inferences to which this 'inquiry tends. Though they were the last to 'suggest themselves to me, they will not be, I 'believe, the least conclusive in the hands of 'others more competent to deal with them than 'myself.

'If the foregoing paper is imperfect, this is almost 'unavoidably the case. The field is almost entirely 'new; and many points were incidentally sug- 'gested, while I was preparing the paper; for 'though collecting materials for a comparison of 'the customs and festivals of nations required 'several years of drudgery, many identities in the 'mode of observing the Festival of the Dead only 'became apparent to me when I had carefully col-

'lated and compared the different references to it, 'which I had noted in the course of my reading 'during the past eight or ten years. Of course the 'difficulty of procuring, in a colony, any works 'bearing on the subject, not a little contributed to 'my labours.

'Before going into what may be regarded as, in 'some respects, a distinct branch of the subject, it 'would be as well to recall the steps which have led 'me so far in this inquiry.

'Accident drew my attention to the *antiquity* of 'certain popular customs; and further inquiry re-'specting them revealed to me some new facts as to 'their *universality*.

'The simultaneous observance of the festival All 'Halloween, All Saints and all Souls, in the old and 'in the new worlds, led me to infer that it must 'have been regulated by some visible mark or sign 'that nature had supplied; and on discovering that 'the midnight culmination of the Pleiades affords a 'clue to the almost simultaneous observance of this 'festival in America, Polynesia, Asia, and Europe, I 'at the same time found that the festival of the 'dead was a *new year's festival*, and that it, conse-'quently, was in Europe, Asia, and America a ves-'tige of a sidereal (or astral) year, actually in use in 'the southern hemisphere, but obsolete and for-'gotten in the north, though forming apparently 'the substratum of all ancient calendars. My next 'and last inquiry was, therefore, into the calendars

'of ancient nations, to see if astronomers have 'noticed any traces of a primitive system of regu-'lating the year having been once in vogue in 'different parts of the globe.

'Greswell, who has not suspected the existence of 'the year or seasons of the Pleiades among ancient 'nations, states that there is conclusive evidence of 'all calendars having been derived from a primitive 'calendar. He also states that they were not regu-'lated by or adapted to the tropical year, and that 'their mutual connexion consists in their relation 'to the 17th day of the Egyptian month of Athyr. 'This, though probably the primitive new year's 'day of the Egyptians, became in time the 17th day 'of the third month, still regulating the year, how-'ever; still the *point d'appui* of all calendars; still 'the basis of all cycles and of all corrections as far 'back as the year B.C. 1355. The earliest reliable 'astronomical data which we possess as to the cal-'endar of the Egyptians extend back to that 'date; and in Hindostan, B.C. 1306 is the limit 'to which we can safely carry back our calcu-'lations.

'Greswell shows us that the Egyptian and Hindoo 'calendars agreed at that remote era; that the fes-'tivals of the Egyptian Isis and of the Hindoo 'Durga were then new year's commemorations; and 'he even supposes them to have been first instituted, 'and the worship of these deities to have been in-'vented or introduced, near that time. As, how-

'ever, we find the rude elements of all the rites and 'attributes of those deities, among the gods, and 'ceremonies of savages of the Southern Ocean, we 'may question the correctness of his inference on 'this point.

'This coincidence in the observance of these fes-'tivals at that date has naturally appeared so 'remarkable, that he can only explain it by 'assuming that they must have had a common 'origin; and this he finds in the astronomical 'science of the Egyptians. Although Greswell 'acknowledges that the existence of a primitive 'universal calendar is evident throughout the 'world, he assumes that the Egyptian calendar was 'the source from which all nations derived their 'knowledge of the primitive year.

'This is plainly most incredible. We must en-'deavour to find in nature some more simple clue 'to these remarkable coincidences.

'Let us see whether this primitive year, the 'traces of which have been discerned in almost all 'countries, was not the year of the Pleiades, or 'rather the two seasons of "the Pleiades above," 'and "the Pleiades below."

'A careful perusal of his elaborate works will 'lead to the conclusion, that the four following 'days stand out with singular prominence as land-'marks of this primitive calendar, viz.,—Athyr '17th (November), February 17th, April 20th, and 'August 28th.

'Greswell appears to regard them all as different 'types of (what is unquestionably the most remark- 'able of them all) Athyr, 17th, as it appeared at 'different times in a moveable year. But he is evi- 'dently mistaken, as I shall hereafter show. All of 'these days were most conspicuous in the Roman, 'as well as in some other ancient calendars, and 'were connected with the primeval festival of the 'dead, or with the superstitions peculiar to it; 'while in more modern times we find the new year's 'festival of the Mexicans, and of the Dayaks of 'Borneo, fell respectively on November 17th and 'February 17th, each regulated by the Pleiades; 'and that on the 19th of February and the 28th 'of August, among the Chinese and Japanese, the 'annual commemoration of the dead, or a festival 'in honour of the new year takes place.

'It is however manifest, that each of these four 'days must have marked a division of the primitive 'year. But if this was the case, they must have 'had reference to some natural phenomena or signs; 'and could not have been merely conventional divi- 'sions of the year, as their unequal duration clearly 'proves; nor could they have been regulated by 'the seasons, because they are found in different 'latitudes.

'Thus a division commencing on Nov. 17th 'would contain 92 days; that on Feb. 17th, 62 'days; that on April 20th, 130 days, while that on 'August 28th would not extend over 81 days. Or,

'supposing that the year was divided into two seasons, the first, if commencing, like the primitive Southern year, on the 17th November, would last only 154 days, while the second season, commencing April 20th, would continue for 211 days. If, however, it was a year commencing, like the primitive Northern year, on February 17th, the first season must have consisted of 192, and the second season of 173, days.

'Such a system is so entirely unsuited to the seasons, and to the natural divisions of the tropical year, that we cannot assume that accident or caprice can have suggested it, much less have preserved such an uniformity, in the observance of such a singular and irregular mode of dividing the year, among nations inhabiting different quarters of the globe.

'The solution for all these difficulties will be found, I believe, in the primitive Southern and the primitive Northern years, each of which was sidereal or astral, and regulated by the Pleiades.

'I give below a statement of the times of the year, in various portions of the globe, when the Pleiades appear and when they disappear in the evening, also when they culminate at midnight, sunset, or at sunrise.[1]

[1] 'The following table, kindly prepared for me by Professor Everett, will afford sufficient data to guide the reader as to the variations in the times when the Pleiades appear, disappear, and culminate at the equator, and in northern and southern latitudes. Of course the

'The midnight culmination of the Pleiades occurs 'all over the world on the 17th of November (or 'Athyr, as it was called in the Egyptian calendar). 'Hence if the primitive year was regulated by the 'midnight culmination of the Pleiades, we may ex- 'pect to find all affinities in calendars connected 'with that particular day. This is exactly what 'Greswell has discovered. He cannot explain why, 'out of the 365 days of the year, the 17th day of 'November should be such a *point d'appui* of all 'calendars. Yet he considers it derived from some 'primitive unknown calendar, in which it consti- 'tuted the beginning of the year, and that in all 'modes of dividing the year, in every portion of 'the globe, a connexion with the 17th of Athyr is 'to be traced.'

ADDENDUM III.

'A study of the stars that are visible in the 'middle of November will, I believe, throw a new

'farther we go from the equator, the greater the variations will be- 'come :—

	Appearance in evening.	Disappearance in evening.	Culmination at midnight.	Culmination at sunset.	Culmination at sunrise.
'Tongatabu, Friendly 'Islands. Lat. 21° 'S., . . .	Nov. 1.	April 22.	Nov. 17.	Feb. 2.	Aug. 7.
'Equator, . .	Oct. 31.	April 28.	Nov. 17.	Feb. 9.	Aug. 14.
'Heliopolis, Egypt, 'Lat. 30° N., .	Oct. 19.	April 30.	Nov. 17.	Feb. 17.	Aug. 21.

'light on the strange tradition referred to by Virgil, 'and which has excited so much speculation—

"Candidus auratis aperit cum cornibus annum
Taurus."

'This has, by all writers, been supposed to refer to 'a very remote period, when the sun was in the 'sign of Taurus, at the time of the vernal equinox. 'It has been assumed that the primitive year began 'at the time of the vernal equinox, and was a solar 'year.

'I think it is very apparent, from the facts re- 'ferred to in the foregoing paper, that the most 'ancient year began in the autumn, and that there 'is not the slightest trace of any ancient year in 'general use beginning in May. How, then, can 'we connect this tradition with the evidence of 'ancient calendars, pointing to November, not to 'May, as the month in which the primitive year 'began?

'It is manifest that this universal tradition, that 'is so discernible to this day in the religious symbols 'and rites of Asiatic nations, and which was so 'conspicuous in the mythology of the Egyptians, 'had reference not to a solar, but to a sidereal year; 'not to the sun being in the *sign* of Taurus, but to 'the stars in Taurus, the Pleiades, which by their 'rising in the evening, culminating at midnight, 'and setting in the morning, marked the beginning 'of the primitive year in November. The reader 'has only to consult the various writers who have

'touched on this point, and he will find that there
'can be but little question as to the correctness of
'this view of the tradition. I have already con-
'nected Io with the year of the Pleiades, accom-
'panied as she was by those stars in her wandering
'over the globe. But I omitted to note a feature in
'the story of Io, which confirms this conjecture.
'Why was she represented as having been changed
'into a *Cow*, and as having in that form arrived in
'Egypt, where she was worshipped as Isis, to whom
'the bull Apis was sacred, as well as to Osiris?

'Io or Isis was called Athyr, which was the name
'of the month, on the 17th of which her great
'festival, the mysteries of Isis, took place. Gres-
'well, who does not seem to have noticed the con-
'nexion of the constellation of Taurus with the
'month of November, says, "according to some the
'"Bull in the heavens is the same as *Io*." "The
'"Arabic name of the sign, or one of the Arabic
'"names, is *Ataur* or *Ator*, which is evidently the
'"same with the Egyptian *Athyr*—Ator or Venus;
'"and she was only another conception of the
'"Egyptian Isis." But the connexion of Taurus
'(Ataur) with the festivals of *first fruits* and of *the*
'*dead*, everywhere, even in the Pacific Islands,
'associated together, is clearly discernible. Sir
'Gardner Wilkinson says that at harvest time the
'Egyptians throughout the country "*offered the*
'"*first fruits* of the earth, and *with doleful lamen-*
'"*tations* presented them at her altar." He traces

'the connexion between two of her festivals in the 'fact that two of her votaries "*presented their* '"*offerings in the guise of mourners.*" As to the 'Egyptian fable of the cow of Mycerinus, Sir Gard- 'ner Wilkinson says, "if Herodotus was correct in '"stating that it was a heifer (not an ox), it may '"have been the emblem of *Athor* in the capacity '"which she held *in the regions of the dead.*" "The '"introduction of *Athor* with the mysterious rites '"of Osiris, may be explained by her frequently '"assuming the character of Isis."

'But the connexion of Taurus (Ataur) with a 'funereal commemoration which took place on the '17th of Athyr, is indirectly attested to by Plutarch, 'who says, "the priests therefore practise *certain* '"*doleful rites,* one of which is to expose to public '"view, as a proper representation of the grief of '"the goddess (Isis) *an ox* covered with a pall of '"the finest linen, that animal being considered the '"image of Osiris. The ceremony is performed for '"four days successively, beginning on the 17th '"day of the above month (Athyr)." "Thus they '"commemorate what they call '*the loss of Osiris,*' '"and on the 19th of the month another festival '"represents '*the finding of Osiris.*'" The autho- 'rities I have already cited seem to show that this 'refers to the 19th of *Athyr* (not of *Pachons,* as Sir 'Gardner Wilkinson suggests). Plutarch supposes 'this funereal celebration to represent the death of 'the year, and the beginning of winter. De Rouge-

'mont makes the same conjecture as to the festival 'of the German goddess of death; but I have 'already shown that these theories are incorrect; 'because in the Southern hemisphere, the *vernal* 'month of *November* is sacred to the god of the 'dead. But Plutarch supplies, unconsciously, the 'clue to the enigma, when he states that these 'funereal celebrations "take place *in the month when* '*the Pleiades are most distinct, i.e.*, in Athyr. 'These *lamentations, followed by rejoicings*, were 'plainly connected with the disappearance and re-'appearance of the Pleiades, and were in no way 'descriptive of the seasons. The Abipones of South 'America call that constellation their "*Grand-*'"*father.*" When it disappears from the sky at 'certain seasons, "they suppose their grandfather is '"sick, and are under a yearly apprehension that '"he is going to die;" when these stars again ap-'pear they rejoice, and hold festivals in honour of 'his recovery. In Borneo, *Se kera*, the God of 'Agriculture, resides in the Pleiades. Hence we find the Pleiades, like Osiris and Proserpine, were 'regarded as the god of the dead and of agriculture, 'and thus the festival of the Pleiades was a feast of 'ancestors, and a first fruits celebration.

'In Australia, on or about the 17th November 'the savages celebrate their great corroboree in 'honour of the stars of Taurus (see p. 384), which, 'as I have shown, is of a funereal character. It 'is therefore evident that, as the Hindoo name

'for November is Cartiguey (the Pleiades), the 'Egyptian name for it, Athyr, is connected with 'Ataur (Taurus), and the seven stars the Pleiades. 'Hence we learn from the fable of Io, that the cow 'or bull, accompanied by the Pleiades, was wor-'shipped at the Isia on the 17th of Athyr, *i.e.*, when 'these stars in the constellation of Taurus are most 'distinctly visible; and thus as the primitive year 'began at that time, the constellation of Taurus 'may be said to have opened the primitive year.— 'See Landseer's *Sabæan Researches*, p. 75 to 85, '861. See Greswell's *Fasti Cath.* II. 88, n. II. 112; 'iii. 255, 257, 370; Introd. 241; iv. 280.

'A plate, in Hyde's learned work on the Religion 'of the Ancient Persians, taken from an antique 'gem, which was supposed to represent Mithra, or 'the sun in the sign of Taurus, evidently refers to 'the stars in the constellation of Taurus, and to 'Orion and Scorpio, which are at the same time 'visible in November, when the primitive year 'began.

'Hyde says that the representations of Mithra 'were intended by Zoroaster to be of an astronomi-'cal, not of a religious or mythical character.

'We have represented in this gem a man holding 'a sword and accompanied by two dogs (the form 'under which Orion was represented), near him a 'scorpion, and above him the seven stars, the sun 'and the moon. The tradition as to the scorpion, 'I have already shown, was connected with Novem-

'ber and with Orion by the ancient Romans, and to 'this day is associated by the Arabs with Novem-'ber. But the Persians themselves, when they 'changed their year from November to February, '*i.e.*, from the time of the midnight culmination of 'the Pleiades to that of their culmination at sunset, 'must have transferred the tradition as to the death 'of Orion by the bite of a scorpion to February, as 'they still celebrate a festival in February, in which 'charms are used to drive away scorpions. Hyde 'says this festival once took place in November. I 'can find no trace in the customs of any race in 'which any superstitions respecting Taurus, Orion, 'and Scorpio are connected with May.—Hyde '*de Rel. Vet. Pers.*, 113. Bailly's *Astr. Indienne*, 'xxx. cliv., 4, 18, 78. See also *ante*, p. 381.

'That the reverence of Asiatic nations, as well 'as of the nations of antiquity, for sacred bulls, 'arose from the seven stars in the constellation of 'Taurus marking the beginning of the year in 'November, is probable from the following facts 'connected with the traditions as to the deluge.

'We have seen that the memory of that event 'was preserved in the great religious festival of 'ancient nations, the new year's commemoration of 'the dead. But as this was regulated by the 'Pleiades, which are in Taurus, let us see whether 'the Bull and the Seven Stars are not mixed up 'with the traditions of the deluge.

'Bryant shows us that the Pleiades were con-

'nected with that event in Grecian mythology, 'though he gives no satisfactory explanation for the 'fact. We have already seen that, beyond any 'question, the Mexicans associated the memory of 'the deluge, and a dread of its recurrence, with the 'midnight culmination of the Pleiades.

'No solution has been supplied for the remark-'able circumstance that the Zendavesta, and even 'the prayers of the Parsees, mix up the bull with 'the memory of the deluge; nor has any clue been 'found to the meaning of the traditions of the 'Chinese, the ancient Britons, Greeks, Persians, 'Hindoos, and Egyptians, as to "the seven celestial '"beings" preserved from the waters of the Flood. 'They all plainly point, for their origin, to the con-'nexion of the memory of the deluge with the new 'year's commemoration. This festival, as we have 'seen, was regulated by the stars in the constellation 'of Taurus. Hence the belief of the Mexicans that 'the deluge commenced at the moment when the 'Pleiades, culminating at midnight, marked the 'beginning of the year, has been shared in by other 'races. We can therefore understand why the bull 'and the seven stars are connected with that event, 'not only in ancient mythology, but also in the 'traditions, and even in the prayers of Asiatic 'nations.

'The belief of many writers that the ancient 'British fables as to King *Arthur* are derived from 'some astronomical myth, will receive some con-

'firmation from the facts contained in this paper, 'and from the references which I give on this point. 'We find the Arkite God Hu (the bull), *Uthyr* or '*Arthur* (Athyr?) connected with the deluge, from 'which Arthur and his *seven* friends escaped. The 'lamentations for the death of *Hu* are traceable to 'the connexion of Taurus with the new year's feast 'of ancestors, which grew in time into a commemora-'tion of the *death of a divinity*, or into a festival of 'the *god of the dead*. Hence the death of Hu '(Taurus) is the same mythical event as the death 'of Osiris, with whom the bull *Apis* and *Athor* '(Taurus) were connected. The lamentations for 'Adonis, Thammuz, Proserpine, and other deities, 'are derived from the same myth. Dupuis says, '"Dans leur mystères on rappelait la chute, et la '"régénération des âmes, par le taureau mis à mort '"et ressuscité."

'The astronomical ideas of the ancient Britons 'confirm this view. We have the testimony of 'Plutarch that in an island to the west of Britain, 'a festival at the end of every thirty years was held, 'which was connected with, and probably, like the 'Mexican cycle, was regulated by the constellation of 'Taurus. "It is mentioned by Plutarch," says Gres-'well, "that the principal object of adoration among '"the Cimbri, in the time of Marius, was a *brazen* '"*bull;* by which they are accustomed to swear on '"occasions of greater solemnity than usual. If '"this bull was not borrowed by the Egyptians, and

'"was not merely their Apis or their Mnevis, we can '"have but little reason to doubt but it must have '"been intended as a type or symbol of the bull in '"the heavens; and we consider this supposition '"much the more probable of the two. This fact, '"however, would do much to connect the origin '"of time and the beginning of things, in the '"opinion of these nations, with the sign of the '"bull. The Hindoos, both of ancient and modern '"times, and the Persians also, have always as-'"sociated the sign of the bull with the origin '"of time; and there is no reason why the nations '"of the North might not have done the same, and '"for the same reasons in general too, viz., be-'"cause *primitive tradition and belief among* '"*them also actually connected the beginning of* '"*things with this sign, or the constellation in par-*'"*ticular.*"

'But we need not go to remote antiquity or to 'distant nations for traces of this connexion of the 'stars of Taurus with the beginning of the year, 'which they regulated by their rising in the even-'ing. To this day the Highlanders believe that '*in the twilight* on *new year's eve* the figure of a 'gigantic bull is to be seen crossing the heavens. 'They even imagine that the course which it takes 'is ominous of good or ill for the coming year. 'Stewart says that as new year's eve is called 'Candlemas "from some old religious observances '"performed at that time by candle-light," this

'mythical animal is popularly known among the 'Highlanders as "the Candlemas Bull."'[1]

'PROOFS FROM ASTRONOMY AND CHRONOLOGY,
'THAT IN RELATION TO THE PLEIADES OUR CALENDAR
'NOW EXACTLY CORRESPONDS WITH THE PRIMITIVE
'YEAR.

'Πληιαδων φαινουσαν Αθυρ τεκμαιρεται ωρην.

'ASSUMING all these inferences to be correct, a 'difficulty will suggest itself to the reader, which 'may naturally seem fatal to the conclusions at 'which I have arrived. It may be said, "It is true '"that these festivals falling among so many races '"at the present day, as well as among so many '"ancient nations, on the 17th November, in the '"middle of February, or at the end of August, '"appear to have been regulated by the culmination '"of the Pleiades at midnight, sunset, or sunrise, '"yet it is only a singular coincidence, that is, the '"result of accident. If those festivals now agree '"with the culminations of the Pleiades at the times '"named, yet they did not do so two thousand '"years ago. The Pleiades gain twenty-eight days '"on the tropical year in every two thousand years; '"hence the Pleiades that now culminate at mid-

[1] See Stewart's *Superstitions of the Highlanders*, 246.

'"night on the 17th November, did so in October
'"two thousand years ago. Hence you must prove
'"that the months have moved onward with the
'"Pleiades, or all your assumptions fall to the
'"ground." This difficulty, however, when inquired
'into, not only strengthens my conclusions, but also
'opens up a new question regarding calendars and
'chronology, that is in itself most important, as
'well as most interesting. It is evident that if the
'primitive year was regulated by the Pleiades, the
'months must have been gradually affected by the
'beginning of the year commencing one day later
'in every seventy-one years, and hence the first
'month, whether November, February, or August,
'if connected with a sidereal or astral year, must
'have moved onward in an equal ratio with the
'movements of these stars, and of course all the
'other months in the calendar must have shared
'equally in this progressive tendency.

'No one hitherto has suspected that the primi-
'tive calendars of ancient nations were based on a
'sidereal year. Let us, however, see whether astro-
'nomers have not supplied us with facts that
'necessarily lead to this conclusion.

'I may assume that if a sidereal year was the
'primitive basis of all calendars, astronomers must
'have been surprised to find *simultaneous and pro-*
'*gressive changes* in calendars, which must have
'appeared to have been the result of *artificial*
'"*corrections*." If the primitive year was regulated

'by the culmination of the Pleiades at midnight, all 'derivative calendars would be found gradually to 'change, and yet to preserve a relation towards 'each other, and this connexion would be traceable 'to the *point d'appui* of these calendars, the day 'when the Pleiades culminate at midnight, sunset, 'or sunrise, by whichever the year was regulated. 'Let us see, then, what Greswell says on this 'point:—

'"The *natural* measures of time have had only '"one *primum mobile*, one point of departure or '"epoch; which never has been, nor could be, nor '"is even at present, anything different from what '"it was at first. The civil calendar also might '"have had only one epoch and point of departure '"at first, though that is a matter of fact which we '"would not be justified in assuming without suffi- '"cient proof of its truth; but whatsoever it might '"have been at first, it would still be notorious and '"incontrovertible that, since the beginning of '"human society, it has had an almost infinite '"number of epochs, and points of departure; *a* '"*different one almost in every age, and in every* '"*country, and among every nation on the face of* '"*the earth.*"

'To analyse, compare, and to trace back to a 'primitive basis, calendars of apparently so variable 'a nature, at first may appear a task too difficult to 'be surmounted. This arises "from not merely the '"possibility, but the fact of the substitution of new

'"types of the standard of nature, instead of the '"first and original one; from the various relations '"of these new ones compared with those of the '"old; and from the necessity of finding out and '"fixing the historical epoch of the substitution in '"each of these instances, and of tracing and follow-'"ing the subsequent history of such variations; of '"investigating in short, and ascertaining the whole '"cycle of the changes, transitions, and modifica-'"tions in passing from one state to another suc-'"cessively, through which the original type of '"nature itself may have had to run."

'"It follows that, when bringing down the '"primitive and universal type of the reckoning of '"annual civil time according to its natural law; '"we are bringing down at the same time in their '"elementary and primordial state, in their seminal '"principles, in their archetypal form, if not in their '"actual conditions and constitutions from the first, '"the civil calendars of all ages, and all countries, '"and all nations. Nor is it more unquestionable, '"in point of fact, that all existing distinctions of '"men (even those which are most widely discri-'"minated in other respects) were originally sum-'"med up and comprehended in the loins of one '"man, and afterwards of three men, than that *the* '"*civil calendars of all such national divisions of* '"*mankind have been comprehended and embodied* '"*in this one type of all*, the civil calendar first of '"Adam, and next of three sons of Noah; and

'"through them the common birthright and com-
'"mon inheritance of their posterity everywhere."

'I have already shown that the system of count-
'ing the day from sunset, which Greswell says is so
'universal as to prove the unity of origin of our
'race, and which he believes to have belonged to
'the primitive calendar, is still in existence in the
'southern hemisphere, and connected with the Hal-
'loween of the year of the Pleiades. Let us see
'whether there are not some other land-marks of
'the primitive calendar that are relics of this
'system of regulating the year of the Pleiades. As
'the Egyptian and Hindoo calendars are the most
'important, let us see how far they exhibit traces of
'the progressive year of the Pleiades.

'I have shown that the *Isia* were originally the
'new year's festival of the dead, and were connected
'always with the 17th of Athyr, and with the mid-
'night culmination of the Pleiades. We find that
'the Egyptians had several modes of reckoning the
'year; two of them were perhaps in reality the
'same. The year commencing at the end of August
'was probably precisely the same as the primitive
'year commencing on the 17th day of Athyr or
'November. They would be both sidereal and
'subject to the same changes; but in the former the
'17th day of Athyr (or November) is the 17th day
'of the third month. This therefore must be borne
'in mind, in reading the following remarks of Gres-
'well respecting that day, which at least will prove

'that it was the *point d'appui* of all calendars,
'though the reason for this has, if I am correct,
'escaped the observation of Greswell, Bunsen, and
'other writers who refer to this subject :—

'"It has been already seen that the Isia, among
'"the Egyptians, were attached from the first to
'"one particular month of their calendar, and to
'"one particular day of that month; and that this
'"particular month was the third, and this particu-
'"lar day was the 17th of the third month. And
'"the calendar of the Egyptians, both at this time
'"and long after it, being altogether the same with
'"the primitive, the 17th of the third month in the
'"civil calendar of the Egyptians, and the 17th of
'"the third in the civil calendar common to all
'"mankind, both at this time and long after it, were
'"absolutely one and the same. It follows that
'"the stated date of the Egyptian Isia, once fixed
'"to the 17th of the third month in their proper
'"calendar, was thereby fixed to the 17th of the
'"third month too in the common calendar of all
'"mankind; and as long as the proper Egyptian
'"calendar and this common primitive calendar
'"continued to be the same, and to preserve the
'"same relation to each other, the 17th of the third
'"month in either was the 17th of the third month
'"in the other; and *vice versa*."

'"This being the case, nothing being supposed
'"to be known as yet respecting the Isia of the
'"Egyptians, except these two facts, that they were

'"fixed to one month, the third in their proper
'"calendar, and to one day, the 17th of that month;
'"the attention of the reader is next to be directed
'"to a very remarkable phenomenon, which the
'"history of the primitive calendar, after a certain
'"time, but not before, brings to light; viz., a suc-
'"cession of modifications, corrections, and changes
'"of the primitive calendar itself on the cyclico-
'"Julian principle, which we are able to trace in
'"the retrograde order (that is, in the order of the
'"recession of the equable in the Julian or natural
'"year), all round the Julian or natural year, from
'"the point at which it began, almost to the same
'"point again: corrections or modifications of the
'"primitive calendar, on this common principle,
'"agreeing with each other not only in that respect,
'"but in a still more remarkable and characteristic
'"circumstance, that of being all attached to the
'"same month of the primitive calendar, the third,
'"and to the same day of this month, the 17th.

'"The fact, which we have just pointed out, in
'"the majority of these instances (and even in all,
'"as we ourselves have seen reason to conclude) is
'"confirmed by proofs that place it out of question;
'"and the fact being admitted, it must be allowed
'"to be something curious and remarkable in the
'"highest degree; something which could not be
'"resolved into an accidental occurrence of circum-
'"stances, in so many instances, in such different
'"quarters of the world, and at such great distances

'"of time asunder; and if it could not be explained
'"on that principle, something which must have
'"been the effect of design. Nothing but design,
'"or reasons of a common kind, motives and causes
'"which must have everywhere alike influenced
'"such corrections, and alike determined the process
'"of such corrections, could account for a coinci-
'"dence like this, extending over a period of 1136
'"years, exemplified in fifteen different cases of the
'"kind at least, yet all in the same way, and sub-
'"stantially to the same effect; beginning in India,
'"the most remote quarter of the world of which
'"anything was known to the ancients, and ending
'"in Sweden or Norway, of which, until a very
'"late point of time, they knew absolutely nothing.

'"What, we may ask, must have been thought of
'"this fact, had nothing been known concerning it
'"except the fact itself? How difficult must it
'"have appeared to account for it, on any principle
'"which should exclude the idea of chance!"

'Greswell tries to account for these extraordinary
'coincidences by pointing to Egyptian science as
'the common fountain of all the analogies of the
'calendars and of the myths connected with the
'year; but the assumption is plainly untenable.
'The Egyptians certainly never taught the Fijians
'to celebrate the festival of the God of the Dead in
'November, nor could they have led the Australians,
'the Dayaks of Borneo, and the Mexicans, to regu-
'late their year by the stars in Taurus. If, as he

'assumes, analogies in the calendars of nations are 'relics of a primitive year, we must look for it 'among the most primitive races, and among those 'who have been least affected by civilisation and 'change.

'If this primitive calendar was inherited from 'primeval antiquity, we may expect to find even 'among the rudest races some trace at least of their 'common heritage from the common parent of our 'race. What do we actually find? In the southern 'hemisphere, at the equator, and in Mexico, unmis-'takable proofs of the existence of a primitive 'sidereal or astral year, regulated by the Pleiades. 'Among civilized races we find all traditions and 'myths pointing to a primitive year regulated by 'Taurus. In Hindostan, November, we have seen, 'is called the month of the Pleiades, and in the 'Egyptian calendar was connected with Taurus. 'In the middle of November and of February, we 'have found among ancient nations, and even 'among existing races, either the commencement of 'a year, or the vestige of an ancient new year's day, 'still lingering in a festival of the dead; and we 'have seen that the Pleiades culminate at midnight 'or sunset at those times which I have mentioned 'as being so conspicuous in the calendars of nations. 'The inference from these facts would naturally be 'that, if any primitive calendar ever existed, we 'have in the year or seasons of the Pleiades the 'original type of the primeval calendar.

'And this we might infer, even if in the calendars 'of ancient civilized nations no trace of the primi- 'tive type could be found. But I believe that 'there are some very significant facts, which have 'already attracted the attention of astronomers in 'connexion with the history of the calendar, and 'which can only be explained by assuming that all 'ancient calendars originally partook of the sidereal 'character of the primitive calendar, and that its 'progressive tendency is traceable in all ancient 'calendars.

'Though I cannot pretend to deal with these 'matters as an astronomer, and feel great hesitation 'in referring to this somewhat difficult subject, 'there are some simple but significant facts in con- 'nexion with the history of the calendar, that can 'be perceived and understood by the most super- 'ficial thinker.

'Before going into the question, it may be as 'well to recall the history of our present Gregorian 'calendar. The correction of Pope Gregory restored 'the calendar very nearly to what it was in the 'time of Julius Cæsar, as respects its relation to the 'tropical year. How then was the calendar affected 'by the Julian correction in this respect? In the 'time of Julius Cæsar the year had been so tampered 'with by the priests, that the months were supposed 'to have receded more than two months in relation 'to the seasons, and to the natural year; accordingly '67 days, exclusive of the intercalary month, were

'added for the purpose of advancing the months to 'their proper position. But the exact amount of 'error in the Roman calendar was probably a mere 'matter of conjecture, and cannot now be precisely 'ascertained. Clinton considers that it was much 'less than has been generally supposed. If so, then 'the months must have been advanced too far by 'the addition of 67 days. If this was the case, the 'effect is most important. For let us assume that 'the excess in the correction was 28 days, then, if 'the Pleiades culminated at midnight on the 17th 'of November in the Roman calendar prior to the 'Julian correction, their midnight culmination must 'have subsequently occurred in October; and it 'would take 2000 years before they would again 'culminate at midnight, on the same day in No-'vember.

'Clinton censures Usher for venturing to make 'precise calculations as to the position of the months 'in the Roman calendar, prior to, and after the 'Julian correction; and considers that he attempted '"a precision for which we have no authority."

'But we have some positive evidence as to the 'time when the Pleiades set cosmically in the 'Roman calendar in the second century B.C. I 'have already shown that in the time of Eudoxus 'the Pleiades set cosmically on the 14th of Novem-'ber; and Greswell supposes November to have 'then coincided with Athyr. But the Pleiades 'must have then set about thirty days earlier than

'they now do; and consequently November, in rela-
'tion to our present calendar and to the seasons,
'must have almost corresponded with our present
'October; if this was the case, the addition of 67
'days was probably nearly 28 days in excess, and
'November was advanced one month too far in
'relation to the seasons, and to the natural year.

'Let us turn to the Egyptian month of Athyr.
'It has been very fully demonstrated that the very
'name of this month, and the rites celebrated in it,
'show that when it first received its name (more
'than 3000 years ago), it must have been con-
'nected with the constellation of Taurus. That the
'connexion is not merely traditionary, is proved
'by the Greek epigram on that month, with which
'this division of my subject is headed, and which
'is referred to by Greswell. In it Athyr is dis-
'tinguished as *the month in which the Pleiades are*
'*most distinct.* Hesychius says that in the Egyptian
'"Athyr meant both a *month* and a *bull*;" and
'Plutarch says that the Phœnicians called a bull
'*Thor* (Taurus). Greswell explains the meaning
'of Athyr given by Hesychius, by referring to "*a*
'"*stated connexion between the month Athyr and*
'"*the Bull*," *i.e.*, Taurus. Athyr is supposed to
'have fallen three days before the Roman month of
'November; but this must have had reference to
'that month before the Julian correction, as Novem-
'ber in the Julian calendar nearly coincided with
'our present month of that name in relation to the

'tropical year. Thus Greswell says, "the Roman
'"Bruma, according to the calendar, bore date No-
'"vember 24; the beginning of winter, properly
'"so called, was dated *from the cosmical setting of*
'"*the seven stars*; in the calendar of Cæsar, (?)
'"November 11."

'It is therefore plain that the statements, that the 'Egyptian Athyr began three days earlier than the 'Roman month of November, must refer to the 'Roman calendar before the Julian correction. But 'Plutarch states that the Isia and other funereal 'celebrations of ancient nations were held "when '"*the Pleiades were most distinct.*" Hence the 'Isia and the 17th of Athyr must have corre-'sponded with the midnight culmination of the 'Pleiades.

'It is unnecessary to go more fully into this point 'at present, as I have shown that the Pleiades cul-'minated at midnight in the middle of the Egyptian 'Athyr, and of the Roman month of November, at 'or near the beginning of our era.

'As we have seen that the 17th day of Athyr is 'the *point d'appui* of all calendars, the great land-'mark of the primitive year, and that the Isia, the 'most solemn festival of the Egyptians, were always 'connected with that day; and that, at the begin-'ning of our era, the 17th of Athyr and the Isia fell 'when the Pleiades were most distinct, let us see 'what was the nature of the Egyptian calendar. 'Probably there are few questions more difficult of

'investigation. Everything connected with the 'year was veiled in the most profound secrecy; and 'simple truths were effectually concealed in the 'most trivial and childish myths. There were pro- 'bably several modes of regulating the year in use 'at the same time; there must have been at least a 'fixed year and a cyclical year; perhaps a sacred 'year known only to the priests. Hence the 17th 'of Athyr appears in different forms, as connected 'with a fixed or with a moveable year, and this 'gives rise to even more uncertainty. Were the 'Isia connected with a fixed year, or with the move- 'able year? If with a fixed year, what was it?

'Bunsen gives us no positive information on the 'subject. Greswell shows that the principle of the 'Julian year was always known in Egypt. Bunsen, 'referring to the probable existence of a civil and 'of a sacred or a sacerdotal year, says, "there can '"be little reason to doubt that the Egyptians had '"a means of marking the progress of the cyclical '"year." After showing the absence of any data 'for calculations on the subject, he says that "it is '"probable, *though there is no proof of it as yet*, '"that the details of these" (their sacred festivals) '"were reckoned by the primeval year, in which '"the 1st of Thoth commenced with the heliacal '"rising of Sirius. Biot even fancies he has disco- '"vered two proofs of it; but they will not satisfy '"anybody."

'"*The best evidence on this head would be ob-*

'"*tained, if we could get some more accurate know-*
'"*ledge of the great festival of Isis.* It has been
'" already remarked that in the year 70 B.C. it took
'" place a month after the autumnal equinox."

'Speaking of the moveable festivals as affording
'data for calculations as to the nature of the year,
'he adds, "It was still easier to mark the com-
'"mencement of the cyclical year, where, together
'" with these festivals, there were others connected
'" with immoveable points in the year, such as the
'" solstices and equinox." "It was easy to calcu-
'" late these points after nature had ceased to indi-
'" cate the beginning of the year."

'If my conjectures are correct, nature never
'ceased to afford a guide for the regulation of time
'to the Aztec or to the Egyptian. Let us take the
'Isia, as Bunsen suggests, as a test. The earliest
'date of their observance of which we have any
'record is B.C. 1350, when they were held on the
'5th of October, and the latest is A.D. 355, when
'they took place about the 28th of October.

'Bunsen supplies us, as we have seen, with an
'approximation to the date of the Isia B.C. 70, by
'which it would appear that they must have been
'held then between the 21st and 24th of October.
'These dates extend over a period of 1705 years,
'and carry us back 3213 years from the present
'time. If the Isia, which were always attached to
'the 17th of Athyr, were held, as Plutarch says,
'"when the Pleiades are most distinct," and if

'Athyr was, as it has been designated, the month 'when these stars are most conspicuous, then these 'dates, though varying so much, should approximate 'to the time when the Pleiades culminated at mid-'night; and the assumption of many ancient and 'modern writers, that the Isia came, in the course 'of time, to be held at various seasons of the year, 'must be incorrect. It should be remembered that 'Eratosthenes only speaks from tradition when he 'says that the Isia were once held in spring; but 'both he and Geminus testify to the fact that, in 'their day, the Isia were celebrated *in the autumn;* 'and the same thing will be noticed as respects the 'alleged dates of the Isia given by other writers; 'they are generally connected with autumn.

'The Pleiades must have culminated 3213 years 'ago, forty-five days earlier than they now do. The 'Festival of Durga, 1306 B.C., fell on the 1st of 'October, and the Isia, 1350 B.C., on the 5th, and 'Greswell considers the coincidence as very remark-'able, and as proving that the Hindoos must have 'been guided by the Egyptians, who fifty years 'before had instituted the Isia, and invented all 'their myths relating to them. But 1350 B.C., the 'Australian savages must have held their Festival 'of the Pleiades about the 3d of October, and in 'that century the Mexicans must have regulated 'their cycle on the 3d of October, if the Aztec 'calendar was then in use. The same coincidence 'is found to exist between the other two dates and

'the midnight culmination of the Pleiades. In the 'first century B.C., the Isia, the Australian, the 'Mexican, and probably the Celtic festival of the 'year, or of the cycle of the Pleiades, must have 'been celebrated almost simultaneously on the 21st 'of October, and in the 4th century of our era, they 'must have been almost simultaneously celebrated 'on the 27th of October.

'Hence we have a very remarkable procession in 'the Isia, in those instances almost exactly coincid-'ing with the year of the Pleiades.

'But it may be said that these are only coinci-'dences. There are, however, some facts to show 'that they are not accidental. When the Isia were 'instituted at the beginning of October, the idea of 'seed-time became attached to them, and the Isia 'were described as occurring in seed-time in the 'calendar. But the Isia moved on in the course of 'time so palpably, that they were held after seed-'time was nearly over. This has already attracted 'attention, as showing a change in the date of the 'Isia, as well as proving the time of their institu-'tion. Couple with these facts what we have 'already seen, that Athyr and Taurus are synony-'mous; that classical writers describe Athyr as '"the month *when the Pleiades are most distinct*," 'and I think it will be conceded that these are 'coincidences that at least deserve very careful 'inquiry.

'But the Celtic race appear to have had a cycle

'of thirty years, and the Mexicans one of fity-two 'years regulated by Taurus or the Pleiades. Is it 'not a little remarkable that the Apis and Mnevis 'cycles were cycles of the *Bull*, and that at the end 'the Apis cycle, the *Bull* Apis was drowned in the 'Nile? It may yet be found that the Mexicans 'and the Egyptians had precisely the same simple 'mode of regulating their eras, by the midnight cul-'mination of the stars in Taurus.

'I now turn from the calendar of the Egyptians 'to that of the Hindoos, in which we can find 'unmistakable traces of the past existence and 'influence of the primeval year of Taurus. The 'worship of Durga is supposed to have, about the 'year B.C. 1306, been borrowed from the Egyptians, 'and to have been introduced into India with the 'astronomical theories of Egyptian science.

'I give below two very remarkable passages from 'Greswell's works, which, in connexion with this 'subject, are well worthy of a perusal.[1] His assump-

[1] '"The history of the calendar and of its various changes brings '"many proofs of this influence to light; and these discoveries are '"among the most important and the most interesting fruits of our '"researches. Who would believe, *a priori*, that the fable of Osiris '"and Isis should no sooner have been invented in Egypt, and asso-'"ciated with certain rites and observances there, than that the very '"same fable, attended with similar observances signalized and per-'"petuated by similar changes and corrections of the calendar also, '"critically accommodated to what had taken place in Egypt, in less '"than fifty years afterwards should be found, merely in a different '"dress and under a different name, in India, Phrygia, Cyprus, '"Arabia, Greece, and elsewhere? in quarters of the world greatly '"removed from Egypt, and between which and Egypt we should '"not have supposed that, at this early period of the history of each,

'tions, however, are open to a good deal of doubt. 'The rites of Isis and Osiris, and of the Hindoo 'Durga, are the same as those of the German God- 'dess of Death, of the Yucatan god *Mam* (the 'ancestor or grandfather), and of the Fiji god of 'Bulu, the world of spirits. All these deities, with 'Pluto, Ceres, and other funereal patrons of agricul- 'ture, sprang from the primeval festival of first 'fruits and of the dead—a festival which was sub- 'sequently converted into celebration in honour of 'a god, and yet still preserved through thousands 'of years its primitive and peculiar characteristics. 'Nor was the Hindoo calendar based on the astro-

'"there could have been any communication. The fact to which we '"allude, however, is certain; being attested by the evidence of the '"calendar itself.

'"At present, as our subject requires, we must confine ourselves to '"the influence exercised by Egypt over its contemporaries in a much '"less objectionable way; *i.e.*, as the centre of knowledge and science; '"where all great and useful discoveries, all influential and perma- '"nent changes, in the principles or details of the reckoning of time, '"first took their rise; and from whence they were extended to the '"rest of the world."

'"It has been already explained that the earliest correction of the '"primitive calendar among the Hindoos of antiquity was made '"A.M. 2699, B.C. 1306, æra cyc. 2701: and that the first idea of this '"correction must have been derived from the Egyptian (if correction '"that could be called), which took place in Egypt B.C. 1350, æra cyc. '"2657, along with the introduction of the worship of Osiris and '"Isis; the proof of this connexion between the Egyptian correction '"of earlier and the Hindoo one of later date being supplied by the '"fact that the Hindoo correction was attached to the 17th of the '"primitive Athyr, æra cyc. 2657; and that the Indian correction '"was associated from that time forward with the worship of '"Deunûs and Durga, as the Egyptian was with that of Osiris and '"Isis; and that the Indian Deunûs and Durga were absolutely the '"same kind of conceptions and impersonations in India as Osiris '"and Isis in Egypt."'

'nomical science of the Egyptians; the arguments 'in favour of such a view would connect the calen- 'dar of the Australians, the Pacific Islanders, the 'Mexicans, and the Celts with that of the Egyptians.

'This primeval calendar, with all its universal 'myths, was a heritage of all nations, and derived 'from the same common source to which the Egyp- 'tians owed their knowledge of the primitive year.

'It appears that prior to B.C. 1306, the Hindoo 'festival of Durga, then attached as now to the 'autumnal equinox, and to the ninth day of the 'moon, had been regulated by some other system. 'From that time forth the new year's festival of 'Durga ceased to be regulated by the Pleiades, and 'became fixed by its relation to the tropical year.

'Let us suppose that the year having been sidereal, 'and therefore progressive, the new year's festival 'became fixed. It is manifest that unless the 'original system of the calendar were also changed, 'the months would still move onward as before, and 'the first month in 2000 years would become the 'second month, and the last month would become 'the first. This is exactly what we find to be the 'case. In B.C. 1306, the months first obtained their 'names, but these names the Hindoos state had re- 'ference to contemporary astronomical phenomena. 'This Bentley assumes to have been the case. At 'that date, Cartica or Cartiguey, the month of the 'Pleiades, was the first month, and coincided then 'with our present October. Bailly, as we have seen,

'suggests that when that name was imposed, the 'year must have been in some way regulated by the 'rising or setting of the Pleiades in Cartica. I have 'already conjectured that Carticeya, the Hindoo god 'of war, was a mythical embodiment of the year of 'the Pleiades, and this I inferred solely from his 'name (which has apparently escaped observation 'hitherto) and from his emblems as they are given 'to us by Sir William Jones.

'But little question can exist that my conjecture 'is correct, as when it was made, the connexion of 'Carticeya with the beginning of the Hindoo year 'and with the month of Cartica was unknown to 'me. "Mr. Bentley has mentioned several facts '"connected with this month, and under this name, '"from which we may infer that it must have re-'"ceived its name at this time, or have been sup-'"posed to have done so. He tells us that to render '"this designation of Kartika, as the first month, '"the more remarkable, and the more effectually to '"perpetuate the memory of it, they fabled the birth '"of Kartikeya, the Hindoo Mars, or God of War, '"in this month, whom he considers nevertheless '"only a personification of the year, as beginning '"in this month."

'"We may perceive a reason for connecting the '"birth of their Mars with the autumnal equinox, '"because that was the beginning of the military '"season in India." On this point I trust a very 'different solution, suggested by me, will not be

'considered less satisfactory than that which I 'have quoted. At the festival of Kartikeya at 'beginning of October, "it was usual to represent '"him riding on a peacock; which Mr. Bentley ex-'"plains of his leading on the year, followed by the '"stars and planets in his train; and various '"epithets were familiarly applied to him, all '"founded on the same supposition of the relation of '"priority or precedence, in which he stood to the '"year, and to everything most closely connected '"with the year."

'Hence, we find that B.C. 1306, when the Pleiades 'culminated at midnight at the beginning of Octo-'ber, the Hindoo year began with the month of the 'Pleiades; and that then, or soon after the festival 'of Carticeya, the god of the Pleiades was fixed at 'the beginning of Cartica, and was a new year's 'festival. Under these circumstances, after all that 'we have seen tending to this conclusion, it is 'difficult to avoid the inference, that as the Austra-'lians must have celebrated their festival of the 'Pleiades B.C. 1306, at the time that the Hindoos 'held their festival of the God of the Pleiades, *they 'were each using a primitive calendar, which must 'have been inherited from a common source by the 'Egyptians, the Hindoos, the Aztecs, and the Aus-'tralians.*

'But it is manifest that the Hindoo calendar still 'bears the evidence of its having been originally 'based on a sidereal and progressive year. In spite

'of the new year's festival becoming fixed to the 'autumnal equinox, the months have actually moved 'on in an equal ratio with the procession of the 'year of the Pleiades. Cartica, which began about 'the time of the culmination of the Pleiades at 'midnight, B.C. 1306, *i.e.* at the beginning of October, 'now begins in the middle of November in the 'Carnatic calendar, and in other instances near the 'time of the acronycal rising of the Pleiades, about 'the 19th of October. It has ceased to be the first, 'and has become the second month; and Aswina, 'the twelfth month of the year 3000 years ago, is 'now the first month.

'Nor was this progressive character of the 'calendar unknown to the Hindoos, who, however, 'like the Egyptians, and most nations of antiquity, 'for some strange reason, involved the subject in 'myths probably often unintelligible to the initiated 'themselves.

'Sir William Jones says, "Although M. de Gentil '"assures us that the modern Hindoos believe a '"complete revolution of the stars to be made in '"2400 years, or 44 seconds of a degree to be '"passed in one year, yet we have reason to think '"that the old Indian astronomers had made a more '"accurate calculation, *but concealed their know-* '"*ledge from the people under the veil of* 14 *Men-* '"*wantaras*, 71 *divine ages*, compound cycles and '"years of different sorts, from these of Brahma, to '"those of Patala or the infernal regions."

'Sir William Jones suggests that many Hindoo 'myths will be found to be astronomical truths, 'veiled under a garb of mystery, and he cites the 'following myth as probably referring to their 'calendar:—

'They believe that "in every 1000 divine ages, '"or in every day of Brama, 14 Menus are suc- '"cessively invested with the sovereignty of the '"earth; each Menu, they suppose, transmits his '"empire to his sons and grandsons, during a period '"of 71 divine ages; and such a period they call a '"Menwantara."

'Let us apply the primitive year of the Pleiades 'to this enigma, and the solution is perfectly clear. '*In every* 1000 *years* 14 *days are gained, and* 1 '*day is gained in every* 71 *years.*

'Hence it is plain that this must have referred to 'a sidereal year, which, it is equally evident, must 'have been the primitive year of the Pleiades.

'The same conclusions to which we have been 'led by an analysis of the dates of the festival that 'marked the season of "the Pleiades above," will 'follow also, I believe, from a careful examination of 'the times of observance of the second festival. As 'far as I have had data to guide me, I have found 'that in remote antiquity, in several instances, the 'latter was held more than a month earlier than the 'date assigned to it at the beginning of our era; 'and that hence it must have shared in the pro- 'gressive tendency of the primitive year.

'I believe it will be found that the evidence of 'the lunar and sidereal mansions of the ancients 'tends also in the same direction, as they seem to 'evince this progressive character in relation to the 'seasons, and to the natural year. For instance, 'Cartica (the Pleiades) which was once the first, is 'now the third Hindoo mansion. But this is a 'matter which I must leave to astronomers, or at 'least must reserve any further remarks for a future 'occasion.'

SIZE AND FIGURE OF THE EARTH; BY THE ORDNANCE SURVEY OFFICERS.

IN the course of 1866 a noble volume was published by the Ordnance Survey Office at Southampton, under the direction of Colonel Sir Henry James, R.E., professing only to give 'comparisons 'of the standards of length of England, France, 'Belgium, Prussia, Russia, India, and Australia.'

This was indeed, in itself, a most important work for perfecting our knowledge of the size and shape of the earth; for the standards alluded to were the standard bars of reference employed by each of the above-named countries, in their measures of arcs of the meridian in their respective parts of the world; and they had never been thus directly and collectively compared before.

The comparisons appear to have been conducted with unrivalled skill by Captain A. R. Clarke, R.E.; and after he had brought his long labours therein to a successful conclusion, he appears, with all the zeal that might be expected from an accomplished mathematician, to have hastened to employ usefully these new and most exact data in correcting, where

necessary, the results of all former arc-of-the-meridian measures; and thence deducing anew the chief elements for the size and figure of the earth.

Working as the learned Captain has done in this instance, with better and fuller materials than any of his predecessors, his results on this occasion must claim more confidence than any which have ever been put before the public; and they stand thus,—

ELEMENTS OF THE FIGURE OF THE EARTH.

	British inches.	French metres.
Polar semi-axis, ... =	250,241,148·	= 6,356,068·
Equatorial semi-axis in longitude 15° 34′ East, ... =	251,116,200·	= 6,378,294·
Equatorial semi-axis in longitude 105° 34′ East, ... =	251,039,664·	= 6,376,350·

The Equatorial compression hence arising . . . =	1 – 3270·
The greatest Polar compression being . . . =	1 – 313·
The least „ „ . . . =	1 – 286·
The mean „ „ . nearly =	1 – 300·

Hence, too, it is computed, that the meridian quadrant passing through Paris, does not contain exactly 10,000,000 times the length of the standard French metre, but 10,001,472 times that quantity. And in fact there is another quadrant of the earth, very distant too from Paris, which may put in a claim for being more worthy than the meridian of Paris as a reference for the length of the French metre, viz., the quadrant in longitude 105° 34′ east; for that quadrant, Captain Clarke computes to be 10,000,024· metres long.

But this peculiar result depending on the last

refinement in the theoretical treatment of earth measures, whereby the ellipticity of the equator has been, or is supposed to be, discovered,—and not being very overpoweringly attested to by all the numerical results, Captain Clarke computes these again on the older doctrine of a spheroid of revolution simply; and then finds, for

	British inches.	French metres.
The Polar semi-axis, . . . =	250,261,452·	= 6,356,584·
And the Equatorial semi-axis, =	251,112,744·	= 6,378,206·
The Polar compression being nearly . . . . =		1 − 294·

and where *any* meridian quadrant will contain more than 1000 too many metres; or show the celebrated French standard of length to be most sensibly smaller than it is usually given out to be.

The above few numbers expressing the lengths of the several axes of the earth, contain the quintessence of all the best observations and measures which have been made towards that end by the whole human race, since the birth of modern science down to the present day. They are based therefore on such an enormous amount of work performed by the best men of all countries, and operating over a large part of the earth, that we may consider that no future more extended surveys are likely to alter the statements much. In fact, as a pure mathematician would like to have the earth described, he need go no further, or ask for no more, than the above numbers representing linear measures for showing size and shape.

But in the present day there are growing inquiries for something else of another kind; and therefore Sir Henry James has very properly added a notice on the *Specific Gravity of the Earth;* stating that Dr. Maskelyne in 1774, by observations on the attraction of the mountain Schehalien in Scotland, made that earth-quantity = 4·90 (times the weight of water); and that in 1855 a party of the Ordnance Surveyors under his, Sir Henry James's, direction, made similar observations on the hill of Arthur's Seat, near Edinburgh, and found the earth-quantity = 5·316.

Sir Henry James probably stopped at this point, because there were no other cases to mention of the earth's specific gravity being determined by Ordnance-Survey observations on British mountains. But he has thereby left us with a rather one-sided impression of what the real numerical value of that all-important physical feature is likely to be; for the Astronomer-Royal's experiment on the subject in the Harton Colliery pit,—in 1855 also,—gave 6·565; and the very extensive experiments of the late Francis Baily with the Cavendish apparatus, in 1842, gave 5·675; as described in the fourteenth volume of the Memoirs of the Royal Astronomical Society; and in the opinion of many persons, forming the closest approach to this truth as it is in nature, that has ever yet been attained by any one experimenter.

The quantities are evidently all rather rough, in

spite of their being taken to three places of decimals, and it is to be hoped that posterity will obtain better and smoother results; but meanwhile we may assuredly expect that the true quantity in fact will be closer to a mean of the whole of the above statements, than to the mountain observations quoted, only. And if we assign half weight to the earliest observation on account of its rudeness,—the mean of the whole variety of results now brought together, comes to 5·7; which numbers we prefer therefore to adopt, as the best interim determination for the specific gravity, or 'mean density,' of the whole earth.

ON THE SACRED HEBREW STANDARDS OF WEIGHTS AND MEASURES.

THE SACRED CUBIT.

SOME preliminary knowledge of this subject is necessary in following out any discussion of Great Pyramid metrology; and as the authorities are often not easy to refer to, very various in their conclusions, and rather imperfect in one or two points,—a condensed statement of how the question may now be considered to stand, will probably not be unacceptable to the general reader.

In each department of the old Hebrew metrology, the names and *relative* values of the measures, are comparatively easy and certain to arrive at; but the *absolute* values, extremely difficult. Thus in linear measure,—the chief standard of length, without doubt amongst all authors is by name the *cubit;* and as that word appears again and again in the Hebrew Scriptures, all readers of the Bible feel assured that it does express a sacred measure of length.

But the moment we apply to any of the same authors for the actual *length* of such cubit, in terms

of some known modern measure, as British inches,—they, the authors, are found at variance with each other, and differing in their asserted values, anywhere between 42 and 12 inches. The reasons for these immense discrepancies are partly,—that there is, in the Bible, no simple mention upon which the absolute length of any cubit can be at once determined; and, partly,—that in the course of the long scriptural history there inscribed by a series of different hands, during a long succession of ages and continued reconstructions of the Hebrew nation on various models, and in many lands,—two and even three different cubits are alluded to. Hence arises a necessity for distinguishing the dates, or occasions when each separate cubit was employed; and from such investigation pursued by many explorers, has arisen a very extensive belief as to one particular length of cubit having been, more than any other, the cubit of the inspired founders and directors of the Israelite people.

What, then, was the length of *that* cubit, to be called, for distinction's sake, as well as of its own right, 'the sacred cubit?'

The venerable Bishop Cumberland, of Peterborough, in 1685,—whose idea of Scripture 'weights 'and measures,' is printed as an appendix to many of the Bibles published by authority in this country,—despairing of any more certain or direct process,—merely *imagined*, that the sacred cubit must have been the same as the old idolatrous Egyptian cubit;

and then adopted the only published length of *that* standard, which he could get,—unfortunately a very erroneous one, viz., 21·888 British inches,—for the length of the sacred cubit of the Bible.

The Rev. J. R. Beard, D.D., in Dr. Kitto's *Bible Cyclopædia*, 150 years after Bishop Cumberland, has found no better principle of research or method of discovery; for he says, plainly and precisely,—'As we have no unit of measure given us in the 'Scriptures, nor preserved to us in the remains 'of any Hebrew building, and as neither the Rab-'bins nor Josephus afford the information we want, 'we have no resource but to apply for information 'to the measures of length used in other countries. 'We go to the Egyptians. The larger Egyptian 'cubit contained about 234·333 Parisian lines, the 'shorter about 204·8. According to this, the Hebrew 'measures of length were these—

'Sacred cubit, = 234·333 Parisian lines = 20·81 British inches.
'Common cubit, = 204·8 Parisian lines = 18·19 British inches.'

Again, the Rev. William Latham Bevan, M.A., in Dr. Smith's *Dictionary of the Bible*, goes over nearly the same ground, adding thereto the determinations of several modern German scholars,—very ingenious, though on equally irrelevant data to anything either contained in the Scriptures, or connected with the Hebrews; and,—after hinting that the sacred cubit *may* be only 15, and *possibly* not more than 12 inches long,—concludes finally for a length

equal to 19·0515 British inches.[1] He also declares that its origin must probably have been trivial and unimportant; being most likely derived from some parts of the human body, as with the measures of other then contemporary nations.

Now while these several authors themselves confess that their materials are insufficient for a safe conclusion, and do bring out such mutually conflicting, and generally uninteresting results,—it has been a matter of extreme surprise to us, that none of these eminent men have taken the smallest notice of the admirable *Dissertation* by Sir Isaac Newton *on Cubits*, reproduced in this volume, pp. 341-366; and alike noticeable for the author, the thoroughness of his treatment of the subject, and the grandeur of the result there brought out for the sacred Hebrew standard—*when still further examined by the light of modern science, as it has advanced since Sir Isaac's day.*

One of the proximate causes of Sir Isaac's remarkable success, in having apparently reached the true, and only, foundation on which subsequent investigators can build securely,—seems to have been,—his clear perception of the radical antithesis, in ideas,

[1] This is by no means a solitary instance amongst writers on Hebrew metrology,—immediately after declaring that they are uncertain to the amount of several units,—yet adopting and insisting on one particular length, exactly defined to the 1-10,000th part of one of the same units. But it is not an honest representation of the state of the subject to set before weaker brethren; who are led to believe that there can be but little more to discover, where the required length appears to be already known to the hundredth part of a hair's-breadth.

association, employment, and more particularly, in the essence of length,—though their names as *cubits* were the same, — between the 'sacred Hebrew 'cubit,' and the 'profane Egyptian cubit.'

The latter he proved to have been very nearly 20·7 inches in length: and our measures on p. 341, indicate that he was remarkably close to the truth.

But the former cubit he finds very different, and by his five successive methods of approach ascertains to be—

First, between	23·28	and	27·94	British inches.
Second, ,,	23·3	,,	27·9	,,
Third, ,,	24·80	,,	25·02	,,
Fourth, ,,	24·91	,,	25·68	,,

and Fifth, somewhere near 24·82.

The mean of all which numbers amounts to 25·07 British inches.

The sacred cubit, then, of the Hebrews, in the time of Moses—according to Sir Isaac Newton—was equal to 25·07 British inches, with a probable error of perhaps $\pm$·1. And what do we find within those limits, and therefore perfectly without the Egyptian cubit?

Why this really glorious consummation for the geodesical science of the present day to have brought to light (and first through the late John Taylor), viz., that a length of 25·025 British inches, or practically the sacred Hebrew cubit, is exactly one-ten-millionth of the earth's semi-axis of rotation; and that is the very best mode of reference to the earth-ball as a whole,—for a linear standard through all time,—that the highest science of the existing

age of the world has yet struck out, or can imagine. In a word, the sacred cubit thus realized forms an instance of the most advanced and perfected human science, supporting the truest, purest, and most ancient religion; while a linear standard, which the chosen people in the earlier ages of the world were merely *told* by maxim to look on as sacred, compared with other cubits of other lengths,—is proved by the progress of human learning, in the latter ages of time, to have had, and still to have, a philosophic merit about it, which no men or nations at the time it was first produced, or within several thousand years thereof, could have possibly thought of for themselves.

Hence we feel bound to give a fair hypothetic trial, connected with *all* Hebrew weights and measures, to Sir Isaac Newton's length of the sacred cubit,—say 25·025 British inches,—and to its being the necessary beginning, exponent, example, and inseparable accompaniment everywhere of the sacred system. If we are wrong in so doing; *i.e.*, if the length given above is *not* the real length of the sacred cubit, nor anything at all near it,—we shall soon be convicted of our error, on attempting to deduce the sacred Hebrew measures of *weight* and *capacity* therefrom; instead of from the 22', or 19', or 15', inch cubits of other men. But if we are right, something else, also noble and pointedly convincing of a more than human origin, for those measures, *may* be expected to appear. Let us first however

inquire what general investigation may have been doing in these further divisions of the subject.

SACRED HEBREW CAPACITY STANDARD.

John Taylor has shown very successfully[1] that the Hebrew weights were derived from their capacity measures, or from the contents of those vessels when filled with rain-water. And as the Bible informs us that the 'bath,' or capacity measure for liquids, was the same as the 'ephah,' or capacity measure for dry-goods,—our inquiry is narrowed down to ascertaining what the standard for Hebrew capacity was, in terms of modern British measure.

As with the cubit, we find here also that the names and *relative* values of the different ancient capacity measures, are easy to discover; especially when the Bible assists us with a remarkable part of the arrangement in decimals; or that

10 omers = 1 ephah;
and 100 omers = 10 ephahs = 1 homer or chomer.

To these, some smaller divisions have been supplemented from the accounts of the Rabbinists, as that

1 ephah = 3 seahs = 6 hins = 18 cabs = 72 logs;

while a more important step in the scale,—not only because it refers to a larger quantity, but because its proportions are stated in the Bible,—has been added by John Taylor, viz., the laver = 40 ephahs

[1] '*The Great Pyramid: Why was it built, and who built it?*' pp. 164-173.

or baths. Hence a complete table of the relative values of generally admitted Hebrew capacity measures, stands thus, beginning with the largest,—

Laver, . .	1							
Homer or chomer,	4	1						
Bath or ephah, .	40	10	1					
Seah, . . .	120	30	3	1				
Hin, . . .	240	60	6	2	1			
Gomer or omer, .	400	100	10	3⅓	1⅔	1		
Cab, . . .	720	180	18	6	3	1½	1	
Log, . . .	2880	720	72	24	12	7½	4	1

Many, nay most, of these subdivisions are Rabbinistical only, and not of any direct importance in the *sacred* system; wherefore the real problem before us now is, to determine the *absolute* value of any one in the series; and then to pick out the sacred *standard*.

Now here again, at this *absolute* point of these capacity measures, just as with the same feature of the cubit, comes the excess of our difficulty; for nothing yet recognised in the Bible has been held to throw any light on the matter.

In dearth, therefore of the proper information, some inquirers, as Bishop Cumberland in former, and M. Boeckh in latter, times, make everything depend on a statement of Josephus that an ephah was equal to an '*Attic Metretes;*' and while some contend with each other on what the value of that measure was, others aver that Josephus was not familiar with the Greek measures, and really meant a '*medimnus.*' Others still, prefer a statement of the Rabbinists,—that 1 log = 6 hen-eggs; and M. Thenius having

ascertained their cubical contents by the quantity of water they displaced, and having also confirmed that observation by a reference to the stated weight of 1 log of water being equal to 61 barley-corns—announces that

	British cubic inches.
1 bath = 4·43 English gallons, ...	= 1239·

while M. Boeckh announces

1 bath = 8·67 English gallons, ...	= 2434·

and Bishop Cumberland announces

1 bath = 7 wine gallons 4 pints 15 cubic inches,	= 1748·

The mean of all these very different results, gives—

1 bath, ...	= 1,807 British cubic inches,
1 homer, ...	= 18,070 ,,
and 1 laver, ...	= 72,280 ,,

probably not very far from the truth.

Now John Taylor had his reasons for considering the laver = 71,329 British inches; and we are inclined to add, that if,—in terms of inches, each ·001 longer than a British inch, and of which longer inches the sacred cubit held 25,—the laver should be found to contain 71,250 cubic inches—or abundantly within the three measured determinations above given—it would be most remarkable as an expression for the *capacity and specific gravity* of the whole globe of the earth,—a problem of surpassing difficulty even to the most advanced science of the present day, yet precisely apposite to the purpose in hand, and ennobling to the soul of man to contemplate. (Vol. iii. p. 152.)

But such a result is not to be admitted, except on data much more precise than any of those above quoted; and we have not had as yet any Bible authority at all, for the absolute value; nor for the laver being considered, more than any other size of vessel, the *standard* of the system; from which standard, the other mentioned measures are derivations only for common purposes. Yet, such testimony exists, as we believe, in Sacred Scripture, and in rigorous connexion with the linear proportions of the sacred cubit, as already laid down; and thus,—

Of all the contents of the Tabernacle of the Congregation, prepared by Moses in the wilderness, none was so sacred as '*the Ark of the Covenant.*' It was kept in the Holiest of Holies; occupied its chief space; and was never to be looked on by any but the High Priest alone, even during a journey. Near it was placed an ephah measure; and outside its compartment, as Michaelis has shown, were various other standards of measure; but no metrological purpose, that we are aware of, has hitherto been assigned to the ark itself. As its original name, '*arca*' implies, it was a box or chest: and its first stated purpose as such, was,—to hold the Divine autograph of the law written on stone.

This box, made of shittim, or acacia wood, was lidless; though a crown of gold was afterwards added round about the rim, and a separate or loose lid was made for it of pure gold, called the mercy-

seat. The actual seat, however—said to be occasionally occupied as a throne by an expression of the Divine presence—was not that lid; but was formed by the wings of two winged angels, constructed in gold at either end of the lid; which lid, at such time, together with the ark below, then *formed the footstool.*[1]

With the lower part only of this arrangement, or the ark, have we to do; and that was in itself (the loose, upper, lid of gold being removed), merely a lidless box, made of a hard and tough wood, derived from a tree common to the hills of Sinai.

Such a shape and material are not unusual for large vessels of capacity measure. But then, what was the size of this one? The Scriptures say, 2·5 cubits long, 1·5 cubit broad, and 1·5 high.

Was this outside measure, or inside measure? Outside without doubt; *first*, because, on the latter supposition, the vertical component of the proportions would inevitably have been spoken of as *depth*, and not *height;* and *second*, because the lid, or mercy-seat being made,—as duly stated in the same place, of only the *same length and breadth* as the open box of the Ark,—would infallibly have

[1] 'The lid or cover of the ark was of the same length and breadth, and made of the purest gold. Over it, at the two extremities, were 'two cherubim, with their faces turned towards each other, and in-'clined a little towards the lid (otherwise called the mercy-seat). 'Their wings, which were spread out over the top of the ark, formed 'the throne of God, the King of Israel, while the ark itself was 'the footstool (Exodus xxv. 10-22; xxxvii. 1-9).'—Kitto's *Bible Cyclopædia*, p. 214.

tumbled down into it, if that length and breadth had applied to that box's inner, and not its outer dimensions.

Hence, with the length of the sacred cubit in our hands, we can immediately approach exceedingly near to the exact cubical contents of the ark. For, although the thickness of its sides is not mentioned in Scripture,—a knowledge of the size, shape, and material of the whole, being already given,—the limits within which such thickness must be found, are left very narrow indeed.

Let the thickness be assumed, for instance, 1·8 inches; and these inches similar to those, of which the sacred cubit contains 25, and the semi-axis of the earth's rotation 250 millions;—then the length, breadth, and depth, will be reduced from an *outside* of 62·5, 37·5, and 37·5 inches, to an *inside* of 58·9, 33·9, and 35·7: the continued multiplication of which three last quantities gives, 71,282 cubic inches for the capacity contents of the box.

Or, if we consider the sides and ends 1·75 inch thick, and the bottom 2 inches,—also very fair proportions in carpentry,—then the inside measures are 59·0, 34·0, and 35·5; which yield for their cubical contents, 71,213 inches. Mean = 71,248.

Thus in any mode, almost, of practically constructing the ark-box, on the data given in the Bible, taken in conjunction with Sir Isaac Newton's length of the *sacred* cubit,—as opposed to the profane cubits of Egypt, Phœnicia, Greece, and Rome,

we come extraordinarily close upon that most important number of 71,250 cubic inches. And that is not only very near to the *mean* of all men's determinations of the contents of one Hebrew *laver*, or forty Hebrew *baths*; but is the very amount also of the coffer in the Great Pyramid,—which building, though in Egypt, will be shown in vol. iii. to have been composed for purposes much more anti- than pro-Egyptian; and without that nation's intelligent understanding, or concurrence. But here it is enough to remind, that the precise theoretical cubic-contents value already mentioned, is so remarkably expressive of the bulk and constitution of the earth as a whole,—that the stated use of the 'ark' under circumstances of Divine presence, *as a footstool*,—instantly brings to our minds the words of the Lord in Isaiah, and repeated in Acts, 'the 'earth is my footstool.'

When such remarkable earth-commensurabilities in size and internal physics, then, are assignable by modern science to the *ark* (of the Covenant), on the Scripture statement of its dimensions,—and when we add thereto the transcendently sacred character assigned by Moses to it, and the extraordinary means applied to its preservation,—we are *obliged* to consider it as the grand standard, and significant origin, of all the other Hebrew measures of capacity, which were allowed to be derived by various subdivisions from it.

The brazen lavers of Solomon, then, which were

each of them of the same *relative*, or stated size as the ark,—*i.e.*, forty baths in contents,—may be considered merely copies of the more ancient ark, as to cubical bulk, for common metrological and other purposes; and may, in so far, remain at the head of our practical table, while their more precious original is only to be referred to on important occasions.

THE MOLTEN SEA.

If the above principles are correct,—they may throw some light on a very much larger measure of capacity still, once in use among the Hebrews for sacred purposes,—viz., the '*Molten Sea:*' that huge vessel cast in bronze by King Solomon,—and which has been restored, imaginatively, of almost every possible shape and size by various modern essayists, —but not connected by them with any very certain principles, or direct application of the sacred standard; while the notices of it in the Bible itself, are rather conflicting.

Thus, for the *relative* value of its contents,—they are stated in Kings to be 2000, and in Chronicles 3000, baths. But inasmuch as the account in Kings is much more full than that of Chronicles,— and in Kings alone is given at the *same time* the contents of the laver in baths also,—we shall secure ourselves from perhaps referring to a profane Egyptian or some other size of bath, if we conclude that the contents of the Molten Sea were 2000 of

those baths of which the laver held 40; or that in fact the Molten Sea was equal, in cubic contents, to fifty times one Laver; and one Laver was equal to the Ark of the Covenant; whose cubic contents in inches we have shown to be as nearly as possible 71,250.

But then, how does the *absolute* size of the Molten Sea, as given by Bible-stated linear measure, accord with such a deduction?

We read in 1 Kings vii. 23-26, 'And he made a 'molten sea, ten cubits from the one brim to the 'other: it was round all about, and his height was 'five cubits; and a line of thirty cubits did com- 'pass it round about. . . . And it was an hand- 'breadth thick: . . . it contained two thousand baths.'

The first point to be ascertained, is the general figure; and here, though some good men have imagined a cylindrical shape, and some a swelling caldron form,—we are inclined to agree with the greater number of all inquirers, who are for a *hemisphere*. For to such a figure the expression 'round 'all about,' conjoined with a diameter given 'from 'brim to brim,' and that diameter equal to twice the height,—seems best to apply; besides such a figure being the most appropriate shape for a large vessel, as this was, of *cast brass*. Josephus, moreover, adds his testimony, whatever that may be worth, again and again, expressly stating that the 'Molten Sea' *was* of a hemispherical form.

There then remains only the one further difficulty, viz., that the circumference of the vessel is stated at

thirty cubits; when, if the diameter of its brim had been really ten cubits, with a circular plan,—the circuit must necessarily have been 31·4159, etc., cubits.

It would seem to be probable, however, that the thirty cubits circumference applies to the *interior* measure; while the ten cubits breadth, coupled with the five cubits *height*, in place of *depth*, evidently allude to *exterior* measures, as explained in the similar case of the Ark. Such too, appeared in a manner of itself, on applying the thickness of 'a 'handbreadth' (deduced from a practical handling of a 25-inch cubit, and a liberal interpretation of the mere term, as meaning five inches or a little more); for, on decreasing the ten cubits diameter by that quantity on either side, the remainder was almost exactly the diameter of a circle, whose circumference measured the thirty cubits actually recorded.

Hence, then, we have to compute the cubical contents of a hemispherical hollow, whose diameter is, not ten sacred cubits or 250 inches, but 238·73 inches only; and such quantity, in the same inches cubic, amounts to 3,562,070; and divided by 50, gives 71,241.

That is, the Molten Sea contained (under the circumstances, within a microscopic quantity of difference), fifty times the contents either of the most sacred *Ark of the Covenant* standard of Hebrew capacity measure; or of the *Coffer* of the anti-Egyptian, and entirely un-idolatrous, Great Pyramid; *i.e.*, 71,250 cubic Pyramid inches.

So huge a vessel might perhaps be looked on by

many persons as a mere solitary wonder, and no part of a regular system of capacity measures. But at the Great Pyramid, there is a space marked off to indicate a very large amount of cubical contents; utterly different in shape from King Solomon's brazen sea,—yet, when neatly and accurately measured, it is found to contain close on the same amount of cubical contents as that, or fifty times 71,250 cubic Pyramid inches. (More exactly, between 71,178 and 71,292; see vol. iii. p. 168.) At the Great Pyramid, too, the chamber space alluded to, fills so important a part, both in extending the practical application of the metrological system there embodied, and in pointing to its high origin and noble purposes,—entirely unknown to any Egyptians,—that we may safely thence infer, that 'the Molten Sea' of the Scriptures, is likewise no accidental or extraneous feature in the sacred Hebrew metrology; but will be found to fulfil purposes, and to have been framed with a wisdom,—as already shown in the case of both the sacred cubit and the Ark of the Covenant,—fully to justify the place which it occupies in Holy Writ.

END OF VOL. II.

EDINBURGH: T. CONSTABLE,
PRINTER TO THE QUEEN, AND TO THE UNIVERSITY.

LIFE AND WORK

AT THE GREAT PYRAMID.

VOL. III.

EDINBURGH: PRINTED BY THOMAS CONSTABLE,

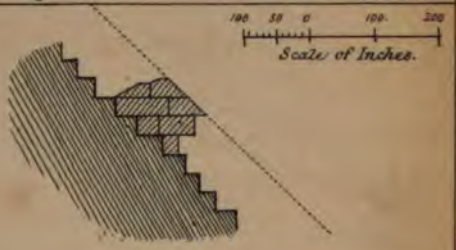
FOR

EDMONSTON AND DOUGLAS.

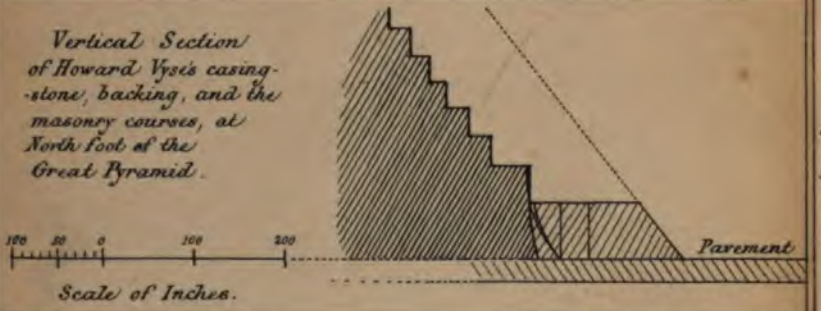
LONDON	HAMILTON, ADAMS, AND CO.
CAMBRIDGE	MACMILLAN AND CO.
DUBLIN	M'GLASHAN AND GILL.
GLASGOW	JAMES MACLEHOSE.

Masonry courses, backing stones, & casing stones of 2nd Pyramid, near the upper part of S. East angle.
From Photograph.

Vertical Section of masonry-courses backing-stones, and casing-stones on the North Stone Pyramid of Dasheor. Howard Vyse & Perring, Large Plate XIV.



Vertical Section of Howard Vyse's casing-stone, backing, and the masonry courses, at North foot of the Great Pyramid.



W. H. Mc Farlane, Lith. Edin.

LIFE AND WORK

AT THE GREAT PYRAMID

DURING THE MONTHS OF JANUARY, FEBRUARY,
MARCH, AND APRIL, A.D. 1865;

WITH

A DISCUSSION OF THE FACTS ASCERTAINED.

BY C. PIAZZI SMYTH, F.R.SS.L. & E.

F.R.A.S., F.R.S.S.A.; HON. M. INST. ENGIN. SC., F.S. ED., AND R.A.A.S. MUNICH AND PALERMO;
PROFESSOR OF PRACTICAL ASTRONOMY IN THE UNIVERSITY OF EDINBURGH,
AND ASTRONOMER-ROYAL FOR SCOTLAND.

IN THREE VOLUMES;

WITH ILLUSTRATIONS ON STONE AND WOOD

VOL. III.

EDINBURGH:
EDMONSTON AND DOUGLAS.
1867.

QC 99
S63
v.3

327325

CONTENTS OF VOLUME III.

DISCUSSION OF RESULTS.

DIVISION I.

LAWS OF PHENOMENA.

PAGE

INTRODUCTION, ... 3

PROPOSITION I.—The Base of the Great Pyramid is square? . 10

PROPOSITION II.—The four sides of the Great Pyramid incline towards its central vertical axis at equal angles? . . 13

PROPOSITION III.—The Angle of Inclination of the Sides of the Great Pyramid is 51° 51′ 14·3″? 19

PROPOSITION IV.—The Angle of Inclination of the Inclined Passages in the Great Pyramid, is 26° 18′ 10″ nearly? . 34

PROPOSITION V.—The Great Pyramid is sensibly in the latitude of 30°? 40

PROPOSITION VI.—Angular alterations in the Earth's crust have been practically insensible during the existence of the Great Pyramid? 52

PROPOSITION VII.—HYPSOMETRY OF THE GREAT PYRAMID, . 60

Datum plane, ... 60

Present Vertical Height, ... 61

Ancient Vertical Height, ... 67

loors of the Chambers, ... 71

Fresh-water Levels, ... 75

Sea-water Level, ... 78

PAGE

PROPOSITION VIII.—MATERIALS OF THE GREAT PYRAMID, . 82
Composition of the Pyramid hill, ... 84
Internal substance of Great Pyramid, ... 86
Exterior substance of Great Pyramid, ... 93
Salt inside Great Pyramid, ... 95
Mortar of Great Pyramid, ... 98
Diorite, ... 100
Granite, ... 101

PROPOSITION IX.—Orientation of the Great Pyramid, . . 106

DIVISION II.

OBJECTS OF CAUSATION.

INTRODUCTION, ... 115

SECTION I.—STANDARDS OF SIZE, ... 123
Pyramid linear measure, ... 142

SECTION II.—STANDARDS OF WEIGHT, ... 143
The Coffer belongs to the King's Chamber, . . . 161
Place of the King's Chamber in the Great Pyramid, . 169
Pyramid Weight and Capacity Measure, . . . 174
Determination of Weights from Linear Measure on the Great Pyramid System, ... 175

SECTION III.—STANDARDS OF HEAT, ... 177
Pyramid Heat Measure, ... 193
Second part of the Heat question, ... 193

SECTION IV.—STANDARDS OF ANGLE, ... 202
Structural reference to 250° in the Quadrant, . . 207
Itinerary Measures, ... 209
Compass Points, ... 211

SECTION V.—STANDARDS OF TIME, ... 215
The Week in the Grand Gallery, ... 219
The Sabbatical Week in the Queen's Chamber, . . 222
Correction for Flooring, ... 229

PAGE

Authority for Twenty-five Inches, ... 232
Authority for the *number* Twenty-five, ... 236
DATE OF THE GREAT PYRAMID, ... 240
Whether the Great Pyramid is to be regarded as Astronomical at all? 246
Siriadic Theory of Mahmoud Bey, ... 251
α Draconis Theory of Sir John Herschel, ... 260
Pyramid data, ... 261
The Year of the Pleiades, ... 263
The Pleiades and the Pyramid, ... 271
Great Pyramid Astronomy, ... 277
Star-maps, explanation of, ... 283
Great Pyramid attestations, ... 286
Conclusion of the Metrological Inquiry, ... 291

DIVISION III.

NOTES IN GREAT PYRAMID HISTORY.

CHAPTER I.—MONUMENTAL DOCUMENTS STILL TO BE PROCURED, 303
An uninterpreted Sign, ... 310

CHAPTER II.—NAMES AND DATES OF THE BUILDERS, . . 314
A Name erroneously advocated, ... 316
Dates of Manetho's Dynasties, ... 321
Names and Designations of Dynasties, ... 329
King's Names, ... 330
Clashing result, ... 338

CHAPTER III.—HISTORICAL AUTHORITIES, ... 340
Osburn and Ancient Writers, ... 345
Greek and Roman Travellers, ... 349
Characteristics of Egyptian Monuments, . . . 351

CHAPTER IV.—EARLIEST PROVED POINT OF EGYPTIAN HISTORY, 356
Baron Bunsen's Authorities demanded, . . . 363
Consequences of there being no Authorities, . . . 367
Origin of the Egyptians, ... 370

PAGE

CHAPTER V.—LIFE UNDER THE OLD EMPIRE, ... 375
Men of the Fourth Dynasty, ... 379
Social Relations, ... 383
Reported Engineering of Nile banks, ... 386
Of the Pyramids and their Kings, ... 391
Conclusion of the Old Empire, ... 397

CHAPTER VI.—LIFE UNDER THE NEW EMPIRE, . . . 400
Invasion of the Hyksos, ... 406
The Joseph Period, ... 410
Rise of the Theban Power, ... 414
Order of Kings under the New Empire, . . . 416
Authorities for the Eighteenth, and later, Dynasties, . 418
Scenes in the Eighteenth Dynasty, ... 423
Of their Religious Principles, ... 429
The kind of Hero developed in Egypt, ... 433
Queen Thuoris, and her adopted son, Moses, . . 441
The Beginning of the End, ... 444

CHAPTER VII.—ORIGINATION OF THE GREAT PYRAMID, ON SCIENTIFIC GROUNDS, ... 449
Research *de novo*, ... 456
Pyramid Idea, whence derived? 460
Wisdom of the Egyptians fails, ... 465
Necessity for seeking a wisdom higher than man's, . 470

CHAPTER VIII.—ORIGINATION OF THE GREAT PYRAMID, ON RELIGIOUS GROUNDS, ... 479
Time of its Performance suitable? 481
Metrology suitable as a subject? 495
Of the Plans which Moses took for the Regulation of Weights and Measures, ... 498
Style of the Metrology suitable? 509
SUITABILITY OF THE MEN CONCERNED? 511
(The Inspired messengers, were Foreigners?) . . 521
(Cuseans retire from Egypt, Northward?) . . 526
(Egyptians punished in the building of Great Pyramid?) 528
(Early Shemites not chosen?) 531
(A new objection.) 533
Pyramid itself, whether acknowledged in Scripture? . 534

PAGE

CHAPTER IX.—ON SOME POINTS IN PRIMEVAL ASTRONOMY, . 545
Who invented the oldest Constellations? . . . 545
Proposed reforms among the Constellations, . . 559
With whom rests the right to Name, or Re-name? . 562
The Constellations as means for perpetuating Ideas, . 566

CHAPTER X.—INTENTIONS AND PURPOSES OF THE GREAT PYRAMID'S MANIFESTATION, ... 570
Proposed Solutions, No. 1, ... 572
,, ,, No. 2, ... 575
,, ,, No. 3, ... 577
,, ,, No. 4, ... 578
Anglo-Saxon originals of Metrology, ... 581
Anglo-Saxons, where from, of old? 590
Metrological test of European races, ... 592
Britain in particular, and Israelitic warning, . . 596

INDEX, ... 605

LIST OF ILLUSTRATIONS

IN VOLUME III.

(THE following Plates, being mostly on very small scales, are capable of little more than giving first approximate ideas of the general nature of the subjects observed and measured. It is particularly requested, therefore, that no 'Pyramid measures' be taken from the Drawings; but that the numerical entries of the original measures, contained in this Volume, be always referred to, when exactness is required.)

No. OF PLATE.

I. CASING-STONES, BACKING-STONES, AND MASONRY COURSES OF THE SECOND, AND OTHER, PYRAMIDS, . . FRONTISPIECE.
REFERRED TO AT P. 24, 26, 27.

INSERTED AT PAGE

II. DIAGRAMS OF PYRAMID THEORY, . . 41
REFERRED TO AT 35, 41, 51.

III. VERTICAL DIAGONAL SECTION OF CORNER OF GREAT PYRAMID, . . . 66
REFERRED TO AT 66.

IV. SUBTERRANEAN CHAMBER, . . . 209
REFERRED TO AT 74, 208.

V. PYRAMID POINTS AND DEGREES, . . 215
REFERRED TO AT 215.

No. of Plate. Inserted at page

VI. ASTRONOMICAL LINES IN GREAT PYRAMID, 219
Referred to at p. 219.

VII. STAR-MAP OF ECLIPTIC POLE, . . . 285
Referred to at 283.

VIII. PYRAMID MERIDIAN STAR-MAP FOR 2170 B.C., 285
Referred to at 284.

IX. PYRAMID MERIDIAN STAR-MAP FOR 1883 A.D., 285
Referred to at 285.

X. VERTICAL SECTION OF NORTH FRONT OF GREAT PYRAMID DOWN TO SEA-LEVEL, 313
Referred to at 313.

XI. MAPS OF EGYPT AT TWO EPOCHS, . . 388
Referred to at 388, 411.

XII. ROYAL OVALS PHOTO-LITHOGRAPHED FROM DR. LEPSIUS' 'KÖNIGSBUCH,' . . 461
Referred to at 259, 319, 461.

XIII. ROYAL QUARRY-MARKS AND OVALS, . . 521
Referred to at 417, 521, etc.

VOL. III.

DISCUSSION

OF RESULTS.

'The fair question is, Does the newly proposed view 'remove more difficulties, require fewer assumptions, and 'present more consistency with observed facts than that 'which it seeks to supersede? If so, the philosopher will 'adopt it, and the world will follow the philosopher—after 'many days.'

MR. PRESIDENT GROVE'S

Opening Address at the British Association for the Advancement of Science, at Nottingham in 1866.

DIVISION I.

LAWS OF PHENOMENA.

'As a first preparation, therefore, for the course he is 'about to commence, he (every student who enters upon a 'scientific pursuit) must loosen his hold on all crude and 'hastily adopted notions, and must strengthen himself, by 'something of an effort and a resolve, for the unprejudiced 'admission of any conclusion which shall appear to be sup- 'ported by careful observation and logical argument, even 'should it prove of a nature adverse to notions he may 'have previously formed for himself, or taken up, without 'examination, on the credit of others.'

SIR J. F. W. HERSCHEL, BART.,
In Par. I. of 'Outlines of Astronomy.' 1849.

DIVISION I.—LAWS OF PHENOMENA.

INTRODUCTION.

HAVING now, in the course of Volume ii., set our numerical observations of 1865 before the reader, in all their rigorous roughness, and perhaps rather confusing multiplicity,—it is a duty to formalize their illustrations up to a certain extent; and show, both what their own internal evidence, and external comparisons of them with other men's observations, may indicate as the proper weight to be attached to their principal results.

This department of the subject, therefore, begins with very little allusion to, and certainly no dependence on, any theory of the Pyramids. We shall curtail our aims indeed even more still, proposing to treat practically not of the Pyramids of Egypt generally, but only, of the Great Pyramid of Jeezeh; and of that too, not by any means in its entirety, but rather as touching certain features of universally allowed, and most evident and tangible character,—wherein it differs from every other known Pyramid.

With all well understood points of *resemblance* therefore amongst Pyramids, we have nothing to do; especially when these points belong to the necessary mechanical road by which every Pyramid builder must have set out, to construct the beginning of any Pyramid whatever. Hence, how or wherewith the builders reared stone upon stone, so as to form the great bulk of the masonry, is not our present topic; for the self-same practical methods which lifted the blocks to form the courses of, say the third Pyramid of Jeezeh, would have been exactly sufficient, more time only being allotted, to lift the more numerous, but not necessarily more weighty, single blocks of the Great Pyramid into their successive places. We see plainly in the dozens of Pyramids still standing, far and near, that the stones *were* lifted, and great exertions of art or strength may have been requisite to that end; but there is nothing in the stone-upon-stone composition of the Great Pyramid, which speaks of the mere building problem to be solved there, as being of a different character, or requiring inventions by man of any absolutely higher order, than elsewhere.

In fact, the *artisan* construction of the Great Pyramid, is as nearly similar to that of all the remaining Pyramids of Jeezeh, and many others elsewhere,—as is the physical constitution of man's bodily frame, or of his bones, muscles, sinews, and blood-vessels, to the bones, muscles, sinews, and blood-vessels of most mammals on the face of the globe;

growing on the same principles of growth, and hurt or nourished by the same, or nearly similar, material agents. Some superior finish and perfection of parts there may be indeed, and actually are, about the composition of the Great Pyramid,—even as the body of man is superior in beauty and perfection to that of all animals. But, if we would look to what *most* distinguishes man, we must attend to what is present in him, and wanting in all the other denizens of earth; viz., mind, language, and soul, his schemes for education in this world, and self-denying preparation for another.

Even in the same manner,—whatever may be ultimately thought as to the degree of the thing shadowed out,—there appears to be a series of features in the Great Pyramid, which have no counterparts whatever in the other Pyramids; and excel, as well in the grandeur of their objects, as elevation of their meaning, the mere corporal existence of any ordinary Pyramid, as far as does the soul, the body of man. To these, so to speak, psychical distinctions of the Great Pyramid, therefore, we propose now to address ourselves; but our progress must be very cautious, and jealously watchful for any possibility of being led astray by imperfect knowledge,—not of what the monument is now, picturesque and grand too in its ruins,—but of what it was at the time of its building; for only in so far as we can regain that state, are we entitled to any certainty in concluding its original character, objects, or purposes.

Now, in this point of view, we cannot realize to ourselves too copiously, that the Great Pyramid has been standing amongst mankind, by the testimony of all modern authors, 3500 years at least,—some say very much more, as even 6500 years,—and we may, in the end, be able to throw some light on the question of how long exactly. It dates, therefore, even at the lowest published computation, in Biblical personal chronology, not only from before the 'birth 'of history on that night when Moses led the 'Exodus out of Egypt,' but before Jacob, and before Abraham; long before any known literal representa tion of language, either Hebrew, Sanscrit, or even Egyptian; before any papyrus that has been preserved, and before any recognised examples of even pictorial representations, other than a few carved and painted stones in and about the Pyramids themselves.

What changes, then, and what mischiefs may not have occurred to the Great Pyramid, through all that enormous space of time, during which Egypt was trodden under foot by nation after nation in succeeding ages of the world; and the Great Pyramid standing all the time in the midst of a field of tombs, one of the grandest scenes of burial throughout the whole earth. For a time, indeed, the sanctity of a place of sepulchres reputed of the kings of the nation, would hedge the whole district around with intense respect, nay, even veneration; and a deposit of other things for safe keeping, besides occasional

gold and jewels, may have been made there. Of treasure, however, in the usual acceptation of the term, there has been remarkably little found at any time near the Jeezeh Pyramids, so that mere robbers for filthy lucre's sake, never received much encouragement;[1] and the first form assumed by want of respect towards the original dead, which arose with new dynasties and strange tribes dominant in the land, was merely an occupying of their expensively constructed, or laboriously excavated tombs for similar burial purposes again.[2] In short, the field of the Pyramids, and often the same individual

[1] Ancient Roman coins are found occasionally in some of the tombs, and we saw a handful in 1864, which had been bought the same day from an Arab near the Pyramid. Gold signet-rings of Egyptian manufacture, *have* likewise been met with: for, not only is there the well-known instance of the ring secured by the late Dr. Abbott, and distinguished by the oval of King Shofo; but we have been lately informed, that a very similar ring, massive and solid, but belonging to a subsequent dynasty, was found in a tomb on the eastern side of the Great Pyramid hill in 1866, and was sold from hand to hand at increasing prices, before the Museum of Boolak could step in to claim its own.

[2] In Hekekyan Bey's *Chronology of Siriadic Monuments*, the following instructive passage occurs at p. 20:—'But we must be on our 'guard not to assign the construction of a monument always to the 'most prominently legible names that have been engraved on it. 'There was a colossal statue of the first class in dimensions in 'Memphis, the cylinders of which had apparently, by the frequent 'sections sliced off from them to engrave new seals or ovals on them, 'been so much diminished, that a mortise was made through and 'through in each hand for the introduction of new cylinders. There 'were also standard statues in the temples, made to the size of life, 'with a hollow in their faces for the introduction of new noses, in 'order to bring about a resemblance to the king of the day. As these 'statues were painted and gilded, a clever artist, assisted by conven-'tionalities respected by public opinion, could gratify the vanity of 'the ruling sovereign.'

vaults, continued to be used for interment over and over again, for more than two thousand years, or up to the time of the Romans; and the full rage for breaking up, ransacking, and plundering,—only really began, after the locust-like armies of the destroying Muslims had issued from their Arabian home, and established themselves in the Coptic land.

Here, then, in the Great Pyramid, are the remains of a building so old that no contemporary writing about it exists; indeed, no subsequent book-writing treats of it within 1500 years at least of its foundation,—when changes of race, religion, and sentiment innumerable had in the meantime occurred, and its real purpose been lost. And now it is so injured, by comparatively recent ravages, as to be in the eyes of some passing travellers little better than a heap of stones. What, therefore, can be undeniably made out from its relics in our day, as to an exact nature or character having ever appertained to it?

Little enough, we may fear; unless, indeed, some far surpassing skill was employed, both in devising its principles, and superintending their methods of execution. But as that is precisely what has been often, and very variously, asserted, and denied,—the question, as above proposed, is brought immediately before us, and invested with important claims for earnest, and even instant, attention. Wherefore, taking for granted that our readers at

this stage are acquainted with all the leading points in its history (so far as written), and the generally acknowledged more conspicuous features of its appearance,—we shall treat of the Great Pyramid, not as a thing just descended upon earth, and requiring a round-about induction before anything whatever is to be inferred concerning the mere existence of any part of it,—but, as something known approximately for a long time; and allowing us freely to begin, by mentioning some very simple propositions already adverted to by numerous authors, and testing how far they may be borne out by these recent, and more than usually painstaking, observations of ours: hence—

PROPOSITION I.

'THE BASE OF THE GREAT PYRAMID IS SQUARE?'

GENERALLY speaking, every one can see that the base of the Great Pyramid has four sides; that the angles at the corners cannot be very far from right angles; and that the sides cannot be very unequal in length: but some men have hesitated to admit any high degree of exactness in those particulars, in face of the following passage from F. Vausleb, A.D. 1664:—

'I have taken notice that none of the Pyramids' '(bases) are alike, or perfectly square; but that all 'have two sides longer than the others. I intended 'to measure the greatest; for that purpose I had 'with me a string of about thirty land yards; but 'because the winds have heaped about it mountains 'of sand, I could not possibly draw a line straight 'from one angle to the other.'

Now, from the confidence with which this author speaks of two sides being so plainly overlong, even to casual observation,—one can hardly imagine that he would infer less difference than about 1-5th of

the whole of one side, which feature at the Great Pyramid measures about nine thousand inches in length. Yet in the early part of April 1865, when I had had three months' acquaintance with the Pyramid,—and then went over all four sides (vol. ii. p. 133) with a 500-inch cord, making the best allowance that I could for broken corners, and heaped flanks,—the difference of the least, from the greatest, measured side seemed under one hundred inches; or, 1-90th only, of the whole; in spite, too, of such evidently large errors of observation accompanying, that this result could be considered only as a first and rather distant approximation.

Yet no closer approach was probably ever made in modern times, until a few weeks afterwards,—when Mr. Inglis uncovered all four of the peculiar *corner-sockets* of the original casing-stone surface, or true exterior of the ancient Pyramid (vol. i. ch. xvii. p. 535; also Plate IV. vol. i.); found them marked sharply and immovably in the solid rock below; and the distances between them not to vary in any two cases above eighteen inches (vol. ii. p. 134), or, no more than 1-508th of the whole side! And even this could only be regarded as another step of approximation, weighted too, more probably with large errors of observation by the modern observer, than of commission by the ancient builder,—because, the ground between each socket is *now* so excessively difficult to measure over, by reason of heaps of broken stones.

The third approximation therefore fell to my share, in measuring with the Playfair altitude-azimuth instrument, the azimuth,—first, of the line of the two sockets on the eastern side, and second, of those on the northern side of the Pyramid ; for such measure was independent of the exact length of the sides, and made positive use of the heaps of rubbish in the middle of them by mounting the instrument upon their bulk, thereby enabling it to see, both the signals placed over the terminal sockets, and also the Polar star. The latter was unfortunately the only means of connecting the two sets of sockets, for each socket is in a sort of hole, and can see no other socket on account of huge intervening mounds of rubbish ; hence the observation is not by any means a *ne plus ultra* of modern measure ; yet it was more trustworthy, *à priori*, than the two former methods, and made the angle of the Great Pyramid's base at the north-east corner, to be equal to 90°,—all but a few seconds short of 1′ (vol. ii. p. 194). Let us say 1′ ; and, to form an idea of what that signifies in the former terms ;—if that 1′ were caused solely by the west side of the Great Pyramid being of a different length from the other three,—a variation of 2·5 inches, or only 1-3600th part of the whole length, would make all the difference of angle found.

In direct proportion then as our means of measuring the contested point have advanced in power, so has the base of the Great Pyramid been proved to

be closer and closer to a true square; and so close at last, that there can hardly be any reasonable doubt left, as to the *intention* of the builders to have made it as perfectly square as their practical means enabled them to do. Seeing, moreover, that no better result of measure is likely to be procured, until excavations and clearings are effected round the entire Pyramid,—and in so extensive as well as complete a manner that no one at present living, whether European or Egyptian, seems disposed to be at the expense of undertaking them,—we may consider this first Proposition to have been temporarily settled in the affirmative.

PROPOSITION II.

'THE FOUR SIDES OF THE GREAT PYRAMID INCLINE TOWARDS ITS CENTRAL VERTICAL AXIS AT EQUAL ANGLES?'

Now Dr. Perry, in 1743, has written, that 'in the 'opinion of most persons the different sides of the '(Great) Pyramid ascend at different angles; that 'one side has an angle of 40°, another of 37·5°, a 'third of 35°, and a fourth of 42·5°:' and although Colonel Howard Vyse remarked, 'this may be 'owing to the dilapidated state of the building and 'to the base having been covered with sand and 'rubbish—for the building was *no doubt* equilateral

' and equiangular,'—yet this does not exactly meet all the difficulties of the case. It might also be further alleged with that party, that not only he, but the French *savants* of 1799, Sir Gardner Wilkinson, and all other really first-rate authorities, have invariably thought it sufficient in their published descriptions of the Great Pyramid, to give the angle of one side only,—or rather to state one angle, even to the accuracy of a single minute of space,—as representing equally and sufficiently the inclination of every side. But then comes the question,—if they only measured one side, of what possible authority can their assertions be, as touching the other sides?

There may be more observations on the subject recorded somewhere by those eminent men, but I am not at present acquainted with them: nor was I when, in January 1865, Mr. Ayrton kindly communicated to me his own observations (given in vol. ii. Section v.); observations taken with a theodolite, and evidently by a man well acquainted with the principles of mathematical investigation. Now, as these observations give the angles of the different sides varying from 51° 51′ to 55° 58′, they appear to prove an immense fact of diversity actually existing in the present pile of the mere internal courses of the ancient Pyramid; an amount indeed of *error*, which the builders would have found it very difficult to restore to truth, with the limited means which the thickness of the casing-stones placed at their command. In this point of view, I conversed

on the subject with other members of the late Cairo Institute; but they expressed the utmost confidence in Mr. Ayrton's observations, as representing a real feature in the Pyramid, and deserving most serious attention. They likewise characterized the whole casing-stone theory as a pure modern invention,—the Great Pyramid having always been, in their estimation, the 'stepped,' or 'laddered,' structure it now is.

Let us therefore first take the present Pyramid just as it stands, and test that by further observation. Before bringing any instruments to bear too, let us make ourselves acquainted with the structure which is to be observed: for, even passing over the asperities of rectangular courses of stone, forming, by their being set one within the other as they ascend, a general oblique line,—it is sensibly inexact on a larger scale, dependent on the greater weathering of the softer stone used for the middle part of every side, and the less weathering of the harder stone introduced all along the corner slopes, and over the whole summit;—a feature well brought out in some of the photographs, especially Stereograph No. 5. Hence the tendency would certainly be,—were a person on the summit of the Pyramid, and directing a theodolite along the edges of the stone courses in the middle of every side as far as he could see clearly,—to obtain too large an angle of dip; and a very inexact one also, because it must be decided by the weathering of the stones at a distant part, where they cannot be well examined.

Now this, I am told, *was* the manner,—very creditable too, to the observer, as touching the brave exposure of himself and theodolite on the top of a dizzy, dangerous height,—in which Mr. Ayrton's observations were made; and his own angles of inclination of the *corner-lines* of the Pyramid (where there is hard stone all along), *if we compute the side inclination therefrom*, prove his mean observed angle of the *side* to be full 2° over great. His corner-line angles are also much more accordant *inter se*, varying only 30′, against the variation of his side angles by 4° 7′. Plainly, therefore, the latter large quantity is an error due to not attending to the practical details of the nature of the thing to be observed; though it gives a gratifying proof of the perfect honesty and general ability of the observer concerned.

My own direct measures of the case were only made on April the 8th; when I had become pretty well acquainted with the accidents of the Pyramid surface. And my method was, to ascend the rubbish-heap in the middle of every side, and choose there amongst stones variously weathered, one that had suffered least, and then measure the angle from that to the summit of the Pyramid,—where I knew from previous observation, though I could not then see it, that all the stones were little worn:—and the result was, that no greater difference than 15′ was found between any two sides (see vol. ii. p. 165).

A more powerful opportunity, however, occurred in the last week of the same month, after the corner

sockets of the original base of the Pyramid had been opened up. For, on observing with the large Playfair alt-azimuth instrument, the angle of altitude of the top of the Pyramid, as seen from the floor of each socket just inside its outer corner,—the differences were reduced to 8′; and when the floors were corrected for their various depressions below a given datum plane, the differences (see vol. ii. p. 176) were further reduced to 3′.

Now this last approximation, which comes so very close to the statement of our proposition, was obtained by employing the present Pyramid at the top, and the ancient Pyramid at the bottom, as represented by its four sockets; and as these are considered to be the sockets of its former outside casing-stones,—their theory is included, and partly confirmed by the result. But we have further testimony on that point.

Herodotus and other authors speak of the smooth surface of the sides of the Great Pyramid, evidently as formed by the bevelled outside of the casing-stones: besides which, we see portions of the casing of the second and third Pyramids still existing; and, by excavation, may find the lower part of the casing of the seventh, eighth, and ninth Pyramids still *in situ*; all these casings being on the same plan, viz., stones of fine quality, admirably worked, rectangular at the back towards the bulk of the Pyramid, and bevelled off on the outer surface to one general angle for each Pyramid.

'That may be,' said learned Cairenes, 'for *all* 'those *other* Pyramids you have mentioned; but the 'Great Pyramid was different from its neighbours 'in that particular, for it was always the "laddered" 'Pyramid; and though no doubt Colonel Howard 'Vyse did find two bevelled stones at the northern 'foot, there were never more than those two!'

I have already described, however, in vol. i. ch. ix. p. 216, the finding by our party, of fragments of casing-stones innumerable, on all four sides of the Great Pyramid: and have now further to record, that when the oblique angles of fourteen of these fragments were afterwards measured carefully in Edinburgh, they gave, within twelve minutes, the same angle for each of the four sides of the monument; as close a proof to the equality of the ancient angle of the Pyramid sides, as could be expected from the small size and injured character of the specimens. And having had, further, a large theoretical model of the Pyramid recently constructed by a very exact-working carpenter,—and having had set in the sides of that model, with either their upper or lower surfaces coincident with a horizontal section of the same, all the available casing-stone specimens,—their outer bevelled surfaces were invariably found practically coincident with the theoretical slope of the model.[1] 'I should not have been so much sur-'prised,' said the carpenter, speaking as a represen-

[1] This model, with its casing-stone fragments, was presented to the Royal Society, Edinburgh, in April 1866.

tative man of his order in the present advanced age of the world, and in a city noted for intellect and education, 'I should not have been so much sur-'prised, if one or two of the stones had fitted; but 'to find all fourteen of them fit; and fit as exactly 'as if they had been made to my own work, that 'does surprise me!'

After this rude though thoroughly practical illustration, it will probably be allowed,—that in its original perfect state, the Great Pyramid must have been a remarkably close approach to the regular figure demanded in our present Proposition.

PROPOSITION III.

'THE ANGLE OF INCLINATION OF THE SIDES OF THE GREAT PYRAMID IS 51° 51′ 14·3″?'

THE two former propositions merely went to ascertain whether the Great Pyramid could be considered as a regular structure, or indeed as a mathematical Pyramid at all—a quality which may or may not belong to any of the other so-called Pyramids around; and is generic only, in its widest sense. But the present proposition is far more particular; for, while from the same base there may be raised, by altering the angle of the sides, an infinite number of regular, though different, Pyramids; it is here asserted that the angle of the sides of the

Great Pyramid is of precisely such an amount, as to cause the linear proportion which the vertical height of the whole mass, bears to twice the length of one side of the base,—to be precisely that of the diameter, to the circumference, of a circle; the invaluable quantity π of all modern mathematics.

This view of the matter is owing certainly and solely to the late John Taylor. He derived it originally from the measures published by Colonel Howard Vyse, giving the angle of his two celebrated casing-stones *in situ* at the northern foot of the Pyramid, as being between 51° 50′ and 51° 52′ 15″. This result was by two different methods of measurement, but the latter slightly better than the former, so as to raise the mean rather above 51° 51′ 8″: and he, John Taylor, held to his views therefrom, notwithstanding that a host of diverse mathematical theorems were advanced by other investigators, as having probably regulated the proportions of the Great Pyramid. Notwithstanding also that Colonel Howard Vyse's friend and assistant in Egypt, Mr. Perring, subsequently fell away from his own original measures; and, having lost by death the Colonel's friendly and honest guidance, committed the fatal mistake,—applauded though it was by Chevalier Bunsen,—of remodelling all the measured proportions of the Pyramid, according to a pure hypothesis as to even numbers of the Egyptian cubit having been employed on the principal lines. Whence resulted the angle 51° 20′ 25″, for the incli-

nation of the sides of the Great Pyramid; a quantity which has therefore been boldly, even brazenly, printed as being the actual fact, in the second volume of Bunsen's *Egypt's Place in Universal History*.[1]

Now, if the question had rested still, where Colonel Howard Vyse left it, I would not have presumed to interfere. For although my angle-measuring instruments were superior to his,—there is not now any feature accessible about any part of the Pyramid, which can approach in the remotest degree to the admirable facilities for correct measure which his large casing-stones *in situ* afforded,—or which can pretend to bring the question within the very small range of uncertainty, which his two perfectly independent methods of measuring the same thing, ultimately resulted in.[2] But when some one else in London, subsequently alters the quantity at will, by more than half a degree,—I have then no compunction in bringing out whatever I may have actually observed in Egypt; and in thereby allowing all men

[1] As an illustration both of the persuasions to which Mr. Perring may have succumbed, and of some men being still sadly prone to put theory, not only before, but in place of, measure,—I may mention having received a letter from an octogenarian in October 1866, suggesting that I should *proportion all my own measures to his theoretical lengths of cofer and Pyramid*; for though these latter hypothetical numbers are often very wide of the actual quantities, their author thinks they illustrate 'eternal laws,' and 'absolute harmonies;' and are therefore infinitely superior to anything that can be derived from direct measures. He likewise advises that the present book should be illustrated, not with drawings of the Pyramid itself, but with photographs of a large diagram representing his theoretical idea of the Pyramid!

[2] See *Our Inheritance in the Great Pyramid*, by the Author, pp. 21 to 24.

to see for themselves, whether there is any probability of 51° 20′ being nearer to the fact of the Great Pyramid, than 51° 51′; for the odd seconds are not worth noting in the presence of more than half a degree of defalcation.

First, then, I would remark, referring to page 165 of volume second,—that my measures of the mere denuded sides of the Great Pyramid, taken with special pains to avoid effects of weathering, are, on every flank of the Pyramid, contained within the numbers 51° 39′ and 51° 59′. And, second, that the fragments of all the casing-stones measured, come (vol. ii. p. 169) in the means of two sets arranged according to their having been derived from the upper or lower edge of the casing-stones,—between 51° 49′ and 51° 58′.

But whereas those two examples may be considered of very limited powers, I would allude, thirdly, to the observations taken with the Playfair altitude-azimuth instrument from the four corner sockets of the Pyramid. There, at least for the lower parts, we had the very original terminal markings of the Pyramid's base; and if for the summit we had only the *denuded* top of the Pyramid, we may have some means of approximating to the *thickness* of casing to be virtually supplied. In fact, on this point the whole question turns; we shall do well, therefore, to inquire into its structural details before referring to instrumental observations.

Now, only by examination of the Pyramids them-

selves, can we expect to become acquainted with their builders' mode of applying their peculiar system of a casing-stone finish to the exterior; and there are some points about it, which have not yet been brought out in print. On looking to the third Pyramid of Jeezeh, we see many of its casing-stones still *in situ* at various heights, simply seated in the angles of the component courses of masonry; and if that were the rule also at the Great Pyramid, the average thickness of the casing must always have been measured by one stone. But, if we examine, on the other hand, the second Pyramid of Jeezeh,—it is found to have one, or more, thicknesses of a sort of intermediate class of *backing-stones*, between the rude courses of masonry and the exquisitely bevelled exterior of the outer casing; the horizontal thickness, consequently, of what must be considered *there*, the general casing, is measured by several stones, and is much greater than at the third Pyramid.

Which of these two plans, then, was probably adopted at the Great Pyramid?

Without doubt that of the second Pyramid: for there, all the casing still visible about the upper part, is of the white Mokattam limestone, such as all the fragments at the foot of the Great Pyramid are composed of; and those two are nearly contemporaneous buildings (see chapter x., vol. i.); while the third Pyramid is an erection of a long subsequent age, and its casing is in red granite, a rare and costly material in Lower and Middle Egypt.

Let us attend then to what are the facts at the second Pyramid; where, after having first noticed certain phenomena from the ground below it, with the eye,—I was subsequently enabled to obtain an approximate measure of them by placing several photographs, then and there taken, under a microscope provided with a micrometer; and the following are the nearly consistent results derived from views of both the north, east, and south sides, but more particularly from the southern end of the east side, close to the lower termination of the casing there—

Height of each of the regular courses of masonry forming the core of the upper part of the building,	= 37	inches.
Height of each of the stones forming the external surface of the casing, ...	= 19	,,
Height of each of the stones forming one or more layers *between* the regular internal courses of masonry and the outside bevelled casing-stones, .	= 20	,,
Horizontal distance from the outside bevelled surface of the casing-stones, to the regular courses of internal masonry core, including, therefore, all the interstitial layers of backing-stones of 20°, . .	= 105	,,

See *Frontispiece*.[1]

---

[1] As a further illustration of the large amount of horizontal projection of the casing-stones beyond the courses of the second Pyramid,—I may mention that our Arab attendant, Alee Dobree, being freed from our service on a Sunday, employed his leisure on one occasion in company with some of his friends, in conducting an eager traveller, name unknown, up the second Pyramid. They progressed well enough for half the ascent; but when they came close under the casing, and saw it spread out over their heads like an umbrella,—the traveller became so nervously alarmed, that Alee and the Arabs had to bind him to them, they said, with ropes, or he would have fallen down like a stone; and there was an end at once to all his ambitious projects, at the second Pyramid.

In Howard Vyse and Perring's folio views the horizontal distance of

Now, inasmuch as these numbers show, that the casing-stones were generally small as compared with the blocks forming the courses of masonry, and were accompanied by other small stones, also of fine quality behind them, and cut rectangularly, —we see immediately why the casing of a Pyramid, cased on such a plan, was so great a prize to the Muslim plunderers of the middle ages, who were in need of building materials for their newly-devised cities. For, such moderate-sized rectangular stones, of the white Mokattam order, are precisely what the Arabs about the Pyramids are still plundering the tombs of,—whenever their internal walls are so composed; and at the Great Pyramid, the supply of such stones could only be got at by pulling off the bevelled casing. While, if this itself was likewise composed for the most part of stones only twenty inches high,—they could be trimmed into shape with far greater ease, than such very large blocks as all the casing-stones have been usually supposed to be, from the enormous size of Colonel Howard Vyse's celebrated two. These, however, formed part of the very base of the casing, and had a particular mechanical reason for being massive, which did not likewise appertain to the majority above them.

the outside casing from the inside courses, is about ninety-six inches, close under the casing; but rather more a few courses lower down. The datum for linear measures of details in my photographs already alluded to, I should add, has been the breadth of the second Pyramid, from point to point of its casing's lower end, as given in the meridian section of the same folio views, and made equal to two thousand two hundred inches.

