

A Potentially Significant Dimension Recorded on an Old Kingdom Papyrus from Saqqara

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Abstract

Examination by others of a fragmentary Old Kingdom papyrus from Saqqara suggests that the texts record the construction of the pyramid complex of Teti. Amongst the information obtained from the papyrus was a dimension – 441 cubits. This paper discusses the possible significance of this dimension in the context of Old Kingdom pyramid building.

Introduction

At a conference in June 2013,¹ Professor Philippe Collombert of the University of Geneva, gave a presentation on his work with a highly fragmentary Old Kingdom papyrus.² The previously unstudied papyrus was found by Collombert in an archive at the IFAO in Cairo and initial examination established that the text had been written in a hieratic script, characteristic of the Old Kingdom. Modern notes contained with the papyrus fragments indicated that they had been collected at the pyramid of Unas at North Saqqara, leading Collombert to suggest that their discovery had most likely been made during work undertaken sporadically at that pyramid by J. P. Lauer sometime between January 1937 and May 1939.³ Given the few examples of Old Kingdom papyri known,⁴ the potential importance of these unpublished fragments (hereafter referred to as the Teti Papyrus) was recognised immediately by Collombert and despite its highly fragmentary state, he separated and individually mounted a significant proportion of the fragments onto a series of seventeen plates.

Although it was clear from the outset that the condition of the Teti Papyrus precluded a comprehensive restoration and translation, a number of significant features were recognised by Collombert. On the basis of the most frequently occurring words and phrases, the papyrus appeared to be an account of a construction project, and recurring references to Teti (the first king of the Sixth Dynasty) and to funerary structures, led Collombert to the conclusion that the fragments represent a record of the construction of Teti's pyramid complex at Saqqara.⁵

Arguably, one of the most significant features of the Teti Papyrus are the references to specific dimensions that Collombert identified and which it is assumed, were used in the specification of the Teti funerary complex. For example, Collombert compares a dimension of 200 cubits given in the Teti Papyrus with one of the principal dimensions of the pyramid enclosure (see 'Width of the pyramid enclosure', Table 1 below).⁶ In the context of Old Kingdom pyramid construction in general and the Teti pyramid complex in particular however, the current author considers that a reference to a dimension of 441 cubits,⁷ may have particular significance.

¹ Ancient World Conference, London, 8 & 9th June 2013

² Collombert (2011).

³ Collombert (2011), p 17.

⁴ For a brief summary of the previously identified Old Kingdom papyri, see Collombert (2011), p 19. Note that Collombert (2011) predates the discovery of papyri from the reign of Khufu, that were found on the western shore of the Red Sea, for which see Tallet and Marouard (2014) and Tallet (2016).

⁵ Collombert (2011), p 25.

⁶ Collombert (2011), p 27.

⁷ Collombert (2011), p 20.

