THE OBELISKS OF PYLON VII AT KARNAK.

An article has appeared in the *Annales du Service*, Vol. XXII, p. 245, by M. M. Pillet, Director of Works for Karnak, in which he carefully estimates the height of the two large obelisks which stood before the pylon which we know as Pylon VII. He arrives at 51 metres for the height of these obelisks by calculation, which he cuts down to some 46 metres as the probable height. To me, this seems an over-estimate.

Let us set out the problem, much as the scribe Ḥori in ancient times put them to the scribe Amenemôpet :—Before Pylon VII we have the base of an obelisk of unknown taper and height. The obelisk dates to Tuthmôsis III. Find the height.

M. Pillet tackles it in this way (I translate from page 245) : " The obelisk must have been much larger than the standing obelisk of Hatshepsôwet. Actually, the south side of its base, which is still intact, measures 3·17 metres, while the mean of the sides of the base of that of Hatshepsôwet measures 2·44 metres and that of Tuthmôsis I 2·107 metres only. The difference of heights of the obelisks of Hatshepsôwet and Tuthmôsis I is, in round numbers, 10 metres (29·50 metres and 19·60 metres), that of their bases 0·34 metre *or* 34 *millimetres per metre* (difference in height ?). Applying these figures to the obelisk of Tuthmôsis III, which measures at its base 724 millimetres more than that of Hatshepsôwet, one finds 51·77 metres for the total height."

Generalised, this is equivalent to saying that, if the difference in the height of two obelisks of very different taper[1] correspond to a certain difference of base measurement, then the difference in height between another obelisk of unknown taper and the larger of the two known obelisks is proportional to the difference in their bases !

The height, on this assumption, appears to have been calculated as follows :—

A base difference of 34 millimetres corresponds to a difference in height of 1 metre.

Therefore 724 millimetres will correspond to a difference of $\frac{724}{34}$ or 21·3 metres.

Hatshepsôwet's obelisk is 29·50 metres high, therefore Tuthmôsis III's obelisk must be $29{\cdot}50 + 21{\cdot}3 = 50{\cdot}8$ metres.

Have we any other obelisk of the same date having a base large enough to make a useful comparison with that of Pylon VII ? That now known as the Lateran Obelisk has a base of 2·87 metres.[2] Let us apply the above calculation to this obelisk, assuming that its height is to be determined from its base-measurement ; here the difference in base measurements is 430 millimetres, so that its height will be $\frac{430}{34}$ or 12·65 metres higher than the obelisk of Hatshepsôwet, making a total height of 42·15 metres. But its height is 32·15 metres only.

[1] By taper I mean the number of units of height required before the obelisk decreases one unit in width.

[2] Gorringe, *Egyptian Obelisks*, p. 145.

On the obelisk of Aswan there is the outline for a smaller obelisk, which it was proposed to extract when the original scheme proved to be impossible owing to the granite being flawed (see my *Aswan Obelisk*, p. 8). The base of this is almost of identically the same size as that of the obelisk before Pylon VII; moreover, the width just below the pyramidion is 2·02, while that of Pylon VII is found, from a fragment, to be 2·08 a trifle lower down the shaft, yet this obelisk is only 32·10 metres high.

The late M. G. Legrain's calculation of the height of this obelisk is correct only if it is assumed that its taper was the same as that of Hatshepsôwet, and that it was *similar*[1] to it in Euclid's sense. This assumption was not justifiable, as the Queen's obelisk tapers 1 in 42·8, which is far less than any other known obelisks, whose mean taper is about 1 in 28. Legrain estimated the length of the obelisk at 37·77 metres,[2] which M. Pillet comments on as being an under-estimate.

As I have pointed out in *The Aswan Obelisk*, p. 42, all known obelisks could have been supported at any point in their length without breaking owing to the stress set up internally due to their own weight, and in ANCIENT EGYPT, 1922, Part IV, I show that, if the upper part of an obelisk now at Constantinople formed part of the problematical 108-cubit (56·7-metre) obelisk mentioned in the inscription of Thutiy,[3] then the stress set up, if supported at its centre of gravity, would be far in excess of the ultimate breaking stress of granite.[4] In other words, it would do what a ship often does in an ice bank, and that is break in two. If we assume that, in the adventures of an obelisk between its quarrying and its erection, it never was liable to be supported for an instant at its centre or its ends, then we must look upon obelisks as evidence, not of clever engineering, but of magic.

Taking M. Pillet's most conservative estimate of 46 metres for the height, let us assume the top and bottom bases to be 2·08 and 3·2 metres (that is a slightly stronger obelisk than that which he assumes was erected) and find what stress is set up when the obelisk is supported at its centre of gravity. I will not give this extremely wearisome calculation at length; a similar one is given in full in the volume on the Aswan Obelisk on page 42. The stress which would be set up in the 46-metre obelisk would be more than 1950 pounds[5] per square inch. Granite, if free from flaws, breaks at 1500 pounds[6] per square inch.

It will be seen from the above remarks that (*a*) mathematically, (*b*) by comparisons with known examples, and (*c*) mechanically, the calculations given in M. Pillet's article might be questioned.

Though obelisks seem to have no very definite relation between base and height as was the case of pyramids, where the height is about equal to the radius of a circle having a circumference equal to the circuit of the base, yet all obelisks, about which I have notes, have their height between 9 and 11 times the length of the base, with the sole exception of Hatshepsôwet's obelisk of which the height factor is 12·3.

[1] It should be noted that obelisks having the same taper are not necessarily *similar* to (that is scale-models of) one another; further obelisks, whose upper portions are identically equal, cannot be similar unless the obelisks are of equal length.

[2] Legrain, *Annales du Service*, Vol. V, p. 12.

[3] Breasted, *Ancient Records*, II, p. 156.

[4] 2,560 pounds per square inch (180 kg. per square cm.).

[5] 137 kg. per square centimetre.

[6] 105 kg. per square centimetre.

When M. Pillet informed me that he estimated the height as over 45 metres, I pointed out on my plan of the Aswan Obelisk the outline of the reduced scheme, and its close resemblance to the Lateran Obelisk and the base of the obelisk of Pylon VII. It may be that his proofs had been passed before his statements could be amended.

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[The simplest point of view is that most obelisks have a height which is between 9 and 11 times the base. The obelisk of Tahutmes III, at Karnak, was probably therefore between 28·5 and 35 metres, 94 and 115 feet, high; so it need not have exceeded the Lateran Obelisk.—F. P.]

[Correction to ANCIENT EGYPT, 1922, p. 102.

I have been checking the calculations in my article on the Constantinople Obelisk, which appeared in ANCIENT EGYPT, as I have long suspected that an error had somehow crept in, since the figure of 5120 lbs./sq. in. seems so very excessive. I find that, by a slip, I have calculated the stress-formula using the Moment of Inertia instead of the Modulus of Section, which is *one-sixth* the cube of the depth of the obelisk and not, as written, *one-twelfth* the cube. This makes the stress set up exactly one half of that given, namely, 2560 pounds per square inch.

This error does not occur in my volume on the Aswan Obelisk, and I am quite unable to account for my lapse. Fortunately, the error does not in any way affect my argument that the Constantinople Obelisk is not part of the 108-cubit obelisk of Thutiy.

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