The Meidum Pyramid

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Abstract

Located more than 70 km south of Cairo, the Meidum pyramid is noteworthy because of its square, tower-like shape and the difficulties associated with its attribution. Drawing from previously published material together with the author's own observations from the site, the following paper will explore these two issues in order to reexamine the origins of this structure.

Introduction: Petrie's Work at Meidum

In the form in which it exists today, the Meidum pyramid, at the most southerly Old Kingdom pyramid site,[1] resembles a steep-sided (ca. 75°) tower-like structure characterized by a single "great step' and a pair of broad horizontal bands of roughly worked masonry (fig. 1).[2] This "tower' appears to stand on a low isolated hill that Vyse described as a "rocky knoll."[3] By the time of Petrie's first publication on the site, however,[4] it had been established that this "hill' was in fact an accumulation of debris that obscured the base of a smooth-sided, truncated pyramid that had a uniform slope of ca. 51° 50' (fig. 2).[5] As previously noted by Lepsius,[6] however, steep-faced sections of dressed articulated casing stones (ca. 75°) and overlying sections of more-roughly worked masonry were also visible within the debris mound (fig. 3) and Petrie regarded these as being from a step pyramid. In order to reconcile the evidence for both stepped- and smooth-sided forms, Petrie concluded that the structure at Meidum had initially been built as a step pyramid that had been overlaid with additional masonry to produce the first smooth-sided pyramid in ancient Egypt (see fig. 4).

The development of the Meidum pyramid had however, been more complex than Petrie's reconstruction suggests. Petrie considered that the structure at Meidum had originally taken the form of a "primal' mastaba about "100 cubits square,"[7] which had been enlarged to produce the initial step pyramid. Petrie's conviction that the Meidum pyramid had a mastaba at its nucleus appears to be based on the presence of a broad shallow depression (ca. 2–3 cm deep and 490 to 540 cm wide)[8] that can be seen on the eastern face of the structure (fig. 5). This feature runs vertically from the top of the tower-like remains, to the "great step" and then continues to run down the face of the structure, as far as the upper rough band of masonry (b on fig. 1). Petrie noted that this shallow vertical depression is not positioned

[1] Excluding the small chamberless structures at Elephantine, Edfu, El-Kula, Ombos, Sinki, Zawiet el-Meitin and Seila. See M. Lehner, *The Complete Pyramids* (London, 1997), 96.

[2] All drawings and photographs are by the author unless otherwise stated.

[3] H. Vyse, *Operations Carried on at the Pyramids of Gizeh* (London, 1840), vol. 3, 79.

[4] W. Petrie, *Medum*, 3.

[5] Lehner, *Complete Pyramids*, 17.

[6] K. Lepsius, *Denkmäler aus Ägypten und Äthiopien* (Berlin, 1849–1859), Abtheilung I, Band I.

[7] Petrie, *Medum*, 5.

[8] Petrie, *Medum*, 10.

Journal of the American Research Center in Egypt, Vol. 51, pp. 203–224
doi: http://dx.doi.org/10.5913/jarce.51.2015.a010