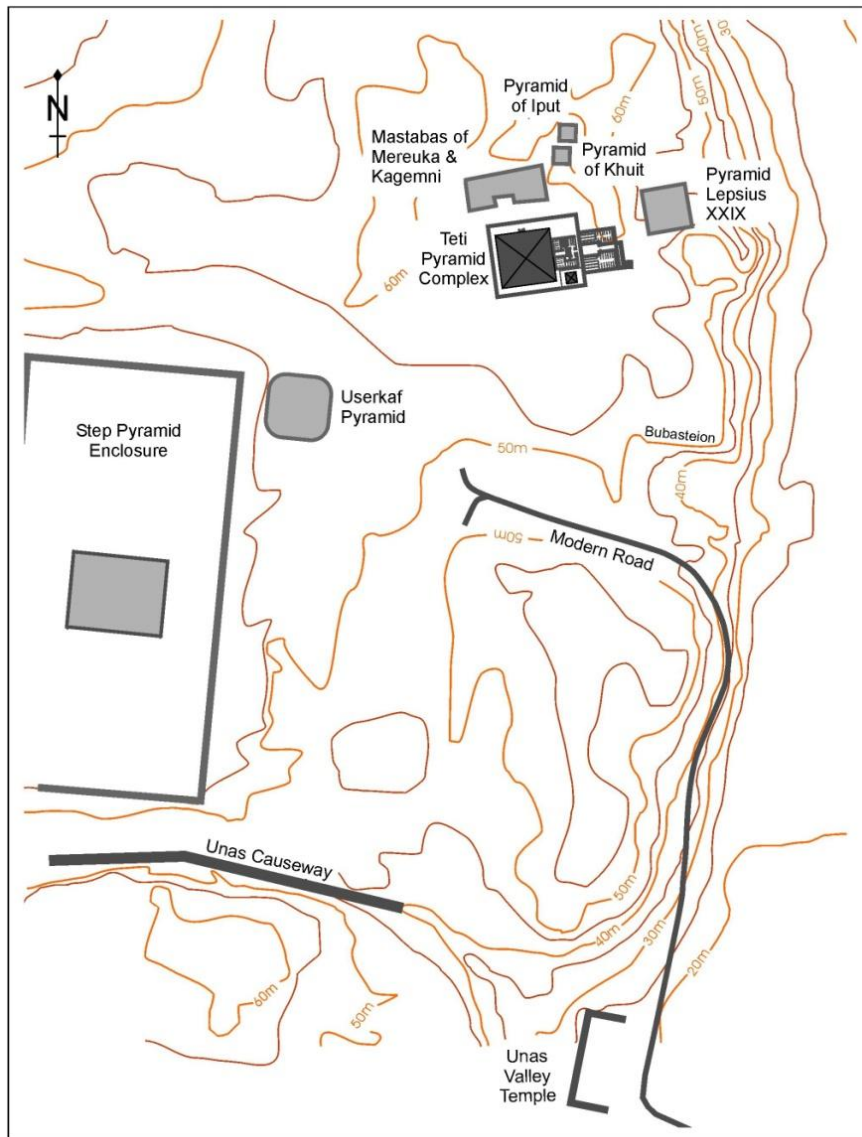


Fig. 1. Overview of North Saqqara showing the relative location of the Teti Pyramid complex (after Egyptian Ministry of Housing and Reconstruction Sheet Cairo H22¹⁶).

The Teti Pyramid Complex

As reconstructed,⁸ the Teti pyramid complex consists of a main pyramid within a walled enclosure, with a single ‘cult’ pyramid in the south east corner of the enclosure (Figures 1 and 2). Although a number of elements of the pyramid temple lie within the enclosure wall, the foreparts of the temple extend some distance eastward beyond the enclosure, to connect with the upper end of the pyramid causeway. The only remains of the causeway that have been identified are at the point where it meets the pyramid temple, at a position that is offset to the south of the central temple axis. It is also notable from published reconstructions that the surviving upper elements of the causeway are orientated to the south of due east (Figures 1 and 2).⁹ The position and alignment of the pyramid causeway (as indicated by the remains of its upper elements) may have been to avoid the nearby pyramid Lepsius XXIX, which is

⁸ See for example, Lehner (1997), p. 156-7.

⁹ Lehner (1997), p 157.

located to the east (Figure 1) and has been attributed to the earlier reign of Menkauhor.¹⁰ In addition to Lepsius XXIX, at least two smaller pyramid complexes (attributed to Iput and Khuit, royal women associated with the reign of Teti) have been found in separate enclosures to the north of the pharaoh's funerary complex. No evidence for a valley temple associated with the Teti funerary complex has so far been identified.¹¹

Feature	Dimension (cubits)	Dimension (m)
Base length of the main pyramid	150 ¹²	78.75
Vertical height of the main pyramid	100	52.5 ⁹
Base length of the satellite pyramid	30 ¹²	57.14
Length of the pyramid enclosure (N-S)	243 ⁹	127.58
Width of the pyramid enclosure (E-W)	200 ⁹	105
Maximum dimension from western enclosure wall to eastern limit of the pyramid temple.	356	187 ¹³

Table 1. Principal dimensions of the Teti Pyramid Complex. Figures given in bold have been taken from published sources, figures in plain text have been calculated using the value of 52.5cm to 1 cubit.¹⁴

Table 1 summarises the key dimensions of the Teti Pyramid Complex. When compared with this data, the figure of 441 cubits (231.53m) identified by Collombert from the Teti Papyrus, evidently represents a substantial feature. The current author considers that there are two commonly recognised elements of pyramid complexes which could have had such large dimensions:

1. the pyramid causeway;
2. a temporary linear ramp used in the building of the main pyramid.

