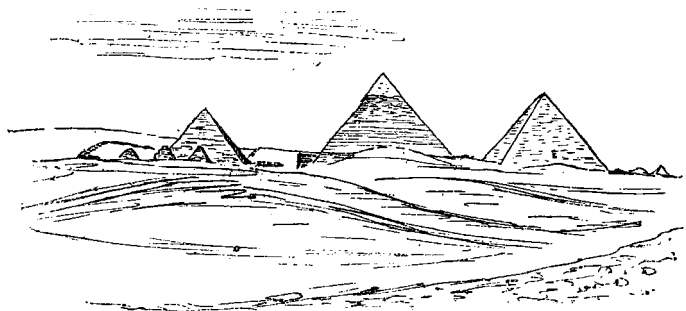


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Excerpt

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I. THE PYRAMIDS OF GIZEH.

CHAPTER I.

THE PYRAMIDS OF GIZEH.

1881-2.

WHEN, in the end of 1880, I first started for Egypt, I had long been preparing for the expedition; during a couple of years before that measuring instruments, theodolites, rope-ladders, and all the *impedimenta* for scientific work, had been prepared and tested. To start work under circumstances so different to those of any European country, and where many customary appliances were not to be obtained, required necessarily much prearrangement and consideration; though on the whole my subsequent experience has been that of decreasing the baggage, and simplifying one's requirements.

The first consideration on reaching Egypt was where to be housed. In those days there was no luxurious hotel close to the pyramids; if any one

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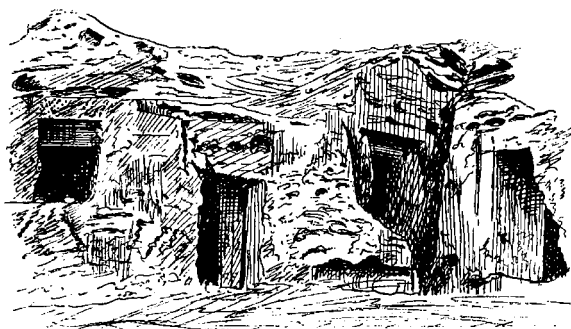
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needed to live there, they must either live in a tomb or in the Arab village. As an English engineer had left a tomb fitted with door and shutters I was glad to get such accommodation. When I say a tomb, it must be understood to be the upper chamber where the Egyptian fed his ancestors with offerings, not the actual sepulchre. And I had three rooms, which had



2. MY TOMB AT GIZEH.

belonged to separate tombs originally; the thin walls of rock which the economical Egyptian left between his cuttings, had been broken away, and so I had a doorway in the middle into my living-room, a window on one side for my bedroom, and another window opposite for a store-room. I resided here for a great part of two years; and often when in draughty houses, or chilly tents, I have wished myself back in my tomb. No place is so equable in heat and cold, as a room cut out in solid rock; it seems as good as a fire in cold weather, and deliciously cool in the heat.

I lived then, as I have since in Egypt, independent of servants. The facilities of preserved provisions, and

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the convenience of petroleum stoves, enable one to do without the annoyance of having some one about meddling with everything. I had one of the most intelligent men of the place, Ali Gabri, to help me with the work, and his nephew and slave used to sleep in the next tomb (on the right of the sketch) as my guards at night. Such was my first taste of sweet independence from civilization.

The object in view for which the work was undertaken was to decisively test the various theories concerning the pyramids, which were then being widely discussed on very insufficient knowledge. If all, or any, of these theories were correct, there were some very tough questions to be picked over between different parties; but the first question to be settled was whether the theories agreed with the actual facts of the case, as if they did not there was no need of further discussion. They must pass the test of fact before they could be further considered on the grounds of their abstract probability or metaphysical coherence. One of the most obvious of all the facts, and most deeply concerned in the various theories, was the actual size of the great pyramid; yet this was not known with any accuracy, the best measurements varying by several feet. Most of the theories involved the notion of extreme accuracy of workmanship, yet we were entirely ignorant of the amount of accuracy in the form of the pyramid, and in most of its internal construction.