To infer again what the arrangement of the upper part of the casing of the Great Pyramid must have been, from another example than that of the second Pyramid,—we may allude to Colonel Howard Vyse's description of the north Pyramid of Dashoor, the architecture of which he frequently compares to that of the Great Pyramid; besides its being, in point of size of base, the nearest approach to that grand example, of all the Pyramids of Egypt. This Dashoor monument, then, was built of a local reddish stone, full of petrified shells, but was cased with white Mokattam stone. Some patches of this casing still exist *in situ*, at various heights of the Pyramid's sides; and one of them, represented on Plate I., shows unequivocally the backing, or filling-in, with rectangular blocks of white Mokattam material, between the bevelled casing-stones and the regular courses of constructive masonry of the Pyramid's core. There is no scale to the Colonel's or Mr. Perring's view (Plate 14 of his folio views); but, measured by his stated breadth of the entrance passage which is close by,—the mean horizontal thickness of the white casing and backing stones represented, is rather more than 120 inches. In other parts of the Pyramid the same feature varies from 60 to 130 inches,—the figure given by the mere masonry courses being very rude, and requiring much larger corrections in some places than in others.[1]

[1] The following further account of this Dashoor Pyramid is important. 'The top of the Pyramid was built entirely with Arabian

Now comes the all-important question, viz., what thickness shall we assign to the casing that once surrounded the *present* summit of the Great Pyramid; which so-called summit, let it always be borne in mind, must have been some 350 inches below the original culminating point? Colonel Howard Vyse gives for the distance of the outside of *his* two casing-stones, from the Pyramid courses, on their level, 'about nine feet,' or 108 inches; and in his view, he fills part of that space with certain filling-in blocks, as also shown on our Plate I. fig. 3. But if we take for the summit casing's horizontal thickness in the middle of one of the sides, the round number of 100 inches,—and add one inch for the thick layer of red mortar between the outside of the masonry course and the first surface of the backing-stones,—similarly with what may be seen outside the present north-eastern corner of the Pyramid near the ground (stereographic photograph No. 1),—we then have a *side* thickness which gives a diagonal measure at the *corner*, of 143 inches. And, from our actual measure, at the socket below with the Playfair altitude-azimuth instrument, of signals held out at the top of the Pyramid to dis-

(Mokattam) stone. The apex had been formed of one block, and the 'course below it of four others, 57 inches thick; but in general the 'courses towards the top were about 24 inches, and those near the 'base 36 inches in thickness. The stones are laid in horizontal 'courses, and the whole of the masonry is good, and resembles that of 'the Great Pyramid of Jeezeh.'

'Being still very sharp at top, it is called by the Arabs "Haram 'Mesinee," the pointed or sharp Pyramid. It is also called "Haram 'el Watawoot," from the number of bats within it.'

tances of both 100 and 150 inches in the diagonal direction,—we are justified in stating (see vol. ii. p. 176), that the 143-inch diagonal would have an altitude at every corner, between 41° 58′, and 42° 1′; while the theoretical corner angle arising from John Taylor's side angle of 51° 51′ 14·3″, is 41° 59′ 48·7″.

This example may perhaps suffice to show, that Colonel Howard Vyse's measured, and John Taylor's adopted, angle of the side inclination of the Great Pyramid, cannot be very far from the truth. But there is even a fourth reference which may be made to observation; and if the things referred to therein do not appear at first sight, to be in any immediate way connected with the matter, and never have been so connected yet by any author or traveller,—they will speak for themselves when they come to be *measured*. Most happily too, every part of them which has to enter into the measurement, still exists visibly and tangibly; so that good, painstaking, modern observation is perfectly able of itself, either to prove or disprove what has just been advanced.

The features here alluded to, are the azimuth trenches, as we have termed them (vol. i. p. 134 and 416; and vol. ii. p. 125 and 185; see also Plate xv. vol. ii.), before the Eastern face of the Great Pyramid; features which are unique, and have nothing at all resembling them, about any other of the Pyramids of Jeezeh. The earliest distinct notice which I have been able to identify as alluding to them, is

that of Dr. Richardson in 1817; and he, travelling in the train of a peer of the realm, and at a time when the trenches were half filled with rubbish, speaks of them as resembling the inclined roads by which a gentleman's carriage would be taken to and from a pond of water. He then speculates upon whether they might not really have had something to do with moisture in a more important manner,—imagining that the water of the Nile was raised up in ancient days by bucket-wheels innumerable to the top of the hill, and then poured into the trenches; which, if cleared of their present anomalous contents, might be found, he suggests, to descend very deep, and convey their fluid supplies to the concealed tomb of King Cheops, keeping that structure thereby perpetually surrounded with water, in the island-like manner detailed by Herodotus.

Subsequently, M. Caviglia in 1820, and Mr. Perring in 1837, did clear out most of the loose rubbish; and thereby showed the untenability, either of the carriage-road or the water-trough hypotheses:—in their place, however, announcing the idea, that the trenches had been used *for mixing mortar in at the time of building the Pyramid*; an idea repeated by Sir Gardner Wilkinson, though without particular affirmation. Dr. Lepsius again looked on at the same hollows in 1843, pronouncing them, according to his map, *to be tombs*. And finally, the moment I caught sight of them in January

1865, they gave me the impression of being somehow or other connected with an original laying out of the dominant angles of the Great Pyramid,—in the manner of an astronomer's marking the meridian and prime vertical lines with much exactitude, before beginning to build a public observatory.

Two of the trenches, the north and south ones, evidently indicate a meridian line, or rather a parallel to the east face of the Great Pyramid. And then a very peculiar, sharply, and deeply cut trench,—the east-north-east one,—goes off from the middle of the linear distance between them (Plate xv. vol. ii.), at an angle, measured accurately with the Playfair instrument, of 76° 25′ 52″ with the line of the north and south trenches; and of 76° 11′ 22″ with the line of the two sockets at the north-east and south-east corners of the Pyramid's base. The mean of these two quantities, being 76° 18′ 38″,—while the angle at the summit of the Pyramid between opposite faces, according to John Taylor's theory, is 76° 17′ 31″.

Again, from the same starting-point, the angle between the north-north-east and east-north-east trenches, is 51° 53′ 22″; evidently a near approach to John Taylor's number for the angle of elevation at the foot of the Great Pyramid in the middle of one of its sides. But as this angle can be deduced trigonometrically from the angle at the summit of the Pyramid, of which we have the two distinct trench measures above given,—there can be produced

from the azimuth trenches three determinations for the angle of the foot of the Pyramid, as thus—

1,	. . . . .	51° 53′ 22″
2,	. . . . .	51 47 4
and 3,	. . . . .	51 54 19
	The mean of all which, is .	51 51 35

an astonishingly close approximation surely to John Taylor's 51° 51′ 14·3″: and utterly removed from Mr. Perring's and Chevalier Bunsen's hypothetical quantity of 51° 20′.

True, no doubt, that these trench results may be termed 'only a coincidence;' but then what a coincidence, compared to any other that could be instituted in all that region, even amongst forms more apparently similar! Look round, for instance, at all the rest of the Jeezeh Pyramids, some of them indicated historically to be built in imitation of the Great Pyramid,—but by kings or architects who were of a diametrically opposed religious belief; and who evidently, by the fact of the measured proportions of their works, did not appreciate the invaluable geometrical consequence of the particular angle 51° 51′ 14·3″. For thus are given those Pyramids' angles by modern independent observation—

Second Pyramid,	52° 50′	by the French *savants*.
	52 20	by Howard Vyse.
	52 50	by C. Piazzi Smyth.
Third Pyramid,	51 0	by Howard Vyse.
Fifth, ,,	52 15	,,
Seventh ,,	52 10	,,
Eighth ,,	52 10	,,
Ninth ,,	52 10	,,

That is to say, each and every one of these Pyramids is largely removed,—or, by a great many times the value of the azimuth-trench angular differences,—from the typical angle of the Great Pyramid! But, while pointing out this remarkable feature as a crying fact, I am at the same time quite ready to bow before a civil engineer like Mr. Perring, in a matter of building,—and allow, that the trenches were used, and probably opened out and widened along their axes at the time of the building of the Great Pyramid,—for *'mixing mortar'* in. Or, to be equally respectful before Dr. Lepsius, as a sepulchral authority, —and consent to the trenches having been used, after the building was over, and mortar-mixing no longer required,—for *the interment of corpses;* (indeed, our own people, in clearing out rubbish from the southern end of the north trench, turned out several lumps of bitumen, and a few mummy rags). But these employments can by no means explain, and have not even attempted to explain, the particular, nay, the more than particular, *angles* at which the axes of the trenches are azimuthally situated with respect to each other; and the placing of them *at those angles,* must have *preceded* their employment for the other more material and subsequently useful purposes alleged.

Either, then, the trenches were placed by their original diggers at the actual angles now ascertained, intentionally, or not intentionally. If the former, those men, who must also be looked on as the

builders of the Great Pyramid, knew what a remarkable property they could give to a Pyramid, by constructing its slope at the critical angle of 51° 51′ nearly, and we shall do wisely to attend with care to their other angular works. But if the latter, that is, if the angle was the result of pure accident, without the will or intention of the builders being exerted to any extent,—and if we find, on investigating further, that the Great Pyramid is full of similar accidents,—each of them dovetailing into the other, and forming a regular system with a set purpose and grand design,—then what some men call accident, others will be inclined to look on as Providence 'overruling the works of men, and 'causing them to assist in bringing out results 'which they never anticipated.'

For the present, however, we merely request attention to the features of this one case on its own merits; for there, no *subsequent* use which the trenches may have been put to, during the last four thousand years, has prevented an *original* feature of them being recovered by modern scientific measure; and when it is so recovered, it is found eminently corroborative of John Taylor's peculiar angle, while it lends additional force to the truth and reality of this, our third Proposition.

PROPOSITION IV.

'THE ANGLE OF INCLINATION OF THE INCLINED PASSAGES IN THE GREAT PYRAMID, IS 26° 18′ 10″, NEARLY?'

In so far as the Great Pyramid has a descending entrance passage leading to a subterranean chamber, it is like every other Pyramid at Jeezeh; but from a certain part of that entrance passage, defined on the floor by a device of the builders which our linear measures discovered (vol. i. p. 154, and vol. ii. p. 15), there branches off the system of *ascending* passages, known now by name of the first ascending passage, and the Grand Gallery; and these, as they exist in the Great Pyramid, are quite unique throughout all known Pyramid architecture. Considering, then, the descending entrance passage, from its mouth to the sign on the floor, a necessary means of approach to the other two passages, both of them ascending,—we have three passages peculiar to, or at least connected with, the typical part of the Great Pyramid; and of which passages we require to know the angle of inclination. While we may well be urged to a more studious examination of the subject, on recognising in the walls of these passages the very surfaces, still existing, that were formed by the handiwork and intentions of the original builders.

Generally speaking, all modern travellers have

at once pronounced the amount of angle of the ascending passages above a horizontal level, to be equal to that of the descending passage below the same; though some have stated sensible differences amongst them, and have given angles for one or all varying anywhere between 25° and 27°. For, as to 30° and 60° of some earlier authors, they must be attributed to the effect on their nerves of the darkness, and their 'terrour of descending the slope,' the *facilis descensus Averni*, as they thought it, rather than as the result of their applying any instrumental clinometer, however rude.

The angle, on the other hand, contained in our proposition, is a very simple deduction (which occurred to me in 1864), from a consideration of Mr. Taylor's figure of the Pyramid already given; and is to be further explained in our next Proposition, as well as in Plate II. Being therefore founded in its birth upon the proved and measured proportions of the whole Pyramid,—the passages' angular quantity hence asserted, may be fairly allowed the honour of standing the ordeal of a trial, upon its merits; though no further opinion can be declared, until the result of such trial becomes known. We shall, therefore, at once take each of the three passages in succession, and examine it rigorously by itself.

First, of the entrance passage. When the modern approved measures of this feature were handed me in Cairo, before going out to the Pyramid, as standing,—

'Angle by Colonel Howard Vyse, = 26° 41′ 0″
'And angle by Mr. Ayrton,' = 26 40 18

each of these angles being measured by a theodolite at the upper end, observing a lamp at the lower end of the passage,—I expected the theory would be found inapplicable; but proceeded to make measures notwithstanding. Now, although my observations went no further down the passage, than the fiducial mark on the floor already described,—that ought not to have made any sensible difference in the angle; because those who have been down further, describe the passage as perfectly straight throughout its chief length. Yet, a very great difference was found between the former results, and mine; indeed, so constant, abiding, and decided a difference, that in no part fifty inches long, of the one thousand inches in length that I examined, was there a single case,—even when the particular angle there was swelled by error of observation, and dilapidations of the building,—of the numbers reaching so high as 26° 40′; and the means of three perfectly different modes of observing, with different instruments, and at different times (vol. ii. p. 145), united in giving the angle as 26° 27′, without a chance of an error so large as 2′.

Second, of the first ascending passage. This passage angle is too generally *assumed* by travellers to be necessarily the same as that of, either the Grand Gallery, or, the entrance passage reversed; and the only distinct statement that I can find of its having

been really measured by a competent observer, is Colonel Howard Vyse's, where it is given as 26° 18′. My double series of observations, however, with one instrument observing from below to above; and with another, long after in point of time, from above to below (vol. ii. p. 151), combined inexorably in giving 26° 6′,—certainly true within 2′.

These two small passages, then, which we have now examined,—give, one of them more, and the other less, than the theoretical quantity: their mean, or 26° 16′ 30″, being within 2′ distance therefrom; and looking like a case of probable error of construction on the part of honest workmen, who knew the right theoretical angle, and wished to hit, but had practical difficulty in hitting, it exactly.

Yet if this be the fact, then we are entitled to expect that, in the Grand Gallery, the angle is much more closely approximated to; for the result of our months of measuring inside the Pyramid was eminently to show, that the builders had ever risen in accuracy of work, conformably to the architectural or theoretical importance of the part they were working upon; and the Grand Gallery, from its superior length, as well as vastly superior height and finish, must be considered far to overweigh both of the little passages by which it is approached. With extraordinary anxiety, therefore, to be accurate in my measures, did I begin the testing of the Grand Gallery, and in utter uncertainty how the affair

would end; for if, on one hand, Colonel Howard Vyse has stated the angle of the Gallery as 26° 18′, on the other, his angles of the two previous passages had proved erroneous by many minutes; and Mr. Ayrton had since made the following observations on the Grand Gallery :—

'Angle of Grand Gallery by measurement of a 'base and perpendicular, ...	=	25°	17′ 36″
'The same, by hypothenuse and perpendicular,'	=	25	42 53
The same, as recorded by M. Jomard, . .	=	25	55 30
The same, by Mr. Edward Lane, . . .	=	26	30 0

I attacked the Grand Gallery, then, with three different instrumental methods, (vol. ii. p. 155), measuring it both optically from end to end, and mechanically along every step of both sides. And as the work progressed, and even more now, I am perfectly confounded to think, how the excellent observers above mentioned could possibly have obtained the quantities set down against their names; for no angles beginning with 25°, ever entered even into any single observation of mine, not even the most discordant; and all the sets joined in pointing with admirable unanimity to 26° 17′ 37″, as the true mean quantity, certainly correct within the limits of 1′. While if, from original error of construction, the angle in some limited portions of the run of the Gallery varied from 26° 2′ to 26° 35′,—that was only towards the middle of the whole length, where a little undulation was not of so much importance as at either end; and there, it was most instructive to see how closely the mean angle had

been preserved, equally too, on both sides of the room. (See vol. ii. p. 158.)

The undoubted result, then, of the most severe measurement by the most powerful angular measuring instruments ever brought into the Pyramid,—for such the Coventry clinometer and Playfair altitude-azimuth may fairly be considered,—has been to show an error from the theory of less than 1′. In fact, we may say, practically to prove the theory,—in a case where modern observers had differed from each other in their observations of the same thing by at least 70′ (minutes).

This allusion is made in no critical spirit, but rather with the useful object of drawing a few much-needed conclusions for the regulation of our Pyramid theorizing. Some men, ardent for mathematical accuracy, may refuse to consider our proposition proved by observation, unless the latter has brought out the same second, or fraction of a second, that can be computed theoretically ; but these gentlemen must be reminded, that the Pyramid, even though the plan of it should have been drawn up by an angel with absolute perfection, was realized only by the hands of mortal men of the handicraft trade of masons, whose powers of accuracy were, and are, limited. And, if modern philosophers have considered that they have identified the same part of the Pyramid, by their observations of angle differing from each other by 70′,—is it too much to concede to the ancient masons, in their far more difficult

process of *constructing* the long slope of stone, that they considered their whole Grand Gallery angle, when within 1′ of the theoretical angle, to mean the same thing as that?

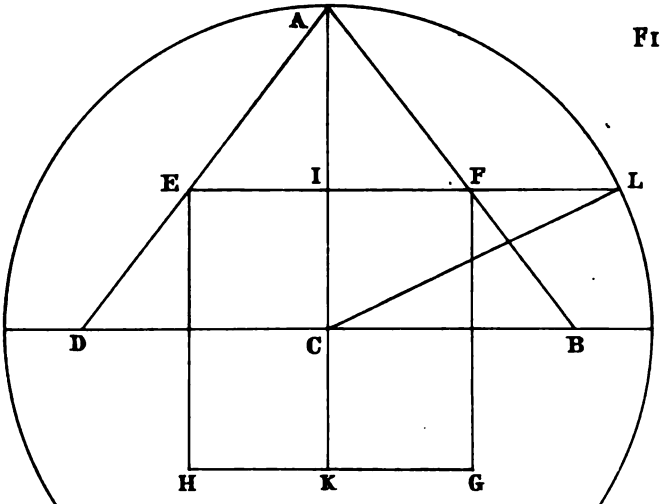
But in the Grand Gallery they put out all their possible powers; and were far closer there, than in the two small passages, where the errors are + 9′, and −12′. Let us then in future limit our ideas at the Pyramid of a practical angular proof of theory, when in an unimportant part of the structure to something that comes within 15′; and in an important part, to within 2′, of what can be computed.

PROPOSITION V.

'THE GREAT PYRAMID IS SENSIBLY IN THE LATITUDE OF 30°?'

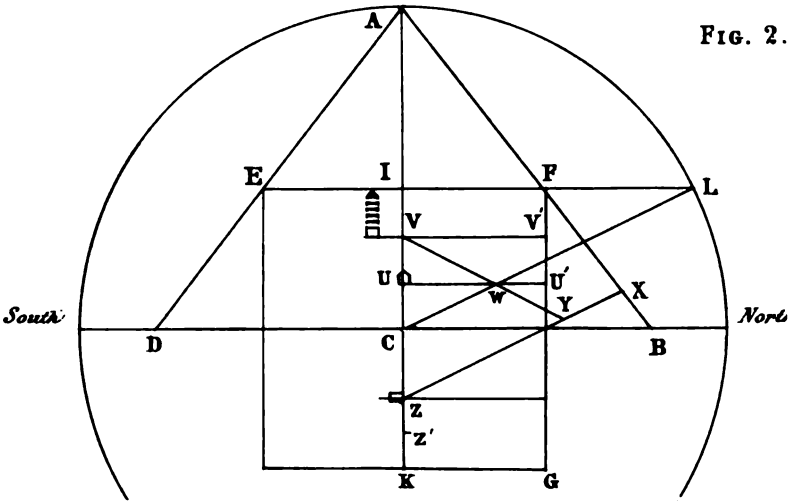
THERE are not many authorities to examine for the latitude of the Great Pyramid, and by reason probably—that few persons having hitherto considered any very precise angular distance from the equator, to be *a priori* necessary for the import of the monument—men had not that peculiar stimulus to observation in universal science, of comparing fact with theory, and ancient performance against modern measure. A still further development, however, of John Taylor's original idea to that

FIG 1.



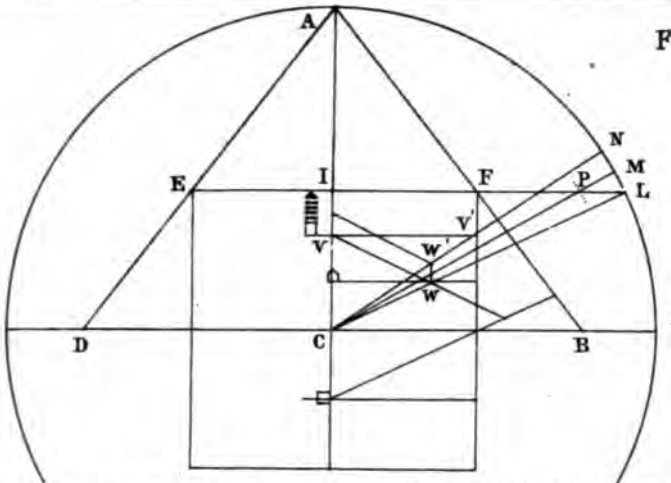
Given A B D = Section of Great Pyramid according to John Taylor.
(i.e. A C : 4 D B :: radius : circumference of circle.
& E F² = A C × B C,
then angle B C L = angle C L I = 26° 18' 10".

FIG. 2.



Given Fig. 1, also I C trisected by lines parallel to I F, in V & U,
& C K similarly bisected, in Z,
then X Y Z, parallel to C L, = entrance Passage, with angle of incl. = 2
Y W, = 1st Ascending Passage, with angle of incl. = + 26° 18.
& W V, = Grand Gallery, with angle incl. = + 26° 18'.

FIG. 3.



'iven Fig. 2, also CN drawn through V' & CM through P, where CP = EF, –

'en angle BCL = 26°. 18'. 10" = Lower culmination of a Pole star

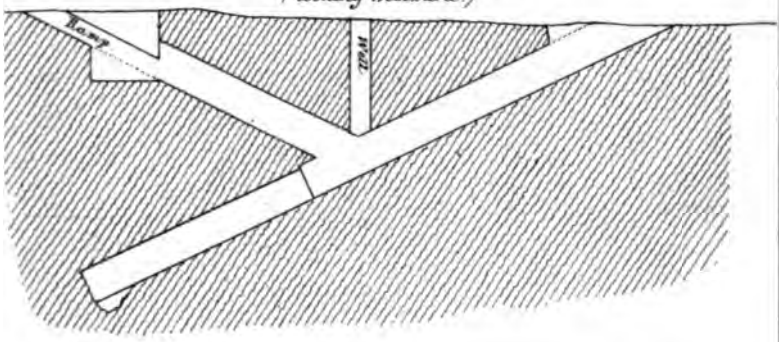
—— BCM = 30°. 0'. 0" = Latitude of Pyramid.

—— BCN = 33°. 41'. 24" = Upper culmination of same Pole-star nearly;

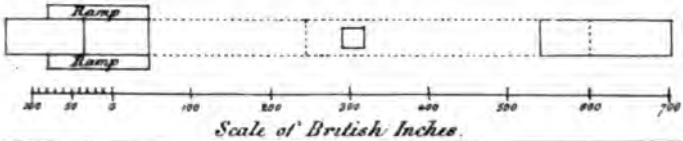
and WW' = height of Grand Gallery, nearly.

Vertical section of the ancient trial passages, Eastward of the Great Pyramid, after Colonel Howard Vyse. (looking Westward.)

FIG. 4.



'uth *Ground plan of the above.* North



Scale of British Inches.

Eaz'

described in our last Proposition, induced me, before visiting Egypt,—to think that a latitude of 30° was necessary to complete the fulness and appropriateness of the Pyramid's geometric symbolizations. Such an angle certainly came out from a very simple treatment of John Taylor's proportions of the Pyramid, and may be described thus :—(In Plate II. fig. 1) the triangle A B D represents a section of the Great Pyramid through its vertical axis, and the middle of opposite sides; and the proportions are, according to the above venerable authority, such,—that A C, the vertical height, is to 4 B D (or to four times the length of one side of the base),—as the radius, to the circumference of a circle. On that assumption, any one can compute the angle and find—

Angle at either foot,	.	.	.	.	=	51°	51′	14·3″
And angle at summit,	.	.	.	.	=	76	17	31·4

The linear *proportions*—for as yet we do not say anything about *absolute lengths*—may of course be computed from the same data. And having in that manner obtained a theoretical area of the given vertical section of the Pyramid,—a square of equal area, E F G H is formed and placed centrically and symmetrically, as in the figure; where, by continuing the line E F to the circumference of the circle and parallel with B D, and by joining C L,—we obtain in the angle C L I, or its equivalent B C L, a new quantity, and by computation = 26° 18′ 10″.

Now, in the first place, this angle is peculiar to a Pyramid of John Taylor's characteristics; for if there

should be one higher in proportion to the breadth of its base, the above angle would be smaller, and if lower, it would be greater: and, in the second place, this angle, as confined to 26° 18′ nearly, has been made much practical use of by the builders of the Great Pyramid,—who, as shown in Proposition IV.,—appear to have regulated all three of the inclined passages upon it. Accordingly, without altering anything in fig. 1, if we merely add thereto the additional lines in fig. 2,—viz., trisection of the upper half and bisection of the lower half of the centrally disposed square, by lines parallel with the base of the Pyramid,—we obtain, first, a point Z; from which, if we draw a line parallel to the former C L, we obtain one X Y Z, which lies almost as exactly as it can be measured (see Pl. III. vol. i.) in the very peculiar position of the entrance passage of the Great Pyramid.

In the next place, if from V downward we draw a line at an equal but opposite angle to the C L I of fig. 1,—we obtain a line V W Y, which occupies the position in the Pyramid of both Grand Gallery and first ascending passage; while from the intersection point W, we have the line W U already formed, and representing closely the horizontal passage leading to the Queen's chamber.

This is surely a large amount of confirmation from the actual building; and if confined as yet to mere mechanical geometry, there follow some tests derived from astronomy,—seeing that the entrance passage has been claimed by various authors, as a

tube pointed to the lower culmination of a star which was Polar at the period of the Pyramid's construction.[1] Agreeably with this idea, our fig. 3 shows, that by drawing one line from C through v′, already given, and another also from C through P, (where C P = E F), we obtain together with the line C L, three lines, C L, C M, and C N; of which, if C L be really the direction of a circumpolar star at its lower culmination, C N is its direction at the upper culmination, C M being the place of the Pole, within limits of a few seconds only; the computed values being—

B C L,	. . . . .	=	26° 18′ 10″
B C M,	. . . . .	=	30 0 0
and B C N,	. . . . .	=	33 41 24

Now these are angles which, under the same mode of treatment, would be yielded by no other shape of triangle than that arising from John Taylor's proportions of the Great Pyramid; and they appear remarkably confirmed by the masonry of that building, inasmuch as they seem to regulate the excessively increased height of the Grand Gallery, over the original small height of one of the ordinary passages, as shown more particularly in Plate VI. But a more serious test will consist in ascertaining, whether the angle of latitude in which the Pyramid stands, is *really* the angle pointed to in the diagram by BCM; for if it is, the concurrence of the geometry, geography, and astronomy, of the Great Pyramid will be remarkable to a degree past all mere chance

[1] See Sir John Herschel's letter in Colonel Howard Vyse's *Operations at the Great Pyramid of Gizeh*, vol. ii. pp. 107-109.

coincidence; and a striking reason will then be obtained for the monument standing in its present parallel, and no other.

The first point to be tested in this astronomical department of the general question, is one which has been usually *taken for granted*, by all those authors who have claimed the entrance passage for a polar star; viz., that the Pyramid must have been correctly oriented, or placed with its several faces accurately to the north, south, east, and west points of the horizon. Yet the only instrumental observations on the subject, were those by the French *savants*, and they had shown an error, $=19'\ 58''$ of arc.[1]

That quantity, however, being overlooked by all theorizers,—showed very plainly, that they did not think it capable of vitiating their astronomical deductions: and it is not a *much* greater error, than

[1] 'La Pyramide est orientée avec exactitude. M. Nouet, astro-'nome, a trouvé, par des opérations géométriques et astronomiques '(Voyez *Décade Egyptienne*, t. iii. p. 105, et suiv.), que la côté du 'Nord déviait de la ligne Est et Ouest de 0° 19′ 58″ vers le sud, d'où 'il a conclu que la ligne méridienne qui fut tracée pour orienter le 'monument, déclinait de 20′ vers l'Ouest: mais, comme le revêtement a 'disparu, il n'est pas certain que cette petite différence provienne de 'la direction primitive des faces, et il est naturel de l'attribuer, au 'moins en partie, à la difficulté de déterminer avec une précision par-'faite la direction des degrés qui bornent aujourd'hui les faces. On 'sait que l'orientation de l'observatoire de Tycho Brahé a été trouvée 'à Uranibourg, par l'Académicien Picard, en défaut de 18′.

'D'ailleurs, suivant la remarque même de l'observateur, la ligne 'méridienne étant tracée et dirigée exactement au nord, on aurait eu 'de la peine, en élevant ici une perpendiculaire, de ne pas dévier, sur 'une longueur de 113 mètres ½, de trois décimètres, quantité suffisante 'pour donner 20′ de différence. Il aurait fallu, selon moi, observer

what was permitted in the most celebrated European observatory of two hundred and thirty years previous. But when the Great Pyramid, of nearly twenty times as many years earlier, came recently to be examined by us, with due attention to its fiducial markings (vol. ii. p. 196), behold its utmost error, not the 19′ 58″ alleged, nor even the 18′ of Tycho Brahe, but only 4′ 35″!

Hence, we may now go forward with renewed confidence to the next point, and consider the *latitude* of the Great Pyramid. The result of M. Nouet's observations in the celebrated national French work, is set down as 29° 59′ 6″; and my recent result with the Playfair altitude-azimuth instrument is, 29° 58′ 51″; accurate probably to within 3″. Nevertheless, if M. Nouet's original observations can be found, or shown to have been as extensive as mine,—I shall not be disposed to quarrel with any one who prefers taking a mean of the two results, to either one by itself; though

'quelle direction a le plan du premier canal de la Pyramide, celui qui 'aboutit à l'entrée dont j'ai parlé plus haut: l'opération aurait été 'difficile sans doute; mais le parallélisme exact et l'entière conserva-'tion de ses faces auraient procuré une ligne presque mathématique à 'comparer au meridien du lieu. Nous connaissons l'angle du plan 'formé par le fond de ce canal avec l'horizon, et cette notion fournit 'déjà des remarques intéressantes; elles le deviendront davantage 'encore, quand on connaîtra parfaitement, si elle existe, l'inclinaison 'de son plan vertical sur le plan du méridien: ce travail, qui importe-'rait à l'histoire de l'astronomie, ne serait que la continuation des 'recherches que l'Académie Royale des Sciences ordonna dans le 'xviii^e^ siècle dans la vue de comparer les observations de cette espèce 'chez les différens peuples.'—M. Jomard, in *Déscription de l'Egypte, Antiquités, Déscriptions*, tom. ii. p. 61.

meanwhile I beg to be allowed to retain my own determination.

Now the numbers 29° 58′ 51″, do come so abundantly within our rule of 2′ discordance being allowed, that we might in so far at once declare the case practically proved. But that rule is not to prevent our testing any one particular instance more accurately still, if possible; nor was it intended to apply to exactly such a subject as the minutes of *latitude* angle. There is therefore no objection whatever, to any one asking, 'why the builders did not 'hit the theoretical angle of 30° 0′ 0″ of latitude, a 'little closer, than to a distance of 1′ 9″ only?

To this, the answer seems to be,—especially when looking at the real Great Pyramid passage pointing to an actual star in the sky,—the asking, in Scottish fashion, of another question; viz., 'Ought not the 'latitude rather to be such as, with a mean amount 'of refraction added to it, will place the Polar point '*visibly* to men, rather than theoretically only, at 'an angular elevation of 30°?'

On some grounds, this view is decidedly to be preferred. But noting that there is only *one*, of the *two* daily meridian culminations marked by a material passage, where men could look out at the actual fact in the sky (during the building of the Great Pyramid, though not afterwards, for other and very different reasons), we may be safer in taking a mean between the two hypotheses; *i.e.*, between an angle of 30° absolute from the equator,—and a certain

other angle therefrom, which, with the refraction added, would present an *apparent* elevation of the Pole to the same amount of 30°. And as the refraction at such altitude is on the average about 1′ 37″, such geometric polar angle is 29° 58′ 23″: the mean between which and 30°, is equal to 29° 59′ 12″.

But 29° 59′ 12″, is still something very perceptibly greater than 29° 58′ 51″, though no doubt a remarkable approximation. The original question may therefore still be put, by some who expect superhuman accuracy in others: viz.: 'Why did not the 'builders hit the mark even yet a little more closely? 'Or, why did they not carry the Great Pyramid 21″ 'farther north, and make it thereby perfectly accu- 'rate in its geographical place?'

The answer here is simply, Go and look at the topographical position of the Pyramid; and see, that the realizing of those 21″ would have taken the building off its noble hill, and buried it ingloriously in a broad bay of sand which intervenes to the north of it, and extends in that direction through several whole minutes of latitude; while if we alter the longitude also, to avoid that low ground, and shift the Pyramid westward as well as northward, we should find only the indistinct undulations of a desert valley for an indefinite distance in the exact parallel of 29° 59′ 12″ of latitude. Hence there is in fact no other conspicuous or suitable rocky hill for the Pyramid to stand on, except its own hill, throughout all this region; for though the eminence

to the south of the palm-trees, is bold enough, it is very much too far southward for latitude purposes.

There was therefore no choice left to the builders, but to place the Pyramid on the hill where they did place it; and if in being there, it is slightly in geographical error, they have indicated a strangely perfect knowledge on their part, of the existence of such an error; for why, otherwise, upon any hieroglyphic theory of the Pyramid that has ever been brought forward, has that most massive building of the world,—when there was plenty of room southward for mere foundation,—been pushed so close to the very northern edge of the hill! Yea, even so dangerously close to its northern cliff, that there is, just in front of the north-eastern corner of the Pyramid, a slicken-side scratched surface of rock, indicating a land-slip of part of the cliff to have already occurred there; and still worse, there is a deep cleft in the local rock, 'a chasm,' according to Colonel Howard Vyse, preparing for another breaking away of the cliff, and passing slantingly under the front of the very Pyramid itself. (See Plates II., III., and IV., vol. i.)

The builders too knew of this most dangerous feature, for they filled it up with good masonry to a depth of forty feet, and cemented it over; and they further made those enormous banks of their ancient rubbish on the northern front of the cliff outside (vol. i. p. 186), to keep it up, as it were; recognising that a fall of that part of the rock would be ruinous indeed to the Pyramid. As yet

the rock has not given way, though it may always be considered as threatening; but meanwhile, if ever a building vividly represented the scriptural phrase of standing on 'the utmost bound of the 'everlasting hills,'—it is surely the Great Pyramid; reared, and with a remarkable reason for it, on the very ultimate northern edge and brink of its steep-sided, desert, table-land.

For its own *safety*, then, we would not wish to see the Great Pyramid pushed any farther towards the north: and it is surely far enough already in that direction, to satisfy the requirements of modern scientific travellers, in strict justice to their own latter-day work. Because, have their measurements of any of the angles of the Great Pyramid been conducted within an agreement amongst each other, of 21″? Nay, have they been within 21′?

Also worthy of note is it, before leaving this subject, that if the Great Pyramid be not quite far enough northward in latitude,—it yet comes nearer to what theory points out, than any other Pyramid whatever, large or small. For all the others in its neighbourhood, are to the *south* of it; the second, third, fourth, fifth, and sixth, notoriously so; and the seventh, eighth, and ninth,—when we consider, in proper scientific process, the places of their centres as compared with the centre of the Great Pyramid,—fall in the same category.

One rather disputable case, however, exists out-

side all these; seeing that north of the seventh Pyramid, and north also of the latitude parallel passing through the Great Pyramid's centre, there is a system of inclined passages in a vertical and meridian plane, tunnelled into the rock of the hill,—and looking so much like the commencement for building a small pyramid,—as to have induced some authors to declare, that if no pyramid was ever actually erected there, men had *intended* to erect one, and may have begun it, though no stones are found there now. And such a pyramid,—though its proportions must have been insignificant, as being necessarily curtailed by the edges of the hill north and east,—would yet have been, as to its centre, a *little* nearer to the proper latitude desired by theory for the Great Pyramid, than the Great Pyramid itself.

This is serious. But on turning to Colonel Howard Vyse, we find that that most trustworthy authority, assisted by Mr. Perring, made careful measures of these passages (see fig. 4 on our Plate II.), and arrived at the conclusion,—that they are neither in the meridian line of the passages of the seventh, eighth, and ninth Pyramids; nor at a commensurable distance, in any meridian line, to form one of a regular series of Pyramids with them along the eastern side of the Great Pyramid. Mr. Perring likewise expresses an engineering opinion, that the surface of the ground, near to and above these passages, was never *prepared* to receive building stones upon it; and he alludes to Herodotus

noticing only *three* small Pyramids on the eastern side of the great one, as reason for concluding that no other small pyramids, other than the three now to be seen, ever stood in that neighbourhood.

But why was there *not* a complete line of them constructed? Or why was the partial line begun from the south instead of the north? And what were those inclined passages in the rock for, if not intended to have a pyramid erected over them?

The two first features of this rather over-much-demanding question, would be satisfied,—if it was considered reasonable, that the architects of the Great Pyramid would allow no other building to interfere with their mighty work in any of its higher attributes, not even in correct geographical position. And the last portion of the question,—which is the most important, and is even necessary to the whole,—throws some light on itself when practically examined.

For, look at the passages in plan and vertical section (Plate II.), and see that they are a system, in principle of arrangement, such as exists in no other Pyramid whatever, except the Great Pyramid; for there is the long descending entrance passage; an upward and opposite rising passage from the middle of that, like the Great Pyramid's 'first ascending passage;' then the beginning of a horizontal passage, like that to the Queen's chamber; and finally, the commencement of an upward rising Grand Gallery, with its remarkable ramps on either side.

The angles, heights, and breadths of all these are almost exactly the same as obtain in the Great Pyramid. And if the lengths only, are so curtailed as to be ridiculous in compairson,—or rather such as to show all the leading angular features of the Great Pyramid's passages within the space of a few feet,—that assists to a conclusion which the facts of the neighbouring azimuth trenches first prompted me to:—viz., that this system of inclined passages in the rock north-east of the Great Pyramid, was merely a trial, or model, cut beforehand into a spare part of the hill surface by the masons of the Great Pyramid,—to improve their understanding of the *internal* figures they were afterwards to form close by; just as the azimuth trenches were to show the *exterior* angles. Hence, the Great Pyramid is finally and most decidedly left the northernmost, and nearest to the theoretical latitude, of all the Pyramids of Jeezeh, either at present, or ever, existing.

PROPOSITION VI.

'ANGULAR ALTERATIONS IN THE EARTH'S CRUST HAVE BEEN PRACTICALLY INSENSIBLE DURING THE EXISTENCE OF THE GREAT PYRAMID?'

THROUGHOUT all our previous Propositions we have discussed differences between theory and fact,

as referrible only to errors of either ancient workmen or modern measures, combined with inevitable effects of dilapidation; but where an interval of several thousand years is concerned, it may be expedient also to inquire, whether any slow natural changes of the earth itself,—though utterly insensible during all the period of existence of our post-mediæval civilisation,—may not have accumulated with greater time to some appreciable extent.

At the last meeting in Dublin of the British Association for the Advancement of Science, for instance, a learned traveller stated,—in connexion with a mathematical paper which had just been read on certain views regarding the interior consolidation of the earth,—that he had seen ancient buildings in Abyssinia which indicated a sensible difference in the direction of gravity at the time of their erection, from what obtains now. And, again, there was the question, much agitated by Dr. Hooke in his day, as to whether there is any slow progressive change in the place of the axis of rotation of the earth within its substance;—or again of the crust of the earth over the position of the poles,—altering in that manner both the latitudes and longitudes of all places, to some minute quantity, in the course of many ages.

Had our observations at the Pyramid, alluded to under the last Proposition, come before Dr. Hooke, the practical Newton of his day,—he would inevitably have seized on the 21″ defalcation of north latitude, and the 4′ 30″ west error of the Pyramid's meridian

line, as indicating an oblique movement of the north Polar point of the world in a north-eastern direction. And he would further have had by this time, in the successive decreases of the published latitude of Greenwich by every succeeding Astronomer-Royal during the last century, something like a confirmation of the latitude part of the effect closer at home.

But what are we, who live now, to think,—taking all things into consideration,—as to the Pyramid's evidence of such terrestrial change? This probably, that a shifting in place of the earth's axis of rotation within itself, if solid, or nearly so, to the amount of 21″ in four thousand years, is utterly beyond all physical probability,—so overwhelming is the dynamical stability of the axis of rotation in so huge and heavy a ball as the earth; such a computation, though not for those precise numbers, having been made by La Place long ago, and confirmed, we believe, very recently by Professor P. G. Tait of Edinburgh.

The question, again, of the earth's crust being rather thin, and carried by variations caused in its local amount by special chemical and other actions, to or from the place of the pole of rotation of the grand fluid internal mass, supposed to remain constant,—has also, I believe, been considered; but without any one venturing to say how much change might be produced in the latitudes of places in a given time from that cause. We are left, therefore, only to

speculate on a smaller and more confined class of changes, produced either by temperature or volcanic agencies,—which push, twist, elevate, or depress sometimes whole continents, but more generally parts of them only; and occasionally act in opposite directions within very small areas, according to the distance of the solid surface of the ground from, either the molten interior of the whole earth on which it is floating, or the fluid contents of subterranean lakes and cavernous receptacles of similar matter contained within its substance. Now the amount of *these* changes, is wholly without the power of theoretical science to compute; and such a case as that of the Great Pyramid, giving the result of human experience through the longest series of years of any monument yet erected, is probably the best, if not the only, opportunity of practically ascertaining whether anything of the sort has really taken place.

With regard to the latitude effect, however, I would remark; first,—that the defalcation of 21″ is only chargeable on the Pyramid through reference to the deductions from John Taylor's figure of the monument; for without that, we should have no means of knowing what the latitude of the Pyramid was thought or observed to be in the days of its building; and, second,—we have shown topographical and other reasons why such an amount of error, if it existed at the time, might very properly have been neglected by the builders. But with regard to

the azimuthal deviation from the meridian, there is not only a much larger quantity to be dealt with there, but it is independent of John Taylor's or any other man's theory, further than this general belief, —that the Great Pyramid was originally intended to be correctly oriented; and that its builders had the capacity to place it so, true within 2′, if not much less. Something is therefore to be explained in that anomaly; and we *may* have a reason to suggest in a future chapter, without requiring the Egyptian earth to have been twisted round 4′ or 5′ in four thousand years.

Meanwhile, though thus practically confessing that the great geographical ordinates of the Pyramid have not been materially interfered with by physical causes, there remain to be considered the probable effects of such disturbing actions, in altering the correctness of its lesser mechanical and geometrical features. Has the rock, for instance, under the Pyramid, been tilted up in one direction or another, thereby throwing out of the vertical or horizontal that which was once both plumb and level true?

As touching directly on this subject, we may turn to the article by M. Ernest Renan on 'Egyptian 'Antiquities,' in the *Revue des Deux Mondes* for April 1865, as giving both his own views and those of the extensively experienced Mariette Bey also. And there we read, that there is not a particle of deviation discernible in that most carefully constructed room of all the rooms throughout the Great Pyra-

mid, viz., the King's chamber; or, in the author's own words, 'Malgré l'épouvantable poids que porte 'cette chambre, elle n'a pas fléchi d'un millimètre; 'le fil à plomb n'y accuse pas la moindre déviation.'

Sorry am I to say that my observations upon the walls of the King's chamber, taken very carefully through means of the circular clinometer applied with a beam one hundred and twenty-six inches long, do not in any way agree with the above assertion; for they indicate, in the first place, very consistently, that every wall is inclined to the central *quasi*-vertical axis of the chamber by the amount of 3′ 47″; and, in the next place, that that axis is tilted at the top towards the west by the amount of 6′ 9″, and towards the south by the amount of 6′ 4″ (vol. ii. p. 163).

That is the instrumental fact, which cannot be departed from until better observations are made; but the whole quantity of deviation is by no means to be necessarily put down to a permanent physical earth change, for the chamber's floor is greatly shaken and disjointed even since Colonel Howard Vyse's time,—either by the progress of dilapidation, or ruinous effect of a passing earthquake shock.[1] Let us therefore see what sort of tale the three inclined passages tell, touching depression towards the south. Such an effect, if general over the whole

[1] Such as that recorded in Mr. Sopwith's *Notes on Egypt*, to have occurred in 1856, and injured much the house of the hospitably-inclined English engineer of the railway from Alexandria to Cairo.

building, will tend to increase the dip of the entrance passage, and decrease the rise of the other two. And what do we find? Why, that the dip of the entrance passage *is* greater than the theory by 9′, the rise of the first ascending passage less by 12′, and that of the Grand Gallery also less, by 0′ 35″. But as the large deviations of the two first passages have already been shown to be probably due to error of construction on less important parts of the Pyramid, the only thing left securely outstanding to attribute to a general tilting of the whole Pyramid, is the 35″ of the Grand Gallery; indicating therefore that the 6′ of the King's chamber is a local error or masonry defect, magnified in angular value by the short radius of the walls.

There is another set of our observations, however, bearing on the point, viz., the measurement of the corner angles of the Pyramid's summit from the sockets below, by means of the Playfair altitude-azimuth instrument; and this would have been a very sufficient method, had there not been the one weak feature about it, that the dilapidations of the top rendered it most difficult to decide, within a few inches, where the general corners of the summit platform should be considered to lie.[1] Referring,

[1] On a future occasion it might be worth while to enclose the topmost course of stones, forming the summit platform of the Pyramid, with a grand square of carpentry: for that woodwork might be made in itself an approximately true square, and the position of any one of its corners would be regulated, not by that same corner, only, of the broken stones, but by the general contour of the whole topmost area of stones.

however, to vols. i. and ii. pp. 538 and 173, for the efforts that were made to be accurate in this point, we have now only to deal with the observations as taken and recorded at the time; and they are as follows: the south-east and south-west observations give a greater tilt to the Pyramid than the north-east and north-west, by 0′ 30″,—implying a dip of the ground southward by that angle; and the north-east and south-east give a greater angle than the north-west and south-west by 2′ 39″,—implying a dip of the ground eastward by that angle.

These quantities evidently throw discredit on the large angles of deviation in the King's chamber, *as an earth effect;* but they coincide, it is not uninteresting to remark, with the south-east dip of all the limestone strata composing the hill on which the Pyramid stands; and which may be distinct from any large portion of the rest of the country, even as it is believed generally in Egypt now, that the land of the Delta is sinking, while that of Suez is rising. Hence, while we omit making any further reference for the present to the eastern element of angular variation about the Pyramid, we are bound to acknowledge that every one of five different subjects of observation,—nay, six, including the geological strata,—have combined in giving a dip *southward*, as an effect that has come over the foundations of the Pyramid with time. The amount, however, of such dip can only be inferred with safety from the large radii of the Grand Gallery,

and the corner observations of the whole Pyramid; and as it is indicated in both these quarters to be barely more than 32″, such a quantity may well be neglected in any ordinary discussion about Pyramid angles. Though there is no harm, and perhaps even the merit of following strict rule, if we add that number of seconds to the angle of the Grand Gallery, as observed in A.D. 1865; increasing its 26° 17′ 37″ to 26° 18′ 9″. Or bringing the observed angle of that noble, and most ancient, hall,—within 1″ of the 26° 18′ 10″ independently demanded by modern theory, and published to the world before our observations were made.

PROPOSITION VII.

'HYPSOMETRY OF THE GREAT PYRAMID'?

Datum Plane.

THE datum plane to which it is proposed to refer all levels taken at the Pyramid, is the upper surface of the pavement, alluded to in connexion with the corner sockets (vol. ii. p. 137); and found to be, practically even with the floor of the south-west socket; from six to ten inches above, the floors of the north-east and north-west sockets; and rather more above, the lower floor of the south-east socket. The same pavement too, it is believed, from whose broad and well constructed surface, in the middle of

the northern side, Colonel Howard Vyse found the inclined slope of the whole Great Pyramid flank at once to begin.

Present Vertical Height.

This feature may most appropriately be reckoned from the pavement's upper surface, as the lower starting-point for such measure, up to the flat, square area on the summit, as its higher reference. On that area, near four hundred inches long in the side, there are, it is true, two fragments of courses of masonry, one on the other, and twenty-one and nineteen inches in respective heights. A learned authoress, too, a few years ago, described herself and party very racily mounting on them to get a little nearer still to the sky ; and they do enable any one to stand absolutely higher by forty inches, than if on the four hundred inch area level. But they are unfortunately too fragmentary and low, to assist one in forming safe conclusions respecting the whole deficit between the present broken, and the ancient unbroken, Pyramid top,—or a quantity closer in linear height, upon almost any theory, to 380 inches. It seems better, therefore, to terminate the vertical measuring at the four hundred inch area, which does possess some degree of completeness, and offers an approach to those required data on which the final quantity must be computed.

Another description of that area, is this ; viz., that

it forms the upper surface of the 202d course of masonry from the Pyramid pavement upwards. Hence, when good measurers give the height of '204 'courses,' they may be expected to have included the two fragmentary sets, and require to have forty inches subtracted from their observed height to compare it with ours.

These points it is well to settle, before coming to the height itself; for the time may arrive, when more of the upper courses will have been broken away,—as several have been already within the historical period,—and the 'topmost area' will then signify a different number of courses from the pavement upwards, from what it does now.

How many courses there may have been at any particular past epoch, it would be difficult now to say; but probably within the last three hundred years, there were never more than 204; most likely less,—the maximum required to complete the whole figure of the Pyramid, with a topmost corner stone 100 inches thick, and the two next courses approximating to the same thickness (agreeably with the still visible masonry finish of the Northern Pyramid of Dashoor, and the superior size of the lower socket-holes, and lowest row of casing-stones at the Great Pyramid), being something like 210,—with an uncertainty of not more than two or three, one way or the other. Wherefore, it is melancholy to find among earlier travellers such varied statements as the following, —in which their absolute errors as to courses,

are often further illustrated by the heights assigned :—

	Date.	No. of Courses of Masonry existing at the time.	Height of Great Pyramid.
			British inches
Sandys, . . .	1610	255	...
Greaves, . . .	1638	207 or 208	5988
Melton, . . .	1661	206	6240
Vansleb, . . .	1664	255	7944
Lucas, . . .	1699	243	8748
Egmont, . . .	1709	206	6000
Pococke, . . .	1743	212	...
Perry, . . .	1743	...	8244
Davison, . . .	1763	206	5532

That all very recent travellers are talking about the same 'topmost area' surface is evident, both from the age of many of the inscribed names of visitors, as well as from the length of the side of said area as measured and given by them; for every lower course will evidently have a greater length of side, to an extent extremely easy to measure. When, therefore, Messrs. Aiton and Inglis, in 1865, give 195 courses on the north-east angle, and 199 on the south-west; or Mr. Lane in 1843, 203 courses, and *some* of the French *savants* in 1799, also 203,—we may suspect a misapprehension in counting, and not an alteration in the Pyramid.

Of these observers, the first statement, as I have shown in vol. ii. Sect. v, has so many anomalies in the first fifty steps from the ground, that I have not attempted to follow the rest. But Mr. Lane, of the *Modern Egyptians*, was a phenomenon for accuracy,

and produced one of the most careful drawings of the Pyramid ever made by human hand ;[1] while the French *savants* of 1799, devoted themselves, in number, and with peculiar enthusiasm, to linear numerical measures about the Pyramid (which kind of mensuration was indeed special to the science of that day, when physics meant the application of geometry to a subject, and was as yet innocent of geology, chemistry, and many other branches both of natural philosophy and natural history, which are now occupying the chief attention of the mass of learned men). It was with no small relief therefore, that I found the 203 courses of the French *savants*, and apparently those of Mr. Lane also, meant the same as my 204 ; for their lowest, and which some of them (*i.e.*, M. Le Père, and Colonel Coutelle), have actually entered in two portions of 20, and 52 inches respectively in height,—must really be considered as two distinct Pyramid courses.

That they were long held as one, was partly due to the first French measures made in 1799 or 1800, being previous to the later excavation of MM. Le Père and Coutelle, which took place only '*in the* '*month Rainy, of the year* 9' (January 1801) ; and first disclosed the full depth of the supposed lowest course being, not 40 inches only, but 72 inches, or in excess of any other known Pyramid course ; and partly also to the circumstance that, at the north-

[1] See Plate XII. of Colonel Howard Vyse's and Mr. Perring's folio views of the Pyramids. London, 1840.

eastern corner of the Pyramid, the upper surface of this 72-inch duplex course, is, for a small space, seen to be formed in the solid standing rock of the hill. Whence M. Jomard concluded, that there was anciently a raised pedestal of seventy-two inches on which the Pyramid stood, and that its inclined sides only began *above* that level.

Such an idea, however, has not only been directly disproved since then, by Colonel Howard Vyse's casing-stones, as already mentioned, beginning at seventy-two inches *below* that level,—but it is also shown, by our photographs now brought home, combined with the measures, to be a mistaken apprehension of Pyramid masonry.

For these peculiar modern documents testify, 1*st*, That that portion of a rock course seen at the north-east corner, was abundantly within,—not only the external casing and proper position for a base or pedestal,—but within, likewise, several thicknesses of the stones of the inner masonry courses, themselves also within the casing-stone series.

2*d*, The standing rock was used merely to supply economically a portion of the internal bulk of masonry,—not to form any part of, or react upon, the external form and surface of the Pyramid. For this, indeed, it would not have been good enough; and the Pyramid builders knew the fact so well, that *therefore* they sent painfully to the Mokattam or Arabian hills on the eastern side of the Nile, for the denser limestone from there, for the outside blocks.

And it is not a little notable, that this north-eastern portion of the native rock course, and which has only recently been disclosed by the process of dilapidation—is already far more decayed than any of the fragments of the casing-stones found by our exploration; which fragments too, though now, and for the last one thousand years, buried in rubbish, —must have been exposed on the flanks of the Pyramid to the weather, for full three thousand years previously; or for several times as long as this unhappy piece of rock-course has been visible to men.

3*d*, The portions of standing rock thus employed to make up the *interior* substance of the Pyramid, though cut square and level on the upper surface of their terraces, are by no means also cut in every case coincidentally with the surfaces of the abutting courses of masonry; and as the rock addition is only partial and accidental, while the masonry courses are structural and extend unbroken around, and as we believe through, the entire Pyramid,— we cannot allow the enumeration of the latter, to be interfered with by a casual and local feature of the former. Many of the data of these conclusions are rendered in the Photographs described in Section v. of vol. ii.; and *their* general testimony is pictorially represented in Plate III., which gives a *diagonal* sectional view of the north-east corner of the Pyramid, and shows the subservience of the rock to the masonry courses, at that point.

Hence we trust there is no real error in represent-

Restored
Vertical diagonal Section
of N.E. lower corner of
Great Pyramid.
shewing the relation of the rock courses
there, to the masonry courses and
to the ancient exterior surface
of the casing stones
Parts at present standing, are shaded;
casing stones and backing stones straight lined;
Internal masonry, wavy lined; and its
courses numbered as in the table
Ancient Pavement.
N.East corner stone.
N.East corner socket
cut in rock.
Rock of Hill.
Rock-
courses.
Scale of British Inches.
100
50
0
100
200
300
400
W H M^c Farlane, Lith^r Edin^r

ing the courses between the *pavement* below, and the present (A.D. 1865) *platform* at the top of the Pyramid, as 202 ; even by the French measures, and Mr. Lane's also. And we then have, for the vertical height between these two places, the following results of different authorities :—

Measurers.	Date A.D.	Mode of Measure.	Reference.	British Inches.
MM. Jomard and Cecile, .	1800	Steps,	Vol. ii. Sect. v.	5433
MM. Le Père and Coutelle,	1801	Steps,	Vol. ii. Sect. v.	5435
M. Nouet, . . .	1800	Trigonometry,	Vol. ii. Sect. v.	5443
Colonel Howard Vyse, .	1837	Unknown,	His own work.	5409
Mr. Lane, . . .	1843	Unknown,	Mrs. Poole (5472-40,)	5432
Mahmoud Bey, . .	1862	Barometer,	Alexandrian Pamphlet of 1865.	5445
C. Piazzi Smyth (April), .	1865	Steps,	Vol. ii. p. 131.	5445
Messrs. Aiton and Inglis, (May), . . .	1865	Steps,	Vol. ii. Sect. v.	5475

The simple mean of all which comes out, 5440 British inches.

Ancient Vertical Height.

From the present fragmentary portion of the Great Pyramid, to deduce the height of the ancient complete structure, theory must be referred to in some way or to some extent ; and the simplest idea appears to be, that the now missing portion was only a continuation of the present structure ; or, that the building was simply and altogether a Pyramid, but ' cased' about, of course, as already

much alluded to. Yet this conclusion has not been always or usually followed; for many travellers have had a great fancy for mounting a colossal statue on the existing platform.

After searching for their reasons, however,—they appear to be no other, or better, than that 'they 'thought such a termination to the Pyramid *would* 'look well;' or such imperfect reasoning and positive statements without foundation, as the following:—

'On the top of the greatest Pyramid there was 'anciently a statue or a *colosse*. This appears, be- 'cause it is not sharp as the others, but plain; and 'there are yet to be seen great pits, which were to 'keep fast the *colosse* from falling.'—F. VAUSLEB, 1664.

And again:—'The other two Pyramids terminate 'in a point, and hence 'tis conjectured, that there 'might have been some colossus erected on this.'—VERYARD, M.D., 1701.

On the opposite side, however, it is alleged by learned Egyptologists, that—1*st*, the Egyptians never put their colossal statues on a height; 2*d*, no one ever saw a statue of any kind on the top of any Egyptian Pyramid; 3*d*, the hieroglyphic representations give only the mathematical form of a Pyramid, or terminate it at the top in a point; and 4*th*, though the topmost area now measures near 400 inches in the side, it has been traced backwards, through various authors, mischiefs, and dilapidations, gradually decreasing in size from now up to the time

of Pliny, when it was reported to have been only 100 inches in side length; and as the casing was still existing in his day, such statement, if its measure can be depended upon,—indicates that the Pyramid had then lost only its *chief* and *topmost corner-stone.*

Hence we adopt the Pyramidal hypothesis for completing the present figure of the Great Pyramid, as the only one at all probable ; but must steer wide of an error in applying it, which even so eminent an authority as Sir Gardner Wilkinson has fallen into, on p. 173 of Murray's *Handbook to Egypt.* For therein, that admirable traveller computes rigorously the height of the missing part required to be added to the present decapitated, to reproduce the ancient complete, Pyramid. But he computes it on the datum of the *present* length of the sides of the summit-platform, instead of the *ancient* length at that level,—*i.e.*, the present quantity increased out horizontally at either end by the thickness of the casing-stones and backing-stones ; which important layers were once there, and must be virtually replaced now, in any attempt to compute the *original* height of the monument.

Attention to this refinement in practical construction at the Pyramid, will fortunately be found to remove almost entirely, a difference to a serious amount between two methods of Sir Gardner's for arriving at the same thing, viz., the ancient height. For whereas on one hand he gives a computation from Howard Vyse's data of Pyramid base-side, and

casing-stone angle, as making the whole height of the complete Pyramid 5832 inches :—on the other side, he computes the height of the missing portion at 240 inches; and that quantity being added on to the same authority's measured height of the *present* platform, or 5409 inches, gives only 5649 inches for the ancient height by that method; or leaves a difference of 183 inches between the two results,—a difference large enough to invalidate any theory on which the calculations are founded.

Better instructed, however, by his example, we now proceed thus:—1*st*, The vertical height of the ancient, and complete, Pyramid,—given by the ground base-side = 9140 inches (see page 136), and the angle of slope = 51° 51′ 14″—amounts to 5819 inches.

2*d*, The upper platform side of 400 inches (vol. ii. p. 132), increased by 200 inches,—for twice horizontal thickness of the casing-stones of old (p. 27),—yields, with the same angle, a vertical height of 382 inches; which, being added to our previous mean measured height of said platform, or 5440 inches (p. 67), gives for the ancient full height, in this manner, 5822 inches. That is to say, it differs by only 3 inches from the former result, where *no* part of the height was *directly* measured; and enables us to state the quantity now being sought,—or the *ancient* vertical height of the Great Pyramid from its pavement plane upwards to its absolute apex,—as something that must have been very near indeed to 5820 British inches.

Floors of the Chambers.

The heights of the floors of the Queen's and King's chambers in the Great Pyramid, are important theoretical quantities to have determined. But the only two full authorities to be referred to, are, Howard Vyse and Perring in 1837, and Aiton and Inglis in 1865; for the French interior of the Pyramid has many glaring errors; and my own measures, though taken with more care than perhaps any others, were not connected, for want of opportunity and means, with the exact features of the ancient outside of the building. Hence the numbers we here refer to are—

Measurers.	Date A.D.	Queen's chamber, its floor above pavement.	Passage floor.	King's chamber, floor above pavement.
		British inches.	British inches.	British inches.
Vyse and Perring, .	1837	808	830	1665
Aiton and Inglis, .	1865	860	891	1720

The differences of the authorities are evidently large; but being in the same direction as their differences in the whole height of the Pyramid from the mean of the observers,—we may expect the truth to lie between the two. It will be noticed also, that agreeably with what has been remarked on these chambers by other persons, each of the observers makes the level of one chamber very nearly half the

height of the other; though this approximate equality requires the general *passage* floor to the Queen's chamber to be taken, in Howard Vyse and Perring's case; but the chamber-floor itself, in Aiton and Inglis's. This is a difficulty, though, which need not be very much dwelt on now, since both chamber and passage floors, as abundantly shown in vol. ii. p. 60, are in an unfinished and negative condition. Assuming, however, Howard Vyse as the correcter expression of the idea,—my own observations may be made some use of on that hypothesis, as they allow the *difference* of level of the chambers to be determined pretty well.

Computing, therefore, 1883 British inches, or my measured length of the Grand Gallery, with an angle of rise of 26° 18′, as observed,—we have a vertical height of 834 inches. To which, adding 1 inch for the elevation of the floor of the King's chamber above the great step at the head of the Grand Gallery, 6 inches for the elevation of the step's surface above the southern termination of the floor slope produced to the south wall, and 5 inches for the southward dip of the reputed horizontal passage leading to the Queen's chamber;—but subtracting 6 inches for height of the north end of that passage above the beginning of the Grand Gallery floor,—we have, finally, 840 British inches. That being our result for a quantity, which, according to Howard Vyse, is repeated no less than three times in the building; or 1*st*, from the Pyramid's pavement to the floor of

the Queen's chamber passage; 2*d*, from that level to the floor of the King's chamber; and, 3*d*, from that to the roof of the topmost chamber of construction, the highest known room in the whole Pyramid.

Hence for height of Queen's chamber passage floor, above pavement of the Pyramid; we have in all, by

	British inches.
Howard Vyse and Perring, ...	= 830
C. Piazzi Smyth, ...	= 840
Aiton and Inglis, ...	= 891
Mean, ...	= 854

and for height of King's chamber floor, above pavement of Pyramid—

	British inches.
Howard Vyse and Perring, ...	= 1665
C. Piazzi Smyth, ...	= 1680
Aiton and Inglis, ...	= 1720
Mean, ...	= 1688

To which we may add, that the height of the roof of Campbell's chamber,—the angular-roofed topmost chamber of construction above the King's chamber floor,—is at the height above the Pyramid pavement of, not the 2496 as given by Colonel Howard Vyse, but more probably, 2540 British inches.

Similarly also, the roof of the subterranean chamber will be depressed, not 1088, but more nearly 1112 British inches; and its floor, with the Colonel's given wall-height of 138 inches, will be, not 1226, but 1250 British inches below the Pyramid pavement. But then, again, that wall-height is a special maximum in a chamber which, though its roof is level and truly rectangular, its

floor (like all the rest of the room, chiselled out of the solid rock) is so excessively uneven as to make the walls in various places of all heights from 40 to 138 inches. (See Plate IV.) Something more nearly approaching, therefore, to a mean of the various heights, would be safer to employ; and as the quantity of 91 inches—not very different from a mean—is given by the very point of the floor, on which Colonel Howard Vyse and Mr. Perring have marked 'the centre of the Pyramid,'—or as being touched by the central vertical axis of the Pyramid produced downwards,—we prefer to adopt that height in place of 138 inches. Hence must be reduced our final statement for the depression of the floor of the subterranean chamber below the Pyramid pavement, from 1250, to 1203 inches.

Fresh-water Levels.

By an approximate hand-levelling method, I ascertained that 'East Tombs,' where we lived, and where the meteorological observations were taken, was about 980 inches below the pavement of the Pyramid; the sand-plain at the foot of the hill, about 1400 inches; and the water in the well of King Shafre's tomb, about 1800 inches below the same datum plane in the month of February 1865.

Next, by closer levelling with a regular surveyor's telescopic levelling instrument and staff, Mr. Inglis ascertained, in the month of April 1865, that the sand-plain at the foot of the Pyramid hill was

variously between 1380 and 1460 inches beneath the Pyramid pavement; that the water in the well of King Shafre's tomb, was at the same level as that in the many agricultural wells in the neighbouring irrigated plain; and that such level was, 1766 British inches beneath the Pyramid pavement.

In Messrs. Aiton and Inglis's large MS. plans and sections of the Pyramid, such level is attributed to 'the Nile;' yet there is reason to believe that the Nile itself was not measured on the occasion, but only believed on principle to coincide with the well-water near the Pyramid hill,—a hydrostatic circumstance, however, by no means necessary to obtain, as we shall presently see.

Thirdly, here,—but primarily in point of time,—Howard Vyse and Perring made many and accurate observations of levels in the years 1837 and 1838; arriving at some curious results too which puzzled themselves, and several other Egyptologists of the period also. These results were mainly, that at certain seasons of the year, the well-water near the Pyramids was much, even many feet, above, though sometimes as many below, the water in the Nile,—down to whose very river course those gentlemen appear really to have carried their measures.

But they believed on theory, that the well-water at the Pyramid should always coincide with the *existing* level of the Nile; and on finding the well-water so much higher at times, they concluded rather hastily, that it must be fed by local springs

from the Pyramid hill. Knowing, however, that from the rainless character of the climate, true springs are unknown in Egypt,—they pounced on this apparent or supposed proof they had stumbled on, of the existence of *one* spring supply of water at the Pyramids,—as indicating the existence of a special phenomenon of extraordinary importance in the Coptic land. Sufficient, indeed, they considered, to explain that very strange story which Herodotus gathered from the Egyptian priests, about the shepherd Philition and his flocks being located for so long, and so remarkably, about the Pyramids, at the time of their building.

The hydrostatic theory, however, was wrong, or imperfect rather, though the facts were well enough observed. For, on the great scale of the Egyptian valley, the well-water at its borders appears to be supplied by a slow, average effect only of saturation of the soil by the river; whence, *time* must be taken into account; and the greatest height of water in the wells, two or three miles from the parent stream, can only occur several weeks or months after the greatest height of the actual river-inundation. Neither is it then so marked a phenomenon; for the resistance of some miles of soil tends to create in the wells an approach to a mean level all the year through, or between high Nile, low Nile, and high Nile again. Hence it is easy to see, that the water in the wells at the Pyramids *must* be sometimes higher and sometimes lower than the

water in the open bed of the river, nearly three miles off,—and yet have been all originally derived from thence. Add to which natural phenomenon, the effects among particular wells of more or less drawing upon them during the day, for the supply of some hundreds of workpeople,—and that some of the shafts were in the solid limestone rock, where the water could hardly get in at all, while others were in porous rubbish;—and then the anomalies nearly vanish. Wherefore we may condense the Colonel's observations as follows, and consider them in so far, as very useful and well-observed facts:—

	British inches.
Sand-plain near the Pyramids, below the pavement of the Great Pyramid, ... from	1500
to	1536
High Nile level in October 1838 (above the average), .	1647
High Nile level in October 1837 (below the average), .	1714
Well-water in June 1837, in shaft No. 3, one of many such wells, ...	1755
Well-water in October 1838, in same shaft, . . .	1779
Mean Nile level in 1838, ...	1796
,, ,, in 1837, ...	1805
Low Nile level in June 1837, ...	1896
,, ,, in June 1838, ...	1945

It is observable here, that the high Nile of 1838, which Colonel Howard Vyse describes as above the average, has barely the height above the previous mean Nile,—of what other authors, as Sir Gardner Wilkinson and Mr. Lane,—both of them with larger and more varied Egyptian experience,—attribute to an ordinary rise of the river at Cairo; neither are the low Niles by any means so low, as those observed by the French *savants* from 1798 to 1801.

We shall not be far, however, from the truth, if we combine all the results (see the French measures in vol. ii. Section v.), and consider for the year 1865 that the following levels hold good :—

	British inches.
East Tombs station, below Pyramid pavement, .	= 980
Sand-plain, in parts, ...	= 1400
Do. in other parts, ...	= 1500
Ordinary high Nile in October, ...	= 1650
Well-water near the Pyramid in April, . .	= 1780
Ordinary low Nile in June, ...	= 1950

These three last levels, however, vary progressively with *long continued time;* for, according to the very sure testimony of Sir Gardner Wilkinson and the monuments,—the bed of the Nile, as well as the surface of the irrigated land, goes on elevating every year by deposited matter, to the extent of about 4·0 or 4·5 inches for each hundred years near this part of Egypt; or from 160 to 180 inches in four thousand years. A period this, taking us back to a very remote date, but which we may have to deal with on paper, and when the fresh-water levels quoted, were a large number of inches lower than they are now.

Sea-water Level.

The Pyramids are distant about ninety miles direct from the Red Sea; and one hundred and ten miles direct from the Mediterranean, but one hundred and fifty along the course of the Nile. Recent levelling operations having shown the identity of the mean levels of the two seas,—we can turn our

attention to the Mediterranean alone, in attempting, from the length of course and character of the Nile, to estimate both seas' depression below the Pyramid base. To this end, we have to deal with the river, not when in flood and violent current, but rather at low Nile, when its stream is more regular; though still very notable, as indicated by trafficking boats being wafted along by the current against any, but the strongest, winds blowing in the opposite direction.

What is the fall, then, per mile on the surface of the water in the river for the last one hundred and fifty miles of its course?

For the mean distance between Assuan and Rosetta, or 720 miles, Sir Gardner Wilkinson says about, per mile, . .	= 6 inches.
And Professor Chaix, about	= 5·8 ,,
From the Nilometer at Rhoda, when the Nile was at its lowest in 1846, to Tineh on the Mediterranean, according to M. Talebot, were 554 inches of fall, equal, on 150 miles, to 3·7 per mile. (This result was kindly communicated to me by Mr. Samuel Birch of the British Museum, from the late Leonard Horner's paper in the *Philosophical Transactions*), .	= 3·7 ,,
'Cairo' is stated by Russegger to be 780 inches above the sea-level, per mile of distance, . .	= 5·2 ,,
The Rhine falls in the last 300 miles of its course, per mile, ...	= 4·0 ,,
And the Thames from Chertsey to Cheddington, per mile, ...	= 17·5 ,,

From all these particulars we may pretty safely take for an *ordinary* low Nile, 4·2 inches per mile, on 150 miles,—or, 630 inches. Which, being added to 1950, or the previously stated level of such Nile, gives 2580 British inches, as the depression of the

sea-level below the Pyramid pavement for the epoch A.D. 1866.

But was this element different in amount, four thousand years ago? On one side we have our own observed fact of a dip of the Pyramid pavement south and east; also a generally believed in, slow sinking of the Delta region of the Nile; and a probable alteration of the agricultural physical aspects of upper Egypt, by the escape of the waters of the Great Ethiopian lake of William Osburn, subsequent to the epoch of the Pyramid's building. But, on the other side, the apparent dip of the Pyramid pavement in one direction, may have been caused by an elevation of it in the other,—making no difference in the hypsometric position of the centre; even as the sinking of the Delta region, is said to be at least made up for in the intervening country, by a rise of the land near Suez; while a bursting of the supposed Ethiopian lake may be attributed to many other more likely causes, than a large alteration of the levels in the Pyramid region.

Altogether then, the historical evidences may be certainly considered to imply, that the change, if any, in relative level of sea and Pyramid base during the last four thousand years, must have been very small; and the same idea is given by our Plates II. and X., representing John Taylor's theory, as extended by myself, to meet the positions of the several passages in the Pyramid.

When last referring to Plate II., we contented ourselves with computing the *angles* resulting therefrom ; but let us now calculate the *lengths* of the several *lines* concerned, viz., thirds and fourths of the semi-side of the central square there depicted ; the data for calculation being,—the angles already assigned,—and, the number of 9140 British inches elsewhere concluded to be the closest measured approach to the length of one side of the Pyramid's base, or the line B D in Plate II.

Had the sea-level been the only hypsometric quantity successfully approximated to by the hypothesis, I would not have called attention to the circumstance ; but we have also,—and in addition to the whole height of the Pyramid,—the levels of the topmost construction chamber, the King's chamber, Queen's chamber, subterranean chamber,[1] and the ancient well-water, all closely represented ; as will be evident from the following tabular statement, both of practically measured, and theoretically computed, hypsometric values :—

[1] This chamber exhibits the largest difference found anywhere, between theory and observation ; equal to 87 inches on a run of 1200 inches. But that is rather the necessary consequence of the residual practical anomaly or correction introduced by the builders, in that —for some reason not hitherto explained, or even suspected, by any modern author,—they ceased the dip of the entrance passage, and made it nearly horizontal for a short distance before reaching the subterranean chamber. And yet, it is possible that an important reason, both symbolical, and structural, may appear in our next division of this volume. (See Plate IV.)

HYPSOMETRIC TABLE OF THE GREAT PYRAMID.

Names of Parts alluded to.	Letters in Plate II.	Observation. Measured Quantities.	Theory. Computed Quantities.
		British inches.	British inches.
Ancient height of Pyramid, .	A C	+5820	+5819
Present height, A.D. 1865, .	...	+5440	...
Outcrop of air-channels on ancient surface, . . (?)	...	+3230	...
Arab's half-way corner niche, (?)	...	+3203	...
Roof of topmost construction chamber, . . .	C I	+2540	+2578
Floor of King's chamber, . .	C V	+1688	+1719
Floor of Queen's chamber passage, ...	C U	+ 854	+ 860
Pavement of Pyramid, . .	D C B	0	0
East Tombs meteorological station, ...	...	− 980	...
Mean floor of subterranean chamber, . . .	C Z	−1203	−1290
Sand-plain, east of Pyramid-hill,	...	−1450	...
Present well-water level, . .	...	−1780	...
Ancient well-water level, . .	C Z′	−1950	−1934
Sea-level present and ancient, .	C K	−2580	−2578

PROPOSITION VIII.

MATERIALS OF THE GREAT PYRAMID?

AFTER the frequent mention in vol. i., of the materials met with in and about the Pyramids, and the further description of hand specimens in vol. ii. Sect. v., little more notice of that subject would seem to be necessary here; especially as the natural substance in which nearly pure geometric forms have

been executed, can be of no importance *directly* to the theory of them,—though of some indirect influence touching both the lasting powers of the monument they compose, and a few other questions connected with its human history and interests. The present is, however, the appropriate portion of our book, wherein we are bound to bring before our readers' attention, and against our own observations, any and every antagonistic statement that can be found, —if it can only claim the smallest respectability of origin, or be likely, in the present educated day, to claim a single believing soul on its side. And we make this proviso, because, there *have* been some things hastily written about the Pyramids in mediæval times,—as 'that the Pyramids were built, 'not by men, but by fallen angels, for *they* only 'could have moved stones four hundred feet long,' 'etc. etc.,—which no one would thank us now for occupying their time with: especially too, when some of those things were written with reference to features, where the several sets of measured numbers which we have brought together in vol. ii., contain their own internal evidences, and are capable of giving up a silent story of proof to all reflecting readers, more convincingly than any verbal attempt of ours could speak for them.

But advanced, as we now are, to some special subjects beyond the bounds of numerical demonstration,—we must here request indulgence for some extent of mere speech, in order to set forth in their

true colours a few of the extraordinary things which a student of Pyramid literature, even in the plain-sailing department of 'materials,' may still expect to find by his wayside; and in such a position, or brought there by men with such authority, that they cannot be passed over altogether unnoticed.

Composition of the Pyramid Hill.

We have already stated, as one of the broadest-based foundational truths of the region, that the Pyramid and neighbouring hills are composed of limestone full of fossils, and without any trace of igneous or metamorphic action of any kind or degree; to the utter impossibility, therefore, of certain published theories, as to Egyptian Pyramids being always formed around basaltic protrusions of rock. But, to our great surprise, having met since then with an officer from India, employed for many years in that Peninsula on geological surveys, he spoke with the greatest confidence of the 'trap 'dykes' on the Great Pyramid hill. He had seen them himself, 'when he visited the Pyramid on his 'way home from India, and there was no doubt 'about the matter; for they, the trap dykes, were 'cropping out on the eastern edge of the hill 'through the other strata and the sand'!

'Were they standing up, then, as planes or walls 'of rock above the surface?' we asked.

'Not exactly,' he replied; 'the chief plane or 'dyke that had once stood up was now lying in

'pieces *in situ* at the foot of the hill; but the case 'was nevertheless perfectly clear, for the dyke 'appeared again higher up the hill; a regular 'greenstone dyke, such as every geologist would 'distinguish in a moment, and at any distance, from 'limestone!'

'Had he judged of it from a distance, or by going 'to the place and tracing the vein of greenstone 'material in contact with the beds of limestone?' we again inquired.

'Oh! only at a distance,' responded he; 'in fact, 'he did not leave the usual road by which all visitors 'ascend the hill, to the Pyramid; but the notable 'elevation of that road had enabled him to see these 'evident traces of igneous rock, just a little way off, 'to his left hand'!

'Then, now, I know precisely what you are allud-'ing to,' I was enabled to reply; 'viz., to the black 'basalt stones which do appear two or three times 'in a line straight eastward from the Pyramid 'down the side of its hill to the plain, and on a 'track only a few feet south of the visitors' road of 'ascent. But I have been amongst those stones often, 'and turned many of the smaller ones over, and 'found them to be only loose masonry blocks 'brought from elsewhere; and now to be seen on 'that spot, as having once formed there some part 'of a well-shaped building; perhaps a tramway; 'and even still showing a carefully prepared, if 'not also polished, surface on one side, and some-

'times even on two adjacent sides meeting at a 'particular angle.'

After this, the officer admitted 'that he might 'have been mistaken on the subject of *natural* 'dykes; though, as for the materials of the stones 'he saw, being igneous rock,—what he was now 'told, proved that he had not been deceived *there*; 'and so he felt sure at the time.'

Internal Substance of the Great Pyramid.

The plain and simple account by Howard Vyse and Perring, who excavated extensively in various parts of the Pyramid, is,—that excepting a small proportion of the rock of the hill left standing,[1] and the granite linings in and near the King's chamber, with a few others,—all the rest of the Pyramid substance is built of rectangular blocks put together by masons' art, and in a limestone material. This material is also stated to be generally the product of the Pyramid hill; but occasionally, the denser rock of the table-lands on the eastern side of the Nile,—and distinguishable still, not only by that greater density, freedom from nummulites, and uniformity of consistence,—but by quarry-marks, more or less legible, in red paint, being usually found on the under or inner sides of the blocks formed out of it.

Fully confirmatory of every item in this account were all my experiences, so that I had considered it

[1] 'Averaging 8 feet in height over the whole base of the Pyramid,' they say; i.e., 8 feet only out of the whole height of nearly 490 feet.

to have disposed for ever of all the talk of some men about white marble; of others, that Herodotus's bringing stone from the Arabian hills was nonsense and supererogatory, because the Pyramid hill could furnish plenty of the same sort; and of others, that there had been no large amount of building of any kind, because the Pyramids were merely hills trimmed down where they stood.

But errors, as well as truths, have much vitality; and this last notion has recently been produced again with such effect, as to have appeared in more than one shapely book; and not unfrequently to have been flung at ourselves in conversation, as being something we could not gainsay. An eminent contractor for the execution of first-class earth engineering works, has recently declared—so these authorities aver—that the Great Pyramid 'was never con-'structed,'—a sounding phrase, even a signal flag to fight under; and meaning, the technicality of the words being interpreted, that the Pyramid was not built by masons, but banked up or dug away by navvies and quarrymen.

Well, the engineers of the present day, and contractors too, are a wonderful class; and have a right to be heard on the *modus operandi* of ancient works, either of architecture or engineering. But what are the proofs of their new battle-cry, 'The 'Great Pyramid was never constructed'?

These two, according to themselves—1*st*, the ground around the Pyramid *looks* as if it had been

excavated; and, 2*d*, one of these able contractors who has been twice to the Pyramid, and spent about three hours there each time, 'is certain that the 'ancients had no machines by which they could have 'lifted such large stones.'

'Is he a well-read man in ancient architectural 'literature?' asks an onlooker.

He himself says, 'Oh no! not at all! He never 'reads a book in any language.' And when referred to the Pyramid's side, where he may see the masonried stones up on high, actually lifted, no matter how it was done, but as a proof it was done,—he replies, 'that is only apparent, not real, building; 'the stones were cut into shape on the ancient hill-'side up there, and left as we see them now. And 'he will not acknowledge any difference between 'the dense limestone from Mokattam, and the friable 'nummulitic limestone of the Pyramid hill; free-'stone all of it, he roundly declares.'

His questioner then began with an argument of power:—'You say those stones on the Pyramid 'side were not lifted up there, because no machine 'known to the ancients was strong enough to lift 'such heavy blocks; and as they are of limestone, 'and the whole hill is of limestone, you hold they 'must have been portions of a high original hill 'trimmed into shape *in situ*. Vastly bigger, how-'ever, and heavier too, than any of these limestone 'blocks you see,—are the granite blocks in and about 'the King's chamber; and as they could not have

'formed part of a limestone hill, they must have 'been lifted up by human agency to occupy their 'present well-built, and well-devised, positions. So, 'if the heavier blocks were lifted, why not the 'lighter?'

But this pointed shot fell harmless off the contractor, like a mustard-seed from the sides of a rhinoceros; for he answered with amazing *aplomb*, 'That's not granite at all in the King's chamber, it's 'all concrete,—a mixture that was carried up in 'little basketsful at a time, and then cast in a mould.'

'Not granite!' gasped the questioner; 'why, look 'at this specimen of the mineral: it was picked up 'outside the Pyramid, as being almost exactly of the 'same order as the walls of the King's chamber!'[1]

'Oh! that's granite, of course,' said the contractor, taking the specimen in his hand, and turning it over and over jauntily; 'but that's not the walls of the 'King's chamber. Have you seen Pompey's Pillar 'at Alexandria? No, you haven't. Well, I thought 'so; and it's a pity you haven't, because there you 'would find the whole thing most completely proved 'to your own and everybody's satisfaction. There 'are some marks made on Pompey's Pillar by cannon-'balls at the siege; and wherever one of them has

[1] Neither in this conversation nor elsewhere in this work, have the mineralogical differences of granite, syenite, and syenitic-granite been taken into account; for, as regards architecture, granite is the well understood term that includes all three; and all three are, for the purposes of a mason, so nearly similar to each other, and entirely removed from soft limestone.

'struck and torn up the surface, you can see quite 'plainly that it's all concrete inside, and nothing 'else. All cast in moulds; though men who look 'at the outside only, are always raving about the 'beauty of the *granite* shaft, forsooth!'

'And you formed all that idea for yourself,' asked the other; 'didn't get it out of any book?'

'Haven't I told you I never read any books?' returned the contractor.

'Yes, I remember now, that you said so,' replied his questioner; 'but it is so very strange to find an 'old idea exactly repeated in modern times. For 'this is how a writer expresses it in 1702; the 'quotation beginning at the middle of a paragraph 'at the foot of page 202, thus—

'"The only entire pieces that have escaped the common fate 'of the rest, are the column of Pompey, and four obelisks of 'granite. 'Tis said the first was erected by Cæsar, to the 'memory of Pompey: some think it a kind of *marble*, but others 'incline rather to believe that 'twas built of *melted stone*, cast in 'moulds upon the place. The latter opinion seems most pro-'bable, for there is not the least piece of that stone to be found 'in any part of the world, and the pillar is so prodigiously big and 'high, that it could hardly be erected without a miracle. I 'know 'tis alleged by those who believe the story of the Rhodian 'colossus, that the ancients had the advantage of admirable 'machines to raise such bulky pieces; but I should reckon my-'self extreamly obliged to these gentlemen, if they would show me 'any probable reason why among so great a variety of Egyptian 'monuments of antiquity there is not one of *marble;* and by 'what unaccountable accident the stone called *granite*, which 'was then so common, is now grown so scarce, that the most 'curious enquiries into the works of nature cannot find the least 'fragment of it, that was not employed in ancient structures.

'And even though I should suppose, with my adversaries, that 'the quarries out of which this stone was dug were by degrees 'so entirely exhausted, that there is not the least footstep of 'em 'left; and that Nature herself has lost so much of ancient vigour 'and fecundity, that she is not able to produce new ones; I may 'still be allowed to ask why granite was only used in obelisks 'or columns of a prodigious bigness: for if it were really a sort 'of stone or marble, I see no reason why we might not find small 'pieces of it, as well as *porphyry*, and other precious kinds of '*marble*. These reflections, in my opinion, may serve to confirm 'the hypothesis of those who believe that all these admirable 'monuments were actually cast in a mould: and if they would 'take the pains to view this column attentively, they would soon 'be convinced by the testimony of their own eyes, that 'tis only 'a kind of cement composed of sand and calcined stone, not unlike 'to mortar or lime, which grew hard by degrees. I will not 'pretend to determine by what artifice these ancient workmen 'kept the cement from yielding or sliding till the pillar was com-'pleated; though perhaps it might be probably alledged, that 'they made a mould of stone or wood, besmeared on the inside 'with some fat or unctuous substance, to hinder the matter from 'sticking to its cover; and that after the work was finished, and 'the column almost dry, they broke the mould that preserved 'the regularity of its figure, and kept it from falling.'

'"This column is 80 foot high, and 24 in compass: 'tis placed 'on a marble pedestal eight foot square, and crowned at the top 'with a chapiter of the same *granite*, of which the pillar consists. 'I know not what opinion you may have of the ancient engines, 'but for my part I must confess, whether I consider the weight 'or bulk of so vast a mass, I find it equally impossible to con-'ceive that it could be raised by the strongest and best contrived 'machines that were ever invented."'

'So there,' continued the questioner to the modern engineering contractor, 'you have, in a book 'printed 164 years ago, your own theory of the easy 'formation of granite in moulds (only you must 'remember to grease them well inside), and a 'disbelief in the power of ancient machines to raise

'large stones; and all this in reference to the well-'known and frequently-visited Pompey's (Diocle-'tian's) pillar. A thing, not secluded in a dark room 'of difficult access, like the King's chamber in the 'Great Pyramid, but standing out in the open sun-'light, in a sea-port town, appealing to all observers; 'and those curious inquirers, would therefore have 'long ago found out, and made patent to all the world, 'such a flagrant case of cheating; or, if you like, such 'a splendid invention for imitating granite,—had it 'really been as represented. But I rather incline 'to think that the true difficulty to man, is not the 'mechanical exertion of lifting a heavy stone when 'you have got it,—but competing with Nature in '*making* a natural rock. The idea, however, that 'men could do so, seems to have prevailed rather 'extensively at one time, and has led to the ill-'treatment of other monuments besides the King's 'chamber and coffer of the Great Pyramid; for 'thus the worthy Dr. Stukely is compelled to write 'about Stonehenge, in 1740 A.D.:—

'"Nevertheless the current of so many ages has been more mer-'ciful to Stonehenge, than the insolence of rapacious hands (besides 'the general soccage brought upon the work of old) by the unac-'countable folly of mankind, in breaking pieces off with great 'hammers. This detestable practice arose from the silly notion 'of the stones being factitious. But alas! it would be a greater 'wonder to make them by art, than to carry them sixteen miles 'by art and strength; and those people must be inexcusable, 'that deface the monument for so trifling a fancy."'

Exterior Substance of the Great Pyramid.

Portions of Great Pyramid casing-stones which we have placed in the hands of a lapidary, have not come up to the polish of 'marble,' only to that of moderately hard limestone; yet it is a nice and pleasant species of worked stone to handle, uniform in its structure, of small specific gravity, of a warm and rather more than a *cream*-colour in tint, and with a great adaptability to cut up into accurate mathematical figures, of any angle.

But the ancient *exterior* surface of these specimens is found, in nine cases out of ten, to be of a rich brown hue, the exception being a pale blackish tint; and underneath the brown colour, a thin film is sometimes perceivable, rather whiter than the rest of the stone. Altogether, the brown tint has been taken by many persons as the remains of paint or 'shellac varnish;' and as a proof of the *lubrication* of Pliny, meaning some unctuous coating applied to the stone; though others translate the word as merely polished, and consider it to imply that sort of polishing which results from grinding, or other mechanical smoothing process.

Dr. Wallace, of Glasgow, however, has found (vol. ii. Sect. v.) the brown material to be oxide of iron, and considers it to be an exudation from the stone. This suggestion, too, explains the similar browning which is found over all the tops and external sides of most of the stones forming the present

summit of the Great Pyramid; stones from Mokattam in every instance there, though never on the ancient exterior surface of the Pyramid; and therefore never in a position to get part of a coat of paint once spread over the bevelled outside, if such a coating was ever really applied.

The development, however, of this outward iron-browning, would seem to require a long exposure to sun and air; for however much of it there may be on the bevelled, and therefore ancient, outside of an ordinary casing-stone fragment,—there is none on the same fragment's own adjoining surfaces, *if* they formed any part of the course of masonry, and were in so far in an interior position. Every chipped or scraped surface of any of the stones still standing *in situ*, as those about the entrance to the Pyramid, is furthermore lighter and lighter in colour, according to the recentness of the scraping. A matter abundantly provable by the dates attached to the names of travellers, in the label spaces which they have often prepared for themselves by scraping; and which, in photographs of the cyclopean blocks placed *en décharge* over the entrance,—appear like so many white paper patches on the brown stone; while Dr. Lepsius's inscription to the late King of Prussia, looks like the large advertising-bill of some unscrupulous trader. The untouched parts, therefore, of these inclined blocks, are decidedly brownish; and if not of the full casing-stone, or topmost stone, hue,—it is because they have not the same unmiti-

gated exposure to sun and wind, on account of their position in a hollow on the northern side of the Pyramid; and it was on that flank of the building alone, that several casing-stone fragments were found by us with their original outside surface, occasionally, not brown, but pale black. Another exudation of the stone, however, there is, which seems notably to require darkness, quiet, and *want* of change of air for its manifestation, viz., the salt.

Salt inside the Pyramid.

This substance is so abundant, *i.e.*, in dense plates, an inch thick often, in the horizontal passage and Queen's chamber,—and so scanty everywhere else,—that the Arabs believe, both that it exists nowhere throughout the Pyramid except in these two named localities; and that it is to be found there, simply because the builders put such 'salt stones' into that particular department of the building. Yet there are incrustations of salt in large superficial extents, though to small thickness, developed on the walls of the Grand Gallery.

Similar incrustations, too, are to be seen on the horizontal part of the entrance passage and the walls of the sepulchral chamber of the *second* Pyramid,—though greatly reduced from their appearance when Belzoni entered it, some seven hundred years after its last mediæval visitors had left; for he then found incrustations, or rather exfoliations, more like 'endive leaves, and several inches long,' where now

they ar[illegible] be measured only by tenths of inches. Yet in [illegible]ery case, the material comes out of the wall with curving fibres, as if it were a viscous substance forced out through small apertures with enormous pressure; and it is still coming out, as proved by its decorating recent scratched figures. This fibrous aspect, appears to have been well noticed by Mr. W. R. Wilde,[1] who, speaking of similar saline formations in the chambers of construction in 1837,—or the very year of the discovery of those rooms by Colonel Howard Vyse, and therefore before they were blackened by the smoke of visitors' torches,—describes what he saw as 'a remarkable incrustation of a shining white, curly, and crystalline substance, not unlike the moss called *ursnea barbata* covering some of the trees in Madeira. It is found in little bunches on the roof, and as it is a substance, not, that I am aware of, as yet accurately described, being generally supposed to be nitrate of potash or saltpetre, it has been subjected to chemical analysis by my friend, Professor (since Sir Robert) Kane, and found to be common salt, *chloride of sodium*. He states to me that its occurrence in this form is of considerable interest, as it illustrates the manner in which some species of the alum family assume the curious fibrous and contorted figure of these specimens. A question of exceeding interest here presented itself,—how did it get

[1] *Narrative of a Voyage to Madeira, Teneriffe, etc.* Dublin, 1840.

'into and crystallize on the sides of these chambers? 'Three modes of resolving the problem have oc- 'curred to me: either that the granite (?) itself 'was filled with this substance in its original bed, 'and that it oozed out and crystallized in this 'curious form afterwards; or that the atmosphere 'from the desert, where salt is found (as it is in 'the neighbourhood), becoming impregnated with 'fine and impalpable saline particles getting into 'the interior of the Pyramid, so encrusted it as I 'have described, although we know that for cen- 'turies there was no apparent inlet for it; or, 'thirdly, that it was used in some of the mystic 'rites that were of old practised in the lower 'chambers, and, being carried up in the form of 'vapour, cooled and crystallized in the upper apart- 'ments. But, at the same time, I must acknow- 'ledge that none of these modes satisfy me as to 'the way in which this salt was formed.'

That the salt is almost entirely common salt, or *chloride of sodium*, Dr. Wallace's recent analysis confirms the older; and that *one*, if not the only, origin for it, is its original presence in the material of the Pyramid (not the granite indeed, on which I have never seen any trace of the salt, but the lime- stone),—is also shown by his analysis of the num- mulitic lime-rock of the Pyramid hill, and the shell limestone of the southern hill: as well too as by my own late finding, that the recently cut and polished specimens of the Great Pyramid casing-

stones, after being put away for a few months in a closet, are quite salt to the tongue.

But *that*, I must confess, does not of itself explain why there should be twelve times as much salt found in the construction of the stone forming the lining of the Queen's chamber, as in any other part of the Pyramid, or Pyramid hill, yet examined. So that the question may still be opened up, as to whether the Pyramid builders used this *very* salt-stone for the Queen's chamber and its passage, through accident, or design. Unless the following suggestion should be deemed of weight, viz. :—That there is a tendency of the salt contained in all the mass of the Pyramid, to crystallize out towards, and into, any internal void ; and that the product goes on increasing therein, if there be no *ventilation*. Co-incidently with which idea, it should be remembered, that the Queen's chamber is absolutely without visible ventilation,—forming, as it does, a *cul-de-sac* out of the line of the passage leading to the King's chamber, with its peculiar air-tubes ; the Queen's chamber, moreover, being conspicuous in most travellers' accounts from the time of Sandys and Greaves downwards, for its ' noisome savour and ' grave-like smell forcing a quick retreat.'

Mortar of Great Pyramid.

From a paper,[1] by William Wallace, Esq., Ph.D., of Glasgow, to whom two specimens of Great Pyra-

[1] *Chemical News* for April 1865, p. 185.

mid mortar, one from the interior, the other from the exterior of the structure, had been furnished by William Clarke, C.E.—the following analysis is taken :—

	Interior.	Exterior.
Sulphate of lime, hydrated, . .	81·50*	82·89*
Carbonate of lime, ...	9·47	9·80
Carbonate of magnesia, . . .	·59	·79
Oxide of iron, ...	·25	·21
Alumina, ...	2·41	3·00
Silicic acid, ...	5·30	4·30
	99·52	100·99
* Water by actual estimation, . .	16·66	17·38

Both varieties of mortar being described as appearing, 'a mixture of plaster of a slight pinkish colour, 'with crystallized selenite or gypsum,'—I should be inclined to say, that Mr. Clarke had not secured any of the more precious *milk-white cement* of the finishing blocks of the interior,—but only some of the ruder cement of the masonry courses. This, too, is the same in every part of the Pyramid, and has just the pink aspect ascribed to it, together with a variety of little particles and lumps,—all under the size of a small pea; and in colour, chiefly brown, red, and white. A portion of this sort of mortar, of my own gathering, which I recently transmitted to Dr. Wallace, he describes as identical, chemically, with what he had previously examined.

Hence the above analysis represents the mortar of all the chief mass of the Great Pyramid structure,

and shows it to be different from ancient Phœnician, Greek, and Roman mortars,—perhaps all mortar, in consisting almost entirely of sulphate of lime; and having little or nothing of the carbonic acid with lime, silicic acid and sand which abound in *them*. This characteristic fact of Pyramid mortar seems to have been first discovered by Dr. Wallace, through means of genuine chemical examination; and appeared to him so unusual, that he was not a little interested to receive from me *afterwards* some specimens of rock, as well as loose crystals picked up near the Pyramids, and which he then ascertained to be 'sulphate of lime, *very pure*.'

Diorite.

The stone which I have called *diorite*, and which Dr. Wallace looks on rather as a '*hornblendic quartz-*'*ite*,' is apparently the same as that forming the statue of King Shafre in the Museum of Boolak; and is abundantly distinguishable to the most common observation from the black or blue basalt, and greenstone of all varieties in size of grains, found lying in fragments on various parts of the Pyramid hill. But it is the occurrence of chips of the diorite (?) amongst the ancient rubbish north of the Great Pyramid, to which I would now call attention,—for no presently existing part of the Pyramid is constructed in this material; and there is much uncertainty as to whence so remarkable a mineral was brought.

The Arabs always say, with every strange stone

they are asked about, 'From Upper Egypt;' but I have not met with a single man, either Arab or European, who has seen it there *in situ*; and the coloured plates of minerals from Assouan in the great French work, do not contain anything at all resembling it; so that the question would seem to be still an open one.

There are likewise, some similar questions, yet to be settled finally, as to the Sinaitic or Syene-itic derivation of the Great Pyramid's red granite.

Granite.

Hence, a little more about *granite*, but upon a new accusation, must really be requested of our kind reader's patience. The extract which we formerly gave, p. 90, indicates the scanty knowledge of this lordly mineral possessed by Europeans in recent ages; and the mystical impossibilities, therefore, attached to it. In the present day, when the quarries of Aberdeen and St. Petersburg have enabled all men to talk quite glibly about 'red granite,'—even 'as maids of thirteen do of puppy-dogs,'—we are rather surprised at the laborious phrases with which the learned Dr. Clarke found himself obliged to convey to his readers, of only sixty years ago,—a notion of the sort of substance he was speaking of; but had to make plain to them in the following roundabout manner:—'By *Greaves' Thebaick marble* 'is to be understood that most beautiful variety 'of *granite*, called by Italian lapidaries, *granito*

'*rosso* (see Forbes' *Travels*, p. 226, London, 1776), 'which is composed essentially of *feldspar*, of *quartz*, 'and of *mica*. It is often called *Oriental granite*, 'and sometimes *Egyptian granite*, but it differs in 'no respect from *European granite*, except that the 'red *feldspar* enters more largely as a constituent 'into the mass than is usual in the *granite of* '*Europe*. The author has seen *granite* of the same 'kind, and of equal beauty, in fragments, upon the 'shores of the Hebrides, particularly at Icolmkill.'

Yet, was Dr. Clarke quite right in his day, to take so much pains; and had he lived now, he might not have found his task everywhere quite finished; for thus, an English visitor,—a graduate of the University of Cambridge, and bearing a name respected in science,—remarked to us in our dining-room tomb, at East Tombs, Pyramid hill, with the petrified nummulites staring him in the face,—'What an interesting *granite* cave you are 'living in here!' And again, divers recent travellers have spoken of the entrance passage of the Great Pyramid, being *lined with granite;* when there is nothing but soft limestone there to be seen. The excuse may perhaps be made for these gentlemen, that they did not try the hardness; and only looked at a distance to the corrugated surface of weathering, more or less blackened by smoke, and rubbed for ages on the points of the corrugations by passing Arabs in greasy clothing; which gives occasionally, with the assistance of chance drops of wax from

flaring candles, a very peculiar mottled appearance.

What shall we say, however, of a literary man, who has been often and long in Egypt,—has written many books upon it most learnedly; has excavated at the Pyramid hill; and, through means of broken pieces of the limestone, has seen beneath the corrugated, parti-coloured exterior surface,—witnessing there only the soft, white, uniform powdery character of the interior of Mokattam blocks,—and persists, nevertheless, 'that it is all granite!'

'Impossible!' might any one well exclaim; and yet here is the fact:—

'Another point also regarding the Pyramid of Suphis, seems 'to require explanation. It is the generally received opinion, 'that the Pyramid was originally covered with a casing. . . . The 'researches of Colonel Vyse, and Lepsius, led them to the con-'clusion, that the casing-stone was of limestone of Tourrah '(Mokattam). We are compelled to say that such is not our 'impression. In the course of repeated visits to Jeezeh, includ-'ing a residence there for a time, it occurred to us, that the casing 'had been removed from the Pyramid of Suphis at a very early 'period, *long before the days of Herodotus*,' etc. etc.

'We were induced by this consideration, to examine the 'mounds of detritus, which everywhere, and to an enormous 'depth, encumber the platform of rock on which the Pyramid 'stands. We found they were composed all but entirely of frag-'ments of a grey granite, identical in appearance with that which 'lines the inner passages and vaults. It was this circumstance 'which forced upon us the conclusion, that the outer casing also 'had been of the same material like that of the third Pyramid. 'This granite was obtained, not from Syene by the Cataracts, but 'from the Peninsula of Sinai. Accordingly Herodotus tells us 'that Cheops brought the stone with which he covered the 'Pyramid, from the mountains of Arabia; an epithet not ap-

'plicable to the limestone hills of Tourrah, which everywhere 'overhang the Nile, and do not reach so far either northward or 'eastward, as to be with any propriety entitled to the name of 'Arabia.

'The casing of the Great Pyramid, then, was of grey granite, 'a material not to be found anywhere either in Lower or Middle 'Egypt, or their vicinity; and, therefore, very valuable in that 'country, because brought thither from a great distance. It 'served for a series of ages as the granite quarry of Heliopolis, 'Memphis, and other cities in the vicinity. It is, we submit, 'thus, and thus only, that we can account for the entire and 'early disappearance of the casing, and also for the vast and 'deep *couche* of granite detritus which surrounds the Pyramid.'

Now this author, is no other than William Osburn, member of the Royal Society of Literature; and the work quoted from, his *Monumental History of Egypt*, published in 1854, in two large volumes octavo,—containing unitedly more than a thousand pages, and filled for the most part with admirable investigations and disquisitions concerning the interpretation of hieroglyphics, and their application towards elucidating the early history of Egypt. Even in this passage, too, the author shows his perfect honesty and loyalty, in openly stating at the beginning, that the testimony of two such weighty authorities as Colonel Howard Vyse, and Dr. Lepsius, is dead against him. What, then, can we think of this formal declaration on his part, of grey granite in place of white[1] limestone?

At first, I hoped there might be some explanation under the cover of the word 'grey;' which may

[1] Dry oxidated fragments seem to lose their cream-colour, and form powder as white as flour.

mean, according to the speaker, almost anything from white to black. But on p. 271 of his volume i., the following words of the same author settle that point, —when we know of how dark a chocolate colour, nearly black, the coffer of the Great Pyramid is,— 'The whole interior cased with grey granite, and 'the square inscriptionless sarcophagus of the *same* '*material*.' Hence, the *colour* also, which Mr. Osburn assigns to the fragments forming the hills of rubbish outside the Pyramid, and lying against the sides of its base,—is as totally different from what we found it, and our photographs represent it,—as are their material and mineral characters.

What, then, are we to do with Mr. Osburn's book? Are we to throw it altogether away from us, as undeserving of any confidence, because it has this flagrant error in a single simple matter? No, certainly; not on that account, according to any principles of common justice: for there is no one who has written yet on the Great Pyramid, who has not blundered at some one point or other. And when the writer has been a great man,—say a French Academician, for instance, writing down the depth of the coffer three whole inches too great,— the world has not ceased on that account to continue to pay such great man adulation, and believe in all the rest of his writings as before; especially if the slip should have occurred in something that was not his *forte*, or his usual subject of pursuit.

Now the latter characteristic appears to have been precisely that of Mr. Osburn and mineralogy; for his main subject is hieroglyphical interpretation, and there he seems even to be a giant.

But his case, as already intimated, is not a solitary one; and the records of Great Pyramid investigations (as these volumes will probably indicate before they are concluded), contain instances numerous and striking enough,—either to destroy all faith in the testimony of man, and to confound any computer of mathematical probabilities,—or, to lead to the institution of new inquiries on the admission and weighing of evidence: either one result, or the other, according to the nature of each recipient's mind.

PROPOSITION IX.

ORIENTATION OF THE GREAT PYRAMID?

ALTHOUGH some features of this question have been touched on in previous pages, yet for the sake of condensing all the information and depositing it in a part of our work appropriate for the purpose, and easily referred to,—we beg to wind up our *phenomenal* Division I., with a few remarks on this important question of astronomical emplacement.

A Pyramid would evidently still be a Pyramid, towards whatever quarters of the horizon the sides

of its base were pointed. But something may be added to its other meanings, if one particular direction has been selected with some trouble, out of all other possible ones. And that seems to have been the case not only with the Great Pyramid, but with all the other Pyramids, and most of the monuments round about it; even down to the small sepulchral square-shafted wells,—for their sides are always approximately north, south, east, and west.

This is a direction peculiar, apparently, to the Egyptian monuments; for the Rev. G. Rawlinson, in his *Ancient Monarchies*, describes all the earliest of the Chaldean temples (and he would place some of them synchronously with *our* date of the Great Pyramid), as having, not their *sides*, but their *angles* pointed to the four astronomical quarters.

With the Egyptian structures, again, their sides are directed, not towards those points of the *compass*,—as runs the prevalent idea of many existing men,—but according to the azimuthal direction of the earth's axis, and a line at right angles thereto. What the direction of the compass was at the Great Pyramid four thousand years ago, probably the man amongst us best versed in the theory of terrestrial magnetism, and the rate of movement of the magnetical poles,—would avoid any attempt to calculate; but at present the north end of the needle on the Pyramid hill, inclines some 10° towards the west; and as all the larger monuments are within, and much within, *one* degree of the astronomical or

earth's axis direction, we need not allude to the compass again. Neither is there occasion to refer to the smaller constructions; for, unavoidable tear-and-wear on the stones composing them, has made it impossible—with their short radii—for modern observation to determine, whether they are, or ever were, once so remarkably accurate as the Great Pyramid has been lately proved to be.

Many celebrated travellers and competent men, take the Viscomte de Rougè for an example, have spoken with admiration of the Pyramid's 'astonishing justness of orientation;' and the Egyptian astronomer, Mahmoud Bey, has described interestingly that when he mounted, on the evening of March 21st, 1862, shortly before sunset, upon the eastern end of one of the courses of masonry on the north side of the Pyramid, immediately above the rubbish-mound,—he saw the sun apparently descending vertically just on the head of his friend, whom he had placed at the western end of the same course. But as these verbal terms of laudation may yet include anything under half a degree,—the result of M. Nouet, Astronomer to the French Academicians in 1799, giving the instrumental error of 19′ 58″ for the north end towards the west,—may be taken as closer; and was even thought very close, by the Academy. (See p. 44.)

My own measure, too, of the north and south azimuth trenches, giving 19′ 14″ in the same direction,—looked very much like a confirmation of M.

Nouet, touching the amount of error in the Pyramid as now existing. But on afterwards measuring the traces of the *original* Pyramid, and comparing them directly with the Pole-star, there were obtained for the error westward (vol. ii. pp. 190-195)—

Of the north end of the line of the outer corners of north-east and south-east sockets, west of north, .	+ 4′ 44″
Of west end of the line of outer corners of north-east and north-west sockets, + 90°, ...	+ 4 0
And of north end of entrance passage from under granite portcullis to mouth, ...	+ 5 0
Mean, . .	= + 4′ 35″

Now this is a remarkable result, not only for the very great proportional amount of reduction in the instrumental error previously believed in,—but in the consistence of all three parts of the Pyramid; so that none differs more from the mean, than 35″. Notable enough is this angular agreement if found in *any* part of the Pyramid; and capable of proving, on former experience, that the builders must have attached extreme importance to the feature; but still more notable is it, when the greater difficulties of astronomical, over geometrical or mechanical observations are taken into account. All three angles may, however, be merely geometrical deductions from one and the same original astronomical observation; and which, if it did in this case turn out + 4′ 35″,—might, on a second attempt being made, have given −4′ 35″, or some other largely different quantity.

There is, however, as I have proved to my cost,

so much difficulty in comparing the inclined and high entrance passage with any side of the Pyramid's base,—that I am rather inclined to think that two astronomical references by the builders are included in these three given features of the Pyramid. And the only constructional or pyramidally learned way that remains to mankind, of obtaining more evidence on the subject, is, to compare the Grand Gallery with the celestial Polar direction; for the error in that admirable and gigantic piece of construction we may safely assume, as detailed on pp. 39 and 60, to be less,—probably much less,—than 2′.

But how to compare the Grand Gallery with the stars? At present, the three long cork-like blocks of the granite portcullis in the first ascending passage, stop the way. They cannot be pushed downwards into the entrance passage and so got rid of, because the passage tube into which they fit, contracts below them. But could they not be pushed upwards, and southwards, by a hydrostatic press acting against the floor of the entrance passage?

There would be the friction of long-cemented sides to overcome, as well as the weight of the blocks; and besides that, the performers would have to consider whether, looking to the rudely and cruelly broken-out cavern of Al Mamoon's hole close by, the masonry about the portcullis region might not collapse, when the support of its blocks shall be gone. In fact this eventuality looks so probable, that I myself having seen the place, would

only now venture to propose,—that a round hole be bored through the portcullis blocks *in situ*, so that they might be observed through, and no more. Either such an operation; or, an attempt by three observers and three theodolites, worked simultaneously,—one in the entrance passage, one in Al Mamoon's hole, and one in the first ascending passage,—to carry the angle *round* the portcullis blocks. But there is doubt, if this last operation could be conducted with the requisite amount of nicety. And even if it was; and if those who were engaged in its performance, fully believed in the excellence of their own work,—would it equally command the same confidence from the rest of the world,—that a direct comparison of two signals at either end of the Grand Gallery on one side, with the Pole-star on the other, would be pretty certain to receive ?

DIVISION II.

OBJECTS OF CAUSATION.

'Whenever any material step in general knowledge has 'been made,—whenever any philosophical discovery arrests 'our attention, some man or men come before us, who have 'possessed, in an eminent degree, a clearness of the ideas 'which belong to the subject in question, and who have ap- 'plied such ideas in a vigorous and distinct manner, to 'ascertained facts and exact observations.'

REV. WILLIAM WHEWELL, M.A.
History of the Inductive Sciences, p. 9, Vol. i., 1837.

THE GREAT PYRAMID AS A METROLOGICAL MONUMENT.

INTRODUCTION.

After having shown in the course of Division I., the Great Pyramid's striking regularity of figure, perfection of workmanship, and close fulfilling of the requirements of a particular geometrical construction, touching some of those very fundamental matters,—we are called on now to take somewhat higher ground: and, while discussing still further details of mere measures made with care on subsidiary features of the monument,—to endeavour to ascertain how far the numbers given by observation either confirm or refute, certain well-known and long-expressed opinions before the world,—respecting the *reasons* for such and such lengths, breadths, or angles having been given to particular parts.

From the time of Herodotus downwards, or for more than two thousand years, men have been accustomed to talk of the Great Pyramid, and indeed all the Pyramids, as tombs of kings or persons

of kingly race. That is, most men of West-European civilisation have done so; for in the East, there seem always to have been traditions of an opposite character; or as to something connected with science, religion, or wealth, being locked up for future generations, and more remarkably in the Great Pyramid than in any other. Within the past two hundred years, however, this last form of belief has gained many supporters both in Great Britain, on the Continent, and in America; gradually assuming with them the shape of a settled hypothesis,—that somehow or other the Great Pyramid was intended to be a grand metrological, or 'weights and measures,' monument for mankind. Not so much though, as a place of frequent reference for those things,—as for preserving safely—during some thousands of years, and through all intervening revolutions of nations, empires, and religious creeds—the grand standards of metrology, true to their original settlement in old primeval times. For they were considered then, as now, to form some of the most necessary material means of civilisation: yea, even 'the very rules 'whereby all men's rights and properties are set 'forth, distinguished, and valued, the alteration 'whereof might bring much inconvenience, with-'out any prospect of advantage;'—as an anonymous author on the Great Pyramid wrote, in the year 1706.

The first dawn of this view in English literature, is probably contained in the works of Bishop Cum-

berland of Peterborough, A.D. 1685; though it there takes little other form than assuming, that the several parts of the Pyramid were regulated in size, according to convenient even numbers of local standards of measure then existing. But the subsequent anonymous author above quoted, pronounces boldly for the object of the Pyramid's erection having been to supply,—or commemorate through all time what was once supplied,—to the various *origines* of mankind, as their several weights and measures; without, too, having any special connexion with what might be in vogue amongst the Egyptians in particular. And after having shown, but in a manner which he himself allows is rather obscure, and which I must confess myself unable to follow satisfactorily—that some early Saxon measures were represented by certain proportions in the Pyramid,—he more emphatically adds, 'and if we 'consider the standards of our *English* measures here 'found, which you have seen, and the standards of 'such ancient *Persian*, Grecian, and Roman mea-'sures, which you will see if you please, you will 'find it very hard to conjecture that they were all 'in use amongst the Egyptians.'

A second edition of this curious and most ingenious treatise was published in 1745; and states in the title-page, equally with its predecessor, that the author was Mr. John Greaves, 'Astronomy Professor at Oxford.' But he died in 1652, and there is no trace of the work having existed before 1706;

and though his, Professor Greaves', measures at the Pyramid, in 1637, are the things founded on in conducting the investigation,—the conclusions, particularly the date of the Pyramid's building, are directly opposed to his acknowledged publications on the subject.[1]

Metrological purposes for the Great Pyramid were also maintained in France by M. Paucton in 1780; and by M. Romé de l'Isle in 1789 : were much alluded to by the French *savants* in Egypt in 1799 : resumed again in England by the Rev. Thomas Gabb in 1806 in his *Finis Pyramidis;* and finally published on by the late John Taylor in 1859 and 1864.

[1] The title-page of the above work runs thus :—

'The Origin and Antiquity of our English Weights and Measures 'discovered by their near Agreement with such Standards that 'are now found in one of the Egyptian Pyramids. Together 'with the Explanation of divers Lines therein heretofore 'measured.

'By Mr. John Greaves,
'Astronomy Professor at Oxford.

'As also; Some Conjectures concerning the Time when these 'Pyramids were built; in Answer to certain Letters, etc.

'London: printed for G. Sawbridge at the three Flower-de-Luces 'in Little Britain. 1706.'

While in Professor Greaves' own works, collected by Dr. Birch, besides his own opinions, the following likewise appears, being quoted apparently with honour :—

'For my singular good friend, Mr. John Greaves.