The Teti Causeway

As discussed above, except for the point at which the causeway meets the south east corner of the pyramid temple and indications of an alignment for the upper elements, little is known of the Teti pyramid causeway. Given also that the position of the Teti valley temple has not been identified, the length of the Teti causeway remains unknown. Dr Mark Lehner points out that the Teti pyramid stands at a relatively elevated position near the eastern edge of the Saqqara escarpment.¹⁵ As Lehner also states, a causeway serving the elevated site of the Teti pyramid would have needed 'an enormous' embankment to carry the causeway from the low-lying inundation to the edge of the escarpment.¹⁵

Interpreted from the photogrammetric maps issued by the Egyptian Ministry of Housing and Reconstruction,¹⁶ ground levels at the Teti pyramid are at approximately 58m (Figures 1 and 2).¹⁷ The position of the undiscovered Teti valley temple can only be inferred, based on considerations of topography and comparisons with nearby pyramid complexes. The valley

¹⁰ Collombert (2011), p 29.

¹¹ Lehner (1997), p 156-7.

¹² Rossi (2007), Appendix.

¹³ Scaled from Lehner (1997), p 157, Figure.

¹⁴ Rossi (2007), Table 2.

¹⁵ Lehner (1997), p 156.

¹⁶ Arab Republic of Egypt, Ministry of Housing and Reconstruction, Topographic sheets, Cairo H22, 1:5000.

¹⁷ Note the ground elevation at the site of the Teti pyramid taken from the relevant maps differs slightly from the value of ground elevation given by Google Earth, which for consistency in the data, has been used in Table 2.

temple of the preceding pharaoh, Unas lies just below the 25m contour at the edge of the inundation at Saqqara (Figure 1). It is generally understood that one of the roles of the valley temple was to serve as a functioning interface between the pyramid complex and the system of canals and harbours that connected with the Nile. Given that water within any specific section of the Old Kingdom canal system will tend to have found its own level, it is considered likely that valley temples at Saqqara will have been built at the same general elevation.¹⁸

Given these considerations, a number of factors can be identified which allow a general location for the Teti valley temple to be inferred and from that, allow us to speculate on a suitable route along which the Teti causeway may have been built. These are:

- The elevation at the site of Teti valley temple, which is likely to have been comparable with the elevation of the Unas valley temple;
- The alignment of the upper end of the Teti causeway, as suggested in published reconstructions of the Teti pyramid complex;
- The location of Lepsius Pyramid XXIX, which is generally assumed to have pre-dated the reign of Teti; and
- The local topography, as inferred from modern photogrammetric data.

On the basis of these considerations, a possible alignment for the Teti causeway is shown on Figure 2. By scaling from the available maps, it can be determined that this causeway would have been in the order of 263m long (approximately 500 cubits).

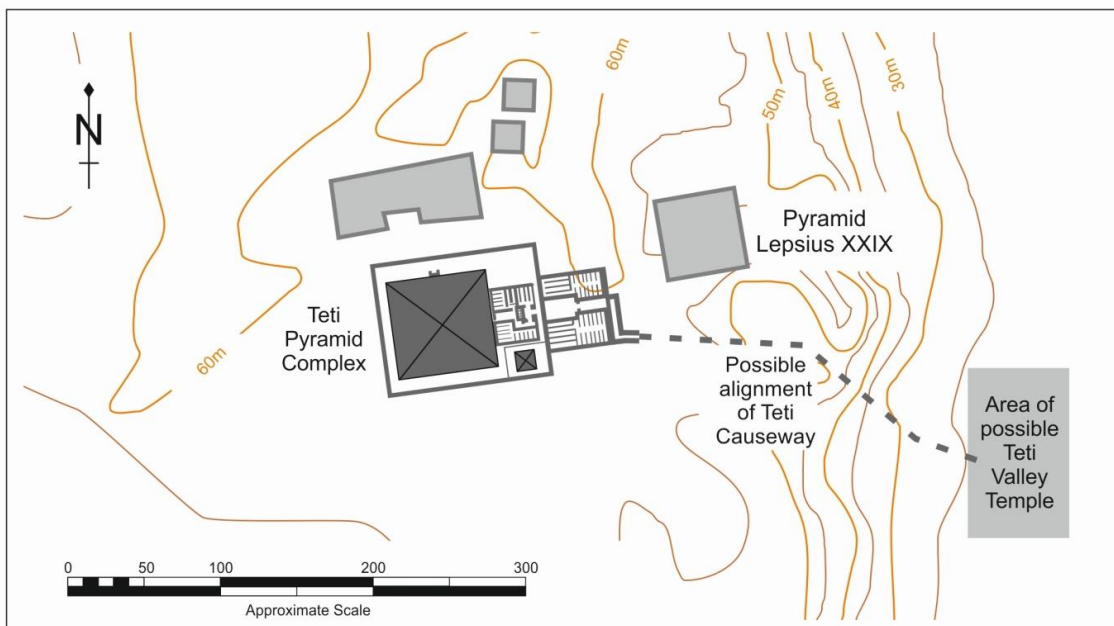


Fig. 2. The area of the Teti Pyramid complex showing the inferred locations for the valley temple and causeway.

