

# THE PYRAMIDS AND TEMPLES OF GIZEH.



## CHAPTER I.

### OBJECTS AND MEANS.

4. THE small piece of desert plateau opposite the village of Gizeh, though less than a mile across, may well claim to be the most remarkable piece of ground in the world. There may be seen the very beginning of architecture, the most enormous piles of building ever raised, the most accurate constructions known, the finest masonry, and the employment of the most ingenious tools; whilst among all the sculpture that we know, the largest figure—the Sphinx—and also the finest example of technical skill with artistic expression—the Statue of Khafra—both belong to Gizeh. We shall look in vain for a more wonderful assemblage than the vast masses of the Pyramids, the ruddy walls and pillars of the granite temple, the titanic head of the Sphinx, the hundreds of tombs, and the shattered outlines of causeways, pavements, and walls, that cover this earliest field of man's labours.

But these remains have an additional, though passing, interest in the present day, owing to the many attempts that have been made to theorise on the motives of their origin and construction. The Great Pyramid has lent its name as a sort of by-word for paradoxes; and, as moths to a candle, so are theorists attracted to it. The very fact that the subject was so generally familiar, and yet so little was accurately known about it, made it the more enticing; there were plenty of descriptions from which to choose, and yet most of them were so hazy that their support could be claimed for many varying theories.

Here, then, was a field which called for the resources of the present time for

its due investigation ; a field in which measurement and research were greatly needed, and have now been largely rewarded by the disclosures of the skill of the ancients, and the mistakes of the moderns. The labours of the French Expedition, of Colonel Howard Vyse, of the Prussian Expedition, and of Professor Smyth, in this field are so well known that it is unnecessary to refer to them, except to explain how it happens that any further work was still needed. Though the French were active explorers, they were far from realising the accuracy of ancient work ; and they had no idea of testing the errors of the ancients by outdoing them in precision. Hence they rather explored than investigated. Col. Vyse's work, carried on by Mr. Perring, was of the same nature, and no accurate measurement or triangulation was attempted by these energetic blasters and borers ; their discoveries were most valuable, but their researches were always of a rough-and-ready character. The Prussian Expedition sought with ardour for inscriptions, but did not advance our knowledge of technical skill, work, or accuracy, though we owe to it the best topographical map of Gizeh. When Professor Smyth went to Gizeh he introduced different and scientific methods of inquiry in his extensive measurements, afterwards receiving the gold medal of the Royal Society of Edinburgh in recognition of his labours. But he did not attempt the heaviest work of accurate triangulation. Mr. Waynman Dixon, C.E., followed in his steps, in taking further measurements of the inside of the Great Pyramid. Mr. Gill—now Astronomer Royal at the Cape—when engaged in Egypt in the Transit Expedition of 1874, made the next step, by beginning a survey of the Great Pyramid base, in true geodetic style. This far surpassed all previous work in its accuracy, and was a noble result of the three days' labour that he and Professor Watson were able to spare for it. When I was engaged in reducing this triangulation for Mr. Gill in 1879, he impressed on me the need of completing it if I could, by continuing it round the whole pyramid, as two of the corners were only just reached by it without any check.

When, after preparations extending over some years, I settled at Gizeh during 1880-2, I took with me, therefore, instruments of the fullest accuracy needed for the work ; probably as fine as any private instruments of the kind. The triangulation was with these performed quite independently of previous work ; it was of a larger extent, including the whole hill ; and it comprised an abundance of checks. The necessary excavations were carried out to discover the fiducial points of the buildings, unseen for thousands of years. The measurements previously taken were nearly all checked, by repeating them with greater accuracy, and, in most cases, more frequency ; and fresh and more refined methods of measurement were adopted. The tombs around the pyramids were all measured, where they had any regularity and were accessible. The methods of workmanship were investigated, and materials were found illustrating the tools employed and the modes of using them.

5. For a detailed statement of what was urgently wanted on these subjects, I cannot do better than quote from a paper by Professor Smyth,\* entitled, "Of the Practical Work still necessary for the Recovery of the Great Pyramid's ancient, from its modern, dimensions"; and add marginal notes of what has now been accomplished.

"As my measures referred chiefly to the interior of the structure, and as there the original surfaces have not been much broken, the virtual restoration of that part has been by no means unsuccessful; and requires merely in certain places—places which can only be recognised from time to time as the theory of the building shall advance—still more minutely exact measures than any which I was able to make, but which will be comparatively easy to a scientific man going there in future with that one special object formally in view."

Notes of work,  
1880-2.

The whole interior now re-examined and much remeasured, more accurately.