It may not be amiss here to point out what is the meaning of accuracy. One often hears that something is 'quite accurate.' If I ask a workman if his

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work is accurate, he will indignantly refer to his foot-rule to prove it; but if you were to ask if his foot-rule is accurate he would doubt your sanity. What is accuracy for one purpose is inaccuracy for another. Children build castles on the sand, and make them perhaps tidy enough; but their accuracy would not do for laying out a garden; nor would the garden bed quite do to regulate the straightness of a tennis court. When a house is planned, still further particularity is needed for the accuracy of its squareness and straightness; and yet the joiner needs a better straight edge than the bricklayer. In turn the joiner's ideas would never suffice for the accuracy of putting together a Forth bridge, with its lengths of furlongs of steel, needed to exactly fit into place. And even beyond that, the telescope maker, dividing his circles, or polishing his object glasses, must attend to quantities which are quite beyond the accuracies of the engineer. There are as many kinds of accuracy as there are of cleanliness, from the cleanness of a clean-swept path, up to the absolute lifelessness and chemical purity of some tedious preparation in the laboratory.

There is, therefore, no such thing as absolute accuracy; what is called accuracy in each business is that amount of inaccuracy which is insignificant. If we want to understand what kind of precision the ancients aimed at, our errors in examining their work must be so small as to be insignificant by the side of their errors. If they went to the nearest hundredth of an inch, we must go to the nearest thousandth, in order to know what their ideas of accuracy were.

The main work of the first season, therefore, con-

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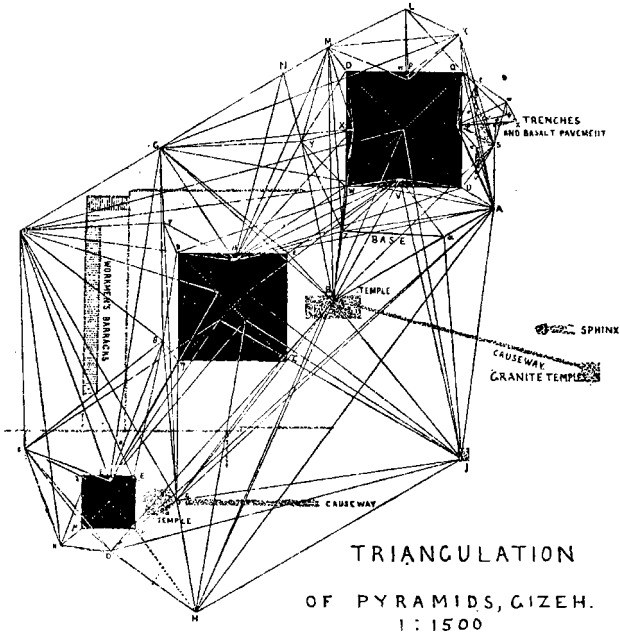
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sisted in making a very precise triangulation all over the hill of Gizeh ; including points around all the three pyramids, and on the temples and walls belonging to them. A fine theodolite was used, by which single seconds of angle could be read ; and the obser-



vations were repeated so many times, that if I finished the work at a single station in one day I was well satisfied. The result of all this mass of checked observations, after duly reducing and computing, was that there was scarcely a point about which one quarter inch of uncertainty remained, and most of the points were fixed to within one-tenth of an inch. These points

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were, however, only arbitrary marks put on suitable spots of the rock ; and it needed a good deal of less elaborate work to connect these with the traces of the ancient constructions near them. The second season I obtained permission from Prof. Maspero to search for the ancient casing and points of construction of the pyramids. Many points were found easily enough ; but some required long and dangerous work. To reach the casing, which still remains at the middle of each side of the great pyramid, was a hard matter ; it was heaped over with broken chips a dozen to twenty feet deep, and they lay so loosely that they soon fell into any hole that we dug. It was needful therefore to begin with a very wide space, and gradually taper the hole, walling the sides roughly with loose blocks. Thus we succeeded in finding the casing on each of the three sides, where it was as yet unknown ; the north casing having been cleared by a huge excavation of Col. Vyze over forty years before. These holes were very ticklish places, make them as we would ; the Arabs dared not work them, and I had to get negroes to face the business. As it was, we could not venture to knock a bit of the stone, for fear of the vibration loosening the sides ; and I was all but buried once, when—just as I had come out of the bottom of the hole—many tons of stones went pouring down the pit from the loose stuff above.

At the third pyramid the difficulty was varied ; there the pyramid was encumbered with loose blocks lying on a bed of sand. So soon then as we dug into the sand, the blocks came sliding down into our hole. But here the matter was settled by adding more stones,

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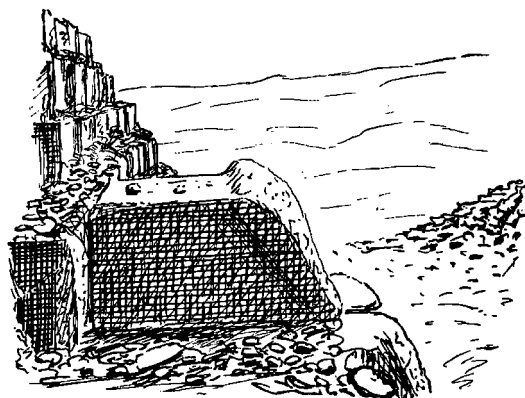
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and so wedging all the blocks around into a ring ; thus they balanced around the hole, and kept each other out.