Clearly, the proposed causeway shown on Figure 2 follows one of several possible alignments and may differ in a number of respects from what had originally been planned or built. It is important to note however, that the 500 cubit figure derived above, is likely to represent a *minimum* length for the Teti causeway. Further detailed considerations of the actual alignment that the causeway *may* have adopted are unlikely to significantly alter the

¹⁸ In this regard, it is interesting to note that the elevations for valley temple locations given in Table 2, all lie within the range 20-23m amsl.

inferred length of the causeway much below this 500 cubit figure. Furthermore, given the difference in elevation between the inferred position of the valley temple and the site of the Teti pyramid complex, a 500 cubit-long causeway which followed an alignment similar to that shown on Figure 2, would have had an average gradient in the order of 1 in 8 (13% - Table 2).¹⁹ When such a causeway is compared with other causeways from this period (Table 2), this gradient appears to be rather steep. If by contrast, the form of the Teti causeway had been determined primarily on the basis of gradient, conservatively taking the 1 in 12 gradient calculated in Table 2 for Khafra, the Teti causeway would have been approximately 731 cubits long (in the order of 384m).²⁰ Given these considerations, had it been built, the Teti causeway is likely to have been significantly longer than the 441 cubit dimension referred to in the Teti Papyrus.

Pyramid	Causeway length (m) ²¹	Approx elevation at pyramid temple (m) ²²	Approx elevation at valley temple (m) ²¹	Gradient	Gradient (%)
Teti (postulated)	263	55	23	1 in 8	13
Khufu	740	60	22	1 in 19	5
Khafra	495	61	20	1 in 12	8
Menkaura	608	68	21	1 in 13	8
Sahura	235	37	21	1 in 15	7
Unas	750	57	23	1 in 22	5

Table 2. Data for the a selection of Old Kingdom pyramid causeways and the resulting gradients.

Linear Construction Ramp

The methods used by the ancient Egyptians to raise the blocks of stone used in pyramid construction remain a matter of some debate. Whilst the details of this debate lie outside the scope of the current paper,²³ the use of temporary ramps has long been suspected, with a number of possible forms having been proposed.²⁴ Amongst the perceived disadvantages of ramps is that their construction required the placing and subsequent removal of significant volumes of fill materials.²⁵ Given however, that the ancient Egyptians placed millions of tonnes of masonry and mudbrick when building the Old- and Middle Kingdom pyramids, the current author does not consider that the additional resources required for the construction of temporary ramps is sufficient justification to preclude their use. Furthermore, when compared with other hypotheses that have been put forward (e.g. the use of levers, pulley systems etc.), it is considered that any disadvantage that was associated with the construction of temporary ramps was offset by the straightforward nature and relative versatility of their use.

¹⁹ Assuming a causeway some 500cubits long (263m), with ground levels at the lower (valley temple) end of ca. 23m and ground levels at the upper (pyramid) end of 55m, gives a fall for the causeway of 32m vertically over 263m horizontally, or 1 in 8 (i.e. approx 13%).

²⁰ Vertical separation is 32m (see note 19). A 1 in 12 gradient (8%) gives a horizontal distance of 32 x 12 = 384m or 731 cubits.

²¹ Lehner (1997) except for Teti which as described in the text, has been inferred.

²² For consistency, all elevation data in Table 2 is taken from Google Earth, accessed 27th December 2016.

²³ For further discussions see *inter alia* Lehner (1997), p. 215-217, Arnold (1991), p 79 et seq, Isler (2001), p 211-221.

²⁴ Arnold (1991), p. 98-101 and Fig 3.53.

²⁵ Hodges (1989), p. 10-16.

If for the purposes of the current paper, the use of temporary ramps is accepted, there remains the issue of the form these ramps took. By relying in part on the underlying pyramid for support, the spiral ramp would have required a much reduced volume of material compared with a linear ramp that was capable of reaching an equivalent height. The current author however, considers that the main disadvantage of a ramp that was wrapped around the growing form of the pyramid (i.e. a spiral ramp) will have been that the temporary structure will have largely buried the underlying pyramid masonry and will have therefore, prevented the masons from using sight-lines along and down the corners of the pyramid to control the shape of the structure as building works progressed. In contrast, a linear ramp would have left the corners of the pyramid exposed, allowing the shape of the growing structure to be constantly checked, something considered essential given the accuracy that has been identified for a number of pyramids, most significantly, the Great Pyramid of Khufu.