"The exterior, however, of the Great building, is exceedingly dilapidated, and I have few or no measures of my own to set forth for its elucidation. That subject is, therefore, still "to let"; and as it is too vast for any private individual to undertake at his own cost, I may as well explain here the state of the case, so that either Societies or Governments may see the propriety of their taking up the grand architectural and historical problem, and prosecuting it earnestly until a successful solution of all its parts shall have been arrived at."

Total cost of present work  
£300.

"Size and Shape, then, of the ancient exterior of the Great Pyramid, are the first desiderata to be determined."

(A statement of the various measurements of the base here follows.)

"As preparatory, then, to an efficient remeasurement of the length of the Base-sides of the Great Pyramid, itself an essential preliminary to almost all other Pyramidological researches, I beg to submit the following local particulars."

"(1.) The outer corners of four shallow sockets, cut in the levelled surface of the earth-fast rock outside the *present* dilapidated corners of the built Great Pyramid, are supposed to be the points to be measured between horizontally in order to obtain the original length of each external, finished, 'casing-stone' base-side."

Sockets are not corners of base-side.

"(2.) Previous to any such measurement being commenced, the present outer corners of those sockets must be reduced to their ancient corners, as the sockets have suffered, it is feared, much dilapidation and injury, even since 1865; owing to having been then imperfectly covered over, on leaving them, by the parties who at that time opened them."

Sockets are apparently quite uninjured.

"(3.) The said sockets must be *proved* to have been the sockets originally holding the corner stones of the casing; or showing how far they overlapped, and therefore and thereby *not* defining the ancient base of the Great Pyramid *to the amount so overlapped*."

By form of core, and by casing lines lying *within* the sockets, no others are possible.

\* *Edinburgh Astronomical Observations*, vol. xiii., p. 3.

Notes of work  
 1880-2.

. . . . the ground should be cleared far and wide about each corner to see if there are any other sockets in the neighbourhood."

Casing now  
 found on all  
 sides, and  
 completely  
 fixed.

"(4.) Whether any more rival sockets claiming to be the true corner sockets of the ancient base are, or are not, then and in that manner, found,—the usually known or selected ones should further be tested, by being compared with any other remaining indications of where the line of each base-side stood in former days. Some particular and most positive indications of this kind we know were found by Col. Howard Vyse in the middle of the Northern side; and there is no reason why as good markings should not be discovered, if properly looked for, along the other three sides; and they are so vitally important to a due understanding of the case, that their ascertainment should *precede* any expense being incurred on the measurement of lengths from socket to socket."

Measures hav-  
 ing been  
 taken by tri-  
 angulation,  
 no extensive  
 cuttings  
 were needed,

"(5.) Col. H. Vyse found those invaluable markings of the line of the North base-side, or part of the very base-side itself, by accomplishing the heavy work of digging down by a cross cut, through the middle of the heap of rubbish, near 50 feet high, on that side. But he has published no records of how those markings, or that actual portion of the base-side, agree, either in level or in azimuth with the sockets. Indeed, he left the ground in such a state of hillock and hole, that no measures can, or ever will, be taken with creditable accuracy until a longitudinal cut through the rubbish heap shall be driven from East to West and all along between the two N.E. and N.W. sockets."

Casing-stones  
 are not  
 broken up,  
 and the cut-  
 ting is not  
 necessary.

"(6.) The making of such a long and laborious cut, and then the 'lining' and 'levelling' of the bases of the Colonel's casing stones *in situ* (or their remains, for they are said to have been mischievously broken up since then), and their comparison with the sockets or their joining lines by appropriate and powerful surveying instruments, should be the first operation of the new measurers, to whom, it is fervently to be hoped, an intelligent Government will grant the due means for effecting it satisfactorily."

Sides now  
 found by  
 pits, and fix-  
 ed by tri-  
 angulation.  
 Pavement  
 traced on  
 each side.

"(7.) A similar longitudinal cut, and similar comparisons are to be made in the other base-side hills of rubbish, together with a wider clearing away of the rubbish outside, in order to determine the form and proportion of the 'pavement' which is believed to have anciently surrounded the Pyramid; but of which the only positive information which we have, is based on the little bit of it which Col. H. Vyse cut down to near the middle of the North side."

Cuts, if want-  
 ed, might be  
 made for a  
 tenth of this  
 sum.

"This work might cost from £12,000 to £14,000; for the material to be cut through is not only extensive but so hard and concreted that it turns and bends the hoes or picks employed in Nile cultivation, and which are the only tools the Arabs know of. But besides the theoretical value of such an operation for *distinguishing and identifying* the base to be measured, it would certainly yield practically abundant fragments of casing stones, and perhaps settle the oft-mooted questions of ancient inscriptions on the outer surface of the Pyramid."