'Sir,—I am more indebted to your affections, than to your judge-'ment in making me a censor of your learned piece. It had not per-'adventure been much amiss, if you had been so far at cost as to have 'afforded us a particular topographical map of the place where these '*insanæ substructionum moles* stand. For by that we might have been 'able the better to have judged of the discourse of a learned gentle-'man of Bavaria, *Johannes Fredericus Herwart*, who in the twentieth

Some other authors probably should be mentioned as having written with similar views; but I have not met with any of their theories, either so original in their nature, grand in conception, or whose numbers come by any means so close to the best Pyramid measures, as do the late John Taylor's; and that sort of numerical agreement is, in so far as it exists at all, the main feature which we have to look to in the present department of our work. No apology need therefore be offered, for beginning with John Taylor, and giving his ideas a severer scrutiny than those of any other theorist. Simply, therefore, leaving his numbers to come out of such a trial brighter,

'chapter of his *Admiranda Ethnicæ Theologiæ Mysteria*, endeavours to 'take off from the founders of these stupendous buildings the scandal 'of folly and madness, which in the common judgement of the world 'hath struck upon them; and would persuade us, that the Pyramids 'are monuments of the singular wisdom of the raisers of them, and of 'wondrous use and benefit to the country, in maintaining the banks 'of that part of the river upon which the city of Memphis stands, 'which otherwise were in danger to be swept away by the unruly 'eruptions of the river, if it were not checkt by these wonderful 'structures. If your leisure will give you leave to write unto me, 'give me your judgement upon that discourse of his. One thing I 'miss'd in your work, which makes me suspect it is not of such 'moment as many report, because I find not that you do it so much 'honour as to name it; I mean the Sphinx, which is wont to be repre-'sented unto us in the shape of the head and shoulders of a woman. 'When you list to lose so much time, let me hear from you what you 'have observed concerning that piece, if at least it yielded anything 'worth your observation. Sir, let not the world be deceived in their 'expectations to partake of your collections in your travels. I assure 'myself, that as they will greatly benefit the generality, so will they 'more particularly your true and faithful friend,

'JOHN HALES.'

'*From* ETON COLLEGE *this* 18*th of October* 1646.'

'Commend me to Mr. Pullein, and request him to send me *Philo-'storgius*.'

if they can,—we shall proceed forthwith to institute such examination, and in as impartial and even unsparing a mood as we can muster for the occasion.

Etymologically, indeed, Mr. Taylor may be wrong, or he may be right, in the Greek derivation of the word Pyramid being, not as hitherto supposed, from *πῦρ, fire* (which had made some persons look on monuments of that shape and name as having been erected by Persian fire-worshippers), but from *πυρὸς, wheat,* and *μέτρον, measure.* Words which might be taken, as designating the primitive purpose for which weights and measures were first employed amongst men ; and some foundation, too, for the popular tradition, so rife in Sir John Maundeville's day, of the Pyramids having been built by Joseph for granaries.[1] Yet it matters little, we say, what meaning of

[1] 'And now also I schalle speke of another thing that is beyonde 'Babyloyne (Babyloyne the lesse, nigh the righte gret cytie of Cayre) 'above the flode of Nyle, toward the Desert, between Afrik and Egipt 'of Canopic ; that is to seyn the grenneres of Joseph, that he let make, 'for to kepe the Greynes for the perile of the dere yeres. And thei 'ben made of ston, fulle wel made of masonnes craft ; of the whiche, 'two ben merveylouse grete and hye ; and the tother ne ben not so 'grete.

'And every gerner hathe a gate for to entre withinne, a lytille 'hyghe fro the earthe ; for the land is wasted and fallen sithe the 'gerners were made ; and withinne thei ben alle full of serpentes.

'And aboven the Greneres withouten ben many scriptures of dyverse 'langages ; and sum men seyn, that thei ben sepultures of grete Lords, 'that weren somtyme : but that is not treue ; for alle the common 'rymours and speche is of alle the peple there, both far and nere, that 'thei ben the Gerneres of Joseph, and so fynden thei in here scrip-'tures and in here cronycles. . . . wherefore it is not to believe, that 'thei ben Tombes or Sepultures.'—*The Voiage and Travaile of Sir John de Maundeville, Kt.,* A.D. 1350.

their own language the Greeks put on the word,[1] —if its invention was long antecedent both to them and their nation, and had been, as said by some, from the earliest times recognised as a name by the builders of the monument; or in the ancient Coptic language; and as meaning, a 'division into ten; 'from "*pyr*," division, and "*met*," ten.'[2]

Now this derivation, which we first heard of in Cairo, and have since tested by reference to European digests of the earliest Egyptian language,—is not only connected with the right ethnological quarter,—but is a much wider and more significant appellation for a metrological monument of the most scientific kind, than any of the Greek forms. It coincides too, in some degree, with the leading

[1] From πυρὸς, *wheat*, and ἀμάω, *to collect.*—*Rees' Cycl.*

From πυρῶν καὶ μέλιτος, *a cake of pointed figure, and sweetened with honey, as used in the Bacchic rites.*—Mr. Kenrick and Sir Gardner Wilkinson, *in Rawlinson's Herodotus.*

From the Arabic *ahram*, or *háram.*

From *perami*, 'lofty;' thought to be the same with the Hebrew *Charaboth*, which in Job iii. 14, obviously signifies 'a sepulchre,' though rendered in our version 'desolate places.'—*Rev. G. Trevor, M.A.*

From *pouro*, 'a king;' and *misi*, 'a race' or 'generation,' in the Coptic language.—Wilkins, *Disser. de Ling. Copt.*

The name of Pyramid in Egyptian appears to be *br-br.*—*Sir Gardner Wilkinson.*

See also a whole essay on the derivations of the name by M. Jomard, in the great French work.

[2] The above words in italics are merely written down by us, rudely phonetic, as we heard them. But, on referring to Bunsen's *Egypt's Place*, where no such origin for the word Pyramid is hinted at, and where the Great Pyramid itself is positively claimed for a sepulchral monument only,—we have since found at p. 474 of the Egyptian vocabulary, in vol. i., ' =division;' and again, in volume iv. p. 107, in the chapter on Egyptian numerals, 'X (10)=Mênt, mêt, Copt.'

mechanical features of the whole Pyramid; which are,—that it is a mathematical body with five sides (including the base), and with five corners; or, masonically, five corner-stones.

Hence, if the metrology taught by the Great Pyramid is to coincide, either with its name (where we cannot pretend to be quite certain), or figure (where we are quite certain and perfectly assured of the facts),—we must expect to meet frequently with multipliers and divisors, powers and times, both of ten and five. That is, whenever the subject really admits of such numbers with advantage; for there are some things to which even decimal division, notwithstanding all its ravishing beauties for many minds, cannot be applied. An example, too, of these inflexible subjects, is held up by the Great Pyramid at once to all men, and at very first sight, —in its vertical height, as compared with the length of the four sides of its base, being arranged with particular care to be in the proportion of the radius to the circumference of a circle; two things which are incommensurable evenly,—not only in this world, but in every other throughout all the bounds of the Universe.

With this proviso, we proceed at once to consider the several measured features of the Great Pyramid, in an order suited to the heads or principal natural divisions of any large and comprehensive system of Metrology. And in that spirit, have to deal first with—

SECTION I.

STANDARDS OF SIZE.

A COMPLETE system of these measures will evidently embrace cubic and superficial, as well as linear; but the two former being merely geometrical variations of the last,—we have only to employ ourselves, so far as scientific physical standards are concerned, in seeking for those of *linear* measure. Now, such standards have been already looked for by many and many an author, in the sides of the base of the Great Pyramid; even before they knew that the terminal points of those magnificent base-lines, had been carefully marked in the solid rock of the hill, by the socket-holes of the builders. (Vol. i. p. 528; vol. ii. p. 134.)

My own measures of the mere present masonry-courses,—correcting by estimation for the extra breaking away and ruin at the corners,—yielded about 8950 inches for the mean length of one of the four sides of the base, exclusive of the ancient casing and backing stones; and having elsewhere (p. 27), elected to take 101 inches horizontal, for their thickness on one side,—we must add twice that to the above measure,—and accept 9152 inches

as the original length of one side of the base of the finished Pyramid. But this determination is affected by such very large errors of observation (± 50 inches at least) that it is not worth any attention in presence of measures by other men, who have operated upon the actual socket-marks alluded to above.

Now the only man, who ever had the privilege of measuring all four sides of the Great Pyramid's base, between their respective corner-sockets, is my young friend and sometime fellow-labourer, Mr. Thomas Inglis,—representing for the time, Mr. William Aiton, of Glasgow. And he (vol. ii. p. 134), made the

North side,	. . .	9120	British inches long.
South ,,	. . .	9114	,,
East ,,	. . .	9102	,,
And West ,,	. . .	9102	,,
	Mean, =	9110	

But the north side had been previously measured between its two sockets, by the first and always to be gratefully remembered discoverers of those sockets, viz., the French mathematicians in 1799; also by Colonel Howard Vyse and Mr. Perring; and finally, by Mahmoud Bey, Astronomer to His Highness the late Viceroy Said Basha, in 1862.[1] Some other names, indeed, might also be given as having measured from the north-east socket,—but their accounts are not quite clear as to what they touched at the north-west corner, where they seem to have

[1] *L'Age et le but des Pyramides lus dans Sirius.* Par Mahmoud Bey. Alexandria, 1865; but based on observations made in 1862.

looked on the stone,—which has merely tumbled by accident into some part of the general area of that socket-hole,—as the true and veritable ancient corner of the Pyramid itself. The sole authorities, therefore, to be quoted, stand as follows :—

		British inches.
North side, by French Academicians in 1799,	=	9163
,, by Colonel Howard Vyse in 1837,	=	9168
,, by Mahmoud Bey in 1862, . .	=	9162

These look fair enough by themselves,—but what shall we say on comparing them with Mr. Inglis's measure of the same side ; or of the other sides, all between their respective and appropriate sockets! Closer together are the results, than those of previous centuries, when they are found thus :—

		English inches.
Professor Greaves, A.D. 1637, a side of base of Great Pyramid, ...	=	8316
Dr. Shawe, . . 1721, ,, .	=	8040
Dr. Perry, . . 1743, ,, .	=	9360

But a difference of 50 inches in a run of 9100, is far too great to be tolerated in the present day. And yet we suspect it will have to be borne with, until the long-desired opening-up of all four sides of the base, from end to end, shall be performed by some country, or ruler, or people. For, to demand of any single scientific traveller to make a correct measure over the hills of broken stones, as they are now,—is like asking a Londoner to ascertain the horizontal breadth of base of St. Paul's Cathedral, by measuring over the outside of the dome thereof. But the present encumbrances of the ground at the Pyramid, are

modern and factitious ; and the lines whose lengths we require to know there, were not only nicely laid out by the ancient builders on a level surface of rock all the way,—but their terminations were well defined, by having been neatly and deeply cut into the solid rock of the hill. Hence, if modern men have not yet ascertained the true length, it is *their* fault, rather than that of the monument,—that the residual uncertainties we have to deal with, lie among tens of inches, rather than single inches, or smaller portions of space still.

From the numbers actually given above, the probabilities *seem*, that the northern side is rather longer than the others. But that may arise merely from the rubbish-heaps there being, as they undoubtedly are (see Map, Plate III. vol. i.), steeper, more broken, and consequently more difficult to eliminate in their tendency to give an increased length to a superficial, over a horizontal, line. Again, one is almost inclined to fancy that Mr. Inglis's mode of measuring must have had some constant error about it, when all his sides come out so much smaller than one of the sides measured between the same marks by three independent observers. But we are hardly entitled, on that presumption merely, to give his four measures the weight of one only, when taking a mean between him and the other three observers; nor yet, looking at the natural reason for some such presumption, can we give him the weight of four, where each of three good predecessors are accorded

only one. Allowing him, therefore, the weight of two,—the *mean* of all four observers (which we may after that consider to approximately represent the length of the mean of all four sides of the Pyramid's base), presents the following numbers, viz., 9142 British inches.

Wherefore upon that foundation, derived as it is from the best modern measures yet made, comes the question—What does that definite length of base-side mean, or imply, as a standard of linear measure?

Some men, chiefly hieroglyphic scholars and general antiquaries, looking at the matter too much in an Egyptian point of view,—have pronounced rather hastily for the base-side representing the round number of 400 ancient Egyptian cubits, or of so many of the cubits of Memphis and the Nilometer, even. But as that cubit, according to Sir Isaac Newton, was about 20·7 British inches in length,—and, agreeably with the various examples of it quoted by that very safe authority Sir Gardner Wilkinson, has hardly ever, if ever, been found to vary more than from 20·4 to 21·0 British inches,—and by our own determination (vol. ii. p. 340), was more nearly 20·72 British inches,—that gives a length at the utmost of 8400 inches,—which is totally impossible to receive, in face of 9142.

Next came M. Paucton, in France, with his '*Metrology, or Treatise of Measures, Weights, and Monies, of both Ancient and Modern Nations*,'—a

noble quarto of 960 pages, and he a worthy man, publishing in 1780, with the approbation and privilege of the King. Stating, moreover, on his title-page, that 'God had arranged everything in measure, 'weight, and number;' and giving on the reverse of title, six memorable quotations from Scripture,—showing that a care for the justness of weights and truth of measures was not beneath the attention of the Almighty in legislating for His peculiar people, and when granting revelations of His will for the instruction of all mankind.[1]

After drawing a theoretical picture of what the ancients *might* have done to preserve a knowledge of their measures for posterity,—Paucton takes ground boldly on his page 6, in stating 'that they have at 'least done what is quite equivalent thereto. For, in 'the first place, they have preserved their linear mea-'sure on a monument as durable as a monolithic 'rock; and, in the second place, upon a model or 'type taken from nature, as ingenious and exact as 'the pendulum itself, viz., a degree of the meridian.'

This idea is further developed in his pages 110 to 116, and mainly depends upon the belief or assertion that—

500 times the side of the base of the Great Pyramid,
or 20,000 times the cubit of the Nilometer,
or 500 times a certain 'stade' measured in 'Laodicea by Mr. 'Smith of London,'

all mean the same thing, or amount to the same

[1] 'Omnia in Mensurâ et Pondere et Numero disposuit Deus.'—Ex Libr. Sapient. xi. 21. Leviticus xix. 35-36; Deut. xxv. 13-17; Proverbs xi. 1; xvi. 11; xx. 10; and xx. 23.

length ; and *that* length is the measure of a degree of latitude ; such degree being, the 360th part of a circle.

Now, as Paucton's Egyptian authorities do not seem to ascend higher than the Alexandrine Greeks, or within some two thousand years of the Pyramid-building day,—we may well ask for some further proof than 'the practice of Ptolemy and Theron,' that the Pyramid builders were accustomed to divide the circle into 360°. But without pressing that point at present, the previous statement may at once be settled—by comparing the attributed equality of the Pyramid bases' side, with 1-500th of *such* a degree, applied to the earth ; for the quantities are by modern measure, Pyramid base side = 9142, and 1-500th of degree = 8750 British inches.

These conflicting numbers are enough, as a late classical friend would have said, to make poor Paucton turn in his grave ; for he had received some travellers' notes in his day, taken without reference to casing-stones or socket-holes either, and making the length of the Pyramid base side = 684·2 *pieds de Rois*, or 8754 British inches. Indeed, he had been cruelly misled about many of the Great Pyramid's proportions ; for, amongst other things, he was made to believe, that the angle of the sides with the base, was 54° 44′ ; a monstrosity of modern European measure, or guess-work, long since exposed.

A few years after M. Paucton, appeared on the

field, his countryman, M. de Romé de L'Isle, with a *Metrology, or Tables for the Understanding of Ancient Weights and Measures.* But the times had then become troublous and foreboding of evil; wherefore it is almost melancholy to read his touching dedication :—

'TO MY COUNTRY,

'being born again under the auspices of Louis XVI., in the year 'of grace 1789, M. Neckar being Minister of Finance, and the 'French nation assembled for the restoration of law and public 'credit.'

In addition to length, surface, capacity, weight, and money, De L'Isle treats very properly of *time* as a necessary part of metrology; and in a rather long Preface, where he has some small faults to find with Paucton's evaluation of Greek measure, he yet lauds his Egyptian Pyramid meridian degree theory to the skies; considers that its original conception 'has a just title to rank as one of the chief works of 'the human mind,' and he would like to see it made the basis of a reform of the French measures. But he does not add anything to Paucton's theory, nor correct his very large errors in the actual size of the Pyramid; and therefore falls irretrievably into the same pit with his unfortunate predecessor,—so far as concerns the explaining wherefore the Pyramid base was made of the precise size we find it to be.

The sage M. Jomard, the principal author of the Pyramidal antiquities, in the great French work detailing operations from 1799 to 1801 A.D., —is fully

as enthusiastic as any of his predecessors for a metrological meaning in the Great Pyramid,—of which building he has a special Plate, with lines cutting it up for reference to various measures: and to which *one* building he evidently alludes, in sundry rhetorical passages where plural Pyramids are mentioned.

Thus, 'these Pyramids,' writes he (on page 531, *Antiquités Mémoires*, vol. i.), 'to which both ancients 'and moderns have assigned so many different ob- 'jects, which have been attributed to vanity by 'some, to superstition by others, but saluted by all 'ages as the wonders of the world,—have perhaps 'served as tombs according to the idea of many 'authors. But in such case they are the tombs of 'Princes who either wished or permitted that their 'remains should attest to posterity the lights of 'learned Egypt; and they, the Pyramids, have ful- 'filled their destination, for they have preserved to 'us the certain type of the size of the terrestrial 'globe, and the inappreciable notion of the invaria- 'bility of the celestial pole.'

From these generalities the learned author advances to particulars, and having Colonel Coutelle's measures of the base along its northern side—from socket to socket—before him,—is too well informed to take either 1-500th or 1-400th part,—but adopts 1-480th of the terrestrial meridian degree of 360° to the circle, as having been *intended* for one side of the Great Pyramid's base. But that result, or 9115

British inches, is neither close enough to the measured quantity to be received as its representative; nor is any reason whatever given, for introducing such a fraction as 1-480th, into that particular part of the Pyramid.

Next comes before us the Rev. Thomas Gabb, R.C., of Retford, in 1806, with a whole book, and a very well written book too; but containing only a sort of accidental or relative theory about the Pyramid base's side; viz., that it was made one hundred times the outside length of the coffer in the King's chamber. Very decided, however, is he on that point, having heard 'such proportion to have been 'ascertained by Bonaparte's *savants* in 1799,' and that they believed said coffer's exterior had been intended by the Pyramid builders as a standard of length. Wherefore Mr. Gabb gladly concludes, that 'that proportion of 1-100th is now most incontro-'vertibly ascertained; that the curious granite chest, 'hitherto incongruously called a sarcophagus, was 'deposited in its place by the architect himself, who 'certainly knew it to be commensurate in its length 'with the side of the external foundations, and did, 'no doubt, so design it for metrical purposes; 'whence it is another illustration of this perfect 'harmony, this happy, pleasant, useful commen-'surability of the Great Pyramid of Jeezeh.'

Unfortunately, though, the said coffer, as already set forth in vol. ii. p. 117, is not very regular in external figure; and, on the mean, only measures

about 89·71 inches in length: and one hundred times that, cannot be looked on as the happy, useful, and perfect representation of 9142.

Lastly, however, comes the late venerable John Taylor; who, though not a scientific man, yet endued with appropriate knowledge by his Pyramid literary researches carried on for nearly thirty years, at once transcends in this particular all the most learned geodesists of every age and country: for he teaches us to look,—not at either a degree, or a quadrant, or any other length of any part of the *surface* of the earth,—but to the internal *axis of rotation*, as the one most important linear feature of the whole earth—as well, too, in its abstract physics, as its practical requirements when serving for man's abode; and more especially in its sufficiency to form, in the best manner, the basis of a grand metrological reference for linear measure.

This position, after its publication, was admirably defended and enforced by Sir John Herschel, in the *Athenæum* for April 1860; as likewise was the venerable Mr. Taylor's second enunciation, viz., that five hundred millions of a certain kind of inches,—each of them being ·001 of an inch only, larger than the legalized British inch,—measure the length of the axis of rotation of the earth; with the full accuracy, moreover, of all the geodesic knowledge yet accumulated by mankind, and whether represented in the latest trigonometrical surveys or the highest

mathematical investigations by the best men in France, Germany, Russia, and England.[1]

In so far, then, we have in the 5, with the many 0's that follow it, a Pyramidally commensurable and symbolically appropriate unit for the earth's axis of rotation. But what is the nature of this unit's connexion with the length of the side of the Great Pyramid's base, already assumed from measure, as the rough-looking quantity of, 9142 British inches?

Thus it is that John Taylor proceeds. Referring to Sir Isaac Newton's most remarkable investigations on the length of ancient cubits,[2]—wherein that gifted author, both shows the Egyptian or 'profane' cubit to have been close on 20·7 inches in length; and equally proves 'the sacred cubit of the Israelites' (a most peculiar and cherished cubit of theirs, which they possessed as a people or family 'long before 'they went down to Egypt,' and which Moses took special care that they should always employ for *sacred* purposes after the Exodus), Sir Isaac proves it to have been close on 25 inches in length,[3]—basing then

[1] The latest authority for the size and figure of the earth (vol. ii. Sect. v.) is the noble quarto published last year by the Ordnance Survey, after comparing the linear standards of many countries. Two methods for computing arc-surveys are there adopted, with the same materials observed. The first of them gives the earth's polar axis = 500,482,296, and the second = 500,522,904 British inches; and as the former has rather more weight than the latter, the weighted mean of the two comes out exceedingly close upon 500,500,000 British, and 500,000,000 Pyramid inches. The mean equatorial axis is about 1-300th larger, or near to 502,179,000 British inches.

[2] See page 341 of our vol. ii.

[3] The *last* length obtained from all his data by Sir Isaac Newton for the sacred cubit, is nearly two-tenths of an inch less than 25 inches,

on this remarkable research by the greatest master mind that ever lived in modern times, John Taylor shows, that such a 25-inch cubit is most remarkably and astonishingly earth-commensurable,—being, the one-ten-millionth of the semi-axis of rotation of the earth. Or, whereas the modern French metre was chosen by decimal-loving mathematicians, to be the one-ten-millionth of a *quadrant* of a particular meridian of the earth,—the sacred cubit, received so very early into their possession by the descendants of Abraham, was the same admirably even fraction, but of an infinitely better portion of the earth-globe to refer to; viz., a straight line coming from the centre to the surface, along the governing axis of the world. An extraordinarily convenient length too, for man to handle and use in the common affairs of life, is the one-ten-millionth of the earth's semi-axis of rotation, when it comes to be realized;—for it is extremely close, either to the length of the ordinary human arm, or to the ordinary human pace, in walking with a purpose to measure.

Now this remarkable, or even more than remarkable cubit, Mr. Taylor believed the planners of the Great Pyramid knew perfectly well of,—even in all its grand relations to nature,—though the Egyptian people did not. They, the Egyptian people at large, deep-dyed idolaters in their hearts, worked their

and has too generally been the only one quoted; but it is worth while to remember that the mean of all his *nine* determinations or limits, amounts to 25·07 British inches. See 'Hebrew Standards,' Sect. v., vol. ii.

ordinary work according to their well-known profane cubit of 20·7 inches in length, with its subdivisions, if necessary, into six palms, and each palm into four digits;[1] but the planners of the Great Pyramid were no more bound to that measure, which is void of all modern scientific recommendation,—than they were to the degrading animal-worship of the dwellers in the valley of the Nile, or to that grievous sin which themselves so strenuously, though in vain, endeavoured to put down.[2] Those purer-minded architects indeed contrived, apparently, to make their heathen masons labour in such a manner, as to be in reality introducing the sacred measure, when they least suspected what they were about; and to introduce it too in the most signal and appropriate manner, or in a form pervading the whole building, and with a reference to that which measures everything; for, after many thousands of years, the method seems to have been discovered with certainty, and to be simply this, viz.,—that there are as many lengths of the sacred cubit in one side of the Pyramid's base, as there are days in a year.

That is, $25 \times 365{\cdot}25 = 9131$. But these represent Pyramid inches; and when reduced to British inches, are $= 9140$; while the mean length of the Pyramid's base side derived from measure, is, with

[1] Some hierologists say, in later times into seven palms, and each palm into four digits; see vol. ii. Section v.

[2] See vol. i. chap. xv. p. 467.

some small limits for probable error (see p. 127), = 9142.

The nobler cubit therefore really employed, or intended to be perpetuated to distant ages,—was concealed from vulgar gaze, under the veil of the earthly connexion between time and space. By no means an inappropriate idea, when the standard of length is founded on the earth's axis of rotation, the action of which mechanically *makes* the successive days; and when the general form of the whole Pyramid, according to John Taylor's grand circular proportion, causes its vertical height to present towards the continued length of the four sides of its base, the proportion of radius to the circumference of a circle; —or a model of the circuit of the mean earth round the sun in the course of a year,—and where, on the perimeter of the Pyramid, the earth's mean daily motion is represented by the round and even quantity of, 100· inches of length.

I had formerly imagined, that the expression for one side might be, not 365·25 times the sacred cubit, but 366·00 times,—as being the nearest even number of turns made by the earth on its axis in the course of a year; but under the aspect of more numerous Pyramid measures than I was then acquainted with, especially those of Mr. Inglis,—the 365·25 appears to be the more probable supposition. And yet the 366 may perhaps in a manner be present, simultaneously, through means of the peculiar office of the 'pavement,' which lies both around

and partly under the Pyramid ; and this is a feature which we must pay close attention to, in spite of the trouble of so doing, if we would understand the smaller and residual features of the monument.

Architects in *modern* times, have in their drawings, plans, or elevations, often finished off the Pyramid below, according to their own æsthetical ideas of propriety,—based either on Gothic or Grecian art ; and hence large pediments, bases, flutings, and what not. While one very well-intentioned and venerable investigator of geometrical proportions, writes me that he has just arrived, theoretically, at a high and noble base for the Pyramid,—which base, finished off with a plinth, he conceives would be most suitable for enabling a whole row of astronomers to observe the Pole-star from, like a row of harpers, harping with their harps!

But of all these additions to its simple figure, the known facts about the Pyramid give no testimony whatever. M. Jomard, indeed, in the great French work, has, with some appearance of authority, drawn the Pyramid with a rectangular base 72 inches high ; but that seems merely derived from a misapprehension as to the nature of the 'course' of rock, left standing by the builders near the north-east corner, merely to save interior component masonry ; and the only *real* authority touching the ancient appearance of the lower part of the Pyramid outside, is Colonel Howard Vyse with his casing-stones *in situ*.

These remarkable stones, according to his testimony, spring at once, with their oblique exterior slopes of 51° 51′ 14″, from the upper surface of a broad, flat, level, area of exquisite masonry, known as 'the pavement;' which in *that* part of the Pyramid passes under it to some extent, is 21 inches thick and 402 inches broad, from the outer line of the casing-stones. Hence the extensive assumption has been made by some persons, that a pavement of the same breadth and thickness completely surrounds the Pyramid; but, so far as thickness is concerned, a portion of pavement is shown in one of our Stereophotographs, taken near the north-west socket,—and is found to be barely more than 10 inches thick. By examining, however, the angles and positions of the joints of this fragment, the inference may be pretty safely made, that the lower part of the *corner-stone* of the oblique casing-stone sheet there, must have been of rectangular figure, though pyramidally bevelled above; and that it did, by the depth of such rectangular part or base, go through the whole thickness of the pavement there, whatever that was, and into the socket-hole cut for it in the rock below. Hence the horizontal distance from outer corner of one, to outer corner of another, adjacent socket-hole, —measured *on* the pavement and by means of the rectangular edges of the holes worked therein,—is, or should be, the true measure of the length of the ancient maximum bevelled side of the Pyramid; and may be considered equal to, either 9140 or 9142

British inches, as already indicated. But whether that number would be extended to 9159,—by the slope being carried symbolically through the pavement, and then measured on the level of its under side, or at a thickness nearly similar to that which obtains at the north-west corner,—is a residual problem that must be left, notwithstanding its importance, for future excavations to settle; seeing that the earth, and the earth only, still retains the secret.

Meanwhile, attending to nothing but what has been actually secured by measure; and remarking, too, that all the minute differences of the slightly varying theoretical lengths we are now in search of, are contained *within* the mutual discordances of the best modern observations,—it may be expedient to inquire, whether the Great Pyramid stands sensibly alone; or whether it has many competitors amongst the other Pyramids of Egypt,—for making so noble a use, as it seems to do, of the sacred cubit. That is, for coming either so close, or perhaps closer, to the expressive quantity of 9140 British inches. Referring, therefore, to the works of Colonel Howard Vyse,—the best authority on the subject amongst all men of all nations,—we find that he has published from his, and Mr. Perring's, measures for the lengths of one side of the bases (always assumed square), of many Pyramids, respectively as follows :—

	British Inches.
Second Pyramid of Jeezeh, lat. 29° 59′ N., side of base, ...	= 8493
Third „ „ „ . .	= 4254
Fourth, Fifth, Sixth, Seventh, Eighth, and Ninth, all under	= 2064
Pyramid of Aboo-Roash, lat. 30° 2′, . .	= 3840
„ Zouyet el Arrian, lat. 29° 57′, .	= 3600
Great Pyramid of Abooseer, lat. 29° 54′, .	= 4320
„ „ Sakkara, lat. 29° 53′, .	= 4212
North Stone Pyramid of Dashoor, lat. 29° 49′,	= 8634
Southern „ „ lat. 29° 48′,	= 7402
Greater Pyramid of Lisht, lat. 29° 38′, about	= 5400
Pyramid of Meydoon, lat. 29° 27′, . .	= 6360
„ Illahoon, Faioum, lat. 29° 17′, .	= 4320
Other Egyptian Pyramids generally, under	= 3000

Hence there is no other known and measured Pyramid throughout all Egypt, which can compete in the remotest degree with the Great Pyramid of Jeezeh, for possessing after so signal, or anything like so accurate, a manner, if indeed in any way, a memorial of the sacred cubit. A length, that cubit, in its earth-polar radius commensurability, above all human knowledge or effort from the beginning of history to within the last two hundred years,—to have been arrived at *intentionally;* though when once the idea is given out in the present age of the world, any one and every one can instantly see the many recommendations which attach themselves to such a standard for linear measure.

Most fortunate, therefore, is it for practical metrology, that with the theory of the sacred cubit in our minds, and the results of recent scientific measures of degrees of the meridian in our libraries, we may entirely dispense for the present with a

solution of the small remaining uncertainties about the base of the Great Pyramid. And, content with its measurement having given the cubit's length as $9142 \div 365{\cdot}25 = 25{\cdot}03$ British inches, accurate probably within ·005 of an inch,—we may proceed to recover with still greater exactness that grand linear standard from the earth itself; arranging a scheme of linear measures thereupon in the following form, but with leading reference to the Pyramid numbers of 5 and 10,—and finishing with 4, in imitation of the four sides of the base :—

PYRAMID LINEAR MEASURE.

1 inch, roughly a thumb-breadth,	= the unit.
25 inches, roughly an arm, or a pace, length,	= 1 sacred cubit.
100 sacred cubits, or 2500 inches,	= 1 acre-side.
25 acre-sides, or 2500 sacred cubits,	= 1 mile.
4 miles, or 100 acre-sides, or 10,000 sacred cubits,	= 1 league.

COMPARISON OF PYRAMID, WITH BRITISH, LINEAR MEASURE, AND WITH THE EARTH'S SEMI-AXIS OF ROTATION.

Pyramid measures.	British measures.	Earth's semi-axis of rotation, assumed = 250,250,000 British inches.
1 inch,	1·001* British inches,	1-250,000,000th.
1 sacred cubit,	2·083 „ feet,	1-10,000,000th.
1 acre-side,	0·9992 „ acre-side,	1-100,000th.
1 mile,	0·9874 „ miles,	1-4000th.
1 league,	1·3166 „ leagues,	1-1000th.

The inch and sacred cubit are the only Pyramidally authorized parts in the above scheme; though there appears much probability that there

* ·001 of an inch = half a hair's-breadth of the finer human order.

will be found by and by, similar authority for the acre-side in the 'pavement,' when fully opened up. But meanwhile, the above-given Pyramid acre-side and mile, come so very close to the British acre-side and mile,—that they can hardly be passed by; and the Pyramid league forms so neat a fraction of the earth's semi-axis of rotation, as to present the very essence of a connecting link between terrestrial, and celestial, distance measures.

SECTION II.

STANDARDS OF WEIGHT.

With measures of weight, those of capacity are usually classed; and will be here also, because they serve as a bond of connexion between weight, which would otherwise be perfectly isolated in metrology, and a linear standard supposed to have been already determined; but they further evidently require, besides the certain mensuration of any cubical amount of space, as such, that that bulk shall be occupied for the time by some substance or matter of a known and uniform density or specific gravity. The reference for this purpose usually made by most nations, has been to distilled water of a given temperature; and the standard of weight then becomes the weight of the quantity of water necessary to fill a vessel, whose hollow interior

measures a certain previously chosen amount of cubical size, or capacity measure, defined in terms of the linear standards.

On this well-known principle the late John Taylor announced, after studying many Pyramid writers, that the once so-called *porphyry*, but really *granite*, perhaps syenitic-granite, coffer in the secluded King's chamber,—must have been intended to serve, with its hollow cubical space or contents, as a standard measure of capacity and weight. And he enlarged much upon the evident manner in which the whole Pyramid was planned and builded, as if its chief purpose were to keep that hollow, rectangular, open, box-like vessel, and nothing else than that,—in the utmost degree of safety that can be materially insured to anything whatever upon earth.

So far, he was not altogether original; for the Rev. Thomas Gabb, R.C., in 1806, mentions that the French *savants* of 1799, 'give it as their belief that 'the excavation of this granite chest was originally 'intended, by the founders of the Pyramid, not for 'the repository sarcophagus of a corpse, as has been 'the prevalent but truly ridiculous opinion, but for 'a standard measure of capacity.' Similarly a certain Mr. A. P. J. de V——, of Paris, in 1812, in his *New Researches on the Origin and Destination of the Pyramids of Egypt*, speaks of the coffer in the Great Pyramid as a 'vase of porphyry, that 'can never be taken out of the Pyramid, and was 'intended to serve as a *measure of capacity*.' The

English anonymous author of 1706, also obtains some measures of capacity from the coffer,—but in a manner not dependent on its cubical contents,[1] and not necessarily forestalling any of these later authors in their simpler and larger conception.

John Taylor, however, is yet to be noticed before each and all his compeers,—not only on account of the superior extent and variety of his researches touching the coffer, and which should be read in his own book, (*The Great Pyramid: why was it built, and who built it?*); but by reason of his successfully identifying its cubical contents with that of the ancient Hebrew capacity measures on one side, and the Anglo-Saxon, on the other. So that, according to him, either, four Hebrew chomers, or, one Hebrew laver,—and, on the other side, either, four British quarters, or, one original Anglo-Saxon chaldron, chalder, or chaudron,—equally represent the exact cubic contents of the Great Pyramid's primeval coffer.

This interesting conclusion, however, depended entirely on the correctness of the numbers employed by John Taylor for the internal capacity of the Pyramid coffer; and though he had taken them fairly and with judgment from two good observers, viz., Professor Greaves in 1639 and Colonel Howard Vyse in 1837,—yet there was a strange mass of testimony against them, as evidenced by the follow-

[1] By taking some single linear measure, either from the inside or outside of the coffer, looking on such length as the axis of a sphere, within whose hemisphere a certain polygoneous figure of a particular capacity may be described.

ing table of authorities prepared by myself in 1864 :—

MODERN MEASURES OF THE GREAT PYRAMID COFFER.

Authors.	Date.	Material as Named.	Exterior.			Interior.		
			Length.	Breadth	Height.	Length.	Breadth	Depth.
	A.D.		Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bellonius,	1553	Black marble,	144·	72·	..	..	..	..
P. Alpinus,	1591	Black marble,	144·	60·	60·	..	..	..
Sandys,	1610	....	84·	47·	Breast High	..	..	..
De Villamont,	1618	Black marble,	102·	..	60·	..	..	..
Professor Greaves,	1638	Thebaic marble,	87·5	39·75	39·75	77·856	26·616	34·320
De Monconys,	1647	....	86·	37·	40·	..	..	..
M. Thevenot,	1655	Hard porphyry,	86·	40·	40·	75?	29·?	..
M. Lebrun,	1674	....	74·	37·	40·	..	..	..
M. Maillet,	1692	Granite,	90·	48·	48·	..	..	..
De Careri,	1693	Marble,	86·	37·	39·	..	..	..
Lucas,	1699	Like porphyry,	84·	36·	42·	74·?	26·?	..
Egmont,	1709	Thebaic marble,	84·	..	42·	72·?	..	..
Père Sicard,	1715	Granite,	84·	42·	36·	..	..	..
Dr. Shaw,	1721	Granite,	84·	36·	42·	72·?	24·?	..
Dr. Perry,	1743	Granite,	84·	30·	36·	..	..	..
M. Demon,	1799	.... ?	84·	48·	38·	..	..	..
M. Jomard,	1799	Granite,	90·592	39·450	44·765	77·836	26·694	37·285
Dr. Clarke,	1801	Granite,	87·5	39·75	39·75	..	..	..
M. Hamilton,	1801	Granite,	90·	42·	42·0	78·?	30·?	..
Dr. Whitman,	1801	....	78·	38·75	41·5	66·?	26·75?	32·
Dr. Wilson,	1805	....	92·	38·	..	80·?	26·?	34·5
M. Caviglia,	1817	....	90·	39·	42·	78·?	27·?	..
Dr. Richardson,	1817	Red granite,	90·	39·	39·5	..	..	..
Sir Gard. Wilkinson,	1831	Red granite,	88·	36·	37·	..	..	..
Col. Howard Vyse,	1837	....	90·5	39·0	41·0	78·0	26·5	34·5

From these particulars, it will be seen that—without having regard to the almost incredible differences amongst minor observers,—the depth element, as given by the French *savants* of 1799, disagrees from the determinations adopted from Greaves and Vyse, by nearly three whole inches; equivalent in its effects on the capacity of the coffer, to an addition of about 6000 cubic inches! With whom, then, lay the burden of such an error as this; or did it perhaps reside in the coffer itself, owing to its not being of

a regular figure, and having been measured in different parts by successive travellers?

These were the questions to be practically settled in 1865; and I very soon satisfied myself at the Pyramid, despite all the modern chippings of the edges of the coffer; *first*, that the errors of its internal figure were contained within very narrow limits; and *second*, that the French *savants* were the parties who had been so unfortunate as to have an error of three inches of excess in their measured depth, though true to the tenth of an inch as to length and breadth. But there was a worse error still, pervading both their engravings, measures, and descriptions; an error, too, vitiating the measures of all the other known authorities as well,—in that, none of them had alluded, so far as I know, to a certain ledge which is cut *inside* the top of the coffer sides, on the east, south, and north, and all over the breadth of the western side, to a depth of 1·72 of an inch.

Greaves, in 1639, describes the coffer as presenting a rectangular figure of pure mathematical form; 'or two cubes finely set together, and hollowed 'within; it is cut smooth and plain, without any 'sculpture or engraving, or any relevy or emboss-'ment;' and the admirably executed plates of the French national work make it, therefore, a regular-shaped, equal, box-sided vessel in the year 1799; such, also, is the appearance given to it in Sir Robert Ainslie's view, copied by John Taylor, into

his *Great Pyramid: why was it built, and who built it?* and there are numerous allusions in older authors, to the coffer's having been always a lidless vessel, like a water cistern; a stone box without a top; a granite chest without a cover, and many similar phrases. Yet, the mere presence of such a ledge as is plainly now to be seen, not only implies the once existence of a lid,—but also that the vessel must have been serving as a sarcophagus; and, because, that is the manner, or very near it, in which the lids of genuine sarcophagi are pushed on, and fastened down, into their places.

Although an absolute discovery to me at the time, this ledge feature, I have since found, is represented in Howard Vyse and Perring's large Pyramid views, published in folio, in 1840. How these able authors regarded the feature, does not appear; nor do I know whether the usually irreproachable members of the French Imperial Institute, are prepared to maintain the truth of their large engravings, *for the date at which they were made;* or to imply, that the ledge was cut between their day, and that of Howard Vyse. In the meanwhile, however, most persons will probably assume that the remarkable cut-out must be far older than the first French Revolution; and some will even hastily consider it as entirely subversive of the recent metrological-coffer idea.

So, too, it would be, perhaps, if there were anything in the present sarcophagus-guise of the coffer

in *addition*, as to substance, to what was required for the original coffer, or mere box-shaped vessel. But that is not the case; for the ledge is merely something cut into, or removed away from, such a vessel; and something, too, which would be very easy for any granite mason to effect, after the box form had once been realized.

We may prove, moreover, that after the coffer had had a sarcophagus-appearance given to it by the cutting of such a ledge into its top,—it would not have made a good sarcophagus according to the ideas of the time; for, at the second Pyramid, where there is an acknowledged sarcophagus of red granite, and which is, with its lid, in excellent preservation,—the following system obtains. The lid slides on to the top of the body, by means of acute angled grooves; and when finally in its place, certain vertically-sliding pegs fall partly out of holes in the lid, into corresponding holes in the top of the lowered side of the sarcophagus,—completely preventing the lid being drawn horizontally back; while the oblate spread of the side grooves, prevents its being lifted up or taken off vertically. The whole thus forms an arrangement which locks itself, and is eminently suitable to the purposes of a sarcophagus proper.

But at the Great Pyramid vessel, though there are similar holes in the west side for falling pins to fall into, out of a once existing or intended lid,—and the arrangement would prevent such lid being drawn

horizontally back, after being once pushed into its place,—yet the side grooves being *rectangular*, and parallel with the coffer sides, they could not in the slightest degree prevent the lid being lifted straight, or vertically, up,—and freely exposing the contents of the coffer, if any.

Now this shows a degree of clumsiness in contrivance and inefficiency of workmanship which we should be careful how we charge on the architect of the Great Pyramid, where everything else is carried out with far more skill and perfection than at the second Pyramid; and it may even be taken as a pretty secure indication, that the cutting of the ledge and turning, or attempt towards turning, the coffer into a sarcophagus,—were the work of subsequent hands. Whose these were, during the long ages which intervene between us and the original builders, may be an interesting inquiry to take up when we come to the history and personal experiences of the Great Pyramid; but meanwhile their names signify nothing to our present purpose, which is solely directed to finding out, if possible, by modern measures—what were the cubical contents of the vessel in its *original state*, before any ledge was ever cut into its fair proportions; and then ascertaining—if such cubical contents correspond, or not, with a certain exact, and even inexorable, quantity, derivable from the theory of the Great Pyramid, when applied to the earth as known to modern science.

This theory is shortly, as regards the kind of standards now under discussion,—that a cubic space is to be formed, with sides having a length equal to the one-ten-millionth of the earth's axis of rotation, or 50 Pyramid inches.[1] A *tenth* part of such space, —or 12,500 cubic inches (agreeably with the Coptic interpretation of the name of Pyramid), is then to be filled with matter of the *mean density* or specific gravity of the earth as a whole. In which case, such a mass will form the grand *weight* standard of the Pyramid; while the *space* occupied by an equal weight of pure water, at a given temperature,—will form the grand *capacity* standard of the Great Pyramid; or, as we believe, will represent, and be represented by, the cubic contents of the hollow of the coffer: but this is the point to be tested by actual measure and calculation.

Much in the problem, evidently depends on the precise value of the earth's mean density, as compared with that of water; and such an introduction of that important natural characteristic of density, with respect to the mean of the whole contents of our earth-ball globe,—is a novelty amongst all known human systems of metrology; the very best and most modern of which, either make their weight-

[1] The standard of *linear* measure is the one-ten-millionth of the *semi-axis* of rotation, or 25 inches; because, in distance-measuring amongst celestial globes, the quantity to be measured is always scientifically the distance from *centre to centre of them*. But the moment we come to any questions of the earth's actual bulk, the whole diameter, from one side to the other, is the effective length to be guided by.

standard a something entirely accidental, as with the English (*i.e.*, so far as most modern Englishmen are aware of) ; or overlook every other constituent of the earth, except that one article of water; as with the French metrical, and other European, arrangements on modern scientific principles.

Yet if there is commendable virtue amongst any of these systems,—and they do take much praise to themselves, in referring their *linear* standards by an even fraction to some *length* scientifically connected with the size of the earth as a whole,—surely there must be similar intellectual advantage, in referring all weight and capacity standards to the most practical features bearing on the weight and capacity of the earth, likewise as a whole. The capacity of the earth, indeed, is evidently derivable from linear measure and geometrical theory ; but its weight, depends altogether upon the proportionate amounts and densities of all the multitudinous solids and fluids which together make up its wondrous bulk ; and in which too, there is a far larger amount of solid and heavy, than light and watery matter.

One chief superiority of our earth over the larger planets, such as Jupiter, Saturn, Uranus, and Neptune,[1]—according to that universal genius, the late respected Master of Trinity, in his *Plurality of Worlds*,—consists in its possession of so large a per-

[1] The density of these planets, in terms of the earth's mean density, is stated in Sir John Herschel's *Outlines of Astronomy*, as 0·24, 0·14, 0·24, and 0·14 respectively.

centage of heavy solid matter, as to make its specific gravity nearly five times theirs; and led him to conclude that their vasty spheres, consisting of little but water and mist, can be no sufficient or appropriate abode for reasoning and intelligent beings. How important then for man, both æsthetically to acknowledge the *terrestrial* fact of superior density, in the principles whereon terrestrial standards for measuring weight and density are founded;—and what a duty, religiously, to symbolize his thanks for all the myriad curious substances,—all of different densities or capacity weights,—and usually esteemed more and more precious as they exceed in specific gravity,—which the Creator has been pleased to introduce into the composition of this earth of ours. For no other purpose, too, that the greatest sages can see,—than for the present and future benefit, and ultimate high civilisation, as well as enjoyment,—of working, intellectual, and continually advancing mankind.[1]

Fortified, therefore, by this view,—which, in so far as it came to me through the Pyramid, is not

[1] Sir Samuel Baker, in his recent explorations in Central Africa, had an admirable opportunity of witnessing some difficult social questions reduced to their primitive simplicity, and elemental clearness. Hence we find him recording that the poorest, lowest, most degraded and most miserable of all the nations he met with, were on the marshy banks of the White Nile, in a fine warm climate, but a world of water, mud, and reedy vegetation, abounding in, and apparently just fit for, hippopotami, crocodiles, buffaloes, wild-geese, and nothing higher. But as soon as he reached the hilly country,—especially where the hills produced heavy iron, as well as lighter stones and agricultural soils,—instantly there was a most marked improvement in the natives, and a rise in their whole style of life and social well-being.

of my invention,—let us see how the earth's mean density comports itself in the particular coffer question. The numerical value of the remarkable quantity (in terms of water), is not yet quite so accurately determined by modern science as it should be; but may, for reasons presently to be adduced, be taken as 5·70; *i.e.*, 5·70 times as heavy, as an equal bulk of distilled water at a temperature of 68° Fahrenheit. Wherefore, on the previously announced principles, 12,500 cubic inches multiplied by 5·70, or, 71,250 cubic Pyramid inches, ought to form the internal bulk of the grand standard of capacity-measure for the Great Pyramid.

Now what does the interior of the coffer measure, when restored,—by reference to many of the original traces which happily still remain,—to its original unsophisticated shape and true internal size?

Referring to the measures in vol. ii. p. 122, the mean length, breadth, and depth, inside, by sixty measures, came out, in British inches, 77·93, 26·73, and 34·34 respectively. These are, in Pyramid inches, 77·85, 26·70, and 34·31; and give—by being multiplied together—71,317; or too much by rather less than 1-1000th.

Of the practical closeness of this approach to the theoretical quantity, we may best judge, by computing the cubical contents of any acknowledged sarcophagi, treated in the same manner as unledged vessels; for then, the sarcophagus of the second Pyramid

is found to give by the measures in vol. ii. p. 272, 66,410; or 64,554 by Howard Vyse's numbers; that of the third Pyramid by Howard Vyse's measure,[1] = 46,219; a sarcophagus in a large tomb near the Pyramid, pictured in the great French work, = 51,117; while that in the fourth Pyramid = 29,610; and in the fifth Pyramid, = 39,775 (both of them, according to Howard Vyse); and others are still smaller. These others are further more or less ornamented artistically on the exterior; and in so far, stand entirely removed from the simple conception of vessels for purposes of mensuration; whose only claim to admiration should be, the closeness of their realization of simple truth and exact physics. Yet this idea is not so generally admitted as it might be,—for I was lately rather scornfully attacked by a really very able member of one of the learned professions in public, and in private a wealthy, highly-educated, representative man of the nineteenth century A.D., with—'but if 'this Great Pyramid coffer was intended for such an 'important destiny as to be a standard of measure 'for all nations, pray what sort and amount of *orna-* '*ment* is there about it?'

Of *that* species of meretricious perfection, then, let all men know at once, there is nothing whatever about the Great Pyramid coffer; while there are traces, on the contrary, that if anything else was indulged in beyond the rectangular figure, it was

[1] Volume ii. p. 123, of Vyse's *Pyramids of Gizeh*.

rather in the direction which the venerable Mr. Jopling has maintained during some years past; as, that it was formed with views of *relative* commensurability; at least in so far that the cubical contents of the outside were made just twice those of the inside. An entirely theoretical conclusion of Mr. Jopling's was this idea, for none of the recorded measures came even approximately near the desired quantities; but on referring to my measures in vol. ii. p. 119, where the linear dimensions are corrected, for the first time in the history of such measures, for the error of figure of the hitherto assumed perfect planes of the sides, they will be found, expressed in Pyramid inches, to be

$$(89{\cdot}62 \times 38{\cdot}61 \times 41{\cdot}13) \div 2 = 71{,}160$$

the mean of which, with the interior determination, allowing for errors of measurement and straining of figure by the tilted position of the coffer, comes to 71,238; while the theoretical quantity required, is 71,250; showing an error of barely 1-6000th.[1]

Let the uncertainties, however, of our present measures touching the true size of the coffer's interior, or of this practically obtained number, 71,238,—be

[1] The sarcophagus of the second Pyramid, treated similarly, without reference to its cover, or ledge, yields 82,200 nearly, against 66,410·; the sarcophagus of the third Pyramid, deeply carved outside, gives 62,160, against 46,219·; the sarcophagus of the fourth Pyramid, 38,440, against 29,610·; and that of the fifth Pyramid, 70,565, against 39,775·: leaving the Great Pyramid's coffer, therefore, perfectly *unique* throughout all Egypt yet measured; and, as well for the absolute contents of the interior, as for the duplex commensurability of interior and exterior.

considered 100 cubic inches ±, though they are probably less;—then it is most important to note, as comparing modern science on the whole, with the primeval tradition of the Pyramid,—and for understanding our own place in 'universal scientific history,'—that the uncertainties of the *theoretical* quantity of 71,250,—as depending on the imperfections, or at least unexpected and anomalous differences found amongst the *best modern scientific determinations* of one of the natural elements involved in the question,—amount to *several* hundreds, and perhaps even *thousands* of inches!

The usually received quantity, as an instance, for the *mean density* of the earth, has been for some years past, not the 5·70 we have assumed, but 5·67; as depending on the late Francis Baily's repetition of the Cavendish experiment in 1842, —where his mean results, for several different branches of the trial, varied between 5·6604 and 5·6754. (See vol. xiv. of *Transactions* of Royal Astronomical Society.) But though Francis Baily's was by far the best determination ever made, up to that time,—his successors were not satisfied with it; and, on one side, the present most learned Astronomer-Royal, with all the power of the ancient National Observatory at his disposal, has since tried a different method of arriving at the same quantity in nature; as likewise, on another side, has Colonel Sir Henry James, with the far more extensive means of the Ordnance Survey establishment placed under his hand.

If two men and two offices had been picked out from the whole nation for undertaking this question, no others probably could, or would, have been selected as more proper and efficient for it, than these two chiefs; and the wisdom of the choice has been testified by the Royal Society of London printing both their papers, descriptive of their respective proceedings, *in extenso* in the *Philosophical Transactions*. Wherefore, by looking to the results recorded there, we may have a measure at once of what the powers may be of modern science in that particular field; and they appear to be thus:—Had the Astronomer-Royal's 6·565, been the only new determination,—the earth's mean density (the mean between the above numbers and Mr. Baily's being taken), would have been raised up from 5·675 to 6·120, and the theoretical coffer numbers from 70,938 to 76,500; but had Sir Henry James's 5·316, been the only modern repetition,—the received mean would have been reduced to 5·496, and the coffer numbers to 68,700; or, with similar reference to both, it would have been raised to 5·852, and the coffer numbers to 73,150. Indicating, in fact, that the question of the earth's mean density, though a thing exact in itself, and well known to the Almighty,—is so exceedingly difficult to man, that modern science is hardly sure of being right in the unit's place of it; and is quite incompetent as yet, to speak positively of its tenths, hundredths, or thousandths. While the advance in accuracy of this sort of observation has been so

nearly imperceptible during the last quarter of a century, that hundreds of years may pass away—before even the best philosophers will have determined, *from the earth*, what a very moderate man may determine *from the coffer*, viz.,—whether, in the theoretical expression already assumed, the earth's mean density ought to be expressed by 5·69, 5·70, or 5·71.

We must confess, that 5·70 appears to us not only the quantity indicated within very narrow limits by the coffer,—but that which is pointed to also by the earth-experiments, though within wider limits; on giving, as judgment requires, a much greater weight, to Baily's, than to the two subsequent determinations. (Vol. ii. p. 451). Hence, in assuming 5·70, for the value of the earth's mean density—expressed in terms of water,—we are not only within the limits of the best individual observations of that quantity by the first modern philosophers,—but, as close as can be, to the most rational mean of all their measures. And if any one chides us for not waiting contentedly for a few centuries more, until a much better earth determination,—and one not depending on a mean amongst hideously discordant single results,—shall have been obtained by modern science; we are compelled, amongst other things, to state in self-defence,—that both the explanation of the theory of the Great Pyramid (which has been waiting for four thousand years already), and the settlement of vexatious agitations respecting the best metrology for existing mankind, can admit of delay *no* longer.

Hence, while in the matter of *linear* measure, the Great Pyramid both originated the idea of reference to the earth's semi-axis of rotation, by a one-ten-millionth for a standard; and has also furnished from its own base side the material length of such a standard with considerable exactness, say to within 0·01 of an inch,—we yet preferred taking the length, much within that 0·01 of an inch, from modern scientific knowledge of the earth, when employed in accordance with the Pyramid *idea;* and capable then, of giving the standard true, probably to within 0·001 of an inch. But with *weight* and *capacity* measure, we must not only accept as a gift the idea of referring to the earth's mean density,—rather than to the density of only one of its myriad components —from the Great Pyramid; but must also receive therefrom, the exact numerical value of that *mean density* element—in shape of measures of the coffer, treated according to the Pyramid formula; and certain, within a very small fraction of those large differences, which are found among the best existing of direct *earth-mean-density* measures.

Our proof, then, that the coffer is the right vessel originally intended for a weight and capacity standard,—depends upon its measured contents coming out close to what was expected by a certain theory, closely based upon the previously proved linear standard. But seeing that that theory must also, be partly founded on, or rather tested by, modern determinations of the *earth's density*, which deter-

minations are by no means very close or accurate, —the proof may be regarded as not an absolutely certain one. Most valuable, therefore, is some further evidence which the Pyramid itself affords, illustrating not only that the coffer's size is no accidental matter, but that it was something had in extraordinary regard by the architect, when building in the mighty granite blocks of the King's chamber. For by those blocks he has given us another numerical test, by which we may prove that the present coffer was the *original* one; and is still therefore the right vessel in the right place, viz., the chamber originally prepared for, and adapted to, it; and which would suit no other known Egyptian sarcophagus or coffer-like vessel in the same strikingly appropriate manner, or in any way suitably with the admirably scientific linear-standard theory.

The Coffer belongs to the King's Chamber.

In the so-called, in modern times, 'King's 'chamber' of the Great Pyramid, stands the coffer now; but what was the apartment designated originally?

Over its doorway of entrance, and on the outside thereof, or as forming the south wall of the ante-chamber, is a remarkable symbol, which has been variously described as consisting of four, or five, lines. Our measures of the thickness of each line, and the width of the separations between them, compared with the whole breadth of that wall, in-

dependently measured (see vol. ii. p. 97 ; also Plate XII. vol. ii.), prove incontestably that there are four deeply cut, equidistant vertical grooves, so placed as to divide their containing wall into five vertical strips ; illustrating, therefore, *a division into five.*

This, too, is all that can be really stated about them ; for, as to the architectural apology that they were grooves for ropes employed in lowering certain supposed portcullis-blocks in the antechamber,—that was not a usual Egyptian practical method of accomplishing such work ; and there are no corresponding grooves on the opposite sides of the room or on the floor ; nor have any good reasons been given, why the grooves on the south wall should pass along its entire extent in height, or from actual top next the ceiling to very bottom, as marked by the low entrance into the King's chamber, —when the supposed portcullis-blocks, and even the utmost reach of their sliding frames, were only a small part of the same height.

Hence all that we can declare as the fact, is, that near the interior of a building whose ancient name, it is said, was 'a division into ten,'—there is one wall typifying, or rather positively illustrating, 'a division into five.' And this symbol is the last object seen by any one entering the King's chamber, as he makes his final stooping progress to enter that important room ; for the sign may be said to be fastened over the doorway thereof outside, and to

belong therefore rather to the large King's chamber than the small antechamber.

Is that symbol, then,—so remarkably held forth to every entrant,—the true name of the larger chamber; or is it intended to call attention to something of a similar character therein?

Let us see.

The coffer, according to the metrological theory, is founded, in part, on the one-ten-millionth of the earth's axis of rotation; or, fifty inches.

This is something suspicious of a connexion, especially if divided by the Pyramidal 10, but not enough; and on looking round the room, an attentive observer may soon perceive a more striking illustration of a division into five; in that the four walls of the room have each, four horizontal joint lines, actually dividing the walls' whole surfaces into *five* horizontal stripes or courses. (Plate XIII. vol. ii.)

Rather remarkable is it for testing the sufficiency of modern travellers' descriptions (for no Greek or Roman visitors were ever in this room), that some of them have stated these walls to be composed in a single course, and others in six courses, or variously as thus:—

SANDYS, A.D. 1610, says—'Eight stones flagge the ends, and 'sixteen the sides.'

PROFESSOR GREAVES, 1639.—'From the top of it descending to 'the bottom, there are but six ranges of stone, all which, being 'respectively sized to an equal height, very gracefully in one and the same altitude run round the room.'

Lord Egmont, 1709.—'The walls were composed of five ranges 'of stone.'

Dr. Shaw, 1721.—'Height (of five equal stones) sixteen feet.'

Dr. Pocock, 1743.—'Six tiers of stones of equal breadth 'compose the sides.'

M. Fourmont, 1755.—'The walls are composed of six equal 'ranges.'

Dr. Clarke, 1801.—'There are only six ranges of stone from 'the floor to the roof.'

Dr. Richardson, 1817.—'Lined all round with broad flat 'stones, smooth and highly polished, each stone ascending from 'the floor to the ceiling.'

Lord Lindsay, 1838.—'A noble apartment, cased with 'enormous slabs of granite twenty feet high.'

W. R. Wilde, and Mr. R. J. A., 1837.—'An oblong apart-'ment, the sides of which are formed of enormous blocks of 'granite reaching from the floor to the ceiling.'

E. W. Lane, and Mrs. Poole, 1843.—'Number of courses in 'walls of King's chamber, six.'

Poor John Taylor, too, misled himself and others in this particular, by making a copy from Sir Robert Ainslie's[1] view of the King's chamber, the frontispiece of his first edition of the *Great Pyramid: why was it built, and who built it?* for therein are pictured *six* courses, as clear as the art of the engraver can make them.

But that the number is five, I presume I may state with certainty, and without apology,—from having measured them again and again; besides comparing the individual height of each course, and the number, with the whole height of the room independently ascertained; as likewise did Mr. Inglis afterwards, with the same result (see vol. ii. p. 305);

[1] Sir Robert Ainslie's *Views of Egypt*, 1840.

and we may even venture, therefore, to state the right designation of the chamber to be 'the chamber 'of five,' or sometimes 'the chamber of the standard 'of fifty.' True, there are not also five courses in either ceiling or floor; but there are four walls or vertical sides against those other two sides, and these two are *irregular* in the number of courses or joints they do possess. That is, the floor consists, it may be said, of six courses, or stripes of stones crossing the room from north to south; and the ceiling, of nine large beams; but the widths of both floor-courses and ceiling beams are unequal taken consecutively, or in any other way; and have therefore not had the attention bestowed on them, that was eminently paid to the wall-courses, in bringing out the idea of number and regularity of *division*.

The walls, indeed, are in this respect deserving of most particular notice; for, with one exception, presently to be described, every one of their courses is of equal height with every other, and runs round and round the room at the same height; just as, in so far, well and eloquently described by Professor Greaves. Such an arrangement, too, being not only quite different from the ordinary Pyramid masonry, —where, if the purpose was to build a wall of so much area, the builders looked little or not at all to the regularity in size or shape of the stones, so long as the joints were good, and the surface-planes even —(sufficiently demonstrated both in the walls of the Grand Gallery, and in the pavement, according to

Howard Vyse, besides the neighbouring instance of the walls, both limestone and granite, of King Shafre's tomb),—not only different, we say, from the ordinary Egyptian mason's ideas of what need, or should, be done in mere wall-building, but a thing especially difficult and expensive to realize in *granite*. This is on account of the hardness and amorphous character of that material, causing the quarries seldom to yield two blocks of the same size or shape; wherefore, the expense and waste of trimming a continued length of more than 6000 inches of granite blocks, near 50 inches broad, to a uniform height, must have been immense; and not to be undertaken by any one,—certainly least of all by sage, religious-minded men,—without some very peculiar and important reason.

But there is an anomaly, as already hinted, affecting the equal vertical heights of all these courses; for they are each 47 inches high, except the lowest,—which is 47 less 5, or 42 inches only. More apparent, may be considered this difference, than real; for it is only an effect to the eye, caused by the granite floor being introduced within, and up within, the granite walls of the chamber by the amount of five inches;—the blocks of this lowest wall-course itself, when examined at the sides of a hole at the north-west angle of the floor, being seen there to be *really* 47 inches high, like the rest. But still, why even that apparent anomaly; why that too visible breaking in upon the other-

wise perfect symbolization of five pervading the entire room?[1] (See Plate XIII. vol. ii.)

The following consideration may have something to do with the reason; especially when we remember that the five-inch space concerned, though quite an unmeaning fraction when measured in terms of the profane Egyptian cubit and its subdivisions,—becomes a most peculiarly Great Pyramid quantity, both with reference, 1*st*, to the length of the earth's polar axis, 2*d*, to the *number of inches* which it, the five-inch space, contains, and 3*d*, to its actual fraction of the sacred cubit of the Pyramid and the Israelites; viz., a fraction of 1-5th. The coffer stands on the floor, amongst the stones of that lower course of the four walls, like a small vessel within a larger one of the same capacity-measuring kind, but of a higher order; what proportion then, does the one bear to the other, in cubical capacity?

The length of the room, by our measures, is 412·55 British, = 412·14 Pyramid inches; the breadth, 206·30 British, = 206·09 Pyramid inches; and the corrected, and by the Pyramid builders corrected, depth of that lower course is about 42 inches. About only, is all we can say, so lamentable are now the dislocations of the floor blocks; for, though described as admirably smooth and level in

[1] Over the doorway, inside, the five courses of the north wall are interfered with for a small space, by two of them joining into one, to form a stout roof-block for the said door; but that is a constructive requirement, only to be looked at for a moment, to be allowed at once without prejudice to the chamber's whole idea.

Howard Vyse's time, they now vary an inch and six-tenths in places; and give, on a mean, of ten points measured, a depth for this course, of 41·84 inches; but indicating, that a majority of high places had been needlessly taken, and that the true mean of the whole would have been between 41·84 and 42·0; say, 41·9 Pyramid inches. Then—

$$412{\cdot}14 \times 206{\cdot}09 \times 41{\cdot}9 = 3{,}558{,}899 \text{ cubic inches,}$$

$$\text{and } \frac{3{,}558{,}899}{50} = 71{,}178.$$

Now, inasmuch as the 1-50th of the cubic contents of that course, if left by the builders at the uncorrected, or original depth of 47 inches,—would have been 79,842 cubic inches,—we may see that their correction of that one element, by an even quantity of the Pyramidally characteristic 5 inches in 'the chamber of five,' has at once brought out a result almost exactly fifty times the cubic contents of the coffer proper, or 71,250.

The result, too, may originally have been somewhat closer; for, as the walls of the chamber do not now present such marvellously close joints as many old authors have described—('it is really impossible 'to force the blade of a knife between the joints; 'this has often been related before, but we actually 'tried the experiment, and found it to be true,' says Dr. Clarke in 1801; whereas, now, some of the joints rather gape in our photographs of them in 1865);—we may expect some small alterations of the interior size of the chamber to have occurred

in the direction of enlarging it, at least in length and breadth. Assuming, then, the original measures to have been laid off in *even* Pyramid inches, and taking the nearest inch always to what the respective parts measure now, we find that—

$$\frac{412^{\cdot} \times 206^{\cdot} \times 42^{\cdot}}{50} = \frac{3{,}564{,}624}{50} = 71{,}292.$$

Or actually closer than before, both to the measured contents of the coffer, and the theoretically deduced value it should possess, as the Pyramid standard of weight and capacity.

Hence the chamber is constructed commensurably to the coffer, and the coffer to the chamber, with fifty and five as the ruling numbers. But there exists even more testimony of this sort, identifying the *whole Pyramid* also, with the coffer and its chamber; in a quarter too where I had certainly never expected to find anything of the kind, viz., the component courses of masonry of the entire building.

Place of the King's Chamber in the Pyramid.

These grand courses, which are seen so prominently on the outside of the Great Pyramid in the present day, from having had their once outer covering of casing-stones stripped off, are—as often described—rude and rectangular. Yet though rude even to barbarism, if intended for outside work, they are strongly and consistently built; for not only is cement used abundantly in every joint, and the break-joint well managed, but the stones are keyed

and wedged into each other, so that hardly can one be extracted from the mass, without being first broken in pieces, (a feature which should be well weighed beforehand by any one who rashly proposes to 'drive tunnels right through every part of the 'Pyramid;') and then all the stones of each course, are arranged in admirably horizontal layers, extending for certain all around, and apparently also, through, the whole Pyramid.[1]

The French *savants* early noted the faithfulness with which every component course of stone was carried at the same thickness round every side of, and by inference through, the Pyramid; but they also remarked the large irregularities which often and even generally occur amongst *successive* courses. So likewise must have, almost all travellers who ever ascended the Pyramid; though why those gentlemen busied themselves so frequently in counting the number of the courses, does not appear; especially as they were content to vary from each other between 206 and 255,—as see the accounts of travellers throughout the last two centuries.

In some places, the present visible contour of the courses is rather interfered with by debris; but

[1] A single case of discrepance appears at the north-east angle, where a part of one of the courses is broken in upon by a double layer; but on close examination, that small top layer is found to be merely a making up of a 'left part' of the standing rock to the same height as the course of masonry proper. There are also instances in the measured courses, of two thicknesses of stone being occasionally employed in place of one; but that is positively to keep up the full thickness of the whole course; and can be distinguished from two small courses by ollowing the run of the platform for some distance.

towards the west side, of the south-west angle, it is freer than elsewhere; and one may contemplate from below, and at a distance, the formation of the courses, under various angles of solar illumination, with eminent advantage. This I used often to do; and over and above special anomalies in single courses, noted the rate at which the whole of the courses gradually decreased in thickness, with their height, up the Pyramid side.

Thus, near the ground, they were very large, and gradually diminished in size as they ascended, with some few minor variations. But at the thirty-sixth course from the bottom, all of a sudden a much larger series of courses begins; *i.e.*, larger than the very small size which the original ones had gradually dwindled down to there. One could fancy an overseer coming to the men at that stage, and telling them that they had contracted the size too rapidly, and must enlarge again; or, that a new series of quarries had been opened, yielding larger blocks than the older ones. But whether the alteration was voluntary or accidental, it is equally plain that unless it *had* been introduced, there would have been above that point a larger number of courses in the Pyramid side than what now obtain; and in such case, there would not have been found the peculiar commensurability which seems actually to exist and cannot be altogether accidental. For on referring in vol. ii., and Division I. of vol. iii., to all available measures of the individual heights of the courses on one hand, and

comparing them on the other with all determinations of the level of the King's chamber floor,—it will be found, that the fiftieth course of the whole Pyramid from the pavement upward, is practically identical with the floor of that already remarkable chamber. Or, such fiftieth course forms the plane, on which stands the mysterious coffer,—making use of a standard of 50 inches, in its tank of 50 times itself, in the chamber of five, or the chamber with walls in five courses, and with the symbol of five inscribed over its entering doorway. The mensuration numbers, with their errors, are as follows,—

Fiftieth masonry course, vertically above Pyramid's pavement, as measured by—

MM. Jomard and Cecile, in A.D.	1800,	= 1675	British inches.
MM. Le Père and Coutelle, .	1801,	= 1696	,, ,,
C. Piazzi Smyth, in April . .	1865,	= 1686	,, ,,
Messrs. Aiton and Inglis, in May	1865,	= 1702	,, ,,
Mean height,		= 1690	

Floor of King's chamber above Pyramid pavement, as measured by—

Howard Vyse and Perring in .	1837,	= 1665	British inches.
C. Piazzi Smyth in April . .	1865,	= 1680	,, ,,
Aiton and Inglis in May . .	1865,	= 1720	,, ,,
Mean height,		= 1688	

Thus the Pyramid itself *appears* to be closer in these two elements, than are the observations of any two modern observers on one and the same element ; and shows a point where future scientific men may usefully distinguish themselves, and redeem at the same time the modern exactness and

power both of physical science and instrumental investigation.

Meanwhile the case, so far as now proved, fully joins the other metrical phenomena; and enables one to say that there is more, and even far more, than accident—in having come again and again, in connexion with this chamber, upon these constructive allusions which it makes, to fives and fifties *in accordance with the scientific theory of Pyramid metrology*. And this too, although its more ostensible commensurabilities, so far as made out by Sir Isaac Newton on Greaves' measures, had nothing to do with five or ten, but only with the profane cubit of Memphis, and its division into six and twenty-four, or, according to some, into seven and twenty-eight, parts. Hence we seem to be fully justified in condensing a practical conclusion of the whole, in the neat, and, so to speak, Pyramidal form, in which it enables a small standard of Great Pyramid *weight* to be described, but with a noble reference to universal weight, and capacity, measure. For, if the weight of the whole, original, coffer's contents of water (at the temperature of 68° Fahrenheit) be divided by fifty times fifty, there is produced what may be called a pound weight of the Pyramid; and which can be referred to, or scientifically checked anywhere all the world over, in weight, as, '5 cubic 'inches of the earth's mean density.'

The arrangements of this most cosmopolitan

standard, to form a practical system of weight and capacity measures, are expressible thus,—the intervening multipliers or divisors being understood to be arbitrary, except in so far as they accord with the already established Great Pyramid numbers and proportions :—

Pyramid Weight Measure.

			Earth's mean density, substance of, in Pyramid cubic inches.
Unit	=	1 grain, . . .	= 0·0005
100 grains	=	1 dram, . . .	= 0·05
10 drams	=	1 ounce, . . .	= 0·5
10 ounces	=	1 pound, . . .	= 5·0
10 pounds	=	1 stone, . . .	= 50·0
10 stones	=	1 cwt., . . .	= 500·0
25 cwt.	=	1 ton, . . .	= 12,500·0
50 tons	=	1 rock, . . .	= 625,000·0

Pyramid Capacity Measure.

			Sacred Hebrew Standards. (Vol. ii. p. 470.)		Pyramid cubic inches of bulk.
Unit	=	1 drop, .	. . .	=	0·00285
100 drops	=	1 spoon, .	. . .	=	0·285
10 spoons	=	1 glass, .	. . .	=	0·85
10 glasses	=	1 pint, .	. . .	=	28·5
10 pints	=	1 gallon, .	. . .	=	285·0
10 gallons	=	1 bushel,	. . .	=	2,850·0
25 bushels	=	1 coffer	= 1 ark, or laver,	=	71,250·0
50 coffers	=	1 keel	= 1 'molten-sea,'	=	3,562,500·0

Relations of Pyramid Capacity, and Weight, Measure.

1 drop of water,	at	temp.	=	68°	Fahr.,	in	weight	=	1 grain.
1 spoon	,,	.	.	.	.	.	,,	=	1 dram.
1 glass	,,	.	.	.	.	.	,,	=	1 ounce.
1 pint	,,	.	.	.	.	.	,,	=	1 pound.
1 gallon	,,	.	.	.	.	.	,,	=	1 stone.
1 bushel	,,	.	.	.	.	.	,,	=	1 cwt.
1 coffer	,,	.	.	.	.	.	,,	=	1 ton.
1 keel	,,	.	.	.	.	.	,,	=	1 rock.

The relations again of these Pyramid weights and measures with the British Imperial system, at their most important points of connexion, are—

FOR WEIGHT.

1 grain Pyramid,	=	0·998 grains, old English.
		0·729 „ new English.
1 pound,	=	1·025 pound avoirdupois.
1 cwt.,	=	0·915 cwt. „
1 ton,	=	1·148 ton „
		0·956 ton, shipping.

AND FOR CAPACITY.

1 drop Pyramid,	=	0·792 drop apothecary's.
1 pint,	=	0·987 old wine pint.
1 gallon,	=	1·031 gallon imperial.
1 coffer,	=	1·007 of *four quarters* imp.

Determination of Weights on the Pyramid system.

Much importance is usually attached among metrologists, to an easy method of determining weights from linear measures; and the English arrangement has been much decried on this particular point, in comparison with the French. But the Pyramid system appears to combine most of what is advantageous in either, with some merits that are peculiarly its own.

For, the number of cubic inches in any mass having been obtained,—its weight in lbs., is simply 1-5th of that number: or, if the bulk has been worked out in cubic cubits,—its weight in tons, is the same as the number of such cubits with 1-4th more

added to them.[1] That is, the weight will be so many pounds, or so many tons, respectively, if the quality of the substance as to density be like that of the mean contents of the whole earth; but if it be of the heavier, as gold, or the lighter, as water, an alteration must be made accordingly; or, in short, a table of specific gravities must be referred to, as with the English, French, or any other system.

The usual tables, however, at present most frequently met with, are arranged in terms of water as unity; except, indeed, the astronomical, which have long used the more exalted Pyramid unit, of the earth's mean density. We may therefore appropriately conclude this section, by an example of a general table of specific gravities, arranged to suit the requirements equally of the ancient Pyramid metrology, and the most advanced modern astronomy.

SPECIFIC GRAVITIES.

Earth's Mean Density, = 1.

COSMICAL.

Sun,	0·25	Mars,	0·95
Mercury,	1·12	Jupiter,	0·24
Venus,	0·92	Saturn,	0·14
Meteoric stones,	0·61	Uranus,	0·24
Meteoric iron,	1·23	Neptune,	0·14
Earth,	1·00		

[1] Conversely, the weight of a body being given, to find its cubical measure,—multiply the pounds-weight by five, for the number of cubical inches; and decrease the tons-weight by 1-5th, to find the number of cubic cubits.

TERRESTRIAL.—(*Specific Gravities.*)

Cork,	0·043	Aluminium,	0·460
Poplar wood,	0·067	Red granite (Peterhead),	0·464
Larch wood,	0·095	Red granite (Great Pyramid),	0·479
Honduras mahogany,	0·100	Bottle glass,	0·480
Lithium,	0·100	Diorite (Great Pyramid),	0·484
Pitch-pine,	0·116	Jasper,	0·494
Beech-wood,	0·122	Basalt (mean of 3 varieties from near Great Pyramid),	0·500
Riga fir,	0·132		
Spanish mahogany,	0·150	Arragonite,	0·517
Potassium,	0·150	Flint-glass,	0·584
Wax,	0·158	Diamond,	0·618
Tallow,	0·166	Sapphire,	0·701
Oakwood,	0·170	Ruby,	0·751
Sodium,	0·170	Arsenic,	1·01
Distilled water,	0·175	Chromium,	1·04
Sea water,	0·180	Tellurium,	1·10
Water from Dead Sea,	0·218	Cast antimony,	1·18
Lignumvitæ,	0·234	Cast zinc,	1·26
Calcium,	0·280	Cast iron,	1·27
Bone of an ox,	0·291	Cast tin,	1·28
Magnesium,	0·310	Bar iron,	1·36
Ivory,	0·320	Hard steel,	1·37
Graphite or plumbago,	0·340	Cast brass,	1·47
Brick,	0·351	Cast copper,	1·54
Great Pyramid casing-stone,	0·367	Cast bismuth,	1·72
Glucinum,	0·370	Cast silver,	1·84
Gypsum,	0·381	Cast lead,	1·99
'Paving stone,'	0·424	Mercury,	2·38
'Common stone,'	0·442	Cast gold,	3·38
Strontium,	0·450	Hammered gold,	3·40
Desert sand from near Sphinx,	0·454	Pure platinum,	3·42
Flint,	0·455	Platinum, laminated or beaten into leaves,	3·87

SECTION III.

STANDARDS OF HEAT.

INASMUCH as all known substances, both fluid and solid, vary in size and specific gravity with every

accession of imponderable heat, some definite temperature must be referred to, when dealing accurately with standards either of length, capacity, or weight; and thus it came, that many years ago, the British linear standards were referred for their zero of length to the temperature of 62° Fahrenheit, and the French metrical system to 32° of the same scale. Not indeed expressed by the French authorities in that scale, for they refused to be bound, as the English so easily allowed themselves to be, by the whim of the Dutchman Fahrenheit; and perceiving early the intrinsic connexion between heat and other subjects of metrology, they, the French authors of the metrical system, very wisely made their subdivisions of the great natural unit of heat, conformable to their other decimal arrangements, whence their now celebrated Centigrade scale of the thermometer, having 0 at the freezing point, and 100 at the boiling point of water.

In practice, indeed, some unexpected difficulties were found in the way of realizing, as a heat referring point, the 0° of their scale for all the French standards of measure; and in the same searching furnace of practice, the British referring point of 62° Fahr., has been somewhat departed from in its full integrity and simplicity. Yet, inasmuch as the necessity of referring any and every part of metrology to something definite on the water-scale of heat, has rather grown, than lost, in importance in the eyes of modern philosophers, with all this increase of

perplexity and trouble,—more attention than ever must be paid to its ultimate refinements, in any system which may hope to continue before the world. Let our first inquiry therefore, at the Pyramid be, whether it possesses *any* heat-reference for its standards of measure?

No indications, indeed, of a thermometer of any acknowledged kind, are to be seen in the Great Pyramid; but a little reflection will soon show the attentive visitor, that the whole building forms in itself a something more important still, towards attaining success in carrying out practically, even the most refined operations of metrology; for the Pyramid's enormous mass of solid, and slow conducting-of-heat, masonry, at whose overwhelming amount the world has hitherto merely wondered, or jeered, or inveighed, or abused, must have the useful and inevitable effect of remarkably equalizing the temperature on anything, as the granite coffer, contained within its substance.

The *linear* standard, it is true, does not seem to have that protection; for, being the length of one side of the base of the Pyramid, and defined by the corner-sockets, it depends not so much on the building, as the natural rock of the hill. But there, we presume, that not the most critical geodesists of the present day, would pretend that any season temperature correction could possibly be required; for in all their own practice, whenever they have measured base lines directly, or trigonometrical lines

indirectly, on any part of the surface of the earth, whether by day or by night, summer or winter, or even year after year, they have never considered any reduction for variations of temperature admissible or sensible : the variations felt on the surface, being supposed to be merely skin-deep, over a uniform heat below, and unable to produce any mechanical alteration of size.

Equally then, at the Pyramid, must the linear standard, seeing that it is not a loose bar of brass, but part of the earth surface,—be considered by the involuntary testimony of all modern geodetical practice, to be invariable in the temperature which governs its size ; and whatever that temperature may be, the capacity standard is bound to the same, —by being surrounded and covered in, in its place in the King's chamber,—with so huge a mass of nearly solid building,—that variation of season, cannot be felt within its interior. A necessarily constant and therefore definite temperature, exists for each of the Pyramid standards ; and, in so far, they can be introduced worthily amongst the most perfect inventions of modern science towards the same end,—*if* we can discover what that definite temperature is ; and if, also, there be anything about it, either in amount or character, indicative of design in the builders, or desire on their part to have obtained that particular temperature, rather than any other ?

Now here, is one of the most curious parts of the whole Pyramid question ; for, on referring to the

French observations of temperature in and out of the Pyramid, they will be found to indicate that the temperature is close to 68° Fahr., or what might be called a temperature of 1-5th; that is, 1-5th the distance between the freezing and boiling of water, measured upwards from the freezing point. And if that quantity be further supposed to be divided into fifty parts,—suitably with the 50-inch standard referred to for weight and capacity measure in the chamber of *five*, or the King's chamber reached by fifty courses from the ground,—then the whole distance between freezing and boiling will be represented by 250; while 1000 of the same degrees represent as nearly as it has been measured, or given out by the 'Diffusion of Useful Knowledge 'Society,' that very notable physical point in the temperature scale, where heat begins to give out light, or iron is seen to be red-hot in the dark.[1]

All these numbers, then, are eminently coincident with the divisions and subdivisions of the rest of the Pyramidal metrology; while the reference to an earth temperature, viz., that of the Pyramid hill, depending chiefly on its parallel of latitude, and expressed only, but not regulated, by the accurate mensuration afforded in the physical nature of water,—is perfectly suitable to the principle already shown to have been followed in capacity and weight measure; or that of employing for their regulation

[1] Diffusion of Knowledge Society's *Natural Philosophy*, vol. ii. p. 63.

the whole earth's mean density, but for their practical expression, water. Hence, *design* will be begun to be indicated in the temperature arrangements of the Pyramid, if the heat point of 68° Fahr. be really found to prevail there, on further measures being obtained than the few and scanty French ones[1] already alluded to.

The first and most definite inquiry, therefore, to be made with this view, is to ascertain the temperature of the King's chamber; and the moment that was made by myself, and equally whenever it was made (see the observations in vol. ii. p. 207), extending from 19th January to 1st April, the temperature came out, not 68°, but closer to 75° Fahr.

Of this there was no doubt whatever, for variations of two or three tenths of a degree are not worth talking about in presence of 7°. Was the whole proposition, therefore, negatived? By no means, as yet; for what feature of the Pyramid is there, which renders at once by measurement, in the present day, its ancient proportions? None; seeing that in every case the first measure only gives us the original building *plus* (perhaps I should say *minus*), some awful amount of dilapidation, destruction, or alteration, and which must be immediately inquired into as to its numerical effect. So it is with the heat question; and the first anomaly to

[1] The temperature is stated by M. Jomard and Colonel Coutelle to have been 22·° C. in the King's chamber, 25·° C. in tombs outside, and 17·° or 18·° C, in Joseph's Well at Cairo.

force itself on the attention of a careful observer is, the finding that while the King's chamber marks 75°; the Queen's chamber below, marks 74°; and the well mouth, lower still, marks 73°.

'Ah!' then might even an untutored countryman easily see reason enough to exclaim, on finding,—in such a latitude and elevation above the soil,—mean temperatures *decreasing with descent*, and all of them too great; 'Ah! there is a centre of 'disturbance up here aloft, and prevailing to a 'larger extent in the King's chamber than in lower 'parts of the building; the cause of it must be 'searched for without delay.'

One source of the anomaly is without any doubt the daily visits of numerous parties of travellers, with their multitudinous Arabs, all of them supplied with lighted candles, and abounding in animal spirits, dancing their hornpipes 'over King Cheops' 'tombstone,' banging the coffer for accompanying music, and throwing off waves of heat all the time; which heat-waves, first entering the air of the chamber, and not being able to escape thereby, as the ventilating tubes are *now* choked up,—must infallibly affect the walls. But as these walls are 170 feet thick, no sensible carrying away by conduction or radiation from their outer surfaces can possibly take place; and there seems no other eventuality in store, than a continual rising of temperature in the King's chamber, so long as these ceaseless evolutions of imported heat of a higher temperature take

place, and no counteracting effect can gain admittance. Even when a small party had visited the chamber on one occasion, March 25, I found after they had gone, an increase of 0·4° in a thermometer inside the hole of the northern air-channel; and, more notably still, when I was, although *solitarily*, watching for three hours, yet in the confined space of the forced passage intercepting the northern air-channel further on,—and representing therefore more nearly the effect of a large party almost filling the King's chamber,—the thermometer rose 3·6°, or to 78·2° Fahr.

Hence a likely remark that an observer, seeing and feeling all these things, may probably make, will be, 'What a wise idea and necessary institution 'those air-channels of the ancient builders must 'have been, to keep up equality of temperature in-'side the Great Pyramid; or rather to prevent 'disturbances to the said equal temperature accru-'ing. For, if living men were intended and expected 'to visit the inside, nothing but a current of air 'could efficiently carry away the doses of heat they 'would involuntarily throw out, so long as they 'were there; and which doses, if not bodily carried 'away, must go on, in such a locality, perpetually 'accumulating.' Important of course that the air-channels should not be too large, lest the heat of a summer's day and cold of a winter one should thereby enter too freely to the central apartment of the Pyramid; but on comparing the smallness of

the bore and length of stone channel of these air-tubes of the Pyramid, with the similar elements of culverts in the new Palace of Westminster,—and allowed there, on the testimony of critical examiners, to give something very like the mean temperature of the year, to air passing through them, even on the hottest summer's day,—there seems to be abundant, and even superabundant, security that the same controlling effect will be exercised at the Pyramid.

When Colonel Howard Vyse opened both of the air-channels in 1837, he speaks of 'the sudden rush 'of air that took place,'—indicating pretty clearly the anomalous state of temperature into which the King's chamber had previously grown, during the long closing of these important channels. And had he observed thermometers then, and at frequent intervals subsequent to his successful unlocking of the vents,—he would have found the extra heat draining away, from day to day, just as the waters of the great Ethiopian lake are reported to have done, when their northern barrier was broken through in the days of Joseph's patron king, Phiops, Aphophis, or Apappus. But what thermometrical point the chamber would have lowered down to, at least by this process of merely drawing off the extra heat, or to what point it was lowered before the air-channels were again stopped up,—is very difficult to say; and though the world is now so much increased in wealth, it may be long before another equally liberal-minded man to Colonel

Howard Vyse will be found, to undertake the clearing out of the air-channels once more from the mischievous quantities of sand and stone thrown into them; and allow of the temperature experiment being tried again, and this time more fully and scientifically.

In the dearth, however, of such opportunities, we will venture our own opinion, that the lowering would by no means amount to the 7° required to reduce the 75° at present observable, to the 68° of the hypothesis; and because, a part of the anomaly is due to another source, and one equally unintended by the original builders,—viz., *the practical absence of watery vapour*. The climatal effect of this most important natural agent has been well entered into by Principal Forbes, in his paper on Mean Temperatures, in the 22d volume, part 1, of the *Transactions of the Royal Society of Edinburgh*; and with the effect of showing, from an inductive examination of the relations of mean temperature, latitude, and the relative proportion of land and sea in a given parallel,—that there would be in latitude 30°, an increase of 19° Fahr. in the mean temperature, were the surface made entirely of land, in preference to entirely of water.

Now, though we all know that neither the globe nor the parallel of 30° north, is composed entirely of land, yet the region about the Pyramid speaks more of desert than of ocean; and besides that, in confined localities, as inside any of the tombs, and

even over definite tracts of the desert,—caused by the hold of the ground upon the air, and the not *perfect* mobility of the latter,—there are some very close imitations occasionally found of the temperatures proper to a globe without water. Hence it is, that temperatures higher than 68°, as 73° and 74°, are found even in the well of the Great Pyramid, in the sepulchral chamber of the second Pyramid, and many other localities not visited by very large numbers of travellers or Arabs. But all these temperatures come within, and abundantly within, the limits assigned by Principal Forbes to 30° of latitude north, on either the total land or total water hypothesis, *i.e.*, between 80·9° and 61·9°; while they would also be infallibly reduced somewhat, and in the direction of 68°, if an evolution of, and ventilation by, watery vapour were freely allowed in their vicinity; and an approach thereby made to the natural circumstances of the parallel as a whole.

That, on one hand, the builders intended watery vapour to be present, may be assumed; first, from the part which water plays in the capacity measures of the coffer; second, from the existence of the lower well, which, though in commencement only, descends from the floor of the subterranean chamber straight down *towards* the well-water level of the region, even as the square well of the sepulchral chamber in King Shafre's tomb does descend to, and reach, it; and third, from the fragments of tradi-

tion gathered by Herodotus and others as to the tomb of King Cheops, the builder of the Great Pyramid, being at the bottom of the structure, *on an island surrounded by the waters of the Nile.* And that, on the other hand, by such introduction of the Nile waters into the lower parts of the Pyramid, the temperature of the hollow portions of the upper part of the building (communicating by open passages with the lower), would be brought to something exceedingly close to the temperature of 1-5th, or 68·° Fahr., may be concluded from several sources.

First, general earth observation and physical theory.

These are given well in Principal Forbes's paper, already alluded to ; the observations being the extensive collections of all countries made by Professor Dove of Berlin, and the theory,—Principal Forbes's physical theory,—connecting them all together ; and they give, for the mean temperature actually existing in 30·° of latitude north, the former 69·8°, and the latter 69·4°. The reduction of these quantities to the latitude of the Pyramid, or 1′ 10″ south of 30°, is practically insensible, amounting only to 0·015° Fahr. ; but their reduction from the sea level, at which alone they apply, to the elevated position of the Pyramid at its base, or 2580 inches there above, is much more important, and unfortunately rather uncertain ; for though in our own country, say in latitude 53°, the decrease of temperature with elevation has become pretty well ascer-

tained to be, at the rate nearly of 1° for every 3312 inches of height from the surface of the earth,—a much more rapid decrease may be expected in a latitude of 30°, where the surface is exceedingly heated by continual sunshine, while the streams of the atmosphere over it, must present a balance of many, and more shaded, latitudes. The only observation, too, which I was enabled to make bearing on this point, viz., one between the minimum temperature simultaneously of East Tombs and the summit of the Great Pyramid,—shows the rate exceedingly greater, or 1° for every 1000 inches of ascent; but that is probably exaggerated, for the mean temperature at least; and the result we are therefore brought to for the mean temperature of the base of the Pyramid, as derived from both general earth observations and approved physical theory, is something between 69·0° and 66·9°; the mean whereof *happens* to be, 68·0° Fahr.

Good observations for mean temperature at the Great Pyramid itself, would of course be preferable to these deductions from observations taken in every other part of the world except the Pyramid; but such observations are wanting, for no person capable of observing has ever stayed there long enough. My own observations bear on the question no doubt, but, extending over only a third part of the year, cannot be employed without an uncertain reduction of the first four, to the whole twelve, months. Let us see, however, what they indicate.

The atmospheric observations (vol. ii. p. 265) taken daily by self-registering thermometers, give for the simple mean of maximum and minimum thermometers (a very usual, though not perfectly accurate method), 64·6° for the period in question; while the discussion of the hourly observations taken once a week during the same time, and safe from some of the sources of error to which the minimum thermometer was exposed, give 63°·4. Wherefore, doubling the weight of this result on account of its instrumental superiority, the best mean result deducible from both methods would seem to be, 63·8° Fahr.

Then for the reduction of any number obtained during the four months employed, to a whole year, the following data have been collected from the following sources:—

Date.	Place.	Latitude.	Reduction of mean temp. of first four months, to the whole twelve months of the year.	Authority.
			Fahr.	
1856-1865	Towns of Scotland,	56° 12′ N.	+ 6·9°	Meteorological Society of Scotland.
1840-1851	Dublin,	53 23 ,,	+ 6·0	Rev. H. Lloyd, D.D.
1853-1865	Malta,	35 54 ,,	+ 10·0	Royal Engineers and Military Medical Staff.
1862	Bombay,	18 54 ,,	+ 2·8	Bombay Observatory Volume.
1848	Aden,	12 46 ,,	+ 4·4	Col. Sykes, *Phil. Trans.*

Some of these numbers we fear are not so accu-

rate as they might be, for one set assumes that observations at 9h. 30m. A.M., and 3h. 30m. P.M., necessarily give the mean temperature of all the instants composing 24 hours,—whereas it will be seen from our table of hourly corrections (vol. ii. p. 261), that these instants are both in excess, one of them, indeed, very near the time of maximum solar influence; and the other observers have seldom noted more than the simple points of maximum and minimum, the latter marked on a thermometer not so sensitive as what is employed for the former. Taking, however, from them all a positive correction of + 6°, for the seasonal effect, and an elevation effect of −1° from our own experience to reduce from the meteorological station to the Pyramid base,—we have for final result, and as deduced from local atmospheric observations, 68·8° for the quantity sought after; in place of 68·0° even.

And lastly, referring to the well temperatures, which are often thought to give at once the mean temperature of a country without further trouble, the mean of twelve observations (see vol. ii. p. 202) of Cairo wells gives 69·9°; of ten observations of agricultural wells in the alluvial flat opposite to the Pyramid, 69·1°; and of six in King Shafre's tomb-well, closely approaching in position, age, and character, any water well in the Great Pyramid, these give 64·6° Fahr.

The further small corrections which these raw observations may require for season and elevation,

I will not attempt to inquire into, with the scanty means for that purpose at my disposal. When, too, we find that every result, whether from theory, atmospherical observation, or well-water observation, oscillates closely upon the temperature of 1-5th, or 68° Fahr.,—it is probable a long series of measures would have to be carried on daily, and for many years, before any one could decidedly say from local data alone, whether the true quantity is below or above that peculiar point.[1] In the meanwhile, however, it is most likely plain to every one, that both watery vapour and hypsometric elevation are required in the latitude of the Pyramid, to prevent the actual mean temperature being too high: or, these things being given, that a very different latitude from 30°, could not have been fixed on for the Pyramid with any appearance of a temperature of 1-5th; the mean temperature of 20° north latitude being no less than 7·5° greater, and of 40° north latitude 12·3° less, than for 30° north latitude, according to the general collection of observations and the theory, already mentioned.

Hence, compared both with nature, and the modern European scales of temperature, the assumed, and apparently the real, Pyramid scale of temperature reads as follows :—

[1] The annual mean temperatures by observation at fifty-five stations of the Meteorological Society of Scotland were, in 1856, = 45·7°; in 1857, = 48·0°; in 1858, = 46·6°; in 1859, = 46·8°; in 1860, = 44·5°; in 1861, = 46·9°; in 1862, = 46·9°; in 1863, = 46·8°; in 1864, = 45·5°; and in 1865, = 46·9°.

	Pyramid Scale.	Fahrenheit Scale.	Centigrade Scale.	Réaumur Scale.
Iron bright red in the dark,	1000·°	752·°	400·°	320·°
Water boils, . . .	250·	212·	100·	80·
High summer temperature at Great Pyramid.	100·	104·	40·	32·
Mean temperature at Great Pyramid, . .	50·	68·	20·	16·
Water at maximum density, nearly . .	10·	39·2	4·	3·2
Water freezing, . . .	0·	32·	0·	0·

Second part of the Heat question.

As already indicated on p. 178, so insidious, multifarious, and difficult are the actions of heat, that the originally simple references of both the British and French systems have rather broken down in practice; and exhibit now, how vain are the efforts of man to set his own rules to nature.

Thus the British idea of referring everything metrological to 62° Fahrenheit, is generally ignored by all Englishmen in their measures of specific gravity, where the more even number of 60° Fahrenheit is preferred; sundry references too are made to the density of water, by some at the temperature of 39·2° Fahrenheit, and by others at 40° Fahrenheit; while more recently still, the copies of the standard yard made under Government supervision, if found too long or too short at the standard temperature of 62°, are issued, under authority, as being of the correct length at some other temperature—as 59°, 63°, 65°, or whatever the individual case of linear error

may require, according to the expansion of the material from heat.

In the French philosophers' system, again, it was thought to be a magnificent idea at first, to have declared the freezing temperature of water *their* heat referring point; because, there was then no dependence on any thermometer. But though such a temperature may answer with permanent solids, it is very inconvenient, and something worse, when using these in combination with water to obtain the French unit of weight; and in fact, for that purpose, the water had to be raised in temperature, until it had ceased the anomalous expansions it indulges in on approaching the crystalline state, and had acquired its condition of greatest fluid density somewhere beween 39° and 40° Fahrenheit.

A thermometer, then, must be employed after all to get the expansions of the solid vessel, holding the water, between 32° and 40° Fahrenheit; and neither of these two temperatures are found agreeable or conducive towards good measures being obtained by man. For not only does man, as a warm-blooded animal, use his faculties to most advantage in a temperature very much higher than that of freezing water; but there are pernicious effects to the instruments he is studying, when the difference of his own heat and theirs, amounts to a large quantity; such heat exchanges increasing at a very accelerated rate, with the simple increase of the differences between two neighbouring bodies. So important is

this consideration in some inquiries, that we have heard an eminent Indian geodesist hastily declare, that 'he would have his experimenting and instru-'ment-making room heated up to blood-heat, say '98·4° Fahrenheit.' But then he soon after allowed, that such a temperature would be rather *too* high for his full purpose; for though 98·4° Fahrenheit, *may* be the heat of man's interior, it is not that of his exterior and neighbourhood,—besides being, in the air breathed, too relaxing to both body and mind when at difficult work.

Lastly, too, we have to chronicle the inglorious termination of the French heat-referring point, for their solid and official metre; for the said metre bar having been found too short by a very notable quantity, owing to an error in the triangulation of France recently discovered,—the freezing point has been given up, and that parent of all the metres is now referred to, as representing its intended length, only when it has been expanded by rising to a temperature of something near to 50° Fahr. An accidental temperature, in fact; the accident of an accident; representing nothing great in nature; and liable to be altered again at any subsequent time, to some other accidental quantity, when a new error in the steps by which the metre was obtained, shall unhappily be discovered.

The friends of the French metre, either hush up this result; or, affect to look rather too kindly upon it, and say,—'How beautiful that the French metre

'should be self-adjustible, and always show mankind, 'through means of more or less heat-expansion, the 'length of one-ten-millionth of the quadrant of the 'meridian passing from the North Pole through the 'city of Paris to the Equator.'[1] But supposing, or allowing to them, that it does so,—they must themselves confess, that they keep up their connexion with that one natural linear unit, and not the best of its kind in the world, by sacrificing their connexion with another unit of a different natural element, and not less important,—viz., the heat unit.[2]

If then, both the British and French heat references have failed, in practice, to hold men true to their ancient covenants with them,—is there any chance that the Pyramid reference, if tried, would fare any better?

We believe it would, and for the following reasons:—

[1] The friends of the metre are not often quite so clear in their statement of the fact,—for they delight sometimes, in referring the metre's origin, even as a decimal scale, to 'one of the great circles of 'the earth,'—when really only 1-4th part of such circle was ever attempted to be referred to,—and the decimal division cannot apply equally to both. Neither, again, do they often let their readers know, that late researches on the figure of the earth, have shown that quadrants of the meridian in the northern hemisphere, vary in length with their longitude; so that the length of the French quadrant is local and national only, not universal and cosmopolitan to all the nations of the earth. (See vol. ii. p. 450.)

[2] In the enlarged Natural Philosophy of the present day, expanded as it has been by the dynamical theory of heat,—questions of heat are more momentous to the prospects of life and energy, in and throughout the universe, than anything connected with a little more or less linear proportions.

1*st*, As a temperature of 1-5th, and marked by 50° on its own scale, it would have certain numerical advantages in arithmetical operations; or, the evenness of the Centigrade, with the greater expressiveness of the smaller degrees of Fahrenheit.

2*d*, The temperature of 1-5th, or 68° Fahr., is most admirably adapted to human beings to breathe and labour in; or literally for life and work; feeling, as we have experienced again and again in Egypt, simply pleasant, fresh, and wholesome, without sense either of numbing cold, or oppressive heat; and

3*d*, There seems a prospect of its being a vastly more important natural unit, than what has been hitherto mentioned; and a something, therefore, which all men endued with sense, would be as careful how they altered, as they would be morally with regard to removing their neighbour's land-marks. We have hitherto, for instance, merely spoken of the temperature of 1-5th as being by nature, or art, or both, that of the Great Pyramid, in the particular spot of the earth where that building was set down; but what will nations say if that temperature be, and that one place be found to have, the mean temperature of the whole surface of the earth; and yet this may be inferred, at least to the degree of accuracy whereto modern observation enables us to proceed.

In some works, no doubt, and works much spread among the people, the temperature of 50° or 51° Fahr., is mentioned as that 'of the whole earth.'

Of the whole *surface* of the earth, may be presumed to have been meant; for, if we were to take account of a molten interior, there would be an inconveniently high result for mankind to examine metrological standards in; and climate, which is so important to man's well-being, is an affair of surface, and superficial influences on the earth, only. Even in this necessarily limited view of the case, however, the above authors seem to have mistaken a determination of the temperature in latitude 45°, or the middle point of a meridian *line along* the surface, for that of the area of the *whole surface* of the earth. The latter is of course the true reference, and the middle parallel in either hemisphere for *surface*, is by no means 45°; but, if computed as a sphere, comes out 30°; or the exact latitude of the Pyramid as already mentioned, all but the small defalcation of 1′ 10″.

Hence, the annual mean temperature of the parallel of 30° latitude, is more likely to be the mean temperature of the whole surface of the earth, than is that of 45°. But not necessarily with exactness; for it must depend, partly on the rate at which the temperatures increase, or decrease, on either side of the parallel; and also, on the difference of temperatures in the two hemispheres of the world. Of this last, indeed, very little is known as a whole; for though in low latitudes, southern parallels are colder than northern, there is no necessity,—as Professor Dove has remarked,—that the same feature should still prevail in higher latitudes.

As a first approximation, then, let us take the northern hemisphere alone, and ascertain the temperatures both of 30° latitude,—which parallel evenly divides the *surface* between Pole and Equator,—and of the latitudes 48° 35′ and 14° 29′, which likewise evenly divide the surfaces between the Pole and 30° latitude on one side, and between 30° latitude and the Equator on the other.

The data for this purpose are extracted from Table III. of Principal Forbes's important Memoir, above quoted, and appear as follows:—

Latitude.	Temperatures, in degrees Fahrenheit.			
	Observations collected by Dove.	Theory by Forbes.	Forbes's Formula.	
			All land.	All water.
North.				
60°	29·8	27·5°	18·4°	37·4°
50	42·5	43·0	39·9	46·5
40	56·5	58·0	61·4	54·9
30	69·8	69·4	80·9	61·9
20	77·5	76·6	96·5	67·3
10	79·9	79·6	106·3	70·6
0	79·7	80·0	109·8	71·7

Whence we derive the mean temperature for latitude—

		Fahr.
48° 35′ Lat.	By theory, . . =	45·1°
30 0 ,,	,, . . =	69·4
14 29 ,,	,, . . =	78·2
And the mean, doubling the middle latitude co-efficient,	=	65·5

The first approximation, therefore, by doing little more than attending to the nature of the circum-

stances really concerned, when the *surface* of the earth is in question,—has brought up the quantity from the previously believed 50° to 65·5° Fahr., or within 2·5° of the 1-5th temperature; and the chief part of that comparatively small difference, may be suspected to arise from error in the theory employed, when computing for the northernmost latitude.

That there is such an error may be inferred thus: The mean temperature of Scotland, derived from fifty-five of the stations of its Meteorological Society, having a mean lat. of 56° 30′ north, and elevation above sea = 3072 inches, is for the period from

	Fahr.
1856 to 1857, or 2 years inclusive, . . =	46·8°
,, 1858, or 3 years ,, . . =	46.8
,, 1859, or 4 years ,, . . =	46·8
,, 1860, or 5 years ,, . . =	46·3
,, 1861, or 6 years ,, . . =	46·4
,, 1862, or 7 years ,, . . =	46·4
,, 1863, or 8 years ,, . . =	46·4
,, 1864, or 9 years ,, . . =	46·3
,, 1865, or 10 years ,, . . =	46·4

Whence any one may clearly see, that the last quantity is not likely to be much altered by further observation with the same instruments and methods; in fact, that it is, with the above limitation, very well determined, and probably much better than the great majority of stations on which the theory is founded.

But that theory (see second column of above Table) makes the mean temperature of the parallel of 56° 30′ = 32·9° Fahr.; or hardly raised above the freezing point; and in so far, is 13·5° in differ-

ence from the observed mean temperature of many years. Only in difference, though, not in error; because the theory attempts to represent that whole parallel, while Scotland only occupies one point of it,—and that point a locality, where ocean abounding over land, a something of the warmth of a water climate over a land one when north of latitude 45°, ought to be felt. To what extent though? The theory fortunately answers for itself, stating that, if the globe were 'all water,' and therefore the highest possible result obtained from that source,—the mean temperature of 56° 30′ north, and at the sea-level, would still be only 40·6° Fahr.; or no less than 5·8° below what actually obtains in Scotland, where, though there are complaints that the climate is very rainy, it is not all water yet.

Hence although the theory alluded to, is termed by its talented author the 'rational theory,' in contradistinction to Brewster's and Mayer's, which are 'empirical,' or 'merely mathematical,'—and although it is decidedly in advance of theirs in taking into account the distribution of earth and sea over the land's surface,—yet, either these have been erroneously estimated; or, as we rather believe, there are other important, though hitherto neglected, physical conditions to be taken into account, in deducing terrestrial mean temperatures. Whichever be the cause, the effect of the results being at last attended to by future investigators, will inevitably raise our previously deduced mean temperature of the whole

world's *surface* from 65·5°, to something nearer, if not absolutely to, 68·0° Fahr., the standard 1-5th of Great Pyramid heat metrology.

SECTION IV.

STANDARDS OF ANGLE.

As men improve in science, or advance in the magnitude and importance of the subjects they apply themselves to,—angular measure, seldom heard of in primitive society, becomes one of the most important branches of metrology.

The pure mathematician, indeed, might go on for a long time, expressing all his angles in terms only of the whole circumference as unity, or in terms of the angle subtended by the arc which is equal to its radius; but the practical man, whether mineralogist, surveyor, astronomer, or many another professional, would seldom attain much accuracy, and would infallibly lose a vast deal of time over every determination,—unless assisted by some predetermined system of dividing the circle into small equal portions or degrees; and these arranged suitably with the prevalent arithmetic of the day. So thoroughly was this principle confessed by the *savants* of the first French revolution, that they altered the 90°, assigned from Greek-Alexandrine example, for the quadrant, to 100°—in order to

make a decimal, or centigrade, scale a pervading feature through the whole of their metrical arrangements.

But their 100° for the quadrant and 400 for the circle, have not taken with the world at large; wherefore, after some gallant efforts in the way of producing logarithmic tables, astronomical books, and angle-measuring instruments arranged on the 'centesimal' method,—the Parisian *savants* have reverted to the ancient 'sexagesimal' system, and divide once more their whole circle into 360°. Not, however, without the step having been pronounced by high authority in this country 'a calamitously 'retrograde one in the progress of science;' so many advantages are there in a centesimal over a sexagesimal arrangement, if properly carried out.

Although, then, at the present moment, the French metrical system is without an angular arrangement of its own,—its past history confirms our principle, of no metrology being complete which does not include *angle*. Now, at the Great Pyramid, so much of the importance of the questions discussed in vol. iii. Division I. turns upon very peculiar angles, and their remarkably close realization by the builders,—that a system of angular graduation may fairly be expected to have prevailed amongst them.

Against this idea, it is true, there immediately arises a class of antiquaries, declaring, that in the early day of the world's history when the building

of the Great Pyramid took place, men must have been so ignorant of true science, as to have had no idea of angle, as angular measure; and that if certain *inclines* now appear in their work, it is because they are the hypothenusal, or joining, lines of the ends of certain horizontal and vertical lengths laid out in mere, and simple, linear proportions.

This statement has indeed been met by another, and from an antiquary of remarkable mathematical and philosophic attainments, too,—with the effect of showing that angle, as angle, is after all not so very recondite a matter, but that it might have easily occurred to intelligent minds in an early condition in the world. But it is rather our duty throughout this book, to take no theories of any kind about the Pyramids or their builders for granted; and in this part of our labours, at least, to do nothing more than ascertain, what the measured parts say for themselves.

Now, in the Pyramid, there are, by observation, *two* dominant angles; one of them that of the foot of the Pyramid, or ascent of the sides, = 51° 51′ 14·3″; and the other the angle of the passages, or 26° 18′ 10″ (see vol. iii. Division. I. p. 34). To the former, we might perhaps add the angle of the summit of the Pyramid, and the upper angle of a horizontal section through the sides,—but these being in reality only trigonometrical consequences of the other, have no separate scientific existence.

What proofs, then, can be produced, that the two sets of inclined lines which we have read off on our present European 360° scale, as 51° 51′ 14·3″, and 26° 18′ 10″,—were derived from linear proportions?

The following is the best I have heard:—Two horizontal and one vertical, gives an angle of 26° 33′ 54″; and twice that, is close to the angle of the foot of the Pyramid. Nay, but how close? Why, it makes 53° 7′ 48″.

In the last century, 53° 7′ 48″ might have passed as being *perhaps* the angle of the Great Pyramid's foot; but, since Colonel Howard Vyse's measures, and our own (see vol. iii. Division I. p. 28), we imagine that no other angle than 51° 51′, and some seconds, can be admitted. Similarly, too, on referring to our chapter on the passages (vol. iii. Division I. p. 38), it will be found that 26° 33′ 54″, is decidedly outside the actual angle of *all* the passages.

The dominant angles, therefore, must have had some other origin than the simple linear proportions of 'two horizontal and one vertical;' and, that the Pyramid builders did look on angle as angle purely, we may refer to the azimuth trenches (vol. iii. Division I. p. 30, and Plate XV.), where the absence of perpendiculars and the elimination of the inner ends of all the radiating lines, appear to form proof positive that they were laid out as angles; and can be connected still, by angular measure only.

As angles then, but on what system of angular mensuration? Men call them now 51° 51′ 14·3″,

and 26° 18′ 10″,—but what numbers did the Pyramid builders give them? Having already condemned those, who made the Pyramid builders divide the circle into 360°, merely because the Alexandrine Greeks used that method two thousand years afterwards,—we must seek something more to the point; and the following general principles, highly approved of elsewhere, immediately suggest that—

1*st*, The method of division should be agreeable to what is followed in other departments of Pyramid metrology; and

2*d*, The dominant angles of the Pyramid, when expressed in those terms, should be as nearly in *whole* numbers as possible.

For the first, then, we have the following parallelism afforded by the French circle graduation with their thermometer scale, but substituting the Pyramid thermometer numbers;—viz., 250° for the quadrant, 1000° for the circle, and decimal subdivisions of each degree.

And for the second, we have, on computation by that system, the two angles above mentioned, expressed *in even degrees* to less than one-tenth of such a degree; or, within those limits of probable error, already assigned to good Pyramid practical work. This *Pyramid* system of angle-mensuration, too, seems to be the only one yet tried in the world, which *will* give those two angles with tolerable evenness; as illustrated by the following numbers:—

System of Angle Mensuration.	Angle at Foot of Great Pyramid.	Angle of Passages in Great Pyramid.
360° to circle, ...	51° 51′ 14·3″	26° 18′ 10″
Same, with degrees divided decimally, ...	51·85°	26·30°
400° to circle, ...	57·62	29·23
100 to circle, ...	14·40	7·31
32 to circle, ...	4·61	2·34
1000 to circle, or the Pyramid method,	144·05	73·08

Structural reference to 250° *in the Quadrant.*

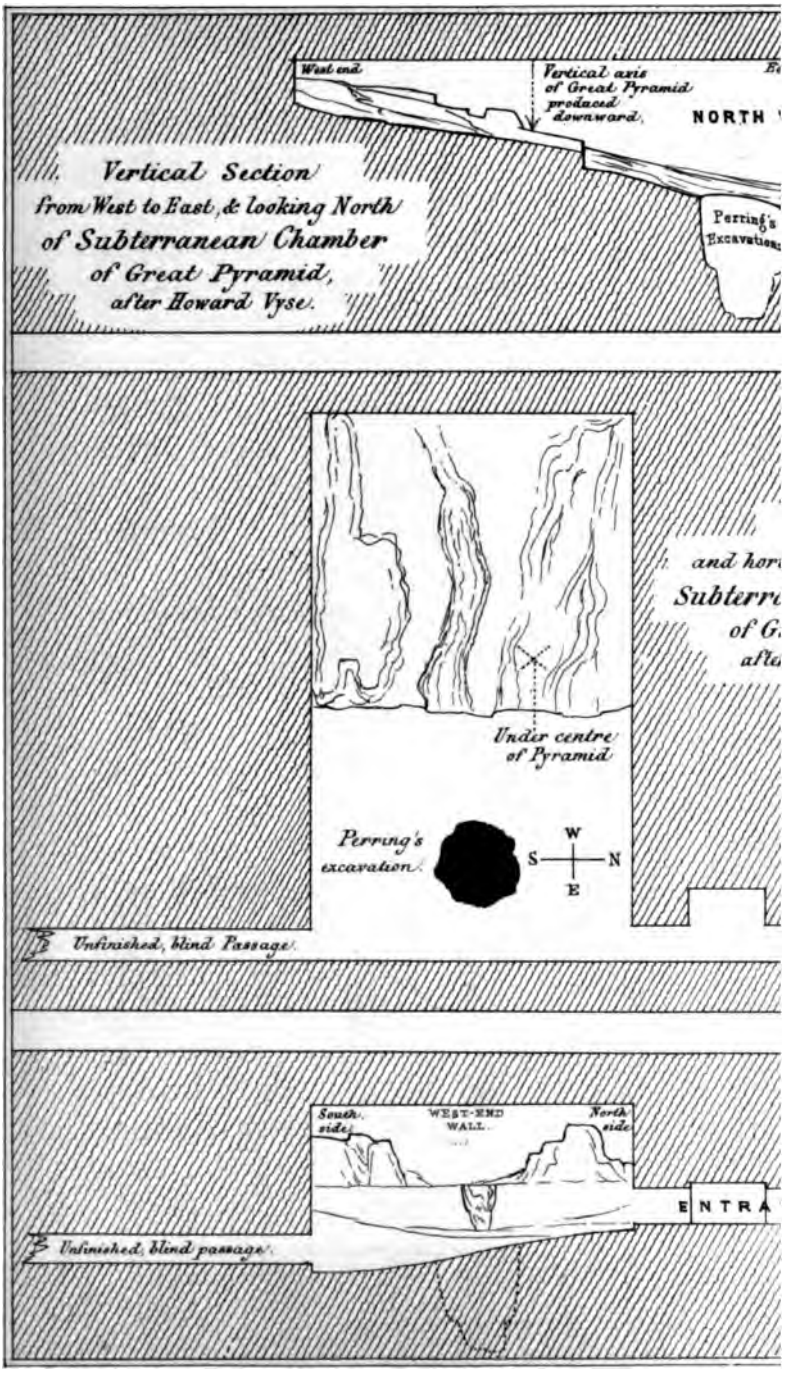
But there is some further testimony in the Great Pyramid, and actually marked into the building, as to the adoption of 250° for a quadrant.