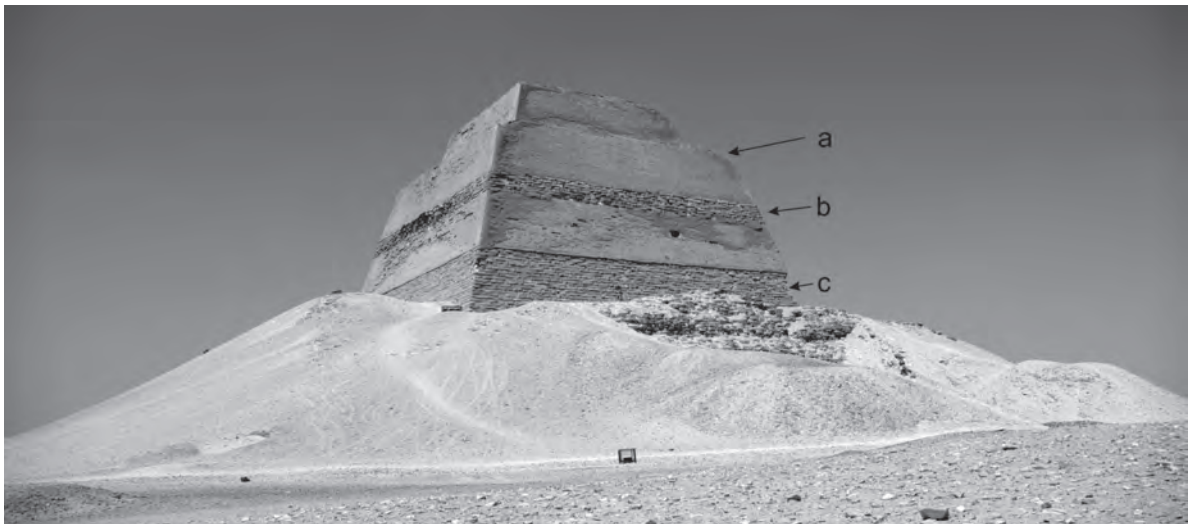

Fig. 1. Meidum pyramid viewed from the southeast. The "Great Step" is identified (a) together with the two rough masonry bands that characterize the pyramid remains (b and c).

Fig. 2. The smoothly cased base of the Meidum pyramid after removal of the debris mound. (The western end of the northern section of casing, viewed from the wooden entrance scaffold.)

Fig. 3. Smoothly dressed casing of a step-pyramid phase of the Meidum pyramid, buried behind later core masonry used to provide a true-pyramid shape to the structure.

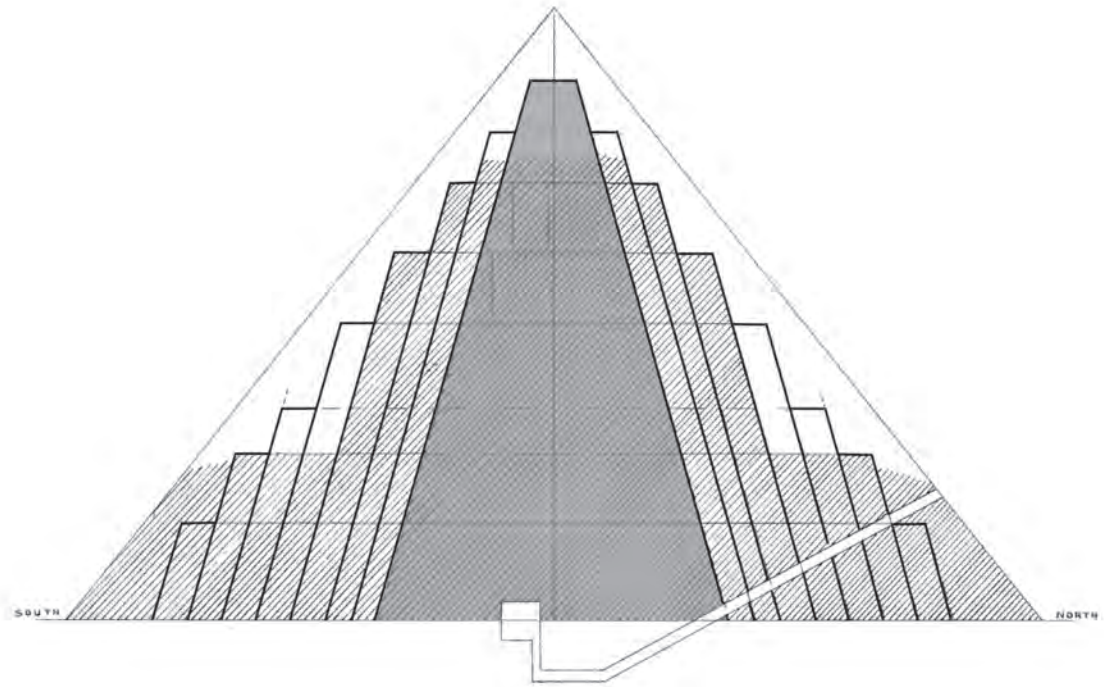

Fig. 4. General section through the Meidum pyramid showing the initial step pyramid overlain by a true pyramid structure (from Petrie, Meydum, pl. 2).

Fig. 5. The shallow depression identified by Petrie. Shown here is the lower section of the depression below the "Great Step" and above the upper band of rough masonry.