Inscribed cas-  
 ing found,  
 Greek.

- “ (8.) When the four sides of the base, and the corresponding sides of the pavement are exposed to view,—a new fixation of the exact original places of the precise outer corners of the now dilapidated and rather expanded corner sockets may be required ; and then, from and between such newly fixed points, there must be
- A. Linear measures of distance taken with first-rate accuracy. Done.
- B. Levellings. Done.
- C. Horizontal angles, to test the squareness of the base. Done.
- D. Astronomical measures to test the orientation of each of the base sides. Done.
- E. Angular and linear measures combined to obtain both the vertical slope of the ancient Pyramid flanks, and the distance of certain of the present joints of the entrance passage from the ancient external surface of the Pyramid in the direction of that passage produced—a matter which is at present very doubtful, but a new and good determination of which is essential to utilize fully the numerous internal observations contained in this and other books.” Done.
- “ (9.) When all the above works shall have been carefully accomplished, the men who have performed them will doubtless have become the most competent advisers as to what should be undertaken next ; whether in search of the fourth chamber, concerning whose existence there is a growing feeling amongst those who have studied certain laws of area and cubic contents which prevail among the presently known chambers and passages ; or for the more exact measurement of certain portions of the building which shall then be recognised by the theory as of fiducial character and importance.” Much of the interior now remeasured, with higher exactitude.
- “ (10.) Should the next remeasurement unfortunately not be under sufficiently favourable auspices or powerful patronage enough to attempt all that has been sketched out above—I would suggest to those employed upon it the importance of endeavouring to operate in that manner on at least the north side of the Great Pyramid alone, where much of the work has been already performed, and where traces of the old base-side are known to exist, or did certainly exist 34 years ago.” All results obtained without patronage.
- “ (11.) The levels as well as temperatures of water in the wells of the plain close to the Pyramid, and in the Nile in the distance, should also be measured through a full twelvemonth interval. A meteorological journal should likewise be kept for the same period at the base of the Pyramid, and the corrections ascertained to reduce it either to the summit or King’s chamber levels above, or to the plain level below ; while no efforts should be spared to re-open the ventilating channels of the King’s chamber and to prevent the Arabs from filling them up again.” Channels filled by wind, not by Arabs.
- “ (12.) An examination should be made of the *apparent* Pyramid in the desert almost west of the Great Pyramid ; likewise of the Done.

Notes of work, 1880-2. N.W.diagonal done. Done partly. Done.	northern coasts of Egypt, where they are cut by the Great Pyramid's several meridian and diagonal lines produced ; also of the fourth dynasty remains in the Sinaitic Peninsula ; and of any monuments whatever, whether in Egypt or the neighbouring countries for which any older date than that of the Great Pyramid can reasonably be assigned ; including also a fuller account than any yet published of King Shafre's Tomb and its bearings with, or upon, the origin, education, labours and life of the first of the Pyramid builders."
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6. To carry out, therefore, the work sketched in the above outline, and to investigate several collateral points, I settled at Gizeh in December, 1880, and lived there till the end of May, 1881 ; I returned thither in the middle of October that year, and (excepting two months up the Nile, and a fortnight elsewhere), lived on there till the end of April, 1882 ; thus spending nine months at Gizeh. Excellent accommodation was to be had in a rock-hewn tomb, or rather three tombs joined together, formerly used by Mr. Waynman Dixon, C.E. ; his door and shutters I strengthened ; and fitting up shelves and a hammock bedstead, I found the place as convenient as anything that could be wished. The tombs were sheltered from the strong and hot south-west winds, and preserved an admirably uniform temperature ; not varying beyond 58° to 64° F. during the winter, and only reaching 80° during three days of hot wind, which was at 96° to 100° outside.

I was happy in having Ali Gabri,\* the faithful servant of Prof. Smyth, Mr. Dixon, and Mr. Gill ; his knowledge of all that has been done at Gizeh during his lifetime is invaluable ; and his recollections begin with working at four years old, as a tiny basket carrier, for Howard Vyse in 1837. He was a greater help in measuring than many a European would have been ; and the unmechanical Arab mind had, by intelligence and training, been raised in his case far above that of his neighbours. In out-door work where I needed two pair of hands, he helped me very effectually ; but the domestic cares of my narrow home rested on my own shoulders. The usual course of a day's work was much as follows : —Lighting my petroleum stove, the kettle boiled up while I had my bath ; then breakfast time was a reception hour, and as I sat with the tomb door open, men and children used to look in as they passed ; often a friend would stop for a chat, while I hastily brewed some extra cups of coffee in his honour, on the little stove behind the door ; Ali also generally came up, and sat doubled up in the doorway, as only an Arab can, fold together. After this, starting out about nine o'clock, with Ali carrying part of the instruments, I went to work on the triangulation or measurements ; if triangulating, it was Ali's business to hold an