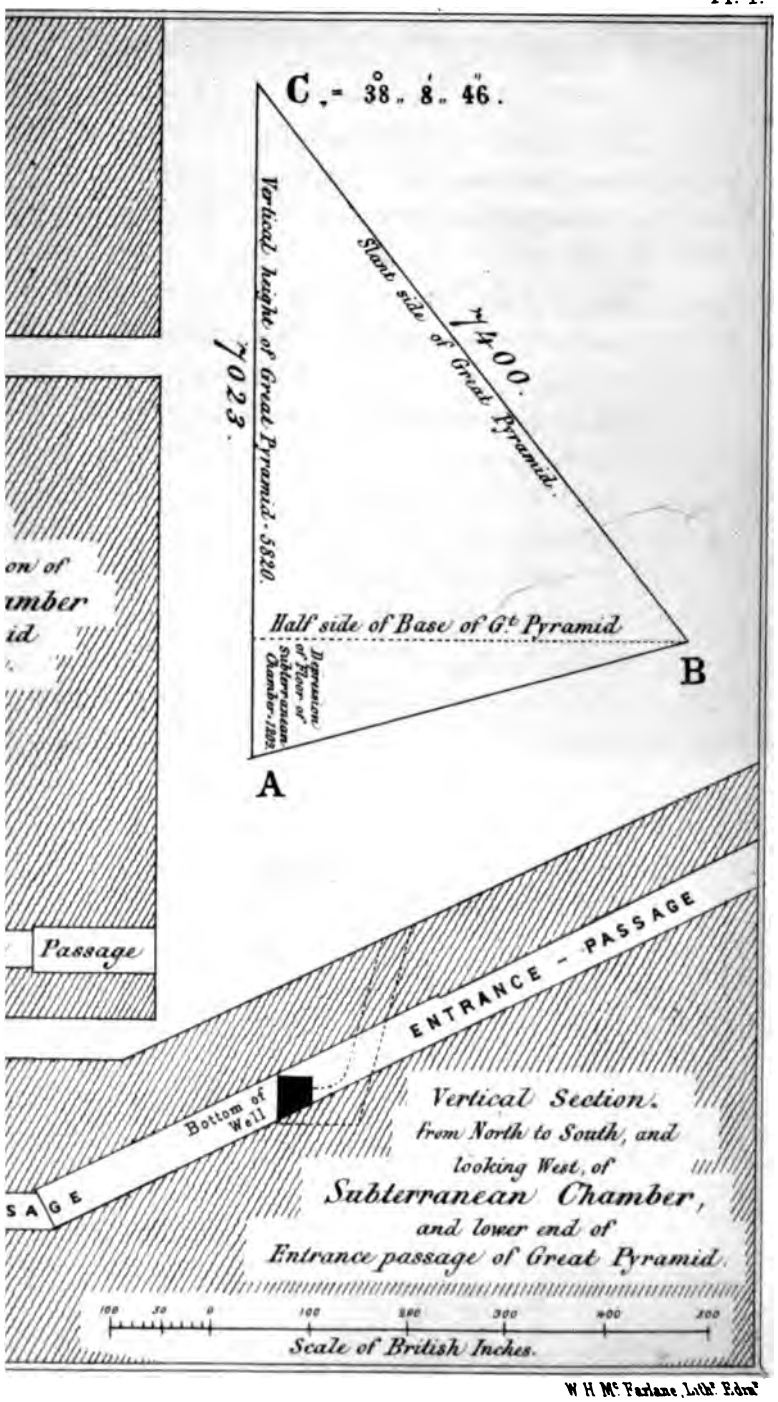
We have already shown, that despite the irregularity of the thicknesses of successive courses of the general masonry in the whole structure,—yet the final number of 50 was found to extend from the pavement, upwards to the floor of the King's chamber; or the chamber where the employment of a standard of 50 inches in length, was a distinguishing feature: and equally, a final number of twenty-five courses will be found to extend from the pavement to the floor of the Queen's chamber, where the employment of a standard of 25 inches in length, was a similarly important characteristic of its symbolization. But no reason has yet been found for the number of courses in the *whole Pyramid*, and no scientific use for the third, or *subterranean* chamber of the Pyramid. Yet, if the King's may be called *the chamber of the standard of* 50; and the Queen's,

the chamber of the standard of 25,—there seems reason to term the subterranean, *the chamber of angular measure.*

The chief actual, visible, and generally acknowledged *angularly* placed line in the whole Pyramid, is the entrance passage; and the chief virtual line which must necessarily be referred to, as the zero for that species of measure, is the central vertical axis of the whole building,—and this axis, if produced downwards, will meet the entrance passage close to, if not actually within, the subterranean chamber. The entrance passage is indeed actually in a different vertical and meridian plane from the central axis, and would therefore pass by it altogether, without contact,—but for the former's expansion, at its lower end, into the subterranean chamber; on the floor of which Colonel Howard Vyse and Mr. Perring have accordingly marked the place of the central vertical axis of the Pyramid produced. (See Plate IV.) The question, therefore, now is,—standing at that point of the floor of the subterranean chamber,—what is the angular subtense therefrom, of the whole side of the Pyramid, in degrees of the Pyramid, or 250° to the quadrant?

This question is fortunately very simple to compute; for in the triangle A B C (Plate IV.), C B, the length of the slant side of the Pyramid, or 7400 British inches, is computed from the elements of the vertical height, angle at summit, and base-side length already given, in Division I.


West end.
Vertical axis of Great Pyramid produced downward.
NORTH
Perring's Excavation
Vertical Section from West to East, & looking North of Subterranean Chamber of Great Pyramid, after Howard Vyse.
Under centre of Pyramid
Perring's excavation.
W
S
N
E
Unfinished, blind Passage.
South side.
WEST-END WALL.
North side.
ENTRA
Unfinished, blind passage.



W H Mc Farlane, Lith. Edin.r

C A, or 7023 British inches, is the sum of the vertical height 5820 inches, and the depression of the floor of the subterranean chamber below the Pyramid pavement, or 1203 inches, as determined on page 74.

And the angle at C, = 38° 8′ 46″, or half the angle at the summit of the Pyramid, likewise already given in Division I.

With these elements, then, the angle at A, or the intersection-point on the floor of the subterranean chamber, may be computed, and found = 75° 15′ 1″ of ordinary, *i.e.*, Greek-Alexandrine degrees;—and these, reduced to Pyramid degrees, are = 209·03°.

If we now therefore turn to page 62, for the number of masonry courses in the whole Pyramid, they will be found to be stated, subject to a small residual uncertainty, as 210 ± 2 or 3: including, in fact, the very number computed; and forming as good a numerical proof of the quadrant having been *intended* to be divided into 250 degrees, as had been before deduced for the cubit being divided into 25 smaller portions, which we call inches.

Itinerary Measures.

Rather an antiquated, and now practically exploded form of linear measures would it be, to have one standard on which to measure the length of a day's journey, and another to ascertain the length and breadth of a field. But we use the term here, to designate a particular class of linear measures

which are bound up with angle, and rendered compulsory on all those who journey by sea; viz., 'nautical miles,' as distinguished from 'statute 'miles.'

The latter, of course, every one knows as arising from the mere multiplication—according to Act of Parliament—of smaller measures of length; and consisting, at the present moment, in Great Britain, by name either of 1760 yards, or 5280 feet, or 63,360 inches. But the former, or nautical miles, are nearly confined to navigators and geographers; and depend on the system in vogue of angle-mensuration, combined with the size and figure of the earth. Omitting at present the small variations due to the spheroidal figure of the world, the nautical mile is the length of 1′ of arc (or the 1-60th of a degree, of which degrees 360 go to the circumference of a circle), on the surface of the earth near the sea-level; and is valued by most authorities as near 72,984 inches.[1]

Hence we see at once that the approximation—between the lengths of a nautical, and a statute, mile—is something very distant; and though tolerated hitherto, is productive of continual confusion in many practical operations,—as in stating the speed of ships; the registration of revolving anemometers;

[1] At the Pole, the value is 73,037; and at the Equator, 72,783. 'As the lower latitudes are more frequented by shipping than the 'higher, 40° has been assumed as the average latitude. Also as the 'curvature of the earth is different on the prime vertical and on the 'meridian, the circle of curvature, crossing the meridian at 45° of 'azimuth, has been employed.'—Raper's *Navigation*.

and many other subjects, where a difference of so much as 1-7th of the unit can by no means be permitted.

Now let us see how this matter would be regulated in the Pyramid metrology.

1*st*, The Pyramid mile is in length (see p. 142), equal to 62,500 Pyramid inches.

2*d*, The Pyramid knot being considered the 1-25th of a Pyramid degree, of which 250 go to the quadrant, will be almost exactly,—and on a mean between the Pole and Equator,—equal to 62,995 of the same inches.

Hence the difference between a nautical mile and a statute mile would, on the Pyramid system, be reduced from the present large amount in British navigation, of 1-7th, to so low a fraction as 1-125th, —a quantity that might be neglected in most practical operations, to the saving of much valuable time.

Compass Points.

Amongst other features of diversity which prevail presently between those 'who go down to the sea in 'ships,' and those who remain on dry land, is this often most inconvenient one,—that the former employ 360° to the circle in all their astronomical and more exact proceedings, but 32°, or 'points,' to the circle when alluding to azimuthal direction; whereas the latter employ 360° for everything angular. And yet, that there is no absolute necessity for so striking an anomaly, occasional seamen of

education sufficiently testify from time to time, by taking the direction, where great accuracy is required, of either a ship's course or the wind, in terms of degrees of which 360 go to the circle. This they do, when they once make up their minds to it, with facility; and are then able to reap advantage immediately,—in the resulting computations which may be required,—from all the numerous trigonometrical tables which are prepared and published for degrees of the 360° order.

But the general sailor, having observed the same natural things in terms of compass points, has either to reduce his points, half-points, and quarter-points to degrees proper,—an awkward proceeding, on account of the incommensurability of 11° 15′ or one point, 5° 37′ 30″ or a half point, 2° 48″ 45″ or a quarter of a point, and 1° 24′ 22·5″ or 1-8th point, to 360°,—or he must refer to a special set of tables prepared for entry by points, half-points, quarter-points, etc., which tables are comparatively rarely to be met with, and are understood to be adapted only to the rudest and clumsiest of work.

Seeing how stoutly the sailors have stood out for ages against the recognised land method of dividing a circle, there is no prospect of controlling them to uniformity by Act of Parliament; and the only chance of producing that desirable bond of union amongst men, would seem to be, by offering them something eminently recommendable in itself for their own purposes.

Now the conveniences which seamen find in their method of points of 32 to the circle are chiefly, the fewer numbers they have to deal with then, as compared against degrees having 360 to the circle. But the inconveniences are,—the difficulty of treating arithmetically the barbarous fractions which arise, when directions have to be defined with greater accuracy than a whole point; without saying anything further on the bad commensurability of all of them, with angles reckoned in the usual manner.

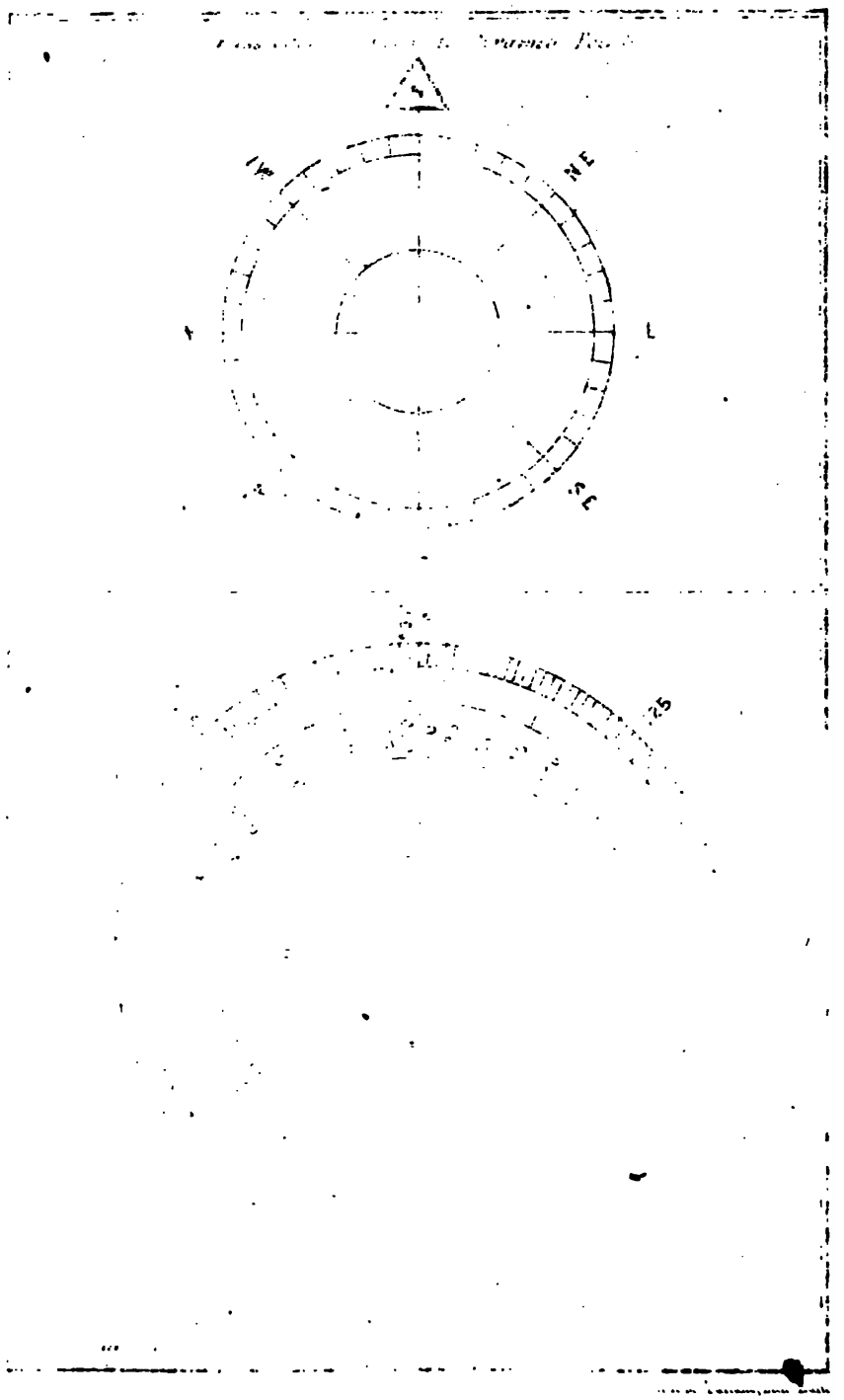
Hence, if there is to be a practical method of compass directions on the Pyramid system—it must be, not by degrees, but by 'points' containing many degrees; attending, however, rigidly to this, that the Pyramid metrology can never admit of such an anomaly as *eight* points to the *quadrant*. But there may be ten; and then each point will contain 25°, a most proper content for any standard of the Pyramid.

On this principle, too, the eight chief cardinal points, so-called, are retained, as N., N.E., E., S.E., S., S.W., W., and N.W; and the only variation is, whether between these named points there shall be four divisions, as at present, or five. Four may be the easiest in some senses; but five presents no difficulty, at the same time that it is more expressive and exact. A greater number than five could not be admitted, because there would be an uncertainty in distinguishing at once by the eye which was which. Set out, for instance, ten even divisions, and few persons will be able to say instantly, on ocular inspection

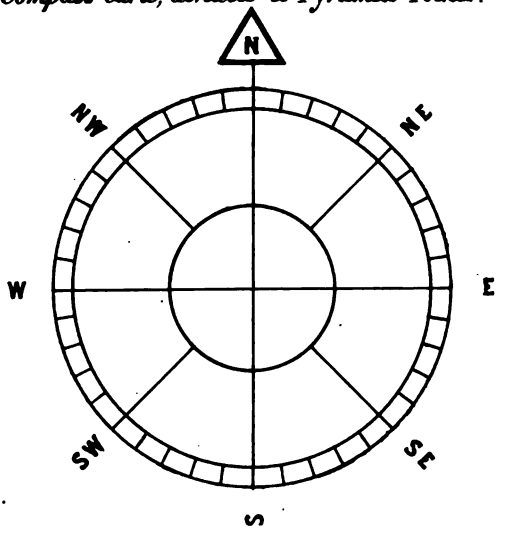
only, which was the fourth, or fifth, or sixth; but set out *five* similar divisions, and any one can say at a glance which is the second, or third; or first, or fourth.

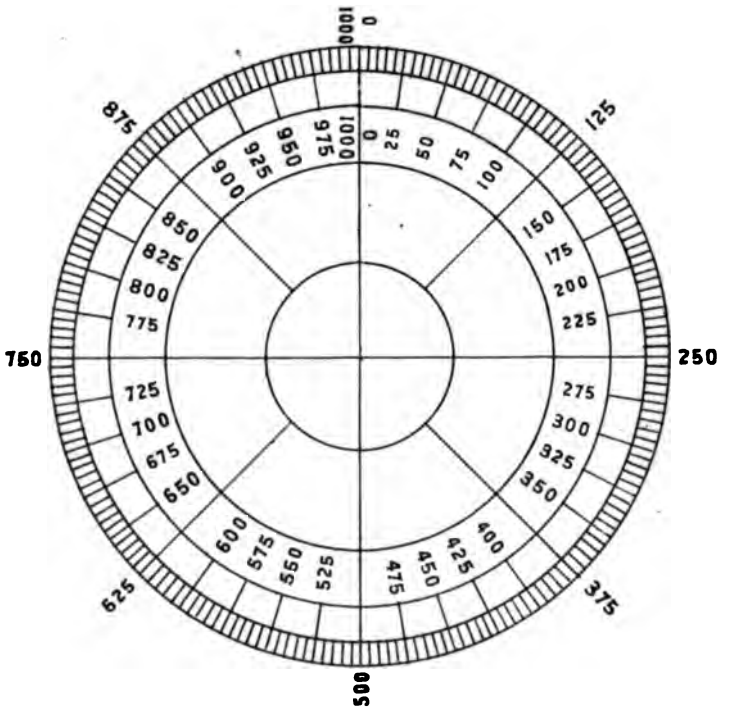
This is a peculiarity connected with the number 5, which we are told has been practically turned to account by the musicians of all modern nations in their choice of the number of lines wherein, or whereon, to write the notes of music; four would be too few for their purpose, and six too many to distinguish by the eye in a moment; but five serves either purpose. The same feature of advantage is further found when subdivisions have to be made with the eye; so that if we have a scale divided mechanically to tenths of inches, and require to read off to hundredths,—*i.e.*, to subdivide each tenth into ten parts again,—a mistake of one of those tenths may often be made by inexperienced persons measuring in haste; but if the same scale be divided mechanically into half-tenths, so that the estimator has only optically to divide each space into five parts, there is hardly any possibility of erring then, to the extent of any *one* of those parts.

Hence we may see, that there is really something noteworthy in the Pyramid system, and increasing its adaptability to all kinds of metrology, even in this one feature of making so much as it does of the number 5, as well as the number 10; and we trust that sailors will take kindly to the fact. At all events, in this manner they may have, if they


NE
SE
25

Compass-card, divided to Pyramid Points.





Pyramid Circle for Angular measure;
divided to every 5', & numbered to every 25' of 1000' to the Circle.

W H M^c Farlane, Lith^r Edin^r

choose, between the eight cardinal points, five smaller points, each equal to a whole number of Pyramid degrees taken in groups of 25. And should they desire, as doubtless the best among them will, to steer closer still than to a single point, —if they will divide each of these Pyramid points into five parts, these will still be equal to a whole number of Pyramid degrees, or 5 degrees each; and will express very nearly as small a quantity in nature, as the troublesome half of a quarter of a point on their present system. While a further division still by five, will bring them to Pyramid degrees; and enable seamen then to speak in full and sympathizing community of terms, with all who make use of angular mensuration in its highest and strictest form.

See Plate v., for these things graphically represented.

SECTION V.

STANDARDS OF TIME.

In Romé de l'Isle's metrological tables, the department of *time-measures* occupies a considerable space,—illustrating thereby the widespread belief, that time is one of the subjects to be treated of in any complete metrology. Later still, in the same country, not only did the arrangements for the new French metrical system confirm the same fact, but

involuntarily indicated the further truth,—that there are some features about *time*, which refuse to be bound by any rules invented, or to be invented, by man.

Thus, decimal division and multiplication were to have been the rule of everything throughout the metrical system; and therefore its authors, on coming to 'time,' began upon the week as hitherto kept in the world,—and changed its contents from seven, to ten, days. The difficulty indeed there, was spiritual rather than physical, yet cogent nevertheless; and will be, so long as the greater part of civilized nations believe, that the period of seven days was appointed by Almighty God as a rule to be perpetually observed by man. The grounds for believing this, we may examine afterwards; at present we have only to deal with the fact, that the French metrical system practically ignored the belief, in their decades of days; and then proceeded, or symmetrically should have done so, to their next steps in time-mensuration, viz., the periods of 100 days and 1000 days.

But then it was, that they were met, and decidedly overthrown, by nature; which has caused the year of the earth's revolution round the sun, to be so extraordinarily marked by changes and seasons,—the study of, and compliance with, which are absolutely necessary to man's existence on earth,—that the period during which these seasons accomplish their cycle, is of infinitely more vital

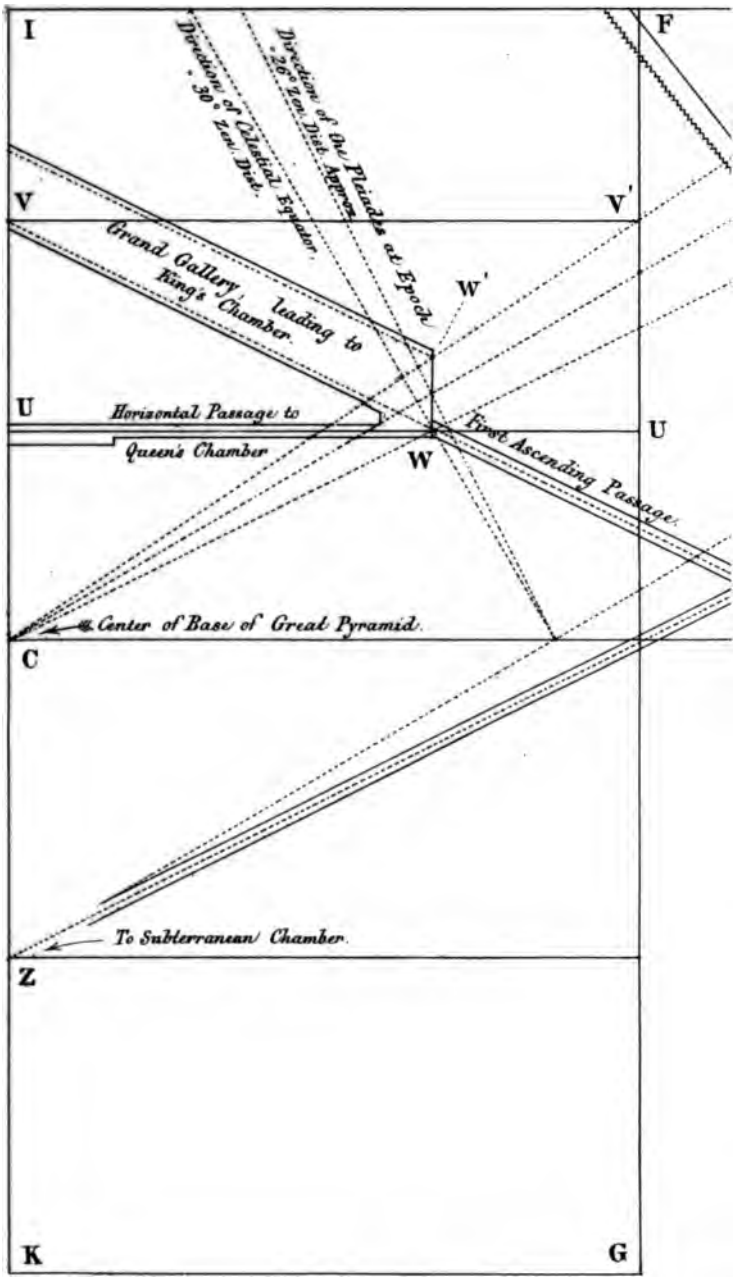
importance to humankind, than all the niceties of decimal arithmetic. The year is in truth one of the units of nature, as is the day; each and both of which must be observed by man, if he would live; and the day, whether taken singly, or in tens (the decadal weeks of the French metrical system), cannot be made by any decimal arrangement to give evenly the actual length of the year, which all our readers well know consists of 365 days, and very nearly a quarter of a day.

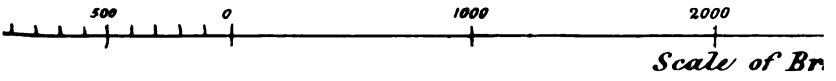
The year, then, in spite of attempts at alteration, is still the same in France as it used anciently to be, before the metrical system was ever thought about; and so is the week too; for the metrical reformers found it in the end, as practically impossible to impose a decimal arrangement there, against the moral and religious prepossessions of mankind in favour of seven, as to fight against the physical arrangement of 365·242 days in the solar tropical year. As so signal a failure, then, of their attempts has been the result, pity 'tis they ever tried the proposed alteration; but they were driven on probably by the popular enthusiasm of the moment for decimalizing everything,—without waiting to consider whether everything can, or ought to be, decimalized. Now this piece of common information, so useful for the framers, as well as the subsequent employers of metrological arrangements, but which the Parisians were void of in the last century,—was furnished ages before in a most conspicuous manner at the

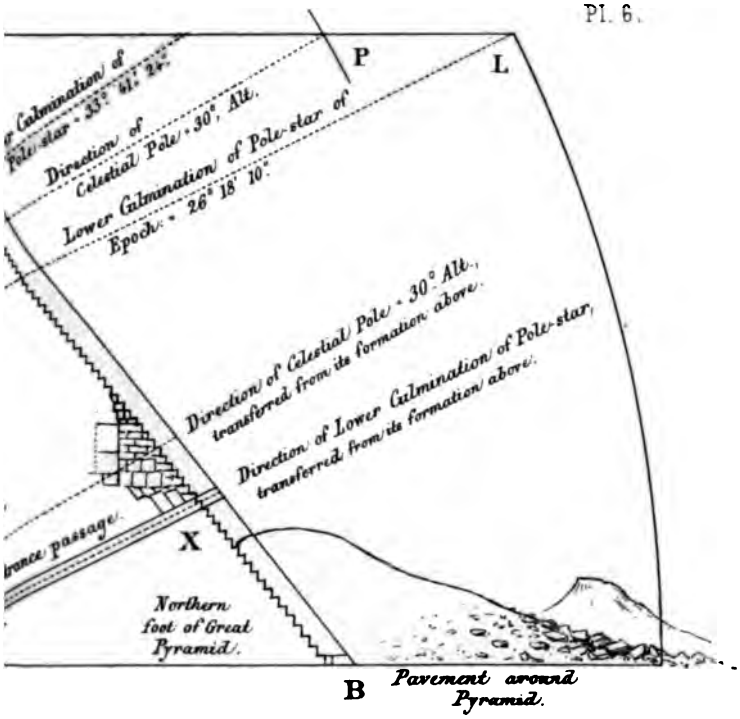
Great Pyramid: for the first feature held up by the general form of the whole building, is, the incommensurable relation evenly,—as we have already had occasion to mention,—of the radius to the circumference of a circle (see vol. iii. p. 20); a proportion indeed which no man through all time coming, will ever be able to divide evenly, upon either a decimal, or duodecimal, arithmetical system.

Again the incommensurability evenly of the day and the year is exhibited practically in the same ancient structure, by the expression of the number of whole days and the portion of a day, constituting a year, in terms of the sacred cubit, in the length of one side of the base of the Great Pyramid; which combination too, of time distinctions with linear standards, seems to furnish further proof positive, that *time-mensuration* was to be treated of in the Great Pyramid, as well as other more usual topics of 'weights and measures.'

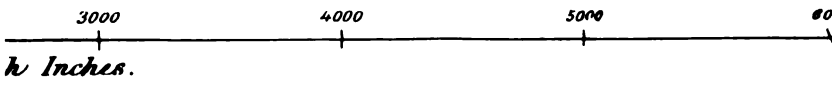
A still further warning seems to have been given to the effect,—that the seven days composing a week, formed an essential interior institution; though how this was to be represented with clearness and certainty in a Pyramid where the arrangements, proportions, and parts generally go by fives, may not appear immediately on the surface; and in fact, presented itself to me only recently, when considering the measures contained in Volume ii.


I
F
Direction of Celestial Equator. - 30° Zen. Dist.
Direction of the Pleiades at Epoch. - 26° 8 m. Dist. Approx.
V
V'
Grand Gallery leading to King's Chamber.
W'
U
Horizontal Passage to Queen's Chamber
W
U
First Ascending Passage.
Center of Base of Great Pyramid.
C
To Subterranean Chamber.
Z
K
G


500
0
1000
2000
Scale of Br



Enlargement of the lower right-hand portion of diagram 3 of Plate 2, Vol. III, preserving the same letters of reference, and showing the coincidence of symbolical astronomical lines, dotted, with the lines of construction of the passages, of the Great Pyramid, taken from Plate 3, Vol. I.



The Week in the Grand Gallery.

Of all the internal architecture of the Great Pyramid, the Grand Gallery is the most unique, anomalous, colossal, and hitherto entirely unexplained. Why, for instance, was it made so enormously high, when the passages both before and behind it are so distressingly small; these so low that no man can move through them without stooping painfully, the other so high that a visitor's torch can hardly show him the roof; and all this in a building where our careful inspection of the joints, sizes, qualities, and fittings of the stones convinced us, that everything had been well considered, and thoroughly calculated beforehand, with a view to the maximum of economy, combined with efficiency, for some worthy purposes intended.

A further development on Plate VI., of the geometrical theory of the Pyramid (illustrated in small upon Plate II.), showing that the direction of the celestial equator enters the north end of the Grand Gallery, from an astronomical intersection on the base of the Pyramid,—had led me, in 1864,[1] to look on the Grand Gallery as connected with *time*; and then, the seven architectural overlappings which every one has remarked in the side walls, suggested a possible connexion with the week of seven days; this idea being further strengthened,—on believing that the vertical height of the Grand Gallery, an expression for which was also obtained from the

[1] See *Our Inheritance in the Great Pyramid.* Part IV.

same geometrical and astronomical diagram,—must be seven times that of one of the ordinary small passages, which might be considered to represent unit days.

To such an idea, then, what answer is returned from our measures last year?

First, That the vertical heights of the small passages are by no means uniform; that of the inclined passage entering the Grand Gallery from the north, being 53·0 British inches; and that of the horizontal passage leaving it at the opposite, or south, end, being only 43·7 British inches. Such an amount of difference would be fatal to the two lengths meaning the same thing in linear measure; but then it is not linear measure for its own sake, which is now being sought; for that having been settled and proved with all exactness in the base of the Pyramid, does not need being proved anew; and, indeed, there are indications in other places besides this,—as in the mutual incommensurability of the lines employed for the shape of the coffer,—that men were purposely by such differences deterred from seeking linear standards inside the Pyramid, or anywhere else than the one true place for them, viz., the sides of the base of the entire Pyramid.

But in our late discussions about the coffer, we neglected its figure, as an ultimate object,—because, mere figure is of no essential importance for the purpose of capacity measure; and we considered only the cubical contents. In the Grand Gallery,

therefore, we must on the same principle similarly neglect the differences between the passages of entrance and exit from its either end, and consider only their mean value, which is 48·4 inches; and then ascertain how many times that goes into the height of the giant hall.

The height and length of this important feature of the Pyramid's interior, have been thus variously given by diverse authorities :—

Authority.	Date.	Height, supposed always to be vertical, of Grand Gallery, from inclined floor to roof.	Length, supposed to be always along the incline, of Grand Gallery, from north wall to south wall.
	A.D.	British inches.	British inches.
Greaves, . . .	1639	312	1848
De Monconys, . .	1647	...	1947
Thevenot, . . .	1655	...	1944
Maillet, . . .	1692	300	1488
Egmont, . . .	1709	270	1632
Shaw, ...	1721	270	1632
Dr. Perry, . . .	1743	288	1800
Fourmont, . . .	1755	...	1848
De Binos, . . .	1777	288	1632
Coutelle, . . .	1800	320	1595
Jomard, . . .	1800	323	1461
Richardson, . .	1817	312	1440
M. Caviglia, . .	1817	360	1824
William Turner,[1] . .	1820	'about' 600	'about' 4200
Howard Vyse, . .	1839	336	1872
E. W. Lane, . . .	1840?	...	1896
C. Piazzi Smyth, . .	1865	339·5	1883

Out of these various heights, it is to be hoped I may be excused for preferring my own, seeing that the practical measure is a very difficult one to make at the place, without some special apparatus being

[1] *Journal of a Tour in the Levant.* London, John Murray, 1820.

provided; and which apparatus is not mentioned as having been possessed by any of the former observers. My own result, too, being the mean of a large number of measures (see vol. ii. p. 86) taken at various parts of the length of the Gallery, can claim to represent the mean height of the whole Gallery; and, with its assistance, we find 48·4 going into 339·5, 7·014 times; or certainly sufficiently close to seven times even, to enable any one to distinguish that it is 7, rather than 6, 8, 9, or 10, which is intended.

The Sabbatical Week in the Queen's Chamber.

A division by 7, suddenly occurring in a Pyramid generally devoted to tens and fives, requires emphasis to assure one, after thousands of years have passed away, that it was no mistake or accident of the builders, but an intended purpose of their system. Accordingly, we have already seen the local division of 7 repeated twice in the Grand Gallery, and shall find it yet twice again before leaving the neighbourhood.

From the lower northern entrance point of the Grand Gallery, there radiates off, pursuing a nearly horizontal direction thenceforward to the south, a passage, known as the horizontal passage, leading to the Queen's chamber. Source of unnumbered perplexities has been this passage to Pyramid measurers; for some begin to measure its length at once from the north wall of the Grand Gallery; some

from the beginning of its own horizontal floor, twenty-two inches south of that; and others again from the point of its passing under the floor of the Grand Gallery, nearly 200 inches from the first starting-point. This latter idea, however, seems just as unsupported by the whole facts concerned, as that of other men beginning to measure the length of the Grand Gallery from the same point,—merely because it is a signal beginning, yet not the first, of its inclined floor-plane.

Now the manner in which the Grand Gallery floor *seems* to terminate at some distance from its northern end, is undoubtedly very striking in an architectural point of view (see Plate VI. vol. i., and Plate X. vol. ii.); and as it connects itself with the roof of the horizontal passage passing under it,—deserves some attention in this inquiry; especially on considering, that that roof is the only fully finished part of the horizontal passage, whose floor is indeed so entirely unfinished as to be no floor at all, in a Pyramid sense of masonry. While further symptoms obtrude themselves on the eye, to the effect—that all this northern end of the horizontal passage was once intended to be built up and concealed, beneath an apparent continuous inclined floor of the Grand Gallery; which would then have extended from its northern wall the whole way up to the grand step in front of the southern wall. Nevertheless, attending for the time, only to the forms and finish actually before us,—breakages ex-

cluded,—the distance from the north wall to the mean of the two cuts-off, by whose united effects the great triangle, viewed in section of the Grand Gallery floor, is terminated northward, has been found equal to 217·8 inches (vol. ii. p. 58.)

Taking this, then, as a pointed or pricked-off part of the length of the horizontal passage,—how many times does it go into the entire length? That quantity being by our measurements 1519·4 inches, the answer is 6·98; or practically 7 times, and certainly not 6 or 8, or any other simple number.

This, however, is not all which the passage has to indicate; for at its farther or southern end is a portion having a suddenly increased depth or height, —after a proportion of 68 to 46 nearly,—and in length equal to 216·1 inches. A simple matter, yet stumbled at grievously by modern authors; for the great French work in its fine engravings ignores this deep step altogether; and Chevalier Bunsen, in his Plate XI. vol. ii. of *Egypt's Place in Universal History*, turns it, the step, the wrong way, or makes that part of the passage of *decreased* height. But Colonel Howard Vyse's measures agree entirely with ours, and enable the statement to be put forth confidently,—that the southernmost part of this passage is the largest and noblest in its proportions of height; while in length, it is practically again 1-7th of the whole passage, or, more accurately, 1-7·03.

Now here is the first possible indication of a very different thing from a mere division by 7; for many

early nations are said to have counted by sevens, and by weeks of seven days, too; the practice being attributed to them by modern *savants*, on account of the facility of the days of the year being almost entirely disposed of without large remainder for intercalation, by fifty-two weeks of seven days each; and similarly the days of the month, by four weeks of the same length. But the Egyptians of the Pyramid and earlier days did not even make this use of 7, preferring to divide their lunar month of 29·53 days, into three portions of ten days each, or to use a decadal week; and the year into three seasons, the inundation, the growing, and the harvest; much less, then, did the Egyptians attend to, or respect, a period of seven days ending with a sabbath, *i.e.*, one day of a more important character following six ordinary ones. In fact, such approved books of reference as Kitto's *Cyclopædia of Biblical Literature* and Smith's *Dictionary of the Bible*, together with all their authors quoted from, profess entire ignorance of either the Egyptians or any other early heathen nation having been acquainted with the week as we now understand it from the Hebrews,—viz., again, seven days ending with a sabbath day; though communities in different parts of the world had simple weeks of a variety of days—five, seven, nine, and ten.

Agreeing, then, with these authors in the mere fact that a week of seven days ending with a sabbath is a far more rare, peculiar, and advanced institution than one of seven days merely,—but

acknowledging the Pyramid principles which we have submitted to elsewhere; or that nothing important can be considered intended to be proved, unless in the finest and truest of workmanship,—we must leave this entrance passage, though it does bear some constructive resemblance to the definition of the Hebrew week, and enter the chamber it leads to, viz., the Queen's chamber, so called.

Why so called, it is difficult to say with any good reason conformable to tradition or discovery; for if kings were reported to be buried inside great Pyramids, queens were said to be buried in small Pyramids outside; and here, in this chamber, not the smallest line or scratch of a hieroglyphic, such as tombs proper to Egypt abound in, or any remnant of the ordinary sepulchral preparations, has been found in modern and provable times. One of the early Arabian historians, indeed, Aboo Djafar Mohammed Edrisi, who flourished about seven hundred years ago (see Howard Vyse's *Pyramids*, vol. ii. p. 335), speaks of this chamber as 'a square room, wherein 'was an empty vessel, and on the roof of the room 'are writings in the most ancient characters of the 'heathen priests.' He afterwards visits the King's chamber, and describes that as 'a square room also; 'and with an empty vessel similar to the former.'

All this description, is evidently inapplicable to the Queen's and King's chambers as we know them now; but how much we may retain as true, is not easy to say, on the historian's own merits.

Mr. Perring, again, whose ideas as an engineer and architect, and while still working under Colonel Howard Vyse, were sound—considered that this chamber was merely a hollow space for storing, during the building of the Pyramid, the huge blocks of stone with which the first ascending passage was afterwards completely filled up, solid, from the inside; the men escaping by the well, in the manner he has indicated. And Mr. Perring having had the blasting and clearing out of some of these strange fillings of the passages in other Pyramids,—where he was the first man, since the original builders, to make an entry,—we bow so far to his authority; at once confessing the probability, both that the first ascending passage of entrance in the Great Pyramid was so rammed; and that the blocks wherewith it was rammed full—when everything else in the structure was complete,—*may* have been kept waiting the occasion in the Queen's chamber.

The Queen's chamber, then, in actual fact and utilitarian reality, served, or may have served once, as a store-room for stone blocks; but was that *all* the purpose the builders had in view when constructing it? Few parts of the Pyramid have fulfilled one purpose alone; and not only have we seen already, in the azimuth trenches, that both mortar-mixing during the building, and mummy-burying afterwards, had followed the institution of a peculiar angular arrangement,—explainable only on the hypothesis of its having served an important

feature in the theory of the building. But the most casual observer who looks to anything at all, in this Queen's chamber room (and many hasten away quickly on account of the close smell and unventilated air), must be enraptured with the original whiteness of the stone, and microscopic fineness of the workmanship on the blocks lining or forming both walls and roof; for some parts of them, certainly several of the joints in the west wall, are the closest and most accurate in the whole Pyramid.

That being the recorded and positive case, then, every maxim of the building we have learned yet, points to something else of a nobler order having been once intended for the chamber, than mere storage of stones. Let us look at it therefore, *first*, in a merely mechanical point of view. The floor is nearly square, *i.e.*, 205 by 226 inches, or vastly nearer such a form than is any other room in the Pyramid; besides which, this chamber includes between these approximating lengths that special length we were just discussing, of the higher and nobler terminating seventh portion of its *own* entering passage, viz., 216 inches.

We may *next* remark that the room is *seven*-sided; not walled, but sided like a crystal or a geometrical figure; for it has a floor, four walls, and two ceilings, on account of the covering above being angular, or in two halves, each inclined about 31° to the horizon. But what are the proportions of these seven sides as to area? for unless something similar

comes out in that way, we could not think of them as units of the same order. The following is what appears on merely taking the rude lengths, breadths, and heights as given by present measure (see vol. ii. p. 66) :—

			Square inches.
North wall,	226	× 183	= 41,358
South wall,	226	× 183	= 41,358
East wall,	205	× 214	= 43,870
West wall,	205	× 214	= 43,870
North roof,	226	× 119	= 26,894
South roof,	226	× 119	= 26,894
Floor,	205	× 226	= 46,330

No very distinct story of anything is told by these numbers ; and we are driven thereby to consider, whether the existing measures represent the ancient room ; for unless they do, of what service can they be in such an inquiry ? No sooner, too, do we look at it with this view, than the question comes up,—What method are we to pursue with the floor, or about the floor ? for flooring proper, as suitable to a Pyramid chamber, or even passage, this chamber is not in possession of.

Correction for Flooring.

As already mentioned in vol. ii. p. 62, the floor lining blocks of this room, if ever put in, are now decidedly taken out and gone ; wherefore we must replace them by computation, if we would hope to come at the original proportions of the chamber. But of what thickness shall these imagined floor blocks be ? The evident answer is,—'See if there

'are any markings on the walls showing how high the 'flooring once stood.' On examining the lower part of the walls accordingly, nothing was found; and we had to follow the walls upwards from their very bottom, to the level of the first overlappings of the niche in the eastern wall, and to the top of the northern doorway,—before any horizontal cuttings were met with.

But these three necessary cuts and shapings are all on one level; and therefore, though a floor line at their height presents the incongruousness of sealing up the entrance to the chamber,—yet seeing that it is a symbolic chamber, and *was to have been sealed up again*, and at that same precise height, by the completion of the Grand Gallery floor at the north end of its entering passage,—this virtual closing up of the entrance may be allowed as a trial hypothesis in our present research; and a symbolical flooring may be imagined at the marked height alluded to, or sixty-seven inches above the actual rude foundation blocks. Subtracting, then, this quantity from the height of each of the walls, we have the corrected area of the sides of the room, as

		Square inches.
North wall,	226 × 116	= 26,216
South wall,	226 × 116	= 26,216
East wall,	205 × 147	= 30,135
West wall,	205 × 147	= 30,135
North roof,	226 × 119	= 26,894
South roof,	226 × 119	= 26,894
Floor,	205 × 226	= 46,330

Something more is beginning now to appear, but

not very clearly as yet; wherefore returning to an examination of the room, and wishing our measures had been more exact than they were, when they necessarily had the uneven floor stones as their base plane,—we are reminded of the presence of the colossal niche in the eastern wall. (See Plates VII. and VIII. vol. ii.) That niche, we had left out of the calculation at first, as being a subsidiary feature of the apartment, and rather difficult to deal with. What was it intended for, for instance? There is nothing like it through all the rest of the Pyramid. 'I excavated in vain below it, in quest of a sepul-'chral pit,' wrote Sir Gardner Wilkinson years ago; and years further off still, other men had burrowed a distance of 50 feet eastward into the masonry at the back of the niche, searching for treasure, or a pathway to the Sphinx, and found neither.

Our only safeguard here, from numerous unfortunate errors, would seem to be—mechanical appreciation of facts and forms; in which sense, the niche is evidently an addition to the bulk of the cubical contents of the room; and the easiest way to allow for it would be,—to suppose the east wall of the chamber, simply as a plane, pushed outwards to such a distance farther eastward, as to produce thereby the same increase of cubical space as that given by the niche. Now the niche recedes over its chief extent, about 41 inches; but is nearer 140 inches in some of its middle and lower parts; though how much exactly, we cannot say, on account of

modern dilapidation. Let us try, however, 25 inches, in the calculation of the wall; and then we have,—

		Square Inches.
North wall, . . .	251 × 116	= 29,116
South wall, . . .	251 × 116	= 29,116
East wall, . . .	205 × 147	= 30,135
West wall, . . .	205 × 147	= 30,135
North roof, . . .	251 × 119	= 29,869
South roof, . . .	251 × 119	= 29,869
Floor, ...	205 × 251	= 51,455

or, expressed in terms of ten thousand inches, six of the sides of this fair and white-walled chamber represent three each, and the seventh represents five; the latter an important number in its place as a Pyramid number, as well as of more actual weight than the others. So that we seem to have now the original secret of this room before us, in the same elemental manner as we had that of the azimuth trenches, on measuring their axial angles; and find it to be no other than the culmination of the various symbols of a week, which we have been touching on indistinctly elsewhere, but now have come to positively, and are absolutely shut up with, finding it to be a week like the Hebrew week, consisting of six ordinary days, terminated by, or founded on, one larger, nobler, and, in the Pyramidal terms in which they are measured, more glorious than the rest.

Authority for Twenty-five Inches.

But all the approximate accuracy of this result, as 3, 3, 3, 3, 3, 3, and 5, in terms of even numbers

of 10,000 square inches,—depends on having employed a length of 25 inches on the surface of the whole east wall, to represent the cubical contents given by the greater depth, but smaller surface, of the eastern niche; and though *some* correction of the sort was evidently required by the presence of the niche, there has been no structural indication as yet recognised in the room, distinctly counselling that one, rather than any other, number of inches to be used.

Under these circumstances of mental dissatisfaction, the idea spontaneously arose, and only recently, in my mind,—to test by measure this chamber's second and next most striking anomaly to the existence of the niche itself; and one equally unexplained by all hierologists and Egyptologists who have ever written on the Great Pyramid. This second anomaly is, that so grand and admirably wrought an architectural feature as the niche, should *not* have been placed in the middle of its containing wall! (See Plates VII. and VIII. vol. ii.)

The wall being *pointed* towards the top, shows clearly enough where its central vertical axis lies; and then one sees, as a most painfully evident want of ordinary architectural symmetry, that the niche is on one side, or to the south of such a line. Not so far as to belong altogether to the southern half of the chamber, for a plumb-line from the central top of the wall would strike within the lower and broader part of the niche; but still, grossly far to the south

of the similar feature of the room. So far, that no modern—with eyes set square in his head—can fail to perceive it as a most notable fact; and so far also, that no ancient Pyramid builders could have committed a fault to so huge an extent; or have knowingly introduced such a feature, without careful calculation beforehand, of the sizes and shapes of the fine-qualitied, well-worked stones required to give it a form and local habitation. How *far*, then, is the vertical axis of the niche horizontally from the vertical axis of its containing wall?

Here, I have to regret exceedingly, that no idea of the amazing importance of the Queen's chamber occurred to me, when there; and that I merely measured general features, standing on the rough, uneven floor-stones, and not knowing particularly what most required measure. But I fortunately took, pretty accurately, the breadth of the base of the niche, and the distance of its either side from the terminating lines north and south, of the east wall; and computing recently from these, the distance of the central axis of the niche, from the central vertical line of the east wall,—what was my surprise, to find it practically 25 inches; or, as the numbers came out, 25·3 inches; and again, to find that the breadth of the head of the niche was likewise 25, or 25·3 inches.[1]

[1] The only test for these last numbers, rather inferred than very closely measured (as I could not, when standing, reach to the higher part of the niche), are,—so far as I know,—Mr. Perring's drawings in Colonel Howard Vyse's folio publication on the 'Pyramids of Jeezeh;'

'Why, here at last we have come upon the sacred 'cubit of the Israelites!' was the very natural exclamation to make; 'and how, or in what position, 'have we found it? In the act of serving as the 'signal under which has been commemorated the 'sabbatical week; that week which may have been 'a primeval Divine command to all men, in terms 'of the 2d chapter of Genesis; but which had been 'since so generally forgotten by them all, that we 'may now for the moment distinguish it by the pro-'portions of its parts, but without reference to date, 'as the week of the Hebrews and Mount Sinai. We 'have this communication, too, in a chamber of the 'whitest stone of the Pyramid, and one wherein, 'both by its want of ventilation, and the prepara-'tion for filling up the entrance passage to its roof, 'man was evidently not intended to dwell much. 'Certainly, he was not to interfere there as a master, 'or presume to alter any of the symbols of days ex-

and they give, with some evident errors of drawing, for the breadth of the niche at the top, 23·5; for the distance of its central axis from central vertical line of room, = 26·0 inches; and for distance of same from plumb-line hanging from top of angle of wall (not quite the same as the half distance between the two side walls), = 24·0 inches. But it is a greater strain than any drawing on such a small scale ought to be exposed to.

With regard to the excess of 0·3-inch on my own measures, it is not more than error of observation with error of appreciating dilapidation-effects, under the circumstances, would render very probable. Chevalier Bunsen, too, has remarked, in vol. ii. p. 31 of his *Egypt*, and with reference to a determination of other cubits, 'A difference of three 'lines (old French measure) is certainly no reason for doubting the 'original identity of two measures which has been established by in-'dependent systems, and with different materials for making the 'calculation.'

'pressed by its walls, and indicated by the standard 'above them, as derived from a source higher than 'man. The only source, too, which *could* in primeval 'days, have furnished, for the sacred cubit, the un-'approachably perfect terrestrial reference which it 'has; viz., the one-ten-millionth of the earth's semi-'axis of rotation.'

Authority for the Number Twenty-five.

But we must still delay all *quasi*-religious or psychical discussions, and attend merely to mechanical, or rather to masonic features, used in the architectural, not mystical, sense. And then, there is the further fact of construction to be found,—that the Queen's chamber,—or, as it might more appropriately be termed, the chamber of seven, or again, the chamber of the standard of 25,—has another reference still to a standard of 25 inches; a standard, indeed, as eminently and intimately connected with this chamber's main symbolization, as the standard of 50 inches has already been shown to be with regard to the King's chamber, and its scientific interpretation.

'Standards of length, *equal* to 25 and 50 inches, 'but not necessarily expressed in inches,' might any one unacquainted with the Great Pyramid correctingly remark. To which, however, the Great Pyramid itself answers, 'Nay; but the actual number 'of the units, of the same length very nearly indeed, 'as inches, call them by what name you may, must be

'respectively 25 and 50; for the latter number was 'shown (p. 172), to enumerate correctly the courses 'of masonry reaching up to the floor of the King's 'chamber, from the Pyramid's base; and now it will 'be proved, that the number of courses reaching 'from the same plane to the floor of the Queen's 'chamber, is apparently 25.'

As no such connexion has been detected, or even imagined, hitherto by any known author, and the data are still very scanty,—we will try to lay them in all their scantiness and weakness before the reader, that he may not be misled by mere assertion.

First of all, then, for the height of the upper surface of the twenty-fifth course of masonry of the Great Pyramid above the pavement,—we have the following authorities from our vol. ii. sect. i. and v.:—

		British inches.
MM. Jomard and Cecile,	in 1800 A.D., . .	= 859
MM. Le Père and Coutelle,	,, 1801 ,, . .	= 877
C. Piazzi Smyth,	,, 1865 ,, . .	= 869
Messrs. Aiton and Inglis,	,, 1865 ,, . .	= 858
Mean height of twenty-fifth course,	. .	= 866

Colonel Howard Vyse and Mr. Perring do not seem to have made these necessary measures of every building-course of stones in the Pyramid,[1] imagining probably, and with most persons, that there was nothing, in their dimensions, accurate or intended beforehand; but they fortunately did their best to measure the next element which we require, or the height of the floor of Queen's chamber above

[1] See Vyse's *Pyramids of Gizeh*, vol. ii. p. 110.

the Pyramid's base. There, other authorities are more rare; neither is it easy to perceive how to proceed, with what those few have given us. For, to what part of the Queen's chamber ought we, in due architectural propriety, to make the hypsometric reference? Not to the present floor, which has been already shown to be a mere excavated hole, or unfinished pit; and not to the roof of the apartment, because that was not the portion of the King's chamber to which we referred, when investigating there for a similar commensurability with another masonry course. But we referred, then, to that room's *coffer-bearing* floor, which is very notably 42 inches below the ceiling of its entrance passage. And as the ceiling of the entrance passage to the Queen's chamber is likewise an accurately formed feature,—we take 42 inches below that, and then find the horizontal plane there, to be vertically above the Pyramid pavement, according to

		British inches.
Howard Vyse and Perring, ...	=	833
And Aiton and Inglis, ...	=	894
Mean,		864

or much closer to the height of the twenty-fifth course, than any one could have expected from the roughness of the measures employed; and showing too, without the smallest doubt, that that course is contained *within* the uncertainties of the floor as dependent on modern measure to prove either its present existence, or ancient structural intention.

Now, this is in itself a very noteworthy circumstance connected with the question of 'design;' for whereas the Pyramid courses, on the whole, decrease in thickness as they ascend (from 58 to 26 inches, says Colonel Howard Vyse approximately), and the King's chamber floor is as much vertically above the Queen's chamber floor, as this is above the Pyramid base, according to the same authority,—evidently that coincidence of both the fiftieth and the twenty-fifth courses with these chambers respectively, could not have taken place if such decrease of course-thickness had been perfectly regular. For in that case, if 50 had reached the King's floor, less than 25 would have reached the Queen's, or if 25 had touched the Queen's, a greater number than 50 would have been required to attain the King's floor.

But here we may see the effect of that remarkable increase in the thicknesses of the courses, which takes place between the 25th and 50th, as well as the over-rapid rate of diminution from the foundation courses upwards until the above correction is interposed; and which correction any good photograph of the Pyramid will show. Show it, too, not beginning or terminating with either of these courses, for that might have revealed the secret too easily; but occurring sufficiently within their limits, to prevent more than 50 being required to step up to the chamber of the standard of 50 inches,—after 25 had successfully marked a similarly placed floor in the chamber of the standard of 25 inches.

Hence the proportions and arrangements of parts we have been enabled to describe in the Queen's chamber,—not only indicating a week like the week of the Hebrews, of six ordinary days and a sabbath day,—but connecting it with the sacred standard of length of the Hebrews, or 25 inches; or again, the one-ten-millionth of the earth's semi-axis of rotation, —are also connected with the finest and best, largest and most pervading structural features of the whole Pyramid; so that they could have been introduced at no other period than that of the very building of the entire monument, and by no other man than the original architect himself.

If, therefore, for the further elucidation of the general question of the sabbatical week,—of such infinite importance to mankind,—we should desire to find the *date* of its symbolization in this remarkable chamber of the Pyramid,—we are thrown back on the larger, and more general, question of, 'What 'is the date of the building of the Great Pyramid 'itself?' And here the authorities to be consulted are numerous.

DATE OF THE GREAT PYRAMID.

Without at this point going very particularly into minutiæ or reasons, there is no difficulty in gathering that the general progress of literary inquiry during the last fifty years has been to increase the received antiquity of the Great Pyramid.[1] Thus, in and

[1] One exception, indeed, does exist in the *Historical Survey of the*

about A.D. 1817, the date of 1800 B.C. was frequently quoted for the building of that Pyramid; but in Sir Gardner Wilkinson's *Ancient Egyptians*, published in A.D. 1837, the period is extended to between 2083 B.C. and 2123 B.C.; and in the same author's subsequent Murray's *Handbook to Egypt*, in A.D. 1858, the date is raised to 2400 B.C.

This increase is, however, only a moderate portion of what had then grown with the times, and which our truly sage British Egyptologist resisted admitting to its full extent; notwithstanding, too, that the researches of the most learned German philosophers, with the indescribable prestige in this country in favour of everything German, had been mainly instrumental in bringing about the new idea. Thus, the renowned Chevalier Bunsen,—the authorized English translation of whose great work on Egypt began in 1848 and ended in 1860,—gives for the date in question, and with the utmost confidence, the year 3280 B.C.; while the equally learned, and

Astronomy of the Ancients, by the late Right Hon. Sir George Cornewall Lewis in 1862, and a most melancholy affair it is; for, persisting in looking at all things in the world merely through ancient Greek classical authors, and employing himself in writing privately on astronomy, instead of perfecting the establishment and developing the powers of a Royal Astronomical Observatory placed officially under his charge, he concludes that there are no authentic accounts of anything earlier amongst men than the era of the Olympiads, or 772 B.C. (p. 433); and that 'it is difficult to fix any event resting on a certain tradition which 'can be carried up to so high a date.' But on page 440, he consents to name 1012 B.C. as the higher limit of all possible dates for building, either the Pyramids of Egypt or any other of the monuments 'extant 'in the time of Herodotus.' Neither does he think (p. 445), that the whole world has a much higher antiquity.

perhaps still more practically experienced in Egyptology, MM. Brugsch and Lepsius, are understood to incline in their different publications between 3100 and 3500 B.C. More recently still, these views have been enlarged by Mariette Bey; and have found a most eloquent exponent in his original countryman, M. Ernest Renan, who has a communication on the subject in the *Revue des Deux Mondes* for April 1865, and insists on a date of at least 4500 B.C.; while Hekekyan Bey, from a different source, and publishing in London in 1863, states, on page 15 of his erudite and severe work, that the Pyramid of Soris (Osiris) and Suphis dates in B.C. 4863.

All these conflicting determinations are claimed by their authors to be based upon, or at least confirmed by, 'the monuments;' treated in most cases from a hieroglyphic, but in the last from a hydraulic, point of view. Astronomy has also been tried, and with the following results:—

In 1839 A.D., Colonel Howard Vyse communicated[1] to Sir John Herschel his principal measures of the Pyramid, besides some very crude remarks by previous explorers in 1817 A.D., as to their having seen the present Pole-star, *a* Ursæ minoris, by looking at night 'near the period of its culminating,'[2] out of the inclined entrance passage of the Great Pyramid. This statement approached particulars a little more than that of M. Jomard; who, in the

[1] Volume ii. of his *Pyramids of Gizeh*, pp. 105-109.

[2] We hope that these gentlemen meant the *lower* culmination.

great French work,[1] speaks in rather a mystic way 'of the Pyramids having preserved the inappreciable 'notion of the invariability of the celestial pole;' and was more advanced, because the said entrance passage does not point to the place of the pole at all, but to a distance of more than 3° therefrom! Yet the passage, being in the plane of the meridian, there may possibly be some allusion contained *to the meridian transit of a circumpolar star, with a particular north polar distance at the epoch.* Such a phenomenon, however, is by no means, as the explorers of 1817 A.D. appear to have thought, invariable; but alters so unceasingly, and through such large extents, with time,—*i.e.*, the polar distance does, at which any given star will in successive ages cross the meridian,—that, as Sir John Herschel had to explain, the present Pole-star could not by any possibility, or at any part of its diurnal circle, have been seen out of the tubular entrance passage of the Great Pyramid, either at or anywhere near the reputed date of its building; for the star was then so far from being circumpolar, as to be at the large distance of nearly 24° from the pole.

But what time, in that case, did this eminent astronomer take as the date of the building?

He seems to have assumed, that 'the supposed 'date' of the literary world in the year 1839 A.D., or the epoch of 2123 B.C., was *likely* to be true; and then, for the facilities of computation, took four thousand

[1] *Antiquités Mémoires*, p. 531.

years back from 1839 A.D., and computed for 2161 B.C.,—what large star, if any, fit to be a polar star of reference for the naked eye, was at that particular distance from the pole, which would have enabled it to be seen both at its transit of the meridian beneath the pole, and under an angle of altitude at the Pyramid, equal to 26° 41′—viz., the angle of the entrance passage according to Colonel Howard Vyse. On solving the problem, Sir John Herschel found,—assuming the latitude of the Pyramid at 30°,—that, at the date in question, the star *a* Draconis was in the required position within some 28′; or close enough, in his very competent opinion, to settle that *a* Draconis was the Pole-star of the Pyramid building day, and of the northern hemisphere of the world, in and about the year 2161 B.C.

This was a most original contribution, and a splendid advance on the style of Pyramid investigation then in vogue; and inasmuch as the date produced, agreed to a handful of years with the approved literary dates of the time,—the question was considered by most men as finally settled. But when, after a few years, the literary dates, under the influence of German scholarship, again rose in amount, and attained 3200 and 3500 B.C.—the *a* Draconis view dropped out of sight, with any or all men aiming at a 'scholarly reputation;' and at last the Egyptian astronomer, Mahmoud Bey, appeared on the scene, and by means of a theoretical reference of the Pyramid's southern face to the star Sirius,—a

reference conceived in his mind on a particular night during the spring of the year 1862 A.D.,—deduced thence an astronomical date of 3303 B.C. as that of the building of the Great Pyramid.

Astronomy seemed thus as ready to confirm the new literature, when produced, as it had been to side with the old; and with regard to the 2200 (nearly) date of Sir John Herschel's reference, it might be remarked,—though we are not aware that it has been as yet in print, to assist Mahmoud Bey's and Chevalier Bunsen's side of the question,—that, if the course of *a* Draconis under the influence of precession be traced a little further back in point of time, the star will be found to have reached its closest position to the pole—almost at the pole itself—in 2800 B.C. roughly; and would again have reached some 3° or 4° therefrom, or be seen at such a height above the horizon as to have its lower culmination in the direction of the entrance passage of the Great Pyramid, in the year 3400 B.C. nearly.

In this manner, too compliant with the received human authority, astronomy received another short meed of praise for its new agreement with the hierologist's conclusions; and was then betrayed irretrievably when their literary dates were presently taken up higher again, or to 4500 and 4700 B.C.,—with indications too, from M. Renan, that they will shortly be elevated higher still.

Now this is not the usual position which modern astronomy has occupied in questions of chronology;

and as its failure is due to no real weakness of its own, but rather to imperfect knowledge of the Pyramid forms to which its doctrines have been applied,—it is incumbent upon us to inquire into the matter rather closely; and ascertain, if we can, whether the Pyramid is really capable of giving out determinate, or only indeterminate, answers as to the length of time it has stood upon the surface of the earth.

First, then, let us inquire—

Whether the Great Pyramid is to be regarded as astronomical at all?

Before we can expect to make any advance in this question, we must free ourselves of all mere vague and inferential hypotheses about the Pyramid; and attend more minutely than has been the practice hitherto, to the actual measured and measurable facts still existing upon, or within it.

Quite aware that he had not put out his whole strength on the occasion, the greatest astronomer who has yet taken up the question, wrote, in 1839 A.D.,—that his calculation of a star angle for the Pyramid, might nevertheless 'be considered quite 'equal, in point of precision, to any direct observa-'tion, that an Egyptian astronomer of that date '(2161 B.C.) could have made;' and in 1849 A.D., publishing on the subject again, after additionally attending to the physical astronomy concerned, the same great authority changed his computed angle

from 27° 9′ to 26° 16′. But that amount of difference, though nearly a whole degree, must still have been thought, rather complacently by its author, to be quite small in comparison to the average error of observation of an 'Egyptian astronomer of the 'period;' because, in seeking for a Pyramid-passage observed angle wherewith to compare his anew computed angle for the Great Pyramid,—the modern physicist, in his book referred to, takes a mean indifferently between angles obtained from *many Pyramids*, and varying from 25° 55′ to 28° 0′.

Now this constitutes towards the Great Pyramid, a strangely unjust procedure; for it overlooks all that building's superior workmanship—so far in advance of what obtains amongst the rest of the Pyramids; and all the *closeness* with which—after employing painful, laborious, and enduring methods of construction—its *three* inclined passages were made to agree with each other. 250 years ago Kepler declared, that if he could only be certain of Tycho's observations within 8′, he would thereby be able to alter the whole theory of the planetary motions; and he did thereupon succeed in demonstrating, that circular eccentrics were erroneous, and ellipses sensibly true. But what would be thought of any one testing Kepler's triumphant conclusion, by swamping Tycho's observations with others recorded so very badly, as to be seldom within several degrees of the truth!

Yet this is, in effect, what men have been doing

for years at the Great Pyramid. Allowing their prejudices to lead them,—indulging preconceived notions of what an infantine approach only, towards accuracy, could have been made by an *ancient Egyptian astronomer;* and then, forming a resolve not to condescend very far towards such a mere beginner in the first rudiments of the art.

But there is so little known now, of what was practised either by Egyptian, or any other class of men four thousand years ago, or whether an Egyptian astronomer was concerned in the matter at all,—that such prejudices ought not to prevent us from taking account of ancient facts still existing, when they present themselves in a clear manner and measurable shape. And amongst many facts of this order, are the now undeniable ones, that the Great Pyramid has totally different proportions and arrangements from any other known Pyramid ; and is no more to be made answerable for their imperfections, than Newton's *Principia* for *Zadkiel's Almanac.* Wherefore, the angle of the Great Pyramid's entrance passage *we* will take only from observations made upon itself; and we shall then find it something capable of being defined within a very few minutes ; or, taking the measures of all the instruments employed into account, within a few seconds.

These several angles, and their closeness to each other, as given at length in vol. ii. pp. 144-161, and vol. iii. p. 39, are capable of mechanical testing at any time ; but the main point of difficulty that next

arises, is,—where exists any proof of these angles having had *an astronomical intention?*

That the sides of the Pyramid are duly oriented and the entrance passage is in the plane of the meridian, are much towards that end (see vol. ii. p. 194, and vol. iii. p. 109),—has been already accepted, as we have seen, by so eminent a philosopher as Sir John Herschel, and many others. But the hierologists are even now rising up once more to claim the passage as a mere slope necessary for the introduction of a sarcophagus; and ask also, 'What 'purpose in astronomical observation could be sub-'served by a passage which, though looking towards 'a Pole-star, was blocked up with stone as soon as 'the building was complete?'

The first objection appears to us of little force, seeing that large tombs near the Pyramid accomplish the same purpose for their sarcophagi, by means of sometimes vertical, and sometimes horizontal, shafts and passages. But the second, is a feature not yet sufficiently noticed among most Pyramid theorists; who, finding the entrance passage open now, are too much disposed to think it was always so, and must therefore have been *intended* to be used as a telescope; or a means of observing stars by day-light,—as the fable reports them to be so observable from the bottom of a well: while another theorist of a different order, inquires, with deep-felt emotion, whether the intention was not rather 'the levelling 'a tube at Draco?'

We cannot, however, too fully realize to ourselves, that when the Pyramid builders left the Great Pyramid, its entrance passage was filled up all the way with long blocks of stone, and the outward termination of it concealed in the masonry of the casing. Hence, it could not possibly have been intended for observing astronomy; *i.e.*, the entrance passage could not have been intended to be used, after its construction, for an observatory. Why, then, may be reasonably asked, was so much trouble taken in placing it both in the plane of the astronomical meridian, and at a particular and precise angle of elevation therein?

To this we answer, suitably with all the metrological features of the Pyramid we have yet come upon, 'for the purposes of *symbolical* astronomy; 'for memorializing, by lines, angles, and positions, 'sundry facts in astronomy ascertained previously 'or otherwise,—but necessary to be marked there, 'and rendered readable in after ages, in order to 'carry out the full system of standards originally 'intended. Such a system requires time-measures 'on the large scale, as well as the small, and 'references to star directions are the only means of 'indicating long periods of time with certainty.' Such a destination, then, completely gets over the difficulty of the passage either having been once used for lowering a sarcophagus, if the hierologists will; or having afterwards been built up with solid blocks,—for when these are withdrawn, as they are

now, the passage is again available for its originally intended purpose, if men are only able to read it aright. And we may even add the further confirmation, seeing that John Taylor's theory extended, has already explained so many of the angles of the Great Pyramid with a correctness of a few seconds, —that its expressive lines (see Plate VI.), while they acknowledge that the actual building shows only one, of the two daily meridian transits of a Pole-star particularly marked,—yet accounts for, or shows the direction of the other transit, and the place of the pole as well.

Hence, we conclude the character of the astronomy of the Pyramid, to be *symbolical* only ; and in this view proceed to discuss some existing interpretations.

Siriadic Theory of Mahmoud Bey.

This theory takes for granted, and is founded altogether on the assumption of, such a symbolical character as that just described, and nothing beyond it, belonging to the astronomy of the Great Pyramid ; yet is remarkable for making no mention of *a* Draconis, or the entrance passage, or Sir John Herschel, or any thing or person whence we have drawn our chief ideas and views.

All the European friends of the ancient name, and warm-hearted promoters of the modern resuscitation of the kingdom, of old Egypt, must have been affected most agreeably to hear of a new astronomical

theory on the age and objects of the Pyramids, being produced in these days by a native astronomer of the Siriadic land; and they will be equally delighted to find, that in the department of calculation, a full mastery is shown of the best French methods, and a skill that would have adorned a memoir from any countryman whatever. But there is also, unfortunately, a more striking omission still, than any we have above alluded to, and one rather damaging to the author's credit in several ways; for, with one small exception,—and which rather makes the matter worse,—not only is there no mention of any British traveller connected with either the history, measurement, or calculation of the Pyramid, from one end of the pamphlet to the other,—but the name and labours of even Colonel Howard Vyse, have not the least mention, or acknowledgment, though they really outweigh those of all other travellers, and natives too, put together, for sound and extensive numerical data.

Howard Vyse, as most of the world knows, was at the Pyramid for seven months, working hard with several hundred assistants; while Mahmoud Bey was there in the year 1862, the date of his paper, only four days with two friends. Hence his measures are merely a few of the outside of the Pyramid, and when he requires some from the other Pyramids he has to refer to Colonel Howard Vyse's measures after all; but in place of taking them from him directly, with acknowledgment of his

name, which is indeed still in the mouths of all the Arabs about the Pyramid hill,—he, the Bey, takes the Colonel's numbers, from Chevalier Bunsen's copy of them, mentioning only his, Bunsen's name, as though he were the original authority. All this strange proceeding too, is not for the purpose of attaining in 1862 greater accuracy than Howard Vyse reached in 1837 ; for whereas *he* attained the close limits of 2′ of error for his angles of the casing of the Great Pyramid—Mahmoud Bey is content to employ in computation an angle for the same, nearly *three-quarters of a degree* different from his own observed, and more than half a degree different from the true, angle. While finally, the Bey more unhappily concludes his omissions of Howard Vyse's name for what he did do, by bringing it in, as '*le* '*Général Wyse*,' for what he did not do, and would have been rather scandalized at its being attributed to him, viz., confirming Bunsen's literary date of 3310 B.C., as that of the termination of the fourth dynasty.

Thus faults there are of commission, as well as omission, in this otherwise very creditable Egyptian pamphlet ;[1] but faults which, depending as they do more upon the tastes, predilections, and perhaps patriotic fancies, rather mistakenly interpreted, of the author,—he has the means of rectifying when-

[1] *L'Age et le But des Pyramides lus dans Sirius.* Par Mahmoud Bey. Alexandria, 1865 A.D. ; reprinted from the Bulletins of the Royal Academy of Belgium, vol. xiv. 2d series, pp. 171.

ever he chooses; and will doubtless do so in his next publication.

Having now performed all this part of the duty which a simple sense of common justice requires, we can turn calmly and kindly too, to consider the Bey's Pyramid theory on its own merits; and the statement of it appears to be as follows.

The star Sirius, Soth, or Sothis, the great Dog-star, says Mahmoud Bey, was the god of the dead with the old Egyptians; and his hieroglyph was a triangle or pyramid, a star, and a crescent. Whereupon he, the Bey, proposes,—that the Great Pyramid was constructed with its southern face,—placed too, as he is most glad to show, very exactly towards the astronomical south,—at such an angle of elevation, that the supposed beneficent rays of the star Sirius should shine down on it, at the moment of the star's culmination in the sky, at right angles to the plane of the surface of masonry; and therefore in the most powerful direction, he thinks, to transfuse all the substance of the Pyramid; and, through its solid substance, about 200 feet thick near that part, reach and affect favourably the mummied corpse of the monarch, reposing in his sarcophagus in the dark and mysterious King's chamber near the centre of the building.

As an actual effect, the amount of such favour must evidently be rather homœopathic; but with that, perhaps, we have nothing to do, the present

occasion being only with the Pyramid as a scientific monument of geometrical design; and our business, merely to see if the above theory is proved by measurable facts; for we need hardly repeat, that the theory is purely the thought of Mahmoud Bey's own mind, and can only be received as one expressing also what were the thoughts of the Pyramid builders, according to the proof it may receive from the monument itself.

At present, Sirius, when on the meridian, does not shine down directly, or at right angles to the southern face of the Pyramid, being some 6° too high; but as precessional movement is concerned there, we may compute back, and find when the star was at precisely the required height; and that being done, the calculation brings out, according to Mahmoud Bey, the year 3303 B.C. nearly. Nor need there be any doubt about this result being fairly close to the truth; for the Egyptian astronomer's mode of treating the case is such as to do great credit to his former scientific training at the Imperial Observatory of Paris, not only by his readiness to make practical use of a formula by La Place, but his consideration of the vexed question of the proper motion of the star; bringing out, indeed, the very remarkable result, that that anomalous movement of Sirius in declination during the last five thousand years has been, probably, to the extent of 3°,—or nearly one-third of its ultimate amount of precessional displacement. Likewise does the Bey demonstrate

that the *variations* of the proper motion within moderate periods of time have been so marked, and with a tendency to show in past days a greater amount of annual proper motion still,—that it is rather hazardous to fix on what precisely may have been the mean quantity of this anomaly during several thousand years elapsed.[1]

In fact, Sirius is a dreadfully bad star to try to fix an ancient date by; and there is perhaps hardly a worse through all the extent of the sky. An orb it is to wonder and gaze at for its brilliancy; but what with its recently detected orbital movements round some dark body unknown, or preternaturally dark, if it is known, in addition to all we have previously stated concerning its proper motion, —its place cannot be computed back for long periods of time with anything approaching to the ordinary accuracy connected with what, by comparison with it, may well be called 'the fixed stars.'

Still, such as it is, Mahmoud Bey computes that about the year 3303 B.C., more or less, Sirius, when on the meridian, must have been in a rectangular direction from the southern face of the Great Pyramid. But he wisely allows that that, by itself,

[1] The following are some of the particulars :—

Declination of Sirius by modern observations in A.D. 1850,	$= -16° 13'$
,, by Mahmoud Bey's computation for B.C. 3250,	$= -25\ 23$
,, the same, corrected for a mean proper motion in declination of 2·2″ in the interval,	$= -22\ 20$
Observed proper motion in declination between 1750 A.D. and 1850 A.D., . . .	$= 1{\cdot}16''$

is no proof that the Pyramid was built either then or for that purpose; because an immense number of stars in the course of a night, and with the precessional effect of ages, may be seen for the moment of their culmination, at some date or another, in such a rectangular direction; and he adduces, as his only proofs of a cogent order, 1*st*, that the hieroglyphic of the star Sirius, has a *Pyramid* attached; and, 2*d*, that his Sirius date agrees with Bunsen's and Brugsch's dates, derived from other sources.

From a mechanical point of view, however, we are inclined to object—

First, that there is nothing visible about the south face of the Great Pyramid, to distinguish *Sirius* from all other stars near its extensive parallel; or, in fact, to show any exclusive and intended relationship between that side of the building and any star.

Second, The angle of the face of any Jeezeh Pyramid, was a much more exact matter than Mahmoud Bey seems to have been aware of; and that of the Great Pyramid was set to a very peculiar quantity,—the same, too, within a few seconds, on every one of its faces; but different by a large part of a degree from any other Pyramid. Now supposing for a moment, that the south face was set to its actual angle to suit the Bey's idea about Sirius in culminating,—why should great pains have been taken to set all the other faces exactly and scrupulously to the *same* angle; for, at the same angle *there*, or in those directions E., W., and N., they

could not have been equally adapted to receive the utmost transfusion of essence from one and the same star divinity, as that one shining down on the south side. John Taylor's theory, on the other hand, accounts for the angle of every side being similar, and gives an independent statement of what the angle should be, which agrees with fact as closely as the most refined observation can detect. The building is, in truth, excellently formed to demonstrate John Taylor's theory; but by no means of the shape, as a whole, to realize Mahmoud Bey's idea: for that would have been more promising if the south face had been rather concave; and the other three, so decidedly convex,—in order to throw off all other influence there,—that the Pyramid would not have been a pyramid at all, but a huge beehive form, with a large slice cut out of one side.

Third, Overlooking, for argument's sake, the opposition of the actual east, north, and west sides of any Pyramid to the southern star-view theory, and taking only the south side; granting also for the same purpose, that the slope there of any Pyramid was always arranged so as to be at right angles to Sirius when on the meridian at the time of the building,—then we ought to be able to fix the *relative* dates of different Pyramids from the differences of these southern angles. Now, in the case of the seventh, eighth, and ninth Pyramids of Jeezeh, both tradition, and their arrangement symmetrically about the base of the Great Pyramid,

have led almost all men to be confident that they were built subsequently to that mighty monument. Yet their angles being all 52° 10′, according to Howard Vyse, or 52° 13′ according to Mahmoud Bey, quoting through Bunsen,—while the angle of the Great Pyramid is 51° 51′,—that implies, on the Bey's theory, that the former were built in a previous age to the latter, instead of a subsequent one.

Fourth, the hieroglyphic of the star Sirius, is stated by Mahmoud Bey, to be 'a triangle or *face of* 'the *Pyramid*, a crescent, and a star,' thus But a Pyramid, in hieroglyphics, had a peculiar *base* attached to it, as see them in the titles of the Memphite Kings in our Plate XII. (photographed from Dr. Lepsius' *Königsbuch*.) See also p. 523 of Bunsen's *Egypt*, vol. i. The mere acute triangle above given, —a different sign altogether, and far too acute angled to stand for a side of the Great Pyramid,—is said by Bunsen, at his p. 534, to mean (except when employed for Soth), 'a pyramidal cake, a kind of food, 'ragout; and to represent the sound *sns*.'

Fifth, and last, we have to mention, that Mahmoud Bey's second supposed proof, viz., his astronomical date agreeing with the supposed true date of the Egyptologists,—is cut from under his feet by the further extension, since then, of precisely the same sort of Egyptological inquiries; for these — as effected by his adopted compatriot Mariette Bey in Egypt, and elaborated by M. Renan in France,— have shown, that on the same principles as Bunsen

extended the date of the Pyramid from 2100 B.C. to 3300 B.C., it should now—when the Museum of Boolak has become possessed of more inscribed stones, —be extended from 3300 B.C. to 4500 B.C., at least. In fact, the Siriadic theory is left without any support, and has its most serious refuters in Egypt itself.

a Draconis Theory of Sir John Herschel.

This theory recommends itself much more to the reason than that just described; because, in the first place,—it bases itself on one Pyramid passage or tube, looking in one direction only, and not on four broad surfaces looking in as many different directions, only one of which is made any use of; and in the second place,—because the direction in which it does look, being not only in the plane of the astronomical meridian, but close to the pole, appears thereby,—besides being astronomically inclined,—to pick out one particular star, out of all the sidereal heavens; or at least, to confine itself to a very small circumpolar region of the sky, where the number of large stars must always be extremely limited.

Hence Sir John Herschel, in selecting *a* Draconis as the star to which the Pyramid builders referred, had very few stars to choose amongst; and has happily selected the one and only star, both large enough to be reckoned a polar guide by primitive men, and which *could* have been in the prescribed position, or 3° 42′ from the northern pole, during all, or any of, the various dates that have been fixed

on by any one whatever, for the Great Pyramid's building. Thus there is every probability that *a* Draconis, as a particular star, was really made important use of, and much looked to, by the men of the Great Pyramid; and the only ultimate failure in the theoretical scheme is,—the uncertainty as to which of the *two* occasions of that star being 3° 42′ from the pole, viz., before or after, the star's closest appulse to that celestial pole, was *the* occasion intended to be typified. If the latter one was meant, the date must be not far from 2200 B.C.; and if the former, 3400 B.C., nearly: but nothing monumental, in the scientific way, has ever yet, so far as we are aware, been brought up to shed the smallest light on the difficulty.

Sir John Herschel's work, then, was excellent as a scientific performance so far as it went,—but it did not go far enough to reach firm standing-ground; and we have now to inquire at the Pyramid itself, whether there are any further data *there*, by means of which the balance of evidence may be turned to one or the other side; *i.e.*, to show whether the Pyramid was built at the last, or the last but one, occasion of *a* Draconis being 3° 42′ from the northern pole; and a difference of more than 1200 years waits upon the result.

Pyramid Data.

In taking up the Great Pyramid at this particular point, we must confess to have originally deduced

from, and now to add to, our measures,—a general belief in that building's excellent adaptation to its original purposes, whatever they were. Hence we have been more struck than most of our predecessors seem to have been, with this apparent anomaly,—viz., that if the meridian transit of a Pole-star, at a given polar distance, was the phenomenon to be commemorated in the building of the Great Pyramid,—why was *one* only of the two daily transits marked, and that one the *lower* and less important of the two?

We had, indeed, ourselves pointed out, in 1864, that the northern air-channel seems to be in the direction of the upper transit; but that air-channel is itself balanced by the southern one, and required therewith in a different problem; nor can it for a moment compare in mechanical importance with a passage like the entrance passage, large enough,—and indeed the only one in all the Pyramid,—for men to enter at. Wherefore the anomaly still remains, of the lower and inferior culmination of *α* Draconis having alone been signally marked; as if, to the builders, it had been vastly more important than the upper and more visible culmination!

Why this strange anomaly, or preference?

'For some good reason,' our respect for the long-buried architects suggested; and the following presently appeared the most weighty, as well as the most simple, reason that could be adduced,—'Because when that star was crossing the meridian

'below the pole, another and more important star 'was crossing the meridian above the pole; and it 'is not the manner of the Great Pyramid to wear 'its most vital signs "or meanings" in the most 'prominent and external situations.'

That was merely an hypothesis to be tested; and on trying by calculation what star or stars of chief importance crossed the meridian above the pole, and at any polar distance whatever, when *a* Draconis was crossing below at the 3400 B.C. period, with a polar distance of 3° 42′,—we could find none. But the moment we tried the same thing for its 2200 B.C. epoch, we alighted immediately on the Pleiades.

The Year of the Pleiades.

Now the group of stars variously known as the Pleiades, the Seven Stars, the Doves, Brood-hen, Gluck-henne, Hen and Chickens, Cabrillas, or Little Nanny-Goats, Peliads; in Hebrew, *Chima*, the Congregation of the Judge; in Arabic, *Wasat*, or the Centre; and in Latin, *Vergiliæ*, also with an allusion to a centre of turning,—are not only an interesting and pleasantly regarded cluster to all men in the present day, but were propitiously mentioned in the Bible as far back as the time of the patriarch Job. They were also, as recently shown by the learned researches of Mr. R. G. Haliburton,[1] very extensively referred to in the earliest of primeval times, as part of a traditional rule of chronology, bearing traces of

[1] Barrister of Halifax, Nova Scotia. See vol. ii. p. 370.

wisdom of so very elevated a character, as to demand at once both admiration and inquiry.

Mr. Haliburton's works, which have as yet only been printed privately in America, appear under the title of 'New Materials for the History of Man, 'derived from a Comparison of the Calendars and 'Festivals of Nations: No. 1, Festivals of the Dead' (extending to 104 closely printed pages); 'and 'No. 2, On the Astronomical Features in the Mosaic 'Cosmogony' (to 14 pages); and much is it to be hoped that their acute and persevering author will soon be prevailed on to print them in this country for the general public. (See also vol. ii. Section v., Letters of the Freemasons.) In the meanwhile, we may shortly state for him, that the result of his inquiries into the literature of many nations, and the traditions of most existing savage tribes,—has been to find traces amongst them all of their having once employed a common, universal, original system of chronology, based on the Pleiades, and in a manner equally simple and perfect. Thus, the year begins on that one night when 'the Pleiades are above,' or 'are most distinct,' or 'when most is seen of them,' or, in fact, *when they cross the meridian at midnight.*

Now this is a faultless principle of observation, that of a midnight noting of a star when at the culminating point of its celestial path; and one to which modern astronomy can add little else than merely some technical improvement of the means by which the principle is to be carried out; while, as a

working method through long periods of time, for determining the beginning of a new year,—it is not only capable within itself of the utmost precision, but has the same exactness after thousands of years, as after one year,—subject only to a small and very slowly increasing natural correction. Very different, therefore, is this, from the hopeless confusions of calendar which the more civilized nations of the world,—in its subsequent, but still early historical days,—were always floundering in,—from accumulations of the annual difference between the real length of the year and *their supposed* length of it.

Quite a large chapter in the history of the Chaldean, Egyptian, Greek, and Roman astronomy is it, the chronicling the successive approximations made by their astronomers as to the real length of the tropical year, and *their always being wrong.* This was because they never could conceive the idea of the real length being incommensurable in even terms of days ; so that, driven on by their own inventions, they assumed, say 360 days for the length of the year, and then went on counting their years by 360 days, until the difference between that and the true number, or 5·2422, etc., days, mounting up every year,—soon made a calendar that once began at seed-time, appear at length to be heralded in by autumn, or *vice versâ.* Then a new approximation was tried, which brought the calendar year somewhat closer to the natural one; until the Egyptians,—of a day long after that of the Great Pyramid,—seemed to

think they had attained the very height of all calendar regularity, when they made their theoretic year to consist of 365 days.

Yet even then, they had the confusion, that in the short space in the history of a great nation, of 1460 years, or really a little more,—the seasons of sowing and reaping, winter and summer, passed through every month of the year. The Egyptians tried indeed to make a glory of their error,—for that period of 1460 years, produced from supposing the fraction of a day to be a quarter of a day exactly, they converted into the mystical and highly lauded wisdom of their Sothic cycle. But a most confusing cycle it must have been; repeated itself in the duration of their monarchy more than once; and was endeavoured to be bolstered up, and its single years distinguished by a variety of complicated contrivances, such as the Phœnix cycle, Panegyrical Periods, the Triakontaeterides, etc., etc., which have occupied learned men during long ages, and in large books, to try to make either effective or clear.

'Did not the Egyptians then know of the simpler, 'better, and more efficacious Pleiades year?' is a question that may be asked. And the answer is, 'Yes, they knew of it, or had known of it once; 'for traces and allusions to it may be found in 'some of their religious rites, especially in the festi- 'val of the Isia; but these remembrances seem to 'have been involuntary on their part; for, in so far

'as they could, the Egyptians had cut themselves 'free from the Pleiades year, both as to the stars 'and the manner of making the observations,— 'binding themselves astronomical slaves for ever to 'Sirius Sothis, the great Dog-star, and his heliacal '*risings or settings.*' Hence our only hope of learning more, of what was in reality a pre-Egyptian institution, would seem to depend on searching the traditions of savage tribes; where, as Mr. Haliburton shows, knowledge is well-nigh absolutely stationary; and thereby reveals to us, in the present day, and equally whether amongst the Australians, Fijians, Mexicans, or Peruvians, that which was once communicated to them, and to all men, long before the days of the first known observations of Chaldean astronomers, or the first recorded thoughts of Phœnician sages; in a word, before any of the Eastern empires which have left any historical traces whatever behind them, had either waxed or waned.

The common possession of this Pleiades year by so many isolated and far removed races of mankind, is a sufficient proof that they did not receive it from any one or other of the great nations of antiquity, —the Egyptian, for instance,—exclusively; for they, the Egyptians, never had any dealings with Australians and Fijians. Besides which, both Egyptians, Greeks, Romans, and others such, in proportion as they advanced in civilisation, academical learning of their own, and national importance, invariably sophisticated down, or thinned away the original

Pleiades method, until hardly a trace remained amongst them, to communicate elsewhere if they would. Thus, not content with the beauty and power of the primitive maxim for observing a star on the meridian at midnight,—*they*, the said great heathen nations, must prefer to observe it when on the meridian at sunrise or sunset, though the twilight nearly rendered the faint stellar ray invisible; then, the star itself was to be observed at its rising or setting, with the vapours of the horizon added to the difficulties of twilight. And finally, the *ne plus ultra* of impossibility for an observer was fixed on, when the sages of the profane world had got to the furthest possible point from the spirit of the Pleiades method of old; and instead of fixing the beginning of the year when the sun was at the maximum of distance from the Pleiades, or when these were 'above' at midnight, and 'most distinct,'—they made it when the sun was *in* that group, or its constellation Taurus; *i.e.*, when the Pleiades were 'above' at *noonday*, or, not only not distinct, but absolutely invisible; and when no man could directly tell, during several months, whether the priests and the almanacs were right or wrong.

The Pleiades method having been thus reduced, in the temples of the most humanly advanced of the heathen nations, to something well-nigh futility,—the arena was considered open to new inventions; and then began those calendar methods already alluded to, according to imperfect human estimates

of the length of the year in terms of days, which occupied the learning of the classic world through all its history; exhausted its attention, and kept up its praises and admiration for man and his doings, —has led to dislocations of the calendar again and again, but with glory always to some new man for setting it right for a time,—given different reckonings to different nations at varying epochs,—and is untowardly felt, even in this present age of the world, in the shape of one European people, 'who 'possess the ninth part of the habitable globe,' counting their time differently by twelve whole days from all the rest of the civilized world.

Now the original method of the Pleiades would have saved mankind, if they had kept to it after receiving the gift, from all this confusion, intricacy, and waste of human energy; for it is, in its application, as universal as it is simple and effective; and can be observed and profited by, wherever man lives on the earth-surface. Not only too, does it enable the beginning of each year to be fixed; but, if well observed, it proves also what year, each year is, in a something which may be regarded as approaching to absolute chronology; or in a cycle of time, admirably definite, and so vast, that all the known period of man upon earth, has not yet run through one-fourth part of it; and the duration of any great nation, nay even the life of a distinct language, has in few cases yet amounted to the one-twelfth part.

Let us explain practically. The Pleiades, as stars, come, and as nearly intertropical stars come very notably and measurably, to the celestial meridian of any place 3m. 59s. sooner every night; therefore any one who can determine when it is midnight, and when these stars are on the meridian to the rude quantity of a minute, can determine on which night such a year begins. But a tolerable astronomer, even with moderate means, can, not only determine that phenomenon far more accurately, or to a single second,—but can measure the place of the star from a definite point, the vernal equinox, to a second of time also, or less; and the Pleiades increase their distance each year from that point by about 3·5 seconds, through means of the so-called precession of the equinoxes. Hence such astronomer can determine the place of his star on that line of its precessional motion, to an accuracy abundantly within the quantity of a year's movement; or, in other words, he can settle in which year's place the star is, and how many years have elapsed since the star left its celestial starting-point for measuring from, viz., the vernal equinox. And inasmuch as that grand effect on the places of the stars, the precession of the equinoxes, goes on so slowly, that a star does not travel through its whole precessional cycle, or begin to repeat itself therein until 25,868 years have passed by,—there has been no ambiguity as yet, since man began to chronicle

anything, as to which of its precessional rounds his celestial referring point is in.

This, then, is the chronological system of 'the 'year of the Pleiades,' as so admirably worked out by Mr. Haliburton from the traditions of all peoples and tongues; and shown by him to have been more perfectly followed in the ages *preceding* the rise of the great heathen civilisations, than *since*. But granting the correctness of all his eloquent deductions, our readers may ask, 'What are the proofs of 'that system having been appreciated or attended 'to by the builders, or rather the planners, of the 'Great Pyramid?'

The Pleiades and the Pyramid.

When used at any time, according to the above indications, by men concerned in metrological arrangements, there can be no doubt that the Pleiades must have been to them the most important star, or star-group, by far in the whole heavens. Many other stars may be infinitely more conspicuous, as indeed was Sirius the Dog-star, but its splendour could have been no more than idle tinsel, compared to the metrological aid furnished by the Pleiades under that system. Hence, granting for a moment a use of the system, we may be morally as well as scientifically certain, that for the sake of having the Pleiades commemorated on the meridian *above* the pole, *a* Draconis,—though otherwise, as for orienting the whole structure, a useful enough star,

—must be content to appear *below* the pole, if the two are to be observed together; especially seeing that at the hour when *a* Draconis was above the pole (the stars being supposed opposite in right ascension), the Pleiades must have been altogether invisible or apparently under the earth.

At present the two stars,—for it will be convenient to allude to the Pleiades as a single star, selecting for that purpose its principal component, *η* Tauri, whose Greek name *Alcyone*, when reduced to an Arabic root, signifies 'the centre,'[1]—at present we say the two stars are by no means exactly opposite, being nearly 30° distant therefrom. But neither is *a* Draconis *now* at the distance of 3° 42′ from the northern pole, but rather at something like 25°. Compute, however, the place of both stars back, as affected by precession, for every past century; and with every century earlier, *a* Draconis will be found nearer the north celestial pole, and *η* Tauri nearer to being opposite to *a* Draconis in right ascension; until, indeed, after retracing many centuries, you will find there is one, wherein, not only was *a* Draconis precisely 3° 42′ from the northern pole—but *η* Tauri was then also just twelve hours distant from *a* Draconis in right ascension; or, crossing the meridian above the pole, when the other star was doing the same below the pole.

The ingenious author of the article 'Egypt,' in the

[1] *Mazzaroth or the Constellations.* By the late Miss Rolleston. London: Rivingtons, Waterloo Place, 1862.

last edition of the *Encyclopædia Britannica*, does not scruple to say, p. 500, that Sir John Herschel's finding the entrance passage of the Great Pyramid at the time of its building pointed to *α* Draconis 'is not to be regarded as more than accidental;' and for this one reason only, that 'the entrance pas-'sages of Pyramids were always closed at the com-'pletion of the building.' Not only however have we removed that objection, by showing that the Great Pyramid is all along, in every one of its features, not an observatory for making new observations, but a place of deposit for remarkable standards of metrology previously in existence,—and requiring in astronomy, solely, that the phenomena of a particular epoch should be memorialized once and for ever,—not only have we thus shown the groundlessness of that objection upon our view of the case,—but now a new star, and the most important of all stars for metrology in the early primeval ages, is exhibited in precise angular coincidence with what was computed for *α* Draconis in combination with the entrance passage; rendering therefore the chances against the latter being an accident, perhaps seventy times more secure than before.

The Great Pyramid, however, does not leave the matter even in that very nearly established state only, but furnishes further data for conclusion and settlement, of the following order:—

First, for instance, we may now advantageously

take account of Lord Valentia's truly sage critique of nearly sixty years ago; when his Lordship asked, with all common sense on his side, 'Why, if in the 'opinion of all Egyptologists the Pyramids had been 'built solely to preserve the sarcophagi of buried 'monarchs safely, why did not the builders pull out 'all the fine white lining from the passages, and 'build up the long holes with ordinary masonry, 'like the rest of the mass; for then half the moun-'tain-like building, or more, would have had to be 'pulled down before the concealed central room 'would, or could, have been discovered; whereas 'now, with the fine and polished lining left in, 'whether the passage itself be internally stopped up 'or not, the line of it is clearly distinguishable, and 'conducts a depredator at once and inevitably to 'the very chamber where, on the burial hypothesis, 'he ought not to go?'

We thank his Lordship for the sensible idea; and can now suggest, that had the builders of the Great Pyramid obliterated its entrance passage in the effective manner proposed by Lord Valentia,—they would not only, in all human probability, have preserved the proposed sepulchral chamber from violation, which seems, from the whole of the facts now known, *not* to have been their purpose; but they would thereby just as certainly have deprived distant posterity of the required symbolical key, wherewith to unlock the secrets of the Great Pyramid's primeval chronology; and *that* they seemed to

have most positively desired, *should* one day be understood.

Secondly, as α Draconis,—recovered by Sir John Herschel, through means of the entrance passage being still visible,—may be regarded as the key, and the Pleiades, now found, as the lock,—let us see how the key works in the lock. Wherefore, compute the *absolute* right ascension of η Tauri, when it was at that peculiar *difference* of right ascension just described, or *opposite to α Draconis at the time of that star being* 3° 42′ *from the pole*, and what do we find? why, no less than this, that η Tauri was then at 0h. of right ascension, or in the equinoctial point itself, *i.e.*, at the necessary and essential starting-point and commencement of all reckonings by Pleiades years; in the very beginning, therefore, of the Pleiades chronology, and at the one epoch of all others during the last six thousand years, and many more too, when, if ever a monument was to be, or could be, appropriately erected to symbolize and commemorate the Pleiades calendar, it should have been erected.

Not only, too, was the epoch thus remarkable in pure astronomy, but in its applied form to agriculture and the general affairs of men, it was equally precise and noteworthy. For when the Pleiades and the equinoctial point were on the meridian together at midnight, then the primeval year began *coincidently with the autumnal equinox* of the northern hemisphere; and that autumn, as well as

that night became, agreeably with old tradition, 'the 'mother-night of the year.'

Again, Mr. Haliburton's researches have shown (vol. ii. pp. 372 to 438), that amongst most early nations there was a very wide-spread idea of connecting both the constellation *Taurus* and the *Pleiades* stars, with reminiscences of a saving from the Deluge and a beginning of 'sweet influences.' *Why* there was such a connexion, otherwise most inexplicable, the astronomy of the Great Pyramid seems to furnish a very tangible clue. For, though there was no particular *absolute* change among known stars about the epoch of the Deluge (for whose date see Division III. chap. viii.), yet, viewing them according to the peculiar and very accurate principles of Great Pyramid observation,—there was a Pyramidal *relative* alteration just then of the whole sidereal heavens; and with the effect, of even making the most positive antithesis between the normal constellations for chronological purposes, of antediluvian, on one side, and postdiluvian, times, on the other.

Compute, for instance, for the date of 3400 B.C., or any other certainly antediluvian time, what were the equatorial and zodiacal constellations on the meridian above, when *a* Draconis was on the meridian below, the pole,—and you will find them to be *Serpens*, *Ophiuchus*, and *Scorpio*. But as the year 2800 B.C. came on, a rapid displacement of those constellations began to be effected, amounting almost to a rushing round of the whole heavens (dependent

on the exaggerated effects of precession on *a* Draconis, then quite close to the pole of rotation of the sky). And when towards 2200 B.C., the extreme rapidity of that change had passed,—and the dangers of the Deluge also, according to the traditional chronology of every nation,—then, if you compute what constellation was above, when *a* Draconis was below, the Pole,—and in the direction of the entrance passage of the Pyramid—you will find, that all the former mentioned zodiacal stars are entirely departed from the visible hemisphere,—leaving Taurus dominant in their place, and the Pleiades exactly on the Meridian.

Hence, too, a chronological method for a stellar year, that formerly began in spring, would be changed almost suddenly into an autumn observation,—explaining further traditions. But let *us* continue to inquire more and more closely into all *our* necessary facts; and, first of all, into the calculation of the proper Pyramid sidereal coincidences, as yet only cursorily mentioned.

Great Pyramid Astronomy.

The general results of our observations in vol. ii., show decidedly that the Great Pyramid, though approaching closer to perfection than most persons had hitherto allowed, is yet by no means an absolutely perfect building; and has certain small probable errors of construction, partly perhaps induced from dilapidation-effects difficult to eliminate, but certainly existing in the present day.

In a similar manner, all the calculations which I am able at present to bring forward, for computing the places of the stars four thousand years ago, though agreeing in the general facts, have some variations. We must not, consequently, expect absolute agreement in the inquiry we are entering upon, but only a practical amount thereof; and then, we shall probably find observation closer together with theory, than different modern observers at the Pyramid have been hitherto with each other.

The circumstances of origin of these almost necessary errors, are not always easy to investigate; and would have been less so still, had not the two stars of Great Pyramid reference, viz., η Tauri and α Draconis, both been as it were so admirably selected in primal times from amongst all stars, for certain qualities of transcendent cosmical physics,—that they have hardly any proper motion at all sensible in the present state of astronomy; hence, full freedom with them, from all the worst of the drawbacks connected with trying to use the Sirius Sothis of Egyptian hierarchy, for any of the grander purposes of long chronology.

The first authority for the calculated places to be presented before our readers, is at least quite a disinterested one,—being a friend of Chevalier Bunsen, and his Pyramid date of 3280 B.C.; viz., the learned Professor Heiss, of Münster. This gentleman's testimony, moreover, was quite unintended; for he

had merely furnished to Bunsen's fourth volume of *Egypt's Place in Universal History*, two star-maps; one of them showing the precessional movement of the pole, and the other the precessional displacement of the equator of the sky, for several thousand years back; and both maps were actually constructed for the purpose of illustrating a point connected with *β Ursæ minoris*, as the probable Pole-star of the ancient Phœnicians. But, as the maps contain, besides many other stars, both *α* Draconis and *η* Tauri, we may as well ascertain what they say about them; and it seems to be as follows:—

1*st*, α Draconis was at 3° 42′ from north pole of sky in year 2071 B.C. nearly.
2*d*, α Draconis at above date, was not 12h. from η Tauri, but 11h. 23m.; and
3*d*, η Tauri, was at 0h. A.R., or in the meridian of the equinoctial point, in year 2100 B.C. nearly.

Hence, the first and third phenomena agree very fairly, but the second is largely in error; due, with little doubt, both to the necessary imperfection of small maps, and to these particular star places not having been expected to be called for.

In the second place, we submit two results by Sir John Herschel for *α* Draconis alone. These were both computed for Colonel Howard Vyse's value of the angle of the entrance passage, or 26° 41′, giving 3° 19′ of celestial polar distance. We have, therefore, reduced them to the later more correct determination of 26° 18′ for the mean passage angle, and 3° 42′ for the north polar dis-

tance, using an annual precession in north polar distance of 20″; and find,—

α Draconis at 3° 42′ from north pole, by computation of 1839 A.D. in 2011 B.C.; and
α Draconis at 3° 42′ from north pole, by computation of 1849 A.D., in 2158 B.C.

the last being preferred.

In the third place, we submit the results of a computation for each star in both elements, or right ascension and declination, by the formula contained on p. 19 of the Introduction to the British Association Catalogue, and applied to every hundred years;[1] whence it would seem,—

		B.C.
1*st*, α Draconis at 3° 42′ N.P.D., . . .	in year	2128
2*d*, α Draconis and η Tauri opposite, or 12 hours distant in right ascension,	„	1550
(And 12h. 15m. 30s. in 2100 B.C., α Draconis *following* η Tauri by that quantity); and		
3*d*, η Tauri, at 0h. A.R., ...	„	2228

Here the second item is still very discordant, and the first and third not so close as might have been desired; wherefore, we began to suspect the full applicability of the formula, to the very much greater lapse of time it is employed for here, than any which seem to have been contemplated by the worthy Francis Baily, to whose long and earnest labours the

[1] The formula being as follows:—

$$\Delta\alpha = m + n.\sin\alpha.\tan\delta.$$
$$\Delta\delta = n.\cos\alpha.$$

where $m = 46{\cdot}02824'' + y\ 0{\cdot}0003086450''$.
$n = 20{\cdot}06442'' - y\ 0{\cdot}0000970204''$.
α = Right ascension.
δ = Declination.

British Association owes the opportunity of appending its name to the best star-catalogue the world has yet seen. There is something too, even still, not quite so well understood about the numerical quantity of precession, as it should be; La Place having one annual value, and Bessel another, while an excellent author on physical astronomy printed, a few years ago, the prudent conclusion :—'This 'rate of motion, 50·2″ per annum for precession, is 'not perhaps sufficiently well determined to make 'it worth while to compute exactly the time in 'which the equinox describes the whole heavens, a 'period between twenty-five and twenty-six thou-'sand years.'

With reference also to some errors that had been previously committed in precessional computations, Sir John Herschel subjoins to Par. 319 of his *Outlines of Astronomy* the instructive note :—

'On this calculation the diminution of the ob-'liquity of the ecliptic in the four thousand years 'elapsed has no influence. That diminution arises 'from a change in the plane of the earth's *orbit*, and 'has nothing to do with the change in the position 'of its *axis*, as referred to the starry sphere.'

Now this paragraph is not a little interesting, as a reminder, and a timely one, of the extraordinary importance in celestial physics of the earth's axis of rotation; that axis which is already referred to at the Great Pyramid for the standard of linear measure, as well as for weight and capacity measure;

is typified statically, in the vertical height of the Pyramid; and as to its dynamics, in the base thereof. Most worthily too, for that axis of the earth's rotation, with its uniform rate of turning and power of keeping its own angular position (that is, of following its own laws of slow angular change such as precession, in defiance of other angular changes going on round about it on a vastly larger scale, as in the alteration of the plane of the enormous orbit carrying the earth itself round the Sun),—that axis of the earth's rotation, immaterial though, like the orbit, it be,—is endued with more power of permanency and constancy than any of the other movements or properties of the earth; and does directly govern both the polar distances of the stars, and all our ideas of, and means for, checking the uniformity of our first invaluable standard and unit of time.

Hence, as the fourth example, we exhibit the results of the computation of 50·211″ as a mean amount of annual precession for the whole period, supposed to be uninfluenced by any other changes, and then find for—

	B.C.
1*st*. α Draconis at 3° 42′ N.P.D., the date . . =	2170
2*d*. α Draconis and η Tauri, opposite in R.A.; first in 1797 B.C.; second in 2562 B.C.; Mean, . =	2180
(α Draconis following η Tauri at that mean date of 2180 B.C., by 12h. 5m. 28s.) and	
3*d*. η Tauri at 0 h. R.A. in date . . . . =	2176

The places of the stars in 1800 A.D., and between 2000 and 2300 B.C., being as follows :—

Date.	η Tauri or the Pleiades.		α Draconis.	
	Right Ascension.	Declination.	Right Ascension.	North Polar Distance.
	h. m. s.		h. m. s.	
1800 A.D.	3 35 37·9	23° 28′ 32″	13 58 58·5	24° 39′ 59″
2000 B.C.	0 8 59·6	5 22 32	12 12 20·9	4 38 35
2100 B.C.	0 3 52·2	4 49 14	12 8 34·5	4 5 18
2200 B.C.	23 58 45·1	4 15 55	12 4 25·8	3 32 0
2300 B.C.	23 53 28·2	3 42 36	11 59 42·8	2 58 41

Having thus exhibited without favour all the widest variations in results, of which the case seems well-nigh capable,—we may be pretty certain that the true date will ultimately prove to be contained within them; and will be found, if not actually 2170 B.C., at least closer thereto than the beginning or end of the duration of the Great Pyramid's building can be to its middle date.

Star-Maps, explanation of.

In Plates VII., VIII., and IX., the principal features connected with the astronomy of the Great Pyramid, are approximately represented in a graphical form.

PLATE VII.

Plate VII. is therefore a star-map, showing both the place of the pole of the ecliptic and its surrounding sky for a breadth of from 80° to 90°; near the middle of which space, the circle,—described under the influence of precession in 25,867 years approximately, by the celestial pole of rotation traversing round the pole of the ecliptic, or rather round its own mean position during the whole period,—is duly marked; together with the series of actual places successively occupied in that circle by the rotation-pole, at the end of every hundred years, continuously, from 4000 B.C. to 2000 A.D. of the Christian era.

This map is of course independent of the geographical position of the place of observation; and the cosmical accident may

be noticed with interest, that whereas the seven larger stars of the Great Bear are the most easily recognised group in the sky,—and two of the stars forming the preceding side of the square, so-called, in that group, serve as the popular 'pointers' to direct attention to, and enable beginners to recognise, the present polar star of the world, or α Ursæ Minoris,—so the two stars forming the opposite or following side of that square are the pointers, even more directly and immediately, to the ancient Pole-star of the world, or α Draconis.

This star will likewise be readily identified by being half-way between ζ Ursæ Majoris, and γ Ursæ Minoris; also, by having another star near it, in the same direction almost as ζ Ursæ Majoris on one side of it, has ε of the same constellation, and γ Ursæ Minoris on the other, has β of that constellation: so that α Draconis and its companion are the middle pair, of three parallel-placed pairs of stars, between the Greater and Smaller Bears.

Modern observations do not show any notable proper motion affecting the place of α Draconis; but there is a sensible fluctuation in its apparent brightness, making its limits of magnitude lie between the second and fourth, and in a period amounting very vaguely to some two or three hundred years; so that we are only enabled thereby to say, that at the period of the Great Pyramid's building, α Draconis *may* have been brighter than it is now, which is somewhere about, and probably rather below, the *third* magnitude, at which we have depicted it.

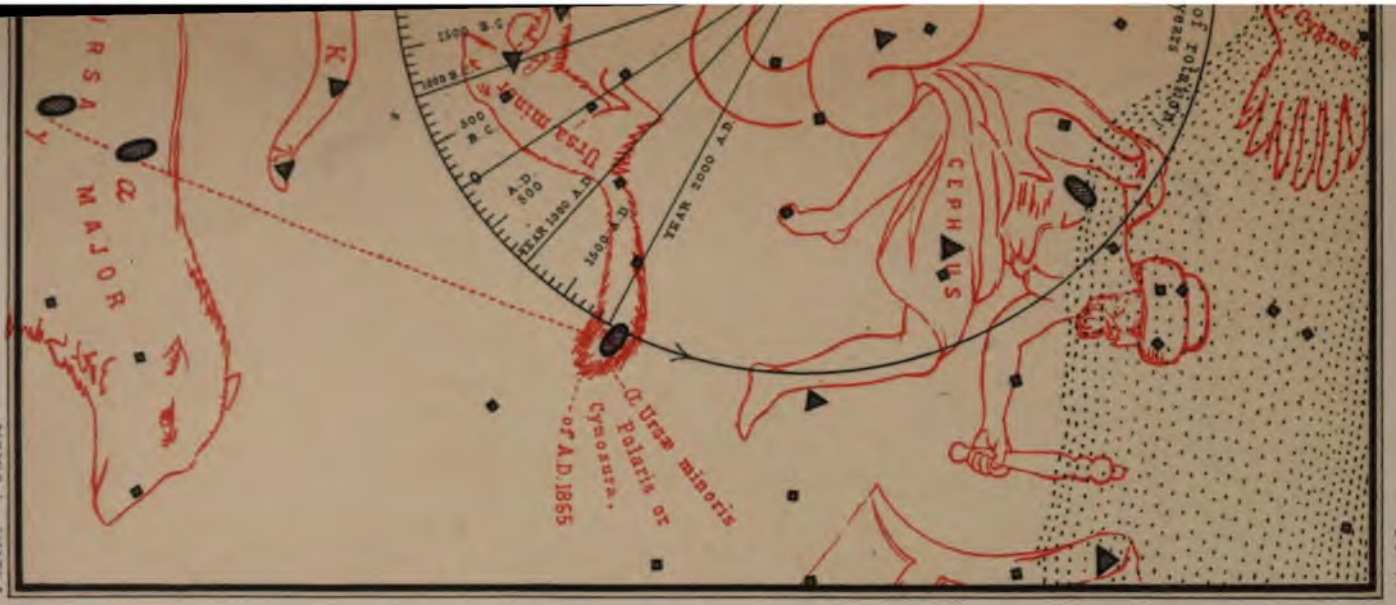
Plate viii.

Plate viii. is another star-map, but a local one; and representing on a smaller scale, both for the particular year 2170 B.C. and for the special latitude of the Great Pyramid, a meridional strip of the sky extending the whole distance from the southern horizon, through the zenith and to the northern horizon,—with a breadth of rather more than 40° on either side of the meridian. The meridian line, the prime-vertical, the equator, and the pole are indicated by black lines.

The stars represented in this definite space, are those which filled it at the moment when the Pleiades were crossing the meridian, at night,—say rather—as characterizing the season of the year, and a primitive observation for determining the beginning of the year—at midnight.

The map next shows, that the following further coincidences

α Lyræ
or Vega
LYRA
Precessional movement of
one revolution
HERCULES
BOOTES
Arcturus
α Draconis
Polar Star of 2170 B
YEAR 8000 B.C.

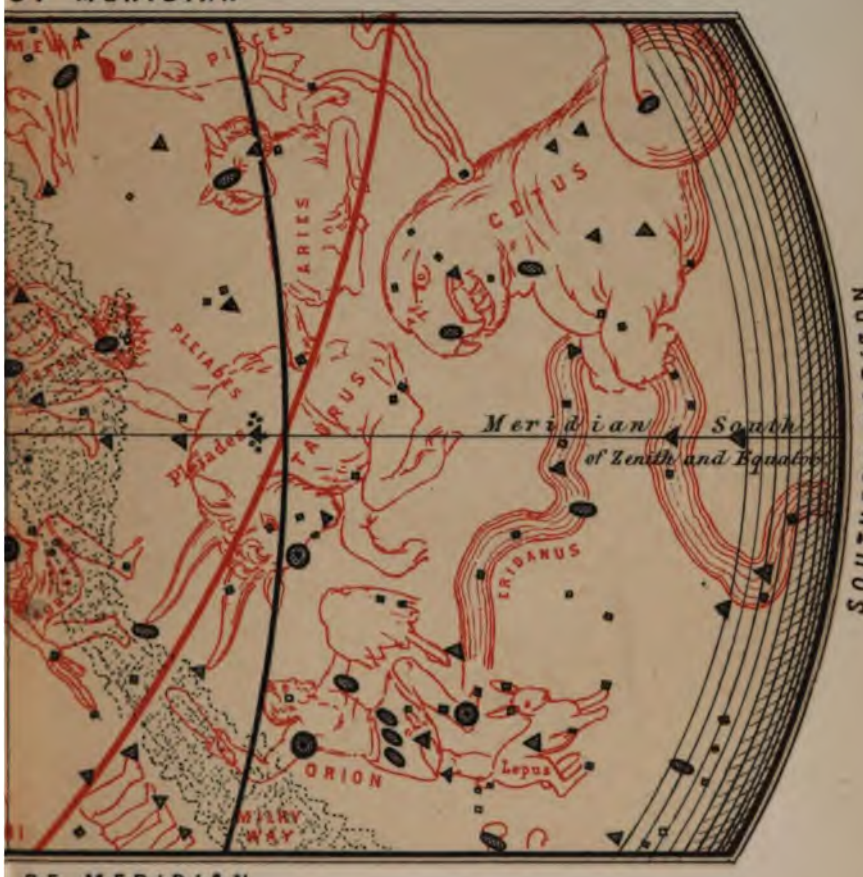


Star-map, representing the precessional movement of the Celestial Pole of rotation and especially marking it from the year 4000 B.C. to the year 2000 A.D.