The Great Pyramid has been subject to more detailed scrutiny than possibly any other Egyptian pyramid, with some of these discussions focussing on the possible form of the temporary ramps used in its construction. The Great Pyramid is built close to the northern edge of the Giza plateau and as such, the northern approach to the pyramid would have been an unsuitable location for a linear construction ramp. In addition, the entrance to the pyramid was located in the northern face and is likely to have been obscured by a linear ramp approaching from the north.²⁶ To the east and west of the Great Pyramid are the major necropoleis of Khufu's court, areas that were under development at the same time that the pyramid was being built.²⁷ In addition, to the east was the mortuary temple and causeway. Given this development, it is considered unlikely that a temporary ramp would have approached the Great Pyramid from either the east or west. The features to the south of the Great Pyramid (including the two boat burials and a series of mastaba tombs) however, were built shortly after the reign of Khufu.²⁸ Lehner has already indicated that in his view, the ramp used in the construction of the Great Pyramid, approached the structure from the south.²⁹

Returning to North Saqqara, in addition to the pyramids of the two royal women, to the north of the Teti pyramid are a group of Old Kingdom tombs, which include that of Mereruka, a senior courtier and vizier to Teti (Figure 1). We can assume that construction of these tombs was underway at the same time as the construction of the Teti pyramid complex and that a construction ramp would not therefore, have approached the pyramid from the north. To the east of the Teti pyramid were other elements of the pyramid complex, the presence of which is also likely to have precluded the use of this area for a temporary construction ramp. The areas to the immediate west and south of the Teti pyramid however, are currently understood to be free of substantial features which are contemporaneous with, or pre-date the Teti pyramid and could therefore, have provided suitable areas in which to construct a temporary ramp.³⁰

Given the need to import granite from Aswan for the pyramid chambers, basalt for the sarcophagus and Tura-quality limestone for the casing of the Teti pyramid, although a construction ramp approaching the pyramid from the west would have been possible, such an

²⁶ Another disadvantage of a spiral ramp is that as it wrapped around all four faces of the pyramid, it would have blocked the entrance to the internal passages and chambers, delaying the construction of these important elements of the pyramid.

²⁷ Lehner (1985), p. 118, item B2 (Western Cemetery) and B3 (Eastern Cemetery).

²⁸ Porter and Moss (1974), p. 216-228 and plan XIX.

²⁹ Lehner (1985), p. 128 item C15.

³⁰ The area immediately south of the Teti pyramid has been subject to geophysical survey and "no large mastaba type structures" were found. See Mathieson (2007), Fig 2 and 4.

arrangement offers a less pragmatic approach than a ramp located to the south of the pyramid. A linear construction ramp approaching from the west, would have directed the flow of imported goods to the far side of the construction site, away from the Nile, the main transport artery for these imported stones.

To the south of the Teti pyramid is a wadi through which a modern road connects the tourist entrance to Saqqara with the antiquities (Figure 1). This wadi, part of which has been the focus of recent excavation by the French Archaeological Mission to the Bubasteion,³¹ would have allowed construction materials brought to Saqqara by river and canal, to have been transferred to the elevated surface of the plateau. It would then have been possible to link the upper end of the wadi to the Teti pyramid complex by means of a linear construction ramp which approached the pyramid from the south (Figure 3). By scaling from the photogrammetric map,¹⁶ the modern road through the centre of the wadi lies approximately 270m south of the foot of the Teti pyramid. The 50m contour to the north of the modern road, lies above the floor of the wadi and is some 220m south of the pyramid. As shown on Figure 3, the foot of a 441 cubit ramp (approx 250m long) would have sat within this wadi.