\* Called Ali Dobree by Prof. Smyth. G is universally pronounced hard by Egyptians, soft by Arabs ; thus either Gabri or Jabri, Gizeh or Jizeh, General or Jeneral, Gaz or Jaz (petroleum).

umbrella so as to shade the theodolite from the sun all day—the observer took his chance ; if measuring, I generally did not require assistance, and worked alone, and I always had to get on as well as I could during Ali's dinner hour. At dusk I collected the things and packed up ; often the taking in of the triangulation signals was finished by moonlight, or in the dark. Then, when all was safely housed in my tomb, Ali was dismissed to his home, and about six or seven o'clock I lit my stove, and sat down to reduce observations. Dinner then began when the kettle boiled, and was spun out over an hour or two, cooking and feeding going on together. Brown ship-biscuit, tinned soups, tomatoes (excellent in Egypt), tapioca, and chocolate, were found to be practically the most convenient and sustaining articles ; after ten hours' work without food or drink, heavy food is not suitable ; and the great interruption of moving instruments, and breaking up work for a midday meal was not admissible. Then, after washing up the dishes (for Arab ideas of cleanliness cannot be trusted), I sat down again to reducing observations, writing, &c., till about midnight. Ali's slave, Muhammed the negro, and his nephew, little Muhammed, used to come up about nine o'clock, and settle in the next tomb to sleep as guards, safely locked in. Having a supply of candle provided for them, they solaced themselves with indescribable tunes on reed pipes ; often joining in duets with Abdallah, the village guard, who used to come up for a musical evening before beginning his rounds. Very often the course of work was different ; sometimes all out-door work was impossible, owing to densely sand-laden winds, which blew the grit into everything—eyes, nose, ears, mouth, pockets, and watches. During the excavations I turned out earlier—about sunrise ; and after setting out the men's work, returned for breakfast later on in the morning. On other occasions, when working inside the Great Pyramid, I always began in the evening, after the travellers were clean away, and then went on till midnight, with Ali nodding, or even till eight o'clock next morning ; thus occasionally working twenty-four hours at a stretch, when particular opportunities presented themselves. The tomb I left furnished, as I inhabited it, in charge of Ali Gabri, and not having been looted in the late revolt, it will, I hope, be useful to any one wishing to carry on researches there, and applying to Dr. Grant Bey for permission to use the furniture.

7. My best thanks are due to M. Maspero, the Director of Antiquities, for the facilities he accorded to me in all the excavations I required, kindly permitting me to work under his firman ; and also for information on many points. It is much to be hoped that the liberal and European policy he has introduced may flourish, and that it may overcome the old Oriental traditions and ways that clogged the Department of Antiquities. Excepting Arab help, I worked almost entirely single-handed ; but I had for a time the pleasure of the society of two artists : Mr. Arthur Melville, staying with me for a week in May, 1881, and

kindly helping in a preliminary measure of my survey base, and in an accurate levelling up to the Great Pyramid entrance ; and Mr. Tristram Ellis, staying with me for a fortnight in March and April, 1882, and giving me most valuable help in points where accuracy was needed, laying aside the brush to recall his former skill with theodolite and measure. Thus working together, we measured the base of survey (reading to  $\frac{1}{100}$ th inch) five times, in early dawn, to avoid the sunshine ; we levelled up the Great Pyramid, and down again (reading to  $\frac{1}{100}$ th inch) ; took the dip of the entrance passage to the bottom of it, and gauged its straightness throughout ; took the azimuth of the ascending passages round Mamun's hole ; callipered the sides of the coffer all over, at every 6 inches, and raised the coffer (weighing about 3 tons), by means of a couple of crowbars, to 8 inches above the floor, in order to measure the bottom of it. For the instrumental readings, in these cases, Mr. Ellis preferred, however, that I should be responsible, excepting where simultaneous readings were needed, as for the base length, and in Mamun's hole. To Mr. Ellis I am also indebted for the novel view of the Pyramids, showing the nine at once, which forms the frontispiece of this work.