Symbols adopted to represent the magnitudes or brightnesses of the stars, 1st ●; 2nd ⬬; 3rd ▲; 4th ▫.

Approximate star-map representing for the ye
the meridional appearance of the stars, at t
is crossing the Meridian below the Pole and th
the Pole, at midnight, and have the same Righ

Symbols adopted to express the magnitudes or bright



r 2170 B.C. and the Latitude of the Great Pyramid,
e instant when α Draconis (at 3.° 42′ N.P.Dist.)
s Pleiades (near the Equator) are crossing above
Ascension as the Equinoctial point.
uss of the stars; 1st. = ●; 2nd. = ●; 3rd. = ▲; 4th. = ■

W.H.M.c Farlane, Lith.r Edin.r

Approximate star-map representing, (for the y
the meridional appearance of the stars, at the
are crossing the Meridian at midnight, but whe
is on the Meridian, either above or below the P

Symbols adopted to express the magnitudes or brig

Pl. 9.

1883 A.D. and the Latitude of the Great Pyramid,)
stant when the Pleiades, (now near the Zenith),
neither α Draconis, nor any other circumpolar star

ss of the stars, 1st ●, 2nd ●, 3rd ▲, 4th ■.

must have occurred at that moment, and been peculiar to that date of 2170 B.C. :—

1*st*, The equinoctial point, or crossing of the equator and ecliptic; and

2*d*, The Pole-star, or α Draconis, must both have been on the meridian at the same instant, viz., the instant of the Pleiades also being on the meridian.

α Draconis was indeed *below the pole*, but that position, combined with its particular polar distance of 3° 42′ in 2170 B.C., gave it then to observers at Jeezeh, an angular altitude of 26° 18′; or practically the same as the entrance passage of the Great Pyramid, and therefore in so far connecting it therewith.

PLATE IX.

Plate IX. resembles Plate VIII. precisely, in so far as it is intended to show, for the latitude of the Great Pyramid, the appearance of the meridional portion of the starry heavens at night, just at the instant when the Pleiades are crossing the meridian; but the date, in place of being the long-past date of 2170 B.C., is now the future, or near-present one of 1883 A.D.

With this difference of date, 'precession,' not to say anything of 'proper motion,' accumulating through the long interval, has introduced many changes in the appearance of the usually reputed 'fixed stars;' as thus—

1*st*, The ecliptic no longer cuts the equator symmetrically in the same right ascension as the Pleiades.

2*d*, α Draconis is no longer on the meridian either above or below the pole; neither is it at 3° 42′ from the pole.

And 3*d*, No other circumpolar star is on the meridian either at that, or any other, north polar distance: so that the entrance passage of the Pyramid, in the *present* day, points at vacancy; but assists thereby in indicating the remarkable importance of the several consentaneous phenomena which are depicted in Plate VIII., as then, and then only, or in the year 2170 B.C., accompanying the meridian passage of the Pleiades.

The figures of the constellations which appear in red lines on each of these three Plates, VII., VIII., and IX., are chiefly introduced to render the stars more easily identifiable to readers in the present day; and not to indicate now, ideas supposed to have prevailed in the primeval world. But as the figures may prove to be a first step towards knowledge in that direction,—the subject will be alluded to again, with such a view, in Div. III. chapter ix.

Great Pyramid Attestations.

Just possible is it now, after having succeeded thus far, in showing astronomical agreements with Great Pyramid construction,—that the supporters of the elongated hierological dates of 3300 B.C., 3700 B.C., and 4500 B.C., etc. etc., may object, 'that any 'number of concurring astronomical phenomena, 'even though indicated in the lines of a building, 'and too numerous and exact to be attributed to 'accident, does not *prove the building to have been* 'erected at that date; for the lines might have been 'computed by theory for so many centuries back, 'or so many centuries forward, from the building 'date, when there was no such visible coincidence, 'or even any approximation to it in the sky.'

Such objection may be made, though with less and less force in proportion to the complication of the problem and the early age of its supposed numerical performance; but the most signal and unique answer that may be returned for the Great Pyramid, of all the monuments in the world, is this,—the Great Pyramid has a theory (John Taylor's developed), whereby its metrological features have been already abundantly illustrated, and especially the interwoven character of its time, and space, symbols. Now this theory, already honoured with success at many other points, indicates by its lines equally the position of the Great Pyramid *in time*, as *in space*, *i.e.*, in its latitude on the surface of the earth; and

we have visited the building in the spot where it actually stands, and found by measurement that it does sensibly, or to within a few seconds, fulfil the latitude, or space, requirement. Therefore it would seem, that the resulting conclusion should be in favour of a high probability, and something that *must* be admitted until more direct and positive evidence can be adduced on the opposite side,—that if we could by a miracle overtake the time that is passed, and revisit the Jeezeh hill at the date of 2170 B.C., as indicated by the theory, we should certainly find some part or other of the building then in progress; or in other words, the operation itself would be abundantly visible from that computed point of time,—even as the consequences of the operation are to be seen now, from the similarly computed point of space.

And now we come to some further constructive details in the building itself, which are well worth attending to. In Plate VI., the two culminations of the Pole-star, including the polar point, are symbolically indicated in the height of the northern end of the Grand Gallery, as seen from the centre of the base of the Pyramid; and having before remarked that the equatorial line of the sky, as seen from an important astronomical intersection of the base, enters the lower north end of the Grand Gallery,—we may presently add thereto, that the line of direction of the Pleiades, as seen in the year 2170

B.C., or 4° 22′ north declination, approximately strikes the middle height of the Grand Gallery from the same point; a symbolism which, combined with the seven overlappings, might well seem to bear out the ideas of those who have thought, for other reasons, that this slanting corridor was a part of the monument specially devoted to 'the seven stars.'

With our own more practical tastes, however, we rather incline to note the remarkable observing qualifications of the combination of a polar, with an equatorial, star. An astronomer of the present day desirous of obtaining time with the utmost accuracy, procures a transit-instrument, which contains in its collimation, the essence of a T-square,—or of the correct base of a square Pyramid; levels its axis, orients it by looking at the Pole-star when on the meridian; and then, and not till then, observes another star near the equator, to obtain the time by. Even thus does the Great Pyramid indicate that its fiducial lines were first oriented by *α* Draconis near the pole, and then the time obtained by the Pleiades; which group, though now upwards of 23° from the equator, was in the year 2170 B.C. only 4° 20′ therefrom, or, to all practical intents and purposes, formed a good equatorial 'clock star.' Thus *each* of the Pyramid stars had a special purpose to fulfil; and the astronomy of the Great Pyramid would not have been complete or capable of accuracy, symbolic only, or rather memorial though it be, without both of them being employed.

Neither, perhaps, would the Great Pyramid be thought fully furnished, unless, besides a system for minute accuracy in procuring time at the instant, some further and grander arrangements were made, capable of indicating the total length of the whole cycle, in terms of which such periodical time is to be chronicled,—viz., the full length of the 'Great 'Year' of the Pleiades. Now this is, and must evidently be, the period of the precession of the equinoxes; and we have just witnessed one prudent man of the present day declining to risk the computation of the exact length of the cycle,—so many are the minutely disturbing causes which may be brought to light in its course. Until recently, indeed, the published statements have been very various; or

25,816 years,	according to	. . .	Tycho,
25,920 ,,	,,	. . .	Ricciolus,
24,800 ,,	,,	. . .	Cassini,
and 25,740 ,,	,,	. . .	Bradley;

but now the number ascertained by Bessel, or 25,868 years, has most favour; and this must be our test,—because the best one available,—of whether the Great Pyramid speaks here also in terms of astronomical truth.

Much struck with having found inches in even hundreds when measuring the diagonals of the sockets (see vol. ii. p. 135), and connecting that with the length of 100 inches representing the time-unit of a day, when the perimeter of the whole Pyramid represents a year, or 100 inches × 365·242;

reflecting also on the extraordinary importance of diagonal equality to prove a square, and the probability of the symbol of the whole chronological system pervading the entire monument, if any part of it,—I computed the diagonals of the base of the Great Pyramid from the previously observed measures of the sides and angles contained; and then, allowing an inch for a year, the cycle of the Pleiades seemed to appear at once, in the sum of the two diagonals.

9140 British inches, we have elsewhere assumed as the most probable length of one side of the base; and that number being equal to 9131 Pyramid inches, yields, for the sum in question, 25,827 of the same inches. Or if, as we have also shown elsewhere, the base may for some purposes be measured, not on the upper, but the lower surface of the pavement, so as to give 9150 Pyramid inches in the side, the sum of the diagonals then amounts to 25,880 of the same units. The mean of the two, or 25,854, is certainly an amazingly close approach to the 25,868 of Bessel's cycle for precessional change, —or, as usually expressed, for the circle described *about* the pole of the ecliptic *by* the pole of the equator; but perhaps more correctly to be defined as the circle described by the pole of the equator, under the influence producing the precessional movement round its own mean position in space; for the rotation of the mass of the earth about its polar axis is *the* grand fact which rules everything

material, as well in all human astronomy as in the symbolisms of the Great Pyramid.

Conclusion of the Metrological Inquiry.

Let us pause now for a moment, and consider the stage we have reached in this progress of plain mechanical interpretation of the measured facts of the Great Pyramid.

A most comprehensive metrology arranged in five different branches, appears, indeed, to have been discovered, each of them imbued with characteristics of a most commendable, and even excelling, kind; but the objection may nevertheless, or rather on that very account, be raised,—and we beg to be excused for always relating most fully any or all serious objections whenever we hear of, or wherever we meet with, them,—for our prevailing desire is to afford our readers a full view of either side of the argument, as the only method of ultimately reaching the truth,—the objection, we say, *may* be taken that, *first*, the foundations of the units and standards concerned in that supposed metrology are vastly too high, or deep, or difficult in scientific investigation to have been arrived at by a primitive people; and, *second*, the units and standards themselves are in every case utterly diverse from the units and standards of the same branches of, or subjects in, metrology, as employed by the ancient Egyptians.

Now the reasons mentioned under these two heads are fairly stated by the objectors; and the latter one

especially, is most perfectly as well as pointedly true; and we would ourselves, previous to our experience of the Great Pyramid inquiry, have looked rather suspectingly on any book or person found either attributing to any ancient people a higher degree of acquaintance with astronomy and terrestrial physics than what is certainly known and generally practised in the present day,—or finding something amongst them totally alien to all their acknowledged manners and customs throughout their whole historical period. But any one so doing would be acting to a certain extent under the influence of prejudice in favour of what he knew, or supposed he knew, before; and would be only justified therein, if his old beliefs were established on very firm data, and the new ideas rested on no additional, or certain, or sufficiently numerous facts to allow of chance coincidences being eliminated, and something approaching to proof established.

So far, however, is the Great Pyramid from being in this latter questionable condition, that it possesses infinitely more facts capable of close and accurate measurement than does any other subject of equally long standing on the surface of the earth; and we have now before us a greater number of, and more refined observations as to, those facts than have ever been seen in print before. Hence we have considered ourselves not only allowed, but pre-eminently called on, to drop all past prejudices as to what early nations might be supposed able, or not able, to do; and try

what the measured features of the Great Pyramid, taken merely on their own inorganic merits, can say for themselves.

If, then, after having long followed this, in principle, unexceptionable course, certain all the while of the unrivalled closeness of our measures,—we find developed before our wondering gaze a consistent, continuous, and most philosophic system of metrology, explaining far more of the measurable lines and angles about the Great Pyramid, than any other theory has ever done or attempted to do,—what answer shall we return to the sweeping judgment enunciated by Chevalier Bunsen on p. 658 of vol. iv. of his *Egypt's Place in Universal History*, and religiously believed in, we are told, by a vast majority of the heads in the literary world,—a judgment pronounced, indeed, originally upon Sir John Herschel's and John Taylor's researches, but more applicable now, if at all, to our own? The words are, in the authorized London edition of 1860 A.D. :—

'The *groundlessness of the fancies* which have 'been again very recently indulged in about the 'astronomical purposes of the Pyramids, and about a 'hidden symbolical system of astronomy, is demon-'strated by that thorough conviction which is forced 'upon us by a view of the monuments and the 'reading of the hieroglyphics.'

The following is all the answer we propose—simply to examine the alleged demonstration of Chevalier Bunsen on the same principles we have

been testing the Great Pyramid by, or with little beyond plain common mechanical sense. On which understanding, let us inquire, first, what monuments these are, so undefiningly alluded to; and, second, what sort of a view of them is it which is required to be taken?

If a material view of any of the standing monuments of the land, we believe that Chevalier Bunsen was never in Egypt to enjoy that important and instructive sight; and if a literary view of them only, through the works of other men, what were the monuments viewed? For if they were not the Great Pyramid, they can hardly be received as being more weighty in a question of and about the Great Pyramid than the Great Pyramid itself! We fear, too, that the mention of 'the reading of the hiero-'glyphics' shows that the monuments which the scholarly Chevalier preferred for explaining the Great Pyramid by, were not even other Pyramids of any kind or degree, but merely small buildings or excavations, like the tombs—things of no sort of resemblance to the Great Pyramid, and not unfrequently of a very different age.

Chevalier Bunsen's knowledge of the Great Pyramid's wondrous mass of building, 'in number, 'weight, and measure,' appears to have been confined to his copyings from Howard Vyse, and to some unfortunately manipulated contributions by Mr. Perring; the Chevalier's statement, too, of these, is accompanied with so many slips or misrepresen-

tations of his own, that in the course of ten pages (155-165 of his vol. ii.) we have marked twenty notable errors of facts and features of mechanical construction.

We do not detail each and every one of these errors here, partly because to find out mistakes in a copyist when the original authority can be referred to, is rather supererogatory for the advancement of science; and partly because, in charity, we remember how very difficult it was in our first Pyramid book of 1864 to realize all the facts of the Pyramid, on other persons' mutually contradicting descriptions alone. But there is one of the faults of the eminent German author of too serious a nature, and too wilful on his part, to be passed over in silence, and it is this,—after having profited his own volumes most largely, both in the plates and descriptions from Howard Vyse's labours, Chevalier Bunsen indulges in successive ungenerous animadversions on the laborious and successful explorer he has been borrowing from. Thus, as one example, M. Bunsen tells his readers, in page 164 of his *Philosophy of History*, 'Vyse has made a collection of quotations 'from different travellers in the sixteenth and seven-'teenth centuries, to prove that Dr. Clarke (1801) 'did his countrymen an injustice by asserting that 'the sarcophagus was broken to pieces by English 'soldiers. The French *savants* merely remark that 'they did not find the lid.'

The first sentence of this extract gives to Colonel Howard Vyse rather a fool's errand to collect quotations of one and two centuries *earlier*, for the purpose of proving that the coffer had not been broken to pieces in 1801 (the occasion of English soldiers visiting the Great Pyramid), when he knew of his own observation in 1837, and all the world did too, that it, the coffer, was not 'broken in 'pieces' even then; but the Colonel is grievously misrepresented by the German philosopher. Dr. Clarke's charge was, see pp. 198 and 199 of volume v. of the fourth edition of his Travels, that the coffer 'was entire when our troops were landed in Egypt;' 'that they began, alas! the havoc of its demolition,' 'and left behind them a sad memorial of the British 'name; but only succeeded in accomplishing a 'fracture near one of the angles.' And to this charge, Colonel Howard Vyse, jealous of the honour of British soldiers under false accusation, showed most conclusively that they did not *begin* the first fractures of the coffer,—because French and Italian travellers of preceding centuries had recorded, and even gloried in recording, that they had broken off, and carried away small bits of it. In fact, Colonel Howard Vyse's note on the subject, at the foot of his 283d page, volume ii., is logical, moral, and eloquent. But what shall we say of the concluding sentence of Chevalier Bunsen's paragraph, already given, under any of these heads; for, as it stands there, it has no visible connexion with what precedes, and when we

refer to the Great Egyptian work for what the French *savants* did say, we find in a note to page 75 of *Antiquités, Description*, tom. ii., not the innocent phrase which Bunsen states is what they 'merely 'remarked,' but the following version of Dr. Clarke's erroneous charge;—'Since the French expedition, 'the sarcophagus has been broken, as they pretend, 'by English soldiers.' 'Depuis l'expédition Fran-'çaise le sarcophage a été brisé, à ce que l'on pré-'tend, par des soldats Anglais.'

Neither would the untenable nature of Chevalier Bunsen's paragraph have been explained, had more of his preceding matter been introduced, while some of his errors of another kind would have been thereby exhibited; for only six lines previously, he states that the coffer (sarcophagus) of the Great Pyramid, 'is somewhat shallower and shorter, than 'that of the second largest Pyramid.' Shorter it is, but not shallower; on the contrary, very considerably deeper, my measures, and Colonel Howard Vyse's, for the former vessel's depth, being 34·3 and 34·5, respectively; and for the latter's, 29·4 and 29·0 respectively: my own being expressly stated to exclude *the ledge* in both cases; that ledge, which, in the case of the Great Pyramid coffer, is so strange an omission on the part of the French *savants*, and which Chevalier Bunsen does not bring to light.

In fact, upon the proportions of the Great Pyramid, as printed by Chevalier Bunsen, in company with his frequent blunders,—we doubt whether any

metrological theory could be got to hold. But there is no proof yet, that he made even an attempt to see whether such a theory would hold on either his, or any one else's numbers; and he has therefore no right to issue *dicta*, controlling those who have, and to charge them before the world roundly and utterly with *indulging groundless fancies*.

Hence, there is not one measure of line or angle, and not a single description of material or mode of building about the Great Pyramid, that we have founded on in all the previous pages,—and laid the particulars of before our readers at length,—which need be altered to the smallest extent, at least on account of any of the sweeping judgments, or rather most '*groundless fancies*' and erroneous numbers contained in all Chevalier Bunsen's four large and very learned volumes.

Some small alterations in our final figures, we may have to introduce in future years (if we live to see them), when new, better, and completer observations than our own, shall have been made at the Great Pyramid; when the four sides of the base and the whole pavement surface shall have been cleared of rubbish; the portcullis pierced; the Grand Gallery compared with the Polar star; the air-channels opened; and the subterranean water-chamber reached. But in the meantime, we cannot, if we would, escape from the grand and accomplished fact, that a magnificent metrology, worthy of all

attention from scientific, commercial, and philosophic men, has been evolved from a sound method of treatment of all the best obtainable measures of the entire Great Pyramid, both inside and outside, up to the present instant. It is, in fact, the stones of the Pyramid, themselves 'crying out.'

If, then, so much early excellence in pure mathematics, terrestrial physics, and practical art as this resuscitated Great Pyramid Metrology implies,—seems to be inexplicable, as the hierologists insist it is, according to their long-taught ideas of Egyptian society at the period, but yet to stand on a broad and sure basis of mechanical proof of its own,—let us submit those hierological ideas to a more searching scrutiny, from a monumental point of view, than they have ever yet undergone; and inquire thereby, whether the puzzling anomaly complained of, may not prove the forerunner in discovery, of some remarkable events in the history of human life and its trials on the earth.

DIVISION III.

NOTES IN GREAT PYRAMID HISTORY.

'When I have bent Judah for me, filled the bow with
'Ephraim, and raised up thy sons, O Zion, against thy
'sons, O Greece, and made thee as the sword of a mighty
'man.'

ZECHARIAH IX. 13.

NOTES IN GREAT PYRAMID HISTORY.

CHAPTER I.

MONUMENTAL DOCUMENTS STILL TO BE PROCURED.

SUCCESSIVE ages have witnessed both writers and theorists clustering strangely about particular features of the Great Pyramid; instinctively convinced apparently of something important being there, and fully borne out in such an impression by subsequent discoveries, though all their own guesses were usually very wide of the mark. In the number of such attractions of concealed truth, are to be placed many of the points alluded to in the curious work, of 1706 A.D., attributed to Professor Greaves; and amongst them, perhaps the following, where the anonymous author writes,—'and the best 'reason that can be given why they' (the metrological standards of the Hebrews, Saxons, and other nations commemorated in the Great Pyramid,) 'were expressed with so much obscurity, that in all '*likelyhood* they might for ever remain unintelligible, 'is, that the contrivers of these antient monuments 'had a fore-knowledge by Divine Revelation, that 'in the latter days they should be understood.'

Without attempting to go to all the serious length and extent of this unknown author,—we would yet remind our readers, that the several features accompanying the peculiar arrangement of joint-lines in the floor of the entrance passage, as discovered by ourselves just under the junction point of its ceiling with the granite portcullis of the first ascending passage,—led us inevitably to the conclusion (vol. i. p. 156) that the builders had left there a sign by which future men, expected to visit the building,—not indeed soon after, but in long subsequent ages,—should be enabled, whatever the language they spoke, at once to find out the particular ceiling-stone which hid the narrow ascent to the Grand Gallery and upper chambers, with all their truly wonderful symbolization of standards in weight, capacity, and time.

As it happened, the key never required to be had recourse to; for the accidental dropping out of the one important ceiling-stone, when Khaliph Al Mamoon was quarrying in the neighbourhood,[1] disclosed the secret of the existence of the first ascending passage to him and his accompanying Arabs. 'But would the key ever have been interpreted 'without such an accident?'—is a question we have already been asked, and by those to whom it is our desire and duty to endeavour to answer as well as we can. Wherefore we reply mainly as follows:—'Much, almost everything, depends on the mental

[1] See *Our Inheritance in the Great Pyramid*, p. 86.

'preparation and scientific skill of the modern in-'quirer.' It is generally believed, for instance, from indications in the classic writers, that the later Egyptians of Persian, Greek, and Roman times had opportunities of passing down the entrance passage and into the one and now well-known subterranean chamber of the Great Pyramid; in monumental proof whereof, M. Caviglia, who rediscovered and cleared out that chamber in 1817 A.D., is said to have found certain smoked inscriptions in Roman letters on the chamber's roof. 'The letters are good 'uncials, and therefore cannot be of the time of the 'Khaliphate,' writes Chevalier Bunsen on a subject where he is an authority of power. But yet those Persian, Greek and uncial-writing Roman visitors did not succeed in finding the ascending passages and their carefully hidden, upper chambers; as monumentally testified to again, by the earliest inscriptions *there*, being the Arabic ones either of, or posterior to, Khaliph Al Mamoon and the year 850 A.D. Neither again have any of the numerous visitors in modern times who have tramped up and down that one long entrance passage, believing it to have been constructed for leading to a sepulchral chamber only, or 'for the greater mysteries of the 'Freemasons,' ever perceived even the existence of the key; but the moment a man entered impressed with the idea of practical geometry having been an aim and object, and in so far the language of the builders for expressing their purposes in,—

so soon the peculiar joint-lines on the floor were discovered.

Not only, too, did we find them thus speedily, and by our measures of line and angle inside the entrance passage,—but they impressed us vividly with the belief, that they were something very peculiar, and most important in the intentions of the builders,—even *before* we had found their relation to the butt-end of the granite portcullis in, or rather above, the passage's roof; for to so marked and signal an extent were they a geometrical anomaly in the otherwise close regularity which prevails in the joint lines thereabout.[1]

[1] The construction of the entrance passage generally, and its connexion with the ascending passage particularly, have been strangely involved by Chevalier Bunsen, in his vol. ii. pp. 160 and 162; and to the extent of his at last declaring, that a certain very important and necessary examination is now impossible, which in truth is extremely easy; his least unexceptionable sentence being as follows:—

'The western passage, which was forced by the Khaliphs, has suffered 'serious injury, just where the ascending and descending passages 'meet in the ledge of the rock; so that it is no longer possible to 'ascertain whether the three great granite blocks placed at the entrance 'of the ascending passage 14 feet 9 inches long, were intended to con-'ceal one passage, or the other, or both.'

To which let us answer that,—

First, The ascending and descending passages do not meet in a ledge of the rock; but in the midst of masonry.

Second, The western passage of Khaliph Al Mamoon being merely a rudely forced, broken way, smashing through everything that opposed it, can hardly be considered as having '*suffered* serious injury,' but rather inflicted it upon the entrance and ascending passages, when it met them nearing the point of junction.

Third, Khaliph Al Mamoon's 'broken way' assumes an *enlargement* near the point in question, so as to enable it to compass the ascent from the lower descending entrance passage to the upper ascending passage; and by breaking, as it does, through the western walls of either. But that enlargement, so far from making the task 'no

'Granted, however, this much,' say our questioners, 'that the diagonal joint-lines in the entrance 'passage floor would inevitably have been discovered 'sooner or later; and would also have been per-'ceived (by whomsoever had the fortune to be the 'original discoverers or subsequent confirmers, of 'their existence), to constitute an intense anomaly 'in the Pyramid masonry;—still there is doubt, 'whether those or any other persons would *thereby* 'have been led to the further discovery of the par-'ticular secret of what lay behind, at the back of, 'or above, the roof of the passage, opposite to the

'longer possible to ascertain whether the three great granite blocks 'placed at the entrance of the ascending passage, were intended to 'conceal one passage, or the other, or both,' is precisely what, with the assistance of going into the passages also, enables any one now to study the nature of the said granite portcullis, at its either end, north and south, and also along a portion of one side, the western one; and see with the utmost certainty,—that all three blocks form merely one long cork or plug driven from above towards the lower end of the ascending passage; but not *through* and beyond it into the entrance passage beneath, on account of a contraction in the bore of the channel near the bottom; but still several inches above the roof of the entrance passage (as see vol. ii. p. 41, etc.) So that the blocks are now, and always have been, up *within* the limits of the ascending passage, and never could have protruded down and through, into the lower or descending entrance passage, so as to stop that. And

Fourth, The office of the granite blocks was, therefore, with the ascending passage only; and to *stop* it up, not *conceal* it; for plugging a large square hole in white-limestone with red granite, is rather a way to call attention to the fact of a hole having been made there, than to conceal it. Concealing was required also, no doubt; but that office was undertaken by the limestone block in the ceiling of the descending passage, which entirely hid from view, so long as it was in its place, both the hole formed by the upper passage and its heterogeneous filling; making thereby that particular part of the ceiling of the entrance passage indistinguishable from any other part thereof, for a long way either north or south of it; and in effect, delaying the dis-

'lines on the floor,—unless its nature had been pre-
'viously disclosed.'

We admit there is ground for the doubt, but not for absolute negation; and while we are exceedingly thankful to have been assisted by the disclosure, as above, having been made before our time, —we would also call attention to one practical result of that disclosure when it was made; and suggest, with the consent probably of every one, that if the ascending passage, Grand Gallery, and chambers of the standards of 50 and 25, had *not* been discovered then, or up to the present time,—the true aims, objects, and ends of the Great Pyramid could have been guessed only very imperfectly indeed: so imperfectly,—that even now, before proceeding any further in our proposed course of historical discussion, the question may be asked with much propriety, whether we are yet in possession of everything material required to be known; or

covery of all the ancient built chambers beyond, to far within the centuries of the Christian era.

In happy contradistinction to the entangling mistakes of Chevalier Bunsen in this matter, is the luminously clear account of Sir Gardner Wilkinson, p. 167 of Murray's *Egyptian Handbook*:—

'On going down the entrance passage, at about 80 feet from its 'present mouth, you perceive the end of a granite block, which closes 'the upper passage, and which was once carefully concealed by a tri-'angular piece of stone fitting into the roof of the lower passage, and 'secured in that position by a cramp on either side. This stone has 'been removed, and the end of the granite it once covered is now ex-'posed. But the granite closing the upper passage still remains in its 'original place; and in order to avoid and pass above it, you turn to 'the right by a forced passage, and, after climbing a few rough steps 'you come to its upper extremity, and ascend to the Great Gallery,' etc.

whether there may perhaps be still, some hitherto undiscovered chamber of importance in the Great Pyramid ?

That numerous persons have fancied there is, the abundant excavations at the well-mouth, north top of Grand Gallery, Queen's chamber, King's chamber, Davison's chamber, and Howard Vyse's huge hole in the south side of the Pyramid, sufficiently attest. Still more too, does the latter's extensive digging in the rock on the north front of the Pyramid ; for this proceeding was mainly actuated by the mention in Herodotus, and other classic authors, of the tomb of the King of the Great Pyramid being down some deep shaft, and in a chamber upon an island surrounded by Nile water.

So consistent too are the accounts of the old writers herein, that after concluding all his vain attempts to reach such a chamber, Colonel Howard Vyse still describes himself as under the impression that it will be found some day in the low, as well as aqueous, position foretold.[1] We ourselves also have been much puzzled by the ancient legend, that nearly a third of the time employed in building the whole Pyramid, was spent preliminarily on subterraneous excavations ; for the lower parts of the well and entrance passage, together with the one central unfinished subterranean chamber (the only parts now known which can be included in such a description), need not have occupied by any means so long.

[1] See p. 104, vol. ii., Vyse's *Pyramids of Gizeh.*

An uninterpreted Sign.

In connexion then with such views, it is interesting to note,—that if there be any virtue in our supposed key in the entrance passage floor, pointing to the upper chambers of the Pyramid,—the same passage has another key of a closely similar order, alluding apparently to something else not yet discovered, or even suspected. We allude here to the two joint-lines crossing the *walls* of the entrance passage diagonally near its upper end, and quite as striking an anomaly in their way, as are the two in the floor lower down under the granite portcullis. The difficulty however of interpretation in this new case, is, in there being *two* such symbols; or, one pair of lines in either wall. Had the symbol existed on one side only, any one would have said, from experience of the portcullis, 'Search on the opposite side of the passage;' but here the opposite side reflects the same signal. What shall be concluded then? The case is open to every one, and fully described in pages 37-39 vol. ii., and in Plates II. and III. of vol. ii.

Our own idea, merely an idea, but derived inductively from known Pyramid facts in other cases, is, —that the direction to search in, lies at right angles to the line joining the two symbols, that is, either straight above or straight below.

Now straight above, thanks to modern dilapidations, we can examine the structure (as see the the Plates in section), and shall then find there the

cyclopean blocks, placed pent-roof-wise, which magnificently decorate the present entrance into the Pyramid. They are unique, too, in the Great Pyramid, for there is not anything similar over the entrance passage of the second, third, or any other known Jeezeh Pyramid; and though the present double set of blocks placed in a single vertical plane, are not precisely over, but rather to the south of, the two anomalous joints of the passage walls below them,—yet there are traces, in abutments left in the masonry, that there were formerly two or three other pairs of similar angularly disposed stones outside, or north, of the present ones; and to such a thickness, that the mean position of this great mass of architectural device was really, when complete, in a vertical above the passage marks below.

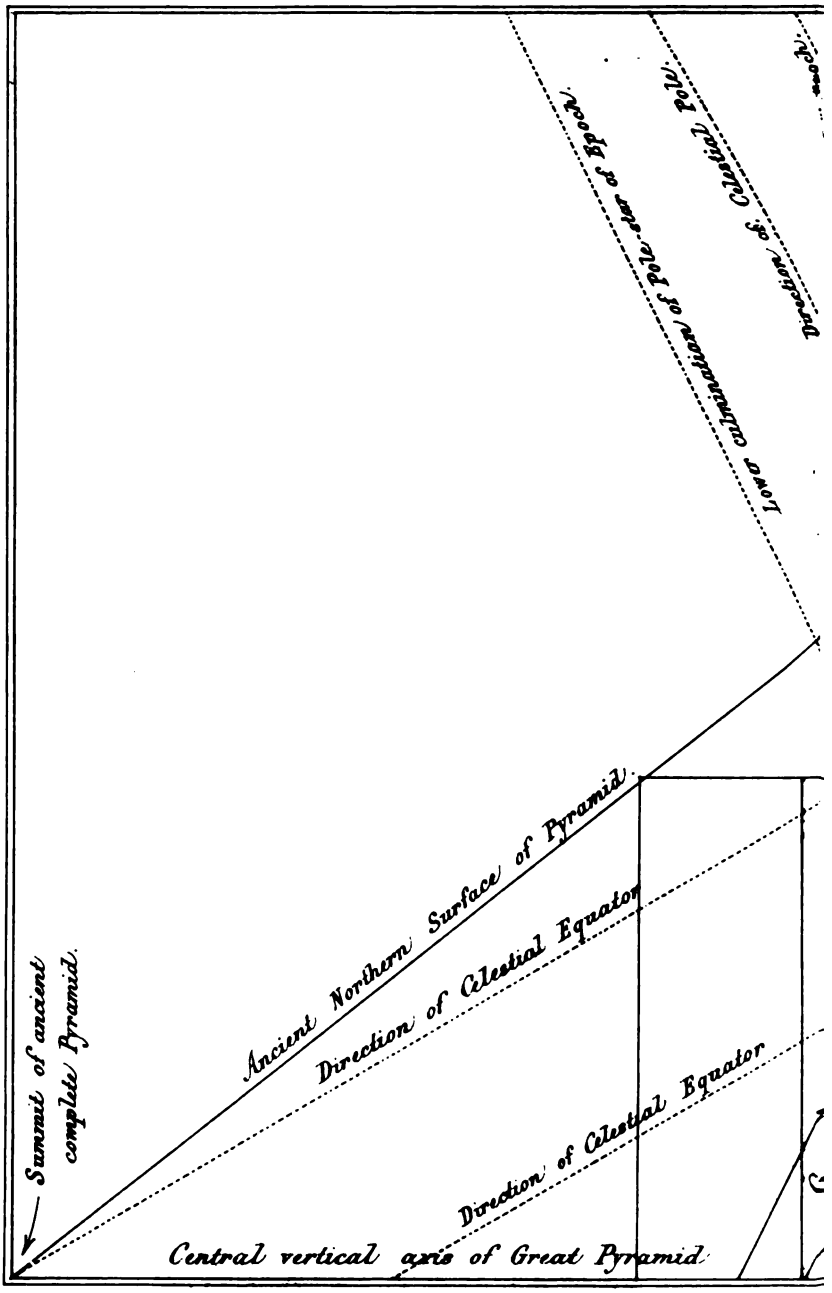
But then what object did these large inclined stones serve?

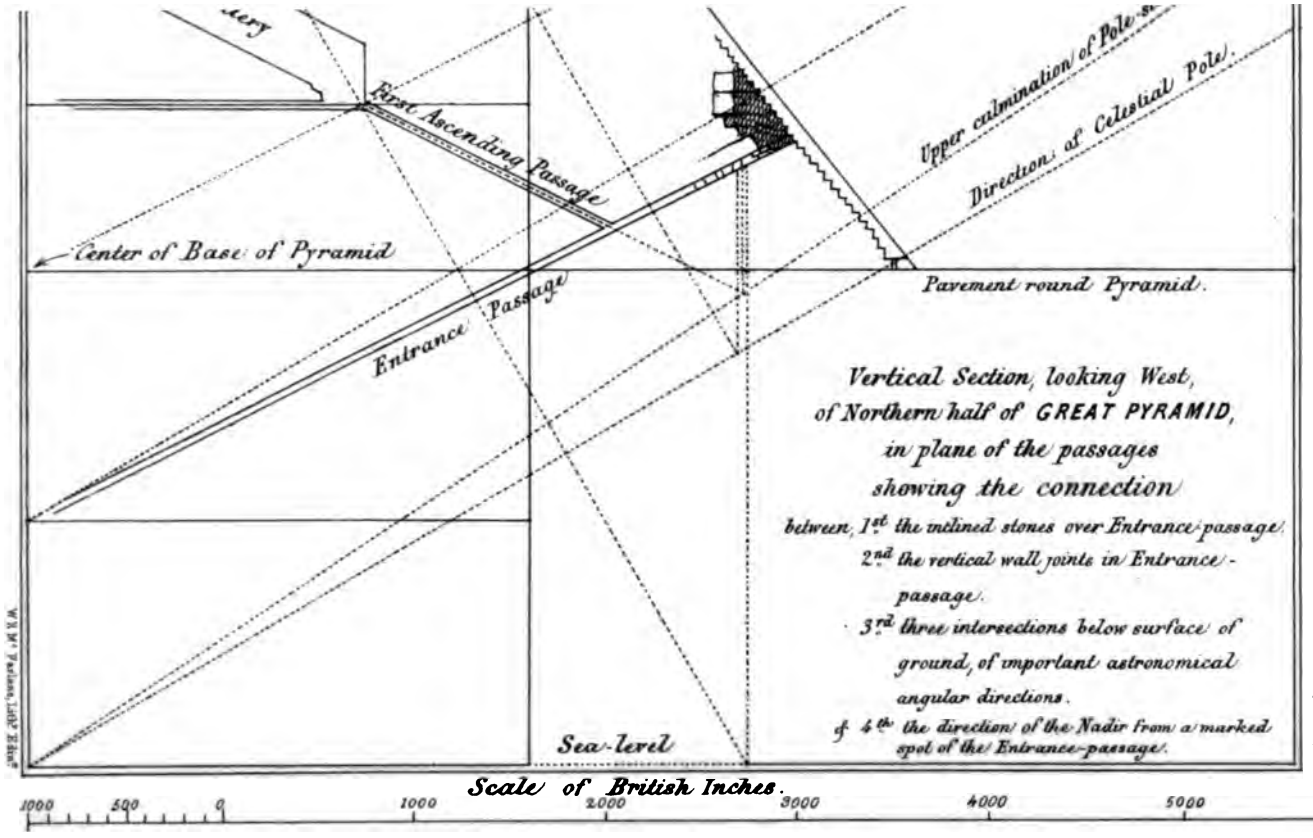
Some writers have suggested, 'to relieve the roof 'of the entrance passage from the enormous weight 'it has to bear of all the upper parts of the Pyra-'mid.' But Colonel Howard Vyse very properly rebukes these authors, academicians and good mathematical mechanicians though they may have been, for not perceiving that the position, close under the sloping side of the Pyramid, secures to these pent-roof-forming stones, their having very little weight to bear. Moreover, if connected with the entrance passage at all, it is only at its outer end, where the pressure is least; for while the pas-

sage *dips* southwards at an angle of 26° 27′,—the basal line of the inclined roof-stones runs *horizontally* southward, and would therefore rapidly leave the neighbourhood of the entrance passage; even if it, the basal line, were to be continued further than where we now behold it; but that is not the case, for the Colonel assures his readers that there is ordinary course-masonry, immediately at the back of the present gable-end blocks we see.

Mechanically, then, these mutually sloping-to-each-other blocks appear to be useless; and would have been so architecturally also in the perfect days of the Pyramid, if, as most probable, or rather quite certain, they were then hidden under the outside coat of the casing-stones of the whole structure. What, then, could they have been inserted for?

We can only suggest, inductively again from what we have observed for ourselves, that they were intended 'to add additional force during the Pyra-'mid's latter days of decay, to the indication that 'opposite to them—or *downwards* through the floor 'of the entrance passage, and between the two 'diagonal points of its walls—is a shaft leading to 'a most important and probably water-furnished 'chamber of the builders of the Pyramid; not in-'deed supplied by a canal from the Nile, as some 'have thought, but by the same general infiltration 'through the rock, which fills the sepulchral well in 'King Shafre's tomb.' And we are rather confirmed in the notion of such a chamber existing in the


Lower culmination of Pole-star as Pole
Celestial Pole
Ancient Northern Surface of Pyramid
Direction of Celestial Equator
Direction of Celestial Equator
Summit of ancient complete Pyramid.
Central vertical axis of Great Pyramid


First Ascending Passage
Upper culmination of Pole-s
Direction of Celestial Pole.
Center of Base of Pyramid
Pavement round Pyramid.
Entrance Passage
Vertical Section, looking West,
of Northern half of GREAT PYRAMID,
in plane of the passages
showing the connection
between, 1st the inclined stones over Entrance passage
2nd the vertical wall joints in Entrance-
passage.
3rd three intersections below surface of
ground, of important astronomical
angular directions.
& 4th the direction of the Nadir from a marked
spot of the Entrance-passage.
Sea-level
W. H. M. Parsons, Lith. Edin.
1000 500 0 1000 2000 3000 4000 5000 6000
Scale of British Inches.

Pl. 10.

locality, both by Plate x., which shows three important astronomical intersections in the indicated direction, and also by remembering the many fragments of *diorite* mixed up with the ancient rubbish on the northern or neighbouring edge of the hill, and unconnectable with anything yet seen by any modern man within the Great Pyramid.

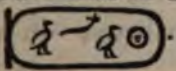
If there really exists such a chamber, the history of the monument will be written far more completely after its discovery, than before; but meanwhile, as we know of no one likely to undertake the search, and have exhausted all our own small stock of means,—it is our duty now to make what literary use we can of the materials already collected; and of which the portion now newly added, amounts to a larger mass of Pyramid detail, than was ever before discussed in a serious manner.

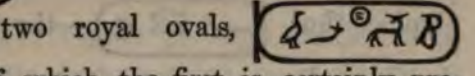
CHAPTER II.

NAMES AND DATES OF THE BUILDERS.

In the first edition of Sir Gardner Wilkinson's important publication on the *Ancient Egyptians*, but which particular edition is only now to be read for illustrating the advance since made both by the author and his science,—in that edition, we say, of 1836 A.D., there is a well-reasoned-out theoretical, or purely literary, conclusion that the builder, or the king over the builders, of the Great Pyramid, was Suphis; otherwise and variously called—according to inflections used by different interpreters and nations—Chufis, Shofo, Khufu, Saophis, and Cheops; or the second royal personage in Manetho's fourth dynasty of Egyptian kings.

Now at the time of Sir Gardner's publication, Colonel Howard Vyse had not yet begun any of his celebrated excavations, nor does he seem to have been acquainted with the published opinion when he did so begin. Amongst the most delightful and satis-

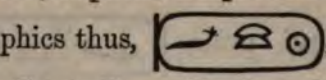
factory instances, therefore, of theory confirmed by fact, must it be classed, that when,—within a year after Sir Gardner Wilkinson's book had appeared elsewhere,—Colonel Howard Vyse broke his way through solid masonry into the 'chambers of con-'struction' of the Great Pyramid, and thereby saw things never intended by the builders to be seen until the final ruin of the long-lasting monument,—he perceived rude paintings or red crayon markings on some of the blocks of stones; and having had them copied by various hands, and transmitted to the learned Mr. Samuel Birch of the British Museum,—that experienced Egyptologist pronounced them to be ancient quarry-marks; and found amongst them the oval of King Suphis, or Shofo, or Khufu; viz.,  .

Also, these two royal ovals,  , of which the first is certainly pronounced by authority to read Sen-suphis, Nu-suphis, Nu-Shofo, or Knemu-Khufu; and the last is, I believe, accepted as the same name written short, or Knemu or Nu only: equally therefore alluding to the same man; viz., a brother of Shofo, also a king, and a co-regent with him in the fourth dynasty.

These three ovals are the only ones that have been found in any part of the Great Pyramid; and that they really exist in the chambers of construction

there, as described by Colonel Howard Vyse, is testified to by the first page of the third folio volume of large plates by Dr. Lepsius; where that scholarly and in-the-field-experienced philosopher has had the original red markings on the stone re-copied by his own artists, and has given the oval of Shofo upon an extra large scale, followed by those of Nu and Nu-Shofo on a smaller size.

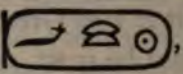
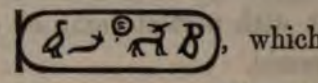
A name erroneously advocated.

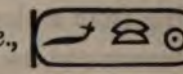
The testimony, then, of the Great Pyramid itself, is simply for Shofo and Nu or Nu-Shofo; and had, we thought, been allowed by every one, until Chevalier Bunsen, in his second volume of *Egypt's Place in Universal History*, p. 161, made Shafre, Shafra, Sephres, Chephrenes or Chabryes,—in hieroglyphics thus,  ,—the principal King of the Great Pyramid: introducing his oval, and his alone, into the text, p. 161; 'for Shafra,' says he, 'must either have completed the upper part, or at 'least have cased and arranged the upper chambers, 'of the Great Pyramid.'

Now here is very positive language, and from a man of pre-eminent fame as a literary philosopher; we inquire, therefore, from him himself, whence his reason for adding so notably to the Pyramid's testimony about its regal authors; and find it in the next line to be,—'This is the only way of explain-

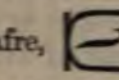
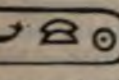
'ing his (Shafre's) title "*the Great of the Pyramid*," 'and the statement of Diodorus about Chabryes, as 'well as the ignorance of the historians whom Pliny 'consulted, and of which he complains, as to who 'really built it (the Great Pyramid). Shafra's title 'again, would be most appropriate, if he completed 'it. The king who actually completed this Pyra-'mid might with perfect right be called the Great 'of the Pyramid.'

With all deference for the author of this statement, we cannot look on the whole of it as proof; certainly not of that simple and straightforward kind which the Pyramid's metrological theory has hitherto been receiving from a close and searching examination of the monument itself. In another part of the eminent Teutonic scholar's deeply-read work (vol. i. p. 163), we are indeed informed that 'history does 'not admit of the cogent proof of mathematics, 'precisely because her province is an infinitely 'higher one, that of mental and moral conviction.' But even on these latter grounds, so far as we understand them, it may reasonably be suggested that, because 'Pliny,' as above mentioned, complained of the historians he consulted not knowing who built the Great Pyramid, he, Pliny, does not thereby pronounce an opinion in favour of a new and particular name recently produced by Chevalier Bunsen; and as to what Diodorus, whom Bunsen elsewhere calls 'the bewildered and bewildering,' says

about Chabryes,—the statement is inserted on page 125 of Bunsen's own book, as due to Herodotus; and a few pages further on the name is identified with Shafra, and Shafra again with Knemu-Khufu; or, in the Egyptian tongue,  , which has never been found inside the Great Pyramid, is made the same with  , which *has* been found there, and is perfectly different in all its symbols but one.

Hence we cannot really discover any force in the classical, and less in the monumental, reasons hitherto cited for making Shafre, *i.e.*,  , the chief builder or completer of the Great Pyramid; and the sole remainder of Chevalier Bunsen's proof must rest on his interpreting correctly that peculiar title of Shafre's, which he renders '*the Great of the Pyramid*;' for though, in a following paragraph, speaking of the Queen's and King's chambers in the Great Pyramid, the Chevalier states with the most complete positivism, 'Shafra converted the former 'into the apartment, and made the upper one his 'sepulchral chamber, as appears from his having 'had his sarcophagus introduced into it,'—yet all this is mere assertion, without one particle of additional evidence tending to single out Shafra more than any one else in all Egyptian history as having

performed the works, or owned the sarcophagus alluded to.

This latter assertion, therefore, as well as the former, equally depends upon the name of Shafra, or Shafre,  , not unfrequently found in neighbouring tombs on the Pyramid hill,—though never in the Great Pyramid itself,—having sometimes a complementary device after it of a bird and a pyramid (see our Plate XII.); and upon the true, certain, and correct translation of that device being, as Bunsen gives it, '*the Great of the Pyramid.*' But both Sir Gardner Wilkinson and another hieroglyphist of mark, translate the same device as, '*of the little Pyramid;*' the bird being said by them to be really a sparrow or swallow, and not a pigeon, as it had been taken for in the 'great' interpretation. Both these latter authorities, too, place Shafre in the fifth dynasty; making him represent the Sephres of Manetho; and our own observations of the entrance passage of the recently discovered granite and arragonite building near the Sphinx,—either the tomb or temple of King Shafre from his statue duly signed  being found there (see vol. i. chap. xii.), —connects that monarch in a practical manner, and equally whether he was of the fourth, fifth, or any other dynasty,—with the second, and not the Great, Pyramid.

Hence, monumentally, or according to any existing or known direct evidence of the monuments—Pyramids and others—Shofo and Nu-Shofo were the only kings who had to do with the building of the Great Pyramid; and they both belonged to the fourth dynasty according to the testimony of every modern Egyptological author, as well as of the ancient Manetho.[1] Let us now therefore apply our own monumental and astronomical date from vol. iii. Division II. to that dynasty, and see how it then comports with received chronologies of Egypt. In the following table, accordingly, the first twenty, out of Manetho's thirty, dynasties of kings subsequent to Menes, have their dates entered against them according to the several authorities mentioned at the head of each column :—

[1] One modern writer, indeed, has to be excepted, viz., Hekekyan Bey, in his 'Treatise on the Chronology of Siriadic Monuments, demonstrating that the Egyptian Dynasties of Manetho are records of 'Astro-geological Nile Observations which have been continued to the 'Present Time' (London and Cairo, 1863, printed privately): for this subtle and ingenious theorist, with a good knowledge of mathematics, and of extensive as well as varied and quaint reading, inserts seventeen kings' names into each of the two first dynasties downward from Menes; and makes the second such dynasty include the names of Manetho's fourth; while he completes the whole Egyptian history down to the time of the Persians in twenty-two dynasties, in place of Manetho's thirty. But then, again, the very title-page indicates some new theory with regard to Manetho not a little revolutionary in its character,—as yet unsubscribed to, so far as we can learn, by a second individual,—and not traceable through any series of alleged monuments, in so far as our examination of them has extended.

MANETHO'S EGYPTIAN DYNASTIES,
DATES AND DURATION OF THE FIRST TWENTY, ACCORDING TO VARIOUS AUTHORITIES.

Number of Dynasty.	The most advanced hierologists.	Dr. Lepsius' 'Letters from Egypt,' Berlin, 1852.	Dr. Lepsius' 'Königsbuch,' Berlin, 1858.	Chevalier Bunsen, 'Egypt's Place,' vol. iv. pp. 496-526.	E. W. Lane, Sir Gardner Wilkinson, R. S. Poole, 'Encyc. Brit.'	W. Osburn, 'Mon. History of Egypt,' vol. i. p. 405; vol. ii. p. 632.
	B.C.	B.C.	B.C.	B.C.	B.C.	B.C.
1	5735	4800	3892	3623	2700	2429
	5472	...	3639	3434	2480	2329
2	5472	...	3639	3433	2480	2429
	5170	...	3338	3210	2080	2329
3	5170	...	3338	3433	2670	2329
	4956	...	3124	3210	2440	2229
4	4956	4000	3124	3209	2440	2228
	4472	...	2840	3055	2200	2108
5	4472	...	2840	3054	2440	2228
	4254	...	2592	2948	1860	2108
6	...	...	2744	3054	2200	2107
	...	...	2546	2948	2080	1959
7	...	...	2592	2947	1800	...
	...	...	2522	2926	1800	...
8	...	...	2522	2925	1800	...
	...	...	2380	2782	1650	...
9	...	...	2674	3054	2200	2107
	...	...	2565	2948	1750	1959
10	...	...	2565	...	...	1959
	...	...	2380	...	...	...
11	...	...	2423	2925	2200	2107
	...	...	2380	2782	2080	1959
12	3435	...	2380	2781	2080	...
	...	...	2167	2635	1920	1959
13	...	...	2136	2634	1920	...
	...	...	1684	2228	1525	1800
14	...	...	2167	2287	2080	...
	...	...	1684	1777	...	1674
15	...	...	2101	2547	2080	...
	...	...	1842	...	...	1900
16	...	...	1842	...	...	...
	...	...	1591	1777	1800	1900
17	...	...	1684	1776	...	...
	...	...	1591	1626	...	...
18	...	...	1591	1625	1520	1674
	...	...	1443	1409	1325	...
19	1314	1322	1443	1409	1324	...
	...	...	1269	1300	1233	1314
20	...	...	1269	1299	1232	1314
	...	...	1091	1115	1135	...

Remembering then, that our astronomical date for the building of the Pyramid was 2170 B.C., we find, on referring to the above table, that there is only one of the authorities, within the alleged period of whose *fourth* dynasty, that date is included. Our result is indeed just outside that of Sir Gardner Wilkinson and Mr. Lane, largely different from Chevalier Bunsen, more so still from Dr. Lepsius, and entirely irreconcilable with M. Renan and Mariette Bey. But we cannot on that account give up our astronomico-architectural determination of the Pyramid's date, seeing that it rests on so large a mass of observations at the Pyramid itself; and is far more direct and cogent in character than the series of indistinct literary probabilities derived from a subsequent age, out of which the early chronicles of Egypt have been attempted to be elaborated, by the world-famous writers in question; and on which, also, they have hitherto arrived at so little agreement among themselves.

Let us ascertain, however, inquiringly, what those authors' foundations are. Early Egyptian monarchs, as every one knows, are always arranged in dynasties; what are these dynasties?

They first appear by name in the work of Manetho, the Egyptian priest of Sebennytus, in the age of Ptolemy Philadelphus, 280 B.C.; or nearly a hundred years after the last reputed dynasty had expired under Nectanebo II., and four thousand years after the first is *reported* to have begun under Menes. The

'dynasties' *may* have formed a mode of arranging, or talking about their past kings always in vogue among the Egyptian priests; or they *may* have been so arranged first by Manetho himself, as part of a *memoria-technica*, to enable his new Grecian prince, Ptolemy, to acquire thereby more easily a bird's-eye view, rather than a deep knowledge, of the history of the ancient land of Egypt. Certain it is that subsequent critics have been much puzzled to define a dynasty in Egyptian history, so little is there often to distinguish between the last king of a former, and the first king of a following, dynasty; or to show why a dynastic separation should have been made between them.

Certain is it also that dynasties are never alluded to in hieroglyphics of regal names. Hence, when hierologists proclaim that they have found such and such a dynasty on 'the monuments,' they mean, that they have read the names of the kings in the engraved ovals there, and found some of them something more or less similar to certain of the Grecized names in one of Manetho's dynasties. But there was, on the monument, nothing about the dynasty, either in name or number. And, as two of the modern interpreters seldom read a hieroglyphic precisely the same,—and a large amount of latitude is allowed between what they do read, and what is written in the scraps of Greek treatises (through which alone whatever fragments of Manetho's original work still exist, have come down to us),—

we need not wonder at different authorities often varying, as into which dynasty of literary invention to put such and such an oval, cartouche, escutcheon, or hieroglyphic royal signature found on the monuments; and yet complacently declaring, both that *that dynasty* is found on the monuments, and that the monuments confirm Manetho's dynasties or lists.

Again, even when agreeing as to the number of the Manethoan dynasty to which a particular monumental oval shall be assigned, the modern hierologist authorities are by no means always at one, as to what name to call the said dynasty by; whether to attach it to Tanis, Memphis, This, or some other city; and to say, whether its sovereign and his officers were Lower Egyptians, Amalekites, Philistian-Shepherds, Thebans, or perhaps even Negroes; and whether one dynasty was contemporaneous with, subsequent, or anterior, to some other. Occasionally, too, the same author makes a change in his previous arrangements, on account of some newly discovered fact; and then the amount of such change is a fair measure of the certainty of the science professed; as when Bunsen, vol. iii. p. 10, shifts the construction of the Lake of Mœris, at one stroke of his pen, from the first king of the sixth dynasty to the fourth king of the twelfth dynasty.

While as an example of the different conclusions of acknowledged Egyptologists on one and the same inscribed or sculptured remain, the following extract may be quoted :—

'Perring, the Pyramid measurer, has, in a recent 'publication, attempted to establish the strange 'notion, which I found also existed in Cairo, that 'the monuments of El Amarna were the work of 'the Hyksos (*fourteenth dynasty*); others wished 'to refer them to a period anterior to that of Menes '(*first dynasty*), by reason of their certainly great 'but not inexplicable, peculiarities; I had already 'explained them in Europe as contemporaneous 'kings of the *eighteenth dynasty*.'—(DR. LEPSIUS' *Letters from Egypt*, p. 111.)

These are merely specimens of a very small order of discoveries, ascertained while testing—from a mechanical point of view—the degree of reliance to be placed on the assertions of some one or another very first-rate Egyptologist, when he asserts that he has found such and such an historical fact on the monuments; and that it must therefore be admitted by all the world. But the methods of Egyptologists have been most extensively examined by Sir George Cornewall Lewis,[1] from a *grammarian* point of view; and have unhappily led him to consider—that, 'the 'operations of Bunsen and other modern critics upon 'the ancient history of Egypt, rather resemble the 'manipulation of the balance-sheet of an insolvent 'company by a dexterous accountant (who, by 'transfers of capital to income, by the suppression 'or transposition of items, and by the alteration of 'bad into good debts, can convert a deficiency into

[1] *An Historical Survey of the Astronomy of the Ancients.* 1862.

'a surplus), than the conjectures of a speculative 'historian, who undertakes to transmute legend 'into history.

'Egyptology,' continues Sir George, 'has an 'historical method of its own. It recognises none 'of the ordinary rules of evidence; the extent of its 'demands on our credulity is almost unbounded. 'Even the writers on ancient Italian ethnology are 'moderate and tame in their hypotheses, compared 'with the Egyptologists. Under their potent logic, 'all identity disappears; everything is subject to 'become anything but itself. Successive dynasties 'become contemporary dynasties; one king becomes 'another king, or several other kings, or a fraction 'of another king; one name becomes another name; 'one number becomes another number; one place 'becomes another place.'

Among examples to illustrate his assertions, the Right Honourable Baronet cites the opinions of both Baron Bunsen and Dr. Lepsius, regarding that potent name in Egyptian antiquity, Sesostris; and finds at last these two leading Egyptologists, 'though differing in other respects, agree in think-'ing that Sesostris is not Sesostris.' 'But here 'their agreement stops. One assigns Sesostris to 'what is called the Old, the other to what is called 'the New Empire, separating his respective dates 'by an interval of 3793 years. What should we 'think, if a new school of writers on the history of 'France, entitling themselves Francologists, were to

'arise, in which one of the leading critics were to 'deny that Louis XIV. lived in the seventeenth 'century, and were to identify him with Hercules, 'or Romulus, or Cyrus, or Alexander the Great, or 'Cæsar, or Charlemagne; while another leading 'critic of the same school, agreeing in the rejection 'of the received hypothesis as to his being the suc-'cessor of Louis XIII., were to identify him with 'Napoleon I., or Louis Napoleon?'

Even the method of interpreting hieroglyphics according to the principles of Young and Champollion, is attacked root and branch from the same grammarian point of view by the late learned member of the Palmerstonian Government; and he insists that it is to be described only as 'the uncer-'tainty of uncertain conjectures built upon other 'uncertain conjectures.' But here we can by no means fully agree with the distinguished classic; and can only imagine him to have arrived at such extreme opinions, by attending solely to the points of divergence amongst Egyptologists and hierologists. These are sufficiently wide, and frequent too, to take away from *all* their announcements the positive trust that was for long accorded to them; and by referring to Baron Bunsen himself, vol. i. p. 479, we may instantly see the amount of license with which he would indulge himself, when interpreting old Egypt; for the following series of English words is given as being, each and every

one of them, equally the true rendering of the Egyptian sound *sr*, viz. :—

a camelopard.
a sheep.
a spike.
a species of duck.
fire.
to distribute.
an arrow.
a chief, a noble.
to drink.
a flabellum.
cheese ?

But though there be some points extremely unsettled even still among the Egyptologists, that must not blind us to the very great number of points on which they are either perfectly, or almost, agreed ; and do produce nearly identical, and those sensible, phrases out of the same hieroglyphic inscription.

Similarly too, in the vexed subject of the dynasties, they form at least a something tangible on the surface of the dark waters of old historic literature ; they do assist the memory to a considerable extent ; there is not anything else to refer to for first ideas in these distant times ; and, that some portion of them has tolerable certainty, we subjoin herewith, *first*, the designations of the nineteen earlier dynasties ; and *second*, the names of their kings, as given by the leading authors of the most opposite views in various schools of hierology.

NAMES AND DESIGNATIONS OF THE FIRST NINETEEN, ACCORDING TO VARIOUS AUTHORITIES.

No.	Manetho, in Julius Africanus.	Manetho, in Eusebius.	Erastosthenes.*	Lepsius' 'Königsbuch.'	Chevalier Bunsen, vol. iv.	W. Osburn.
1	Thinites.	No name given.	Thebans.	Thinite.	Thinites.	Memphite.
2	Thinites.	No name given.	Thebans.	Thinite.	Thinites.	Memphite.
3	Memphites.	Memphites.	Thebans.	Memphite.	Memphites.	Memphite.
4	Memphites.	Memphites.	Thebans.	Memphite.	Memphites.	Memphite.
5	Elephantinæans.	Elephantinæans.	Thebans.	Memphite.	Elephantinæans.	Abydan.
6	Memphites.	No name given.	Thebans.	Eliphantinæan.	Memphites.	Memphite.
7	Memphites.	Memphites.	Thebans.	Memphite.	1 Theban King, p. 504.	.....
8	Memphites.	Memphites.	Thebans.	Memphite.	Memphites.	.....
9	Heracleopolitans.	Heracleopolitans.	Thebans.	Heracleopolitan.	Heracleopolitans.	Sebennyte or Heracleopolitan.
10	Heracleopolitans.	Heracleopolitans.	Thebans.	Heracleopolitan.	Heracleopolitans.	Sebennyte or Heracleopolitan.
11	Diospolitans.	Diospolitans.	Thebans.	Diospolitan.	Thebans.	Theban.
12	Diospolitans.	Diospolitans.	.....	Diospolitan.	Thebans.	Theban.
13	Diospolitans.	Diospolitans.	.....	Diospolitan.	Thebans.	Theban.
14	Xoites.	Xoites.	.....	Xoite.	Xoites.	Xoite.
15	Shepherd Kings.	Diospolitans.	.....	Hyksos.	Arabian Hyksos.	.....
16	Other Shepherd Kings.	Thebans.	.....	Hyksos.	Palestinian Hyksos.	So-called Memphite Shepherds.
17	Other Shepherd Kings.	Phœnician Shepherds.	.....	Diospolitan.	Thebans.	.....
18	Diospolitans.	Diospolitans.	.....	Diospolitan.	Thebans.	Theban.
19	Diospolitans.	Diospolitans.	.....	Diospolitan.	Thebans.	Theban.

* Erastosthenes does not allude directly to dynasties, but each of his kings, whose names, so far as they go, generally correspond closely to Manetho, are entitled as 'of the Thebans.'

KINGS' NAMES IN MANETHO'S FIRST NINETEEN DYNASTIES.

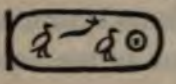
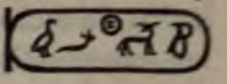
Dynasty.	Manetho in Africanus.	Bunsen, Vol. ii.	Bunsen, Vol. iv.	Lepsius' 'Königsbuch.'	Gardner Wilkinson.	William Osburn.
1	Menes.	Meni.	Menes.	Menes.	Menes.	Menes.
	Athotis.	Atet.	Athothis 1.	Athothis.	Athothis & others.	Semempses.
	Kenkenes.	Rasmentetihem.	Athothis 2.	Kenkenes.	....	....
	Uenephes.	....	Diabies.	Unephes.	....	....
	Usaphaidos.	....	Pemphos.	Usaphais.	....	....
	Miebidos.	....	....	Miebis.	....	....
	Semempses.	....	....	Semempses.	....	....
	Bieneches.	....	....	Bieneches.	....	....
2	Boethos.	Kaiechos.	....	Boethes.	....	Cechous.
	Kaiechos.	....	....	Kaiechos.	....	Raophis.
	Binothris.	....	....	Binothris.	....	....
	Tlas.	....	....	Tlas.	....	....
	Sethenes.	....	....	Sethenes.	....	....
	Chaires.	....	....	Chaires.	....	....
	Nephercheres.	....	....	Nepherchenes.	....	....
	Sesochris.	....	....	Sesochris.	....	....
	Cheneres.	....	....	Cheneres.	....	....
3	Necherophes.	Ratetkar.	Momkheiri.	Necherophes.	Shofo and others.	Aches.
	Tosorthos.	Khufu.	Stoikhos Ares.	Tosorthres.	....	Sephuris.
	Tyreis.	An.	Gosormies.	Tyris.	....	....
	Mesochris.	Seserenra.	Mares.	Mesochris.	....	....
	Soyphis.	Sahura.	Anoyphis.	Soyphis.	....	....
	Tosertasis.	Senefru.	Sirios.	Tosertasis.	....	....
	Aches.	Raenseser.	Khnubos Gneuros.	Aches.	....	....
	Sephuris.	Rasesermakar	Rayosis.	Sephuris.	....	....
	Kerpheres.	Aakaru.	Biyres.	Kerpheres.	....	....
	....	Asses Karf.	....	....	....	....
	....	Sent.	....	....	....	....
4	Soris.	Khufu.	Saophis 1.	Soris.	Shofo.	Soris.
	Suphis 1.	Num Khufu.	Saophis 2.	Suphis.	Nushofo.	Suphis.
	Suphis 2.	—— Kar.	Menkheres 1.	Sophris (?).	Menkere and others	Nu-suphis.
	Mencheres.	Menkara.	Menkheres 2.	Mencheres.	....	Nepherchere
	Ratoises.	Raneferkara.	Pammes.	Ratoises.	....	Sesochris.
	Bicheris.	Rashaf.	....	Bicheris.	....	....
	Sebercheres.	....	....	Sebercheres.	....	....
	Thampthis.	....	....	Thampthis.	....	....
5	Usercheres.	Usskarf.	....	Usercheres.	Usercheres.	Usercheres.
	Sephres.	Senefru.	....	Sephres.	Shafre.	Tatcheres.
	Nephercheres.	Raneferkar 1.	....	Nephercheres.	....	Sephres.
	Sisires.	Raneferkar 2.	....	Sisires.	....	Mencheres.
	Cheres.	Ratetkar 2.	....	Cheres.	....	....
	Rathures.	Raneferkar 3.	....	Rathures.	....	....
	Mencheres.	Harmeren.	....	Mencheres.	....	....
	Tancheres.	Sneferkar.	....	Tancheres.	....	....
	Onnus.	Kaenra.	....	Onnos.	....	....
	....	Raneferkar 4.	....	....	....	....
	....	— neferkar.	....	....	....	....
	....	Neferkar.	....	....	....	....
	....	Sneferkar.	....	....	....	....
	....	Merenra.	....	....	....	....
	....	Harmenkar.	....	....	....	....
	....	Tetu.	....	....	....	....
	....	Unas.	....	....	....	....

KING'S NAMES—*continued.*

Dynasty.	Manetho in Africanus.	Bunsen, Vol. ii.	Bunsen, Vol. iv.	Lepsius' 'Königsbuch.'	Gardner Wilkinson.	William Osburn.
6	Othoes.	Pepi.	Apappus.	Othoes.	Tata.	Cheres.
	Phios.	Mentuhept.	Ekheskos.	Phiops 1.	Papa.	Sentis.
	Methusuphis.	Teti.	Nitokris.	Menthuophis 1	Merenre.	Onnos.
	Phiops.	Nitakar.	....	Phiops 2.	Nitokris and others	....
	Menthesuphis	....	....	Menthuophis 2	....	....
	Nitokris.	....	....	Nitokris.	....	....
7	70 Kings for 70 days?	....	Amyrtaus.	....	....	....
8	27 Kings for 146 years?	Mentuhept.	Thuosimares.	....	Ementefs.	Imephthis.
	....	Hantef.	Sethinilos.	....	Mantoftep 2.	Senucheres.
	....	Hantefaa.	Semphukrates	....	Senofrkere.	Menthesuphis.
9 10 11	16 Kings for 43 years?	Hantef.	Khuther Tauros.	....	Mandothp.	Nubecheres.
	....	Hantef.	Meires.	....	Enentef.	Usercheres 2.
	....	Rasneferkar.	Tomaephtha.	....	Ammenemes.	Nesteres.
	Ammenemes.	Ranubter.	Soikunis.	....	....	Achthoes.
	....	Sesoren Ra.	Peteathyres.	....	....	Amenemes.
12	Ammenemes.	Amenemha 1.	Ammenemes.	Ammenemes 1.	Osirtasen.	Sesortosis 1.
	Gesongosis.	Sesertesen 1.	Stammenemes	Sesortasis 1.	Amunmhe 2.	Amenemes 2.
	Ammenemes.	Amenemha 2.	Sistosis.	Amenenemes 2	Osirtasen 2.	Sesortosis 2.
	Sesostris.	Sesertesen 2.	Mares.	Sesortasis 2.	Osirtasen 3.	Sesortosis 3.
	Lacheres.	Sesertesen 3.	....	Sesortasis 3.	Amunmhe 3.	Amenemes 3.
	Ameres.	Amenemha 3.	....	Ammenemes 3.	Amunmhe 4.	Amenemes 4.
	Amenemes.	Amenemha 4.	....	Ammenemes 4.	....	Skemiofris.
	Skemiophris.	Sebeknefru.	....	Sebeknophris.	....	....
13	60 Kings for 453 years?	Shetenra.	Sipthah.	60 Kings (?).	Sabaco and other Ethiopians	Menthesuphis 2.
	....	Rasenkhet.	Phuoro.	....	....	Sechemetes.
	....	Sebekhept 1.	Amunthartæus and 60 Kings?	....	....	Sabacon 1.
	....	Sebekhept 2, and others.	....	....	....	Sabacon 2 and others.
14	76 Kings for 484 years?	Rakhutoti.	76 Kings? No names.	Amuntimaos.	....	5 Kings in chamber of Thawek.
	....	Rakherpkar and others; doubtful.	....	Amenemes.	....	....
	....	....	....	Tisaken.	....	....
15	6 Kings for 484 years?	....	Salatis.	Salatis.	....	....
	....	....	Buon.	Banan.	....	....
	....	....	Apakhnas.	Apachnan.	....	....
	....	....	Apophis.	Apophis.	....	....
	....	....	Jannas.	Anan.	....	....
	....	....	Asses.	Aseth.	....	....

KING'S NAMES—*continued.*

Dynasty.	Manetho in Africanus.	Bunsen, Vol. ii.	Bunsen, Vol. iv.	Lepsius' 'Königsbuch.'	Gardner Wilkinson.	William Osburn.
16	32 Kings for 518 years? no names.	....	32 Kings for 511 years? no names.	Ra-Apepi.	....	Saites.
	....	....	....	....	....	Aphophis.
	....	....	....	....	....	Melaneres.
	....	....	....	....	....	Jannes.
	....	....	....	....	....	Assis.
17	43 Kings for 151 years? no names.	Tanaken.	17 Kings for 151 years?	Amosis and Nephris.	....	....
	....	Nakhara.	Mentuophis and others.	Amenophis 1.	....	....
	....	Aahhept.	....	Tuthmosis 1.	....	....
	....	Raspenneb.	....	Tuthmosis 2.	....	....
	....	Khames.	....	Tuthmosis 3.	....	....
18	Tuthmosis.	Aahmes 1.	Amosis.	Tuthmosis 3.	Amosis.	Amosis.
	Chebron.	Amenhept 1.	Amenophis 1.	Amenophis 2.	Amunoph 1.	Chebron.
	Amenophis.	Aahmes.	Tuthmosis 1.	Tuthmosis 4.	Thothmes 1.	Mesphres.
	Amesses.	Tetmes 1.	Tuthmosis 2.	Amenophis 3.	Amun-nouhet.	Achencheres.
	Mephres.	Tetmes 2.	Tuthmosis 3.	Xuenra.	Thothmes 2.	Amenses.
	Mephramuthosis.	Hatasu.	Amenophis 2.	Al.	Thothmes 3.	Thothmosis.
	Thmosis.	Tetmes 3.	Tuthmosis 4.	Tutan Xamun.	Amunoph 2.	Acherres.
	Amenophis.	Amenhept 2.	Amenophis 3.	Horos.	Thothmes 4.	Armais.
	Horus.	Tetmes 4.	Horus.	....	Amunoph 3.	Amenophis-baknaten.
	Akencheres 1.	Amenhept 3.	....	....	Horus.	....
	Rathotis.	Horus.	....	....	Rathotis.	Encheris.
	Akencheres 2.	Amenhept 4.	....	....	....	....
	Akencheres 3.	Aakhenaten.	....	....	....	....
	Armais.	Al.	....	....	....	Al.
	Ramesses.	Titi.	....	....	....	Chebres.
	Armesses.	Amentuankh.	....	....	....	Tal.
	Miamu.	....	....	....	....	Amenophis-Memnon.
	Amenophis.	....	....	....	....	Horus.
19	Sethos.	Rameses 1.	Ramesses 1.	Ramesses 1.	Remeses 1.	Rameses.
	Rampses.	Seti 1.	Sethos 1.	Sethos 1.	Sethi 1.	Sethos.
	Amenepthes.	Rameses 2.	Ramesses 2.	Ram. Miamun.	Remeses 2.	Sesostris-Rameses.
	Ramesses.	Menephtah.	Menopthah.	Menephthes.	Pthahmen.	Siptha. Thuoris.
	Ammenemes	Sephtah.	Sethos 2.	Sethos 2.	Pthahmen-seeptthah.	....
	Thuoris.	Amenemhes.	....	Men. Sipthas.	....	Amenepthis.
	....	Seti 2.	....	Sethnechthes.	....	Sethos 2.

An attentive examination of the preceding tables will probably convince any one, that of all the earlier dynasties, their recording authorities are more unanimous about the *fourth* than any other, declaring it to be Memphite; and of the kings in that dynasty, the same voices are more confirmatory of the once real existence of Shofo and Nu-Shofo, as variously inflected, or of  and  than of any others.

Now these are the two kings' names which the Great Pyramid itself shows in the quarry-marks of the chambers of construction. Of that there can be no doubt; and the only remaining possibility that we see, to prevent the Pyramid's own symbolized date of 2170 B.C. being given to those kings and their dynasty, depends on the following consideration:—

In several of the buildings around the Great Pyramid, stones have been found with hieroglyphics on their lower sides, or in such a useless position, that travellers have unanimously declared they must have been taken out of an older building, and used over again as mere raw material in the new. Is it possible then that these now marked stones in the Great Pyramid, and of which the markings are often upside down, were similarly taken out of an older building; and that their present employment may therefore be of a date long subsequent to the inscriptions and the lives of kings Shofo and Nu-Shofo?

After rather strenuous efforts to find something in this idea, we have been obliged to abandon it, for the following reasons :—

First, The signatures are not hieroglyphics, only quarry-marks ; they give, indeed, approximately the figures of the hieroglyphics, or are in the hieroglyphic language pure and unadulterated ; and are not in the enchorial, demotic, or other forms of writing subsequently found in use amongst the Egyptian people for ordinary purposes. But quarry-marks are radically different things from hieroglyphics, in that economical sense which we have shown elsewhere to have ruled throughout the Great Pyramid building. Hieroglyphics, for instance, as their name imports, must be cut, carved, or engraved into the stone ; always a long, laborious, and expensive process, but so attractive in appearance when executed, as to have therefore ever been a favourite method of decorating, as well as 'rendering vocal,' Egyptian public buildings. Hence travellers have had common sense on their side, when they have deemed that no one would take the trouble to carve hieroglyphics on the surface of a large, well prepared stone, and then turn that surface inwards and bury it in the composition of a rubble wall, side by side with ordinary rough stones.

But quarry-marks, on the other hand, are merely the rudest outline imitation of hieroglyphic figures ; linear daubs put on the stone with a piece of chalk, or a coarse paint-brush, and with a freedom and

carelessness which show they could hardly have occupied the artist-workman more than seven seconds each, in the execution of any regal name. Such is certainly the full extent of time which the rude, almost ridiculous representation of King Shofo's two walking birds (chicks or quails), the horned viper and solar sieve, in the oval found by Howard Vyse in the Great Pyramid's chamber of construction, need have employed. Hence, if *such* works are turned inwards when building a wall, no offence against economy is committed, especially if the marks had already been of some other service. Now the service performed there, is plain enough, when both Howard Vyse and Perring inform us, that these red markings are found only on the Mokattam limestone, whose blocks had to be cut and squared on the opposite side of the river, and, indeed, of Egypt. Baron Bunsen, no doubt, in his vol. ii. p. 164, tells us that they, the four low flat-ceiled chambers, 'are all from 2 feet to 4 feet 10 inches 'high, and *cased with granite*,' when quarry-marks might have been looked for in vain. But this is only another of the great word-philosopher's blunders when treating of mechanical facts, and of which he gives an additional instance in the very next line by writing—'above them lies Campbell's *tomb*.' 'Campbell's *chamber*,' it is, if you like, *i.e.*, one of the five chambers of construction built inside the Great Pyramid, and merely to be a hollow (unenterable by man), for relieving the ceiling of the

King's chamber from too much weight,—but 'Camp-'bell's *tomb*' is the name applied, by the same explorer who named the chamber, to that magnificent and easily enterable tomb near the Sphinx; a real tomb with sculptured sarcophagi of the age of the twenty-sixth dynasty, and totally unconnected with the Great Pyramid in any and every way.

The Campbell's chamber too, would have been well worth more exact attention from the celebrated philologist; for there it is, that in the highest of all the five chambers of construction, and far above any other known chamber in the Pyramid, the oval of Shofo is found. And his too, is the only legible oval in that room; so that if any name were required to indicate who was 'the completer of the 'Pyramid,' surely that proud title, together with its supposed consequent in fame, 'the great of the Pyra-'mid'—must be the due of Shofo, and of no one else, according to the testimony of the stones of the Pyramid itself; and there is no need to bring in any other king, when his, Shofo's, name is actually written up in the sole and highest and most significant place.

In our Plate XIV. vol. ii., we have endeavoured to insert the quarry-marks on the walls of the chambers of construction, as described by Howard Vyse; and they will be found,—by attending to the symbolism of granite and limestone in section,—to appear on limestone-lined walls only.

Hence we may perceive that the ovals and red

figurings in the chambers of construction of the Great Pyramid, are merely passing daubs of quarry-marks connected with certain special blocks of lime-stone brought from a distance; and are markings most probably put on at the quarries, while their purpose was served when the stones had been safely conveyed to the builders of the Pyramid. Wherefore, though stones with the quarry-marks of Shofo and Nu-Shofo—as the reigning monarchs of Egypt—*might* have been subsequently taken out of an old building of *their* day, and inserted upside down or in any other way into a new edifice of a later date,—their is no pressing economical reason why the particular stones of the *chambers of construction* should not have been similarly misplaced, as to the mere reading of their quarry-marks, at their *first* as well as last occasion of being builded into a wall in the time of Kings Shofo and Nu-Shofo.

Second, we may remark, that while it is easy to imagine the builders of any little tomb in the neighbourhood, pulling a few stones out of the Great Pyramid for their petty purposes,—it is much more difficult to fancy the builders of the Great Pyramid supplying themselves with stones for their gigantic purpose out of the comparatively Lilliputian tombs, temples, or any work erected by man, either far from, or near to, them; for all such edifices would afford but a drop to the required bucket. There is no visible symptom too now, of the Great Pyramid being a patch-work building, made up of heterogeneous

materials in size, quality, and intended uses, aims, or ends; but everything, on the contrary, shows one grand uniform idea to have extended through the whole structure, and that its materials were procured by application to nature, or nature's earth-stored supplies, direct and immediate.

And *third*, we are informed that all authors, of every nation and every varied form of chronological belief, have invariably considered hitherto, that the quarry-mark ovals in the chambers of construction were originally drawn for the Great Pyramid works; and thereby prove convincingly under what kings these works were carried on.

Clashing Result.

Hence the whole monumental conclusion, formed by combining the quarry-marks of the Great Pyramid with whatever is to be trusted, or is tolerably agreed upon, among Egyptologists, and both of them with our astronomical date of the building,—can be no other, than that two of the kings of the fourth dynasty of Egyptian history, Shofo and Nu-Shofo by name, lived through a period including the epoch of 2170 B.C.

We do not wish to conceal in any way, but rather to call attention to the circumstance, that this date compels us to differ totally, as regards date, from all the famous hierologists, save one, of modern times; and makes our study of the Great Pyramid, according to the careful measure of its lines and angles,

lead to an entirely different result from that attained by those eminent men. (See Table on p. 321.) To their astonishing learning in many points we bow extremely low; but yet can no more think of denying, or fearing to acknowledge, the existence of those lines and angles which we have measured in the Great Pyramid, and on which we found, or to uphold their contemporaneousness with the Pyramid's building, and to insist on the importance of their scientific interpretation,—than any one else could deny the existence of the Great Pyramid in Egypt, or of Egypt in the world.

Let us pause, however, for one moment in the course of our impartial mechanical investigation, in order to ascertain into whose company our first step into the history of the Great Pyramid has brought us.

CHAPTER III.

HISTORICAL AUTHORITIES.

Mr. Osburn,—the one historian into the very middle of whose date and duration for the fourth dynasty of Egypt, the epoch 2170 B.C. falls,—was only brought to our attention very recently, and then by an accident; but after having experienced something of the earnestness of his manner, and thoroughness of his style of investigation,—we procured one after another of his works, tracing thereby the growth of his knowledge of Egypt, her monuments, and both ancient and modern language, continually increasing through a long period of years, until it may be considered to culminate in his *Monumental History of Egypt*, published in 1854.

His grand and abiding purpose appears to have been, to ascertain if the unlocking of the written materials of Egypt by Champollion's method of interpreting hieroglyphics, would disclose any traces of the sojourning of the Children of Israel in the Nile-land, or anything bearing on the Bible records of early events transacted therein or connected therewith.

'Is it not marvellous that they can now read the

'old Egyptian readily, and understand its grammar? 'These Egyptian discoveries are likely to be one of 'the greatest wonders of our age,'—had written the late Dr. Arnold; and William Osburn pressed forward in his younger life, with a youthful enthusiasm which did not tire during thirty years of devotion to the task, in order to acquire this power both of reading and of grammar, that it might be employed on the one chief object of his life. To prepare himself worthily, therefore, for his subject, he appears to have visited Egypt, made himself well acquainted with its physical features and climatic experiences, studied its monuments *in situ*, and copied hieroglyphics with his own hand,—over and above the never-ceasing task of making himself familiar with all the idiomatic particulars of the Coptic language, the extensions of hieroglyphic interpretation-methods, the works of modern hierologists, and the remains of all authors of antiquity who have treated on Egypt.

Hence while he is often going over the same ground as Gardner Wilkinson, Rosellini, or Lepsius, there is a difference in his manner; with him no dallying by the road-side, entranced by vivid details of private life in ancient times, or the skill of ancient workmen, or the often intricate details of idol and animal worship; that is, for their own sakes, —for he does not neglect such topics altogether, but keeps them in due subservience to his own grander object of pursuit, and estimates their true

value by the light of a more advanced civilisation and a purer religion. To trust no one of intervening times, seems to be a notable principle with him; and after sifting to the utmost all that has come down to us from Alexandrine Greeks, his principal labour begins with the unravelling the tissue of fictitious history composed by the ancient Egyptian priests, and recorded by their despotic monarchs on the exteriors of their temples, in a land of eternal slavery, where none dare openly contradict what was appointed to be inscribed. For this remarkable purpose Mr. Osburn makes abundant use of the hieroglyphics found on private tombs, sealed up in their own day, and only recently disclosed by excavations; but thereby in their turn unfolding for the first time the opposite side, to the official side, of Egyptian history; and delightful is it to observe his astonishing facility in dealing with the hieroglyphic characters of every age, and either in large or small amount.

But he, Mr. Osburn, is not perfect; for we have already, in vol. iii. p. 104, exposed his lamentable error as to the material of the ancient casing of the Great Pyramid; and could now add thereto his further errors, of placing Heliopolis opposite to, or east, instead of north-east, of the Sphinx; and alluding to the still remaining portion of the casing of the second Pyramid near the summit as being of plaster, and the lower part as having been of 'granite of a *vermilion* colour, pieces of which are

'lying about in abundance.' These are real and melancholy facts; and when we sought very recently to enter into correspondence with him, it was mainly to inquire how he had contrived to fall here and there into such astounding mistakes respecting simple things,—for they constituted the exceptional feature to the general rule of his otherwise admirable work and its precise character.

To our extreme regret, however, one of his publishers, and then another, though having a kindly remembrance of the man, and instituting special inquiries after him, were unable to procure any tidings; and by a secretary and member of a scientific and literary society to which he had once belonged, we were only further told,—that he had been much asked after of late, both in London and at Leeds, where he had once resided, but he had not been seen at either place now for many years; not, in fact, since an unfortunate break-up in his pecuniary affairs,—a sudden and total loss of all his private fortune, they feared, by the failure of a bank in which he had deposited whatever he possessed, and to the chief director of which, very shortly before the crash came, he had dedicated one of his learned volumes in sincerity of friendship and confiding trust. Since then,—and whether *all* the particulars were exactly so or not, was somewhat uncertain,—our chief informant repeated, 'Mr. 'Osburn had not been seen, and every one now 'believed he was dead.'

This, then, would seem to have been the melancholy end of a man of peculiar talent, high resolve, noble purpose, and magnificent ideas of devotion in a good cause,—and his works alone now speak for him in the world. What is thought of him generally we know not; and the only expressed opinion we have come across anywhere, is a passage in Chevalier Bunsen, vol. iii. of *Egypt's Place in Universal History*. The name, indeed, is differently spelt, but there can be no doubt it is intended for the author of the *Monumental History of Egypt;* the date of which is also sufficiently indicated by the relative time-allusion thereto, seeing that Bunsen's preface to his English edition was written in November 1858. The passage runs as follows:—

'Unfortunately, too, we are obliged to say of Mr. 'William Osborne's work on Egypt, which appeared 'two or three years ago, that, from a critical point 'of view, it has no value whatever.'

Now, Chevalier Bunsen having previously laid down, in his vol. i. p. 163, that 'Criticism is the 'testimony of a scholar who tests the evidences of 'the past,'—we must confess that this definition appears to us most admirably descriptive of the general contents of Mr. Osburn's historical volumes. And if there is any large difference between his criticism and Chevalier Bunsen's, it is first, that William Osburn translates the hieroglyphics originally for himself, instead of depending, like Bunsen, in the

majority of cases, on two friends always at his elbow ; and, second, that Osburn's critical testing of the evidences of the past, has led him to a different result from that arrived at by Bunsen. Here we suspect is the chief grievance of the complaint ; and if Chevalier Bunsen had, since his time, been proved independently to be right, by the grand test of whether his method of procedure led to truth or error,—there might be no resisting his *dicta*. But on one side, the same methods of philosophizing having since been taken up by the more brilliant M. Renan, have led him to chronologies so much greater than Bunsen's, that these latter have all their once supposed strength completely taken out of them ; while, on the other hand, our recent mechanical and scientific investigations on the Great Pyramid, within their own circle, emphatically declare Bunsen wrong and Osburn right.

Osburn, and Ancient Writers.

One charge is still indeed pressed in some quarters, viz., that W. Osburn's method was merely an 'idle attempt to collect evidence ;' and this is thought very seriously of, because Bunsen has written (vol. i. p. 163), 'to faith it is immaterial whe-'ther science discover truth in a spirit of scepticism 'or of belief,—and truth has really been found by 'both courses, but never by dishonesty or *sloth*.' Now, that idleness of such a kind is not to be charged against Mr. Osburn, the list of his principal

published works below sufficiently attests.[1] While, that it is not proper to term the attempt 'idle,' in the sense of any proper principle of research having been interfered with, when he determined to study Egyptology with reference to one particular class of research only,—may be considered by the public to appear from the title of a great association which has recently arisen in this country,—is at this present moment forming auxiliary committees in every town and city through the length and breadth of the land,—and claims to have been founded expressedly and approvedly 'for the accurate and 'systematic investigation of the archæology, topo-'graphy, geology, and physical geography, etc., of 'the Holy Land, *for Biblical Illustration.*'

Leaving then any further defence of Mr. Osburn's style of research to this new society,—one important and most difficult branch of whose work he laboured at long and successfully through years of solitary, and unsympathized, toil,—we only demand leave to include him amongst our great philologists-of-reference; and can assure our readers of being enabled thereby to lay down a broader and more

[1] (1.) An Account of an Egyptian Mummy. Presented to the Museum at Leeds. 8vo, . . . 1828
(2.) Ancient Egypt: Her Testimony to the Truth of the Bible. 8vo, ... 1846
(3.) Antiquities of Egypt. 8vo, ... 1847
(4.) Israel in Egypt. 12mo, ... 1853
(5.) Monumental History of Egypt. 2 vols. 8vo, . . 1854
(6.) Genesis and Exodus Illustrated from Existing Monuments. 12mo, ... 1856
(7.) Israel in Egypt. 2d Edition, ... 1856

secure track over the morass of doubt, and dark pits of oblivion, which beset man's present knowledge of the affairs of the world, as transacted four thousand years ago.

Thus when Baron Bunsen, with his vast erudition and transcendent critical powers, has gone over the ancient field, in vain searching for any counter evidence,—and when he asks,[1] 'can it then be accidental that everything which has been quoted 'from the theological works of Manetho by classical 'or ecclesiastical writers up to the time of Theodosius, indicates a man of sound reason and sobriety, 'and of extraordinary learning in the antiquities of 'his nation? . . . and would the same man, by 'altering the lists of the kings, which we have now 'authentic proof he had before him, have stamped 'himself as a deceiver and an empiric?'—then it is that Mr. Osburn steps in with a word of caution in due season. For how does Manetho's sound and sober history of Egypt really begin? With the following statement, according to Bunsen himself:—

	Years.	Years.
(1.) Dominion of the Gods, in two divisions, lasting for .		13,900
(2.) Dominion of Heroes, in two divisions, . . .		1,255
(3.) Heroes and Kings of the primeval race, transition from divine to human history, ...		5,813
(4.) Purely human history—provincial princes;		
a. Kings without particular notices (of Thebes?),	1817	
b. Thirty Memphites (Lower Egypt), . . .	1790	
c. Ten Thinites, ...	350	
	——	3,957
Sum-total, . . . =		24,925

[1] *Egypt's Place in Universal History*, vol. i. p. 66.

And this long series of rulers and kings is anterior to the usually-referred-to thirty dynasties of subsequent kings, beginning with Menes, all of them equally constituting what Manetho teaches as real history; and if his name is usually connected with the latter reigns only, it is because his original work has perished; and so far, fortunately for his character, the notices now existing of what he did write, are only the more probable parts of his narration, as culled by the criticism of Africanus, Eusebius, Syncellus, and other early Christian writers of the North African school. But even with the well-known thirty dynasties, Mr. Osburn further points out that Manetho describes, arranges, and numbers them so as to extend ostensibly over 5462 years, but says in a more private manner at the end, and in a mode provocative of many doubts, that they really lasted only 3555 years: and we may add, that even this quantity seems about one-third longer than the empire of Egypt actually lasted. While Sir George Cornewall Lewis does not scruple to say, after referring other lists of primitive kings in reputed ancient chronologists, to the productive powers of late fiction:—'The list of Manetho, must, in like 'manner, be regarded as the result of his own in-'vention; aided, doubtless, by some traditionary 'names and stories received from his predecessors.'

The only subsequent author to Manetho in the antique world, having any independent claim to chronological authority, is Eratosthenes; the Cyre-

nian Greek, supposed to have been librarian in Alexandria in the days of Ptolemy Euergetes (247 B.C.); a shrewd man, but picking up his information at second hand among Greeks only; and now entirely lost, as to his writings, except for some few quotations from him that have come down in other authors. Yet upon Eratosthenes does Chevalier Bunsen rely implicitly, as an unexceptionable source and unquestionable canon of early Egyptian history, —even with as firm a faith as, on the opposite side, Lepsius adopts the shorter, and M. Renan the longer, summation of Manetho; while even William Osburn, who is usually full of praise for whatever he thinks worthy in Bunsen, is obliged to speak of one particular attempt of his to establish a forced meaning of a particular passage in Eratosthenes, 'as a favour-'ite theory of his, Bunsen's, which he seems dis-'posed to support at a considerable expense of 'historical probability, and perhaps also occasion-'ally of accurate rendering of the text of his Greek 'authorities as well.'

Greek and Roman Travellers.

From these doubtful views, therefore, among the chronologists professed, we turn to Egyptian travellers, foremost amongst whom stands the venerable Herodotus. He, though a pure Greek, was earlier than the native Egyptian Manetho, having visited the ancient land about 445 B.C., when Egypt, though already passed over by the destroying hand of

Cambyses, was enjoying rest and independence once more for a brief interval. But though Herodotus is worthily immortalized for his writings in history, and though every one speaks lovingly and with praise of the simple, confiding, inquiring, childlike, manner of the blue-eyed Herodotus,—he wrote of Egypt, not a history, only an account of what he had seen and heard there; stories founded on history perhaps, but with their chronology utterly wrong, doubled up and twisted in and out. Wherefore it is, that even his great admirer Chevalier Bunsen 'lays it down as established,'—

'That the chronology of Herodotus, in the proper 'sense of the word, (only) begins with Psamme-'tichus; that for the previous period he possessed 'no expedient by which the discrepancy between 'the Egyptian computation and his own series of 'dynasties could be reconciled; that these two sys-'tems differ by about ten thousand years, and that 'neither consequently can be considered as either 'certain or possible.' As a traveller, then, only can Herodotus be received in his Egyptian writings; and as a Greek traveller, knowing no language other than his own native tongue; dependent, therefore, on interpreters in all his communications with the people; seeing everything, moreover, through the medium of Greek idolatry, and believing that Greek gods and Greek men had been the founders and originators of everything else upon earth. These imperfections, joined to the tactics of Egyptian

priests and the trickery of the dragomans of the time,—Mr. Osburn in his critical examination of passages sometimes breaks out with virtuous indignation on 'the imposition which had been practised upon the 'father of history by his unprincipled guides and 'informants in Egypt,'—were greatly in the way of the eminent Halicarnassian arriving at the mind of the Coptic land: and have now, to a great extent, deprived his works of that full and perfect credence which they implicitly commanded amongst his own countrymen for several centuries after his death.

Of Diodorus Siculus, who followed in about 58 B.C.; Strabo in 18 A.D., and Pliny in 70 A.D.,—or closer to our own times than to those of the Great Pyramid,—they contain so little in addition to what is related in Herodotus,—that, though they are all to be read and pondered over in connexion with other sources of information, and have been abundantly presented before the British reader again and again by Sir Gardner Wilkinson, Corey, Rawlinson, and others,—still the reader may gladly accept of Bunsen's proposition to 'leave at last all this chaff, and 'turn to the monuments;' for her monuments are undoubtedly Egypt's peculiar glory, and the veritable, and only extant pages of her most ancient experienced history.

Characteristics of Egyptian Monuments.

'No nation of the earth,' writes Chevalier Bunsen, with expressive eloquence, 'has shown so much

'zeal and ingenuity, so much method and regularity, 'in recording the details of private life as the 'Egyptians. No country in the world offered 'greater natural facilities for indulging such a pro- 'pensity than Egypt, with its limestone and granite, 'its dry climate, and the protection afforded by its 'desert against the overpowering force of nature in 'southern zones. Such a country was adapted not 'only for securing its monuments against dilapida- 'tion, both above and below ground, for thousands 'of years, but even for preserving them as perfect 'as the day they were erected. In the north rain 'and frost corrode, in the south the luxuriant vege- 'tation cracks or obliterates the monuments of 'time. China has no architecture to bid defiance 'to thousands of years,—Babylon had but bricks,— 'in India the rocks can barely resist the wanton 'power of nature. Egypt is the monumental land 'of the earth, as the Egyptians are the monumental 'people of history. Their *contemporary* records, 'therefore, are at once the earliest and most certain 'source of all Egyptian research.'

Similarly, too, and even more instructively, does the great Lepsius write :[1]—

'An intense desire after posthumous fame and a 'place in history seem to have been universal in 'ancient Egypt. This exhibits itself in the in- 'credible multitude of monuments of all descrip- 'tions which have been found in the valley of the

[1] Lepsius' *Einleitung*, freely translated by W. Osburn.

'Nile. All the principal cities of Egypt were 'adorned with temples and palaces. Towns of 'lesser note, and even villages, were always dis- 'tinguished by one temple at least,—often with more 'than one. These temples were filled with the 'statues of gods and kings, generally colossal, and 'hewn from costly stones. Their walls also, within 'and without, were covered with coloured reliefs. 'To adorn and maintain these public buildings was 'at once the duty and pride of the kings of Egypt. 'But even these were rivalled by the more opulent 'classes of the people in their care for the dead, 'and in the hewing and decoration of sepulchral 'chambers. In these things the Egyptians very far 'surpassed the Greeks and Romans, as well as all 'other known nations of antiquity.

'Still further to enhance to after times the value 'of these ever-during monuments of ancient Egypt, 'it was universal with the inhabitants to cover 'their works of art of every description with hiero- 'glyphics, the purport of which related strictly to 'the monuments on which they were described. 'No nation that ever lived on the earth has made 'so much use of its written system, or applied it to 'a purpose so strictly historical, as ancient Egypt. 'There was not a wall, a platform, a pillar, an 'architrave, a frieze, or even a door-post in an 'Egyptian temple which was not carved within, 'without, and on every available surface, with pic- 'tures in relief. There is not one of these reliefs

'that is not history, some of them actually repre-
'senting the conquests of foreign nations; others,
'the offerings and devotional exercises of the
'monarch by whom the temple or portion of the
'temple on which the relief stood, had been con-
'structed. Widely different from the temples of
'Greece and Rome, on which inscriptions were
'evidently regarded as unwelcome additions, form-
'ing no part of the original architectural design,
'but, on the other hand, interfering with and mar-
'ring it,—the hieroglyphic writings were absolutely
'essential and indispensable to the decoration of a
'perfect Egyptian temple.

'This writing, moreover, was by no means con-
'fined to constructions of a public nature and of
'great magnitude, such as temples or tombs, but was
'also inscribed on objects of art of every other con-
'ceivable description. Nothing, even down to the
'palette of a scribe, the style with which a lady
'painted her eyelashes with powdered antimony, or
'even a walking stick, was deemed too insignificant
'to be inscribed with the name of the owner, and a
'votive dedication of the object itself to his patron
'divinity. Inscriptions with the names of the
'artists or owners, so rare on the remains of Greece
'and Rome, are the universal rule in Egyptian art.
'There was no colossus too great and no amulet too
'small to be inscribed with the name of its owner,
'and some account of the occasion on which it was
'executed.'

Here, then, is some idea of the vast storehouse of materials for the early history of the world, contained in the monuments of Egypt. There is nothing at all approaching it in any other land whatever, either in quantity, precision, or preservation; it is a phenomenon in the history of the human race, and formed a task so exceedingly important in itself for the world to have executed for its future use and behoof,—while Egypt was so precisely the country in which it would be in every way best executed,—that there seems, to our humble and distant contemplation, less than usual of the vanity of human works attachable to those toil-worn records of the old Egyptians.

Nay, there would even appear to be also a something about those marvellous remains, symptomatic of their having been a task appointed by Divine Providence for the Egyptian people to perform in their day; and they did perform it well. A suggestive idea, perhaps, but one which we shall not attempt to follow further; as all that we have really to attend to at present is this, viz.,—that these most remarkable and speaking monuments, *having* come down to the times in which we live, duty calls upon us to examine their weighty testimony—and with all, and whatever, amount of power we may be able to bring to the task—in the difficult, though happily limited question, which is more immediately set before us.

CHAPTER IV.

EARLIEST PROVED POINT OF EGYPTIAN HISTORY.

From all the characteristics, then, of Egyptian monuments, as described by the most eminent hierologists, we may gather the useful warning, that when a date *is* fixed 'by the monuments' in Egyptian history, it must be fixed indeed. Hence have arisen very strong remarks addressed to those maintaining opposite views, and couched in such terms as these :—

'We may venture to assert, without being charged 'with temerity by competent authorities, that, in 'consequence of Egyptian researches, the arbitrary 'barriers which Jewish superstition and Christian 'sloth have erected upon God's free field of human 'history are for ever broken down ;[1] and again,— 'There exist Egyptian monuments, the date of which 'can be accurately fixed, of a higher antiquity than 'those of any other nation known in history, viz., 'above five thousand years. This fact must be ex- 'plained : to deny it would be proof of little skill, 'and still less candour, on the part of any critic, who 'has once undertaken to prosecute the inquiry.'[2]

[1] Bunsen's *Egypt*, vol. iv. p. 20. [2] *Ibid.* vol. i. p. 28.

These builded monuments of old Egypt do thus in very truth come before us in every way, indirectly as well as directly; gaunt witnesses which will be heard; they are the facts which must be satisfied, and to which everything else that can be referred to for very remote illustrations, is entirely subsidiary. No matter what course of criticism is adopted, as many writers insist, or what road of inquiry is taken, so long as those positive points, those veritable blocks of granite, are taken up at last,—for omitted they cannot be. History,—say these instructors of the people,—in its scientific form, has to deal, not with the question of probability, but of evidence; not with eloquently-drawn inferences, but with positive data, if at all. And again,—'The task which 'European science has now to perform, is to bring 'that (Biblical) tradition within the pale of history, 'i.e., to deal with it conscientiously and honestly, 'and to analyse it for the purpose of discovering 'what is the truth which is to be gleaned from it. 'Of course we must here take our stand on the 'Egyptian monuments and records, including the 'language, and cannot make Biblical research the 'starting-point. It should be still more evident 'that the whole inquiry stands upon the ground of 'philosophical history. And yet, with the growing 'and preposterous claims advanced by the clergy to 'fabricate even historic truth, and with their strenu-'ous exertions to destroy historical science wherever 'it is possible, in order to bring us back to the dark

'ages, it has now again become the more imperative 'to state this in plain terms. It is almost more 'necessary, indeed, to lay great stress upon it in 'Protestant than in Catholic countries. For dog-'matizing Bibliolatry, the superstitious use which 'Protestants make of their Bible as a cloak for in-'dolence and want of reflection, must produce the 'effect which scholasticism and hierarchical tyranny 'have produced in the south of Europe,—a total 'abandonment of all scientific study of the sacred 'records. Ignorance marches step by step with 'perversity, and scepticism with superstition.'[1]

'The nineteenth century has in the last thirty 'years witnessed, together with immortal discoveries, 'the most senseless and shameless attempts to re-'establish in the world ancient and modern fraud, 'falsehood, and nonsense, and pass it off as ortho-'doxy. Posterity will find in the noble love of 'truth and the fearless faith of German research an 'atonement and consolation for political follies and 'despotic violence.'[2]

Agreeing, then, fully with the above author on the importance and even necessity, in Egyptian history, of 'taking our stand on the Egyptian 'monuments,'—we are attracted to his page 57, vol. iv., giving the 'limits of the duration of Egyp-'tian epochs prior to Menes, according to *Egyptian* '*monuments*, records, and traditions;' and then meet with the most confident statement, of a

[1] Bunsen's *Egypt*, vol. iv. p. 378. [2] *Ibid.* vol. iv. p. 397.

civilized government having existed in Egypt for six thousand years before the time of Menes, the leading king of Manetho's first, out of his thirty, generally allowed, dynasties.

Upon this assumption or demonstration, wherein the '*monuments*' are brought to the head of the facts concerned, Chevalier Bunsen proceeds, at p. 488, vol. iv., to particularize true and real Egyptian history as follows :—

	Date B.C.
'The period of the Nomes, and the formation of Osirism, or 'the psychical element of religion, and basis of the union; 'provisional solar worship; beginning of Egyptian nationality,	10,000
'Beginning of the formation of castes; priests and warriors; 'close of the republican period in the Nomes,	9,086
'Bytis, the Theban priest of Ammon, the first sacerdotal 'king,	9,085
'Beginning of elective kings,	7,230
'Beginning of hereditary kings in Lower Egypt,	5,413
'End of them,	3,624
'Contemporaneous Thinite Princes before Menes, during the 'last 350 years of the pre-Menite period, according to 'Manetho, collaterally with the Memphites, therefore 'from 3974 to 3624.	
'Menes king of all Egypt; Orisis-Union, and the consciousness of Egypt being a kingdom,	3,623
'Pyramids built in the first dynasty,	3,460
'Animal-worship introduced, improvement and establishment of writing, beginnings of literature; second and 'third dynasty (contemporaneous beginnings of the Ritual),	3,400
'Building of the largest Pyramid (the second of Herodotus),	3,280

The above remarkable chronology closes with a blunder of description, for the 'Great Pyramid,' which is the largest of all the Pyramids of Egypt, is the first, not the second, Pyramid of Herodotus; his second Pyramid being that which he says 'was

'built by Cephren, the brother and successor of 'Cheops, and which Pyramid he, Herodotus, mea-'sured and found to be much less in size than that 'of Cheops;' in fact it is the Pyramid usually known now as 'the second Pyramid of Jeezeh,' or sometimes more particularly as the 'second largest Pyramid of 'Jeezeh,' but which expression eventually comes to the same thing. In fact the case was simple enough, until Chevalier Bunsen introduced assumptions of his own about the builders, then proceeded to refer to those assumptions as demonstrated facts, or to found on them as such; and finally to bewilder himself; whence we can only explain amongst other errors his statement[1] that 'the elder' (of the royal brothers Cheops) 'built the second largest Pyramid, 'and *that vast appendage to it, the stone dyke;*' for no built stone dyke exists far or near about the second largest Pyramid, though there is such a thing eminently in the going down eastwards from the *third* largest Pyramid; but that was long subsequent to the brothers Cheops and their dynasty; and so very much smaller than the second largest Pyramid, as never at any time to compete with it either in name or fame.

Our purpose, however, now, is not to be critically severe with the last item in the above long list of chronicled events in Egyptian history, but to ascertain how all the preceding items have been obtained and settled. That they are considered by Chevalier

[1] Bunsen's *Egypt*, vol. ii. p. 175.

Bunsen as perfectly secure, and beyond the region of doubt, appears from the manner in which he refers to them again and again; as thus:—

'The result of the researches in this present Book 'has been, that the traditions *prior to Menes* which 'allude to human kings are *real throughout, and* '*exclude entirely heroic fiction and all ideal re-* '*presentations.* We have seen that there was a 'series of organic development; in the first place 'we found sacerdotal kings, then elective kings out 'of the military families, and lastly kings of an 'Upper and kings of a Lower country. Our tables 'of the ages of the world show the connexion be- 'tween these epochs and the general epochs of the 'most ancient national history; and the parallel 'facts we have stated justified us, I think, in call- 'ing the Egyptians the chronometers of universal 'history, and in asserting that Menes and his empire 'are nothing more than the culminating point of 'a long preceding constitutional development of 'Egyptian life.'

The case therefore grows in importance as it is proceeded with, and its essence consists in this,—that a history of an organized, constitutional, and therefore highly civilized Egypt is asserted to have prevailed for a period of 6700 years prior to the building of the Great Pyramid; and at the head of the documents, on which this momentous agglomeration of human experiences in this world of troubles, trials, and vexations of spirit is asserted, detailed,

and chronicled, stands the item which all must treat respectfully, '*the monuments of Egypt.*'

With striking propriety is precedence given to 'the monuments' among other remains of early Egyptian history, because the monuments have lasted better than anything else; there are earlier stone monuments, for instance, than papyri, or books, or papers of any kind or degree; and the stone monuments are all vocal with inscribed hieroglyphics; they speak clearly of what was transacting in their time; and are '*the contemporary records,*' which Bunsen alludes to (vol. i. p. 31) 'as the 'earliest and most certain source of all Egyptian 'research.'

Employed just in this manner, and in this only, it is that Egyptian monuments have the marvellous power that has been attributed to them of clearly establishing the events and stories of life in the earlier days of the world. Thus, also, Dr. Lepsius lays down his view of the law under which Egyptian monuments are to be exclusively, or at least are understood to be exclusively employed in historical researches, when quoted therein by modern Egyptologists and hierologists:—

'We set out then from hence, that the beginning 'of the true history and chronology of no ancient 'nation can, to meet the requirements of their day, 'extend much further backwards than the date of 'the oldest contemporary source of knowledge; and 'we have found this opinion confirmed to the dis-

'credit of the early histories of the inhabitants of 'Europe and Asia. Therein lies the great advan-'tage possessed by the early history of Egypt over 'all other histories, inasmuch as we can draw our 'knowledge of it from contemporary sources of so 'early a date; and they, not literary histories merely, 'but also coeval monuments, the most correct and 'indubitable of all teachers of history. Therefore 'it is that the history of Egypt at so very early an 'era may be constructed.'

Baron Bunsen's Authorities demanded.

Now, then, after being thus informed and prepared, let us ask, Where are the Egyptian contemporary monuments on which Chevalier Bunsen has constructed these 6700 years of Egyptian history, prior to the epoch, or say to within one hundred or two hundred years, of the epoch, of the Great Pyramid?

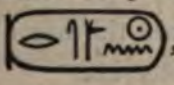
We may ask this question again and again; and echo will answer, Where? For there is not a single contemporary monument of the kind known to exist throughout the whole Egyptian land. The millenniums of years have been piled up one over the other by the great word-philosopher of our age without a single monument to refer to. Chevalier Bunsen, moreover, knew that there was not one such monument for appeal or for guidance, because he has written in his first volume, page 69, of

'these monuments of the fourth dynasty' (including, therefore, the epoch of the Great Pyramid), '*the oldest in the world;*' and though he attributes in his second volume some of the Abooseer Pyramids to the third dynasty, Dr. Lepsius claims them for the fourth; and the difference of years between the two dynasties can in no case be very notable. Extend it even to two hundred years, and ask again —where are all the earlier contemporary monuments on which Chevalier Bunsen constructed the Egyptian history of the 6500 years previous to the dynasty which erected the Great Pyramid, or the Abooseer Pyramids?

Again comes the answer,—such monuments do not exist; not a single one, large or small, fixed or portable, belonging to all that enormous interval of time, has ever been seen by modern hierologist or excavator. Dr. Lepsius, the most experienced both of all men now alive and of all who have lived during the last three thousand years touching the more ancient monuments of Egypt, wrote from his excavations at Jeezeh in 1843:—'Nor have I 'yet found a single cartouche that can be safely 'assigned to a period previous to the fourth 'dynasty. The builders of the Great Pyramid 'seem to assert their right to form the commence-'ment of monumental history, even if it be clear 'that they were not the first builders and monu-'mental writers.' And again he says, 'The Pyra-'mid of Cheops, to which the first link of our whole

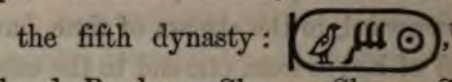
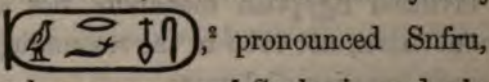
'monumental history is fastened immoveably, not 'only for Egyptian, but for universal history."[1]

Two thousand years only from the Great Pyramid downward, in the stream of time, have covered the land of Egypt from one end to the other with its marvellous piles of chronological monuments,—but of Baron Bunsen's 6500 asserted previous years of highly civilized Egyptian monarchy, not a single monument exists, not even in the resounding pages of the great Prussian diplomate.

The monuments of the third dynasty are the first there directly appealed to as existing; and though in vol. ii. p. 617, the hieroglyphic ovals are printed of kings in the first and second dynasties,—these are not pretended to be derived from contemporary monuments, but are deduced from votive or traditional references on subsequent buildings; in the same way, in fact, as the similar heraldic escutcheons of two of the idol gods of Egypt, Thoth and Hemithei,—which head Chevalier Bunsen's list of real kings,—have been obtained. In a similar manner, we conclude, have been derived most of the escutcheons of twelve reputed kings of the third dynasty; for the only three which are referred to as legibly written anywhere in the contemporary manner, are  ,[2] variously rendered by differ-

[1] Page 21 of Dr. Lepsius' *Letters from Egypt in* 1842 *and* 1845, edited by Kenneth R. H. Mackenzie. London, 1852.

[2] Quarry-marks of a ruined Pyramid of Regah and the middle Pyramid of Abooseer.

ent authorities as Seser, User, Ousre, Ousrenre, Ra-en-seser, Raosis, Userra, and Userehre, and placed by Dr. Lepsius in Plate XXXIX., vol. iii. of his folio plates, in the fifth dynasty:  ,[1] variously rendered Re-shore, Shoure, Shura, Sahu-ra, Soris, Sirios, and placed by Lepsius in Plate XXXIX. of his volume iii., also in the fifth dynasty; and lastly,  ,[2] pronounced Snfru, Senefru, Chnubos-gnevros, and Sephuris, and placed by Lepsius again and again in the fourth dynasty.

Hence all the earliest monuments known even to Chevalier Bunsen, cluster close about the fourth dynasty, or the builders of the Great Pyramid; and according to the Great Pyramid itself, mechanically and astronomically interpreted, they belong more or less to the year 2170 B.C.; which date, and not the year 10,000 B.C., is therefore the earliest date that can be fixed by '*the monuments*,'—used as they only can be safely, properly, or legitimately, for *contemporary events*. Or, in other words, these severe and unexceptionable witnesses, the monuments of Egypt, have shattered in pieces the learned philologist's baseless construction of 6500 years of previous supposed Egyptian history, and over which he had been holding for so many years the name of '*the monuments*' as an ægis of protection.

[1] Northern Pyramid of Abooseer, and a tablet in Wadee Maghara.

[2] Tombs near the Great Pyramid, and also tablets in Wadee Maghara.

Consequences of there being no Authorities.

Having once been cited on the field, these monuments are indeed active, as well as passive, opponents to those who use them wrongfully; for not only do they *not* bear testimony to an Egyptian monarchy lasting through that immense period of time claimed by Chevalier Bunsen, but their absence shows that such a thing could not have been; for had it existed, material traces innumerable of such a world-long period of civilisation would have been left behind, and in Egypt nothing of that sort decays. 'It is not there,' says Bunsen himself, 'as it would 'be in Europe or India, where in the former cold 'and snow, or in the latter heat and rain destroy; 'for Egypt is the monumental land of the earth, 'adapted not only for saving its monuments from 'great dilapidation, *but for preserving them as 'perfect as the day they were erected.*'

Thus, too, the learned and most competent Dr. Lepsius holds forth,—'Even that apparently most 'perishable of all building materials, brick of black 'Nile mud dried in the sun, has retained for 'thousands of years its architectural junctures, and 'the cement with which it is united. Around the 'celebrated temple of Ramses the Great, at Thebes, 'the "Memnonium," stands a suite of great vaulted 'halls, altogether built with this material, and partly 'coated with stucco. These were built at the same 'time with the temple itself at the commencement

'of the thirteenth century B.C. This fact not only 'appears from the architecture, but also still more 'demonstrably from the bricks themselves, which, 'as being made for the king's service, are stamped 'with his name. At that time, and earlier, it was 'a very common practice to coat the tombs excavated in the rocks with Nile mud, and to lay upon 'that the white ground of stucco for the paintings. 'This was especially the case when the rock was 'brittle, and required a vaulted roof. The same 'custom prevailed even up to the most ancient 'times of the Pyramids of Memphis. But not only 'the materials, but also the colours which were laid 'upon them, retain to this day all their freshness, 'without any perceptible change, in closed vaults, 'and in certain cases, even when exposed to the 'open air.'