The casing of the third pyramid has never been finished.

The outer sides of the granite blocks were left with an excess of stone, in order to protect them in transport from Assuan, and this was never removed by dressing



4. GRANITE CASING THIRD PYRAMID.

down, as had been intended. Thus in some examples—as above—the stone sticks out far beyond where the face was to be. In the granite temple the same method was followed, but there the wall was dressed, and hence each stone at the corners of the chambers turns a little way round the adjacent walls, so that the corner is cut out of solid stone all the way up.

The temple of the third pyramid is the most complete, and gives the best notion of the enclosures around the cell or chamber, in which the offerings

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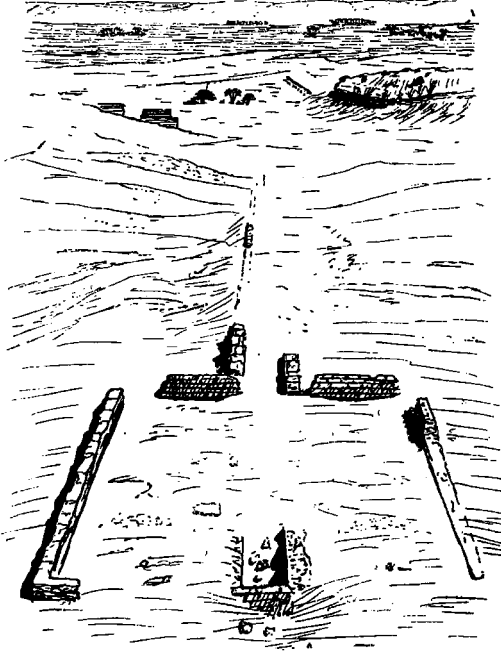
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to the deceased king were presented. This view is from the top of the pyramid, looking down into it. At the end of its causeway are a few trees, and a hill on the right, with remains of another causeway leading from it to the plain.



5. TEMPLE OF THIRD PYRAMID.

Of the inside of the pyramids there were already numerous measurements recorded, which showed that small differences and errors existed in the work ; but some fresh and more accurate methods of examination were needed. Instead then of simply measuring from

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wall to wall, and remaining in ignorance of where the discrepancies lay, I always used plumb-lines for measuring all upright faces, and a levelling instrument for all horizontal surfaces. By hanging a plumb-line in each corner of a room, and measuring from it to the walls at many parts of the height, and then observing the distances of the plumb-lines on the floor, it is easy to find the dimensions of the room at any level, and to know exactly where the faults of construction lie. The same principle gives us the readiest way of examining a solid, such as a sarcophagus; and we can thus, in a few hours, do more than in as many days' work with elaborate apparatus. Some thread, and a piece of wax to stick it on with, are all that is needed beside the plain measuring rods.

The results of thus attacking the subject were, that on the one hand most brilliant workmanship was disclosed, while on the other hand it was intermingled with some astonishing carelessness and clumsiness. The laying out of the base of the great pyramid of Khufu is a triumph of skill; its errors, both in length and in angles, could be covered by placing one's thumb on them; and to lay out a square of more than a furlong in the side (and with rock in the midst of it, which prevented any diagonal checks being measured) with such accuracy shows surprising care. The work of the casing stones which remain is of the same class; the faces are so straight and so truly square, that when the stones were built together the film of mortar left between them is on an average not thicker than one's thumb nail, though the joint is a couple of yards long; and the levelling of them over

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long distances has not any larger errors. In the inside of the pyramid the same fine work is seen : the entrance passage joints are in many cases barely visible when searched for ; in the Queen's chamber, when the encrusting salt is scraped away, the joints are found with cement not thicker than a sheet of paper ; while in the King's chamber the granite courses have been dressed to a fine equality, not



6. CASING BENEATH RUBBISH NORTH OF PYRAMID.
ARAB HOLE ABOVE IT.

varying more than a straw's breadth in a furlong length of blocks.

Side by side with this splendid work are the strangest mistakes. After having levelled the casing so finely, the builders made a hundred times the error in levelling the shorter length of the King's chamber, so that they might have done it far better by just looking at the horizon. After having dressed the casing joints so beautifully, they left the face of the