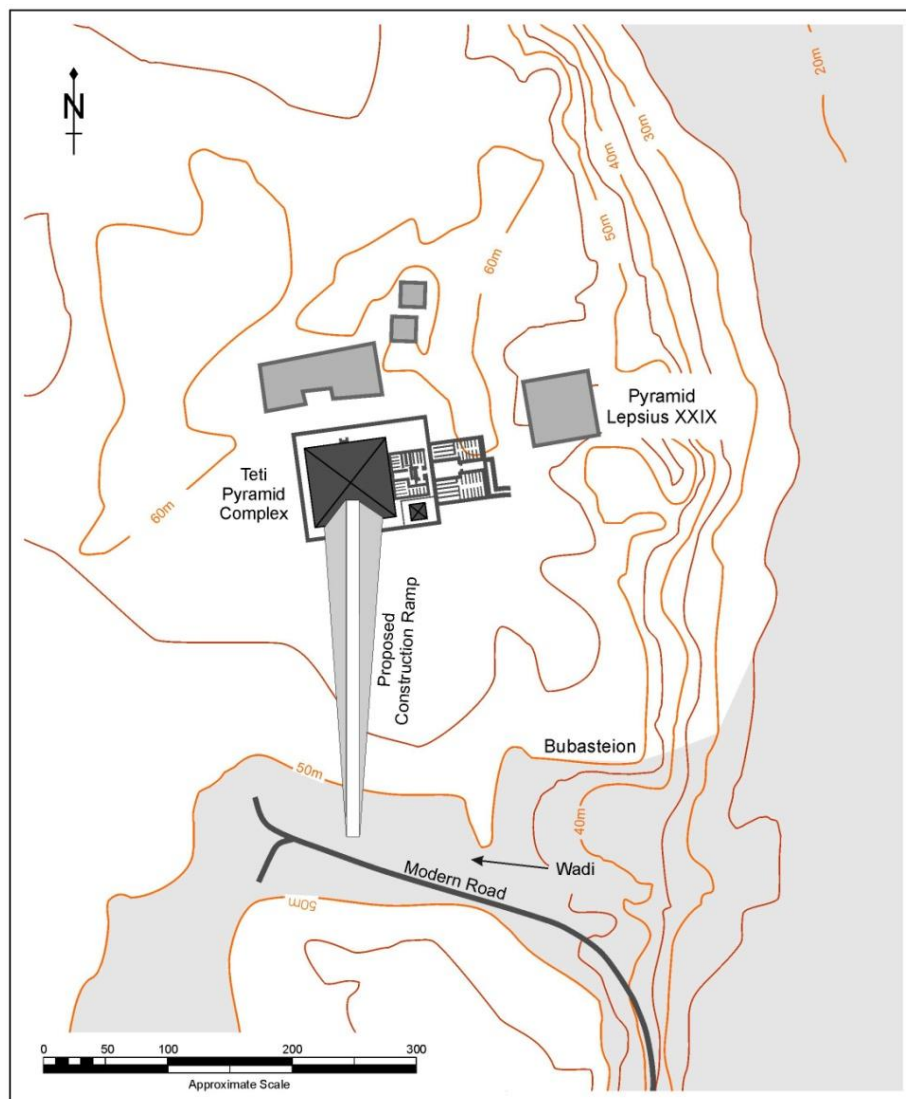


Fig. 3. The area of the Teti Pyramid complex showing a linear construction ramp approaching from the south.

³¹ Zivie (2007).

Conclusions

Given that the current paper is based on a purely desk-based exercise, it has been necessary to use a combination of maps and other publications to obtain and compile relevant data. Notwithstanding the use of a number of sources of relevant information, it is considered that the data on which this paper is based is sufficiently accurate to support the general conclusions that have been reached.

Although a causeway in the order of 500 cubits long can be postulated (Figure 2), when the topography of the area around the Teti pyramid is considered, the gradient of the resulting causeway (1 in 8 or 13%) is considered too steep. If the gradient of the Teti causeway was consistent with that of other, more typical Old Kingdom causeways, its overall length will have been substantially greater than the 441 cubit figure referred to in the Teti Papyrus. On this basis, it is concluded that the reference to 441 cubits identified by Collombert, is not a reference to the Teti causeway.

The foot of a 441 cubit linear ramp which approached the Teti pyramid from the south will have been located in a wadi which today, carries the modern road from the inundation to the surface of the Saqqara plateau. During the construction of the Teti pyramid complex, this wadi will have provided a ready access for imported stone brought along the Nile and associated canals from Aswan, Tura and other quarries.

Given the congruence between the information provided by the Teti Papyrus fragments, which refer to a feature associated with the Teti pyramid that was some 441 cubits long, and the geomorphology of the Saqqara plateau, with a wadi lying at this general distance to the south of the Teti pyramid, it is concluded that the Teti Papyrus presents rare evidence for the use of linear construction ramps in Old Kingdom pyramid building projects.

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