Even, therefore, had Egyptian monuments been executed in mud alone, something of the innumerable buildings in that material during 6500 years of the life of a great nation would have come down to us in that peculiar land. But the Egyptian country excels likewise in its abundance of hard materials of the best quality, either for building or carving into *in situ;* such as its admirable limestones, sandstones, porphyry, basalt, and granite; and the Egyptians, of all people who have ever lived on the earth, were the most skilful in working the hardest materials: delighting apparently ever more and more, to employ them either rudely in archi-

tecture, or to sculpture them finely, the harder they were. Hence both the hollow sarcophagi and solid statues which they worked out of granite, basalt, and diorite,—are alike, even still, a marvel to all practical men as to how they were executed; and the taste for working in these hard materials was at least as strong, if not stronger, in the earlier than the later dynasties.

These materials were also employed in a manner still further to promote their lasting qualities; for as Dr. Lepsius continues to remark,—'Next to the 'abundance and beauty of these works of art, is the 'extreme care for their permanence which was ex-'hibited by the Egyptians, and which was evidently 'in accordance with their religious belief. It is 'scarcely needful to refer, in proof of this, to the 'two great Pyramids of Jeezeh, which are, in fact, 'artificial mountains, constructed with huge blocks 'hewn from the rock on which they stand, and in 'which sepulchral chambers were afterwards ex-'cavated with the chisel, as though they had been 'natural crags. It is as if the builders of them had 'designed to erect two pillars to support the vast 'superstructure of the history of mankind. This is, 'in a word, the peculiarity of all that remains of 'the works of the ancient Egyptians. Whether 'they built halls for pomps and festivities, or dug 'out sepulchral chambers; whether they constructed 'for life or for death, it was always with the inten-'tion that their works should last for ever.'

Hence the proper conclusion will surely appear in the eyes of common sense,—that, if such *lasting* monuments formed the permanent and abiding character of the Egyptian nation, and we find no monuments of it whatever, anterior to the epoch of the reputed, and by moderns so-called, fourth dynasty,—the nation itself did not exist anterior to that epoch, and certainly not through the 6500 years of Baron Bunsen's assumed pre-Pyramid history.

Origin of the Egyptians.

There remains indeed the difficulty of accounting as to how the Egyptian monuments make so grand an appearance as they do, the moment they come upon the scene at all; for the sculptures of the fourth dynasty are not only in as true and fine art as any, but even better than most, of those which followed them; and it is contrary to all experience that a people could spring in a moment from absolute nothingness to such admirable perfection.

The difficulty is indeed a serious one, but not relieved in the slightest degree by going back to Chevalier Bunsen's vision of an early Egypt with both an Upper and a Lower crown, and a city of Thebes founded long before Menes or any of the Pyramids; for the tedious and enduring ages of imperfect beginnings and defective executions should then be findable. And here, at this point and view of the case, the truth of which he also would seem fully to allow, even the acute M. Renan is reduced

to something like wonder, confusion, and despair; 'for when one thinks,' writes he, in discussing the Great Pyramid, Sphinx, and similar well-known monuments, 'when one thinks of this civilisation, 'at least 6500[1] (really 4035) years old from the 'present day, that it has had no known infancy; 'that this art, of which there remain innumerable 'monuments, had no archaic epoch; that the Egypt 'of Cheops and of Chephren is superior in a sense 'to all that followed,—one is seized with giddi-'ness; *on est pris de vertige.*'

This confession is frank, and does M. Renan notable honour; for the facts before him do seem, as he further on confesses, to imply, that all the ordinary understood laws of the beginning and growth of a nation 'have been totally reversed in the case of 'Egypt.' One ray of light in the way of a possible line of explanation, does indeed occur to him, but he does not seem to follow it up; and he does not appear aware that it had occurred some years before to another author, viz., William Osburn; and had been abundantly probed, tested, and investigated by him, even to the extent of showing that the people who afterwards formed the Egyptian nation arrived at the banks of the Nile, near the crown of the

[1] This 6500 years ago, or 4635 B.C., is M. Renan's date for the fourth dynasty; and does not therefore point to anything, relative to Egyptian history, earlier than our statement of 4035 years ago, or 2170 B.C. would do. He is therefore alluding really, under his larger figure, to the same absolute time, monuments, and personages, that we do under the smaller numbers given by the Great Pyramid itself.

Delta, as colonists from another land, only a very short time previous to the epoch of the fourth dynasty.

As colonists from another land, and under very remarkable circumstances: what these were, W. Osburn goes into deeply, in a critical examination of the foundations in nature of the hieroglyphic forms; deducing thence something in the first settlers of Egypt 'as to a company of persons once in 'a state of high civilisation, but that through some 'strange anomaly in the history of man, they had 'been deprived of great part of the language, and 'the entire written system, which had formerly been 'the means and vehicle of their civilisation.' Combining which inference with the indications he obtains otherwise, that 'the Fathers of ancient 'Egypt first journeyed thither across the Isthmus 'of Suez, and that they brought with them the 'worship of the setting sun,'—'how is it possible,' he adds, 'to resist the conclusion that they came 'thither from the plains of Babel, at the first dis-'persion of mankind, and that the civilisation 'of Egypt was derived from the banks of the 'Euphrates?'

And after still further investigations, he speaks more confidently of 'the cares, the fears, the de-'signs of the leaders under whose standards the 'Mizraites first marched westward, before the mys-'terious impulse that drove them forth from the 'fertile plains of the Euphrates. They fled before

'it, nor dared to tarry on the grassy banks of 'Jordan, nor in the shady valleys of Judah, nor 'by the waters of Siloah, that flow softly. The 'voice of a greater than man sounded in their ears. 'The terror of an invincible power awed their 'spirits, and they dared not disobey. They braved 'the perils and privations of a journey over an un-'known desert, before the same fearful impulse; 'nor ever were they allowed to rest, until they had 'reached the uttermost borders of the land which 'He who pursued after them had destined them to 'populate.'

Respecting this theory, we can only say at present, that in so far as it offers a beginning for Egyptian history, it accords with '*the monuments of* '*Egypt*,' those unaltering, unaltered, and unavoidable indices and accompaniments of every such investigation. But if these same monuments do not also, as evidently they cannot in themselves, enable us to trace back to events much earlier than their *own* times,—all-exciting as it would be to the soul of man, were he really able to look into the events of these truly primeval periods of the human race,—we shall do well to endeavour, simply and soberly, to ascertain by the light of their guidance through later times, what was the further course of this remarkable nation *after* its apparently forced, and certainly very sudden, monumental beginning on the banks of the Nile.

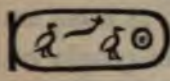
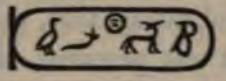
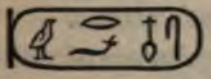
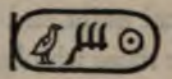
CHAPTER V.

LIFE UNDER THE OLD EMPIRE.

THE earliest identifiable contemporary monuments of Egypt, or the beginnings of its monumental history, so far as known to European researches up to the present year, are, according to the unanimous opinion of all hierologists,—the rock-tablets of Wadee Maghara in the peninsula of Sinai; and the Pyramids, with their surrounding tombs, at Jeezeh, Sakkara, and the Memphis neighbourhood. And this conclusion equally obtains, whether these remains be considered to belong to the fourth dynasty only, or partly to the third, and partly to the fifth.

Equally is it also the fact, that these earliest examples of the monuments are confined to the places mentioned; and that Middle and Upper Egypt, and still less Nubia and Ethiopia, have nothing whatever to compare with them in antiquity. So that the general testimony of the monuments in Egypt itself, is precisely as Lepsius and Osburn have demonstrated; viz., that that species of testimony to the civilisation of Egypt began, and

began suddenly, near the upper corner of the Delta, and *ascended*, as it grew with ages, the valley of the Nile; illustrating thereby its Asiatic, not African, origin.

The Sinaitic remains of these earlier dynasties are not many, but are remarkably well sculptured; are claimed by all hierologists to be authentic and contemporary; belong chiefly to the kings  Shofo,  Nu-Shofo,  Sephuris, and  Soris; show—by their designs—that animal-worship, or animal and semi-animal gods, were already established and reverenced; and that there was armed opposition to the Egyptians from the natives of that peninsula, emphatically represented as thrice hilly; and which we now are aware contains noble pinnacles of mountains upwards of seven thousand feet high,—natural watch-towers overtopping and overlooking everything else in Egypt, Libya, and Arabia for leagues and leagues around them.

The Jeezeh and Sakkara remains, on the contrary, besides being vastly more plentiful, are eminently *peaceful* in their traits. In the case of the Pyramids, indeed,—those closed and artificial mountains of stone say nothing whatever, either by picture or inscription, for one cause or the other; while in form and fact they merely supply the otherwise flat-topped landscape with acute hill-points, and without offer-

ing anything approaching to strongholds for war, or gathering-halls for peace.

But when we enter the tombs, there pictured scenes are witnessed on every side, of agriculture, cattle-feeding, industrious country life, and with hardly anything else. These characteristics, moreover, are continued, often through the lives of two, three, and even more generations of the same family; indicating that, there, or then at least, and however it was procured, the Egyptian people had rest and quiet and freedom from war's alarms.

For those who have not had the privilege of visiting these earliest pictorial monuments of Mizraim, and for many of those who have too,—their chief trust for what is there contained must be placed, and will be most worthily placed, in Dr. Lepsius' large work of twelve folio volumes;—the largest collection of Egyptian plates, out of the many large collections brought out by different European countries, that has ever yet been produced; and the first that has been *chronologically* arranged. This is a unique feature, and one which, to have its requirements properly executed, perhaps needed a Richard Lepsius to pave the way; but having once been executed, and by him, some extension of grasp of the great Egyptian subject must occur to every one, on each successive occasion of looking over the series of carefully-executed engravings.

Volume first, after several maps, begins a long series of topographical views extending through

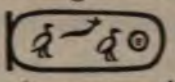
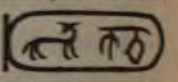
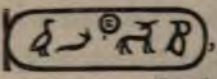
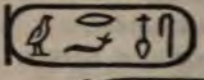
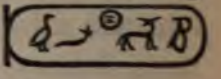
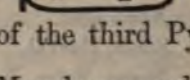
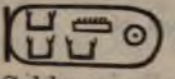
both this and the next volume, and arranged apparently with strict attention to the date of the earliest monuments discovered at each place; the names of such places being then found to run in the following order :—

Sinai, . Wadee Feran.
Wadee Maghara.
Sarbut el Kadem.
Memphis, Aboo Roash.
Jeezeh.
Abooseer.
Sakkara.
Dashoor.
Lisht, . Meidun, Illahun.
The Faioum.
Sais, . Heliopolis, Tanis.
Benihassan.
El Amarna.
This and Abydos.
Thebes, Luxor, Karnak.
Esneh, Eilithya, Silsilis.
Philæ.
Abusimbel.
Soleb, Barkal.
Meroe, Sofra, Naga, etc.

Any good map will show the generally increasing southern distance of each of these localities successively; but only the Plates themselves will give a good idea of how, after the last rays of their meridian splendour at Thebes, the monuments further south become continually poorer, smaller, and even more decayed though more modern, especially at the last-named station in Ethiopia.

But the next volume, or volume iii., begins the

real burden of Dr. Lepsius' great task, viz., the inscriptions on, and views of, the monuments themselves. And how do they begin in his chronologically arranged work?

Plate L, entitled fourth dynasty, contains first, a large-sized reproduction of the quarry-mark of  Shofo, from Howard Vyse's chambers of construction in the Great Pyramid; second, smaller copies of the quarry-marks of  and  , or Nu and Nu-Shofo from the same place; and, third, some indistinct markings from a Dashoor Pyramid. Plate II., also entitled fourth dynasty, gives three tablets from Wadee Maghara, to  Sephuris,  Nu-Shofo, and  Shofo; Howard Vyse's coffin-lid out of the third Pyramid with the oval of  Mencheres, and a door-ornament from Sakkara, now in the Berlin Museum. Then follow five plates of pictures and inscriptions inside tombs at Abooseer, and thirty-two plates of similar subjects from tombs about the Jeezeh Pyramids, all *entitled* of the fourth dynasty. These being followed by forty-four plates entitled of dynasty fifth, of which one is due to Wadee Maghara, sixteen to Sakkara, and twenty-seven to Jeezeh.

Volume fourth represents further subjects of

dynasties fourth and fifth, in twenty-three plates, from tombs at Jeezeh and Sakkara; then dynasty sixth, in thirteen plates, at Sauiet el Meitin, Hamamat, Chenoboskion, etc.; and then follow in this and the next volume dynasties eleventh, twelfth, and thirteenth, from a greatly increased variety of places, and with many new subjects.

Men of the Fourth Dynasty.

Before studying, therefore, these later periods, let us cast a glance on the men of the fourth and fifth dynasties, or those who were contemporary with the building of the Great Pyramid.

On entering every tomb, we have these men before us immediately; reddish-brown men, with long, and either straight or slightly aquiline curved noses, large and long eyes, and rather full lips. Their foreheads are probably low, certainly not notably high, but the rest of the cranium is a phrenological mystery, so completely is it hid in a thick, fuzzy, close-cropped, black, wig.

The wig was a great institution in ancient Egypt, and dyed jet black, so that even with the most aged men,—and whose age is shown both by their leaning on a staff, and having their poor naked breasts, and whole torso seamed with deep, ungainly, transverse wrinkles,—the blackness of the wig remains unimpaired. Other clothing is not very abundant. The princes issue forth to overlook their labourers with an awful baton of authority and chastisement in their

hands, but attired only in a short kilt—usually of white cloth—skate-like sandals, a blue and white necklace, and the wig; on a few occasions a leopard's skin is worn over the shoulder. The overseers next in authority under them, and the succeeding grades of scribes and field-labourers, have only a piece of cloth about the waist, and not always that; no sandals, seldom a necklace, but always a wig.

The women's wigs are larger than the men's, and arranged so as to be typical of long straight-flowing tresses, though rigorously confined to a definite length. The complexion of their skin is a yellowish pale olive; and the costume,—varied only in the case of princesses over servants by necklaces, bracelets, and anklets of blue and white glass beads,—consists of one long, close-fitting and enclosing garment of thin elastic material, like a guernsey jacket; but extending from the ankles, upwards, to close under the breasts, whence two broad straps pass over the shoulders to support it. This envelope is brilliant scarlet in colour, has never a fold or wrinkle in all its length or breadth, and yet appears abundantly to allow of the separation of the feet in walking or dancing.

Throughout the whole of the pictured scenes, there is not a single instance of a peasant enjoying, or working for, himself under his own vine and his own fig-tree; no independent thought, or look, or action, on the part of poor men is allowed, but they are all in official training to serve the Prince of the

time being; and *administration* is the order of the day. The difference of dress described between prince and peasant, is an involuntary method to the artist of distinguishing rank; but his intended method is there also, viz., superior size or scale. Hence, the owner of the tomb is a colossus standing the whole height of the wall; which, in front of him is divided into six, eight, or more compartments, by horizontal lines, on the edge of each of which his servants are engaged on their various services.

Ploughing—and sowing too, in so far as concerns covering up the seed thrown broadcast by hand,—seem both accomplished by driving flocks of sheep and goats over the lately inundated land; reaping is performed with a sickle; thrashing by driving herds of donkeys about a floor; and winnowing with spades. But the agricultural operations are very scanty, compared to the pastoral. The sheep, indeed, long-legged things, with horizontal and mutually diverging horns,[1] and the goats with venerable beards and lyre-shaped retreating horns, are not very numerous,—but the oxen and greater cattle are in exceeding abundance, of magnificent quality, and of a portliness which shows them rather intended

[1] We say sheep advisedly, although M. Renan writes there are no sheep. His account is otherwise good,—but for these very early ages only of Egypt, be it understood,—and stands thus: 'Amongst the 'number of domestic animals possessed by the deceased were, oxen, 'donkeys, dogs, apes, antelopes, gazelles, geese, "*demoiselles de* '"*Numidie*," ducks, tame storks, and pigeons; but one never sees there 'either horses, camels, giraffes, elephants, sheep (?), cats (?), or fowls.' —P. 669, *Revue des Deux Mondes*, April, 1865.

for the butcher than the farmer; their horns are long, tall, and branching, and they, the animals, move about with a pompous sedateness possible only to enormous fat beasts, but with a regularity and order forming an instructive contrast to the donkeys which,—with how many men soever to beat them into shape, have their heads diverging to all points of the compass; and some of the group always giving tongue with might and main.

Not a little remarkable also is it to see the many wild animals, tamed apparently, or undergoing a tentative process to that end; there are in this condition the small gazelle, and some larger antelopes of the size of a half-grown heifer; here with long straight, and there with exceeding curved, horns. Sometimes whole rows of these beautiful and powerful animals, with collars round their necks, are brought up for the great man to inspect; or for his scribes, with one pen behind their ears and another in their ready hands, to enter into the roll-list of his property.

The hyæna is likewise often seen, and very tame; for though he is led along by a string attached to a collar round his neck, the boy holding the string with one hand, is supporting something like a basket of crockery on his head with the other; and while the collar does not fit tightly round the hyæna's neck, that neck is so thick and the head so small, that the animal could easily free himself, if he chose. But he does not choose, and occasionally may be seen

quite unshackled; while a boy behind tries, by rubbing the end of his tail between his palms, to urge the—in these days most ill-tempered—beast, to attack some object in front, in which direction too, he is evidently pricking forward his ears.

And this hyæna is always a large one, drawn with admirable skill and knowledge of wherein the strength and better qualities, or rather efficiency, of a hyæna lie. There is no uncertainty with the artist, no rubbing out of lines, no confusing the anatomical form with hair; but you see a hyæna walking forth as nature originally made him, clean-limbed and powerful, adapted either for speed or strength; neither over young nor over old; over fat or over thin; but just as the Great Creator had intended him to be in the plenitude of his life and powers.

Social relations.

Similar close observation of nature, combined with artistic skill, is shown in the representation of the birds innumerable, inhabiting the thickets of reeds bordering the Nile (or that once bordered it, for they have lamentably decreased since then, and all parts of the Nile which we chanced to strike on, in our own short experience of it, exhibited only clay banks). The consternation, too, amongst the said birds, when the prince approaches in his papyrus raft to smite them; or when his servitors spread large clap-nets for them; and the similar confusion amongst the fishes when they are likewise netted,—all this is rendered

admirably true to life, and full of motion and purpose.

Yet even in these sporting scenes, despotic power is painfully manifest. There is a prince or two here and there, and all the rest of the people are working under or for him; well looked after, but ignobly treated; no labour-saving instruments are allowed, not even a handle to a hammer-head; the wretched slave must make up for want of that mechanical appliance which would cost his lord money, by an extra exertion of his own muscles. Excellent patterns they had to work up to; their chairs for instance being models of mechanical lightness and strength; the two hind-legs curved like the hind-legs of some animals, and the two front ones like the fore-legs,—fastened on to the seat by a mortised joint, with an extraordinary length of bearing to give firmness,—and yet so introduced into the artistic expression, as not to take away from the lightsome look of the whole; but hardly any tools are seen about, and the polishing is executed with little stones held in the hand, or with the fingers themselves and polishing-powder. The human material appears to be held at the cheapest possible rate, and to be used up for everything. The taskmasters, too, are always present, and the people kept in excellent order by the same method that Chinese boatmen are said to manage their ducks; viz., the duck which comes home not slowly, or absolutely late, but relatively last, is killed; or the man whose work makes least show at the close of the day, is laid

down on the ground, and beaten about by his fellow-slaves acting under orders.

On stated occasions come feasts, for there are some respites to all slaves; but in ancient Egypt they were not 'Saturnalia,' for the notion of law and order must never be interfered with there. So when this prince has been satisfied with the exhibition of his property-rolls, he seats himself like a god before a dinner-table; which is thereupon piled up with slices of bread, and on the bread roast geese, joints of meat, etc. etc., are accumulated, while rows of oxen are turned heels over head, and slaughtered before him in the most approved manner; ultimately, no doubt for the mass of the people; but the joints must first be carried to the prince, as if for his use only.

Nothing, too, can be done in these establishments on a small scale; when milk is required, a whole tier, or perhaps two or three tiers, in the mural painting, of cows are being milked at once by as many well-trained, experienced milking-men; and rows upon rows of both men and women servants come laden with provisions to the mighty presence, and servilely attend its nod. No idleness was there in the land of Egypt during the fourth dynasty; something was found for every one to do; and not even a cripple was safe from daily toil of some kind or another; such objects being seen at work in the pictures, and having frequently the heartless and hopeless inscription over them, 'Slaves born in the house, (regis-'tered) in the books of the house for ever.'

This was the more public life, and in private it was just as unlovely. The father was a ruling despot in his family; the wife, indeed, may by grace come up behind, and put her hand from a distance on his shoulder,—but the children are diminutive creatures, reminding one of mice more than human beings, and are low down on the ground below the level of the parents' knees. What they think or feel seems to matter little indeed to the lord their father; who is ever looking straight before him to the administration alone of the affairs of his many estates.

Many estates, for sometimes ten or fifteen are expressly mentioned in the hieroglyphics; each with a name and usually a notice describing by, or under, which king the included land had been reclaimed from the desert. This is an important element in the history of the times; indicating strongly that Egypt was then a new country, with its kings, nobles, peasants, and all its inhabitants strenuously engaged in rendering the ground amenable to culture and suitable to raising food for man.

Reported Engineering of Nile Banks.

We are thereby, too, brought into contact with the tradition related by Herodotus, that Menes, the first king of Manetho's first dynasty (the king therefore with whom almost every writer begins the acknowledged history of Egypt,—though there is not a scrap or a vestige of any *contemporary* monument, belonging either to him or any of his reported successors

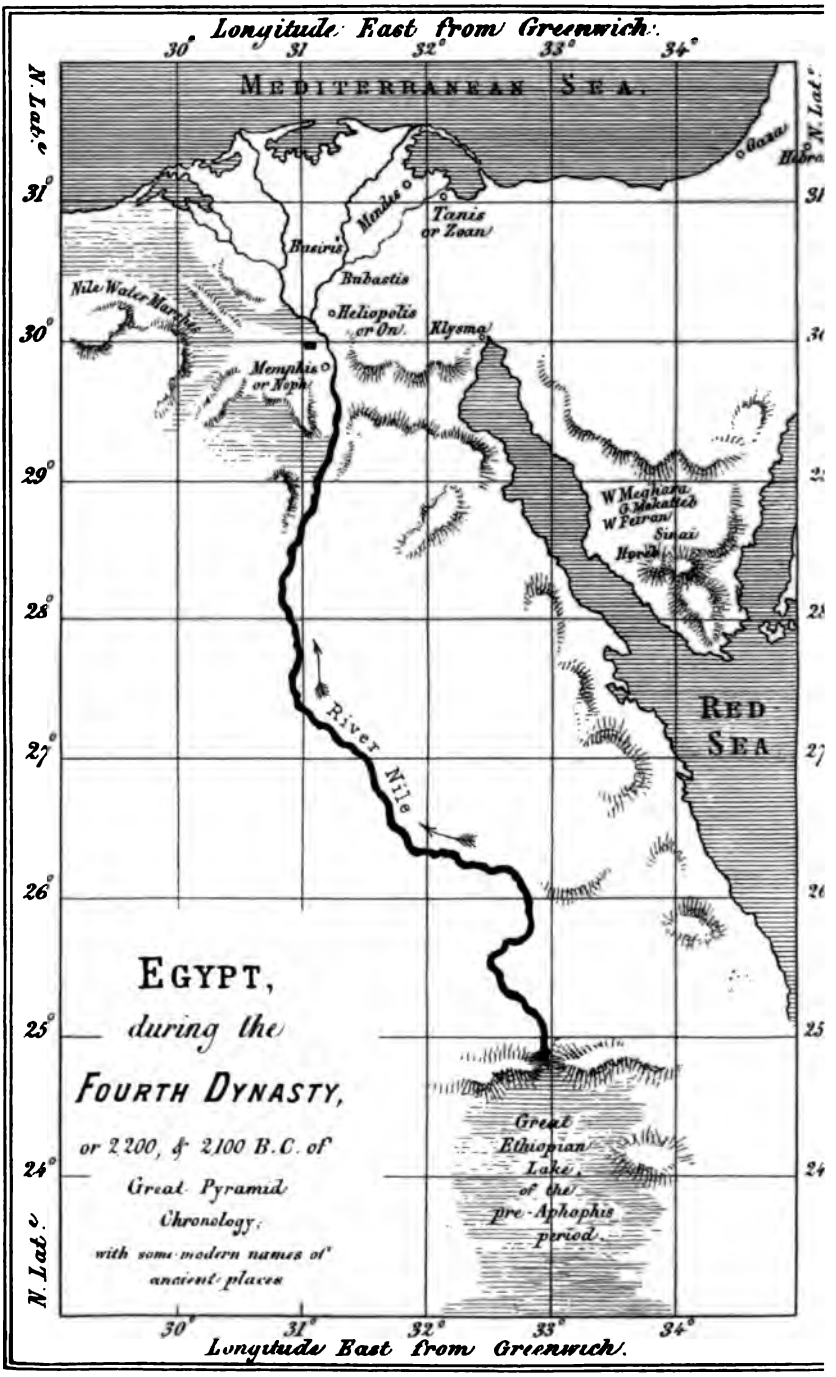
for many generations, still existing),—that this king Menes was the first to cross over from the eastern to the western bank of the Nile; and there to found the city of Memphis, after executing certain important hydraulic works, whose nature has been much disputed. Menes met the Nile, near the subsequent site of Memphis, flowing along on the western side of the Egyptian valley close under the Libyan mountains, says Bunsen, with some assistance from Wilkinson; wherefore he, Menes, executed certain considerable works at a place now called Kafr-e-Zyat, some miles above Memphis,—and thereby turned the river into a new channel cut along the centre of the valley, and then obtained the '*beautiful* '*lowland* of the former side-channel, *which was so* '*well adapted for the site of a great metropolis.*'

With all respect for Chevalier Bunsen, we cannot see the sense of the object thus described; for there was no gain of increased extent to the cultivateable land of the Egyptian valley, but merely a change of the stream's place therein. And we doubt whether the locality of the river's late bed, '*beautiful lowland*' though it be called by a closet-philosopher, could have been well adapted for founding a city in, —unless the chief object were to expose the inhabitants to the imminent peril of drowning at every annual inundation; especially as we see now that towns and villages in Egypt are by preference built on *elevated* ground. There was a theory too, first started by M. Andreossy and the French *savants* of

1799, to the effect that the Nile flowed anciently westward to the sea from, or behind, the Pyramid mountains to Bah-bela-ma (stream without water) and the Natron lakes; these being notable depressions still observable in the Libyan desert; and that Menes prevented this divergence of the water. But Chevalier Bunsen treats the statement as a speculation merely, and as referring to something geological, mythological, and absurd; whereas his own version is 'a historical work of a historical king.'

Again, however, we must differ, as indeed Mr. Osburn has also done before us, from the eminent philological critic. His asserted historical work has no contemporary monument to confirm, and has common sense against it. While, on the other side, there are the natural facts, that the long valley of the Natron lakes is, according to Sir Gardner Wilkinson, more than fifty feet *below* the level of the Nile-bank on their latitude parallel;[1] and though nearly thirty miles therefrom in a direct line, yet experiences an annual rise and fall of the water in these lakes, dependent apparently upon the infiltration of the Nile inundation through the strata of the intervening hills,—a slow process, occupying three months of time, or causing the lakes to be that length of time behind the river. (See Plate XI.)

[1] 'According to a rough observation, I calculate the bank of the 'Nile at Teranek to be about fifty-eight feet above the valley of 'Zakeek, or eighty-six feet above the surface of the Natron lakes.'—Sir Gardner Wilkinson, Murray's *Handbook for Egypt*, p. 226. London, 1858.


Longitude East from Greenwich.
30°
31
32°
33°
34°
N. Lat.
31°
30°
29°
28°
27°
26°
25°
24°
MEDITERRANEAN SEA.
Mendes
Tanis or Zoan
Busiris
Bubastis
Nile Water Marshes
Heliopolis or On.
Klysma
Memphis or Noph
W Meghara
W Mokattel
W Feiran
Sinai
Horeb
RED SEA
River Nile
EGYPT,
during the
FOURTH DYNASTY,
or 2200, & 2100 B.C. of
Great Pyramid
Chronology;
with some modern names of
ancient places
Great Ethiopian Lake, of the pre-Aphophis period.
Longitude East from Greenwich.

W H M.c Farlane Lith.r Edin.r

Some of the Nile water, then, even yet escapes towards the westward; and vastly more would do so, and go to waste, if there were any direct opening through the river's western bank, as far as these undoubtedly low tracts of the Libyan desert. If there ever was such an opening, the sooner the first colonists got it closed up the better, and preserved the precious water for irrigating the Delta. Such a work *may* have been executed, and would now be buried hill-deep under the drifted sand of the desert, but we cannot be certain of it. Neither is there any absolute necessity to suppose, that there ever was a plain mechanical hole in the western bank, to be simply filled up; for quite enough cause would it be, for a westward extravasation of the water, that the river should flow for some distance, as described in the tradition, along 'close under the Libyan mountains.' Because, seeing that they are composed of limestone with a large proportion of *salt*, nothing is more probable than that the water would work its way through them in course of time to the deeper hollow beyond. In fact, that would be the case still, did not the river now pass along the middle of the valley, and 'puddle,' or render nearly waterproof, its own bed by its successive yearly deposits of plastic pot-clay, which is the real characteristic of the much-vaunted fertilizing mud of the Nile. (See vol. i. p. 46.)

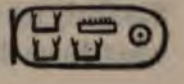
Now, then, we may appreciate the object of Menes, or any other early king-colonist, in removing

the flow of the river from the very hygrometric border of the salt-engrained Libyan desert, into the middle of the retentive clay valley leading on towards the flat and sweet land of the Delta; and there can be no doubt at all, that before his time, or that referred to by tradition, both the Delta was less watered than it is now, and the Natron lakes and Bah-bela-ma much more so. In fact, they must have been extensive, and perhaps pestilential, swamps,—over whose waters the sun, as seen from the Memphian hills, daily went down to his rest; and on the borders of which the white egrets stood pensively silent, giving rise amongst inventive minds to the notion of their being the souls of the dead, waiting in that submissive shape for the sacred boat to convey them to the same western and lower land to which the sun had just descended before them.

Almost in any way we may thus see, that an enormous engineering work of immediate practical utility, and even pressing necessity,—occupied the first energies of the Egyptian colonists; and the tombs tell the praises of every subsequent king who by his dykes, ditches, and other appliances brought more and more of the present land of Egypt under the control of cultivation. But the moment that the ending of the first great occupation had freed the labour of the mass of the community, and while the subsequent small improvements were still going on,—the building of the Pyramids began; those strange and still incomprehensible monuments.

Of the Pyramids and their Kings.

Strange and incomprehensible, in spite of all the explanations yet given by hierologists; for, allow them to have been built, agreeably to Lepsius, Bunsen, Osburn, and any other hierologist whatever, for kings' tombs,—and allow even to Chevalier Bunsen in particular, that 'no rational being ought ever 'to have entertained the slightest doubt upon that 'head,'—still why were they, as tombs, constructed long before the day of burial, of that peculiar shape; why so very large and solid; and why so entirely undecorated,—when the idea of noble entombment carried on by the princes and people round about the precincts of any Pyramid at the very time of its building, went so entirely towards superabundance of ornament, and making 'a good house'?

These questions have never been answered with a successful interpretation of practical details by any hierologist; and we can only remind, towards their possible future clearing up, that the origin of the Pyramids is to be looked for in the very beginning of the Egyptian nation; not only because the largest, best, and purest, or the Great Pyramid of Jeezeh, is almost, if not absolutely, the earliest of them all; but because the idea died out both as to the pyramidal form and simplicity of internal architecture of a king's tomb, before the Egyptian monarchy had run through one-third of its course. Even in the time of King Mencheres, 

(placed by Lepsius in dynasty fourth, after Nu-Shofo, but with more probability by Osburn in dynasty fifth), great size was no longer thought necessary to a Pyramid, the attraction of colour having then become the chief point outside; while inside, the sarcophagus shone a perfect marvel of ornamental carving. After his, Mencheres', day again, pyramids were built smaller still, until at last abandoned altogether; the apprehended necessity for the use, or appreciation of the virtue, of their peculiar form having gradually died away completely out of men's minds.

Wherein then lay the need for building the Great Pyramid so tall, so broad, so heavy, so firm, even as a mountain? We are entirely unaware of any attempt at a hierological solution of this question, save the suggestion of W. Osburn,– that 'Shofo 'and his subjects may have been haunted with the 'recollections of another great tower, which had 'exercised an important function on the destinies 'of the whole human race; that thence the idea 'originated in the mind of Shofo, and thence came 'the motives which awed his subjects into submis-'sion to his tyranny.'

We do not intend now to consider any of the peculiar proportions, chiefly of originally hidden features, by which the Great Pyramid differed from other pyramids,—but only those more external appearances which it had in common with them. Similarly too of King Shofo, we shall now discuss only what characteristics he possessed in common with

other kings of his race; and in this broad view have to consider a fact, which Mr. Osburn brings to light from the hieroglyphics; viz., that some, not all, of the ancient kings were worshipped as gods after their death,—many and many a private man announcing himself to be 'priest to King Shofo' in the Great, or 'to King Shafre' in the second, Pyramid; the worship being conducted outside either Pyramid, but directed towards the late king as though he were tenanting the interior as God.

Now, as Mr. Osburn has well remarked, 'the first 'settler in Egypt, notwithstanding his accomplish-'ments,—a proficient in architecture, masonry, and 'sculpture, with the skill to plan, the courage to 'undertake, and the perseverance to accomplish, the 'mightiest works of engineering,—was yet a slave 'to the fear of the supernatural. This impression, 'call it religion or superstition (the name is unim-'portant), assuredly was upon his spirit, and he 'grovelled in the dust beneath it. In his abject 'slavish terror of the gods, he fenced in what he 'conceived to be their privileges with stringent and 'rigid laws.' In subsequent times these reservations extended, indeed, to many puerilities; but in the earlier days, as Strabo duly records, there were temples in Egypt erected to God, without pictures and without images in them,—in accordance apparently to an impression strong in primitive man, as to the sin of endeavouring to materially represent the unrepresentable Deity. And when one of these

temples was uncovered recently, viz., King Shafre's, near the Sphinx, behold it built without ornament, having smooth square pillars, square beams, and flat walls, but no carving and no painting.

Hence the undecorated interior of the ancient Pyramids we may regard as consequent on the deification of the king there entombed.[1] All the *earlier* gods of Egypt too, maintains W. Osburn, were dead men; Osiris was Mizraim, the chief of the clan who marched westward from Babel, carrying with them as a tradition the worship of the setting sun. Mizraim reached the banks of the Nile, founded the city afterwards called Heliopolis, and finally died, and was deified at Busiris in the Delta. His name signifies 'two cities or strong-'holds;' and was adopted as a special designation for his descendants, as soon as either Menes, or *some* predecessor of Shofo, crossed the Nile and founded a new city on the western bank, in opposition to the older one on the eastern side of the river. This distinction went on continually growing,—as one city pushed its improvements upwards into the longitudinal valley, and the other downwards across the broad Delta,—until it ripened into the historic opposition of Upper and Lower Egypt, with their two distinct crowns, and hieroglyphic royal ovals always written in duplicate.

[1] 'The Great Pyramid with its precinct, was dedicated to the wor-'ship of Shofo after his burial. It is repeatedly named "*the great* ' " *temple of Shofo.*" '—W. Osburn's *Egypt*, vol. i. p. 278.

Every succeeding Memphite king to Shofo, seemed to press further and further up the Nile, and build a new city in the richer alluvial there to be found. Such city was then forthwith presented with a severed limb of the deceased Egyptian patriarch Mizraim, dismembered for the purpose at Busiris ; and it also provided itself with a local god, whose continual presence was assured for the protection of the citizens, through adoption of the gross symbolism of a living animal. The celebrated royal proclamation said by Manetho to have been issued in the second dynasty, assigning *the bull Apis to Memphis, the bull Menevis to Heliopolis, and a goat to the city of Mendes,* being only a small beginning of the dreadful religious leprosy which afterwards spread over the whole land.

To Mencheres, however, is attributed by Mr. Osburn the foresight to perceive, soon after he had founded the city of Abydos, that this completely free trade in the raising up of gods, was leading to a rapid disintegration of interests amongst the now numerous cities of Egypt ; wherefore, he both elevated the priests into a peculiar institution, and set on foot efforts to make Mizraim or Osiris the god of all Egypt. Hence, as a beginning, he proceeded to gather up the severed limbs of the patriarch from every city to which they had been distributed. But from this arose,—for each city tried stoutly to keep its own relic of their common progenitor,—a long series of internecine wars,

which have caused the dynasties from the sixth, to the eleventh, to be without names in Manetho, and without monuments in Egypt. The Mencherian faction, however, conquered at length; the priesthood became powerful, dominated in the temples, wrote the only permitted history of the country, denounced their late opponents, and praised up Mencheres far above any other sovereign, either before or since his time.

The details of all these points, and their explanation of the priestly inventions of the fable of Osiris and Typhon, Isis and Osiris, and their son Horus (who was Mencheres himself, after he, Mencheres, had manufactured Isis by splitting the figure of Osiris in two, and then declaring that the chief god of Egypt was married), these things, we say, should rather be studied in W. Osburn and other special writers. Here, we have only to deal with the general result; or that, with whatever number of gods the early Egyptians supplied themselves, they were never at ease. Not indeed that they were grieved at, or troubled with, the thought of being sinners,—for they were on the contrary for ever declaring themselves to be perfectly 'pure,' and free from every kind of sin, the least as well as the greatest; but they seemed to fancy themselves tyrannized over by a supreme Deity, and therefore turned round, and in their boasted purity of both heart and soul, tyrannized in turn over their fellow-men,—until Egypt 'became then, what it has

'always been since, the house of bondage to the 'human race.'

Conclusion of the Old Empire.

Towards the end of the eleventh dynasty, with which Manetho terminates his first volume, and in the time of Kings Acthoes and Amenemes, Egypt was visited by the patriarch Abraham; and, if we may trust Josephus, expressly to commune with the priests in a friendly spirit on their unhappy religious beliefs. The Bible indeed gives no such particulars, but does not say anything against them, while it indicates that Abraham *was* in the country a long time, sufficiently long too for such a purpose. Nevertheless we presume that little faith is to be placed in Josephus's account, unless confirmed by the monuments. Something however of that sort appears really to be the case; for the sacred patriarch is likewise said in the same passage 'to have 'taught the Egyptians arithmetic, and to have com- 'municated to them the science of astronomy as it 'had then lately been built up in Chaldæa.' In accordance with which, Mr. Osburn finds ever after that date, what he never met in times before, viz., the year of the king's reign always introduced in hieroglyphics. He believes too, that that method was induced in great part from the exactness with which the Chaldæan astronomy, imported into Egypt by Abraham, showed the true length of the year as measured in days easily counted.

Hence, no doubt, the simplification of the Egyptian calendar; for from King Shofo of the fourth dynasty, or even from King Menes, if ever there was such an individual, down to King Acthoes of the eleventh dynasty, the Egyptian reckoning of time is said to have been almost entirely *lunar*, and based on two traditions brought with them by the Mizraites, on first colonizing the Nile valley. The first tradition being to the effect that twelve lunar months proximately made a year; and the second, that the moon immediately after Sirius had been seen to rise cosmically, ought to be held the first moon in the year; whence sometimes thirteen lunar months in their calendar year. Each year further began with a full moon; from which phase to the crescent of the old moon, ten days; then from that to the crescent of the new moon, ten days; and from that to full moon again, ten days nearly, making up three of the old Egyptian decadal weeks of ten days each.

Thus have we followed the stream of Egyptian life, by its contemporaneous monumental traces, from its earliest known remains in the fourth dynasty down to the eleventh; or from the year of 2170 B.C. (perhaps 2200 B.C.) to 1959 B.C., according to the dates of the Great Pyramid and W. Osburn; and have thereby reached the world-known name of the patriarch Abraham,—but have touched, as yet, on no independently settled and generally received chronology, and nothing that can be called history. We are still indeed in a manner high above the strata

of clouds which keep the solid material earth of true historical times from our view; we are still in primeval ages, whereof the only human contemporary chronicles are the Egyptian; and those, imperfect, and very variously interpreted by different modern authorities. Wherefore, though we have with little doubt passed through the age of the chief Pyramid-builders,—it is incumbent on us to pursue the course of their successors still further down the stream of time,—until we have connected them with general documentary history; or seen them arrived amongst events which all nations acknowledge, and upon times where no schools of chronologists have any sensible differences.

CHAPTER VI.

LIFE UNDER THE NEW EMPIRE.

ALTHOUGH several modern authors of repute include in their systems the twelfth Egyptian dynasty, as forming part of 'the old Empire,' whose limits they have concluded upon rather arbitrarily, —we may do better, with William Osburn, in attending to the broad line of separation which Manetho himself established between the eleventh and twelfth dynasties, or the distinction between his first and second books. Especially, too, may we do so, when that line is confirmed in a substantive manner by the monuments.

These authentic testimonies, without doubt, speak of an unusually prosperous period for the twelfth dynasty, testifying to union, numbers, and wealth such as had never before been seen; and the occurrence of which is looked on by the author of the *Monumental History of Egypt*, as the legitimate and to-be-expected result of the conclusion of the long series of Mencherian wars,—terminated as they had at last been by the positive triumph of one party, and its complete domination over all who had once offended them.

Neither was it a mere continuation or even augmentation of the scale of their former life which Egyptians now experienced; for partly owing to increased wealth, and partly to the more complete establishment of the priesthood,—a certain amount of slow change in kind or quality did also take place amongst this people. And it told by degrees on their manners and customs, though as a nation they have been accounted by most writers the slowest of the slow—the Chinese of the earlier ages of the world; or, as M. Renan is pleased in fiction to make them out, the close representatives of the dull and unimprovable English,—while his own countrymen are the very opposite, and mirror exactly the intellectual ancient Greeks, whose land was the glorious mother of everything noble, *spirituelle*, and elevating to the soul of humanity.

In accordance with the general geographical direction of early Egyptian colonization, the monuments of the twelfth dynasty are found further, or more southward, up the valley, than those we have hitherto been considering. Some points in Lower Egypt were still retained possession of, and adorned with costly buildings, as the celebrated obelisk yet standing at Heliopolis sufficiently proves. But engineering works in the Faioum for irrigating that now most fertile province of all Egypt,—followed by the building of the extensive halls of the Labyrinth, with an appended Pyramid of no mean size,—though composed of crude brick, and *cased only* with stone,

—chiefly occupied the attention of successive monarchs. Together with these material works, however, there was a new and more elaborate organization of the religion instituted, and an ordering of the burial rites of the whole country, on the Mencherian model; or that of general subservience to Osiris as the chief god of Egypt, and to Abydos, his now supposed final and complete resting-place, as the holy city of burial for all the land.

Of the inner life of Egypt during this period, we have abundant particulars in the unequalled range of tombs in the cliffs of Benihassan. There, in noble halls hewn out of the solid rock, with their roofs supported on fluted pillared columns, the very prototype of the long-subsequent Doric, are paintings innumerable of almost every art, trade, or amusement ever carried on by any and every branch of the people. 'Egypt of the twelfth dynasty, 'caught in the very fact,' writes M. Renan.

The actors therein are still, in their leading characteristics, the same people as, or the literal descendants of, the fourth dynasty. All the occupations, manners, or customs represented of old in the tombs around the Great Pyramid, are repeated in those of Benihassan; there are the same toiling multitudes, the same official system of scribes, overseers, and taskmasters, and the same feasting according to order. Something, indeed, of the gloomy sameness is gone; manufactures now compete with

agricultural operations, the plough drawn by oxen dispenses with many sheep treading the seed into the soft mud; the cultivation of the vine and the process of wine-making, diversify the scenes; flax may be traced through its several stages,—men reaping it in the fields, and women weaving its fibres indoors. But there sits the great man still in colossal grandeur and unbending severity, overlooking the busy hive, every one of whose human bees is working for his benefit. And he still enjoys his field-sports much as his ancestors did before him, but with a variation; for now the ropes of the clap-nets are led by ingenious devices to his hands, as he sits far away on an easy-chair, so that he may have the honour, by giving a little pull to the trigger, of appearing to have caught all the birds himself. Or if his designs are against four-footed game, as the graceful antelopes of the desert,—no longer content with taking them alive and taming them,—he pursues them now cruelly, both tearing them with dogs and transfixing them with long arrows;—whence some most touching pictures of a poor gazelle turning round in pain to lick the place where one of these darts is standing in its flesh, and even protruding through the opposite side of its body; or another that has fallen lifeless on its tender offspring.

Very great lords were still the many chiefs who ruled over the people, under the king; one of them records his estates and privileges; first the range of the eastern desert and its oasis, for his antelope-

hunting; and of the 'hinder or nether pools' for his bird-catching; second, 'the land of Raophis,' or a tract near the mouth of the Faioum, and 'a sluice 'in the eastern bank of the canal' to water it; third, the land of the Hawk mountain, and another sluice from the canal of the Faioum; fourth, the land of the 'two streams,' or a narrow strip of ground between the canal and the Nile, together with a license for enlarging the sluices both from the canal and the Nile, so as to irrigate the fields to that extent 'prescribed in the sacred book for the growth of 'the plant *asut*;' and the fifth, 'the land of the 'hare,' with a permit to construct two sluices on the Nile.

But this chief is described as holding honourable offices both in church and state; being, *first*, 'the 'custos of the divine stable of the sacred bull;' *second*, the constable of the palace of the King Amenemes; and *third*, 'steward of the land-tax for 'the support of the schools of the sons of the kings 'of Lower Egypt.'

Another chief, who has been an extensive administrator, recites his own praises; for in these tombs, inscribed as well as painted, 'the dead,' as M. Renan well remarks, 'lifts up his voice and 'relates his life.' 'All the lands under me,' says the prefect, 'were ploughed and sown from north 'to south; nothing was ever stolen out of my work-'shops; never was a child afflicted, never a widow 'ill-treated by me. I have given equally to the

'widow and the married woman; and I have not 'preferred the great to the small in the judgments 'which I have pronounced.'

In these tombs of the twelfth dynasty, too, the military element begins to appear; and in vaults beneath some of them, and not yet discovered, are deposited the mummies, so the hieroglyphics tell us, of many hundred soldiers who had fallen in the wars of King Sesortosis against the black Cushites in Nubia. Prisoners, moreover, are brought back from those campaigns,—and account for the negro slaves now occasionally seen in the great man's household; while under previous dynasties, we had met with no closer acquaintance with southern lands than the unpacking of a box containing elephants' tusks. At the same time, however, other personages now appear on the scene, sometimes singly, sometimes in groups; men of aquiline features, brighter colour than, and different dress from, the Egyptians; immigrants from Arabia and Palestine.

The most celebrated pictured group of them is that which, in spite of the time being too early, and the hieroglyphics telling a perfectly contrary story, has often been alluded to as '*probably* representing 'the arrival of Jacob with his family, and their 'presentation to Pharaoh.' But now, after they have been called Greeks, Hebrews, Beni-Israel, and many other names, Mr. Osburn reads their title as —a group of thirty-seven Jebusites, purchased for slaves from one of the petty kings of the Jebusites,

and presented by the chief Nuhophtis to King Sesortosis II. in the sixth year of his reign, on account of their skill in preparing *stibium;* a black powder produced from antimony, and used profusely throughout ancient Egypt as a cosmetic. It 'was 'applied between the eyelids, by means of a bodkin, 'as in modern Egypt; the eyebrows also were filled 'with it, and broad lines were painted with it under 'the eyes. The use of it in ancient Egypt seems 'to have been absolutely universal, and by both 'sexes; so that the labours of these slaves would be 'largely in requisition for the preparation of this 'doubtless royal monopoly.'

Invasion of the Hyksos.

And so they, the triumphant sect of Mencherian Egyptian religionists, went on dyeing their wigs and painting their eyebrows, extending their palaces, and oppressing their slaves,—until suddenly the fatal day arrived, and in a moment King Amenemes the Third, the Amun Timæus of Greek historical legend, was driven forth from his halls of granite, and porticos of so-called white marble in his Labyrinth, the wonder of the world; while his kingdom disappeared like chaff, before the sudden irruption of the terrible Hyksos, the Eastern Shepherd Kings. So at least say the Greek accounts; and they are not altogether without a foundation; though it be lamentably deep and far to find, by reason of its resting on tales derived without critical analysis

from the one-sided, partial history written by the finally dominant faction, and recorded in state temples.

A terrible dislocation occurred, no doubt, about that time in the Egyptian annals; for, from the thirteenth to the seventeenth dynasty inclusive, there are few if any kings' names recorded with certainty by the annalists; there is scarcely a contemporary monument to be found; and this period of triumphant, as well as destructive, barbarism, is said to have lasted for two thousand years by some, and a thousand years by other, hierologist authors. The latter duration is assumed by Bunsen, who agrees with many German writers, in calling the period by the name of the 'Middle Kingdom;' and painting it as something entirely different from the Old Kingdom which preceded, and the New Kingdom which followed with the advent of the eighteenth dynasty.

But here steps in William Osburn, with most important aid from his minutely critical study of such fragments of hieroglyphics as some of the tombs of the period have lately yielded up; and he shows, that the whole interval between the twelfth and eighteenth dynasties, did not exceed some two hundred years; and that the thread of Egyptian public life was never broken, or the current of Egyptian history brought to a stand during that time. True, the nation had to pass through some extraordinarily severe trials; but *they* were the very

results of the working of the Egyptian social and religious principle; which went on developing in its appointed channels, until it finally produced such fruit as it was capable of affording, or naturally ought to bear, in the much-lauded glories and sinful culminations of the nineteenth dynasty.

But was there no invasion then, do our readers ask, by the historical Shepherd Kings? that nation of Hyksos coming, as we have hitherto been taught, from no one knew whence, conquering by the breath of their mouth, and vanishing again as mysteriously into nothingness; while Egypt, after suffering the terrific incubus for a thousand years, re-awoke to go on with its life and mission in the world, exactly at the place where it had previously sunk—in a sleep far longer than that of the seven sleepers of ancient Ephesus—under the feet of destroying conquerors?

Some of these questions, on common-sense principles, answer themselves; but to others, Mr. Osburn replies, in utter antagonism to some ancient and hitherto credited traditions,—'Hyksos,' as a monarchy acting for and by themselves, there were none; but Hyksos, as Shepherd tribes, rangers of the desert, bands of mountaineers from various regions, entering Egypt by the Isthmus of Suez as travellers, or settling as immigrants, and attaching themselves to, and sometimes considerably acting upon, the nearest government there for the time being,—of these Hyksos there were many. There always were, oo, from the time that the renowned fertility and

vast extent of cultivateable land in Egypt, made immigration in that direction as favourite a project to the starving poor of surrounding countries, in and about the year 2000 B.C.,—as are the United States of America in A.D. 1866, to all who find the Old World narrow and overstocked.

The shepherd Philitis,—who, according to one tradition, fed his flocks near the Great Pyramid during the time of that marvellous structure being in progress of erection under King Shofo; and, according to another tradition, was himself the builder,—is an example of one, or rather of a whole tribe, of the generic Hyksos; though at a date long *before* the historically famous and yet not literally exact, 'invasions of the Shepherds,' and 'Shepherd dynasties.'[1] These, however, whether real or fictitious, but as assigned to the later time, are all we have to deal with now; and shall find, through William Osburn, that while the Mencherian twelfth dynasty was enjoying its late victories in fancied security in Upper Egypt,—the remnants of a defeated dynasty had retreated to the swamps of the Delta. There they nursed their enmities on the

[1] In deciding whether the *historical* Hyksos could have been connected with the building of the Great Pyramid, care must be taken, if the method of absolute dates be employed, not to mix up the statements of different systems. For their absolute chronologies have vastly larger errors, and variations from each other, —than have their relative chronologies.

All the systems, for instance, place the fourth Pyramid-building dynasty, relatively before the fifteenth Hyksos. But Bunsen's absolute date for the latter is 2547 B.C., while Osburn's for the former is only 2200 B.C., and that is nearly the true astronomical date also.

thoughts of their plundered Busirides (or special places of sepulture; where they had duly deposited, and whence the Mencherians had violently taken away, their inherited relics of the body of Mizraim Osiris, the common progenitor); and continually increased their numbers with immigrating Palestinian hordes; until, feeling their strength, and watching the right moment, they advanced under their chief Saites, and took possession of the royal city of Memphis. It was an act of vengeance,' writes Osburn, 'in which all Lower Egypt joined, against the representatives of those who had profaned their local gods, and outraged their sense of religion. Such we have found, and shall find to be the characteristic of all the wars of ancient Egypt;' viz., *internal* wars between rival pretensions, and opposite religious beliefs, though intensely idolatrous always.

Soon after this event, Queen Skeniophris, the successor of King Amenemes, was driven out of the Faioum and of all Middle Egypt, and her descendants only just continued to exist in distant southern regions beyond Thebes, for some generations, as the obscure thirteenth dynasty.

The Joseph Period.

In the meanwhile a strong government had evidently been formed in Lower Egypt, having Memphis for its capital; where, third of the so-called Hyksos line, ascended the throne Phiops, Aphophis, or Apappus, a venerable character, who is said to

have been endued with the sovereignty in childhood, and to have retained it for nearly one hundred years. In his reign, if some annalists tell truly, came Joseph as a slave into Egypt; and then followed those scriptural seven years of plenty and seven of famine, whose effects, though general over a large part of the earth's surface, were specially pointed and intensified for Egypt, by the formation, —at the beginning of the plentiful period,—of an opening in the north bank of the great Ethiopian lake; a thing which tradition had often indistinctly hinted at, but only the researches of Lepsius and Gardner Wilkinson at the place, have recently set in a clear and understandable light. (See Plate XI.)

That the southern barrier of this lake was at Silsilis, and that its water extended, at least *during the inundation*, backwards through Nubia and 'the 'plains of Ethiopia,'—seems to be abundantly proved by all these regions being coated, at a height far above the highest modern inundation-level, by an alluvial deposit which ends northwards at Silsilis.[1] The hieroglyphic inscriptions also on the rocks at Senneh, and elsewhere in the south, attest a sudden and permanent lowering of the water-level in all these parts—by more than twenty-seven feet—to have taken place after the reign of the fourth king of the thirteenth dynasty, and before the beginning of the eighteenth,—or in what may be fairly taken as the

[1] See Sir Gardner Wilkinson, in Murray's *Hand-Book to Egypt*, p. 429.

age of Aphophis. On these points all seem agreed; though they do not all consent to the effect of the barrier at Silsilis, when unbroken, having been a *permanent* Ethiopian lake. Even supposing it, however, to have been only an extension of the inundation-surface,—still an extension so vast as that must have been, and in position, above Egypt, must have had to a great degree a lake-effect: *i.e.*, in tending powerfully both to equalize throughout the year the overflow of the Nile in Egypt Proper; and to relieve much of the excessive labour of the peasants, as obligatory on them ever since, at low Nile, in pumping up the water for irrigation purposes, by sheer manual labour.

While, if we allow W. Osburn's fuller hypothesis of a more nearly permanent lake; then, when such lake was emptying itself slowly through the fractured or wearing northern barrier,—the extra supply of water yielded thereby in the lower valleys, produced the years of plenty: and when all the accumulated stock of long-pent-up water was gone, and each new inundation from the equator,—weakened, too, by the rainless times of the general famine in most lands,—had to diffuse itself amongst the gaping mud-crevasses of the late lake-bottom of 100,000 square miles of surface,—then came those trying years of scarcity; a calamity which in Egypt depends not so much, if at all, on rain or no rain there, but upon a scanty inundation, and the river being low down in its bed. With these times of scarcity, too, were instituted, for the

people of Egypt, Joseph's new regulations of land-tenure and sovereign monopoly, which almost revolutionized the condition of society. And came therein also, within the precincts of the well-governed land, the whole family of Jacob, the embryo nation of Israel, to be nourished for a season,—and also to be put through a very useful course of apprenticeship to the practical arts, most necessary to the full education of a tribe of shepherd and tent-dwelling people,—before being sent out to live its completer life, and perform its grandly appointed part in the open world.

Egyptian evidences of these things, whether in monument or story, seem to be numerous and distinct enough, for all authors are agreed on the reality of the main facts, and differ only in detail and ideas of causation. Thus, Mr. Osburn attributes the extraordinary wisdom of Joseph's measures as Prime Minister of Egypt, to Divine inspiration; and is never tired of showing the perfect application of every unusual Hebrew word employed in the Scriptures, when describing the sojourn, to some reality in the life or language of Egypt as now deducible from hieroglyphic interpretation.[1] But M. Renan, on the other hand, after exposing the uniform dull level of Egyptian men, 'where never appeared a 'great warrior, a great philosopher, a great poet, or 'a great artist,' adds, 'Nay, not even a great mini-

[1] See W. Osburn's *Monumental History of Egypt*, and his *Israel in Egypt*.

'ster;' for Joseph, who did produce such enormous changes in the state, was not a native.

Most conducive, however, to the tender planting out of Israel in the land of Goshen, the hieroglyphic 'land of flowers,' on the eastern side of the Delta,—and to the sacred family's ultimate spread over the whole of that rich triangular region,—must have been the unquestioned supremeness of the authority of the venerable King Aphophis; towards the end of whose long reign it was, that the Hebrew immigration took place; and even Jacob himself bowed to him in respect, when he made that touching answer recorded in the Bible, with regard to the length of his life and the years of his pilgrimage upon earth.

Rise of the Theban Power.

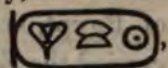
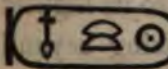
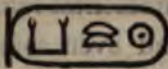
With Joseph's death, however, when that came, then ceased this remarkably placid state of quiet rule; for, far away in Upper Egypt the relics of the Mencherian faith were again making head, and finding at length a suitable exponent in Amosis, the first king of the eighteenth dynasty, a large fanatical army was collected,—which, making a sudden irruption northwards, repeated in reverse order the former invasion of the Shepherds, *i.e.*, of the Shepherd, or Hyksos-assisted Lower Egyptians,—taking their towns, and expelling them themselves from the borders of the 'pure land.' Vindictive and furious appears to have been this return-war from the upper

country, accompanied as it was by an opening of the graves and a desecrating of the sacred places of the conquered party. Mr. Osburn speaks from personal examination, to a whole range of fine tombs, all the faces of whose internal walls had been rudely but completely chipped away, apparently to prevent any trace remaining of Lower Egyptian rule,—called by the Mencherians, to make it appear utterly vile, 'the *Shepherd* domination,'—remaining in the upper land.

Then probably took place the violation of many of the Pyramids, for two or three Shepherd kings were said in their day to have been buried in Pyramids near Memphis; and these Pyramids are now open and ruined to an intense degree. The particular sovereign under whom this misfortune befell, was Asses, the grandson of Aphophis. His children thereupon retreated into the Delta, and rallying around the city of Succoth or Xois, reconstructed there the Memphian kingdom, and commenced a new dynasty; but which appears to have been strangely misplaced in the list, or misnumbered during the confusion of subsequent times. To facilitate references, however, we insert here a tabular view of W. Osburn's arrangement; where the order of date of the monarchs is obtained by following the order of the numbers, whether in one column, or from column to column.

Chronology and Order of Succession of Kings and Dynasties the Newer Empire, according to W. Osburn.

Numbers for Order of Kings.	Names of Kings in Lower Egypt.	Numbers for Order of Kings.	Names of Kings in Middle Egypt.	Numbers for Order of Kings.	Names of Kings in Upper Egypt.	Date B.C.	Event
	Dynasty 10.						
	Heracleopolitans or Sebennytes.						
	No names known.				Dynasty 12.	1965	Abraham le
					Thebans.		Egypt.
	Dynasty 16.			1	Sesortosis 1.	..	
	So-called Memphite Shepherd Kings.		Kings omitted from the lists.	2	Amenemes 2.	..	Tombs of E san.
				3	Sesortosis 2.	..	
				4	Sesortosis 3.	..	
				5	Amenemes 3.	..	Labyrinth b
7	Saites or Salatis.			6	Amenemes.	..	Memphis ta so-called Sh Kings.
		8	Mænis, son of Saites.				
10	Aphophis, son of Mæris.		....	9	Skeniofris.	..	Joseph enter Ethiopian la drained.
					Dynasty 13.		
					Thebans.		
				11	Menthesuphis 2.	1750	Jacob enters and Israe journ begin
22	Melaneres, son of Aphophis.	23	Viceroy of Melaneres.	12 to 16			
				17	Sechemetes.	..	
		24 to 28	No name known for these numbers.	18	Sabacon 1.	..	
29	Jannes.						
		..	....	19 20			
30	Assea.	..	....	21	Sabacon 2, father of Amosis.	1680	
	Dynasty 14.				Dynasty 18.		
	Xoites.				*Thebans.*		
37	....						
38	....	42	....	31	Amosis.	..	Shepherd Ki pelled from
39	....	43	....	32	Chebron.	..	phis ; or
		44	....	33	Mesphres.	..	Egypt inva
40	....	45	....	34	Achencheres.	..	conquers
		47	....	35	Amenses.	..	Egypt, and
41	....	48	....	36	Thothmosis.	..	the Delta u
	Names unknown.	49	Acherres.	49	Acherres.	..	
		50	Armais.	50	Armais.	..	
		51	Amenophis-bekenaten.	51	Amenophis-bekenaten.	..	
		52	Encheris.	53	Al.	..	
		55	Tai.	54	Chebres.	..	
		56	Amenophis-Memnon.	..	....	..	
		57	Horus.	..	....	..	
			Dynasty 19.				Permanent u reunion of
			Thebans.				and Upper
		58	Ramessu.			..	
		59	Sethos 1.			..	
		60	Sesostris Ramses.			1360	The oppress the Israelit
62	Siptha and Queen Thouoris.						Rise of Mose
		61	Amenepthis.			..	One Pharaol all Egypt.
		63	Sethos 2.			1320	The Exodus.

The new Xoite dominion in the Delta appears to have extended as far southward as the Pyramid hill of Jeezeh; and here its chiefs began to devote themselves to the worship of one of the deified kings belonging to the old empire; viz., Shafre of the second Pyramid. Something of the same sort had been done previously by Sesortosis II. and Sesortosis III. of the twelfth dynasty, who had been very successful against the southern enemies of *their* day, says Mr. Osburn; and he is testified to by their hieroglyphic names being compounded with that of Shafre; wherefore these children of Asses, in a later time, with so much need of help against the southern foes of *their* day, also compounded Shafre into their names, as  ,  ,  , etc., and seemed even to entertain the idea of making Shafre a great god in Egypt, in opposition to the Amun worship of Amosis, in Southern or Upper Egypt. (See Plate XIII.) As a beginning, moreover, of their practical measures, 'they proceeded with the elaboration of the Great 'Sphinx out of its living rock, and with the rest of 'the works of decoration which once adorned the 'second Pyramid, and its stupendous precincts;' a locality long considered among Egyptologists as peculiarly connected with King Shafre, although at the time Mr. Osburn wrote, the statue duly signed, and the temple to which we have often alluded, had not been discovered.

But even from this point the Asseans were finally driven back northward, and pent up in the Delta, with the growing numbers of the Israelites; for the great Sphinx was eventually taken possession of and completed, or its dedicating tables of granite erected, by Thothmosis IV, or Armais, the fifth in descent from Amosis of the Theban eighteenth dynasty; in which line the Sphinx-form became thereafter a favourite symbol of regal power. This dynasty indeed, and after them the nineteenth, victorious through all the longitudinal valley part of Egypt, now ruled in royal state at Thebes, and carried the Egyptian monumental fame to its highest point of culmination, and even something beyond down the road to decay.

Authorities for the Eighteenth, and later, Dynasties.

Seduced, it would seem, by the beauty of the monuments, it is with these two dynasties (eighteenth and nineteenth) that most persons' ideas of ancient Egypt and Egyptian history begin.[1] When the oldest of the papyri are alluded to, they belong to these, or even later times; equally so the mummies, for though the process of embalming and

[1] Sir George Cornewall Lewis, indeed, with his deference to Greek writings and Greek experiences only, will not allow of any real existence of Egypt until several dynasties later, or close upon the times of Greek visitations.

mummification had been practised in Egypt long before, it would appear to have depended too much on spices, and too little on 'natron,'—or too much on the plant products of Arabia and Palestine, and too little on the mineral exudations of the soil in the Libyan desert,—and therefore not to have been fully efficacious to prevent resolution of the body into 'black dust.'[1] By far the greater part, therefore, of the remains now findable, and especially the more showy works of art of the *reputed* 'ancient 'Egypt,' all belong to this later period of Theban domination, which extends from 1600 to 1300 B.C.

[1] 'The earliest mummy known to exist is that in the Leeds Museum, 'which is of the time of Ramses IX., 1100 B.C.,' says W. Osburn, p. 447 vol. i. of his *Monumental History of Egypt*.

In the *Gentleman's Magazine* for April 1866, is a short article, signed S. W. B. 'on the oldest relic in the world,' and implying that the mummy, *i.e.*, the greater part, if not the whole, of King Mycherinus or Mencheres of the third Pyramid of Jeezeh, and therefore many centuries older than the Leeds specimen, is deposited and now to be seen in the British Museum. But the writer does not say anything about the opinions of competent men to the effect, that the bones and woollen cloth gathered up by Colonel Howard Vyse's assistants, and which make up the above so-called mummy, belonged to an unfortunate Arab who died in the Pyramid when it had been opened by his countrymen in the middle ages. The writer however does in honesty mention that an old Arabian author,—describing what his countrymen found in the sarcophagus of King Mencheres, when they ransacked it six hundred years before Colonel Howard Vyse entered the Pyramid,—says, 'that with the exception of some plates of gold, there were only *the* 'decayed rotten remains of a man;' a phrase which expresses extremely well the idea W. Osburn has formed from other cases, of the bad results of embalming under the earlier dynasties. The phrase also throws much light on the Colonel's own description of what he found in the interior of the third Pyramid, and even on the sarcophagus, viz., 'a good deal of this deposition (black dust) was also found in the 'large apartment; and the dung of large birds, probably vultures, 'appeared in many places, particularly on the sarcophagus, and seemed 'to have been there for many years.'—Vyse's *Operations at the Pyramids of Jeezeh*, vol. ii. p. 82.

'*Which was of great antiquity, at least as early* '*as the beginning of the eighteenth dynasty,*' is an expression of Sir Gardner Wilkinson in reference to a particular architectural decoration on Egyptian monuments; and it is just and true enough when applied relatively to other Pharaohs whose names are frequently referred to in modern times, such as Shishak of the twenty-second dynasty, contemporary with Solomon; Tirhaka of the twenty-fifth, contemporary with Hezekiah; and Hophra of the twenty-sixth, with Zedekiah. Far more just still, is the phrase, when employed in contradistinction to 'antiquities,' connected with all the race of the Ptolemies and Cæsars; when new inhabitants, new times, new civilisations, and new ideas had introduced into Egyptian life a variety of features which,—though we may find them described in hieroglyphics cut grandly into the temples of Denderah, Ombos, Philæ, and Esneh,—were perfectly strange to the Egypt of the first twenty dynasties.

Requesting our readers, therefore, only to bear the salutary correction in their minds, for their own private information, if necessary,—that the eighteenth and nineteenth dynasties are of the new empire, and even the later part of the new empire, and very recent as compared with that older empire, in whose time the Great Pyramid was produced,—we would pray them by all means to plunge into any and all works wherein those dynasties' remains are described,—though under the mistaken implication of

their forming the very origin of all Egyptian history. For what we, as students in this matter, require first, is,—to gather as much special and particular experience of facts and personages as possible; and we may be able to rectify the chronology and eliminate the erroneous impressions under which they are, or may be presented, afterwards.

Now most books hitherto published on Egypt are of this order. For until recently, the only large collections of artistic pictures belonged to these two dynasties or to subsequent ones; and it was chiefly to see their showy sculptures existing in fact on temple-walls, and there representing the so-called 'Ancient Egypt,'—that every winter for the last fifty years has witnessed a fleet of wealthy travellers' boats anchored off Karnak, while their owners were exploring the wonders of Thebes and the Memnonian Palace; or while traffickers in *antiques* were grubbing about amongst the tombs, seeing what they could steal.

'In Thebes we abode,' writes one of the best of German travellers, 'for twelve over-rich astonishing 'days, which were hardly sufficient to learn to find 'our way among the palaces, temples, and tombs, 'whose royal, giant magnificence fills this spacious 'plain. In the jewel of all Egyptian buildings,—in 'the palace of Rameses Sesostris (which this great-'est of the Pharaohs erected in a manner worthy of 'himself and the God, "*To Amun-Ra, King of the* '"*Gods*," the guardian of the royal city of Ammon),

'on a gently rising terrace, calculated to overlook 'the wide plain on this side and on the other side 'of the majestic river, we kept our beloved King's 'birthday with salute and flags, with chorus-sing-'ing, and with hearty toasts proclaimed over a glass 'of pure German Rhine wine.'[1]

Champollion's grand work, in four volumes of long folio plates, deals largely with the eighteenth and nineteenth dynasties: for, beginning at Ipsambul in the extreme south of Nubia, with the great Ramses cavern-temple, it comes up successively northwards to Ombos, to Thebes, to Denderah, to Benihassan, and finally to Sakkara,—always picking out the most dazzling scenes, and spirited groups of courtly or warlike figures, and which are usually of the new empire; mixing all sorts of subjects just as they come on the monuments; and finally concluding without any notice of the Pyramids, those silent and almost sublime witnesses of an earlier and more serious time.

Rosellini's great work in three volumes of folio plates, will also yield data for the life of this period to a large extent, and his engravings are arranged in subjects; vol. i., referring to history and *public* life; vol. ii., to the trades and employments of everyday *private* life; and vol. iii., to temple scenes and matters connected with the religious belief of the time.

Lepsius alone arranges his plates in chronological

[1] Lepsius' *Letters from Egypt.*

order, and enables any one in his volumes v., vi., and vii., to study no less than ninety-seven large plates of all subjects belonging to the eighteenth dynasty, and eighty-four belonging to the nineteenth. A magnificent contribution to knowledge! Not indeed all original or contributed for the first time, for many of the plates represent the same monuments figured previously by Champollion and Rosellini; but there is advantage in comparing the several styles and capabilities of the different modern artists; and while the palm is perhaps due to the German edition for the most efficient rendering of the mystical awe and fate-like solemnity of animal-headed gods,—the prize for human portraiture is undoubtedly to be given to Rosellini, who contrives to indicate a degree of refinement in nature, depth of feeling, variety of expression, and wealth of human sentiment, in some of his heads of kings and queens, which leaves all his competitors far behind.[1]

Scenes in the Eighteenth Dynasty.

But now let the trumpet sound,—the curtain rise, on the eighteenth dynasty, and who are these on the painted monuments before us? Brick-makers; and desperately are they toiling at their ungainly occupation. With backs bent horizontal, they dig up

[1] Consult also the great French work of 1800, and subsequently Gardner Wilkinson's *Ancient Egypt*, edition of 1847, or later, and Burton's *Excerpta Hieroglyphica*.

the tough clay with short hooked implements, merely a small improvement of their natural hands. The process of moulding the clay, tapping out the pressed lump, piling the rectangular blocks, and carrying them away in collections of as many as one man can just stagger under,—are interesting enough in an industrial art and trade point of view. But there all the time sits the taskmaster with his stick; a cinnamon-coloured, clean-shaved, black-wigged Egyptian he is; and then we may perceive that the brick-makers are not his countrymen, but light brown men, with aquiline noses, grey eyes, and naturally growing short beards of reddish hair;[1] a more northern race evidently than the Egyptians, possibly Israelites, and certainly Palestinians of some order from the now overrun regions of the Delta.

Foreign slave-labour has evidently come into vogue, since we last made acquaintance with these men of the monuments. Some amount of ordinary field-agriculture is still memorialized; but it seems now nearly overborne by garden cultivation, and these gardens are more or less ornamental plots round grand mansions and gorgeous temples, sur-

[1] 'From what I have observed amongst the numerous tribe of Jews, 'first at Gibraltar, now here (Algiers), and further on throughout the 'East—of the many thousands I have seen, a peculiar colour of the 'hair is so striking as to seem characteristic of the nation. Amongst 'us, Jews have almost invariably hair of the deepest black, but this is 'a light auburn, of a tint I have never seen before. If the letter to 'the Roman Emperor may be relied on, this was in all probability the 'colour of our Saviour's hair.'—W. R. Wilde, *Narrative of a Voyage*, 1840.

rounded with little brick hutches for retaining the slaves at night. In place, too, of scenes of open-air country-life, and sturdy chieftains inspecting their stock,—the majority of social pictures is now devoted to the gatherings of the rich in festive town-halls; and these rich again are found to be only dependants in different kind or degree on the monarch for the time being.

In him the king, the Pharaoh, now concentres all the wealth of the people, all the life of the nation. 'In old Egypt scarcely an act of any Pharaoh is re-'corded in the tombs of his subjects; nor does his 'name appear at all, save in the names of their 'estates, and sometimes in their own names. But 'in the tombs of the new kingdom, in the times that 'followed Joseph, all this is reversed; for there is 'scarcely a tomb of any importance, the principal 'subject of which is not some act of service or devo-'tion performed by the excavator to the reigning 'Pharaoh.

'Nor is this difference confined to the secular 'princes of Egypt only. We found the priest's office 'in old Egypt to be a mere appendage to the secular 'functions of the princes and nobles, performed, in-'variably in the cases where the performance is 'depicted, by proxy, and by the hand of menials and 'dependants. The contrast to this presented by the 'monuments of the later epoch is marvellously per-'fect. The priest has risen greatly in authority and 'importance in the State. This office becomes more

'and more exclusive and hereditary, until at length 'he ascends the throne of the Pharaohs, and rules 'Egypt by a dynasty of priest-kings.'[1]

How perfectly these changes are in accord with what the Bible describes as the results of the administration of Joseph, viz., that all the land and all the cattle, and at last all the people themselves, were sold to, and became the possession of, the monarch; except only the lands and goods of the priests, these he bought not. The result of the change is eloquently borne testimony to by M. Renan, in his description of the difference between the subjects of the paintings in the tombs of the fourth, fifth, sixth, and twelfth dynasties, as compared with those of the eighteenth;—which last 'seem to have been invaded 'by a whole *pantheon*, numerous, and accompanied 'by fictions horrible, and at the same time the most 'silly that the human brain has ever conceived.'

The religion, therefore, did not advance in character when so peculiarly protected, though it multiplied its external indications. The walls of palace, and temple, and tombs are now indeed everywhere covered with figures of grotesque animal-gods; they increase in number with the progress of the reign, or the pleasure of the king; and are always more or less in waiting upon him as mere puppets to receive his royal pleasure; though destroying angels to carry it out against his foes. To present him with one symbol of the key of life to smell at, was enough

[1] Twenty-first dynasty.

in former times; but now these flattering gods advance on either side, and anoint the monarch with long streams of innumerable repetitions of the symbols; and every hieroglyphic sentence is pretty sure to begin, or end, with the oft-proved falsity, 'King 'so-and-so, living for ever'!

Of course the said king does not improve in disposition under all this adulation and indulgence, for cruelty amongst other vices becomes a dominant characteristic. A most tender exhibition apparently of family affection, is shown gracefully depicted on one of the monuments of Amenophis (eighteenth dynasty): the queen-mother gently cherishes her stripling son; and he with a magnificent headdress—the ancient wig made now fit for a king—is seated on her knee, her favourite child, affectionately reciprocating her regard; and the scene might appear very passable and even commendable—did we not remark that the boy's feet are all the time on the backs of two sets of captives, Palestinians and Negroes. These poor wretches lie there with their hands cruelly tied tight behind them, their bodies and limbs bent up triple, and internally spiked collars round their helpless necks; to which collars strings are attached, so that the youthful prince, holding them in his hands, can, by jerking on them for amusement, instantly set half-a-dozen grown men into most exquisite bodily pain.

But this was amusement also for the father-king of Thebes as well; all these kings' ideas of a glorious

triumph, either for war or peace, seeming to concentrate in riding in a chariot with prancing horses, (horses, it will be observed, are now added to Egyptian live stock, but only employed in war, or for the king's purposes,) and dragging behind them two long lines of tortured, writhing captives. Sometimes these are Negroes, sometimes Asiatics, but always with their hands and arms bound together in some almost impossible and always perfectly helpless position; while the terrible spiked collars round their necks are connected with the ropes held by the king,—every sudden prance of whose horses must produce unnumbered quiverings in all those lacerated human nerves. The expression of various agonies in these captives, obliged to keep running along after the king in his chariot, and with no hand available to ease the heavy collars which are cutting into their necks,—is one of the highest efforts of the Egyptian artist. It is too evidently from the life, from scenes witnessed often; and one hardly knows which to pity most, the more childish symptoms of yelling and pain amongst the Negroes, or the deeper feelings of the more manly and decorous-visaged bearded men of the North; but both alike suffer all that human nature can bear, and for the purpose merely of enabling an Egyptian king to feel prouder than ever, before his slavish and enslaved people.

Arrived at his palace, then how overwhelming is the state which attends the monarch there! All

the Egyptian nobles are grovelling about him in fancy costumes, as some kind of Lord Chamberlains, or fan-bearers, or gold and silver stick-carriers. Young damsels are beaten before him on their bare backs, by stout men armed with sticks; and truth can seldom be heard in those royal halls, for the king must never see or hear anything that can displease him, and whatever *he* does is perfectly right. He is held to be eternally justified of everything he can do, and inscriptions are continually proclaiming his piety and purity and splendour and power; while his enemies are by very consequence the impure and abominable ones of the earth, and seem to comprise in idea all who inhabit the whole world, save the Egyptians themselves.

Of their Religious Principles.

With that race, self-justification, under any circumstances, was from the first a leading principle of their religion. The forms of their worship and the number of their gods were continually altering from dynasty to dynasty, and were various at the same time in different parts of the country; but the power and right of a man—*i.e.*, an Egyptian man—to justify himself, not against his fellow-man, but against God, was an essential and central thread of their system wherever a single Egyptian existed. And a thread of it, too, which they not only never relaxed their hold of, but kept continually weaving other threads of bad religion and perverted

morality into it, until it formed at length the veritable cart-rope for drawing the national sin.

Another neighbouring nation had shown deep respect to the maxim of religious wisdom and truth, 'let not the sinner say that he hath not 'sinned; for God shall burn coals of fire on the 'head of him, which saith before the Lord God and 'his glory, I have not sinned.' But every Egyptian was taught by the ritual of the book of the dead, to prepare to stand up before Almighty God, and declare—

1. I have done no sin of omission.
2. I have done no sin of transgression.
3. I have neither done any sin, nor omitted any duty to any man.
4. I have committed no uncleanness.
5. I have not spoken lightly.
6. I have not blasphemed with my mouth.
7. I have not acted perversely.
8. I have not accused any man falsely.
9. I have not stolen anything belonging to God.
10. I have not shortened the cubit.
11. I have not shaken off authority.
12. I have not been idle.
13. I have not been a glutton.
14. I have not been a drunkard.
15. I have not forged any of the divine images.
16. I have not withheld the seven linen garments due to the priests.
17. I have not been avaricious.
18. I have not falsified the weight of the balances.
19. I have done no violence.
20. I have not multiplied words in speaking.
21. I have not changed the customs; neither have I enacted foreign abominations.
22. I have not uttered boasting words;

and so proceeds the self-justification, through no less than seventy-four different items.

No true Christian can, of course, regard such a system but with fear and horror; looking upon it, as he must do, as expressing the very antithesis of all which *he* regards as religion; or of the first step toward religion at all, in the light in which it has been revealed to man by God, and those whom He has enlightened for that purpose.

Hence, there need be no question raised, by the hierologists,—as to whether we are deeply learned enough in all the mysteries and vagaries of Egyptian idolatry, to fully comprehend every supplemental idea, which the chief latter-day sophists amongst them attached to each new animal divinity they invented;[1] or the precise office they assigned

[1] The gradual progress from bad to worse in their religion, the more the Egyptian people advanced in arts, wealth, power, and their own proverbial wisdom,—affords a striking historical confirmation, of some of the leading arguments in a recent admirable pamphlet, entitled, *Thoughts on the Doubts of the Day*, by the Dowager Lady Shelley. (London, 1864. Harrison and Sons, 59 Pall Mall.)

True religion, the writer there argues, wherever it appeared in primeval times, 'shone forth suddenly, and in all perfection and 'purity, agreeably with the manner of a gift, or revelation from the 'Most High;' while 'the grossest errors came afterwards to obscure 'it by degrees, side by side with the arts, inventions, and discoveries 'of man.'

And again: 'In some cases (as of the animals and monster gods in-'vented by early pagan peoples), these creations of the imagination 'are so strange and horrible, that we are quite at a loss to account 'for their origin in nations otherwise intelligent. We can only sup-'pose that when the builders of the Tower of Babel were dispersed by 'God for the misuse of the divine gift of language, they fled to all 'parts of the earth, carrying with them debased ideas of the God 'whose power they had defied, which were reproduced later in the

to one god with a jackal's head,—or another under the form of a baboon,—and another still as a monster hippopotamus, or horrible crocodile. These things, we say, need not be so very particularly inquired into, as if just the last touch of colouring given to one of the more obscure of them, were capable of changing the place of all Egypt from the left, to the right, hand of the Great Judge on the last day,—because they are all of them in their entirety the very necessary consequences of a principle which is rotten at the core; and form a course which, compared with revealed religion, was permanently wrong from the first.

Hence, the more religious the Egyptians grew, after their own fashion, the more they rebelled against the God of heaven. Similarly in their morals,—a highly moral people were they in marriage, having generally only one wife; but that wife was too often, both with the princes and people, within the most revolting incestuous degrees of propinquity; so as to be horribly criminal in the eyes of all other nations. And an industrious people were they too, producing great public works; but their plan of operating was through the power of slavery, and the cruel oppression of all the poor and weak, and defenceless ones, whom they ever came

'revolting conceptions of the Hindoos, Chinese, and Egyptians, 'amongst whom (if true religion had been an invention of man's 'intellect), we might have looked for a most exalted idea of God; for 'it is well known that they enjoyed a much higher state of civilisation 'than was ever attained by the family of Abraham.'

into contact with. For a while, this Pagod figure grew and flourished mightily in the earth; but in the hour of its apparent greatest strength, was it touched by more than mortal hand; and calamitous was the ruin which then supervened, and has never ceased yet.

The kind of hero, developed in Egypt.

It was under the reign of Ramses II., of the nineteenth dynasty, that the Egyptian power and might seemed to have reached the most stupendous proportions. He was reckoned to have been the greatest, wisest, and best of all the monarchs that ever sat on the Egyptian throne, and his reign lasted more than sixty-six years. By W. Osburn, and apparently by R. Lepsius also, his name is read Sesostris-Ramses,—though Chevalier Bunsen rather violently contends that there was no Ramses ever called Sesostris; and that all the Greek and Egyptian legends connected with a half-fabulous hero named Sesostris or Sesoosis, belong truly to Sesortosis II., of the twelfth dynasty.

It was this Sesortosis II., insists Bunsen, who built a fleet of long ships on the Red Sea (though where the ship-timbers could come from in that arid region, it is difficult to say), embarked with more than half a million of soldiers, sailed through the Straits of Babelmandeb; landed, and in turn conquered Arabia, India, Bactria, Scythia, and Persia, making a grand tour of conquest through all the

world of Central Asia; and finally returned home through Thrace and Asia Minor, with wealth enormous, and captives innumerable.

But here comes into play once more the varied critical acumen of W. Osburn, in showing that no such Sesostris as he of the legends ever existed. A bold conclusion, but in which he has since been well confirmed by M. Renan, whose superior sharpness to M. Bunsen, enabled him to detect that the Sesostris described by Egyptian priests to classic visitors of Greece and Rome—was 'an artificial per-'sonage, composed of pieces and morsels.'[1] To Herodotus, the said priests of a conquered land, related that their former native king was far greater in his day than Cambyses, who then filled the mind and attention of the enthusiastic Halicarnassian. To Diodorus Siculus, in whose eyes, again, Alexander the Great was the hero of the world,—they made out that Sesostris had exceeded *him* in every particular, and especially as an intellectual conqueror overrunning half the world for the sake of an 'idea.' And to Germanicus, with the historian Tacitus in his suite, they made their Sesostris appear as a more methodical and business-like soldier, than any notable commander of the approved Roman stamp; or one who looked on a campaign in the light of a mercantile transaction, whose propriety was to be measured by the muster-roll of tributary provinces it should produce, or justified by the weight of solid silver and

[1] *Revue des Deux Mondes*, p. 665, April 1865.

gold sent in ;—evidently in every case suiting their tales to the notions of hero-worship amongst their listeners.

But with regard to what any genuine Egyptian heroes either really did do, or would have ambitioned to bring about, in those earlier ages when their monarchy was as yet unconquered by foreigners, and uncontaminated by stranger nations,—there, W. Osburn appears to have caught the spirit of the Mizraite mind with astonishing success ; and to have realized long ago the nature and tendencies of their polity so precisely,—that M. Renan's much later researches, while they have confirmed much, have been able to add little, and alter less. W. Osburn's words, therefore, remain the most instructive that can be quoted, and run thus,—'We have yet 'further to state on this point, and with the same ex- 'plicitness, that no such idea as the conquest of the 'world had presented itself to the mind of Egypt in 'the days of the monarch Sesostris-Ramses, whose 'monumental history is now before us. Egypt 'alone was the world of Egypt, and its entire sub- 'jugation to the Theban sceptre was the loftiest 'pitch to which the ambition of the Pharaohs had 'ever soared at any epoch. Foreign conquest was 'utterly abhorrent to their modes of thought. The 'districts watered by the Nile constituted the only 'country in the world worth possessing. The sons 'of Mizraim were the only beings worthy to bow to 'the sceptre of Pharaoh. The men of all other

'nations were inferior and degraded races, and their 'countries unclean and abominable. The highest 'honour to which a foreigner could aspire in Egypt 'was to be a slave; and, to minister to her luxuries, 'was his country's highest distinction. What charms, 'we repeat, could foreign conquest have for a nation 'holding sentiments like these, and with whom, even 'to overpass the bounds of Egypt, implied ceremonial 'pollution?'

Egypt, then, in the course of its long career of unimpassioned, exclusive, self-satisfied existence, gave birth to no conqueror of the world to rival and excel Alexander the Great, the most brilliant hero of the Arian races of mankind; but succeeded in producing a great man of its own order, viz., Ramses II., of dynasty nineteen, or . This monarch, moreover, may be at once connected with the foundation of truth at the bottom of the absurd tales told to the Greeks about the fabulous Sesostris, in this;—that whereas the latter is said to have far exceeded all his predecessors in building, even to the extent of erecting a temple in every city throughout the land of Egypt, which was then reputed to contain thirty thousand cities,—Ramses II., is found by examination of the existing monuments,—whether still standing in Egypt, or transported to European museums,—to have left more architectural remains

impressed with his name, than have done all the sovereigns of Egypt put together. And yet they number, from Moses down to Ptolemy, about one hundred and fifty known kings, and their reigns extend over nearly two thousand years.

This most remarkable fact, in itself, at once establishes one kind of relative superiority between Sesostris-Ramses and all other native Egyptian kings; and a closer examination of all his principal works, such as the Propylons of the New Palace of Luxor, the Ramesseum of Western Thebes, and the great cave-temple of Ipsambul, will disclose some other notable particulars. These works, for instance, all abound in colossal representations of Sesostris-Ramses going out like a giant to battle; his chariots drawn by fleet horses galloping forth before him over all the walls; then the battle, in which his enemies are smitten in every conceivable manner; and lastly the king himself the day after the battle, seizing a compendious group of some dozens of captives by the hair of their heads, after they have been tied to a stake, and braining them all with a sweeping blow of his mace; while one of the animal-headed gods, possibly of his own or his father's creation, looks on approvingly, and offers him even a more destructive weapon. Wherefore, such slaughtering and truculent scenes, cause most persons to imagine *from the* '*monu*-' *ments*,' that Sesostris-Ramses, though only Ramses II., and not the traditional Sesostris of fable,

must have been a most warlike and conquering king.

But then comes the strange counter information from the hieroglyphics accompanying these enormous sculptures,—that they all represent one and the same action, fought in the fifth year of the reign of the king, near Pelusium in the Delta; and not a very large or glorious affair either. Yet, as the monarch went on for forty years of his long reign, immortalizing the selfsame military exploit, —we may draw the conclusions, *first*, that he had no subsequent battles to boast of; and, *second*, that he was very desirous of being thought a mighty man of valour; in aid of which view he could order any amount of praise to be conferred upon himself, in these public documents; '*Moniteurs* of 'the time,' says M. Renan, 'and false by conse-'quence.'

But how did Ramses acquire the immense command of labour, which he undoubtedly possessed for the execution of his numerous monuments, without having recourse to prisoners of war? may well be inquired; and the answer is, 'By political 'subtleties acting on the weakness of the Xoite 'Pharaohs in the Delta, and their numerous but 'peaceable Israelite subjects.' Cunning and cruelty seem to have characterized the man far more than bravery; and though he be that identical Pharaoh 'who knew not Joseph,' in the way of not remembering the compacts of friendliness made with

him and his descendants—yet he seems to have thoroughly understood and practised some of his principles of administration, in so far as concerned strengthening the throne and enriching the monarch.

In the various portraits which have come down to our times of Sesostris-Ramses, whether in sculpture or painting, he is without doubt a magnificent-looking man, with even a bland expression of countenance, and the inimitable air of being a favoured scion of very high family and long royal descent; but there is, withal, a semi-concealed appearance of cunning, and a power of compassing a cruelty, with all the time an urbane smile on his lips,—that leaves one quite at a loss to conclude what he might not attempt next.

In one way or another he did in the course of his reign, at last contrive to bring about the dominion of all Egypt, Upper, Middle, and Lower, to the Diospolitan sceptre; a scheme in the heads of all his predecessors, but never fully carried out by them, on account of the dynasties in the Delta. The last of these, however, the Xoite, became in his time reduced to a single infant of a year old, whom he then,—in his capacity of ally and guardian,—immediately married to his eldest daughter Thuoris, already far advanced in middle life; and by that method, without a flaw in its legality, and without bloodshed,—but a union which in course of nature could be attended by no inconvenient dynastic

consequences,—he gathered up all that had once belonged to the Xoite dominions into the appanage of his Theban throne. In such manner came the Israelites in the Delta under the control of Sesostris-Ramses, originally of the upper country; and he lost no time in setting them to work day by day in digging irrigation-canals, and in buildings of various kinds throughout all the length and breadth of the united country; in testimony of which, either the ruined mounds and buildings throughout Egypt may be examined, or the terse and effective description of the Bible remembered :—

'And the children of Israel were fruitful, and 'increased abundantly, and multiplied, and waxed 'exceeding mighty; and the land was filled with 'them. Now there arose up a new king over Egypt, 'which knew not Joseph. And he said unto his 'people, Behold, the people of the children of 'Israel are more and mightier than we: come on, 'let us deal wisely with them; lest they multiply, 'and it come to pass, that, when there falleth out 'any war, they join also unto our enemies, and 'fight against us, and so get them up out of the 'land. Therefore they did set over them task-'masters to afflict them with their burdens. And 'they built for Pharaoh treasure-cities (magazines), 'Pithom and Raamses. But the more they afflicted 'them, the more they multiplied and grew. And 'they were grieved because of the children of 'Israel. And the Egyptians made the children

'of Israel to serve with rigour. And they 'made their lives bitter with hard bondage, in 'mortar, and in brick, and in all manner of service 'in the field: all their service, wherein they made 'them serve, was with rigour.'

Queen Thuoris and her adopted son Moses.

Then came, as every one knows from the Bible, severe measures of repression; and at last the royal order that 'Every son that is born, ye shall cast into the river.' In the meanwhile, however, there grew up in the gentle mind of Thuoris, some fellow-feeling of compassion for the strangers so cruelly oppressed by the king her father. She had been sent away from Thebes where he resided, by that unfeeling despot in his family,—but who smiled so serenely in public,—to be his vicegerent in the Delta, along with her helpless infant husband; and there she occupied herself chiefly with attending to sundry religious services, to which she had been in a manner dedicated, even before the strange marriage, forced upon her without any possibility of refusing. Such a religious ceremonial employment it is supposed to have been, which took her down to the river's bank on the eventful morning of the exposure of the child Moses in the ark of bulrushes. Her true womanly feelings, as well as her own experiences of undeserved oppression, prompted her to pity the Hebrew child; her position as queen-vicegerent enabled her to brave her then distant father's infanticidal com-

mands; and her married state allowed her, without any appearance of impropriety, to become a seeming mother to the young castaway.

For forty years, or, as Mr. Osburn says, from the monuments, forty-four,—was Moses thereafter cherished in the palace of Lower Egypt; the bonds of his countrymen were much loosened; and poor Queen Thuoris, at the end of that time become an aged woman, received much comfort and assistance in public affairs, and affectionate attentions in private life, from her Hebrew protégé; but at last came the trial. Her father at Thebes had died, and had been succeeded by his son Amenepthis; and he, after reigning by himself two years only, had also died; and now the succession to the whole of Egypt had fallen on Queen Thuoris in her old age. There was her husband Sipthah to be sure; but he was an incompetent, the last expiring member of a royal race dying out from exhaustion of faculties; he could never rule as an independent sovereign of a powerful people,—but would Moses, so long in *fact* her adopted son, and who had so dutifully performed her behests for so many years; and shown such superiority to all his fellows,—equally in learning as in war,[1]—would *he* now become in the face of all the world her *legally* adopted son, and heir to the throne of the whole of Egypt?

To one like Moses, brought up all his life, save its first few days, in a palace, the opportunity must

[1] See Josephus, Book II. Chapter x.

have been, in a worldly point of view, most attractive. But, as we learn from several passages in the sacred Scriptures, 'by faith Moses, at this time, re-'fused to be called the son of Pharaoh's daughter;' abandoned all his splendid prospects of an earthly throne, and preferred going forth alone and in poverty to share the burdens, and sympathize with the grievances of his oppressed countrymen. Presently, too, even to flee into the desert before their ill-feelings and want of appreciation; as well as before the offended laws of Sipthah, residing then in Lower Egypt.

A sad trial must this refusal of Moses have been to the aged Queen; who thereupon retired to Thebes, and occupied herself during the remainder of her life, partly with the education of the infant son of the late Amenepthis, or Sethos II.; and partly with the preparation of her own and her husband's tomb in the Biban-el-Moluk, or valley of the tombs of the kings at Thebes.

Of the various monumental proofs that Queen Thuoris performed her part of Regent to the youthful Sethos II., faithfully and conscientiously, both in its public requirements and private duties, as long as she lived; and also that her nephew,—in spite of the loving care spent upon him, and 'the special 'books written for his sole use and behoof, con-'taining all the good actions of his predecessors,'—turned out nevertheless an exceedingly bad and even abandoned character,—we will not attempt to say

much in this place; for we should have to draw almost entirely from W. Osburn, and our readers would find greater advantage in referring direct to his fuller accounts, original conclusions, and eloquent pages.

Suffice it then here, that we hurry on to the time, when both Thuoris and Sipthah being dead, the graceless profligate Sethos II., ascended the throne. One of his first acts thereafter, seems to have been to hasten to the city of Ramses in the Delta, and on finding the Israelites no longer toiling as desperately for his royal advantage, as they used to do for his grandfather, Sesostris Ramses,—he instantly renewed their hardest burdens in that excess of unfeeling manner, which caused the complaints of the oppressed to rise up to Heaven; and occasioned the recall of Moses out of Midian, to be the deliverer of his people.

The final Crash.

Most minutely does William Osburn criticise the first nine of the scriptural plagues of Egypt,—showing that they were each of them special intensifications of natural features of the country or climate; almost as if it had been the Almighty's intention to show the Egyptians the inefficiency, one after the other, of each of their gods whom they had set up in charge over those elements. At the same time, this peculiarly prepared and able author shows clearly, that the order in which they are described, proves that the series of these dread plagues

extended over nearly a year; thereby allowing time enough for the mighty preparations to be made for the movement of so enormous a bulk of population, as the Israelites had become at this period; viz., not far short of four millions. An impossible number, remarks W. Osburn, to remove in these present days; but the exodus, we must remember, was the last, or he should perhaps have said, a continuation, of the several great migrations of the human race, which had been directed and assisted by the finger of God.

At length the historian comes to the tenth plague, the death of the first-born. 'In the execution of 'this most terrible judgment, God thrust forth His 'own arm from behind the veil of nature and her 'laws, and Himself struck the blow. Even on this 'occasion, it was not until another message of warn-'ing had been given to Sethos, and rejected; nor 'until he had finally dismissed with obloquy, the 'messenger whom God had thus mightily accredited, 'that the blow was stricken.' This is what W. Osburn writes; while the Bible similarly says, 'And 'it came to pass, that at midnight Jehovah smote all 'the first-born in the land of Egypt, from the first-'born of Pharaoh that sat on the throne, unto the 'first-born of the captive that was in the dungeon; 'and all the first-born of cattle.' But Chevalier Bunsen writes,—'We have stated in the preceding book 'that the exodus was only an episode, or rather one 'link in a fearfully vast, well-devised, plan, carried

'into execution with sagacity and resolution, of 'avenging liberty. That the Palestinians who in- 'vaded the country were, as the Egyptians say, 'called in by Moses, must be considered as an in- 'vention of national hatred; but the invasion is 'historical, and most important. It was a cover for 'the exodus, and the great Sicilian Vespers by 'which Asia took her revenge upon Africa. These 'Palestinians were really, after more than two cen- 'turies of oppression, *the messengers of the Lord*, 'when, in the third year of Menepthah, son of 'Ramses II., rushing down from the north, they 'slew all the first-born even in the king's palace.'

We do not agree with the too rationalistic view of the great philologist as to the agency which wrought on that memorable night. But if he believes firmly in what he has written, then his further testimony is more important than ours, or even than William Osburn's (though that should also be studied), to the effect,—that Egypt never recovered the results of the exodus; that the third volume of Manetho's history, or from dynasty twenty to dynasty thirty,—merely records a succession of degradations, until the Egyptians became utterly enslaved to foreigners,—their religious abomination at all times; were obliged in turn to expend all their inimitable architectural powers and artistic skill, with which they had erected the idols of old Egypt to ensnare the world,—to glorify their several 'impure' conquerors; until now, after having been for ages

and ages the slaves of slaves, and the basest of the base, these artistic capacities are completely departed from them,—and they are left a useless and effete people, an astonishment and a hissing on the face of the earth, until it shall please the Lord to take pity on them again.

But thus Chevalier Bunsen *concludes* his view of the exodus, 'the historical exodus,' as he terms it. 'The courage and judgment of the Egyptians failed 'in face of the moral faith so energetically evinced 'by the man of God. At length a body of troops 'was despatched to attack the multitude as they 'withdrew. These perished in the waves; and the 'weakness of Egypt became self-evident to their 'Palestinian and Arabian neighbours, who fell upon 'the disorganized country which was humbled as it 'never had been before. At the end of thirteen 'years the enemy was expelled, but the strength of 'the nation was exhausted. After the brilliant 'semblance of a restoration by the great conqueror 'of the twentieth dynasty, the power of the 'Pharaohs was so shaken by the Assyrians that it 'never recovered itself again for any length of time. 'Nor did the work of the invaders produce any 'good to their country or to the world. The move-'ment in behalf of human dignity and of liberty 'was alone blest for those who understood it and for 'the human race.'[1] 'At all events the invasion and 'exodus became the death-blow of the new empire.'

[1] Bunsen's *Egypt*, vol. iv. p. 589.

Plainly then here is no difference of note as to the resulting material fact,—that with the night of the exodus, when the visible career of Israel began, and when 'history was born,' the ancient glories of Egypt commenced rapidly their fatal decline. Our absolute dates, moreover, in chronology, cross at this point of the exodus with those of other authorities, —from some of whom we had differed largely when discussing the earlier dynasties; for both Bunsen, Lepsius, and Osburn are all within a handful of years agreed upon the time 1320 B.C. nearly; and differ for the name of the king under whom 'the man of 'God' 'led the departure,' only between the son or grandson of Ramses II.

Hence, having been enabled to trace, to the best of our humble ability, no small portion of the mental and manual characteristics of the Egyptians, even from those primitive times of Egypt's existence, when that country stood solitary and alone in the recorded annals of mankind,—down to the fullest expansion which those characteristics ever subsequently experienced in better-known and more abundantly peopled periods of earth-history,—it is our duty now to return, with such help as may thus have been procured, to our long-interrupted investigation into the mystery connected with the origination of that earliest, and most important of all human monuments, the Great Pyramid.

CHAPTER VII.

ORIGINATION OF THE GREAT PYRAMID, ON SCIENTIFIC GROUNDS.

TOWARDS the close of his Section v. Division III. Book II. of his *Egypt's Place in Universal History*, Chevalier Bunsen, in reviewing the progress of Egypt from dynasties first to twelfth,—has some well-put philosophical remarks; which, though accompanied by a few rather doubtful assertions,—yet giving as they do, his very scholarly ideas on the difference between ordinary Pyramids and the Great Pyramid,—and again, between all Pyramids and Tombs acknowledged or ordinary,—may be expected to be here introduced. They are as follows:—

'Respecting the particular purpose for which the 'Pyramids were designed, we have satisfactorily 'shown, in the foregoing inquiry, that they are ex- 'clusively *gigantic covers of rocky tombs*, built with 'great skill to bid defiance to the ravages of ages; and 'that, as a general rule, they neither contain a sepul- 'chral chamber nor large apartment. The largest 'Pyramid is the only exception, owing, indeed, to 'particular circumstances which we think we have

'to a certain degree explained. It is the only one 'which contains two chambers, one of which served 'for a tomb. Its construction, as well as the pains 'bestowed on concealing and barricadoing all the 'approaches to it, have been accounted for in refer-'ence to one single object—that of protecting the 'hallowed corses of the kings, as far as human 'power and human ingenuity could do so, from 'destruction. But how are we to explain their 'having such an object? Were the hieroglyphics 'complete, and could we thoroughly understand 'them, they would not answer the question. The 'idea which gave birth to these wondrous edifices, 'one after the other, during a period of almost one 'thousand years, in the deserts of Libya, is itself a 'hieroglyphic, and a very mysterious one. Its inves-'tigation belongs to the fifth book.'

In the fifth book, accordingly (p. 651, vol. iv.), the subject is taken up again; and it is argued—that such an extreme desire to preserve the body safe in a stone monument, was connected with the belief of the Egyptians in the immortality of the soul; a belief which existed in their minds from the earliest times, but always accompanied 'by a comfortless 'inability to embrace the idea in all its purity;' in fact, they made the immortality of the soul rest on the due preservation of the body after death. 'This 'was the tribute paid by the Asiatics, in earliest 'times, for the occupation of Africa and the posses-'sion of the Nile.' 'We assuredly owe,' continues

the eminent philologist, 'the stupendous fabric of 'the Pyramids to a superstitious fear of the destruc- 'tion of the body, rather than to the mere vanity 'and love of display on the part of the builders. 'The judgment passed by the people on their kings 'after death (as upon every other person who died) 'was, at the epoch of the first dynasties, no empty 'form. Now the royal builders of the largest 'Pyramids were, according to universal tradition, 'haughty, cruel tyrants, who had good reasons to be 'apprehensive of the popular verdict, the ordeal they 'would have to pass at the hands of the people and 'priests. It was no easy matter for any one to find 'his way into the Pyramids; each of them had its 'own secret barrier to prevent intrusion; but, at 'all events, a forcible entry into them was quite 'impossible.'

Now this attempted explanation,—which we have extracted pretty fully, because it seems to be the highest and ultimate effort of all that mere philology, unaided either by exact science, or the principles of revealed religion, can do,—seems to our moderate apprehension to explain nothing of the innumerable exact structural features which are peculiar to the Great Pyramid, as different from the second and all other Pyramids. Nor, again, is it explanatory of the many particulars and methods of building, distinguishing all the Pyramids alike,—whether of kings reported tyrants, or lauded as philanthropists,—from the tombs proper of their own or subsequent times;

and in which tombs, the preservation, by concealment or barricadoing, of the mummied corpses was just as much attended to as in any Pyramid. Or, indeed, rather more so; for, in some instances, as in the *lined* entrance-passages of Pyramids, *they* tended to *lead*, rather than blind, subsequent depredators to the place of hiding of the precious corpse, deep under, or within, the mass of the covering monument. Nor does Baron Bunsen's explanation throw the smallest light upon the reason why, or by whose agency, the peculiar form of *Pyramids* first stood on the surface of Egypt; and wherefore the building of them ceased again after several centuries, without any alteration having occurred meanwhile in the national faith,—respecting the soul's life being dependent on the dead body's preservation.

Even under the learned author's section of 'Arts,' p. 654, the immense generic difference between the *decorated* tombs and *undecorated* Pyramids is positively ignored; as in the following passage,—'The 'interior of the tombs, *and in particular of the* '*Pyramids*, exhibits the most striking example of 'the grandeur of the style of the old empire, and of 'its artistic perfection.'[1] And when the very ex-

[1] In his *Expedition to the Euphrates*, vol. ii. p. 88, Colonel Chesney intensifies all these errors, thus—'The compartments *of the Pyramids* 'and temples of Egypt exhibit, in colouring still vivid, the history and 'occupations of the inhabitants of the valley of the Nile.' But in that volume, in place of giving any account of his actual expedition, the Royal Artillerist attempts the whole history of the world, from Noah to Napoleon Bonaparte, and a little later; and cannot therefore be an original authority upon everything introduced.

tensively read author proceeds, with the view of making the too much neglected actual features of the Great Pyramid clearer after his manner,—not by ascertaining what they are by measures of line, number, and angle,—but by comparing them, in hazy and elastic allusions only, with something still less known, viz., 'the architectonical form of the 'vastest edifice in the world, the Temple of Belus, 'as the watch-tower of Babel;' we must really beg to decline following his grandly expressed, though mistifying philosophy any longer.

If, indeed, we *could* compare the details of the Great Pyramid exactly and certainly with those of the Tower of Babel,—great would be the advantage to knowledge; but whereto shall we look for certain and accurate particulars of the latter building? Of the Great Pyramid we have, even in this our own book alone, plans and sections, with three hundred pages of numerical observations of lines and angles taken on some most exact surfaces; and we have seen and touched and do testify of these things ourselves. But not one page of such features regarding the Tower of Babel, does the philological philosopher venture to bring forth to his readers; or even to assert that he has in his private possession; or to indicate where in the present state of the world, travellers may proceed and measure such documents for themselves.

In the Rev. George Rawlinson's *The Five Great Monarchies of the Ancient Eastern World*, the foun-

dation plans of all the oldest Chaldæan temples yet examined on the lower plains of the Euphrates (the *supposed* region of the *site* of Babel), are stated to be invariably oblong rectangles,—the sides being in the proportion of three to two nearly,—and not squares like the bases of the Great, and other Jeezeh Pyramids. Further and more remarkably still, it is the *angles* of all these Chaldæan buildings, never their *sides*, which are presented to the four cardinal points;[1] so that they are as different from the Egyptian buildings of Pyramidal ages, in the important feature of azimuthal emplacement, as it is actually possible for them to be. In elevation, there was likewise a characteristic opposition; for the culminating height of a Chaldæan temple was always towards one end, and never vertically over the centre of the base, as with every Pyramid in Egypt: and such culminating part was an open chamber in the former, and a solid mass of masonry in the latter description of building. The former was moreover left in successive stages, usually three in number, and the lower one—rough with protruding buttresses; while the latter, or the Egyptian Pyramids, had all their temporary building steps filled in and bevelled off finally, smooth and sloping outside from top to bottom, in one vast sheet by the agency of the casing-stones.

[1] 'The angles of the building exactly face the four cardinal points. 'According to Mr. Loftus (*Chaldæa and Susiana*) this emplacement 'is observable in all edifices (temples?) of true Chaldæan origin.'—G. Rawlinson, vol. i. p. 96.

Hence if there should be some points about the Great Pyramid, which we cannot examine very precisely there, by reason of dilapidations,—we shall certainly not clear up *those* difficulties by going to such completely alien forms of building as any, or all, of the Chaldæan temples that have come down to our times. Structures entirely peculiar are these in the matter of their materials also; which were so wretched and perishable, as to offer now little more than shapeless mounds, though of an age apparently long subsequent to the Great Pyramid. But the Great Pyramid again must be long subsequent to the Tower of Babel; so that the last clearly recognisable remains of *that* building, if composed in its day of the ordinary Chaldæan materials, must have perished, or 'altered,' very long ago indeed.

Evidently, then, an immense amount of faith is demanded of his readers by Baron Bunsen, when he has no modern-tested facts, to go on, in building up either a theory or a tower. While, on the contrary, he as despotically requires his followers to ride callously over well-ascertained and measured data; and show themselves impervious to belief when an astronomical explanation is rendered of some, even of the most undoubted facts, or features actually existing, in the Great Pyramid; and forming the *ipsissima verba* of its own contemporary account of itself. For all such explanations and even the things themselves, he stigmatizes, as 'groundless 'fancies,' flagitiously *indulged in;* (p. 293).

Research de novo.

There is a most depressing feeling, when one first makes the discovery in life, that those whom we have long implicitly followed hitherto, and respected for their years, station, and higher attainments, their more extensive knowledge, and greater strength of mind,—have *not* the spirit of justice within them. There is no other choice then, but to set forth on one's path in the world—solitary it may be, and for certain with distressed mind and increase of labour with painful toil,—but willing to incur all, rather than be found voluntarily and knowingly opposed to any right moral principle. With some such sense of depression on our spirits do we commence this humble attempt, to investigate scientifically the origination of the Great Pyramid; cheered only with the assurance, that it cannot be wrong to attend to actual facts.

Amongst these may *first* be noted, that all the older Pyramids, as monuments,—call them funeral monuments if you will,—have amongst themselves a general community of figure and an absence of internal decoration; making them, as a class, stand wide apart from the ordinary Egyptian tombs,—which possess far other external figures, with most showy and adorned interiors.

Second, this peculiar class of monuments, the Pyramids, flourished only in the earlier, indeed in the very early, dynasties of Egyptian history; and had disappeared completely, in favour of other

forms, long before the nation of Egypt reached its culmination of empire, and peculiarity of institutions both public and private. Indicating, therefore, that the idea was not a natural one in the Egyptian mind, growing with its growth and strengthening with its strength; but rather an exotic,—which, received from abroad at the very beginning of the national existence, did at every succeeding architectural reproduction lose so much of force, or interest for the people, as at last to die out amongst them altogether.

Hence, to ascertain what chiefly characterized Pyramids when they were best understood or most appreciated amongst Egyptians, we should not visit the latest,—expecting there to see necessarily an accumulation of all the excellences of its predecessors; but should rather,—either search for the oldest; or, with more freedom from all foregone conclusions, seek out by mechanical inspection the most perfect and complete in its original design, and investigate its age afterwards.

Now, simply as tested by modern scientific measure, there cannot be a moment's doubt that as respects size, excellence of masonry throughout, and possession of internal chambers high up in that masonry,—replete too, with very remarkable proportions, and what may be called Pyramidal numbers, —the Great Pyramid stands before all the other known Pyramids. For notwithstanding that some authors claim for the second Pyramid, that,—

though rather smaller and very badly built,—it had a bordering of *coloured* granite round its base; and others for the third Pyramid, that,—though very much smaller again,—it was coloured gorgeously for more than fifty feet up its side;—still these things are deviations from the pure Pyramid principle, and show endeavours to modify it by the introduction of just so much of ornamental tomb or temple architecture. We may fortunately too, trace up the gradual increase, with time, of this parasitical, but truly Egyptian growth of luxury extending itself over the ancient pure form,—by looking at Lepsius' views of the Pyramids of Meroe. For these are *very* modern resuscitations of the old Pyramid idea, after it had been left alone for two thousand years; and are found, though quite trifling in size, yet furnished with channelled and fluted corner lines, appended porticos, and outside sculpture in the intervening Theban-temple manner.

The Great Pyramid is thus, taken all in all, by far the largest, best, and truest Pyramid of all the Pyramids. How long then was required, let us therefore ask, for the idea of a Pyramid after its first invention, or introduction to Egyptian minds, to grow, improve, and fructify up to that point of transcendent excellence, whence they could build the *ne plus ultra* of that species of monument, or, the Great Pyramid?

Then comes the very strange answer from Dr. Lepsius (see pp. 364 and 365), that he believes the

Great Pyramid was the first built of all Egyptian Pyramids, and was even the first of their public buildings of any kind; and that he cannot refer positively to any remains of the Egyptian nation of higher antiquity.

This opinion is indeed not yet allowed in full by *all* authorities: though none venture to put more than two or three items of known remains, and these immediately preceding it, earlier; so that the Great Pyramid, if not the very first, was very nearly the first work in point of time; and absolutely the first in time and excellence combined, of all the buildings ever erected by the Egyptian race, —at the strangely sudden beginning which their national existence once experienced on the banks of the Nile. (See p. 371.)

Hence we are driven back again, by the, in a manner, negative testimony of all monumental remains in Egypt, upon the theory of a Pyramid having been, as before expressed, an exotic to the Egyptian land. The idea was inserted there, evidently in vigour the most extreme and extraordinary,—because it was able to produce, even at the origin of the nation, a monument which, for size, style, and rank, has never since been equalled in any country on the face of the earth; had no known prototype in any other country; and has remained through ages, even of continually growing numbers of the human race, of increasing size of nations, and accumulating wealth of governments,—the emphatic

and chief wonder of the world. The idea, too, was inserted so deeply in the Egyptian mind, that for many generations it was never entirely lost; and Pyramid-building,—though in continually-decreasing scale, and for some other purposes,—with very rude, and often entirely mistaken or ignorant imitation, only, of the original,—went occasionally on.[1] But this again confesses that the idea never grew; and, like a full-blown flower cut from its parent stem, it began to decay from the moment it was planted into a new and unaccustomed soil.

Pyramid idea, whence derived?

If the idea, then, was exotic in Egypt, where did it come from?