To Dr. Grant Bey I owe much, both for occasional help at the Pyramid, in visiting the chambers of construction, the well, &c. ; and also for his unvarying kindness both in health and sickness, realizing the conventional Arab phrase, "My house is thy house." Further, I should mention the kind interest and advice of General Stone Pasha, who gave me many hints from his intimate knowledge of the country ; and also the very friendly assistance of our Vice-Consul, Mr. Raph. Borg, both in procuring an order for my residence and protection at Gizeh, and in prosecuting an inquiry into a serious robbery and assault on me, committed by the unruly soldiery in October, 1881 ; unhappily, this inquiry was a fruitless task apparently, as the military influence was too strong in the examination.

And now I must not forget my old friend Shekh Omar, of the Pyramid village, shrewd, sharp, and handsome ; nor how anxious he was to impress on me that though some people of base and grovelling notions worked for money, and not for their "good name," *he* wished to work for fame alone ; and as he had no doubt I should make a big book, he hoped that I should contract with him for excavations, and give him a good name. I gratified him with one contract, but finding that it cost many times as much as hiring labourers directly, and was not sufficiently under control, the arrangement was not repeated ; but I will say that I found him the most respectable man to deal with on the Pyramid hill, excepting, of course, my servant Ali Gabri, who was equally anxious about his good name, though too true a gentleman to talk much about it. The venerable Abu Talib and the loquacious Ibrahim, shekhs of the Pyramid guides, also conducted themselves properly, and Ibrahim seemed



honestly genial and right-minded in his words and acts, and knew what so few Arabs do know—how not to obtrude. The rank and file of the guides—so familiar, with their little stocks of *antikas* in the corners of old red handkerchiefs—reckoned that I was free of the place, having Ali for my servant; they never gave me the least trouble, or even whispered the omnipresent word *bakhshish*, but were as friendly as possible on all occasions, many claiming a hand-shaking and a hearty greeting. My impression of a year's sojourn with Arabs is favourable to them; only it is necessary to keep the upper hand, to resist imposition with unwearied patience, to be fair, and occasionally liberal in dealings, and to put aside Western reserve, and treat them with the same familiarity to which they are accustomed between different classes. With such intercourse I have found them a cheerful, warm-hearted, and confiding people.

## CHAPTER II.

## INSTRUMENTS.

8. THE list of instruments employed was as follows :

A*	Standard scale, steel	100 inches long, divided to	1 inch.
B*	Steel tape	1,200 "	50 "
C	Steel chain	1,000 "	20 "
D	Pine poles, a pair 1 inch diameter	140 "	10 "
E*	Pine rods, a pair 1 × 2 inches	100 "	1 "
F*	Pine rods, 10 of $\frac{1}{2} \times 1$ "	60 "	1 "
	(Jointing together into two lengths of 250 "	each.)	
G*	Pine rods for levelling } { 3 of $\frac{1}{2} \times 2$ inches	60 "	1 "
	} { 2 " $\frac{1}{2} \times 1$ "	60 "	1 "
H*	Pine rods, 2 " $\frac{1}{2} \times 1$ "	40 and 20 "	1 "
J	Box on mahogany rods, 2 of 1 × 1	25 "	$\frac{1}{10}$ "
K	Boxwood scale, 1'25 × '13	12 "	$\frac{1}{80}$ "
L	Steel scale, 1'07 × '04	12 "	$\frac{1}{10}$ "
M*	Ivory scales, 2 of 1'18 × '08	10 "	$\frac{1}{80}$ "
N*	Boxwood scale, 1'18 × '08	10 "	$\frac{1}{80}$ "
O*	Gun metal scale, 1'06 × '09	6 "	$\frac{1}{80}$ "
P*	Ivory scale, 1'0 × '08	1 "	$\frac{1}{100}$ "

(The divisions of those marked \* are all known to within  $\frac{1}{1000}$  inch).

Q Double calipers, 72 inches long.

R Supports for catenary measurement by tape and chain.

S 10 thermometers for scale temperatures.

a Theodolite { 10 inch circle, divisions 5', vernier 3' } telescope × 35.  
 by Gambay { 7 inch circle, " 10', " 10" }

b Theodolite { 5 inch circle, " 30', " 1' } telescope × 6.  
 by King { 5 semicircle, " 30', " 1' }

c Theodolite { 4 inch circle, " 30', " 1' } telescope × 8.  
 by Troughton { 4 semicircle, " 30', " 1' }

d Box sextant { 1'64 inch radius, division 30', vernier 1'.  
 by Troughton }

e Hand level in brass case.

f Gun metal protractor, by Troughton, 5'9 diam., divisions 30'.

g Mahogany goniometer, 11 and 9 inch limbs.

h Queen's chamber air channel goniometer.

j Sheet steel square, 35 and 45 inches in the sides.

k Folding wooden tripod stand, old pattern.