At present there is no clue; for though there are now occasional Pyramids and Pyramidal buildings in several other countries of the world, they are all held to be far inferior in age, as they certainly are in character, to the Great Pyramid, and could not

[1] That the Egyptians themselves did not understand the meaning of the peculiar proportions introduced into the Great Pyramid, has already been shown in Divisions I. and II., where neither the angle of the outside slope, the length of a side of the base, the number of construction-steps, the commensurabilities of the coffer, nor any other points which have been shown to have been endued with a remarkable meaning in nature or art,—were ever again realized. Nor attempted to be realized,—for there was abundance of manual skill to have done it, had there only been brains enough to decide what the hands were to be employed upon.

More strikingly still do the hieroglyphics show the want of appreciation in the Egyptian mind. For look at our Plate XII. (all whose excellences depend on Dr. Lepsius' drawings), and see how the characteristics of hawks, owls, ibises, geese, hares, etc. etc., are hit off with a

have originated it. All, therefore, that we can venture upon now is, to continue our mere mechanical investigation by inquiring further, if facts permit,—and whoever the real originator may ultimately turn out to have been,—whether his whole intention or purpose in designing the Great Pyramid, was fully subserved in having that *one* monument erected on his plans by the Egyptians in their Siriadic land; or whether any of the subsequent Pyramids were necessary parts of the scheme to be filled in afterwards. How this inquiry is to be efficiently carried out, presents many difficulties; but our first proceeding must evidently be, to concentrate our attention on the numerous mechanical refinements and speaking, though uninscribed, walls of the Great Pyramid.

Now we have already both in this work, and elsewhere,[1] endeavoured to bring into notice the many confirmations, arising from recent measures, to the not new idea of the original purpose of the Great

line or two put in with consummate skill, and turned with admirable truth and meaning. But then look at the little Pyramids in the same Plate, and see what *angles* they have got. By John Taylor's theory we are taught that the angle of rise of the Great Pyramid's side is the all-important feature which it possesses; and that a difference of a few seconds, on one side or the other from 51° 51′ 14·3″ would entirely spoil its meaning. An able artist, therefore, if pervaded by this truth, would endeavour to give that angle *nearly*, when representing the Pyramid;—yet we find by measurement, on Plate XII., that the angles of rise of the sides of three Pyramids attributed to Shofo, are on the paper = 72°, 72°, and 74°; of two given to Shafre = 70° and 74°; of one to Userchres = 74°; and one to Tancheres = 76°!

[1] *Transactions of the Royal Society of Edinburgh*, vol. xxiv. Part II. pp. 385-403.

Pyramid having been, to serve as a metrological monument,—which was to testify, for some unknown reason, but through many thousands of years, to a particular system of weights and measures for all subjects, and on a very grand scale. And seeing that the various mechanical features which we have adduced in Divisions I. and II. of this volume, as typifying these things,—are all of them directly connected with, or do actually form the radical laying out of the foundations, and, so to speak, the bones of the building,—they must have *preceded* the employment of any of the subsequently built and fitted-up parts for any purpose whatever.

Hence it is no objection to the metrological theory, as that of the origination,—if a mummied corpse *was* latterly deposited, either in the King's or Queen's chamber, the subterranean, or anywhere else throughout the Pyramid; nor whether the coffer in the former, when opened by Khaliph Al Mamoon, was either absolutely empty, or filled with gold pieces of large size, or occupied by the body of a man with a golden breast-plate, a sword of inestimable value by his side, and a carbuncle shining with the light of day on his forehead,—each of which stories has one or more Arab historians to vouch for its conflicting truth and superior credit. Neither is it of any importance now, when both the gold and the man, his sword and the carbuncle, if ever there, are all long since gone,—whether they had been deposited in that place by the first builders

of the Pyramid or by Mencherian, Saitean, or Amosian fanatics, breaking into the Pyramid, and employing it for their own purposes, in the fifth, sixteenth, or eighteenth dynasties,—for the emptiness of the coffer is all that remains: while the fractured rampstone over the well-mouth, indicates that *some one*, entering forcibly by the well from the lower subterranean passage, must have burst into the upper parts of the Pyramid, and worked his will there in minor matters, long before the time of Khaliph Al Mamoon and his horde of Muslim excavators.

The intervening experiences of the Great Pyramid are indeed vastly more difficult to investigate, than its present or primitive state; and, happily for our problem, are of little importance. For such intervening effects have always been in the way of petty degradations and mischief, never with the view of adding to, or improving, and certainly not of building up again from the very foundation; so that the work of later men can be easily distinguished from those of the original builders.

We put the metrological hypothesis, therefore, upon its trial for the explanation of the *original* Pyramid form, proportions, characteristics, and requirements; and find that for it, the Great Pyramid by itself, as actually erected in *geographical position* in form and parts, but without artistic ornament inside or out, is admirably suited and perfectly sufficient. Find also, that if executed once in a thorough manner, there need be no further repeti-

tions of it,—so far, at least, as its successful interpretation is concerned; though for the purpose of shielding the one precious monument from barbarous mischief during long ages of war, invasion, and revolution,—a number of successive, nearly similar in appearance, though for the theory, or for practical metrology, really valueless Pyramids,—might be considerably useful. And find also, in actual measurements of the building, the long series of coincidences working, as already detailed, into coincidences,—which terminate at last in showing that the Great Pyramid actually is a containing case or setting for a grandly complete system of metrology,—adapted to everything connected with size, weight, heat, angle, and time,—all on one uniform and admirable system of referring to the most influential and wide-spreading features in nature for the value of its standards; and expressing these in the neatest and most convenient arithmetical forms of one constant order of numbers.

That such a metrological system *should* be contained in the Great Pyramid is no doubt a surpassing wonder; but having been proved for it by all the preceding pages of our work in vol. ii., and Divisions I. and II. of vol. iii., and never having been made out for any of the other Pyramids in the smallest degree,—we obtain a complete solution of the particular question just proposed. That is, we find that the scientific scheme of origination does not depend for its full expression on any of those other

and subsequent Pyramids of Egypt, but is complete and perfect in the Great Pyramid taken by itself, and resting upon itself alone.

Hence comes the encouraging conclusion, that for the still further prosecution of all the really important parts of the mystery in a scientific point of view,—our attention and studies may be concentrated entirely on the Great Pyramid; and then the higher and more difficult personal question comes up again with greater force than ever,—viz., Who was the originator? Nay, who *could* have originated such a building?

Wisdom of the Egyptians fails.

Many worthy persons imagine, in an indefinite manner, that the science of the ancient Egyptians was something of infinite power and scope. They, the Egyptians, had a particular deity, it is further contended, to preside over weights and measures; and, *therefore*, if it be admitted,—as admitted, we conceive, it must be, both from the discovery of the quarry-marks and of superficial traces of the use of the cubit of Memphis,—that the Great Pyramid was erected by *the hands* of Egyptian workmen, while it stands confessedly to all on Egyptian territory —why go further, say these excellent and well-intentioned modern men, than to Egyptian learning, for the origination of the scheme?

The answer is twofold—*First*, if the system had been altogether Egyptian, and Egyptian means had

been employed knowingly and purposely in commemorating it by so expensive a structure as the Great Pyramid,—how is it that not a single element of the system was ever used by Egyptians at any time of their history, early or late? For whenever we can ascertain at any period of their empire what their standards were in length, weight, angle, or time, they are perfectly different,—as already dilated on sufficiently, both in the last volume and the present one,—from those of the Great Pyramid. And *second*, let us test the depth and quality of this mysterious learning of ancient Egyptians, and which a special god in their pantheon was appointed—by themselves—to assist them in.

In our attempt to give a fair abstract of their history from dynasty four to dynasty twenty, in chapters v. and vi., we have certainly not come upon much of the learning. But as *our* testimony may be objected to on principle, we prefer in this matter to appeal to Chevalier Bunsen; whose pro-Egyptian tendencies crop out so vehemently towards the end of his world-famous volumes,—that all men may rest perfectly assured in finding in him, the utmost that can possibly be said with any regard to propriety, in favour of the respectable appearance of ancient Egypt.

Now this deeply learned and very favourably inclined Chevalier Bunsen, when summing up the final statements near the end of his fourth volume, or p. 658, expresses himself thus, under the heads of

'Geometry and Astronomy,' and in so doing he is including everything that can be said not only for the Egyptians of the fourth, or Great Pyramid building, and earliest monumentally proved, dynasty,—but for those of every other dynasty likewise: 'Their knowledge of mechanics and of the 'cognate mathematical principles is evinced no less 'by the artistic perfection of their buildings, than 'by the vastness of their masses. But this will not 'justify us in supposing them to have possessed a 'really scientific knowledge of these subjects. It 'was ingenuity, based upon a keen natural perception, guided by the elements of geometric science.'

'*Their astronomy, like everything Egyptian, 'was strictly provincial, and calculated only for 'the meridian of Egypt.*'

This last sentence is indeed final, and is almost worthy of either W. Osburn or M. Renan, in the felicity with which it fixes on the grand national characteristics of those *quasi* 'Chinese of the earlier 'ages of time, to whom Egypt was the whole world, 'and within the limits of whose Egyptian valley, 'their ideas were entirely confined.'

Another equally favourably disposed author to the Egyptians, M. Brugsch, writes, in his History of Egypt:—'Astronomy was not amongst them '(Egyptians), that mathematical science which 'calculates the movements of the stars, in con-'structing the grand systems which compose the 'celestial sphere. It was rather a collection of

'notes of phenomena, periodical to the sky as seen 'in the Egyptian country, and of which the reci- 'procal bearing could not long escape the eyes of 'the priests, who observed, in the clear nights of 'Egypt, the brilliant constellations. Their astro- 'nomical knowledge was founded on a base of 'empiricism, and not on that of mathematical 'observation.'

While if we appeal to old Greek and Roman testimony, we are told 'that Strabo admitted that the 'Egyptian priests of his own day were destitute of 'all scientific and astronomical knowledge;' and, more searchingly still, that 'the science of Egypt, 'like the wealth and power of Persia, was found by 'the Greeks to be a nullity, when it became the 'subject of certain knowledge and observation.'

Such a people, then, as this of Egypt, never really scientific, 'never with minds sufficiently 'trained in abstract reasoning to be able to follow 'the demonstrations of the conic sections,' and always cooped in their narrow valley, with their narrower opinions and exclusive ideas,—could have had no notion of founding their linear standard on the earth's axis of rotation; their weight and capacity measure on an employment of the whole earth's mean density; a temperature standard on the mean surface-temperature of the whole earth; and their time standard on the precession of the equinoxes, assisted by meridian observations combining a well-chosen polar, with an equatorial, star.

The notion of Egyptians having done this, is evidently absurd beyond all the usual bounds of absurdity; they could not have done it, and we must look elsewhere for the habitation of the originator or planner and well-nigh perfect carrier-out of so remarkable a scheme.

But in that case whereto shall we look? for Bunsen, Renan, and others discourse eloquently of the Pyramid-building age of the Egyptians, being a period when that nation was the one and only community of cultivated and civilized men, descending in their one and solitary bark the mysterious stream of time; whose current was then unploughed by any other keel. At the date of the Great Pyramid's building, too, or 2170 B.C., all the peculiarly so-called 'wisdom of the Egyptians,'—in reality, their more recondite idolatrous mysteries, with statecraft and handicraft,—had not begun. For, on referring to vol. ii. p. 435 to 438, it will be observed, that some exceedingly zealous friends of old Egypt, do not attempt to place the invention of the feast of the Isia, earlier than 1350 B.C.

Even too, though we descend that stream of time to epochs when the Egyptian vessel of state, was hustled by the rival appearance there of the Assyrian, Babylonian, Persian, Grecian, Phœnician, and other nationalities,—Egyptian astronomy was no better than what has been described above; and we shall have to descend very much further still down the course of ages, even to within a few years

of the present year of grace, 1866, before *any* human science will be found competent to have arranged and represented so full, philosophical, and perfect a metrology as that of the Great Pyramid.

Who, then, could have been the originator of that system; and in the day of the Great Pyramid, or when the particulars *were* actually inserted into that building; by the hands of Egyptian workmen no doubt, but without their knowing what they were doing; and when no real physical science existed anywhere in all the world?

Something beyond the usual ken of man, and even above the power and scope of science to grapple with, must have been here concerned (these facts would seem to imply). And the late John Taylor had come to the conclusion,—before he knew more than a tithe of the evidence which the Great Pyramid has since then proved itself capable of yielding, when properly examined by measurement,—that this wondrous monument of old had been built under the direction of chosen men, *divinely inspired* with wisdom from on high for that purpose.

Necessity for seeking a wisdom higher than man's.

Such an origination as that, would of course, if real, instantly relieve the question of all its human impossibilities. But the mere naming of it, in the present day, before scientific men in a scientific subject, and connected with practical facts,—is greeted immediately with a storm of clamour, re-

proaches, regrets, objections, and the most determined opposition. Not without some reason too,—because the attribution of a Divine origin, when men find anything either in science or early history, above their immediate power to explain on simple principles of human learning,—has been hitherto generally, if not always, a sign of weakness in the science of those employing it: so that the progress of natural philosophy in recent years, contains not a few cases of phenomena, once thought supernatural, yet now shown to be amenable to mechanical principles, as well as following implicitly the regular order of nature.

Let us therefore, by all means, attend to, and weigh carefully against the facts already accumulated on our side,—for we cannot drop them on account of mere clamour,—all the explicitly stated objections by able men that we may be enabled to meet with.

First amongst these, must be placed the opinions of men understanding mathematics, mechanics, and practical science. And they, after having examined the numerical admeasurements as given in vol. ii., and discussed in the present volume,—are usually ready enough to allow that a metrology, as alleged, is there indicated. They are then only taken up, with how its introduction can be attributed to something else than Divine inspiration.

Thus says one friend, of much learning after this kind, 'The capacities of the human mind, in special 'instances, are marvellous; and a single great genius

'might think out a whole system of mathematical 'science in the course of a short lifetime; and then 'you might have from him some truly wonderful 'publications, although the nation he belonged to, 'and in the midst of whom he lived, knew nothing 'whatever about mathematics either before or after 'his day.'

To this our answer is twofold:—*First*, according to the very independent testimony of M. Renan, there was never a particle of genius in the whole land of Egypt. 'Egypt,' says he, 'was of all coun- 'tries the most conservative. Not a revolutionist, 'not a reformer, not a great poet, not a great artist, 'not a *savant*, not a philosopher, is met with in its 'history. In that sad valley of general mediocrity 'and eternal slavery, men vegetated for thousands 'of years, they cultivated their fields, they made 'good overseers, they carried stones upon their backs, 'they lived on very contentedly without glory. One 'and the same level of mediocrity pressed upon 'every one.' *Second*, even if there had been such an amount of genius in that dull land, for *abstract* science, or science that can be thought out within doors, and even within the walls of a dungeon, as would have amounted in all actual experience, even in lands most favoured by genius and caprice of Nature, to a miracle in itself,—the mixture on the other hand of *practical*, with *abstract*, science, which is requisite for finding out the several features of the earth as employed in the Great Pyramid

metrology, is not an affair of the mind alone, but of the general progress of all the arts and sciences of a great nation,—combined with much travelling about; and extensive and accurate observations of various kinds, over a large part of the earth's surface, even from the pole, or its neighbourhood, to the equator; and round about the equator again in many different longitudes. And how could the earlier Egyptians accomplish all that, confined as they were in their narrow valley?

Another friend of the same order of knowledge then suggests: 'Grant that the *Egyptians* never 'could have conceived such a metrology as that of 'the Great Pyramid,—but why should there not 'have been nations,—nations whose names we have 'never heard of,—living long before the Egyptians 'through many thousands of years; attaining by 'degrees to more knowledge than we possess at 'present; flourishing for long ages as we have 'never flourished yet; but finally dying away, and 'leaving no other trace of their once existence upon 'the earth, than this single Pyramid, which encloses 'so much knowledge?'

To this we reply: 'that if they did live once, the 'Great Pyramid is not their work,—for the quarry-'marks prove it Egyptian of the fourth dynasty; 'or decidedly, though only just, within recognised 'Egyptian history. And as to these or any other 'supposititious nations performing such great deeds 'through unchronicled thousands of years, and yet

'leaving nothing behind them, even in the land of 'Egypt,—where Bunsen, Lepsius, and Renan all tell 'us "*that nothing decays*,"—we have become so 'accustomed to sound, tangible, and practical proofs, 'as well as sterling material evidence, in our Great 'Pyramid investigations,—that without something 'of the same hard kind being brought up in favour 'of the unknown and unnameable, theoretic, civi- 'lized, and powerful nations long since passed 'away,—we decline to believe that any one of them 'ever existed.'

Next come the objections of men who do *not* understand mathematics, mechanics, and practical science, but are supposed to be strong in mental philosophy and some other subjects; and these individuals mostly refuse to allow that anything connected with metrology has been, or can be, proved, by measures taken at the Great Pyramid. Their reasons appear to be, that all practical sciences are over-ridden by logic and metaphysics, which both fix the bounds within which the others can be usefully employed, and have given forth this dogma, that *no number of coincidences makes a proof:* therefore, say they, no number of agreements in the measured proportions of the Great Pyramid, with earth-features, can ever establish that there was an intention of the founders to typify such things,—much less to arrange a whole scheme of metrology upon them.

Seeing, however, that the Great Pyramid is a

practical matter, the said logicians and metaphysicians may be referred to that very frequent illustration, a watch, and a good watch keeping time to a second a day; and asked,—whether the world at large is likely to accept their dogma practically applied there. Or, that all the numerous coincidences of the watch's wheels and pinions working exactly into each other, and the agreement of the resulting hour-hand's indications with the rotation of the earth on its axis, to such extreme closeness as only to be 1-86,400th in error—special means being also introduced to prevent changes of temperature spoiling that close approximation—that all this forms *no proof* that there has been any intention on the part of an intelligent watchmaker to produce such coincidence!

Lastly, but more numerously, come men, not exactly classifiable under either of the previous heads; but so confident, nevertheless, in the teachings of their own sciences,—which require time almost illimitable for their operations,—that they refuse even to look at the Pyramid subject at all. An eloquent expression of the views of this party, as given by a master amongst them, is contained in the address of the President of the British Association at Nottingham, and runs thus:—

'Can it be supposed that the inhabitants of Cen-
'tral America, or of Egypt, suddenly, and what is
'called instinctively, built their cities, carved and
'ornamented their monuments? If not, if they must

'have learned to construct such erections, did it not 'take time to acquire such learning, to invent tools 'as occasion required, contrivances to raise weights, 'rules or laws by which men acted in concert to 'effect the design? Did not all this require time? 'and if, as the evidence of historical times shows, 'invention marches with a geometrical progression, 'how slow must have been the earlier steps! If 'even now, habit and prejudice resulting therefrom, 'vested interests, etc., retard for some time the 'general application of a new invention, what must 'have been the degree of retardation among the 'comparatively uneducated beings which then 'existed.'

To this excellent piece of writing, however, we may answer,—that it does not attempt to prove anything, directly, of what actually took place at the building of the Great Pyramid; it merely infers what *ought* to have occurred there, according to what is seen now to take place amongst men, whenever an opportunity occurs for positive observations. In so far, then, it represents only, but truly, the deductions of science as to whatever characterizes a purely human beginning; for whether among the modern European nations, or the ancient Greeks, or any other people within historical limits, their beginnings, both in astronomy and architecture, have been invariably marked by long wanderings in littleness, rudeness, and puerility alike of conception and execution; accompanied, indeed, by some

tendency to enlarge or advance, but developing itself so slowly in their earlier years, as to be quite invisible except with the long lapse of ages.

This then is, according to the growing and influential school represented by a large portion of the British Association for the Advancement of Science, *first*, the real characteristic; and *second* (when it is found to have actually occurred anywhere), the scientific proof, of a human beginning. And if so, what follows when we come to the Great Pyramid, and find that its actual mode of beginning (having been sudden, see p. 370, etc.) was perfectly different from all the alleged characteristics of a human beginning,—as comprehensively, powerfully, and truly laid down by the above-mentioned philosophers!

Nay what can follow, but the conclusion, resulting in a belief,—that the Great Pyramid was not altogether of human origination? And in that case, whereto should we look for any supernatural assistance to man, but from Divine inspiration?

If there were any other method whatever of solving the problem, than that of referring to *inspiration*,—or, if proofs were not multiplied on proofs to show that this case of the Great Pyramid, is the most remarkable instance ever submitted to the investigations of science, and is as true and certain as it is old and venerable,—we should have been the last persons in the world to have dared to propose (or to adopt when others proposed it) a mode of solution so awful to contemplate, so dread to

appeal to lightly, and so little instructive if used without reason. But, as we have already shown, there is no other conclusion possible with the facts.

Science, then, leads the case up, nor can it do more, to the boundary line, bordering only on religion. So that if we would next endeavour to ascertain whether, after being brought so far, the subject can really be admitted within that hallowed pale,—recourse must be had to trials and examinations of a very different order.

CHAPTER VIII.

ORIGINATION OF THE GREAT PYRAMID, ON RELIGIOUS GROUNDS.

No sooner have we satisfied the scientific objectors (as we trust has been done in the last chapter) that the manner of appearance and nature of contents of the Great Pyramid, are not according to a merely human beginning,—and that some assistance from the Deity *must* be looked for,—than we find ourselves assailed by many well-meaning and religious-minded persons, for presuming to look to such a source in such a case, example, or cause.

Assistance, direction, instruction, in a word, *inspiration* from God to man, they consider to exist, or be possible, only in the light in which it took place upon the Apostles, and at a certain Pentecost. And being therefore an affair of the Holy Spirit in connexion with the highest mysteries of spiritual religion,—they, the religious objectors, consider it actual impiety for any one to talk about *inspiration* in connexion with giving any man or set of men directions about the size, proportions, and arrangements of mere masonry work,—even though

it should be for a building, so immense, so strong, and so enduring as to last all human time; and in a cause connected with furnishing the metrological symbols of justice, and practical means of honesty, to all the nations of the earth.

We have listened patiently and respectfully to all these objections (some of which have reached us from friends in the southern hemisphere); but can only imagine that their upholders are imperfect readers of their Bibles; and have read of, or remember,—which comes to the same thing,—only one class of cases of inspiration, viz., that most important one above alluded to; and which is, in itself, precisely as they describe. But further reading in the sacred Scriptures would soon show, that it has pleased one and the same Almighty God to send His inspiration, at different times in the history of the world, for almost any, and every variety of purpose; and sometimes for matters fully as material, and on a very much smaller scale, than those of the Great Pyramid. Else why do we find in Exodus xxxi.—

'1. And the Lord spake unto Moses, saying,

'2. See, I have called by name Bezaleel the son of Uri, the 'son of Hur, of the tribe of Judah:

'3. And I have filled him with the spirit of God, in wisdom, 'and in understanding, and in knowledge, and in all manner of 'workmanship,

'4. To devise cunning works, to work in gold, and in silver, 'and in brass,

'5. And in cutting of stones, to set them, and in carving of 'timber, to work in all manner of workmanship.

'6. And I, behold, I have given with him Aholiab the son of 'Ahisamach, of the tribe of Dan: and in the hearts of all that 'are wise-hearted I have put wisdom, that they may make all that 'I have commanded thee;

'7. The tabernacle of the congregation, and the ark of the 'testimony, and the mercy-seat that is thereupon, and all the fur-'niture of the tabernacle,

'8. And the table and his furniture, and the pure candlestick 'with all his furniture, and the altar of incense,

'9. And the altar of burnt-offering with all his furniture, and 'the laver and his foot,

'10. And the clothes of service, and the holy garments for 'Aaron the priest, and the garments of his sons, to minister in 'the priest's office,

'11. And the anointing oil, and sweet incense for the holy: 'according to all that I have commanded thee shall they 'do.'?

This then is the kind of inspiration, if we may so allude to it, which we would seek for in the case of the Great Pyramid. Not, however, presuming to say of our own selves that it *was* exerted,—but merely venturing to inquire what points of similarity or contrariety there may have been between the many undoubted cases which are given us in the Bible,—and the circumstances of origination of the Great Pyramid, so far as known, and in the state in which its question has come to us,—after undergoing scientific examination.

Time of its performance suitable?

Now with these views, one of the first points to be discussed, respects the age of the Great Pyramid; for, as a building, no matter for almost what pur-

pose originally intended, or for which of the many purposes hypothetically suggested at various times, and by various authorities,—it must be regarded as something verging much more on the material, than the spiritual. Wherefore, thence comes this precise point to be settled, viz.,—was the date of foundation of the Great Pyramid a period of the world's history when, *according to the Bible*, either directions were given, or instructions are reported to have been communicated, by God to man, touching the correct performance according to number and measure, of material work ?

An examination of Scripture will soon show, that such subjects were dealt with more frequently in the earlier, than the later, parts of its history ; and two special instances may be taken as including within them, if not the most eminent, at least a very marked period of inspiration having that character; these instances being, the construction of the tabernacle of Moses, and the building of the ark under Noah. In each of which cases the precise measures of length, breadth, and height to be kept to, were clearly announced by inspiration.

The date of the first-mentioned example has been abundantly treated of by many most able writers, on both scriptural and scientific grounds, and concluded to be certainly within the limits of 1600 and 1300 B.C. ; or, as assumed in our chapter vi., with most probability of being close to 1320 B.C. ; and no one doubts but that the Bible description there,

does really refer to work actually performed. But with regard to the date of the latter mentioned, though really prior example,—or the scriptural building of Noah's ark,—there is far greater uncertainty; not only by reason of science being unable to say anything whatever about the operation, its date, or even the thing itself,—but that different Biblical authorities differ by almost irremediable amounts of time from each other. By amounts, indeed, so large as to have assisted in a notable degree to fan a very general impression, now current in much of learned society, to the effect—'that the first book of Moses is to be 'looked on as of profound metaphysical import, but 'not as historical, nor as dealing historically with 'matters of fact;' or, as others more distinctly pronounce upon the case,—'both the Noachic Deluge 'and the Tower of Babel are myths not to be 'taken literally as matters of physical existence, 'though undoubtedly embodying great psychological 'truths.'

But this is not enough for our purpose of illustrating the case of a huge fact like the Great Pyramid. We must, therefore, make some little amount of examination as to the reality of what we are referring to; and, as a first step, should take up the discordances of dates amongst the Biblical scholars themselves. To be certain that this discordance really exists, the reader has only to look into any good compendium of Scripture literature on chronology, such as Kitto's *Cyclopædia* or Smith's

Bible Dictionary, for the date of 'the Deluge' (as something necessarily very close to the building of the ark); and he will immediately find himself entangled with disputes as to the relative trustworthiness of different versions of Scripture, the Hebrew giving one date, the Septuagint another, and the Samaritan yet another, each different from the rest by many centuries.

The upholders of the Hebrew version declare that the Septuagint early dates, obtained by summing up the patriarchal lives, were wilfully altered in the way of extension by the seventy of Alexandria, to make Bible dates more harmonious with Egyptian ideas of long chronology. But the supporters of the Septuagint, on the other hand, retaliate that the keepers of the Hebrew copies of the Scriptures altered them in way of contraction of time after the taking of Jerusalem,—so as to persuade men that the true Messiah of the prophecies must still be for to come; and they further assert that our Saviour and the Apostles in their quotations from Scripture, always used the Septuagint version. As for the Samaritan manuscript, no one of note seems inclined to pin his faith on that uncertain document: and the dispute as to the true scriptural chronological date of the Deluge, or any nearly synchronous event in the earth's history,—will simply go on to the end of the present dispensation in a series of assertions from one side for the Hebrew, and counter assertions on the other for the Septuagint

version,[1]—unless, indeed, some new material data more exactly to the point can be discovered.

Evidence of such improved and additional kind would it be, could a copy of the Scriptures be discovered anywhere, capable of being clearly and indubitably proved to be older than the date of the Septuagint version; but such a relic, we believe, nowhere exists. A friend, recently returned from the Holy Land, was loud the other day in praise of an ancient copy of the Scriptures which he had purchased from some Jews there, under a peculiar combination of circumstances favourable to the production before Western buyers, of the oldest MSS. still existing in the East. And when we therefore inquired eagerly respecting its absolute age, he went

[1] Out of numerous couples of opponent writers, we subjoin the following as a fair sample of the whole:—

(1.) '. . . Our only real appeal is the Scripture. . . . And here, on 'the great primary question of the *Patriarchal chronologies*, and whether 'it be the *Hebrew* text with its shorter chronology, that has by fraud 'been robbed of *eleven centuries*, or the *Septuagint* with its longer, that 'has had them fraudulently added (for that the difference is the 'result of design is a thing evident, and long since noted by Augustine), 'the answer seems on every account to be in favour of the Hebrew 'text.'—P. 255, vol. iv. of *Horæ Apocalypticæ*, by the Rev. E. B. Elliot, A.M.

(2.) 'The contracted scheme of the Hebrew text is rejected by the 'greatest names in this branch of Biblical literature, as being glaringly 'inconsistent not only with the records of other nations, but even 'with the history of the ancient Hebrews themselves.'—Rev. J. R. Beard, in Kitto's *Cyclopædia of Biblical Literature*.

While the Rev. George Rawlinson, in his Bampton Lectures, delivered in the Oxford University pulpit in 1859, seems to refer to the Hebrew text for doctrine and the Septuagint for dates; the latter, too, he has so much confidence in, that he fixes without scruple the date of building the Great Pyramid more than a century earlier than the Deluge according to the Hebrew text.

off at first into a long account of the undoubted proofs he had obtained as to its superior relative antiquity to all other recently discovered MSS.; but concluded by stating, that he had submitted his copy to the examination of an *expert* in these things in Alexandria; and the said skilled hand had rubbed the MS., and wetted it, bit it, and trode upon one corner,—and then pronounced it 'genuine 'beyond all doubt, and *twelve hundred years old.*'

For ability, however, to throw full light on the vexed question between the two chief modern versions of the Scriptures, a manuscript of at least 2500 years old would be required; and proof also, capable too of being appreciated by ordinary men as well as *experts,*—that its writing had nowhere been tampered with in the interval; and that the copy in question had been originally vouched for as to its literal correctness, if not actually written, by an authority of no less unimpeachable a character than one of the prophets capable of receiving the inspired messages themselves. And all that would be tantamount to a miracle in itself.

Yet—within its own order both of subject, and mechanical mode of construction for the expression of its meaning—the Great Pyramid has all these forms of vouchers for its authenticity; and for dating not only from 2500, but from more than 4000 years ago. No one doubts but that the huge stones whose size, shape, and manner of arrangement and junction we can still examine, are, even

by means, or on account, of these qualities, the very *ipsissima verba*, in so far as they represent words at all, of the original builders. Wherefore, in any cause which could be so represented, and where a power of proving at long future times the minute accuracy of the original message, should be important,—there is evidently in practice a virtue in a builded monument like the Great Pyramid, which 'no roll of a book' ever has been endued with or practically can possess,—when it is known only by copies, from copies, and these from other copies again,—all of which, together with the original, are long since reduced to dust. And now comes, or will soon come, the question, whether advantage has been taken for true religion of that remarkable property of almost undying authenticability, residing in the former method of commemoration.

But our inquiries are now confined to the simple question to state,—though rather transcendental, to solve practically; viz., that of testing one particular illustration derived from, and depending on the date of the Great Pyramid, by a proof to be derived from the Holy Scriptures: which latter, in their material form as they now exist among men, are far younger than the Great Pyramid, and infinitely more difficult to authenticate literally, verbally, and more especially, in their chronology.

In this last point of difficulty, finding my own knowledge altogether insufficient, I turned to ecclesiastical authority; and after several fruitless or

unsatisfactory answers from smaller dignitaries,—applied at length officially to the representative head of the largest and reputedly the most learned Established Church in Christendom, viz., the Anglican—requesting to know what that Church had concluded, and did believe, as to the true *scriptural* date of the Deluge; and how far it approved of the dates inserted in the margin of many of the authorized copies of the Bible.

The exact terms of the answer very graciously accorded, almost by return of post, are subjoined:—

'LAMBETH PALACE, S., 14*th May* 1866.

'SIR,—In reply to your inquiry, I write to inform 'you,

'(1.) That the Church of England has assigned 'no date to the Noachian Deluge.

'(2.) That the Church has not fixed any dates 'between which it must have taken place.

'(3.) That the Church of England has not autho-'rized the insertion into the authorized copy of the 'English Bible of any system of dates.—I have the 'honour to be, etc., (Signed) C. T. CANTUAR.'

After receipt of such a letter, there was evidently nothing to be done, but for ourselves to attempt an approximate discussion, of what might seem humanly likely to have been the original Scripture date of the Deluge,—from a comparison of the various results of different private workers in this most interesting and important field.

So far as we can gather the numbers, they run thus; each result professing to be scriptural:—

Authorities.	Date of Deluge B.C.
Septuagint, Alexandrine (Kitto's *Palestine*),	= 3246
Jackson,	= 3170
Hales,	= 3155
R. Stewart Poole (Smith's *Bible Dictionary*),	= 3129
Samaritan (Kitto's *Palestine*),	= 2998
W. Osburn (*Monumental History of Egypt*),	= 2500
Elliot's *Horæ Apocalypticæ*,	= 2482
Browne's *Ordo Sæclorum*,	= 2446
Playfair,	= 2351
Ussher,	= 2348
Petavius (Smith's *Bible Dictionary*),	= 2327
Mean, Years B.C.,	= 2741

From all these various statements, then, what shall we conclude as to the real date of the one particular event which they each and all claim to chronicle?

We have taken a mean of the whole, and it *chances* to come to 2741 B.C.; but, being derived from numbers differing so exceedingly as 3246 and 2327, it can impart little confidence,—either as to the accuracy of the figures themselves, or, to what is more important still, the reality of the event alluded to.

The actual range of the numbers, however, suggests a rudely parallel character with the crucial epochs of Great Pyramid astronomy; for the two occasions of *a* Draconis being seen in the direction of the entrance passage, or the years 2200 and 3400 B.C., evidently circumscribe all of what can be called the *Scripture* dates of the Deluge; while the time

of the star's nearest appulse to the pole, or about 2800 B.C., approximates to the mean and most probable time of the occurrence as above obtained. Such a resemblance of mere numbers, would of itself, be of no kind of importance; but the manner in which the dates are obtained, proved, and memorialized by the Great Pyramid's method of observing, —connects itself astronomically, in a very remarkable manner, with numerous widespread and apparently genuine, independent, and authentic traditions of the Deluge, not yet explained on any scientific hypothesis. And yet when they are at last examined by what we have here to offer from the Pyramid, they are found to contain astronomical truths of rather too recondite a character to have been alighted on by savage tribes of imperfect civilisation.

Now traditions of the Deluge, are undoubtedly rather too abundant in the present day; and when one large work, presently before us, brings up with great rejoicing 'the celebrated Apamean medal,' struck in the time of the Roman Emperors; and another equally ponderous volume discourses largely of Mohammedan traditions,—which even give what the people of the land said to Noah when he was building the ark, and what he replied to them in return, —we object to such traditions entirely, because without any proof that they existed in the world until long after the dissemination of the Hebrew Scriptures among those very peoples and countries.

But *some* of the annals of the Chinese, some of

the Egyptian writings, some of the foundations of early Greek beliefs, some Chaldæan inscriptions, and by an inference of pretty sure character, *some* of the practices of Mexicans, Peruvians, Fijians, Australians, and other New-World savages whom Greece and Rome never knew,—these are free from the accusation of possibly being founded in latter times on the Hebrew Scriptures. And when they all alike tell nearly the same story, they must allude to something founded on very broad, solid, and ancient foundations; or, in other words, on truth and fact of a most cosmopolitan kind.

Amongst such traditions, then, which we must respect,—and a few of which are contained in the quotation from Mr. Haliburton in vol. ii., pp. 380 to 448,—there are not only traces of a belief in there having been a Deluge, destructive to the human race, but in there being some connexion between its cessation and the stars of the constellation Taurus. Why this should be, the traditions and their collectors say not; they are only certain of the fact; and of the stars in Taurus being therefore associated with 'sweet influences,' and favourable to mankind. Wherefore, we take up the case at that point; and suggest, by the light shed on the subject from Great Pyramid astronomy, that this is in the direction of being a reason:—

Compute for the lower limiting date, or 2200 B.C., when *a* Draconis was *last* seen in the direction of the entrance passage of the Great Pyramid,—and

when, both traditionally and scripturally, the dangers were over, and evil effects of the Deluge all subsided,—compute, we say, what equatorial and zodiacal constellation was on the meridian above the pole at the instant; and, as abundantly described on pp. 279, 283, it was Taurus and the Pleiades.

But compute for the upper limiting date, or 3400 B.C., (*i.e.*) Pyramidally the penultimate occasion when *α* Draconis was similarly seen in the same angular direction from the pole,—and when both traditionally and scripturally the threatened punishment of the Deluge was impending over the human race,—and, as indicated on p. 277, the equatorial and zodiacal sky was as diverse from the epoch of 2200 B.C. as anything can be under the whole heaven; for Taurus and the Pleiades were *nowhere* visible, while Scorpio and Serpens occupied the dominant position.

For almost any period, moreover, previous to 3400 B.C., Scorpio and Serpens were nearly similarly dominant,—just as for ages after 2200 B.C., Taurus and the Pleiades were also, as at that epoch, the generally dominant stars; and characterized postdiluvian, just as essentially as the former stars expressed antediluvian, times. But they did this only through means of that most peculiar feature of the Great Pyramid astronomy,—a feature most certainly known to exist, though entirely neglected by modern astronomers hitherto,—viz., the feature of the Pyramid visibly memorializing its polar star *only at its lower culmination.* We, however, having attended

to that clear principle of the builders connected with the lower, and not the upper, culmination,—have obtained for the earlier time-limit, something that seems to explain the maledictory names so generally bestowed by all early Eastern nations on the stars in Scorpio and Serpens; and for the later time-limit, an explanation of the rejoicing, fond, and grateful epithets similarly applied to the stars in Taurus.

But what shall we obtain, on similarly computing for the middle epoch, or that of *a* Draconis being at its closest proximity to the pole (yet still not at the pole, and therefore having a circumpolar daily circle, though an exceedingly small one, to describe, and with an upper and lower culmination, in principle as before); *i.e.*, compute for 2800 B.C., which is so nearly the mean of all *scriptural* dates of the Deluge itself, as to come within sixty years of it? Why, this is what comes out,—that when *a* Draconis was *then* crossing the meridian below the pole, the zodiacal constellation crossing the meridian above the pole was Aquarius! At that very date, the meridian line crosses the mouth of the water-pot whence the stream is issuing; and thence, in the course of a short time, traverses through the water-stream; next, the constellation of Pisces, then Aries, and finally—at the *marked* period of the Pyramid, or 2170 B.C., or when *a* Draconis was 3° 42′ from the pole,—is found as already detailed in Taurus. Not only so too, but the Pleiades seems to

form almost the *limits* of the movement of the meridian opposite to *a* Draconis; so that that circle must have hung on those stars, as it were, almost inalterably for ages near to and about the year 2200 B.C.; and then have begun only slowly to retrograde, even as it is doing now.[1]

So here, we have a series of genuine early traditions, rendered in a manner vocal, or endued with a meaning, through the agency of ideas embodied in the constellations (to be presently shown primeval, prophetic, and memorial), in combination with a monument built not only before the dissemination of the Hebrew Scriptures over the world, but before even the writing of them had begun.

Wherefore can there be any other explanation of so many mutually explanatory circumstances of opposite natures and independent origin, and now first brought together,—than that the Deluge to

[1] Hence, we may see an additional proof of the actual wisdom of the Pyramid's arrangements: for the Pleiades merely *opposite to a Draconis in right ascension*, would have been exceedingly indeterminate in date; but the above, combined with α Draconis at 3° 42′ from the pole (though that again *by itself* has uncertainties spreading over twelve hundred years), is precise in the extreme.

A star-map, specially adapted for tracing such changes as these, is now being prepared by Colonel Sir Henry James, R.E., Director of the Ordnance Survey at Southampton; it will form the fifth of his series of star-maps, and being on his peculiar projection of the sphere, which gives much more than half at one view, or as he both exactly and classically entitles it, '*Cœli, besse tenus, liceat convexa tueri*,'—both the ecliptic pole, and the whole of the constellations, whether zodiacal *or at any date* equatorial, will be commanded on a flat surface. The maps, which are splendidly engraved on copper, are published, and may be obtained at the Ordnance Survey Office, Southampton; or by applying through any bookseller.

which they all refer must have been, at least as regards all mankind then living, a real and material phenomenon, and within the limits of time assigned by Scripture authorities? And if so, of course, it follows that the building of the ark of refuge is to be looked on as historical likewise. So that we then have from the Scriptures, first in this ark, and then in the subsequent ark of the testimony or of the covenant, two cases of real, practical work actually performed; and in each case according to linear measures and proportions previously announced by Divine inspiration,—while the middle date between these two cases, falls very nearly on the time of the building of the Great Pyramid.

We might indeed now, not unreasonably, put forward some further claims for the inspired origin of the Great Pyramid, depending on the manner of its memorializing a primeval and scriptural phenomenon,—but will content ourselves with merely remarking, that so far as the one point of chronology is concerned, there need be no objection to the inspiration hypothesis being tried further. And then there immediately arise some other and more directly related features, as well as some of a higher order, to be examined into.

Metrology suitable as a Subject?

Whether metrology at large, or some special means for the typification and regulation of weights and measures (which we now look on as the chief ori-

ginal purpose of the Great Pyramid), was a subject *likely* in the earlier ages of human society, to have formed the burden of any inspired commands from the dread God of all nature,—whom no man could expect to behold and live,—admits of quick general settlement; for, from the time of Paucton in France to John Taylor in England, very frequent reference has been made to passages in the earlier portions of Scripture, as in Leviticus, Deuteronomy, Proverbs, and Ezekiel, directly stating in the words of inspiration that such was the fact:—

LEVITICUS xix. 35-37.—'Ye shall do no unrighteousness in 'judgment, in mete-yard, in weight, or in measure.

'Just balances, just weights, a just ephah, and a just hin, shall 'ye have: I am the Lord your God, which brought you out of 'the land of Egypt.

'Therefore shall ye observe all my statutes, and all my judg-'ments, and do them: I am the Lord.'

DEUTERONOMY xxv. 15.—'Thou shalt have a perfect and just 'weight, a perfect and just measure shalt thou have: that thy 'days may be lengthened in the land which the Lord thy God 'giveth thee.'

PROVERBS xi. 1.—'A false balance is abomination to the 'Lord; but a just weight is his delight.'

PROVERBS xvi. 11.—'A just weight and balance are the 'Lord's; all the weights of the bag are his work.'

EZEKIEL xlv. 9, 10, 11.—'Thus saith the Lord God, Let it 'suffice you, O princes of Israel: remove violence and spoil, and 'execute judgment and justice, take away your exactions from 'my people, saith the Lord God.

'Ye shall have just balances, and a just ephah, and a just 'bath.

'The ephah and the bath shall be of one measure, that the 'bath may contain the tenth part of an homer, and the ephah 'the tenth part of an homer; the measure thereof shall be after 'the homer.'

These words,—as we have attempted to set forth in Chapter iii. Part 5, of *Our Inheritance in the Great Pyramid*,—few though they be, yet compendious, imply that much besides was, and had been, actually done, performed, and completed practically, —before they could be, in any spirit of justice and mercy, issued as binding commands on a people just escaped from a grinding slavery.

But rather than go over that identical ground again, it may be more satisfactory to the reader, as well as more within the bounds of this division of our whole question, to quote the testimony, now one hundred years old,—and perhaps not so generally known as it deserves to be,—of the learned John David Michaelis of Göttingen.

An unusually good Hebrew scholar, his contributions to Biblical and Oriental learning are said by competent judges to be invaluable, especially when he treats of subjects capable of illustration from history and philosophy. In following up these views, and in order to throw more of the light of modern investigation on Biblical science, Michaelis planned the expedition to Arabia and India which was afterwards conducted by Carsten Niebuhr, and other travellers chiefly selected by Michaelis. His most celebrated work, however, is his *Mosäisches Recht*, in six volumes, in which his object is described by his English translator to be,—'to investigate and 'illustrate the philosophy of the Mosaic laws, to 'show their wonderful adaptation in every respect

'to the very peculiar circumstances in which the 'people to whom they were given had been placed 'by Providence; and, while he takes every opportu- 'nity of establishing the claims of Moses to the 'character of an ambassador from heaven, to incul- 'cate upon human legislatures the important lesson 'of studying those particulars respecting the nature 'and political situation, the ideas and prejudices, 'the manners and customs of their countrymen, by 'attention to which alone they can ever hope to make 'them virtuous, prosperous, and happy.'

Strong, then, in the principles of the subject, though unacquainted with some important features of absolute fact, as well as of characteristic differences, in the Egyptian and Hebrew metrologies,—such as we have attempted to set forth in vol. ii. pp. 454-470, 'On the Sacred Hebrew Standards of Weights 'and Measures,'—the worthy Michaelis expresses himself thus, in an extract which we are indebted to kind friends at Brighton for bringing to our attention :—

'Of the Plans which Moses took for the Regulation of 'Weights and Measures.

'Here, then, we have a remarkable specimen of legislative 'policy; and when I consider Moses merely as a man, without 'any reference to his Divine mission, he must, methinks, have 'profited by his education among the Egyptians; but he has, at 'the same time, far surpassed them, and acted with much more 'honesty, than their policy,—which was so thoroughly interwoven 'with mystery and priestcraft,—permitted them to do. For

'although he constituted the sacred tribe guardians of the sacred 'standards, and imposed upon them the duty of acquiring a 'knowledge of weights and measures with mathematical accuracy, '—yet of things in which all were thus interested, he made no 'priestly mystery, but placed certain models of them all in the 'view of all; besides describing these in the books which were 'put into the hands of the whole people. Considering him, on 'the other hand, as sent by God, it appears to me, that he had 'in this matter, by God's express command, done the very same 'thing that a wise people had done of their own accord; but in a 'much more honest and open manner, and, at the same time, in 'a much higher degree of perfection.

'In the first place, then, the weights and measures were pre-'served in the tabernacle of testimony, in more ways than one, 'and partly in the view of every individual, for at least many 'hundred years. Some of them, it is true, might by use and 'time suffer some change; but for that very reason, there were 'various standards, so that the error of any one could always be 'rectified by the others, and some of them were kept within the 'sanctuary itself, and were thus less liable to variation.

'In the description of the tabernacle, we may, perhaps, have 'read, with some degree of weariness, many particulars relative 'to measures, in which we took no interest, and have often 'thought with ourselves in the meantime, "Why did not Moses '"rather leave this out? I should have dispensed with it."' 'Some people, in order to assign some use to these mensurations, 'endeavour to discover in them a variety of types and mysteries. 'But, although I am very far from denying the typical nature of 'many of the Mosaic ceremonial laws, yet I cannot here agree 'with such people, nor comprehend what moral, doctrinal, or 'spiritual meaning there can be in *ten ells long, one and a half 'ell broad, and a half ell thick.* Others, again, equally short-'sighted, are so vexed at finding that these things are of no use 'to them, as to conclude, with great theological depth, that they 'could not be written by the command of God, because they 'contain nothing useful or edifying; just as if God should have 'had the Bible written for them alone (a requisition, by the 'way, which they would never think of making in the case of 'any human work), or as if in a book written by the immediate 'command of God, there ought to be nothing that did not mini-

'ster to moral edification; and as if revealed religion did not 'inform us that God had condescended to become a civil legisla-'tor to the people of Israel. This very specification of longitu-'dinal measures, which we find so frequently repeated, answered 'one of the most important purposes of police to the Israelites, 'and as a masterpiece of legislative wisdom in this respect, it 'merits our admiration.

'I shall now speak of their measures of length, measures of 'capacity, and weights, separately and in succession.

'1. The longitudinal measure was fixed for future ages in a 'great variety of ways. The measures of the court of the taber-'nacle and its hangings (Exodus xxvii. 8-19); of the curtains 'that covered the tabernacle (Exodus xxvi. 1-13); of the boards 'that framed it, which were made of a wood very little apt to 'alter (Exodus xxvi. 15, 16); of the tabernacle itself, which 'was 30 ells long, and 10 broad; of the altar of burnt-offerings, 'overlaid with copper (Exodus xxvii. 1); are all specified in ells, 'and *that* in a book which every Israelite was to read. It is 'true, that the curtains and the wood might be affected by ex-'posure to the atmosphere, although one error would correct 'another; but still every Israelite that came to attend Divine 'service, in any future age, would here obtain a pretty accurate 'view of the ell, and might, at any rate, measure some of those 'things with more perfect accuracy, and thus judge whether the 'nation still retained in common use the ancient original ell 'or not.

'Still less variation was to be dreaded in those archetypes of 'the ell, that were kept in the sanctuary itself. Of the table of 'shew-bread (Exodus xxv. 23), the altar of incense (Exodus 'xxx. 2), and the ark of the covenant (Exodus xxv. 10), all the 'dimensions are specified. These were made of *acacia* wood, 'and only overlaid with gold. But the most invariable of all the 'standards of longitudinal measures, as being made entirely of 'gold, is the lid of the ark, which was two ells and a half long, and 'one ell and a half broad (Exodus xxv. 17). No doubt, this ark 'always remained in the obscurity of the sanctuary, unless it 'happened to be brought into the light by any rare occurrence, 'as during a campaign in the time of war. But for that very 'reason it was so much the more invariable, and could thus, if 'necessity required, serve, after many centuries, to ascertain

'whether any errors, and what, had affected the other standards 'of the ell.

'I admit, that at last a time *would* come, when all those 'standards of longitudinal measures would become useless, 'because nothing on earth endures for ever. But then new 'standards could be previously made from them; and we find 'that this was actually done. When the tabernacle (according 'to the reading in the printed Hebrew text) was 480 or (accord-'ing to another reading which Josephus and Paul found in the 'Bibles in common use in Palestine in their time) 592 years old, 'and must certainly have been pretty much decayed, Solomon 'began the building of his temple. At this time they would, 'from the remains of the tabernacle, still be able to ascertain 'the Mosaic ell. This measure was transferred to the temple; 'and that edifice which, being built of stone, was liable to still 'fewer changes, particularly in a southern country, where no 'severe frosts make the stones of a building separate from each 'other, was 60 ells long and 20 broad; and thus, without taking 'into account other expedients that Solomon might have em-'ployed for the purpose, the ancient Mosaic ell was preserved 'until the time of Nebuchadnezzar, by whom this temple was 'destroyed. The numerous golden utensils which it contained, 'the vessel called the brazen sea, and the two copper columns, '*Boaz* and *Jachin*, of which the altitude and circumference are 'specified, answered the same purpose. Now the question is, 'Have we ourselves such ancient and such authentically attested 'memorials of *our* ell, as it was 480, 592, or, reckoning to the 'time of Nebuchadnezzar, 903, or 1015 years ago? (I know 'not whether we have or not; and I merely ask: for my readers 'will not be offended at me for my ignorance of many things), 'and are these (I really do not ask this question, for I well know 'the contrary) specified in a book, that is in every one's 'hands?'

'From what I find merely in the details relative to the struc-'ture of the tabernacle, where it is so manifestly his object to fix, 'in different ways, one uniform standard of measure, I am led to 'conjecture, that Moses had done still more with that view, and 'had given to the priests other special patterns of the ell, which 'they were ordinarily to use, and moreover, one archetype which 'they were sacredly to preserve. Of this, however, he does not

'himself inform us; but if it *was* the case, the models mentioned 'in his writings, would always serve the purpose of preventing 'any alteration from being made upon them, either from care-'lessness or fraud, without its being quite manifest to posterity. 'This is actually more than what the author of the excellent '*Essay upon Money and Coins* projected in the year 1758, and 'Parliament took into consideration. And if the British Legis-'lature were desirous to insure to future ages the true measure 'of the ell, on the Mosaic principles and plan, they ought to have 'it ascertained by the mathematicians of St. Paul's Church, with 'the most perfect accuracy, and to have an authentic record of 'the mensuration drawn up in the plainest and briefest terms, 'and published in a book, which every Briton might read, as 'easily, at any rate, as the Israelite heard the law read, once 'every seven years,—in the Catechism, for instance, or the 'Calendar, which should not be allowed to be printed without 'this appendix concerning St. Paul's.'

'It is to be hoped that my readers are, by this time, some-'what reconciled to the Mosaic measures; and that they will no 'longer seek for types in the numbers; nor from the mensura-'tions, whence they can derive neither edification nor amendment, 'deduce any more objections against the Divine mission of Moses, 'and the inspiration of his writings; else must I class them with 'the man who could not comprehend what could be the use of 'the rampart of a fort, because he saw no crop of either rye or 'wheat upon it, and therefore could not be persuaded, by all the 'assurances that were given him, that it was formed after a plan 'drawn by the king himself. "It is not," persisted he, "for '"use as a corn-field; neither wheat nor rye grows upon it; '"and our most gracious sovereign can have had no hand in '"any such thing."

'2. The measures for corn and wine (*mensuræ aridorum et 'fluidorum*) were among the Hebrews more uniform in their 'contents than ours are. For their *ephah* or bushel, and their '*bath* (for liquids) were equally large.'

'It is very certain that there was a standard of these measures 'in the *sanctum sanctorum*, and that it stood before the Ark of 'the Covenant. Moses was ordered to place *an homer* of *manna* '(and the *homer* is the tenth part of an *ephah* or Hebrew bushel) '*before God*; and it appears that the vessel was not of wood,

'but of gold (Exodus xvi. 33, 36; Hebrews ix. 4). It is 'probable that there were various other measures in use, although 'Moses has not inserted in his writings any account of their 'contents. At this no one need be offended, who joined in 'finding fault with the too frequent repetition of the ells; for, in 'fact, measures of this description could not properly be specified 'in the Book of the Law, because the standard vessel, which was 'of gold, could not, without risk of being injured or stolen, be 'put in view of every Israelite, as the tabernacle was, in all its 'specified dimensions.

'To notice, however, some *probable* examples of standard 'measures of capacity which may have been described in the 'catalogue by which the sacred utensils were delivered to the 'priests and Levites (Numbers i. iv.), I would remark that, be-'longing to the table of shew-bread, there were not only golden 'tankards in which wine stood, and from which it was to 'be poured out, but also small drinking vessels, shaped like 'cups, likewise of gold. Now, considering Moses not as sent 'from God, but as merely versed in the learning of the Egyp-'tians, we must think it probable that all these vessels had their 'contents very accurately determined, I presume that the very 'same was the case with regard to the basins belonging to the 'altar of burnt-offerings; and for regulating the baking of the 'shew-bread, the flour for which the law fix't by bushels, there 'may have been a standard ephah within the sanctuary. Before 'the tabernacle stood the brazen laver. In the more particular 'description of the vessels delivered to the priests, it was pro-'bably specified how much water this laver contained, both when 'quite full and when filled only to a certain mark; and accord-'ingly we find that the contents of this brazen sea, as it was 'called, are mentioned in both respects, in the historical books 'of 1st Kings (vii. 26), and 2d Chronicles (iv. 5).

'3. As to weights, Moses specifies them in the following man-'ner—20 *gerahs* make one *shekel* of the sanctuary; see Exodus 'xxx. 13, Leviticus xxvii. 25, Numbers iii. 47, xviii. 16.

'3000 such shekels make *one* kickar, or talent. This appears 'from Exodus xxxviii. 25, 26; where 301,775 shekels are 'reckoned 100 talents, and 1775 shekels more. Moses gave no 'statute relative to the talent, as he did in the case of the gerah 'and shekel; probably because there was no dispute about the

'talent, every one reckoning it at 3000 shekels; whereas the one 'shekel might comprise *more* and the other *fewer* gerahs.

'By this information alone, however, posterity would not have 'been much benefited; for the question would be, *How much is 'a gerah?* and if it was replied, *The twentieth part of a shekel*, 'the question would recur, *And what is a shekel?* and if the 'answer was, *Twenty gerahs*, they would have been in the very 'same predicament in which the evil spirit stood, when he 'catechised the orthodox collier on the subject of his belief. If, 'in the course of time, the shekel became smaller, so likewise 'would the gerah diminish in the same proportion.

'But here, too, a standard was provided. The fifty boards 'of which the walls of the tabernacle were composed, rested each 'upon two silver sockets, and every one of these hundred sockets 'was of the weight of a talent (Exodus xxxviii. 27). Here, there-'fore, they had no fewer than a hundred standards for the talent, 'by which the shekel could at any future period be determined. 'If they lost anything by friction it was in proportion very 'trifling; whereas in the case of smaller weights, like the shekel 'and gerah, the loss by wear or friction amounts to something 'more material. The golden candlestick in the sanctuary, to-'gether with all its appurtenances, in like manner, weighed a 'talent (Exodus xxv. 31-39); and in the catalogue according to 'which the different pieces of furniture belonging to the taber-'nacle were given in charge to their keepers, it was doubtless 'accurately specified what was the weight of the golden candle-'stick by itself, as well as of every golden pair of snuffers, and 'of whatever else belonged to it; and likewise that of all the 'golden articles belonging to the table of shew-bread, and of the 'golden lid of the ark with its cherubims. In this way they had 'a great variety of standards for their weights, and if in any of 'them, by the wear of the gold, any small diminution of weight 'took place, others were always at hand to rectify the defect. 'But it is not to be forgotten that these standards, of which 'some, at any rate, could certainly lose nothing by wear in the 'course of thousands of years, from their being so very sacredly 'preserved, were not of iron and copper, which in process of 'time are corroded by rust and verdigris, if exposed to damp-'ness or even to acids, but of gold and silver, which defy 'moisture and the common acids. Nor was there any reason to

'apprehend that the gold would ever be wilfully and feloniously 'filed down, for the profit of such sacrilege would have been too 'inconsiderable for people so rich as were the priests; and even 'though we should represent them to ourselves as ever so destitute 'of principle, they could scarcely have run the risk of being stoned 'for a few grains of gold. Besides, they must have had to de-'liver the articles under their charge, according to their weight, 'when required; not to mention that the sanctity of the golden 'standards would make them shudder at the very thought of 'committing theft upon them in any shape. The best possible 'provision, therefore, was made for unalterable and authentic 'standards of weight.'

'And now, as to the superintendents of weights and measures. 'These were, much in the Egyptian style, priests and Levites. 'To them the standards were delivered; and, indeed, article by 'article, to particular persons, that so, if of gold or of silver, they 'might re-deliver it by weight; besides, the whole tribe of Levi 'were maintained by the public in return for their devoting 'themselves to the sciences. Nay, more, we find it expressly 'mentioned in 1st Chronicles xxiii. 29, that David, when he 'assigned to each Levite his department, appointed some to 'superintend the weights and measures.'

'Thus were these things really consecrated; and thus are 'the words of Solomon in Proverbs xi. 16 true, in a sense which 'readers seldom think of: *A just balance is sacred to Jehovah; 'and all weights are his work.*

'At the same time, however, Moses nowhere prohibits the 'use of foreign weights and measures; at least I can recollect 'no such prohibition; and from his so often mentioning the '*sacred shekel*, and in Leviticus xxvii. expressly saying, *All 'estimations of vows shall be made by the sacred shekel*, it would 'appear, that there had been another shekel, which he did not 'prohibit, but only meant that everything in his laws relative to 'imposts, penalties, etc. etc., should be understood in reference to 'the shekel of the sanctuary. At any rate, there seem, besides 'this sacred shekel, to have been many foreign ones, and, more-'over, *a royal shekel*, established by later laws (2 Samuel xiv. '26), and of a smaller weight than that of Moses; concerning 'which I have treated in another place, and the origin of which 'may have been the following. As it was not forbidden to deal

'in common life by different weights, there arose, in process of 'time, a much smaller, but variable shekel; and to prevent un- 'certainty and imposition, the kings fixed the weight of this 'common shekel more accurately; so that from this time there 'were two lawful shekels current among the Israelites, the '*sacred* and the *royal*. Even Moses himself, in his historical 'relations, does not seem to adhere uniformly to his own mea- 'sures; as, for instance, where he describes the coffin of Og, 'king of Bashan, as *nine ells long*, and *four broad*, measured by 'the elbow of a man (Deuteronomy iii. 11); concerning which 'passage, I request that the remark in my German version of 'the Bible mny be perused.

'It is no doubt an imperfection of police to permit the use of 'different weights and measures; and it may be asked, Why 'Moses did not go a step further, and expressly prohibit all but 'one set? We must here, however, take into consideration the 'circumstances of the Israelites, and bear in mind, that, not 'being themselves a commercial people, they were dependent for 'trade upon other nations; upon the Phœnicians for maritime 'commerce, and upon the Arabs for the caravan trade that 'passed through Palestine. A people in such circumstances 'cannot altogether avoid making use of foreign weights and 'measures, if they would avoid being over-reached by the foreign 'merchants, in whose hands the whole trade is; only they should 'have one invariable standard of their own, to which all others 'can be reduced, and *that* they ought in justice to use in dealing 'one with another. This standard may, no doubt, be departed 'from by an abuse, and other foreign weights, etc., become 'current among the citizens; and I suppose it was some such 'abuse that gave occasion to the establishment of the royal 'shekel. Some writers, however, look upon the royal and sacred 'shekel as the same; and if that be admitted, much of what I 'have here written falls to the ground.

'That Moses enjoins the use of just balances, and just weights 'and measures, is very obvious. The statutes relative to this point 'occur in Leviticus xix. 35-37, and Deuteronomy xxv. 14-16. 'If it is forbidden there to have a great and a small bushel, a 'great and a small weight, the meaning is not, that beside the 'shekel of the sanctuary, they were not to have any other, nor 'even in their dealings with foreigners to use *their* shekel; but

'only, that they were not to have two different weights of the 'same denomination, a larger to purchase by, and a lesser to 'sell by.

'It would appear, that these statutes were, in the time of 'Moses, pretty sacredly kept, because he does not once mention 'any punishment as being annexed to their violation; but deems 'it sufficient to say, *Whosoever committeth such unrighteous deeds 'is an abomination to Jehovah thy God.* The very circumstance 'of their regarding balances, weights, and measures, as conse-'crated to the Deity, might keep a people, while yet honest and 'religious, from fraudulent practices, as being offences in the 'sight of a holy God. In later times, however, we find the 'prophets often charging them with the use of false weights, 'etc.'

So far the venerable Michaelis, on the proceedings of an inspired teacher among the Israelites and his method of illustrating, exhibiting, enforcing, and preserving extreme exactness with regard to one particular system of weights and measures; a system too, which was considered so sacred, that any deviation therefrom was declared to be immediately and peculiarly obnoxious to Jehovah. All this description refers, indeed, to a period long subsequent to that of the building of the Great Pyramid; but at another period much preceding that event,—or when the commands were delivered to Noah with regard to the formation of the ark,—a knowledge of what the cubits, so called, 'of Jehovah' are equal to, was evidently pre-supposed as then existing on the part of the patriarch. We have shown too, already, the commensurability (vol. ii. p. 470) of Solomon's still later, 'Molten Sea,' with Moses' Ark of the Covenant; and everything that

we know concerning the *continuity* of the scheme of revelation from one end of the Bible to the other, allows us to admit of no other, than one, constant, length as the cubit of the sacred people of God in every age and in every clime.

Hence we cannot but see, that not only the subject of metrology, but more especially the formation of a sufficient monument to preserve the length of a certain set of sacred standards in a practicable and reliable shape,—from the time of the very Deluge or its proximate epoch, down to the ends of the world, —in a religious point of view,—is most agreeable to scriptural enunciations on the case. Nay, indeed, something of the kind would appear to have been, and to be, absolutely necessary; for how otherwise (see vol. ii. pp. 455 and 456), unless the original standards of *inspiration* are set before us, can we have full confidence in a supposed cubit of the present day being of the same length as the *sacred* cubit, and not more like any of the numerous other cubits of profane nations,—the employment of any one of which the Hebrews were especially taught, would have been abomination to Jehovah thy God. The scriptural family of the Hebrews, indeed, living in the earlier ages of the world, and only for a definite epoch,—could, for such period, be supplied and kept safe by a temporary set of standards;—but the Christian nations of the world three thousand years after the inspired Hebrew time, could only be served by something very different

from, and much more lasting than, Moses' standards of wood and gold.

Style of the Metrology suitable?

Although sufficing reasons may now be considered to have been produced, illustrating both the expediency and propriety of some grand and lasting monument of sacred origin having been erected, for the purpose of conveying to present and still future times the originals of the standards employed by Moses and Noah,—yet we are not thereby immediately justified in concluding that the Great Pyramid *is* that monument.

The Great Pyramid is indeed the worthiest building for the purpose yet known to man, being the largest, the most purely scientific in form, the most accurately and solidly constructed, the most capable of resisting alike fire and water, storm and earthquake; and actually does span all the immense interval, stretching from the latter days of Noah of the Hebrew Scriptures, down to—what many writers on the prophecies look on as the proximate termination of the Christian dispensation, and near approach of the second glorious advent. But we must pass all these things by for a time, while we put the building through another more searching test still,—by inquiring whether its peculiar and now well-ascertained metrology is *likely* to resemble very closely, that one sacred system of weights and

measures with which alone, Jehovah of the Hebrews desired to be served.

This point, however, we have in effect already settled, by the concluding memoir in vol. ii.; where, founding on Sir Isaac Newton's admirable dissertation on cubits,—and agreeing with him that the sacred cubit was quite different from the profane Egyptian cubit,—we have yet found it (the sacred cubit), to be precisely the same as the cubit of the Great Pyramid. Found also that the most sacred Ark of the Covenant, was the same lidless-box measure, identical in cubic contents with the coffer of the Great Pyramid; and found still further that Solomon's Molten Sea was of the same cubical capacity as the lower marked-off course in the King's chamber. Beyond this too still, we have shown at p. 240 in this volume, that the week of the Queen's chamber is identical with the sabbatical week, alike of the second chapter of Genesis and of the book of Exodus; and is just as entirely different from the profane Egyptian week of old, as from the decadal week of the modern French metrical system;—and all this being so,—why, the Great Pyramid is simply a representation of the sacred Hebrew weights and measures, so far as known,—and is in large opposition to either ancient pagan, or modern atheistical, measures. Hence our present titular argument is proved entirely.

There still remains, however, quite open, the further very important question,—whether the

people employed in the building of the Great Pyramid were those who, on scriptural grounds, may be considered *likely* to have been made the channels of inspired commands from God to man; and for producing a then world's wonder, but ultimately a benefit in many ways to the whole human race. Wherefore we must next advance to the discussion of the

Suitability of the men concerned?

Nearly all the recorded cases in Scripture, so far as we are aware, of inspiration having been granted for the purpose of promoting either directly or indirectly the revealed religion,—were confined to men conspicuous above their fellows for piety, morality, and amenability to the doctrines of that religion of which they were to become either the mouth-pieces or exemplars; and the number of mortals so highly favoured, in post-diluvian times, seldom travelled far out of the direct line of the family of Shem.

But how does this principle suit the case of the Great Pyramid, if built, under instructions from the same inspiration, but in Egypt, and by the hands of Egyptian workmen,—Egypt being the most wofully idolatrous of all countries; while its people were exclusively descendants of Ham?

Several answers in mitigation somewhat of this extreme view of the Egyptian idolatry,—everything else being allowed as above stated,—have been attempted by various hands.

In the first place, for instance, there has been a growing feeling of late,—among those men who have made a special pursuit of Egyptian hieroglyphics, sculptures, and paintings, and who consider deep and curious investigations into the detail of the animal-headed Pantheon of ancient Egypt, a most worthy and elevating study for Christian men of the present day,—that it was not all so bad as it looks. They have strong impressions, say these well-meaning students, that the old Egyptians were not so very far from the truth; and that all these idolatrous figures on the temple-walls which offend the eyes of casual observers,—were deep-meaning mysteries and symbolical expressions of something really very different in its nature. And in fact, these modern students not only endeavour to show that Moses formed the chief part of the Hebrew worship on the model of the Egyptian; but that the latter faith, on receiving 'its expansion into the world,' became the effective origin of the Christian religion as well. 'At the present day,' says one of these authors, 'Christianity, Judaism, and Mohammedanism keep 'the conscience of the world, and as each of these 'religions was merely *the Egyptian idea* carried '(*colportée*) into another country, it is in reality '*the Egyptian idea* which still rules the world.' 'In stating this fact,' proceeds the author in question, 'we conceive we have been acting in a very 'Christian manner; for it belongs to a Christian to 'know how to render to Cæsar that which belongs

'to Cæsar, and to God what belongs to God; and 'similarly to the Egyptians what belongs to the 'Egyptians, instead of robbing them.'[1]

Now very far be it from us, to refuse to the Egyptians whatever really belongs to them; and with regard to all their sculptures of animal-headed gods, and actual worship of animals, we know of no reason whatever why Egyptians should not have the full credit, and responsibility too, of having invented them. On the very same principles, indeed, whereby we could *not* allow Egyptians to have conceived the idea of the Great Pyramid as a metrological monument,—because its birth was *not* after the necessary manner of all human beginnings (p. 371),—we are specially bound to let them, the Egyptians, take to their share all their false gods; —for the number of these *did* increase with their own growth and strengthen with their strength as a nation, according to the law of human inventions and national commencements. So that although in the earlier monuments such idolatrous figures are few and far between, they abound exceedingly in the later days of the eighteenth and nineteenth dynasties; and have even forced from M. Renan the remark we have already given, as to the temples of that period seeming, when contrasted with the earlier, to have been 'invaded by a whole Pantheon, the

[1] *Les Divinités Egyptiennes, leur origine, leur culte, et son expansion dans le monde.* Par Olivier Beauregard. Paris, 1866. See p. 604.

'most horrible and ridiculous that the human mind 'has ever conceived.'

'Ah!' but say others of the Egyptologists, 'though 'the figures *appear* repulsive or silly, that is only 'because they are mysteries to the uninitiated.'

When these gentlemen have tried to prove their case openly, in some other manner than by mysterious assertion,—it will be quite time enough to examine their reasons; but in the meanwhile it is sufficient for all the plain-speaking world, that neither the Mosaic nor Christian religions either copied or permitted such a pictorial or sculptorial method as that of the Egyptian temples, for concealing grand ideas of religion from the people. The adoption, indeed, of such devices as figures of animal-headed gods in every city of the land, by the Egyptians, even for a good purpose momentarily allowed, placed them in antithesis to the religion of inspiration. But we have only to read the accounts of what the religion of the Egyptians actually was, by those who saw them engaged at it—to perceive that their purpose was not good, and that they did worship animals as gods; for thus, as merely one among hosts of similar witnesses, did Clemens Alexandrinus write 1600 years ago:—

'Among the Egyptians, the temples are sur-'rounded with groves and consecrated pastures; 'they are furnished with propylæa, and their courts 'are encircled with an infinite number of columns; 'their walls glitter with foreign marbles, and paint-

'ings of the highest art; the *naos* is resplendent 'with gold, and silver, and electrum, and variegated 'stones from India and Ethiopia; the adytum is 'veiled with a curtain wrought with gold. But if 'you pass beyond into the remotest part of the en-'closure, hastening to behold something yet more 'excellent, and seek for the image which dwells in 'the temple, a *pastophorus* (or shrine-bearer), or 'some one else of those who minister in sacred 'things, with a pompous air, singing a pæan in the 'Egyptian tongue, draws aside a small portion of 'the curtain, as if about to show us the god; and 'makes us burst into a loud laugh. For no god is 'found within, but a cat, or a crocodile, or a serpent 'sprung from the soil, or some such brute animal; 'the Egyptian deity appears,—a beast rolling him-'self in a crimson coverlet.'

Even if we enter still more into the inner life of their religion, and take for our guide, not an ancient Greek living in the time of the Egyptians, but a modern European 'Egyptologist,' translating recently exhumed papyrus rolls,—the religious phrases and ideas are again found as opposite as they can well be to the religion of the Bible. This one following illustration will probably suffice. We choose it because it is found more elaborated in the later, than the earlier, papyri; indicating it, in so far, to be the growth of the Egyptian mind; and it consists in these two points mainly, 'first, the rejection 'of any idea of an atonement; and second, the self-

'assertion' by every man, of his own absolute and 'complete righteousness.' (See p. 430.)

Hence, our examination of the first apology for the Egyptians, ends in showing them more than ever, as *not* the people likely to have received any inspiration for Bible purposes.

But then arises a second class of apologists,—who allow freely that in the latter days of the Egyptian monarchy, their religion did become very gross,—but state their belief that in the Pyramid-building age, there was no idolatry in Egypt; and that even down to the visit of Abraham, or the close of the old empire, 'the one God was still invoked at 'the altars of the Nile land.'[1] Others further assert, there was no animal-worship in Egypt until after the Exodus.[2]

'There are even passages in the inspired volume,' continues one of the apologists, 'which seem to hint 'at a special revelation to the sons of Ham, anterior 'to the call of Abraham. Horeb would appear to 'have been known *as the mountain of God*, before 'it was made the scene of a Divine manifestation to 'Moses. The Syrian nation in an earlier and purer 'stage of its history seems to have been favoured 'with *a peculiar presence of God*; and the Syrians 'being Cushites, were nearly allied to the children 'of Mizraim, or the Egyptians. The families there-'fore of Cush and Mizraim, Palestine, Egypt and

[1] Rev. George Trevor's *Ancient Egypt.*
[2] Rev. H. Browne's *Ordo Sæclorum.*

'Ethiopia (*i.e.* Arabia), might keep their religious 'festivals at Horeb, as the children of Israel after- 'ward went up to appear before the Lord in Jeru- 'salem. The *Mount of God* would thus be the 'centre of worship to a band of kindred nations, 'scattered beween Libya and the Persian Gulf, till a 'gradual apostasy vitiated their covenant, and an- 'other law, another priesthood, and another people 'were chosen out of the families of Shem.'[1]

With the latter part of the argument we shall not attempt to deal, having no contemporary monuments wherewith to compare it, and considering it therefore altogether above our powers. But with the former part, or that asserting Egyptian idolatry to be a growth entirely subsequent to the time of Abraham, or later,—we enter into direct antagonism; for the Sinaitic tablets of the kings of the fourth dynasty, or two hundred years at least before Abraham,—show animal-headed gods as rampant: besides which, Manetho expressly states, that earlier still, or in the time of the second dynasty, 'the bull 'Apis in Memphis, and Mnevis in Heliopolis, and 'the Mendesian goat, were appointed to be gods in 'Egypt.'

In addition to which we may announce, from finding a large greenstone statue of a baboon god, half-buried in the sand at the north-east corner of King Shafre's tomb,—and from picking up a fragment in

[1] *Ancient Egypt*, by the Rev. George Trevor, M.A., Canon of York, pp. 113-115.

diorite, apparently the shin of a figure of Pthah, —near the temple in front of the second Pyramid,— that the Egyptians had then loose and portable idolatrous images, like Laban's gods, though the standing walls of their temples were not as yet carved and sculptured.

True it is, no doubt, that the Pyramids generally are without either idolatrous decorations or contents; but that is at once shown by the above to depend, not on idolatry being as then uninvented, but more probably because each Pyramid was a blind copy from another Pyramid; and the origin of them all was the Great Pyramid, in which the reasons, whatever they were, for omitting idolatrous allusions, concentrate themselves.

To that vast and admirably preserved monument, all men can still go, and undoubtedly see that there is no idolatry within it at all. While the traditions of 2300 years old,—relating how that freedom was procured; viz., by Kings Shofo and Nu-Shofo of the hieroglyphics, or Cheops and Chephren of Herodotus, shutting up the temples and forcibly stopping the animal-worship of the people for the time,[1]—these traditions, we say, in so far as they can be trusted, only make it more certain than ever that the people of Egypt, were no more at that period than at any other of their history, like those whom Jehovah was accustomed to favour; from Noah who was a preacher of righteousness, or Job

[1] Compare Herodotus, Diodorus Siculus, Manetho, and others.

who was the servant of God, down to Moses and the prophets of Israel.

It might have been expedient, in the 'Divine economy,' to employ the *people* of Egypt in the building operation, on account of their remarkable talent for mechanical work of an enduring order. The descendants of *Shem*, certainly had no leading capacity that way; so that centuries after the great Pyramid had actually been built, Abraham, Isaac, and Jacob lived in nothing more substantial than tents; each of them being emphatically described as 'a Syrian ready to perish;'[1] a mere wanderer on the face of the earth, without settled or solid habitation.

The sons of Cush are indeed honourably noted in Scripture,—and more prominently than their cousins, the Mizraites, and all others,—as adepts in building; so that even before the dispersion, Nimrod's kingdom is at once defined by his four great cities:—

'And the beginning of his kingdom was Babel,
'and Erech, and Accad, and Calneh, in the land of
'Shinar.

'Out of that land went forth Asshur, and builded
'Nineveh, and the city Rehoboth, and Calah, and
'Resen between Nineveh and Calah: the same is a
'great city.'

But not only were these cities,—in so far as we may judge from the remains of some, and of the successors of others, in the same Cushite or Chaldæan land,—

[1] Deuteronomy xxvi. 5.

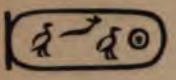
built of very perishable materials; but there were none of them either in, or even near, a country of appropriate *latitude* for the Great Pyramid. That remarkable monument demanded to stand in the parallel of 30°; and Egypt was the only country of the then world containing both that latitude, and a people clever in building after a permanent manner.

But then, it was by no means necessary for the mere performance of the masonry part of the operation, whereat they were already skilful, that the Egyptian workmen, when employed on the Pyramid, should have received inspiration from on High. Enough, if those who kept them to the Great Pyramid, rather than any other work, and more especially those who told them what lengths, breadths, heights, and angles to make the several parts of the Great Pyramid,—were so assisted.

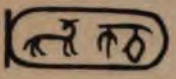
Now all traditional and monumental testimony assure us, that the Kings Shofo and Nu-Shofo were at least those who kept the Egyptians to the work of the Great Pyramid. Were they then also those who were gifted with the superhuman knowledge for the time, of being enabled to lay down the proportions requisite to cause the Great Pyramid to become the wonderful metrological monument which modern science, after four thousand years, is proving it to be?

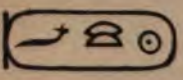
There seems at first to be something in favour of the idea; because, even by the confession of their

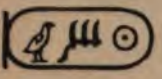
Of the
Fourth and neighbouring
DYNASTIES.

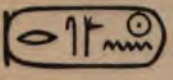

Shofo.

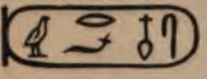
Nushofo.

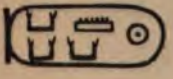

Nu.


Shafre.

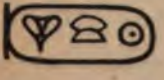

Soris.


Userchre.

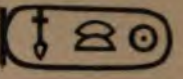

Sephuris.

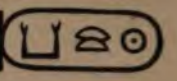

Mencheres.

Of the
XIVth DYNASTY,


Later Xoite monarch.

XIV DYNASTY cont^{d}


Xoite cont.^{d}

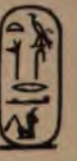

D^{o} D^{o}

Of the
XIXth DYNASTY,

Thothmosis 4 or Armais.

Ramses 2, or Sesostris Ramses.

D^{o} D^{o}


Thuoris.

Sethos 2 or Amenemnes.

ROYAL QUARRY MARKS AND OVALS REFERRED
TO IN THE HISTORICAL SECTIONS.

enemies, those kings did stop animal-worship for a time; and sundry tomb-inscriptions, translated by W. Osburn, show them to have been, in all other things, beneficent monarchs, attending to the solid interests of their people,—and not by any means such barbarous rulers and profligate tyrants as the priests of the idolatrous temples in after times used to love to represent them. But then again, these same traditions going on to describe Shofo and Nu-Shofo (Plate XIII.) as having before the end of their lives become *repentant* towards the gods,—*i.e.*, the animal-gods; or, in other words, become favourers of animal-worship once again,—we are induced, therefore, to fear, that the good courses of the kings during the time of the Pyramid building, were temporary only, and due to some peculiar pressure for the time being; or that, in fact, they were not the original, immediate, and worthy recipients of that inspiration, under which, and under nothing short of which, the arrangements, proportions, and measures of the Great Pyramid could have been received.

(*The inspired messengers, were foreigners?*)

Whereto then shall we look for any known historical medium, that would be recognisable on Scripture experiences of inspiration, wherever certainly enjoyed?

John Taylor found, that on the Hebrew chronology, Noah must have been still living when the Great Pyramid was built; and felt inclined there-

fore to expect that so venerable a character, already experienced on the ark in building according to measures divinely communicated, may have had some share in the operation. And who shall say that he had not? We hardly know, unless it be those ordained priests in the Established Church, who declare that the chronology of the authorized English Bible, as being translated from the Hebrew, is entirely false for all the earlier periods; and that according to the Septuagint, which alone is true in time particulars, Noah must have been dead for several centuries before the Great Pyramid began to be built. But it is hardly worth our while to enter into discussion on this question at present, because, let the death of Noah have occurred at almost any time, there is no direct mention in the Bible of his having been engaged in building a Pyramid in the land of Egypt.

Much the same, too, may be said for the claims of 'Peleg and the sons of Joktan.' For though John Taylor[1] has shown with much learning, that the former name signifies '*division*,' with probable reference to geographical science; and that 'Almodad,' the eldest of the latter, signifies '*the measurer*;' while in an old Chaldæan paraphrase, the same personage is even declared to have been 'the inventor of 'geometry, and one who measured the earth with 'cords;' and though much Divine favour appears to have been shown to the family (each of the thirteen

[1] *Great Pyramid*, chapters xxiv., xxv., and xxvi.

sons of which has his name expressly given in the Bible,—the last of them, Jobab, being thought to be Job, in whose majestic book, as will presently be shown, there do appear some allegorical allusions to the Great Pyramid); still none of these things are sufficiently to the point, or capable, by ourselves at least, of being considered as contemporary Scripture authority, for any one of the personages named having been sent down to the land of Egypt: nor for their being instructed from on High to build a Pyramid in that land; and gifted with eloquence to persuade, or power to control, the men of the region to act according to his orders.

Yet though we can find no direct authority from Scripture for any one being thus sent *to* Egypt during the Pyramid-building age,—there is a very noteworthy allusion in the sacred pages respecting some persons, families, or people being brought back *from* Egypt, and planted in Palestine about that time, and under the Divine favour. There is the well-known tradition, moreover, on the other hand, collected in Egypt by Herodotus—of a remarkable shepherd, or Palestinian, having been encamped near the Great Pyramid during the time of its building; and having had, in the estimation of the people, much to do with the progress of the work.

The first of these notices is to be found in Deuteronomy, second chapter; where Moses,—when encouraging the Israelites to be of good heart in their march under Divine favour out of Egypt and into

Palestine,—mentions two other and *preceding* cases where God had been pleased to conduct other nations into a new country, and had given them the lands of the previous inhabitants, as thus :—

'As he did to the children of Esau which dwelt 'in Seir, when he destroyed the Horims from before 'them; and they succeeded them, and dwelt in 'their stead, even unto this day:

'And the Avims which dwelt in Hazerim, even 'unto Azzah, *the Caphtorims, which came forth out 'of Caphtor*, destroyed them, and dwelt in their 'stead.'

Now these Caphtorims are usually (for there have been other theories broached) supposed to be Egyptians; or persons at least out of Caphtor, which is considered to be the north-western part of Middle Egypt, or the very locality of the Great Pyramid. And, that they were positively brought out of that region under Divine favour, and in a manner typical of the subsequent bringing out of the Israelites,—is still further to be inferred from the following :—

'Have not I (the Lord) brought up Israel out of 'Egypt? and the Philistines from Caphtor, and the 'Syrians from Kir?' (Amos ix. 7.)

The second again, of the above notices alluded to, is the very unintended and incidental tradition in Herodotus, to the effect,—that the Egyptians so exceedingly detested the kings under whom the Great Pyramid was built, that rather than mention their names when asked who erected the colossal monu-

ment, they would say,—either that it was built when the shepherd Philition fed his flocks thereabout;[1] or that the Great Pyramid was called after him, and that he was 'the great enemy of the 'Egyptian gods.'[2]

Now any servant of the Almighty must have been necessarily obnoxious to the gods of Egypt and their worshippers; and while no man of humble calling amongst the Egyptians would ever have been allowed any separate existence or identity under their oppressive government,—we may be assured, from all their traditions and history, that the name 'Shepherd,' implied a Palestinian, or one from Palestine, and arriving in Egypt through the Isthmus of Suez. The particular name of 'Philition,' implying, moreover, as John Taylor was disposed further to imagine, a remembrance of the feasts whereat there is a shedding of blood for the propitiation of sins; or a characteristic of the first shepherd Abel, and the religion subsequently taught to mankind through the descendants of Shem: but hated even to 'abomination' by the Egyptians.

The shepherd Philition, then, with his friends and flocks at the Great Pyramid, looks exceedingly like a Scripture character; and if he would preserve his descendants in the true religion, and free from bondage to the Pharaohs of Egypt,—it was abso-

[1] See Rawlinson's *Herodotus*, volume ii. p. 207, with Sir Gardner Wilkinson's note.

[2] *Ancient Egypt*, by the Rev. George Trevor, p. 118.

lutely necessary that he should leave that land again, as soon as possible after he had performed the business for which he originally journeyed there. Hence, if he went to it charged with the message of the Almighty, we need not be surprised that the Almighty's assistance was given in bringing him out of the tyrant's clutches again; even in such manner as the Lord expressly states that He *did* bring the Philistines and Caphtorim out of Caphtor or Egypt.

(*Cuseans retire from Egypt, northwards?*)

This pre-Mosaic bringing-out, then, for which in itself there is direct Scripture authority, we are inclined, on account of the mutually explanatory facts, to connect with the shepherd Philition, and his friends of Great Pyramid Pagan fame; and there appears to have been, after a most noteworthy manner, from that time subsequently,—a continued series of successions between those Philitian shepherds from Egypt and the Israelites,—in several important parts of the world. The principal steps too in this remarkable chain of coincidences, were, —independently of all Pyramid allusions, and with sometimes needless digressions to the subsequent shepherds of the fifteenth Egyptian dynasty,—discovered by the learned Jacob Bryant, and published by him in his Dissertation on Ancient History in the year 1767.

Sons of Chus, Cuseans, and Cushites, he appears

to consider them,—shepherds too, of Egyptian story, though not of the Egyptian nation or faith either, —in their first retreat from Egypt, they retired towards the Amalekites, and the country to the south of what was afterwards Judah's portion of the Holy Land; 'for there are many names of places that 'correspond exactly with others in Egypt, which we 'have shown,' says Bryant, 'to have been of Arabian 'original. There is in the first place to be found 'the name of the very country they had deserted, 'Goshen or Gushin,' as testified twice over in the Book of Joshua, with the further indication in Chronicles, 'that they of Ham, or out of the land of 'Egypt, had dwelt there of old.'

But these Philitians from Egypt did not remain in these parts so long as to be involved in the subsequent destruction of the Canaanite nations by Joshua;—for they seem, on the contrary, to have at an early period betaken themselves further northward, or into the upper parts of Mesopotamia. Because, 'here too,' says Bryant, 'was a land of 'Goshen, and a river Gozan, the same as the Chabor. 'Also the river Seghor, or Sehor, which was the 'name of the Nile in Egypt. All these circum-'stances prove that the sons of Chus forced them-'selves very early' (after their sojourn on the Nile), 'into the upper provinces of Mesopotamia.'

'In this country also, were the tribes of Israel '(afterwards) placed; at least a great part of those 'who were carried away captive by Shalmanasser;

'who *took Samaria, and carried Israel away into* '*Assyria, and placed them in Halah and Habor* '*by the river Gozan, and in the cities of the Medes* '(2 Kings xvii. 6). Halah and Habor, called likewise Chala and Chabor, were, as I have in part 'shown, in the upper region of Mesopotamia between 'the Tigris and Euphrates; both upon the Gozan, 'called likewise the Chabor; the cities of the Medes 'were beyond. There was something very signal 'in the catastrophe of those tribes, that were carried 'into the country, which I have been describing. 'It is well known how the Israelites, after their 'servitude in Egypt, were conducted to the land of 'promise, which they enjoyed above seven hundred 'years. Upon their repeated rebellion and idolatry, 'ten of the tribes were carried into a second bondage; 'and, what is remarkable, many of them went into 'another land of Goshen; but not like that of old, 'to another Avaris; and in succession to the same 'people, to whom their fathers had succeeded in 'Egypt, even Cuseans.'

(*Egyptians punished in the Great Pyramid?*)

In this reiterated manner do the destinies and successive local habitations of the Israelites and the Philitian shepherds of the Great Pyramid, appear to be interwoven; and it is possible we have not come to the last of their accompaniments and mutual illustrations even yet. But these things belong to another chapter; and meanwhile, if we have been

enabled with regard to the very distant past alone, to indicate something of the course actually taken by Divine inspiration, for propounding amongst men and carrying out the laborious plans of the Great Pyramid,—our readers may probably be struck with, on one side, the scriptural appropriateness of the manner in which the idolatrous and Cain-like Egyptians were made, without being at all aware of it, to carry out other ideas than their own.

This undoubtedly remarkable people, had in its first origin as a nation, fled from before a judgment in the land of Shinar; but arrived on the banks of the Nile, unsubdued, unrepentant, and still determined 'not to be scattered abroad.' They repeated, therefore, their coercive political system; and for a time they throve and waxed exceeding mighty, above all the then nations of the earth; they wrote, they built, they ploughed, they sculptured, they painted, they warred, and they tyrannized; but at the moment they held everything vile before them, and asserted that they were indebted for their greatness to themselves alone, and their own purity,—then were they made to erect the most toilsome monument which the whole world has ever seen; not for their own glory as they thought, but really, and in the latter end, for the honour of the God whom they had despised, and even dethroned, in favour of bulls and goats.

'Egypt, in fact,' says Chevalier Bunsen, and here with the utmost truth, 'Egypt appears as the instru-

'ment of Providence for furthering its eternal pur-
'pose, but only *as forming the background and*
'*contrast* to that free, spiritual, and moral element
'which was to arise out of Israel.'[1]

Even as perfect part of such a scheme, does the manner of erection of the Great Pyramid now appear; for it tells in more than speaking terms of the marvellous talents in constructive art, and for administration, which the Lord had bestowed on Egyptians through their progenitors, and intended them to use them well. But they forgot wherefore these gifts were received, and in place of devoting them to the service of the God of all nature, they employed them to strengthen themselves against Him.

The spirit, then, of the Egyptians at the building of the Great Pyramid, was the same which marked them, both at the oppression of the children of Israel afterwards; and, in conjunction with other peoples, at the building of the tower of Babel before. In so far as the Egyptians could accomplish it in their new work on the banks of the Nile, and as they flattered themselves, too, for ages that they had accomplished it even to the full,—the Great Pyramid was a resurgence in a new land, and with a community speaking a new language, of their thwarted ideas in another place;[2] but through the humble

[1] Bunsen's *Egypt's Place in Universal History*, vol. iv. p. 104.

[2] 'And they said, Go to, let us build us a city, and a tower whose
'top unto heaven; and let us make us a name, *lest we be scattered*
'*abroad upon the face of the whole earth.*'—Genesis xi. 4.

agency of the shepherd Philition, their labours were made really to tell against themselves; and have eventually caused the Great Pyramid to become in these latter days a most distinguished protest against the ancient tower, and all the principles of false religion connected therewith or descended therefrom.

On the other hand, if the inspiration afforded on this remarkable occasion, was vouchsafed not to a descendant of Shem, but to a Cusean, *i.e.*, if Philition was a son of Cush,[1] some other momentous openings thence arise.

(*Early Shemites not chosen?*)

From Abraham downwards, for instance, as every one knows, the race of Shem in his line was peculiarly favoured; in so far fulfilling not only the promises of the Almighty made to Abraham, but those also through Noah to Shem himself. But from Shem to Abraham is a long and dreary genealogical journey; during the latter part of which, at the least, even the lineal ancestors of Abraham had become so engrained in idolatry, and so given to the worship of other gods than the true God,—that Abraham had to be called out from amongst them, in order to live a pure life and receive the blessing.

Hence, while there is reasonable doubt, whether in the year 2170 B.C. a descendant of Shem was then

[1] In subsequent times the name of Cush was applied to Ethiopia; but we here employ it in accordance with Genesis chap. x. verses 8-12.

worthy, on the score of faith and religion, to be charged with any message of the Almighty,—there is on another point almost a certainty, that no Shemite was so fit for the peculiar Pyramid work, as a Cushite. For the Shemites were originally dwellers in tents, and had at that early period no more notion of masonic art or practical science, than any Bedouin Arabs of the present day,—who are still living under both the tent-poles and tent-cloths of Kedar; and, if cultivating and developing any scientific faculties at all, it is rather those connected with logic, metaphysics, moral philosophy, and other mental affections,—than any of those branches of *natural* philosophy which might enable men to execute mathematical forms on a large scale, in a solid material, with exceeding accuracy, and with a power for enduring through all human time.

True it is, no doubt, that the Almighty has it in His power to inspire any man, and for any work whatever, though never so strange to his previous constitution and knowledge. But, judging from Scripture, *that* is not the manner in which it has generally pleased the Lord to exert His inspiration gift; for in the instances recorded there, that man was almost invariably taken for either anointing or gifts who was nearer than his fellows to the quality required; and who could perhaps on that very account, be afterwards permitted so much free agency even under inspiration, that the prophetic messages are generally found tinged more or less

with the previous life-experiences of each particular prophet.

The defect, then, of the Shemites, in not having early improved their faculties for practical science, may have lost them an opportunity indeed, in the history of the world; and in that case, gave it to the Cuseans. Of these we have not hitherto been hearing much; but if it be true that their chief work remains behind them, and speaks in a language of which modern science is the simple and yet powerful key, more will be known concerning them as the centuries roll past.

(*A new objection.*)

But now, that so much connected with Divine inspiration has been approximately made out,—an objection to the whole subject of this chapter may probably arise in some minds; and, if Cuseans were really employed, such objection will be greatly strengthened, and probably stated thus:—

'In the early ages of the world there were, and 'even must have been, many inspirations from God 'to man; but being connected merely with giving 'to him in his infancy the beginnings of useful arts, 'they were not deemed appropriate to be mentioned 'in the Bible, which records alone things necessary 'to salvation. Now,' continue these objectors, 'even 'if the architect of the Great Pyramid *was* inspired, 'still the subject of the Great Pyramid being con-'nected with precisely such useful arts, its inspira-

'tion cannot be looked on as a *religious* inspiration, 'has no place in the Bible, and need claim no regard 'from any Christian in the present day.'

In reply to this, let us see what the Bible, which says so little about the builders of the Great Pyramid, may say about the Great Pyramid itself; for from the Bible alone can a safe opinion be formed.

Pyramid itself, whether Scripturally acknowledged!

This branch of the religious bearings of the subject we owe almost entirely to John Taylor. He it was who first perceived an allusion to the Great Pyramid in the Book of Job—a work arranged in its present shape by Moses,—but descriptive of the life-events of one who had flourished seven hundred years earlier, or at the very time nearly of the building of Great Pyramid.

In the chronology of the margin of some Bibles, the date B.C. 1520 is inserted against the Book of Job, but more to represent the time of Moses writing, than the age of Job's living: while Townsend, in his Chronological Index to the Holy Scriptures, gives the date of Job himself as B.C. 2130, *i.e.*, within forty years of the Great Pyramid's foundation; and appends the following note :—

'The life of Job is placed before the life of Abra-'ham, on the authority of Dr. Hales. Job himself, 'or one of his contemporaries, is generally supposed 'to have been the author of this book, which Moses 'obtained when in Midian, and, with some altera-

'tions, addressed to the Israelites. But my chief 'reason for assigning to the life of Job its present 'date, is derived from a consideration of the manner 'in which God has condescended to deal with 'mankind.

'Idolatry, as we read in the preceding part of 'this period, had occasioned the dispersion from 'Babel. It was gradually encroaching still further 'on every family which had not yet lost the know-'ledge of the true God. Whoever has studied the 'conduct of Providence, will have observed that 'God has never left himself without witnesses in 'the world to the truth of his religion. To the 'latter times of patriarchism, Abraham and his 'descendants; to the ages of the Levitical law, 'Moses, David, and the Prophets; and to the first 'ages of Christianity, the Apostles and the Martyrs, 'were severally witnesses of the truth of God. But 'we have no account whatever, unless Job be the 'man, that any faithful confession of the one true 'God arose between the dispersion from Babel and 'the call of Abraham. If it be said, that the family 'of Shem was the visible Church of that age, it 'may be answered, that it is doubtful whether even 'this family were not idolatrous, for Joshua tells 'the Israelites (Joshua xxiv. 2) that the ancestors 'of Abraham were worshippers of images.'

The times of Job then were evidently remarkable ones in the history of God's government of the earth, even as Job himself was especially 'the servant of

'God;' and we may also imagine those times (without any guiding reference derived from their date, as above, and that of the Great Pyramid), to have been contained within the period of *smaller* Pyramid building for sepulchral purposes,—from the improved translation in Job iii. 13 and 14, as given now for several years past by Mr. Gliddon and other leading Egyptologists; wherein we read after Job's expressed wish to have died, his further exclamation :—

'For now should I have lain still and been quiet,
'I should have slept: then had I been at rest
'With kings and counsellors of the earth, which
'built Pyramids (desolate places) for themselves.'

The manner of mention here contrasts rather noticeably with another, recently pointed out by Dr. Horatius Bonar, in Jeremiah's Lamentations iii. 6. This Prophet wrote his inspired Lamentations in Egypt, so that it is perfectly possible that he may have seen the Pyramids, and included the Great one amongst those 'signs and wonders set in the land 'of Egypt, by *the Lord of Hosts*, great in counsel 'and mighty in work:' and which signs and wonders being made to *last* there, even up to his, Jeremiah's, day,[1] may be inferred to have been of a material order. But that day was long subsequent to the time of Job; probably in 588 B.C., when Pyramid building had long ceased throughout all Egypt; and such specimens as still existed, were separated at their foundation by more than twenty dynasties

[1] Jeremiah xxxii. 18-20.

of kings from that late period of the new empire in Egypt. Wherefore the mention of them by the Prophet of the Lamentations appears peculiarly appropriate in the words,—

'He hath set me in dark places (or Pyramids), as 'they that be dead of *old*.'

While some of Job's descendants are moreover often looked for among the Sabeans of Arabia, Mr. Palgrave mentions, in his volumes of recent and very instructive travel there, that old Arab writers relate of the Sabeans, 'that they had a special 'veneration for the two great Pyramids of Egypt, 'believed by them to be sepulchres of Seth and 'Idrees; that their stated prayers recurred seven 'times a day (although some others say five,—a 'divergence which may admit of easy explanation), 'and that during their devotions they turned their 'faces to the north,'—the direction of the entrance passages of those Pyramids, and 90° distant from the ancient western opening of tombs, or the general eastern direction of prayers.[1]

But with the further and more authoritative Biblical notice of the Great Pyramid, in the paragraph quoted from the marginally corrected translation by John Taylor,—describing indeed ostensibly the Divine creation of the earth, though under the

[1] Idrees, or Edris being, moreover, said to be a name among the Arabians for Enoch; traditionally, merely, the third with Adam and Seth in the invention of astronomy, and particularly connected with the polar star. (See *Mazzaroth, or the Constellations*, pp. 7 and 34, of Part II.; see also Howard Vyse's vol. ii. pp. 342, 349, 358, and 360.)

figure, as he contends, of the mechanical foundation of the Great Pyramid,—there the description contains nothing sepulchral in its allusions; bearing indeed rather on metrology, and of a very signal and unusual kind, as thus :—

'Where wast thou [the Lord answers Job out of the whirl-'wind], where wast thou when I laid the foundations of the 'earth? declare, if thou knowest (hast) understanding.

'Who hath laid the measures thereof, if thou knowest? or 'who hath stretched the line upon it?

'Whereupon are the sockets thereof made to sink (the founda-'tions thereof fastened)? or who laid the corner-stone thereof,

'When the morning-stars sang together, and all the sons of 'God shouted for joy?'[1]

This description, if applied to the earth, that well-known ball of dense and heavy matter, revolving in its endless course through thin ether or practical vacuity,—is not only not exactly, but not in any degree, agreeable to the teaching of modern science; nor indeed to another account of the earth as a whole, and in its position in space, in Job xxvi. 7, where of God the Creator it is said :—

'He stretcheth out the north over the empty 'place, and hangeth the earth upon nothing.'

Hence the presumption is with John Taylor, that in chapter xxxviii. of the Book of Job, we have the creation of the earth under a type of something else, more human, more understandable, and more practical; this type might be, indeed, in the earlier part of the description, the building of an ordinary

[1] Job xxxviii. 4-7.

house,—but the successive features elicited, the laying the measures thereof; the stretching a line upon it, as on its sloping sides, not vertical walls; and above everything, the one and final corner-stone, as contradistinguished from the lower corner, or foundation, stones at the commencement of the building, —these seem to single out a metrological Pyramid, of all other real or hypothetical buildings whatever.

'The sockets thereof being made to sink,' is evidently a most peculiar phrase; and would probably never have been fully appreciated, as it certainly was not correctly interpreted in the authorized Bible,—but for the perfectly independent discovery by Bonaparte's *savants* in 1799, to the effect that the Great Pyramid had at least two such sockets, *i.e.*, at its north-eastern and north-western base corners. Sockets these were, neatly cut out, or 'made to sink,' with the chisel in the levelled surface of the living rock; and the foundational corner-stones of the casing, at these angles, were placed therein. An inimitable discovery was this, and never to be forgotten, though some great men do forget it; for at once those two sockets (so far at least as concerned the northern side of the Great Pyramid), enabled the measures thereof, as originally laid out in primeval times, to be recently recovered; and gave thereby the holding turn both to the theory of the Great Pyramid as being a metrological monument, and to the practice of the same, in showing it to be a good reference for base-line

measures still; besides illustrating this terse Scripture phrase of 'the sockets thereof being made to 'sink.'

Hence, as we have ventured to express in our Dedication, the features thus discovered at the Great Pyramid,—by what one of Napoleon Bonaparte's politically opposed historians could only call, years after, 'a singular accompaniment to a military ex-'pedition,' viz., a corps of first-class *savants*,—these features, we say, are really 'not unalluded to in 'Holy Writ.'

By the Scriptures thus assisted and made plain to our comprehension, we ourselves concluded the further existence of other two socket-holes, making up four equidistant sockets for the four lower corner-stones of the base of the Great Pyramid; and such sockets were found last year by the first person who excavated intelligently for them, as already described in vol. i. chap. xvii.

So much then for the four lower corner-stones at the commencement, and completing the foundations, of the structure; and after them comes the final test of a methodically constructed stone Pyramid being alluded to, in another still, and therefore a fifth, corner-stone being mentioned. Though mentioned as being placed, not anywhere near the bottom or beginning of the Pyramid, but as forming its topmost corner or summit; so that when that top corner-stone, emphatically *the* corner-stone, is laid,—the building is thereby finished, its symmetry

perfected, and in commemoration thereof, 'the morn-
'ing-stars sang together, and all the sons of God
'shouted for joy.' Or, as in Zechariah iv. 7, where it is said that the 'bringing out the *head-stone* of 'the great mountain,[1] was greeted with shoutings, 'Grace, grace, unto it.'

And now let us ask our readers, or our readers their hearers, how a series of men living in tents, as the Shemites of the period seem certainly to have done, were of their own experiences to acquire so much technical knowledge of the mode of building a stone Pyramid; and to grow in such righteous enthusiasm therein, as to look on its final completion with rejoicing ideas of pure and high religion, unless they were assisted by inspiration? And is it likely that acknowledged prophets of religious inspiration, would have employed again and again the features of a Pyramid head-stone (which they had never seen) as a symbol of the Messiah himself,—unless such a use of the figure should have been approved of by the Author of all inspiration?

And that such a use was made of the chief or top-most corner-stone of a stone-built Pyramid, by both the Psalmist of Israel, and the Apostles of the New Testament,—the late excellent John Taylor showed; for their words, said he, apply to nothing else.

Thus David, Psalm cxviii. 22 and 23, 'The stone 'which the builders refused, is become the *head-stone*

[1] 'The Great Pyramid, the nearest approach to a mountain that 'the art of man has produced.'—Dean Stanley's *Syria and Palestine*.

'*of the corner*; this is the Lord's doing, and it is 'marvellous in our eyes.'

And more particularly St. Paul, in Ephesians ii. 20, distinguishing between the lower corner-stones, which are the foundation,—and the upper corner-stone, which is the summit, head, and finish, and therefore the last, the noblest, and most essential part of the whole structure of a Pyramid,—but of a Pyramid alone, of all buildings under the sun, writes thus—

'Ye are fellow-citizens with the saints, and of the 'household of God; and are built upon the *founda-* '*tion* of the apostles and prophets, Jesus Christ him- 'self being the *chief corner-stone*, in *whom all the* '*building, fitly framed together*, groweth unto an 'holy temple in the Lord.'

The same stone, before its visible elevation to the chief or topmost corner of the Pyramid, has likewise been recognised as 'the stone of stumbling and rock 'of offence'[1] to all disbelievers; physically, on account of its inconvenient, many-cornered figure, always lying on the ground, with one acute angle stuck up in the air,—untoward among the other regular-shaped, flattish building-blocks,—forming therefore the very image, according to John Taylor, of the dangerous stone, 'on which, whosoever 'shall fall, shall be broken, but on whomsoever it 'shall fall' (especially if it be from the top of the Great Pyramid), 'it will grind him to powder.'[2]

[1] 1 Peter ii. 8. [2] Matthew xxi. 44.

An early mediæval traveller, M. Belon, reports having been shown, in the valley of Jehoshaphat, near Jerusalem, the stone to which our Lord alluded in the preceding sentence, and states that it was 'triangular.' The mere general circumstance of a relic being shown in any Palestinian locality is usually thought now to be more against, than for, the probability of its genuineness. But in this case, the alleged triangular shape, which is a very usual popular method of describing a Pyramidal figure, is a curious coincidence at the least, with what John Taylor had concluded from his theory of a Pyramid topmost corner-stone; and may have some connexion with mementoes of Egyptian experiences left behind them by Philition and the other Cusean shepherds, at the various spots which they inhabited for a time in South Judæa, and particularly in Hebron, before proceeding farther north.

Should the Cave of Machpelah, among its long-hoarded contents, ever reveal to Europeans such a pyramidal stone in good preservation,—there can be no doubt that scientific examination would be able to distinguish, with extreme accuracy and consequent certainty, whether it *could* have once formed the head-stone of the Great Pyramid or not. From the earliest times of history, that head-stone has been removed; and one is greatly inclined to imagine that its removal may not have been altogether accidental, but that it will be rediscovered some day, a silent yet unimpeachable witness of

events which took place four thousand years ago; and may have still to subserve a part in the history of the world.

Meanwhile, however, as this is only a fond hope; and as we trust that proof has now been abundantly adduced, illustrative of the inspired authors of the Bible both having been familiar, in the spirit, with characteristic features of the foundation, construction, and finishing of the Great Pyramid; and having looked on it with the utmost allowable religious respect,—making use of its similes for the noblest religious purposes known to Christianity, only;—the argument of this last branch of our present subject, or that the Pyramid building in itself, and quite independent of any particular agency employed in its building, is owned and acknowledged in the Scriptures, both of the old and new covenants,—may be considered, like every other section in the chapter, to have been settled in the affirmative. Wherefore the next step should be, to take up the whole elements of the case, and endeavour to ascertain to what end, all these ancient facts and modern discoveries, culminating just at this time, may probably be leading. Yet for one moment more, and in the course of a very short chapter, we must request our kind reader's attention to the bearing on the case of one more item of lay learning, partly astronomical, but unfortunately not altogether so.

CHAPTER IX.

ON SOME POINTS IN PRIMEVAL ASTRONOMY.

Who invented the oldest Constellations?

In preparing the star-maps of Plates VII., VIII., and IX., certain figures of the constellations were introduced, to assist the reader in identifying the stars concerned in the problem then laid before him. Such being the sole purpose, the figures were those ordinarily received in the present day; excepting only, that *Canes Venatici*, *Lynx*, *Camelopardalis*, and a few lesser asterisms, had been omitted, on account of their extremely modern European invention.

The other figures, however, which had been allowed to remain, although generally reputed 'the 'ancient constellations,' are not, for comparison with Great Pyramid astronomy, much more satisfactory than the above rejected ones; being to a great extent not older than the time of the Greeks, and in their present form, of the Alexandrine Greeks only. They were, too, even at that date, so evidently perverted in scientific ignorance and poetic presumption from a still older system, and one of more serious as well as solemn import,—as to give remarkable illus-

tration to that maxim of Scaliger, '*Græculorum est* '*mentiri, et falsa veris affingere.*' Or, as the laborious Bryant feels compelled to write, after extensive investigations into the antiquities of history and geography,—

'Great part of the knowledge that we are pos-
'sessed of, in relation to ancient times, has been
'transmitted to us through the hands of the Greeks;
'for which we are to make proper acknowledgment.
'But when we consider how much more they might
'have transmitted, and how foul and turbid the
'streams are that are derived to us, it takes off
'much from the obligation.'

And again: 'Sometimes they (the Grecians in
'transmitting primeval history) only translated the
'names of places; which was something tolerable;
'for there was then a chance of recurring to the
'primitive language, and recovering the original;
'as the meaning would lead one to the truth. But
'they were too vain to be consistent even in this;
'and what one advanced another confounded; each
'thinking that he had a right to change things, and
'new-model them to his taste. Above all things
'they strove to introduce their own gods and heroes;
'and to attribute everything to their performance,
'wheresoever transacted. Their vanity was so great
'in this respect, and their prejudices so strong, that
'it led them into a thousand childish errors; but,
'when they were not originally mistaken, they wil-
'fully deviated; imposing names on places, and

'adding legendary stories, which they must know 'were foreign to the countries where they introduce 'them. Hence we are informed that one branch of 'the *Nile* was denominated from a sailor of *Mene-* 'laus, and another from *Peleus* of *Thessaly;* that '*Perseus* gave name to *Persia;* and that the Medes 'received their name from Medea; and what hap- 'pened on the occasion. For they were never guilty 'of a mistake, but they framed some story to support 'it.' Or, as a more recent author puts it, a shade more philosophically,—'it was a part of the Greek 'character to frame systems on insufficient know- 'ledge, and to explain false systems by false hypo- 'theses.'[1]

Unfortunately, in the present state of astronomy and literature, it is much easier to find proofs demonstrative of the Greek and Greek-Alexandrine constellations not having been first in the field, than to show what the more ancient system precisely was. With exceeding truth and judgment, therefore, the author of the article Constellation in the *Penny Cyclopædia* writes :—'It is sufficient for us 'here to say, that it is certain we derive our constel- 'lations from the Greeks, and that it is nearly as cer 'tain that they derived them from the East, though 'it is highly probable that they altered the legends 'to suit their own mythology, and in some instances 'even the figures. Their firmament, if it confined 'itself to recording the vast and striking events of

[1] *Saturn and its System*, p. 194. By Richard A. Proctor, B.A.

'their mythic system, as in Argo or Hercules, 'might bear an external presumption of originality, 'which it wants altogether while so prominent a 'constellation as the Great Bear represents nothing 'but the unimportant and irrelevant story of 'Callisto.'

Even if we begin with known and scientific times not very distant from our own, we cannot feel greatly impressed with either the dignity in spirit, or worthiness of the objects, of modern constellation-makers. For thus writes the celebrated Hevelius, whom all men are now so content to follow, that they have placed his new constellations side by side with those which have descended to us of old :—

1*st*, 'Because Bootes is regarded as a caller, brawler, 'and hunter, who pursues the bear in hunting, and 'raises his hand and arm as if in the act of slipping 'his dogs, I could not find a more suitable place for '*Canes Venatici*. One of them I have called *Asterion*, 'because the name is very pleasing to me, and is 'well known to the poets. The other I have called '*Chara*, because most likely to Bootes, after the 'manner of huntsmen, a female dog, on account of 'its greater fleetness of foot, would be more *chara*, 'or favourite.'[1]

2*d*, 'Of certain nine stars I have formed between 'the Great Bear and the Greater Lion, a less or 'junior Lion, and the reason was this :—I wished 'to disturb the arrangement of the astrologers as

[1] From the *Prodromus Astronomiæ*.

'little as possible; and seeing that the Bear and the 'Lion are usually considered the most violent and 'ferocious of animals, I put in between them an 'animal of the same order, that the stars of which 'it is composed might retain the same qualities.'

3*d*, 'The Fox and Goose (*Vulpecula et Anser*) 'constellation was made on this principle, that being 'composed of stars between the Eagle and Lyre, 'both of them over rapacious and voracious animals, 'it (the Fox and Goose) should pursue the same 'nature. This fox, then, has stolen a goose, which 'he carries in his mouth at a run to Cerberus, that 'three-headed, infernal, and devouring dog, by 'which he may have a breakfast and some comfort, 'before he is killed by Hercules, already raising his 'club for the purpose. Thus I have been able to 'locate the Fox and Goose in this position as appro-'priately to the fables of the poets as conformably 'to the rules of the astrologers.'

The Lyre, though we all know it to be a perfectly innocent musical instrument, is here spoken of as a voracious animal,—because the mediæval astronomers made the Lyre a heraldic blazon on the breast of a certain 'falling eagle;' but the classical poem of Aratus, and a very ancient MS. in the British Museum, are generally considered to decide for the claims of the musical instrument, pure and simple; while the Cerberus alluded to above has in most modern maps been replaced by a many-headed snake of small size.

According, in the next place, to a rather earlier authority, or Thomas Hood of Trinity College, Cambridge, in A.D. 1590 and author of a discourse on the celestial globe, the following is an explanation of the length of tail possessed by the Great Bear :—

'*Scholar.*—I marvel why (seeing she hath the 'forme of a beare) her taile should be so long.

'*Master.*—I imagine that Jupiter, fearing to come 'too nigh unto her teeth, layde holde on her tayle, 'and thereby drewe her up into the heaven ; so 'that shee of herself being very weightie, and the 'distance from the earth to the heavens very great, 'there was much likelihood that her tayle must 'stretch. Other reason know I none.'[1]

If again we seek the earliest transmitted Greek legends of the same constellations,—we are told there, much of the amours of Jupiter with the frail Callisto ; of her metamorphosis into a bear by Diana for her breach of chastity ; of Jupiter saving her from hunters by transferring her to the skies ; and of her then component stars not being allowed, in describing their circumpolar revolutions, to dip below the horizon,—because the ocean deities refused to let their pure waters be polluted by the presence of the concubine of Jupiter.[2]

For the earth was at the time considered among the Greeks as being an extensive flat, reaching to the very heavens on the horizon ; while the *omphalos*

[1] Admiral Smyth's *Celestial Cycle*, vol. ii. p. 310.
[2] Sir G. Cornewall Lewis's *Ancient Astronomy*, p. 64.

or navel-stone, marking the centre of such earth-flat, was proudly shown in the temple of Delphi; to prove that Greece was in the centre of the whole world.[1]

In fact all prosecution of the subject of the *constellations* amongst, or from, the schoolmen of the present day, up to and including the classic authors of Alexandria, Rome, and Greece,—ends only in shame of soul, vexation of spirit, and prejudice, probably, that even the most ancient, or pre-Grecian, constellations never had any noble meaning or scientific use. And as the author of *Mazzaroth*[2] says, on viewing the proceedings of one very learned man in this country,—'Therefore it is 'evident that this great astronomer had not, in the 'course of his studies, met with any account of 'their (the older constellations') possible significa-'tion which appeared to him worthy of notice.'

Hence a different track altogether requires to be taken, if we would arrive at an acquaintance with the primeval wisdom of the earth touching the heavenly constellations. And while the Great Pyramid has now recently proved that, quite agreeably with much of ancient tradition, such knowledge did once exist,—the author of *Mazzaroth* has for some years past, indicated that the most probable road to it would be found in the Hebrew language.

[1] Sir George Cornewall Lewis's *Ancient Astronomy*, p. 4.

[2] *Mazzaroth or the Constellations.* By Miss F. Rolleston. London, 1862.

'For it is in the Hebrew antiquity alone,'—says that most learned linguistic writer, after deep researches into the most ancient forms of Hebrew, Arabic, and other Eastern languages,—'in the 'Hebrew antiquity only, that we find any vestige 'of a received, connected, and respectable meaning 'being attached to the names of constellations.' And as an illustration that such an improvement does take place there, besides there being in that language a higher antiquity to rest upon, than amongst any of the classics,—the same author proceeds to describe the signs of the zodiac as borne on the standards of the tribes of Israel,—and with meanings partly retrospective and partly prophetic attached to them,—in their, the Israelites', march under Moses through the wilderness; besides claiming the same signs as being also alluded to in the blessing of Jacob, as early as 1700 B.C., or fully one thousand years before the Greeks were known as a people.

If too, we deviate at all from this well-marked Hebrew road, and try another very different language, though equally pre-Grecian, such as the Egyptian,—we lose sight of the early constellations immediately. For even that eminent Philo-Mizraite, Baron Bunsen, has been constrained to record, at p. 353 of his fourth volume of *Egypt's Place in Universal History*, that the signs of the zodiac were 'wholly unknown to the Egyptians till the reign 'of Trajan.' And although M. Arago and a few

other academicians used to believe in the extreme ancientness of the zodiacs at Denderah, Esneh, and elsewhere on the Nile,—the researches of all modern hierologists have united in fixing them to the later part of the Roman period only.

A claim, however, is put in by the learned M. Ideler, for the zodiacal figures, and perhaps some extra-zodiacal ones also, having been known to the 'Chaldees, *at a very early period*;' and we may fortunately pursue this important, though rather too indefinite, statement, a little further, by referring to Mr. Proctor's admirable book on *Saturn and its System*, published in 1865. For that most original author, dealing with ancient as well as modern astronomy, feels compelled to look through the Chaldees of subsequent history,—when their astronomy was degraded to astrology, and they themselves were enslaved to do the will of Assyrian despots on the banks of the lower Euphrates,—and to trace the rise of their old characteristic science, as well as their own best days, to earlier times, when their Cusean forefathers enjoyed freedom and self-government, in a land situated somewhere about the fortieth degree parallel of north latitude.

This result, again alluded to in his 'star-maps,' Mr. Proctor deduces with much skill from calculations, which he bases on features taught subsequently in both the Greek and Hindoo astronomies; but features evidently not belonging to the dates of those systems, or even to those countries at any

time. Those countries were in fact only making use, and rather ignorant use, of the discoveries of an earlier age, another part of the world, and a different race of men,—or the Chaldeans; at that period of Chaldee history too, when they 'resided 'in Armenia, between the rivers Cyrus and Araxes, 'not very far from Mount Ararat; and at a date 'somewhere between 2200 and 1800 B.C.'

Now these dates include the probable time of the Cusean and Chaldæan shepherd Philition, of Great Pyramid story, immigrating, perhaps returning, through Palestine to that same Armenian and Median region above indicated (chap. viii. p. 527), after his remarkable sojourn in the land of Siriad, or Egypt. And after his eventful occupation there, in superintending the construction of both an astronomically placed, and a generally scientific, building; in which, too, the chief metrological standards commemorated, were the same as those possessed in after days by the Hebrews,—as well when they went down into Egypt under Jacob (see Sir Isaac Newton on Cubits), as when they came up therefrom under Moses.

Hence, even from the metrology alone, there appears a something of possession in common between the early Chaldæan knowledge on one side, and the Hebrew on the other,—as to certain useful and accurate practical deductions from both astronomical and geographical science of a very high order.

But much more remarkably still does this con-

nexion come out in the astronomical part of the memorializations. For there, the Great Pyramid does, by its peculiar combination of a polar star,—taken on the meridian below the pole,—with an *opposite* zodiacal constellation above the pole, very remarkably single out for world-wide notice and time-long attention, the several asterisms of Scorpio, Aquarius, Pisces, and the Pleiades. Not only so too, but it assigns them to exact and precise dates; which, when combined with the Biblical history for the same period, vivifies and renders vocal the characteristic expressions of all those figures (p. 493).

Here then, is a wonderful agreement in mind between, (1.) the building of the Pyramid, (2.) the invention of the constellations, and (3.) certain grand primeval phenomena recorded in Scripture. The agreement too, will appear yet all the more striking, when we consider that there is no attempt made to assign any *physical* effects to the stars in these or all other constellations, and no endeavour to explain, in any manner, the *production* of the Deluge; but that the stars were taken as they were, and as they are still, by the architect of the Great Pyramid, and simply an observing method invented, by which they were made to fix certain dates. Similarly, too, the stars were taken as they were, by the inventor of the constellations, whoever he was or whenever he lived; and out of his mind (not from the arrangement of the stars themselves, for there is nothing of the kind traceable there), certain

figures were invented and attached to those stars. And there those figures have remained ever since, with a preternatural fixity; for, with very little alteration at any time,—either of character, mode of action, or name,—they have outlived all the successive great monarchies of the earth.

Hence the date of invention, of at least the above specified constellations, cannot be less than that of the building of the Great Pyramid, or 2170 B.C., and may not improbably be more. Whether the learned author of *Mazzaroth* is justified, from the quarter of language and old tradition, in taking them up, through the survivors of the Deluge, to a very much higher epoch still, we are not prepared at present to give any opinion.

But having already laid before our readers both mediæval and Grecian ideas of certain well-known asterisms, it may be only right to exhibit also a specimen of the kind of results imagined to have been arrived at by the writer just mentioned,—when studying the same celestial phenomena from a mainly Hebrew point of view. We conclude this section, therefore, with Miss Rolleston's last page:—

'In the time of Seth and Enoch (the supposed 'originators of the ancient constellations under 'Divine inspiration, and for prophetic purposes of 'religious comfort to all mankind after the fall), the 'pole was among the stars of *Draco*, the emblem of 'the enemy; the constellation of the Lesser-sheep-

'fold'[1] had no relation to it. But by degrees the 'pole drew nearer to the brightest star in that con-'stellation; the sheep represented by three of its 'other stars, as quitting their earthly fold (the 'believing Church) seemed going forth to the cyno-'sure, faintly typifying *Him* who was and is the 'object of their faith. In the brilliant intensifica-'tion of this emblem of the fold and sheep going 'forth, *the Greater fold* (now miscalled *the Great* '*Bear*), it is strikingly represented that their course 'is to the Great Shepherd and Guardian of the flocks 'typified in Arcturus, He who cometh and returneth. 'The three stars, daughters of the flock, seem fol-

[1] Notes from *Mazzaroth*, pp. 29 and 30, on the Great and Lesser Sheep-folds, miscalled Bears:—

'It has been remarked by Oriental scholars, that the Arab astronomy 'abounds with allusions to cattle, but without observing that the 'camel, the peculiar possession of the desert tribes, does not exist 'among the emblems. Only once, if at all, does even the name occur 'among the more obscure names of minor stars, as it is said to do in 'Cancer. Were proof needed that astronomy did not originate in 'Arabia, this circumstance would afford it. The cattle with which the 'nomenclature of the stars abound, are the lamb and the kid of sacri-'fice, the flock of the shepherd, the sacrificial ram and bull of the 'zodiac, where the western nations still behold them; but besides 'these are the magnificent emblems of the greater and lesser sheep-folds, 'with their sheep, long obscured by fable and misconstruction of the 'names by which they were originally distinguished—names perverted 'by the Greeks and Romans, but still to be traced in the records of 'Oriental astronomy. Most people know the remarkable constellation 'called by some the Great Bear, by others the Plough, or Charles's 'Wain. In reference to the starry host, the Book of Job mentions 'Ash:—"Canst thou guide Ash and her offspring?" where the Eng-'lish has "Arcturus and his sons," according to the confessedly imper-'fect Greek translation of this most ancient and difficult book. It is 'not, however, far wide of the real meaning in this place, as Arcturus, 'though not in the same constellation, appears to lead or govern the 'three stars, where we still find the name Benet-naish, the daughters

'lowing, seeking Him; but two, representing the 'boundaries of the fold, point above to the star 'typifying Him in the earlier dispensation, *the 'Lesser*, and as it were further removed *fold*. There 'He, the Great Shepherd of the sheep, is figured 'above, gone before; and below in Arcturus, as 'about to return in greater glory. The foot of the 'other figure, *the suffering Mighty One*, is on the 'head of the Dragon below.

'These emblems made part of the ancient astro-'nomy, but the guiding star was not the Pole-star 'then, nor will it always be. Still, while to us it 'seems to be so, it is well to connect it with Him to

'of Ash, the assembled. The Arabs still call this constellation Al-'Naish, or Annaish, the ordered or assembled together as sheep in a 'fold. The ancient Jewish commentators on Job, say that Ash is the 'seven stars in the Great Bear. In the three stars, miscalled the Tail, 'where we find the name Benet-naish, there is also Mizar, a guarded 'or enclosed place. Another name is Alioth, the ewe or she-goat, near 'which is the star celebrated in modern astronomy, Al Cor, the lamb.

'Among other names in this constellation, El Acola also is a fold: 'Phacad is a watched or guarded place; Dubhè, in Hebrew, a she-'bear, is still written on our globes; but in Arabic, Dubah is cattle, 'and in Hebrew Daber is a fold, either of which might easily be mis-'taken for Dubhè by the Greeks, and understood as a bear.

'In the name of the nymph Calisto, by Greek fable said to be 'changed into the constellation, we find the Semitic root, which we 'meet again in the west as Caula or sheep-fold. With the idea of 'a sheep-fold in the mind, it needs but to look at these seven re-'markable stars to perceive how well is imaged there the fold, and 'the sheep proceeding from the corner of it, as if following the bright 'star Arcturus, always said to be the guardian of these stars, whatever 'they might be called. Arcturus means, He cometh the guardian 'or keeper.

'As in Ursa Major, so in Ursa Minor, the Semitic names show 'that here also were set forth the fold and the flock, in Scripture 'metaphor the Church; and its chief star Al Gedi, the kid or lamb 'of sacrifice; called also Arcas, the son of the Supreme Deity.'

'whom the hearts of His people turn as the needle 'to the Pole.

'These leading or guiding stars, Arcturus in '*Bootes*, and Kochab or Cynosura in *the Lesser* '*sheep-fold*, have both symbolized the Great Shep- 'herd of the sheep,—Him whom they follow in life, 'and trust in, to attain to His side in departing to 'be with Him, which is far better.'

Proposed Reforms among the Constellations.

Modern astronomers have little true love for the constellations, as usually accepted and fixed by modern public opinion; for they are of no acknowledged use to *them* when actually observing, and have even become rather ridiculous in their eyes. There was a well organized and rather sweeping attempt a few years ago, headed by the first astronomer of the age, to reform those strange figures—at least for the southern hemisphere,—altogether. The outcry at the Astronomical Society was very loud; 'for,' had said their intellectual leader, Sir John Herschel, in his *Outlines of Astronomy*, 'the con- 'stellations seem to have been almost purposely 'named and delineated to cause as much confusion 'and inconvenience as possible. Innumerable snakes 'twine through long and contorted areas of the 'heavens, where no memory can follow them; bears, 'lions, and fishes, large and small, northern and 'southern, confuse all nomenclature,' etc. etc.

These were among the points, the reform of which

was to be attended to in future; and the improved arrangement was therefore to have consisted, in dividing and subdividing the surface of the heavens by lines, defined for the most part by circles of right-ascension and declination; names being given to such areas or sectional spaces, and also to the principal stars therein, culled from the neutral literary ground of classical antiquity and mythology; on some well-considered general system too, so that the name of a star, or its section, should always give some idea of its place in the sky.

Had this attempt been successful,—it would have been a triumph to the furtive Greeks and their heathen gods and goddesses, who would have been thereby re-established with new force on the minds of all educated men. And it would have been creating greater difficulties than ever in the way of recovering the truly ancient constellations, or what came down to the Greeks from the purer light of primeval times; and which they, before passing on for the use of posterity, sophisticated, metamorphosed, and mythologized, for their own and their false gods' glory. We are rather glad, therefore, that modern astronomy was not allowed to assist at so untoward an improvement; though we must acknowledge that the arguments on which the attempted reform finally foundered, were not the right ones; and are very little satisfying still, to the soul of the astronomer pursuing his science for itself alone. It was said, for instance, 'no modern im-

'prover must presume to disturb an ancient dis-
'coverer, therefore the modern astronomer must
'not remove the long-established Greek names of
'both stars and constellations.' But as we have just seen, the Greeks were not the original discoverers, earliest observers, or first namers of the stars and groups of stars; and for us to be keeping up *their* nomenclature, is only confirming the success of their unjust appropriation of the works of their predecessors; and approving their anticipatory fracture also of our well-considered rules and principles of just procedure.

Again it was said, and said triumphantly, in opposition to the proposed reformation, 'that the
'existing system of constellations maintains the cor-
'respondence between the old astronomy and the
'new; while, moreover, the ancients having looked
'to the rising and setting of certain constellations,
'for their times of ploughing, sowing, sailing, and
'ailing, a general knowledge of the scheme is neces-
'sary for understanding their poets, historians, phy-
'sicians, and writers *de Re Rusticâ*.' But this apology evidently fails, in the first place, by, as before, not going far enough back on the stream of time to reach the real ancients; for Greek authors are the earliest ones alluded to in this extract: and in the second place, by indicating that the method of observing the constellations then in vogue amongst the Greeks, was so weak in execution and erroneous in principle, that no working astronomer

of the present day would care to inconvenience himself very much in his daily practice, for the sake of keeping up the glorious memory of such very poor ancients as those, in the matter of *practical astronomy*.

With whom rests the right to name, or re-name.

Especially too will this be the feeling among workers of the present day, when they discover that the much earlier races of men who really invented those constellations which the Greeks afterwards appropriated, had far more accurate ideas and more successful methods of making astronomical observations; for they observed stars, not at their *risings and settings*, but at their *meridian transits*. So that in times far before those of the Greeks,—the mere existence of this method at once indicates, that there were then a more exact astronomy, better knowledge of physics, and truer understanding of mechanics actually in practice, than that ingenious people of Hellas in after times ever possessed a notion of; in fact, an astronomy as much superior to the early Greek, as the primitive religion of mankind (whencesoever that might have been derived)[1] was purer than the Grecian mythology. We can indeed hardly paint in words sufficiently powerful the not decline merely, but the positive catastrophe, which befell the practice of astronomy when, from the hands

[1] See *Thoughts on the Doubts of the Day*, by the Dowager Lady Shelley: London, 1864; especially pages 16 to 20.

of those who *directed* the building of the Great Pyramid,—in part to commemorate the then polar star, equatorial star, and equinoctial point being all on the meridian together (see Plate VIII.)—it passed on to Phœnicians, Egyptians, and Greeks, to be by them employed not only on less well selected stars for chronological purposes; but, on risings and settings, in place of meridian passages!

This method of *meridian* observation, which so signally marked the pre-Grecian astronomy of the Great Pyramid, and generally of the Pleiades year, —is a main feature likewise of modern astronomy; even as we hope the worship of the true God, the God of the earliest patriarchs of old, is by the grace of God, the inheritance renewed of the present age. So that in seeking, on the score of astronomy, to produce an acquaintance between the earliest and latest times of man upon earth, we find a remarkable resemblance between these two chronological extremes; for on each occasion, the true religion is accompanied by right and learned principles in the grandest of all the sciences. In the last instance indeed, the admirable meridian observation-method was arrived at by the slow development of human learning, gradually working its way through many thousand years of toil, towards the light; but in the former, at least in the case of its chief practical manifestation, or at the Great Pyramid, it was accompanied by proofs both scientific and religious

of having been given at once, and suddenly, to chosen men by Divine inspiration.

This similarity in practical religion and observing methods in astronomy, of either end of man's career, or rather of his earlier, with the present age,—for when the end is to come we know not,—and the total contrast of both of them to all that has been prevailing among nations and people in the interval, —is strangely illustrated in the polar stars of the sky. We have now for the northern hemisphere, a good pole-star, *a* Ursæ Minoris, and the accuracy of modern meridional astronomy is greatly promoted thereby ; five thousand years ago, too, more or less, there was another good pole-star, viz., *a* Draconis, respectable in brightness, and inimitable for proximity to the pole ; but in all the intervening period there has been nothing to compare with either ; as may be instantly perceived on reference to our star-map, Plate VII.

We do not certainly pretend to know any sufficient reason why true astronomy should flourish only when the northern heavens show a good pole-star,—but it has apparently, somehow or other, been so as yet ; and though much is still talked in literature about Greek and Phœnician pole-stars, as used in navigation, they were from six to twelve degrees from the pole, and therefore mightily inexact if looked on as rotation-point references. Neither can we give the mariners of those nations all credit for making the best possible use of what nature placed

at their disposal in that age of the world ; for if, as Chevalier Bunsen states,[1] the Phœnicians employed β Ursæ Minoris, under the name of Astarte, Has, and Hastoreth, queen of the Zidonians, for their polar star, as early as 2000, or even 2200 B.C.,—making as much use of it, and regarding it as holy to them, as the Egyptians did of Sirius to themselves for their ends and their purposes,—we can only say that the Phœnicians did not take the best star, seeing that α Draconis was then at only half the distance from the pole that β Ursæ Minoris was ; and this last star, never even in subsequent years came within some six degrees and a half of the rotation point of the heavens.

Chevalier Bunsen indeed contends in favour of the Phœnician preference, that α Draconis could not compare against β Ursæ Minoris in the matter of brightness ; for according to him, the latter star was of the first magnitude, 'the brilliant one of the *first* magnitude, Beta of the Little Bear,' he writes (vol. iv. p. 350) ; and again, 'this same 'brilliant star β.' But we are quite unaware of his having the smallest authority for asserting that that star was ever above its present size, or of the *third* magnitude only ; and as a little further on, he makes the star belong to the *Great Bear*, we fear that this part of his text, whether by printer's error or otherwise, is not much to be depended on.

[1] *Egypt's Place in Universal History*, vol. iv. p. 353.

The Constellations as means for perpetuating Ideas.

But while we are thus showing the similar stellar facilities for exact astronomy, which the heavens of five thousand years ago, and these alone in all time past, were offering in their day,—to what they are again affording now; and the similar ideas which then prevailed amongst men as to the best method of making astronomical observations, for either the absolute fixation of place, or accurate determination of time,—with what are newly approved of in the world at present,—we are involuntarily affording grounds for an argument, and one of no mean importance, for the continued use of constellation arrangements of some kind.

The modern astronomer in a meridian observatory, working on from year to year, finds the right ascension and declination of a star, spite of the small alterations by precession in such short lengths of time, to be abundantly sufficient, and even very convenient, both for distinguishing the star as by a name, and for directing a telescope to its place in the heavens. But when the most important question for solution, both by that observer and all astronomers, comes to be, the connexion of the present astronomy with that of four thousand years ago,—then, right ascension and declination will neither serve the purposes of a name, nor the uses of a ready finder; for truly we may say, *a* Draconis we know, and the

Pleiades we know,—but who are right ascension 12h. 4m. 26s., with declination 86° 18′ 0″, and right ascension 23h. 58m. 45s., with declination 4° 11′ 55″? They are certainly not the present places of the previously mentioned stars, even to the most approximate naked-eye observation; for these places are respectively, right ascension 14h. 0m. 46s., with declination 65° 0′ 53″, and right ascension 3h. 39m. 31s., with declination 23° 41′ 17″; yet are the former very diverse numbers the places after all of the self-same stars about four thousand years ago!

Although these vast variations of numerical positions, would be lessened by adopting ecliptic latitude and longitude in place of right ascension and declination,—the movements of the plane of the ecliptic, in periods so enormous as four thousand years, would prevent such variations disappearing altogether, besides introducing many other inconveniences; but the 'Pleiades in the shoulder of the 'Bull,' remain in that situation age after age, without any sensible change. Hence, if any one had wished to preserve the same names of the stars, and hand down the same ideas unchanged on certain subjects from primitive man to the most distant posterity,—he could not have selected amongst all objects in nature, anything so appropriate and so permanent as the constellation figures of the stars.

As we have these figures now, puerile and absurd though many of them, after repeated altera-

tion, may have become,—they have lasted some two thousand five hundred years or more; and have been employed by hundreds of thousands of millions of men. But in proportion as we are enabled, and the Great Pyramid *has* now enabled us with several of the constellations, to rise above those adventitious accompaniments which mediæval nations introduced, —so do we find the original figures bring us at once into mental companionship with those who lived five thousand years ago, and even with some who enjoyed the privilege of Divine inspiration.

'From the names and emblems of ancient astronomy,' says the author of *Mazzaroth*, referring to the meanings of the words describing the constellations in a primitive language, and confirmed now very remarkably, in some cases (see p. 493), by the Great Pyramid,—'we may learn the all-important 'fact, that God has spoken; that He gave to the 'earliest of mankind a revelation, equally important 'to the latest; a revelation even of those truths, 'afterwards written for the admonition of those on 'whom the ends of the world should come.'

If it be true, as the late lamented Dr. Arnold remarked, 'that modern history is not only a step in 'advance of ancient history, but *the last step*, and 'appears to bear marks of *fulness of time*, as if there 'would be no future history beyond it,'—then every symptom of the extreme beginning being brought by a higher power to be compared with the latter end, and the intervening clouds and mystifications

of heathen nations passing away as a tale that is told, becomes of most intense interest.

But it is time now, that we should leave this single question of the ancient constellations, their origin, character, and meaning,—for a broader consideration of the *whole* contents of that most authentic book of primeval science, which the Great Pyramid proves itself more or less in essence to be.

CHAPTER X.

INTENTIONS AND PURPOSES OF THE GREAT PYRAMID'S MANIFESTATION.

If, in the course of volumes i. and ii. of this work, we have now succeeded in showing, that both the grandeur and stability of the Great Pyramid, as well as the minute perfection of its parts, are a marvel to all practical working men; and if we have also been enabled to prove in Divisions i. and ii., and the earlier chapters of Division iii. in the present volume, that the original metrological and chronological plans,—in memorializing which after a permanent manner all that unrivalled amount and unequalled skill of workmanship were spent;—that those original plans, we say, must have been based on a knowledge of astronomy, geography, and physics, so vastly beyond the powers of unaided man in the day when the Pyramid was built, or indeed within several thousand years therefrom,—that scientifically there is no resource for us, but to allow that the planners of the building must have been assisted by Divine inspiration; and if we have also been

able to set forth in chapter viii. of Division III., that there are both good historical, and sound religious reasons for believing in such Divine inspiration having actually been afforded, or rather perhaps, that Divine commands were given for the work,—then we are arrived at the threshold of a more difficult question still;—viz., why a divinely originated system of weights and measures, should have been constructed in the earlier ages of the world, to be made known to man only at the present latter day? Or, as others choose to express it,—'if the 'Pyramid system be really all that has been repre-'sented, why was it locked up for so many ages, 'instead of being published as speedily as possible, 'to confer its choice advantages on men of all 'times?'

This form of the question travels, we fear, beyond its legitimate ground; for, on the principles apparently taken for granted, men might equally well inquire, why sundry events appointed to special times in the Biblical history of the human race,—were not carried out earlier; especially when St. Paul tells us, that they had been prepared from the beginning of the world. But such principles being evidently erroneous, in a religious point of view,—all inquiries based on them would prove to be in vain. Our time will therefore at present be more safely, as well as more profitably, occupied in investigating,—not why the Great Pyramid metrological system was not published sooner,—but in ascertaining what are

the *accompanying* features observable in the world in our own times, when the publication is at last apparently taking place; and in endeavouring to apprehend what wants of humanity may thereby be supplied, what purpose served, or what good promoted. There are, too, several proposed solutions of this part of the case, already in the field, and highly deserving of attention.

Solution 1?

The first of these proposed solutions says—If the Great Pyramid is—throughout every part of its building—a monument devoted to memorialize a system of weights and measures, it must have been intended to be *used* as such; and if the standards of its system are based on grand earth-features common to all nations alike, giving to no one people an advantage over another,—the system must, by the logic of facts, have been intended to be a universal one, and to be employed by all nations.

This universality is further contended for by the same party, on account of the geographical position of the Great Pyramid in *Egypt*; which land, 'situated between Africa and Asia, and in easy 'communication with Europe,' was long ago described 'as the centre of the ancient civilized world;' and has been more recently computed by modern science, to be the effective surface-centre of all the inhabited regions of the globe taken together, and treated according to the number and importance of

their populations. Wherefore, if the special question is then put, as to why so admirable and universal a system is only just now produced,—an answer comes to the effect—that mankind was not prepared for general peace and universal brotherhood sooner; and under these social circumstances alone, can one system of weights and measures ever be expected to obtain all the wide world over. Steam-navigation, railway-travelling, the electric telegraph, universal expositions, and international commerce, are now progressing at such accelerated pace, it is contended, that one weight and one measure will soon be required for the merchant princes trafficking over a whole world; and here, just at this very point of time, the Great Pyramid,—situated precisely at the crossing of all the many roads employed by modern commerce, in passing between the East and the West, the North and the South,—has disclosed its system—the most universal in its arrangements and the most scientifically founded in its standards of any that has yet appeared; leaving even the metrical system of the French *savants* a long way behind it. What, then, can the Great Pyramid system be disclosed for, it is argued, at this juncture, but to supply the new wants of humanity, and herald in some of the accompaniments of the promised millennial peace and good-will to all men?

In answer to this statement, it must be confessed, we imagine, that if there is ever to be one weight and one measure for all nations, the Pyramid system

would be the fairest and best; and is in so far worthy the earnest attention of all good men who look towards the future, and desire the ultimate benefit of the whole human race. But we are not sure that the occasion for such a system as painted in the last paragraph, is likely to occur for an indefinite length of time yet. Sager persons than ourselves have doubted long since, whether the growth of mere material prosperity and increased means for driving the wheels of commerce faster than ever, *are* of themselves doing much for peace and good-will to all men. Wealth is accumulating in special localities and for the few, much more rapidly than of old,—but the poor remain as miserable as before. A commercial treaty with a new or weak people, is soon followed up by an armament. Insurrectionists carrying fire and sword with them in one country, are contributed openly by the citizens of another pretending to be at peace with it; and in the very centre of Europe and learning, wars are plunged into, neutral nations invaded, non-combatant peasants maltreated, and hecatombs of fighting men are slaughtered with far greater speed than in any earlier epochs of the world, and apparently with less compunction on the consciences of the slaughterers, regal and subject alike. So that, whether by crowned kings, or arrayed nationalities, or needy political conspirators,—war, in this year of grace 1866, is levied at a moment's notice or without it; man's blood is freely taken by his fellow-man; not

a nation considers itself safe except surrounded with its armed hosts, more numerous than at any previous stage of its history, even in open war; and every new invention out of which peace had been expected, has been turned to increase the destruction of battle; while in the eyes of the people at large, success in war, whether just or unjust, has been recently held to take the place of charity in absolving their rulers from every sin, whether of commission or omission, against the laws and institutions of their country.

In presence then of this scene, which the Germany, Bohemia, Italy, Poland, Canada, Mexico, Crete, and even Siberia, of the year 1866, are exhibiting; and in presence of this failure of mere human learning and modern science to put an end to wars and the tumults and destruction of war,—we must express our entire dissent from the supposition of the disclosures of the Great Pyramid metrology having been *intended* to be so timed, as to greet a state of general amity and peaceful communication already existing, and accomplished by themselves, amongst all mankind.

Solution 2?

Well, remarks another solutionist of the case—granted that the revealing of the Great Pyramid's long-kept secret, was not intended to greet a general peace already accomplished over the earth by man, —but why should it not have come to enable him to

accomplish so great a good, by supplying to his hand such a general means for universal amity, as a system of weights and measures, calculated to be, and worthy of becoming, universal to all mankind?

To this question, probably, many persons besides ourselves will be inclined to answer,—that any new instrument suddenly put into the hands of man, as man merely, is not likely in the next few years to have a totally different effect, from all his previous proceedings and developments during the last four thousand years. He has indeed now, and has had for many centuries, the gospel of Christ to assist him in his endeavours after what is right. But it is even with its assistance, as already described, that the so-called peace-establishment of Europe has grown to be something like four millions of armed men. According to gospel principles, too,—as further abundantly shown in the antithesis, by Egyptian history,—no further assistance from the same quarter need be looked for, until there has been full confession on man's part as to his total inability, of himself, to *make* a reign of general peace and good-will over the whole earth,—any more than to work out his own salvation.

How, too, is such an instrument, or one pretending to the same character of a universal metrology, but not from the same source,—being used at this very moment? Why, we are told in the public papers, that Napoleon III., seeking recently to join the South German States to France as a counterpoise to

the late agglomeration of North German States about Prussia,—proposed to them to adopt the French metric system, in place of their old hereditary weights and measures. And we are also informed, that the said South German States fired up with indignation at the proposal; looking on it as neither more nor less than a proposition to them, to abandon everything national and traditional that they had derived from primeval times,—and to become Frenchmen: Frenchmen, too, of the order of those amongst whom the metric system was produced, who publicly as a nation abolished religion and set up atheism, in their capital city, and finished with consigning all their liberties to a military despotism.

Solution 3 ?

Then says a third solutionist,—All the alteration needed in the last proposition is merely this,—that the revealing of the Pyramid's information is to help man to do, what he would never have been able to bring about by his own powers.

There is a very great deal though in that alteration, if it really comes from the Christian heart. We might then too take account, of the unexpected and confirmatory light which the Great Pyramid has thrown,—not only on the question so disputed amongst Churchmen, and in which they were not receiving any more light by the progress of their disputations, viz., as to whether the Sabbath had ever been heard of in the world before Moses;

—but also on the reality of the still more widely disputed, we might even say, of late, generally doubted, phenomenon of the Noachian Deluge. And any further insight whatever into these things must be of extraordinary importance, and possess a ramifying influence through many departments of religious life and progress.

But the main substance of the Great Pyramid, so far as at present ascertained, is metrological; and though we must confess to be quite unable to see our way as to how its system is ever, notwithstanding all its excellences, to become universal amongst men under the present dispensation,—yet we fancy that there may be traced another part which the Pyramid standards are actually fulfilling; and not so much in combining, as in singling out, or rendering more distinct, both certain classes of men and particular characteristics of nations.

Solution 4?

Of olden time, all the mental and physical distinctions between Hebrews and Egyptians, sacred and profane, revealed religion and man-invented idolatry,—were in a manner typified to the eye under the different lengths of the cubits of the two nations. Each of those nations keeping to its own cubit faithfully or pertinaciously; and thereby still further illustrating their inmost thoughts and even principles of action. For the one people adhered to their 25-inch standard, because they believed

that they had been taught by inspired prophets to observe it as a duty appointed of the Lord their God;—while the other people kept to their 20·7-inch standard, merely because it was a species of custom amongst themselves; and, if traditionally traced up, through the Flood, to Cain, and to his invention of it merely as a means of hasting to be rich at the expense of all his neighbours,[1] they saw no particular objection in that.

In later times, however, a third party has appeared on the metrological field, evidently diverse from either of the former; for while it repudiates the *mere* mammon-acquiring character of the last example, it pronounces still more strongly against the revealed religious origin of the other. This party is, of course, that which originated the French metrical system; whose 39·37-inch metre standard was expressly brought out as the product of modern science alone; and as being infinitely more grand in its earth-commensurability, and more ennobling to the soul of man to contemplate, than any other previously known national measures.

But the introduction of this third system on the scene, instead of either confusing the distinctions of the other two chief systems already in possession of

[1] 'He, Cain, augmented his household substance with much wealth, 'by rapine and violence. . . He also introduced a change into that 'way of simplicity wherein men lived before; and was the author of 'measures and weights; and whereas men lived innocently and 'generously while they knew nothing of such arts, he changed the 'world into cunning craftiness.'—Josephus, Book i. chap. ii.

the ground, or throwing them both hopelessly into even shade,—has only made them more broadly and visibly diverse than ever: while it has more especially invested the Hebrew system with new claims to admiration; and such as can be shared in by the whole educated Christian world of the present day. For now has it been discovered,—and mainly through the Pyramid investigations,—that not only does the ancient Hebrew standard possess all the earth-commensurabilities claimed for the French metre,—but it possesses them in a far higher spirit and of a purer kind: while the Egyptian has nothing whatever of the sort.

Hence we might arrange the three systems, or Hebrew, French, and Egyptian,—as representing, best earth-commensurability, indifferent earth-commensurability, and no earth-commensurability at all. Or by looking to what lies at the grounds of the reasons for their having such qualities,—they might be taken as representing attention to the dictates, or a giving way to the domination, of, revealed religion, modern science without any religion, and old idolatry. This, too, will probably be the more instructive manner in which to look at them; for it illustrates strikingly the direction of the progress of society at the present time, and the principles under which both individuals, and even nations, are now classing themselves.

The carrying out, however, of so general a review of the whole world, is for other minds than ours, as

well as for works especially devoted to such questions. Here, we merely attempt to elucidate the subject of the Great Pyramid, so far as may be in our power, or may lie within the compass of a moderate practical astronomer's professional employments,—leaving many other sides of even the Pyramid question to be prosecuted hereafter by other men better adapted therefor. Hence there remains now but one topic which falls within our province to attempt; but this has so much of both home interest and national importance about it, that we do not scruple to ask the reader's attention for a few minutes longer.

Anglo-Saxon Originals in Metrology.

Not only have we shown, in the last pages of vol. ii. and in chapter viii. of this volume, that the sacred Hebrew and Great Pyramid standards of weight and measure may be regarded as identical,—but we have had again and again to point out, that the Anglo-Saxon measures come, in many of their features, so exceedingly close to the above, that the coincidence cannot be accidental. This fact had not escaped John Taylor, nor indeed the anonymous author of the Pyramid book of 1706 (see p. 117),—but they had not advanced very far in ascertaining whence, or how, so remarkable a triple agreement arose amongst three nations or parties now widely removed in both time and geographical limits.

We ourselves have indeed set forth already, in

chapter viii. and elsewhere, reasons for believing that both the Great Pyramid and the Hebrew measures were communicated by inspiration; at very various times in history, but from the same eternal, all-wise, unchanging Source; and *therefore* they are found to be the same, or, that *continuity* prevails with regard to them.

But in such case where, how, and when did the Anglo-Saxons receive their traditional and hereditary measures; so closely alike, that they must either have been copied from one or other of the above,—at a date something more than two thousand years ago,—or have been similarly derived from the same high and original Source as theirs. This latter idea will probably be forbidden by every one, or found by them without any proofs to support it; while, again, the Great Pyramid was a sealed book to all the world, until this present day, when modern science,—aided in part by the dilapidation of the building and the structural features thereby opened up,—has at length been able to assign the chief interpretations. There remains, therefore, only the Hebrew origin as likely or possible; but still extremely distant as well as difficult, and partly because so little is known of the Anglo-Saxon race at any very early dates.

Anglo-Saxons, where from, of old.

At present, indeed, we all appreciate the name as applying to a majority of the inhabitants of Great

Britain and the United States, with their roots among the Scandinavian, German, and Gothic populations of the Continent; but the Anglo-Saxons are no more the aborigines of these European, than of the American, countries where they are now found. They came, indeed, confessedly, according to all history, to these regions from the eastward, within the last eighteen hundred years; and if we inquire of the ethnologists what all the Anglo-Saxon, Scandinavian, German, and Gothic nations are called in their science, we are told 'Indo-Germanic,' or that they all had an eastern and southern origin.

This subject has been followed up more particu- by Mr. John Wilson of Brighton,[1] for the English-speaking races of the Anglo-Saxon, with some remarkable results; one of the first being, that though in the dark ages constituting a part of the Gothic immigrating hosts, and in so far Goths, with whom we are accustomed to connect everything barbarous and savage, they, the Anglo-Saxon portion, and some others too of the Goths, were not savages; but had, on the contrary, the physiological testimony—in large well-formed brains and fine hair—of a race long nurtured in superior intellectual and social culture, besides political proofs of the same in the possession of very complete and wisely devised systems of laws, with orderly manners and customs.

[1] Especially in his monthly serial of 1866 and 1867, entitled *The Watchman of Ephraim*. See *Language as a Criterion of Race*, p. 202, and other papers.

That all Goths were necessarily barbarians, is an idea that has grown up from our first descriptions of them having been unfortunately written for us chiefly by their enemies, whom they were conquering; viz., the pampered and enervated sons of Rome in her decline and decrepitude. To such luxurious debauchees, the simple and regularly-living Goths were of course mere so-called savages, and yet might be more highly appreciative of moral virtue. While as for artistic feeling, and in architecture, where the Romans did little else than servilely follow the Greeks, the Gothic peoples produced an entirely new variety of the art; and so exceedingly exquisite as to oblige all the present world, by the fact, to use the name of Gothic in connexion with the beautiful, just as systematically and frequently as erroneous literary and Roman-derived prejudices have hitherto made us inclined to appropriate it also, to everything the very opposite of beautiful.

The Anglo-Saxons, then, are not, as a Jewish author lately tried to make out, a mere recently sprung horde of northern savages, emerged only the other day from a mud-hole in a German forest; but a race who had been already long accustomed to virtues and refinements in some land, said by the ethnologists to be south and east of that which they now occupy; and of that one also where they first appeared to astonished Europe in the midst of carrying out their great military migrations in the several centuries following the Christian era.

What was the country, then, whence the Anglo-Saxons started on that occasion? This is the second point on which Mr. Wilson has reached some most noteworthy results, and by the method of language, applied in a very safe and thoroughly inductive manner; for he distinguishes the traces of the original foundation of a language from the often very numerous facts and sometimes preponderating mass of substance introduced into it at subsequent times; an effect witnessed to the utmost degree in the present day on the Jews in Russia, who all speak German, not because they are of the same original race and stock as the Germans, but because they sojourned in the cities of Germany for several centuries in the middle ages before going to Russia.

The chief importation of this nature which Mr. Wilson finds in the Anglo-Saxon, is from the Persian or Median. In this conclusion he was indeed preceded, as he also acknowledges, by Sharon Turner, and many other writers on the Germanic and Scandinavian languages and peoples.

In so far, indeed, there is nothing contradictory either to ancient tradition or modern science, in deriving the Anglo-Saxons, with some portion of Scandinavians, Slavonians, and Germans, from Persia or Media, as one station merely of a more extensive journey, either by the southern or northern route from thence. In fact, the generally acknowledged theory of the German philologists, given expression to in Bunsen's third volume of *Egypt's Place in*

Universal History, p. 459, brings the modern Germans from further east still than Persia or Media, or from what he terms 'the primeval land, Iran 'proper, *Airyana Vaego*,' or the high land about the sources of the Oxus and Jaxartes, between the fortieth and thirty-seventh degrees of north latitude and eighty-sixth and ninetieth of east longitude, or in Eastern Central Asia; that, says he, was 'the aboriginal Iran proper, inhabited by the fathers 'of the Arians (and consequently our own, as we 'speak the same language.')

But Mr. Wilson does not trace up the Anglo-Saxons,—before they arrived in Media and Persia,—to that primeval land of the Arians; nor to an intervening residence in the Indian Punjaub, whereto Chevalier Bunsen traces his own more immediately connected portion of the great Indo-Germanic peoples. On the contrary, Mr. Wilson finds a separate and distinct line of experiences for the Anglo-Saxon tribes, which begins with traces of greater proximity between the Anglo-Saxon and Persian, than between any other modern European language and Persian; implying for the Anglo-Saxons, and perhaps also the Danes, a longer residence in that part of the world, than for the majority of the Indo-Germans. This remarkable fact, fairly arrived at by an inductive examination of the languages, forms an apparent anomaly in the general ethnological problem, of the highest importance as such, for any philosophical mind to trace up to its

source and explanation. And Mr. Wilson does follow it up further, showing satisfactory indications, after eliminating the Persian and Median imported additions, that there is a small portion of Egyptian or Coptic similarly imported; but that the structure and foundation of the language is Hebraic; one of his closing paragraphs having the following words, 'indeed, *the basis of the English language may, to 'a remarkable extent, be found in the Hebrew.* 'Many of our most common words, and names of 'familiar objects, are almost pure Hebrew. I have 'observed this particularly with regard to the Low-'land Scottish.'

Not only, too, does Mr. Wilson show that this Hebraic foundation of our language could not, as such, have been introduced into it by our copying from the Jews subsequent to our Persian and Median period of residence,—and since the time that the Jews, expelled from Jerusalem, have been a homeless people, scattered abroad amongst all nations,—but he further shows that the Hebrew of the English language specially appertains to one tribe of Israel, who never belonged to the kingdom of Judah at all, and were never therefore to be termed Jews; a tribe, indeed, which formed the head of the historical opposition to Judah, viz., Ephraim,—with its capital city of Samaria, and the kings thereof, usually termed Kings of Israel.[1] Hence the Hebraic por-

[1] As an illustration of what the Ephraimite feature of the Hebrew was, the reader may be reminded that the Bible mentions (Judges xii.)

tion of the Anglo-Saxon language may be called either Ephraimite or Israelite with historical truth, but never Jewish.[1]

Now, this is without doubt a very capital point; because as clearly as extensive linguistic connexions can make them so, and agreeably with all the principles of language applied to ethnological science,—and which indeed seldom has such broad and ample foundations to work upon, in its ordinary discussions and conclusions,—the Anglo-Saxons are shown to

that the men of Ephraim could not say *Shibboleth*, but only *Sibboleth*; Samaria also for Shemar; and Mr. Wilson gives the following list of English words derived from the Hebrew, but by an Ephraimitic road, or a dropping out of the difficult '*h*' after the '*s*' at the beginning of the word.

English Word.	Hebrew Word.	Meaning in English of the Hebrew Word.
Sever,	Shaver,	To break or tear.
Sabbath,	Shabath,	To rest.
Sad,	Shad,	Desolation.
Scaith,	Schacath,	Destruction.
Steep,	Shatap,	To drown.
Slake,	Shalak,	To lay.
Saim (fat of swine),	Shaman,	Fat.
Son,	Shanah,	Repetition.
Sift,	Shafat,	To judge.
Speak,	Shpak,	To pour out.
Soak, suck, sack,	Shakah,	To give water.
Scale,	Shakal,	To weigh.
Settle,	Shathal,	To plan.

[1] For the correct use of the terms *Israelite* and *Jew*, see Mr. John Wilson's many publications; where, founding on a most extensive study of the appropriate portions of Scripture, he has been able to define the terms almost with the rigidness of mathematical demonstration,—and at the same time to give more expressiveness to the histories of these two most diverse and hostile nations, though they did, indeed, at one time march together under Moses, and were both originally sprung from Israel.

be compounded of the very Israelite people of old; in fact, they are the representatives of those Israelites, or may be said themselves to be of Israelite descent; and therefore heirs of whatever portions of Hebraism were retained, when the more particular *religious* rites of Mosaicism were abolished and superseded by Baalim, under King Jeroboam.

This is the conclusion from the side of language; and is remarkably confirmed by history. For the Israelites were carried away captive from Samaria some two thousand five hundred years ago; and though they have been lost to sight, as such,[1] ever since,—yet it is known (see p. 528), that they were taken northward to the cities of the Medes, and beyond them still. Whence, excepting some very few stragglers, they not only never had any opportunity of returning southward to their Palestinian land,—but they found themselves compelled to move away westward, in that grand current of the human race, by which their then surrounding neighbours, the Arians, Germans, and subsequently many other nations, were in long ages perpetually passing on towards Europe; and never stopped until, in the fourth and fifth centuries after Christ, they had reached the westernmost coasts looking upon the Atlantic. Mixing then with these nations,

[1] Mainly because they have always been looked for as Jews, or a people with Jewish institutions, and *those* distinguishing religious rites of the Mosaic creed,—which they, the Israelites, had most formally abandoned, and made particular war against from the instant that they set up their separate kingdom.

—the Israelites, always a people of strong vitality,—must have prospered in mere numbers; and if the two tribes of Jews in the present day have eight millions of descendants to show, in spite of all their sieges, wars, and persecutions,—and the continual filtering away also from amongst them of their best minds by conversion to Christianity, and subsequent amalgamation with their European neighbours,—the Israelites, could they only be recognised, ought to have with their ten tribes, no less than forty millions. A large amount of leavening to be introduced amongst the present or mediæval inhabitants of Western Europe.

This conclusion, however, of who are the Anglo-Saxons,—viz., a people largely partaking of Israelite admixture,—although it is something of infinite mystery to man, seeing that its chief facts and phenomena ascend to ages far beyond the powers of any Heralds' Office, or the genealogical rolls of the proudest aristocratic, or even royal, family of Europe, to presume to say anything whatever about,—this conclusion, we say, making out a lineal descent for the mass of the nation during no less than two thousand five hundred years, and then attaching them to the most favoured branch of all mankind, and the longest known to history,—has further and most remarkable testimony afforded to it from the Scriptures.

Most ably, and with eminent success, has this side of the general question been treated by Mr.

Wilson, in the several works mentioned below ;[1] to such an extent, indeed, that not only would it be uncalled for in us, to attempt to throw any additional ray of light upon its foundations ;—but we rather believe that there are contained already, and introduced unintentionally, perhaps, in Mr. Wilson's works,—arguments, illustrations, and indications quite sufficient to help forward all religiously inclined minds, towards appreciating not only how the Anglo-Saxons are now found in popular possession of both old Hebrew words, and the ancient Hebrew metrological standards,—but why there should have been Divine inspiration afforded for the first establishment of the Great Pyramid metrology,—and why also it was sealed up in such impenetrable mystery from the time of its primeval realization, to be opened and appreciated only in these latter days, in which we live.

Nevertheless, there is one part of the question which is so purely in the way of inductive inquiry on metrological grounds,—that it seems to fall within our positive duty to attempt,—and we make its study therefore the concluding portion of our book.

[1] *Our Israelitish Origin.*
The Book of Inheritance.
The Millennium.
The Mission of Elijah.
The Watchman of Ephraim (Monthly).
By John Wilson, 34 Norfolk Road, Brighton; and published by W. Macintosh, 24 Paternoster Row, London, E.C.

Metrological Test of the European Races.

The case may be stated thus,—

If the Ephraimitic Israelites are mixed up in all the nations of modern Europe,—and if it is through the former having preserved their old Hebrew standards (as well as many other of their Hebraic peculiarities—though not all, for causes explained by Mr. Wilson in the works already quoted); if it is for these reasons that the now hereditary weights and measures of the said nations are found with so many resemblances to the Hebrew (or the Pyramid standards, which are the same in principle, and more accessible in fact),—then the resemblance ought always to be closer and closer, according to the amount of Ephraimitic blood in each nation. This is evidently only concluding from weights and measures, what has already been deduced from language, and with highly approved results in all educated society. We at once, therefore, proceed to consider, which of the metrologies of modern Europe, comes closest to that of the Great Pyramid.

Now, the metrologies to be discussed in such a case, are, as with the languages previously considered, the popular ones; or those commonly employed by the mass of the people of each country. We turn, therefore, for information upon what they are,—not to any deep or difficult treatise upon the arcana of science, as understood, and understandable only by

a few philosophers;—but to some book of common information for all classes of society. Many such works there are before the public; and among them, few are more commendable for the care with which it is compiled, than that excellent literary, commercial, and general intelligencer, the *Edinburgh Almanac*, by Messrs. Oliver and Boyd. We consult its well-filled interior, accordingly, and find, on page 83, the popular weights and linear measures of each country given in a compendious form, and apparently accurate manner.[1]

Each of these several weights and measures we then compare with the Great Pyramid standard weight and measure; viz., the Great Pyramid pound weight, equal to five cubic inches of the earth's mean density; and the Great Pyramid cubit, equal to one-ten-millionth of the earth's semi-axis of rotation; and the popular quantities of each nation are then (by our own proportions between the Pyramid and British systems, established in Division II.) given in terms of these Pyramid quantities taken as unity. In this manner we obtain—a Table I., exhibiting in its final column, the comparative distance of each European country from the Pyramid, in weight measure. A Table II., exhibiting the same for linear measure. And a Table III.,—to which most importance is attachable,—exhibiting the countries similarly in

[1] Title,—'Foreign Weights and Measures.—General Table of Metrical Equivalents, showing the Contents of the principal Weights and Measures in the Standards of Great Britain and France.'

order, but for the combined mean influence of both weight and linear measures ; as thus :—

TABLE I.—WEIGHT.

Name of Country or Place.	Name of Weight.	Equivalent in British grains.	Equivalent in terms of Pyramid Pound = 1.	Distance from Pyramid Pound in terms of the same = 1.
Great Pyramid,	Pound, .	7,196	1·000	·0
Prussia, .	Pound, .	7,219	1·003	·003
Spain, . .	Libbra, .	7,101	0·987	·013
Portugal, .	Arratel, .	7,083	0·984	·016
Great Britain,	Pound avoir.	7,000	0·973	·027
Denmark, .	Pound, .	7,720	1·073	·073
Sweden, .	Skalpund,	6,563	0·912	·088
Russia, .	Pound, .	6,318	0·878	·122
Austria, .	Pound, .	8,645	1·201	·201
Leghorn, .	Libbra, .	5,240	0·728	·272
France, .	Kilogramme,	15,432	2·144	1·144
Turkey, .	Oke, .	19,800	2·752	1·752

TABLE II.—LENGTH.

Name of Country or Place.	Name of Linear Measure.	Equivalent in British inches.	Equivalent in terms of Pyramid Cubit = 1.	Distance from Pyramid Cubit in terms of the same = 1.
Great Pyramid,	Cubit, .	25·025	1·000	·0
Denmark, .	Ell, . .	24·71	0·987	·013
Great Britain,	Ordnance Map, mile representative, .	25·344	1·013	·013
Prussia, .	Ell, . .	26·26	1·049	·049
Sweden, .	Ell, . .	23·38	0·934	·066
Turkey, .	Pik, .	27·00	1·079	·079
Leghorn, .	Braccia, .	22·98	0·918	·082
Russia, .	Archine, .	28·00	1·119	·119
Austria, .	Ell, . .	30·66	1·225	·225
Spain, . .	Vara, .	33·38	1·334	·334
British Yard,	Yard, .	36·00	1·439	·439
France, .	Metre, .	39·37	1·573	·573
Portugal, .	Vara, .	43·18	1·726	·726

TABLE III.—WEIGHT AND LENGTH COMBINED.

Name of Country or Place.	Name of Weights and Measures.	Distance from Pyramid in terms of Pyramid Pound and Cubit = 1.
Great Pyramid, .	Pound and cubit, .	·0
Great Britain, .	Pound avoir. and Ordnance Map mile representative, .	·020
Prussia, . . .	Pound and ell, .	·026
Denmark, . .	Pound and ell, .	·043
Sweden, . .	Skalpund and ell, .	·077
Russia, . . .	Pound and archine,	·120
Spain, . . .	Libbra and vara, .	·174
Leghorn, . .	Libbra and braccia,	·177
Austria, . .	Pound and ell, .	·213
British Yard, .	Pound av. and yard,	·233
Portugal, . .	Arratel and vara, .	·371
France, . . .	Kilogramme and metre, . .	·858
Turkey, . .	Oke and pik, .	·916

In this last table, of cumulative importance, it is not a little striking to see all the Protestant countries standing first and closest to the Great Pyramid; then Russia and her Greek, but freely Bible-reading, Church; then the Roman Catholic lands; then, after a long interval, and last but one on the list, France, with its metrical system—voluntarily adopted under an atheistical form of government, in place of an hereditary pound and ancient inch which were not very far from those of the Great Pyramid; and last of all, Mohammedan Turkey.

It is not always easy for a subject to break away entirely from his old allegiance: and when the French nation formally, or rather with a sudden violence, abolished, so far as they could, both Christianity and the week of seven days, adopting decades

of ten days instead, and in everything almost worshipping decimals,—whose crowning expression was thought to be the new metre standard, or the one-ten-millionth of a quadrant of the meridian,—they probably did not see that they had chosen a number which is the 7th power of 10; or expressible as 10^7.*

This is the number which was likewise selected of old, in both the Great Pyramid and primitive Hebrew systems, for fixing the proportion of the cubit of the Sanctuary to the semi-axis of rotation of the earth; *i.e.*, 10^7 sacred cubits = earth's semi-axis of rotation; and is *there* quite appropriate. But in the French metrical system, which in numerical symmetry and meaning should rather have had 10^{10}, the actual 10^7 is altogether out of place. Yet there it is, established in dominant force over the self-called pure decimal system: and while it must ever remind all Frenchmen of what they once resisted and tried to break away from,—it may typify what the better spirits among them, will by and by be coming back to, in the repentant frame of mind, and with the forgiveness, it is to be hoped, of the accepted though once prodigal son.

Britain in particular, and Israelitic warning.

But with Great Britain, too, we must have a word. Great Britain stands at the head of our scale, and it stands low down as well. The low

* From an anonymous letter, received by post on 16th March 1867.

entry is due to accepting the yard for the country's popular measure of length; and it *is* the present legal length; but as John Taylor, Sir John Herschel, and ourselves, have endeavoured to show, the yard is an invention of a few men in recent times, unauthorized by the spirit or antiquities of the nation; and if other persons ever had any doubt of the importance of the remark, let them look at this Table III., and see Great Britain, by means of the yard, hurled out of all the Protestant countries, driven away from the Saxonic, Allemannic, and Scandinavian nations, and forced to a low position among Latins and Roman Catholics.

The inch, said Sir John Herschel lately, with infinite truth, is the real unit of linear measure in Great Britain; and therewith he proposed a length of 25·025 British inches as a new and far better standard of length for the country, scientifically, than the present anomalous yard of 36 inches. Now 25·025 British inches form the length exactly of the Great Pyramid cubit, so that had the country adopted what was proposed, by its first and foremost scientist, it would have stood near indeed to the Pyramid test of the sons of Joseph. But our Government has not adopted it. We therefore insert instead 25·344 inches, as being the length introduced a few years ago, and now largely employed, in the Ordnance Survey Maps of the whole country, on the scale of 1-2500th of nature,—for the representative of one mile.

In this manner,—we fear we should say by this mere side-wind,—Britain has been placed at the top of the column. But let the island kingdom look well that it does not fall; for not only has the 25·344 inch length not yet travelled beyond the region of the Ordnance Maps,—but the Government has been recently much urged by, and has partly yielded to, a few ill-advised, but active, men, who want these invaluable hereditary measures (preserved almost miraculously to this nation from primeval time, for apparently a Divine purpose), to be instantly abolished *in toto*,—and the recently atheistically conceived measures of France to be adopted in their stead. In which case England would have to descend from her present noble pre-eminence in the metrological scale of nations, and occupy a place almost the very last in the list; or next to Turkey, and in company with some petty princedoms following France, and blessed with little history and less nationality.

'How art thou fallen from heaven, O Lucifer, 'son of the morning!' might then indeed be addressed to England with melancholy truth! Or, more plainly, and in words seemingly almost intended for such a case, and uttered with depressing grief of heart, 'O Israel, thou hast destroyed thyself!'

Well, therefore, might the venerable John Taylor, a few days before his death, exclaim, in reference to the Gallicising attempts then being made before the British Parliament,—'If the people of this country

'does allow its hereditary weights and measures to 'be abolished in favour of the recent French inven- 'tions, it will richly deserve to be driven forth from 'its ancient land, like the Jews of old, and made a 'homeless and abhorred race.'

Some very well-intentioned gentlemen affect to be shocked by such expressions; and argue soothingly that there is no reason to feel any alarm at the prospect of the French metrical system ever coming into vogue in this country,—for that the people of Great Britain would never submit to have foreign weights and measures forced upon them. But this is much like the more than proverbial attempt to cry 'Peace, peace, when there is no peace.' For at the present moment there is in force what is called the 'Permissive Bill,'—rendering it legal throughout the length and breadth of Great Britain to appeal either to French weights and measures, or English, in all commercial transactions on paper; and the last month (February 1867) has witnessed Chambers of Commerce in London, and a meeting at the London Society of Arts, passing resolutions to recommend Government to have the French weights stamped, and rendered in every way of equal force with the English, in all practical buying and selling in shops, both wholesale and retail.

A good example of the mode in which denationalizing schemes of this order are attempted to be pushed, and what the effects would be on the nation adopting them, has recently been obtained

from Russia. For having heard rumours upon rumours perseveringly spread through this country, to the effect that Russia was on the eve of adopting the French metrical system,—I wrote lately to M. Otto Struve, the Imperial Chief Astronomer, at Pulkova, near St. Petersburg; and received from him the information, 'that some years ago there 'had been a little talk about the project, though it 'was soon after entirely dropped on finding,—that 'the proposed change would be to the advantage 'only of a few hundreds of merchants, mostly 'foreigners, but *to the damage of seventy millions* '*of Russian subjects.*'

This is, in fact, the true way of looking at the question of any national metrology; for it is a something which refers to the comforts, conveniences, and most useful employments of the mass of the nation, and especially of the many and the poor.

Yet in Great Britain, those who should feel most directly and immediately concerned, do not seem in any way sufficiently awake to the dangerous crisis which is passing. The heart, indeed, of the mass of the people, we are happy to believe, is not on the wrong side in these metrological matters; it is only apathetic. They have a fond regard of old for their hereditary or national measures; and when they are told of those standards' further connexion with the ancient Hebrew, and descent from the Great Pyramid, metrologies—with all their truly superhuman earth and heaven-commensura-

bility—they exclaim, 'How curious! how interest-'ing! what astonishing coincidences! what wonderful accuracy!' But they do so with folded hands, and allow these more than national heirlooms to be daily removed or destroyed, from before their eyes, by eager, industrious innovators, in fatal league with revolutionists from the other side of the Channel.

Now to have good ideas, but to employ them merely in refraining from doing active evil, was a charge brought against Israel in the time, and by the mouth, of the prophet Elijah. And it is also similar to the judgment pronounced in the New Testament against the seventh and last Church; or, as some interpret it, the Church of these the last times, and which is described in pages of infallible authority as being '*lukewarm, and neither cold nor* '*hot.*' Wherefore the first reforming command addressed to it was, '*Be zealous, therefore,*' if its members would enjoy in the future new and better days.

POSTSCRIPT.

WHILE the last of the above pages were going through the press,—two letters reached me, without signature, but containing so much valuable matter connected with the Great Pyramid,—as to require more than a passing notice here.

The first of them refers to some arithmetical errors in my former book, *Our Inheritance in the Great Pyramid.* These errors had indeed already been discovered by me, and corrected in the present work; their numerical magnitude too was at no time sufficient to interfere materially with the principal results deduced;—but they were errors which should not have been committed; for which I alone am responsible; and if, perchance, there should be something

of the same kind, though of lesser degree, in these volumes,—I trust that whoever may alight on such mistakes, will follow the example of the above letter-writer,—viz., 'repeat both the calculations 'and the reference to original sources for physical data,'—and then he may find with him, 'that the theories advanced in the book, are 'corroborated by some *further striking analogies*.'

One of these, we have already introduced into the text on p. 596; and another, the contents of his second letter, we now append in the unknown author's own words :—

'MEMORANDUM ON THE DIGITS IN π.

'A matter thought worth notice in connexion with π as a leading 'Pyramid-proportion, and with the digits 3 and 7, which are peculiar 'in π (as see below), being also elements in some parts of the Pyramid-'analogies, and especially in the hidden and π connected part—its ver-'tical height taken with extreme footing in encastrements, ℈100 S. 'cubits.[1]

18 *March* 1867.

'PECULIARITY A.

'**Three and a Seventh** is the nearest simple approximation to the 'ratio π.

'PECULIARITY B.

'3 and 7 recur exceptionally among the 9 digits (of decimal arith-'metic, which is man's numeration, and therefore the matter is with 'reference to man) in the decimal fraction of π,—so far as we can at 'present verify it, that is, to 608 places.

'Most of the digits recur with the usual degree of irregularity in 'their relative frequency. But 3 and 7 are peculiar. 3 recurs with 'strikingly more frequency, and 7 with more rarity than any other 'digits. The following table shows the details of this fact :—

Name of Digit.	Frequency of its recurrence.	Ratio per 1000 of each Digit's recurrence. The *average* being 100 for each of the ten Digits.
0	60	99
1	62	102
2	67	110
3	**68**	**112**
4	64	105
5	56	92
6	62	102
7	**44**	**72**
8	58	96
9	67	110
Totals,	608	1000

[1] i.e., = 5833·33, etc., Pyramid inches; or implying a height reckoned from a horizontal plane, 14 inches nearly *beneath* the 'pavement-surface;' see pp. 82 and 140 of this volume.

'PECULIARITY C.

'This greater frequency of 3 and greater rarity of 7, than any other 'digits, *not only* holds true thus in the one long decimal of 608 places; 'but it is a more remarkable fact, as holding true very persistently in 'the shorter subdivisions of the decimal; even where few digits are 'concerned, and we should expect to find some other digits taking a 'turn at leading the frequency and rarity.

'Thus, if we go repeatedly through the decimal, and each time stop 'at—say 21 digits further (3 × 7 digits, characteristic of π; for want 'of natural divisions in the fractional expression), we have as follows:—

Length of Decimal, 3·141592, etc.	Average of all digits.	Threes.	Sevens.
In the *first* 21 digits, the	*average* occurrence is $2\frac{1}{10}$, but there are,	of threes 4, and	of sevens 1
„ 42 „	„ $4\frac{2}{10}$ „	„ 7 „	„ 3
„ 63 „	„ $6\frac{3}{10}$ „	„ 9 „	„ 5
„ 84 „	„ $8\frac{4}{10}$ „	„ 10 „	„ 6
„ 105 „	„ $10\frac{5}{10}$ „	„ 12 „	„ 8
„ 126 „	„ $12\frac{6}{10}$ „	„ 15 „	„ 9
„ 147 „	„ $14\frac{7}{10}$ „	„ 17 „	„ 10
„ 168 „	„ $16\frac{8}{10}$		
„ 189 „	„ $18\frac{9}{10}$		
„ 210 „	„ 21		
„ 231 „	„ $23\frac{1}{10}$		
„ 252 „	„ 25		
„ 273 „	„ 27		
„ 294 „	„ 29		
„ 315 „	„ 31		
„ 336 „	„ 33		
„ 357 „	„ 35		
„ 378 „	„ 38		
„ 399 „	„ 40		
„ 420 „	„ 42		
„ 441 „	„ 44		
„ 462 „	„ 46		
„ 483 „	„ 48		
„ 504 „	„ 50		
„ 525 „	„ 52		
„ 546 „	„ 55		
„ 567 „	„ 57		
„ 588 „	„ 59		
„ (608) „	„ 60·8 „	„ 68 „	„ 44
„ 609 „	„ 61		

These further lengths of the decimal have not been examined,—from want of means of doing it.

'The table of Peculiarity B is taken from a letter of Professor De 'Morgan, in the *Athenæum* for October 27, 1866, page 543, and that 'letter induced its reader to make the further examination here shown '—Table C.

'If it be asked, How are we to regard the foregoing mathematical 'facts?—as mere casual coincidences, such as, according to the laws of 'probabilities, *must* take place sometimes, or as in any sense designed? 'The true reply is, That the idea of casual coincidence and laws of 'probability exist only in relation to the human intellect; not in ex- 'ternal creation taken apart from the intellect which examines it; so 'that, in one sense, and a very important one, there is no such thing 'as casual coincidence, or mere general probability. Every physical 'fact (whether mathematical or physical) is a necessary consequence 'of the working of an established order of creation; but it is not the 'less pre-arranged, in all its details of relations and consequences; and 'yet in harmony with that impression on human intellect which men 'term "laws of probability."

'Not a sparrow falls to the ground, nor a hair from our heads, 'without the Living intelligent God—the *True* God[1]—foreknowing it, 'pre-arranging and attending to it; not merely in *general* terms, but 'down to the most minute detail of *each* atom and *each* event in 'creation, the play of its forces and motions as they be influenced by 'every other atom and event in creation, however insignificant, at 'every moment of time. This perfect forecasting and knowledge and 'attention baffles the utmost stretch of our imaginations. *Can* it 'then be true? but so also do the undeniable facts themselves, as 'they exist in creation,—perfect action of mutual atomic influences 'in endless complication and indefinite minuteness. The *true* God 'must be such, as baffles our intellect.'

[1] 'That is, the *Living* intelligent God, not an impersonal abstract deity, Pan (all 'things), Fate, or the unsentient laws of nature,—the rationalist's idea of God.'

INDEX.

Age of the Great Pyramid, iii. 282.
—— Sphinx, i. 332.
Air and sand together, i. 162.
Aiton and Inglis, Messrs., Pyramid measures by, ii. 302-308.
—— Mr., had the four corner sockets excavated, i. 526.
—— Mr., visit to East Tombs, i. 524.
Alee Dobree's descent, i. 401.
Al Mamoon's accident, i. 158.
—— hole, i. 75.
Altitude-azimuth instrument, i. 428, 429.
Amateur quarrying, i. 214.
American missionaries, visit from, i. 34.
Americans on the top of the Great Pyramid, i. 464-466.
Analysis of Pyramid materials, ii. 295-298.
Ancient ventilating channels, i. 91-94.
—— vertical height of Great Pyramid, iii. 67-70.
Andro-Sphinx, i. 324.
Angle of entrance passage, i. 167, 168; ii. 38.
—— of second Pyramid, ii. 275.
Angle of Grand Gallery, ii. 154-161.
—— importance of, i. 301.
—— inclination of passages, iii. 34.
—— sides of Great Pyramid, iii. 19-33.
—— standards of, iii. 202-215.
Angles and passages, i. 141.
—— from sockets, i. 531.
—— lecture on, i. 215, 216.
Anglo-Saxon originals of metrology, iii. 581.
Anglo-Saxons, where from, of old, iii. 582.
Angular proof, i. 217.
Annual mean temperature in Scotland, iii. 192, 200, 201.
Anomaly discovered, i. 152.
Antechamber, grooves in the, i. 362-365.
—— its passages, ii. 92-100.
Antechamber, King's Chamber, i. 355.
—— portcullis, i. 363-366.
Ants, i. 406, 407.
Arab funerals, i. 229, 230.
Arab gun, i. 401, 402.
—— house, interior of an, i. 499, 500.
—— mode of treating a wound, i. 115.
—— nature excused, i. 35.
—— roughs and Turkish rule, i. 392-394.
Arab sawing, i. 113.
Arab tales of tourists' ways, i. 77.
—— tricks on travellers, i. 394-400.
—— unchanged, i. 496, 497.
—— village described, i. 503, 504.
—— —— surrounded with sand, i. 171.
Arabs and the French consul, i. 129.
Arabs on English justice, i. 130.
Arcadia in Egypt, i. 95.
Architects' modern plans of the Pyramid, iii. 138.
Are sides of Great Pyramid equally inclined? iii. 13-19.
Ark of the Covenant, ii. 463-467, 470; iii. 507-510.
Arragonite chambers, i. 341.

Ascending passage, first, iii. 36.
Ascent of Great Pyramid, i. 447.
A secret sign, i. 153, 154; iii. 310.
Astronomical angular measures, ii. 177, etc.
—— date for the building of the Great Pyramid, iii. 322.
—— observations, i. 425, etc.
—— observations, the last, i. 548, 552.
Astronomy and chronology, proof from, ii. 424-448.
—— close truth of Pyramid, i. 434, 438, 439.
—— of the Egyptian's provincial, iii. 467-469.
—— of the Pyramid symbolical, iii. 251.
Authorities, consequence of their being no contemporary, iii. 367-370.
—— demanded for contemporary monuments, iii. 363-366.
—— for date of Deluge, iii. 489.
—— for the eighteenth and later dynasties, iii. 418-423.
—— historical, iii. 340-355.
Authority for the number twenty-five, iii. 236-240.
—— for twenty-five inches, iii. 232-236.
Ayrton F., Pyramid measures by, ii. 299-301.
—— observations on angle of Great Pyramid, iii. 14-16.
—— thermometers lent by, ii. 198.
Azimuth of entrance passage of Great Pyramid, ii. 189-192.
—— second Pyramid, ii. 276, 277.
Azimuths of Great Pyramid corner sockets, ii. 193-196.
—— rounds of, ii. 184.
Azimuth trenches, ii. 125-127, 185-188; iii. 28-33.

Babylon of Egypt, i. 31.
Barometer indicates a storm, i. 160.
Basalt, black, i. 291.
—— Egyptian, i. 284-287.
—— standard, ii. 9-10.
Base of the Great Pyramid, a square, iii. 10-13.
Bats of the Pyramid, i. 552.
Beard, Dr., on Scripture weights and measures, ii. 456.
Beauregard, Olivier, on Hebrew worship, iii. 512, 513.
Bedouin Arabs, two sides to their characters, i. 393.
Belon, M., on triangular stone in the valley of Jehoshaphat, iii. 543.
Belzoni's discovery of the entrance to the second Pyramid, i. 265, 266.
—— opinion on the casing-stone, i. 205.
Benihassan, tombs of, iii. 402-406.
Bevan, Rev. W. L., on Scripture weights and measures, ii. 456.
Birch, Mr. Samuel, on translating hieroglyphics, i. 316, 317, 320, 321.
—— translation on the tablets of the Sphinx, i. 329-333.
Birds of the desert, i. 296-298.
Bones and burials, i. 313.
Boolak, Museum of, i. 8-15.
Britain in particular, and Israelitic warning, iii. 596.
British Consul, i. 1, 2.
Browne's Rev. H., *Ordo Sæclorum*, iii. 516.
Bruce's account of the simoom, i. 421.
Brugsch, M., date of the Great Pyramid, iii. 242.
—— on the astronomy of the Egyptians, iii. 467, 468.
Bryant, Jacob, Dissertation on Ancient History, iii. 526-528.
Builders of the Great Pyramid, names and dates of the, iii. 314-339.
Bunsen, Baron, date of the Great Pyramid, iii. 241.
—— on the astronomy and geometry of the Egyptians, iii. 466, 467.
—— on the difference between the Great and other Pyramids, iii. 449-451.
—— on the scientific objects of the Great Pyramid, iii. 293-295.
—— views of the Exodus, iii. 445-447.
—— —— true Egyptian history, iii. 359.
Business, a new, i. 523.

CAIRENE PHILOSOPHERS, i. 311.
Cairo, daybreak in, i. 21.
—— opinions of, i. 20.
—— seat of the Egyptian and Scientific Institute, i. 2.
—— theories on casing-stones, i. 209, 210.
—— waiting in, i. 16-19.
Calendar, our, corresponds with the primitive year, ii. 424-428.
Calm after the storm, i. 310.
Camel nature, i. 41.
Camels photographed, i. 482.
Camera described, i. 475-481.
Campbell's Tomb described, i. 315-320.
Candle-carrying, modes of, i. 69.
Canterbury, letter of Archbishop of, iii. 488.
Capacity measure, Pyramid, iii. 174.
—— standard, sacred Hebrew, ii. 460-470.
Caphtorims, the, iii. 524, 526-531.
Casing-stones, angular proof in fragments of, i. 217.
—— existence of, denied, i. 209, 210.
—— —— doubted, i. 204-206.
—— fitted into a model at theoretical angle, iii. 18, 19.
—— fragments of, i. 213, 216-218; ii. 167-170.
—— —— second Pyramid, ii. 277, 278.
Catastrophe, the, i. 239, 240.
Cattle disease, i. 18.
Causation, objects of, iii. 313.
Causeway theories, i. 291, 292.
Caviglia's excavations at the Sphinx, importance of, i. 329.
Ceiling of King's Chamber, ii. 111-113.
Chaldæan temples, iii. 453-455.
Chambers of construction, ii. 113.
Chesney, Colonel, expedition to the Euphrates, iii. 452.
Chippings of stones at Great Pyramid, what became of them? i. 185, 186.
Circle observations inside the Great Pyramid, i. 442, 443.
Circular clinometer, ii. 145-147, 156-158.
Clarke, Captain, A.R. (R.E.), computations on the figure of the earth, ii. 450, 451.
Clarke, Dr., on Al Mamoon's hole, i. 159, 160.
—— on ascending the Great Pyramid, i. 450-452.
—— on Egyptian pebbles, i. 177.
—— on the French troops in Egypt, i. 508, 509.
—— on the tribe of Egyptian lizards, i. 405.
Clayey soil of the Nile, i. 46.
Cleaning in the Pyramid, i. 114, 115.
Clemens Alexandrinus on the religion of the Egyptians, iii. 514, 515.
Coffer belongs to the King's Chamber, iii. 161, 163, 167-169.
—— hitting the, i. 90.
—— in King's Chamber, ii. 104, 105, 114-124.
—— ledge cut in the, i. 86-89.
—— measured, i. 377-388.
—— various accounts of the, iii. 146-150.
Compass points, iii. 211-215.
Composition of the Pyramid hill, iii. 84-86.
Concluding week, i. 517.
Constellations as means for perpetuating ideas, iii. 566-569.
—— with whom rests the right to name or re-name? iii. 562-565.
Consular introduction to the Viceroy, i. 4.
Consultation, a serious, i. 125-129.
Cooking fuel of Cairo, i. 24.
Corner angles of the Great Pyramid, ii. 171-176.
—— sockets, azimuth of the, ii. 193-196.
—— —— diagonals of the, i. 529, 530.
—— —— importance of the, i. 528.
—— —— in theory, i. 524, 525.
—— —— measures of the, ii. 134-136.
Cotton fever, i. 17.
—— growing in Egypt, i. 17.
Country between Jeezeh and the Pyramids, i. 44-45.
Courses, number of, in Great Pyramid, i. 452, 453; iii. 62.

Coventry, A., Esq., circular clinometer presented by, ii. 141.
—— description of clinometer, i. 165, 166.
—— clinometer prepared to measure the Grand Gallery, i. 302, 303.
—— clinometer, satisfactory working of, i. 304, 309-311.
Cross the Nile, i. 39.
Cubit, sacred, ii. 454-460.
Cubits, Sir Isaac Newton on, ii. 341-366.
Cumberland's, Bishop, idea of Scripture weights and measures, ii. 455.
—— on Pyramid weights and measures, iii. 116, 117.
Cuseans retire from Egypt northward, iii. 526.
Cush, sons of, honourably noted in Scripture, iii. 519.
Cycle of a day, ii. 260.
Cyclone without rain, i. 163.

Dashoor Pyramid, account of, important, iii. 26, 27.
Data, hypsometrical, iii. 60-81.
Date of the Great Pyramid, iii. 240, 246.
Date-palms, i. 44.
Datum plane to refer all levels at Great Pyramid, iii. 60.
Deaths frequent, i. 230.
Deluge, date of, iii. 276, 482-495.
Departure, final, i. 561-563.
—— of cleaning party, i. 137.
Derivation of the word 'Pyramid,' iii. 120-122.
Desert birds, i. 296-298.
—— precautions, i. 106.
—— swallows, i. 298.
—— vegetation, i. 521.
Deserted in the Grand Gallery, i. 305.
Determination of weight on the Pyramid system, iii. 175-177.
Diagonal joints in entrance passage, i. 152, 153, 156.
Diagonals of the coffer, ii. 123, 124.
—— of the sockets, i. 529, 530.
Diorite, iii. 100, 101.
Diorite, fragments of, i. 188.
—— sculpture, i. 14.
Dip of entrance passage of second Pyramid, ii. 276.
Discordance of Scripture chronology, iii. 483-485.
Discovery of fragments of casing-stones, i. 216.
Disturbances in measuring, i. 149, etc.
Division of scientific labour agreed on, i. 536, 537.
Dogs, Egyptian, i. 335.
Domestic countings, i. 104, 106.
Dynasty, eighteenth, scenes in the, iii. 423-429.

Earliest contemporary monuments of Egypt, iii. 374-379.
Early Shemites not chosen, iii. 531.
Earth's surface, has it moved? iii. 52-60.
East Tombs, admirably protected from wind, i. 160.
—— excitement at, i. 380-383.
—— first dinner at, i. 99, 100.
—— getting settled at, i. 97, 98.
—— position of convenient, i. 121.
—— selected for residence, i. 63.
Ecclesiastic stranger, i. 198.
Efforts of nature, i. 522.
Egypt, effects of heat and drought in, ii. 7.
—— has never liked strangers, i. 169.
—— justice to, i. 15.
—— kind of hero developed in Egypt, iii. 433-441.
—— treasures of, scattered over the earth, i. 9, 10, 15.
Egyptian and Hebrew metrology, differences of, ii. 454-470; iii. 498.
—— dogs, i. 335, 336.
—— forward politics, i. 109.
—— fowls, i. 103.
—— genius for doing nothing, i. 407.
—— history, earliest proved point of, iii. 356-373.
—— labourers, i. 108.
—— methods of justice, i. 128.

Egyptian monuments, characteristic of, iii. 351-355.
—— morale, i. 101.
—— Scientific and Literary Institute, i. 2.
—— taste for wigs, i. 326.
—— travellers, iii. 349-351.
—— wisdom of, fails to explain the Pyramid, iii. 465-470.
Egyptians, origin of the, iii. 370-373.
—— punished in the building of the Great Pyramid, iii. 528.
Elements of the figure of the earth, ii. 450, 451.
Engineering of Nile banks, iii. 386-390.
Englishwoman in Egypt, Mrs. Poole's, ii. 330.
Engravings of great French work on Egypt, ii. 318-320.
Entrance passage and polar star, i. 433.
—— angle, ii. 144, 145.
—— beginning of, ii. 37.
—— blocked up, who did it? i. 76.
—— breadth and height of, ii. 36.
—— holes in floor of, i. 74.
—— linear measure of floor of, ii. 11-16.
—— masonry, i. 146.
—— of Great Pyramid, azimuth of, ii. 188-192.
—— of roof of, ii. 17-20.
—— of second Pyramid, i. 260-262; ii. 274.
—— of walls of, ii. 21-30.
—— peculiar line in, ii. 27.
—— position of joints in, ii. 34.
—— relative lengths of stones in, ii. 33.
—— shaft of the, ii. 37.
—— view of errors of perpendicularity of axis in, ii. 35.
Eratosthenes' claim as a chronological authority, iii. 348, 349,
Escorted to the city, i. 561.
Ethiopian lake, iii. 411.
Ethological researches by R. G. Haliburton, ii. 370-448.
Excavations, M. Mariette's talent for, i. 11-13.
Exhibitions of photographs, ii. 280-284.
Experiments at the air-channels, i. 411-416.
Exterior faces of Great Pyramid, ii. 165, 166.
—— substance of the Great Pyramid, iii. 93, 94.

Feast of Shemm-en-Neseem, i. 488, 489.
Features in the Grand Gallery, ii. 68-70.
Festival of the Dead, by G. R. Haliburton, ii. 371-403.
Festivities after Ramadan, i. 234-236.
Figure of the coffer, ii. 117.
Final departure, i. 561-563.
—— result of clinometer measures, i. 311.
First ascending passage, breadth and height of, ii. 51.
—— —— total length of, ii. 52-54.
Floor-blocks of stone in entrance passage, i. 149.
Floor-joints in entrance passage, i. 152, 157.
Floor of antechamber, ii. 92, 93.
—— of entrance-passage, ii. 11-16.
—— of King's Chamber, ii. 103, 104.
Floors of the chambers, height of, iii. 71-74.
Forbes, Principal, on latitude mean temperatures, i. 418.
—— on mean temperatures, iii. 188, 189.
Former and present prices in Egypt, i. 542, 543.
Fossil shells, extraordinary number of, i. 410, 411.
Fragments of casing-stones, i. 217; ii. 167.
Freemasons, letters of the, ii. 367-369.
French discovery of sockets, ii. 317, 318.
—— Institute in Egypt, Dr. Clarke's account of the, i. 86-88.
—— measures of the Great Pyramid's height in 1800, ii. 309-317.
—— *savants* allude to the metrological purposes of Great Pyramid, iii. 118.
—— work, engravings of, ii. 318-320.
Fresh-water levels, iii. 74-78.

Gabb, Rev. T., *Finis Pyramidis*, i. 201-203; iii. 118-132.
Gala, native party, i. 135, 136.
General holiday-making, i. 236.
—— proportions of King's Chamber, ii. 101, 102.
Genius, ways of a, i. 278-280.
Geological rock of the region of the Pyramids, i. 171-177.
—— specimens brought home, ii. 293, 294.
Gezeereh, description of the palace of, i. 5, 6.
Gods invented, i. 321.
Goshen, place of, i. 28, 29.
Grand clinometer prepared, i. 303.
—— satisfactory working of, i. 304, 309-311.
Grand Gallery, ii. 68-91.
—— angle, ii. 154-161.
—— —— importance of, i. 300, 301.
—— breadth of, between and above ramps, i. 81.
—— deserted in the, i. 305.
—— invaded in the, by travellers, i. 306-309.
—— measures, i. 237, 238.
—— overlappings of, at north end, ii. 87-91.
—— ramp holes on west side, ii. 81.
—— roof of, ii. 86, 87.
—— total length of, ii. 78.
—— upper or south end of, ii. 73, 74.
—— various measures of the, iii. 221.
—— vertical height of, ii. 84-86.
—— week in the, iii. 219, 222.
Grand Joseph canal, crossed by an Arab stone bridge, i. 56.
Granite, iii. 101, 106.
—— block, size of special, i. 345.
—— coffer, ii. 114.
—— coffer made of, i. 85.
—— constructions contested, i. 356-361.
—— halls, i. 340.
—— leaf, ii. 99, 100.
—— —— so named by Professor Greaves, i. 365.
Granite, square beams and pillars of, i. 342, 343.
Great Pyramid, age of the, iii. 481-485.
—— apparent steps of the, i. 448.
—— ascent of the, i. 448-454.
—— astronomy, iii. 277-285.
—— attestations, iii. 286-291.
—— cemetery, i. 312-314.
—— chippings of the stones at the, i. 184-186.
—— different from all others in Egypt, iii. 141.
—— exterior and substance of the, iii. 93-95.
—— first visit to the, i. 68-96.
—— internal substance of the, iii. 86-92.
—— is the, to be regarded as astronomical? iii. 246-251.
—— latter-day tomb, i. 317.
—— manifestation, proposed solutions of the, iii. 570.
—— metrological monument, iii. 115-122.
—— mode of ascending the, i. 449, 450.
—— night spent on the top of the, i. 454-465.
—— orientation of the, iii. 106-111.
—— preparation of report on the, i. 102.
—— required higher wisdom than man's to originate, iii. 470-478.
—— report on the, i. 67.
—— the beginning of monumental history, iii. 364.
—— the four sides of the, incline at equal angles, iii. 13-19.
—— unity of masonry in the, i. 252, 253.
—— various authorities for date of the, iii. 241-246.
Greaves', Professor, cubit deduced from measures, ii. 337.
—— on the beauty of the architecture of the interior of the Great Pyramid, i. 79.
—— relates a Frenchman's account of lizards, i. 405, 406.
—— standard of measure, ii. 334.

Greaves', Professor, weights and measures of the Pyramid, iii. 117.
Greek inscriptions *versus* Egyptian, i. 328, 329.
Grinding-stone establishment, i. 293, 294.
Guards again give trouble, i. 138.
—— on a cold night, i. 120.
—— question of, i. 64, 65.
Gypsum and its use, i. 553.

Hales, Dr., on the times of Job, iii. 534, 537.
Haliburton's, Mr., letter to Mr. M'Gregor, ii. 368.
—— on the Year of the Pleiades, i. 330.
—— researches bearing on the Pleiades' year, ii. 370-444.
Hamilton's, Sir W., ode on quaternions, i. 453.
Hartnup, J., Esq., instruments tested by, ii. 197.
Hassan, an old Arab, described, i. 228, 229.
Hawk photographed on the wing, i. 483.
Heat measures, ii. 197, 198.
—— question, iii. 193-202.
—— standards, iii. 177-202.
—— whence does such heat come? i. 418-420.
Heights of chamber floors, iii. 71-74.
Height, vertical, of Great Pyramid, ii. 128-133.
Hekekyan Bey's chronology of Siriadic monuments, iii. 7.
—— on Egyptian dynasties, iii. 320.
Hero, the kind of, developed in Egypt, iii. 433-436.
Herodotus as a traveller and chronologist, iii. 349, 350.
—— describes the Pyramid as cased, i. 208.
Herschel's, Sir John, a Draconis theory, iii. 260, 261.
—— blue-fluid, adjusting actinometer, i. 124.
—— date of Great Pyramid, iii. 242-244.
—— on unit of linear measure, iii. 597.
—— outlines of astronomy, iii. 559.
Heth, children of, i. 126.
Hieroglyphic note, i. 246, 247.
Hill, Pyramid, theories, i. 180-187.
—— south of the Pyramids, geology of the, i. 179.
Historical authorities, iii. 342-355.
History, notes in Great Pyramid, iii. 303.
Holes in floor of entrance passage, ii. 14-16.
Horizontal angles at the corner base of Great Pyramid, ii. 176.
—— passage, breadth and height of, ii. 58-61.
Humble, on nummulite rock, i. 172, 173.
Hyksos, invasion of, iii. 406-410.
Hypsometric table of the Great Pyramid, iii. 82.
Hypsometrical reference of the Great Pyramid by M. Jomard, ii. 321.
Hypsometry of the Great Pyramid, iii. 60-81.

Ibraheem, engagement and description of, i. 42.
Igneous agency, no traces on the Pyramid hill of, i. 176.
Importance of the angle of the Grand Gallery, i. 301.
Inclined passages, how much inclined? iii. 32-40.
Inglis, Mr., measures of base of Great Pyramid, ii. 134.
—— —— four sides of the Great Pyramid base, iii. 124-127.
—— —— levels of corner sockets, ii. 136.
—— superintended the excavation of the sockets, i. 526-535.
—— uncovered the four corner-sockets, iii. 11.
Inscriptions, conclusions from the, i. 331-352.
—— on the interior walls of the Pyramid, i. 84.
—— on the Sphinx, i. 327-331.
Inspiration, iii. 479-481, 511, 532-534.
Inspired messengers were foreigners, iii. 521.

Instrumentals, i. 272.
Instruments used in measuring the Great Pyramid, ii. 139-148.
Intentions of the Great Pyramid's manifestation, iii. 570-572.
Interior of an Arab house, i. 500, 501.
Internal measures of coffer, ii. 121.
—— substance of the Great Pyramid, iii. 86-92.
Inundation effects, i. 47.
—— disappearing, i. 143.
Invaded by travellers in the Grand Gallery, i. 306, 307.
Invasion of the Hyksos, iii. 406-410.
Invented gods, i. 321.
Irrigation by wells, i. 28.
Israelitic warning, Britain in particular, and, iii. 597.
Itinerary measures, iii. 209-211.

James, Sir Henry, on the specific gravity of the earth, ii. 452, 453.
—— preparing a star-map, iii. 494.
Jasper pebbles, formation of, i. 177.
Jeezeh, town of, i. 40.
Jomard, M., angle of Grand Gallery given by, i. 302.
—— hypsometrical reference of Great Pyramid by, ii. 321.
Joseph period, iii. 410-414.

Kaliph Al Mamoon's hole, i. 158, 159.
Kater's, Captain, yard standard, ii. 9.
King's Chamber, ii. 101-113.
—— caution on entering, i. 366, 367.
—— difficult to illuminate, i. 367.
—— magnesium photography in, i. 490, etc.
—— peculiar masonry of, i. 371-373.
—— place of the, in the Pyramid, iii. 169-172.
—— various accounts of the courses in the walls of the, iii. 163-166.
—— walls of, i. 83.
King Shafre's tomb, i. 338.
—— a sun-dial, i. 440, 441.
—— who first discovered it? i. 462, 463.

Lane, Mr. E. W., Pyramid measures by, ii. 330-333.
Last of the holiday, i. 238.
Latitude observations, ii. 180-183.
—— observations, check on, i. 447-462.
—— of Great Pyramid, iii. 40-47.
Laws of phenomena, iii. 3-9.
—— of Pyramid decaying, i. 183.
Ledge of coffer unrepresented in the French engraving, i. 86, 87.
—— date of the, i. 89.
Lepsius, Dr., date of the Great Pyramid, iii. 242.
—— inscription on the Great Pyramid, iii. 94.
—— on the permanency of Egyptian buildings, iii. 369.
—— opinion regarding the trenches, iii. 32.
—— Pyramid building theory, i. 183.
Letters, arrival of, from the Consul and Consul-General, i. 115.
Levels, fresh-water, iii. 74-87.
—— of King's Chamber, ii. 162, 163.
—— sea-water, iii. 78.
Lewis, Sir C., ancient astronomy, iii. 550, 551.
—— date of the Great Pyramid, iii. 240, 241.
—— examination into the methods of Egyptologists, iii. 325-327.
Lieder, Dr., death of, i. 59.
—— desert Pyramid, i. 455, 456-464.
Life under the New Empire, iii. 400-448.
—— —— Old Empire, iii. 374-399.
Linear measures, ii. 1, etc., 128, etc.
Lines, particular, on either wall of entrance passage, i. 150, 151.
List of positive photographs, ii. 284-292.
Little girls in Cairo, i. 23, 24.
Lizards, i. 405.
Locusts again, i. 520.
—— arrival of, i. 486, 487.
Longitude, attempt to get the, i. 461, 462.
Long nights and short days, i. 102, 103.
Lordly traders, i. 36, 37.

Lyell, Sir C., on nummulitic formation, i. 174.

Machpelah, Cave of, iii. 543.
Magnesium photography, i. 469, 487, 496, 518-521.
—— the last of, i. 554, 555.
Mahmoud Bey's date of the Great Pyramid, iii. 244, 245.
—— measures of the Pyramid's base, iii. 124, 125.
—— Siriadic theory, iii. 251-260.
Manetho's Egyptian dynasties according to various authors, iii. 321-333.
Manifestation, intention of the Great Pyramid's, iii. 570-572.
Manner of sound coming out of the Pyramid, i. 444-446.
Marble, what is it? i. 206, 207.
Mariette Bey, i. 8, 9.
—— interview with, i. 7, 8.
—— statue of the Pyramid king, i. 344.
—— tablet of Memphis discovered by, i. 12.
Masonry of the entrance passage, i. 146, 147.
—— —— fineness of the joints, i. 147.
Material for standard scales, i. 288.
Materials of the Great Pyramid, iii. 82-106.
Maundeville, Sir John, on his introduction to the Sultan, i. 4, 5.
—— on the Pyramids, iii. 120.
Mazzaroth, by Miss F. Rolleston, iii. 551, 556-559.
Mean daily temperature in the shade, ii. 265, 266.
—— density of the earth, iii. 151, 152.
Measurement, style of, in the entrance passage, i. 147.
Measurer, a lost, i. 280.
Measuring, how to begin, i. 145.
Measures connecting portcullis block with passage, ii. 41-43.
—— in Queen's Chamber, ii. 64-67.
—— of first ascending passage, ii. 44-54.
Measures of Grand Gallery, ii. 70-91.
—— of niche in Queen's Chamber, ii. 66, 67.
—— of ramp-holes, ii. 80-83.
—— of second Pyramid, ii. 271-278.
—— on a slope, i. 148.
Mediæval Sultans, i. 5.
Members of Cairo Institute, i. 3.
Memorial to the Viceroy, i. 4-8.
Memphis, length of the cubit of, ii. 337-340.
Men of the fourth dynasty, iii. 379-383.
Meteorological abstract, ii. 263.
—— inquiry, conclusion of, iii. 291-299.
—— instruments set up, i. 119.
—— journal, ii. 210-259.
—— —— commenced, i. 118.
—— observations, reduction of, iii. 190.
—— Society of Scotland, ii. 264.
—— —— Jerusalem station of, ii. 270.
Meteorology of a mean day at East Tombs, ii. 261.
—— the months, ii. 262-264.
Metrological test of European races, iii. 592.
Metrology, style of it suitable, iii. 509-511.
—— suitable as a subject, iii. 495-498.
Michaelis, on the plans taken by Moses regarding weights and measures, iii. 498-507.
Minister of antiquities, i. 7.
Model of Pyramid, iii. 18, 19.
Modern measures of the coffer, iii. 146.
—— paint misused, i. 84.
Moens' English travellers and Italian brigands, i. 393.
Mohammed's use of sand, i. 163.
Mokattam hills described, i. 50-57.
—— limestone, i. 207.
Molten sea, ii. 467-470; iii. 507-510.
Monumental documents still to be procured, iii. 303-309.
—— history, Great Pyramid, the beginning of, iii. 364.
Morning in Cairo, i. 22.

Morning in the desert, i. 105.
Moses the adopted son of Queen Thuoris, iii. 441-444.
Mulqufs, described, i. 22.
Murchison, Sir R., on the nummulitic formation, i. 174.
Museum of Boolak, i. 10-13.

Names and dates of the builders of the Great Pyramid, iii. 314-339.
Nature, efforts of, i. 522.
Neat quarrying, i. 246.
Newton, Sir Isaac, deduction from Professor Greaves' measures, ii. 337.
—— —— Dissertation on Cubits, ii. 341-366; iii. 134, 135, 510.
Niche in Queen's Chamber, ii. 66-67.
—— in wall of Queen's Chamber, what for? i. 200.
Niebuhr, M. on casing-stones, i. 206.
—— on the granite of the third Pyramid, i. 259, 260.
Night comes on before journey is completed, i. 51.
—— guards described, i. 66.
—— troubles about, i. 227.
—— view from the top of the Pyramid, i. 456-462.
Nile birds, i. 49.
—— cross the, i. 39.
Nile valley, clayey soil of, i. 46.
Norden's, Captain, rules for visiting the Pyramid, i. 368-371.
North air-channel, water experiment in, ii. 207, 208.
Northern air-channel, experiment at, i. 411-414.
Notes on character of surface of east and west walls, ii. 26-28.
—— floor of entrance-passage, ii. 13-16.
—— measures of the walls, ii. 31, 32.
—— roof of entrance-passage, ii. 19, 20.
Nouet's, M., observations on Pyramid latitude, iii. 44, 45.
Nubian slave, pursuit of, i. 227.
Number twenty-five, authority for, iii. 236-240.
Nummulites, i. 172, 173.

Objection, a new, iii. 533.
Observations, check on latitude, i. 447.
—— with the Playfair instrument, i. 547.
Observed angles of casing-stones, ii. 169, 170.
Old Empire, conclusion of the, iii. 397.
—— life under the, iii. 374-399.
Oliver and Boyd's Edinburgh Almanac, iii. 593.
Opinion, theory gives an, i. 534.
Optical measure with Playfair alt-azimuth, ii. 147, 148.
Opticians, i. 275-277.
Ordnance Survey Maps, iii. 597, 598.
—— officers, size and figure of the earth by the, ii. 449, 450.
Original opinion of nummulites, i. 172-174.
Originate, Great Pyramid required higher wisdom than man's to, iii. 470-478.
Origination of the Great Pyramid on religious grounds, iii. 479-544.
—— —— scientific grounds, iii. 449-478.
Origin of the Egyptians, iii. 370-373.
—— —— Sphinx, i. 333; iii. 417.
Orientation of the Great Pyramid, i. 434, 435; iii. 106-111.
—— King Shafre's tomb, i. 439-442.
Ornament on granite leaf, ii. 100.
Osburn, W., as an Egyptian historian and philologist, iii. 340-348.
—— critical acumen of, iii. 434-436.
—— views of the Exodus, iii. 444, 445.
Ovals in the quarry-marks, i. 347-349.
—— of King Shafre, i. 348, 349.
Overlappings of Grand Gallery, ii. 87-91.
Owls, i. 304.
Oxoniensis, letter from, ii. 367.

Palace tomb, i. 337.
Palgrave's experiences of the simoom, i. 420.
Passage, first ascending, ii. 149-151.
—— horizontal to Queen's Chamber, ii. 152, 153.

Passages and angles, i. 141, etc.
—— how much inclined, iii. 35-40.
Paucton, M., on Pyramid metrological purposes, iii. 118, 127-129.
Pavement found, Great Pyramid, ii. 136, 137.
Period of Joseph, iii. 410-414.
Perring's, Mr., idea of the use of the trenches, iii. 32.
Phenomena, laws of, iii. 3-9.
Philition the shepherd, iii. 525, 526, 531.
Photographed, group of Arabs, i. 400.
Photographic subjects, qualities of, i. 480-485.
—— witness, i. 351-353.
Photographs, exhibitions of, ii. 280-284.
—— negative, ii. 279, 280.
—— positive, ii. 280-292.
Photography, a witness, i. 351-353.
—— degrees of quickness in, i. 478, etc.
—— effect of a flight of locusts on, i. 486.
—— self-willed notions of, i. 470, etc.
—— under many difficulties, i. 518, 519.
Playfair alt-azimuth instrument, i. 425-431, 435, etc.
—— in Grand Gallery, ii. 159-161.
—— circle again produced, i. 538.
Pleiades and the Pyramid, iii. 271-277.
—— year a prehistoric tradition, i. 330.
Plumb-bob, Arabs admiration of the, i. 538.
Plunderers plundered, i. 508-511.
Pococke, Dr., observations on the second Pyramid, i. 253, 254.
Points of compass, iii. 209-215.
Polar star and entrance passage, i. 433.
Pole-star, Great and second Pyramid compared with the, i. 438, 439.
—— more observations of the, i. 444-446, 461, 462.
Polyspaston, as mentioned by Vitruvius, i. 186.
Ponderous doors, i. 346.
Poole's, Mrs., *Englishwoman in Egypt*, i. 204.
Portcullis, granite, ii. 40-43, 52-54.
Porterage, mode of, i. 432.
Position of second Pyramid, i. 249.
Prepare to use grand clinometer, i. 302, 303.
Preparations for leaving the Pyramid, i. 546, 555-561.
Present vertical height of Great Pyramid, iii. 61-67.
President at the British Association, Nottingham, quoted, iii. 475, 476.
Prices in Egypt, former and present, i. 542, 543.
Primeval astronomy, iii. 545-569.
—— statue, i. 13, 14.
Proctor, R. A., Saturn and its system, iii. 547, 553.
Prodromus Astronomiæ, iii. 547, 548.
Proportions of King's Chamber, ii. 101, 102.
Proposed reforms amongst the constellations, iii. 559.
—— solutions, iii. 572-581.
Psammetichus the Second, tomb of the time of, i. 319.
Pückler Muskau, Prince, account of, i. 193, 194.
Pyramid and modern workmen, i. 438, 439.
—— astronomy, close truth of, i. 434, 438, 439.
—— base, length of sides, ii. 133, 134.
—— builders and Greek workmen, i. 436, 437.
—— chambers compared, i. 268-270.
—— cleaning, difficulties of, i. 132, 133.
—— competing inscriptions on, i. 72-84.
—— derivation of the word, iii. 120, 121.
—— entrance passage, i. 73.
—— hill, composition of the, iii. 84-86.
—— idea, whence derived? iii. 460-465.
—— king, statue of, i. 344.
—— latitude, iii. 40-52.
—— linear measures, iii. 142.
—— materials, analysis of, ii. 295, 296.
—— mean temperature, iii. 192.

Pyramid measures by Aiton and Inglis, ii. 302-308.
—— —— Ayrton, ii. 299-301.
—— —— Lane, ii. 330-333.
—— —— Vyse and Perring, ii. 322-329.
—— of Suphis, iii. 103.
—— passage blocked up, i. 73.
—— present uses of, i. 71.
—— reach the Great, i. 58.
—— stones, raising, i. 182.
—— theoretics, i. 189.
—— theory, i. 89, 90.
—— two dominant angles of, iii. 204-207.
—— weight measure, tables of, iii. 174, 175.
Pyramids and their kings, iii. 391-396.
—— own rubbish heaps, i. 212-214.
—— pictorial qualities of the, i. 514-516.
—— progress of modern discovery, i. 506, 507.
—— view of the, described, i. 48.

Quadrant, structural reference to the, iii. 207-209.
Quarry-marks, ii. 113.
Quarrying, neat, i. 246.
Queen's Chamber, i. 92, 196-201; ii. 62-67.
—— horizontal passage to, ii. 55-61.
—— measures of the, iii. 229-232.
—— Sabbatical week in the, ii. 222-229.
—— saline incrustation on walls of, i. 199; ii. 56, 63.
—— niche in wall of, i. 200.

Ramadan, arrival of, i. 118.
—— boasting against, i. 139.
—— comes, i. 140.
—— ends, i. 232, 233.
—— its first effects, i. 219.
—— its probable influence, i. 220.
—— rejoicings at the conclusion of, i. 234-236.
—— surpassed, i. 222.
—— troubles of, i. 225.
Radiation effects, i. 273.
Raising Pyramid stones, i. 182.
Ramp-holes in Grand Gallery, ii. 78-84.
Rawlinson's, Rev. G., *Five Great Monarchies of the Ancient Eastern World*, iii. 453, 485.
Reception at Sheikh Deadar's, i. 52, 53, etc.
Reference scale, i. 274; ii. 6-9.
—— scale constructed, i. 294, 295.
—— scales, first and second, i. 282-284.
—— system intended, i. 275, 281, 282.
Reis Alee Shafee and his little men, i. 112, 117.
—— Atfee's appeal, i. 142.
Relations of Pyramid capacity and weight measure, iii. 174, 175.
Religious principles of the Egyptians, iii. 429-433.
Remarkable fragments of stone, i. 290.
Renan, M., assertion on the verticality of the walls of King's Chamber tested, i. 376.
—— date of the Great Pyramid, iii. 245.
—— ideas on Egyptian antiquities, i. 10, 11.
—— on the idolatry of the Egyptians, iii. 426.
—— on the most ancient of temple tombs, i. 339.
—— on the Sphinx, i. 332, 333.
—— theory touching the Sphinx, i. 350-353.
Research *de novo*, iii. 456-460.
Results of Pyramid cleaning, i. 136.
Revue des Deux Mondes for April 1865, i. 11.
Rise of the Theban power, iii. 414-418.
Rocks and ancient rubbish, i. 170.
—— varieties of, i. 175.
Rolleston, Miss, *Mazzaroth*, by, iii. 551, 556-559, 568.
Roof of entrance passage, east and west sides compared, ii. 19.
—— Grand Gallery, ii. 86, 87.
Romé de l'Isle, M., on Pyramid metrical purposes, iii. 118, 130, 131.

Royal Egyptian fly, i. 295.
—— Society of Edinburgh, specimens presented to, ii. 294.
Rougé, M. le Vicomte de, mission to Egypt, i. 12.
Rounds of azimuths, ii. 184.
Rubbish-heaps, examine their composition, i. 187.
—— Pyramid's own, i. 212-214.
Rumours ascending, i. 24, 25.
Russian metrology, iii. 600.

Sabbatical week, iii. 222-229.
Sacred Hebrew standards of weights and measures, ii. 454-470.
Saline incrustations on walls of Queen's Chamber, i. 199; ii. 56, 63.
Salt inside the Pyramid, iii. 95-98.
Sand ribbings, i. 163-165.
—— storm, i. 161-165.
Sands of desert advancing on cultivated land, i. 171.
Sandys, George, describes the Pyramids, i. 505.
—— —— on the Sphinx, i. 325.
Sarcophagus covered, i. 320.
—— of second Pyramid, ii. 271-273.
Savi, Dr. Paolo, explanation of the camel red-bladder phenomenon, i. 41.
Scale-slider of 400 inches, ii. 84, 85.
Scales employed for linear measure, ii. 2.
Scenes in the eighteenth dynasty, iii. 423-429.
Scheme of assistance at the Great Pyramid, i. 7, 8.
Scientific requirements *versus* artistical, i. 472, 473.
Scotland, Meteorological latitude of, ii. 264.
Screw steamer 'Thessalia,' loading of, i. 278.
Scripture chronology, discordances of, iii. 483-495.
Sculpture of diorite, i. 14.
Search for a stone for a standard scale, i. 287-293.
Sea-water levels, iii. 78, 79.
Second Pyramid, i. 243-265.
Secret sign, i. 153.
Servants in Egypt, i. 32, 33.
—— deserted by, i. 37, 38.
Sesostris Ramses, monumental history of, iii. 434-441.
Sextant horizon instrument, ii. 144, 149.
—— method of measuring, i. 168.
Shafre's, King, tomb, well in, ii. 204.
—— temple tomb, i. 339-347.
Shaft of entrance passage, ii. 37.
—— of first ascending passage, ii. 46.
Sheikh Abdul Samed's misfortunes, i. 127-131.
—— —— how he managed the travellers, i. 491-494.
—— —— invited to visit, i. 498, 499.
—— Deadar's arrival at, i. 52.
—— Murri's present, i. 545.
—— of Kafr-el-Batran imposed on Col. Vyse, i. 192.
—— Omer's visit, i. 226.
Shelley, Dowager Lady, *Thoughts on the Doubts of the Day*, iii. 431, 432, 562.
Siculus, Diodorus, on building the Pyramid, i. 184.
Side holes in Grand Gallery, ii. 72-73.
Sidebotham, J., on the use of measuring-rods, i. 423.
—— procured organ-pipes for scales, ii. 7.
Sign, an uninterpreted, iii. 310-313.
Signals just secured, i. 550, 551.
Sieur du Mont descending the Great Pyramid, i. 465.
—— description of Arab character, i. 392, 393.
Simoom, i. 420-422.
Size and figure of the earth, ii. 449-453.
—— of coffer, ii. 123.
—— of various Pyramids, iii. 141.
Sizes of special granite blocks, i. 345.
Skaife's, Mr., pistolgraph, i. 477, 478.
Skulls, price given for, in Cairo, i. 312.
Slave merchant, i. 485.
Slider scales, ii. 3-6.
Slope of Pyramid, i. 446.
Small owls at the Pyramid, i. 304.

Smyth's, Admiral, *celestial cycle*, iii. 550.
—— Rev. Mr., measured south air-channel, i. 415; ii. 164.
Snakes, i. 403, 404, 423, 424.
Social relations, iii. 383-386.
Sockets, discovery of, by the French, ii. 317, 318.
—— peculiar lines marked in the, ii. 27.
—— portraitured, i. 546, 547.
Soil of the Nile valley, i. 46.
Solar radiation, i. 123.
Solitary tree group, i. 178.
Solomon's molten sea, ii. 467-470.
Solutions proposed, on the Great Pyramid's manifestation, iii. 572-581.
South air-channel, water experiment in, i. 414-416.
South hill top, view from, i. 408.
Special qualities of Egyptian basalt, i. 284-287.
—— storm, ii. 267-270.
Specific gravities, iii. 176, 177.
Specific gravity of the earth, ii. 452, 453; iii. 151, 152, 157-161.
Specimens brought home, ii. 293, 294.
Sphinx, an andro-Sphinx, i. 58.
—— described, i. 322.
—— first view of, i. 57, 58.
—— oldest known representation of a, i. 332; iii. 417.
—— various authors on the, i. 324-333.
Spring, signs of, in the desert, i. 402.
Standard of basalt, ii. 9-10.
Standards of angle, iii. 202-215.
—— of heat, iii. 177-202.
—— of measure of Professor Greaves, ii. 334-336.
—— of size, iii. 123-143.
—— of time, iii. 215-218.
—— of weight, iii. 143-177.
Star-maps, explanation of, iii. 283-285.
Starting from Cairo, i. 31-38.
Statue, oldest in the world, i. 13, 14.
Stewart, Mr. Balfour, on specific gravities of limestone and sand, i. 322.
Stone, remarkable fragments of, i. 290.
Stone standard scale intended, i. 284.
Stukeley, Dr., on Stonehenge, iii. 92.
Summit of Great Pyramid, temperature at the, ii. 209.
Sun and shade observations, i. 124.
Suspected fragments of casing-stones, i. 211.
Swallows of the Desert, i. 298.

Tables of metrical equivalents, iii. 594, 595.
Tales of snakes, i. 423, 424.
Taylor, John, first to discover the true angle of sides of Great Pyramid, iii. 20.
—— metrological purposes for the Great Pyramid, iii. 118-120, 133-137.
—— on the origination of the Great Pyramid, iii. 470.
Taylor's, John, opinion of King Cheops, i. 468.
—— Pyramid angle theory, iii. 30-33.
—— religious bearings of the Great Pyramid, iii. 534, 537-543.
—— theory developed, iii. 286.
Temperature, i. 417-420.
—— observations in second Pyramid, i. 262.
—— of wells in Cairo, i. 26-28.
Temperatures, Great Pyramid, ii. 206, 207.
—— of room of second Pyramid, ii. 274.
—— of summit of Great Pyramid, ii. 209.
Temple tombs, most ancient of, i. 339-347.
Time observations, ii. 177-179.
Time of Great Pyramid's performance suitable, iii. 481-495.
—— standards of, iii. 215-218.
Theban power, rise of, iii. 414-418.
Theories of causeways, i. 291, 292.
Theory, angular proof of casing-stone, i. 217.
—— appealed to, i. 533.
—— gives an opinion and is justified, i. 534, 535.

Theory, Rev. Mr. Gabb's Pyramid, i. 201-204.
Thickness of coffer, ii. 120, 121.
Third Pyramid, i. 257-260.
Three methods of observation for the angle of Grand Gallery, ii. 161.
Thuoris, Queen, iii. 441-444.
Tourists, increase of, i. 144.
—— nationalities distinguishable, i. 122.
—— on hot days, i. 121.
Tombs, advantages of, i. 272-275.
—— choosing a home amongst the, i. 59-61.
—— fitting up, i. 113.
—— old and new, i. 312.
—— varieties of, i. 59-63.
Traditions of the Deluge, iii. 490-494.
Travellers, a torrent of, i. 194, 195.
—— confounded, i. 308.
—— on the top of the Pyramid, i. 464-466.
—— on the wall-joints, i. 151.
—— ways, i. 368-371.
Treasure, little found at the Jeezeh Pyramids, iii. 7.
Trenches, azimuth, ii. 125-127.
—— clearing out of the, i. 134, 135.
Trevor, Rev. G., *Ancient Egypt*, iii. 516, 517, 525.
Triangular stone in roof of entrance passage, i. 155.
Truth of wall-joints in entrance passage, i. 150.
Turkish rule and Arab roughs, i. 392-394.

Unexpected result of entrance passage angle, i. 167, 168.
Uses made of the casing-stones, i. 210.

Valentia, Lord, on the object of the Pyramids, i. 265.
Vausleb, M., on the non-squareness of the Great Pyramid, iii. 10.
—— Pyramid theory, i. 181.
Variations of masonry in second Pyramid, i. 254, 255.
Various reported angles of Grand Gallery, i. 302.
Vassalis, M., idea adopted, i. 111.
—— on the Pyramid report, i. 107-110.
—— suggestion, i. 110.
—— superintendent of excavations, i. 65.
Vegetation, desert, i. 521.
Ventilating channels, ii. 164.
Vertical height of Great Pyramid, ii. 128-133; iii. 61-70.
Veryard, Dr., on descending the Great Pyramid, i. 465.
Viceroy, His Highness the, introduction to, i. 4-6.
—— Highness the, gracious decision, i. 30.
—— scheme of assistance proposed, i. 7, 8.
Visit to the fossil-shell hill, i. 407-411.
—— second Pyramid, i. 243-257.
Visitors, measuring hindered by, i. 190-194.
Vyse, Colonel Howard, and Mr. Perring, Pyramid measures by, ii. 322-329.
—— discovery of casing-stones by, i. 208, 209.
—— excavation of Campbell's tomb, i. 317-320.
—— experiences of Egyptian Government assistance, i. 110, 111.
—— first to clear out lower entrance of second Pyramid, i. 267.
—— intelligent visitor's account of, i. 191-193.
—— opened up Al Mamoon's hole, i. 159.
—— Pyramid experiences, i. 189-190.
—— thoughts on the Pyramids, i. 512-516.

Wallace, Dr., of Pyramid materials, ii. 295-298; iii. 97-100.
Wall-joints in entrance passage, i. 150, 151.
Walls of King's Chamber, i. 372-377; ii. 105-111.

Walls of Queen's Chamber, i. 197-199.
Watching for the Citadel guns to fire, i. 139, 140.
Water experiment, i. 298-300.
—— of sepulchre well, i. 344, 345.
Weights and measures, sacred Hebrew, standards of, ii. 454-470.
—— on the Pyramid system, iii. 174, 175.
Week, symbolized in the Grand Gallery, iii. 219-222.
Week, concluding, i. 517.
Well, particulars of, in Grand Gallery, ii. 71.
Well-temperature near the Pyramid, ii. 203-205.
—— Cairo, ii. 201, 202; iii. 191.
What an angle of 26° can do, i. 379, 380.
—— is exactly the angle of sides of Great Pyramid, iii. 19-23.
What is Great Pyramid's latitude? iii. 40-52.
—— is marble? i. 206, 207.
What the carpenter said, iii. 18, 19.
When history was born, iii. 448.
Who invented the oldest constellations, iii. 545-550.
Wilde, Dr., on Egyptian hawks, i. 297.
Wig, the Sphinx's, i. 326.
Wilkinson, Sir Gardner, date of Great Pyramid, iii. 241.
—— on certain royal sandals from Thebes, i. 466, 467.
—— on the casing-stones, i. 210.
—— on the Sphinx, i. 324.
Wilson, Mr. John, on Anglo-Saxons, iii. 583-591.
Winds of the desert, i. 418.
With whom rests the right to name or re-name the constellations? iii. 562-565.
Woodcut views of second Pyramid, i. 254.
Working preliminaries, i. 97.
Workmen rebellious, i. 532.

Year of the Pleiades, i. 330, 331; iii. 263-271.
—— by R. G. Haliburton, ii. 370-448.

EDINBURGH: T. CONSTABLE,
PRINTER TO THE QUEEN, AND TO THE UNIVERSITY.