Fig. 6. The pyramid temple (east face) with the two uninscribed stelae in the open court at the rear of the temple (arrowed).

centrally, leading him to conclude that this feature was a marker, provided by the builders of the pyramid to indicate the presence of a *Ka*-chamber on the face of the "primal' mastaba.[9]

During his first phase of site work in 1891, Petrie made perhaps his most celebrated contribution to our understanding of the Meidum pyramid. Drawing inspiration from his earlier work at Illahun, he set about clearing the debris mound from the eastern face of the pyramid in an effort to locate the pyramid temple. Petrie's expectation was to find ruins or traces of foundations and it is clear from his report that he was surprised to find such an intact structure (fig. 6):

> To find under all that depth of ruin such a complete building was an entire surprise ... but here nothing seemed to have been disturbed or injured throughout the whole length of recorded history. Here stands the oldest known building in the world as perfect, except for slight weathering, as it was when even Egypt was bare of monuments. I eagerly looked over the inscriptions on the walls, which I saw were of Tahutmes III. and Amenhotep III; but my satisfaction was complete when I caught sight of Seneferu's name, and knew that at last there was monumental evidence for an attribution, which had always seemed very probable, but which had been as yet without proof."[10]

This extract from Petrie's report is interesting for two reasons. First, is his view that this was a very early structure which Petrie appears to consider as pre-dating Netjerikhet's Step Pyramid at Saqqara. Second is an issue that will be addressed later in this paper: the attribution of the Meidum pyramid to Snefru. As well as clearing the pyramid temple, Petrie also cleared the causeway and followed this towards the

[9] The Ka-chamber was a shallow offering niche, commonly found on the eastern facade of Old Kingdom tombs.
[10] Petrie, *Medum*, 4.

floodplain. It appears that high groundwater levels prevented any exploration for a valley temple at this time.[11] After undertaking a survey of most of the key external features of the pyramid, Petrie then cleared the interior of debris. The pyramid had been opened some years previously but much of the original debris still remained and Petrie set about clearing this to establish whether there were previously unrecorded passages or chambers within the structure. None were found.[12]

By the end of his first season at Meidum, Petrie had established a great deal and felt confident that many of the questions associated with the structure had been answered. His confidence is evident in the following quotation from his 1892 report:

> Four months' work at Medum has cleared up most of the questions about it, and recorded its sculptures beyond reach of future loss; though there are still some interesting matters awaiting a future explorer in that place.

It was to be some eighteen years before Petrie was able to reassemble a team at Meidum to address the "interesting matters" that he identified in 1892. The first task his returning team set about was to further investigate the shallow depression on the upper east face of the steep sided tower-like structure (fig. 5). As discussed above, Petrie had concluded that this feature indicated the position of a *Ka*-chamber and therefore, the presence of a "primal" mastaba within the core of the pyramid. In order to investigate this, Petrie's team, led by Gerald Wainwright, excavated a horizontal tunnel beneath the masonry of the pyramid, starting from the eastern face. The aim of this difficult undertaking was to reach the "primal' mastaba however, work was slow and by the end of the 1909 season, Petrie's objective had not been met.[13] As the tunnel progressed however, the generally rough-worked masonry that was encountered along the underside of the pyramid was found to be interrupted at regular intervals by dressed masonry that had the appearance of finished sections of casing.[14] These findings confirmed the regular structure of the pyramid that Petrie had illustrated in his 1892 publication (fig. 4), which consisted of a tall central "core' with an outer sloping face of ca. 75° (shaded darker grey on fig. 4). Around this central "core," a series of progressively lower mantles of masonry had been built, with each mantle having an external slope angle of ca. 75° (the dressed masonry surfaces that "cased" each mantle are shown as heavy lines on fig. 4). Wainwright's tunnel also established the manner in which the foundations of the pyramid had been prepared. Under the outer smooth-sided pyramid (ca. 52° slope) the masonry was found to be laid on gravels. Before construction began on the inner stepped structure (ca. 75° slope) however, the builders had cleared the superficial deposits down to the marl bedrock.[15]

The 1909 fieldwork also revealed a new and unexpected feature to the east of the pyramid, which Petrie referred to as the "Approach" (see Petrie's plan and section which are reproduced as fig. 7). The Approach appears to be a causeway that had been cut into the bedrock to provide a uniform sloping base and was then paved with mudbrick and mud plaster.[16] The Approach, however, appears not to have been completed,[17] having been abandoned some distance short of the peribolus wall (see the plan, fig. 7a).[18] Petrie noted that if the alignment of the abandoned Approach was extended onto the face of the pyramid, the point at which it made contact with the base of the pyramid would lie directly below the shallow depression that he took to be a marker for a hidden *Ka*-chamber (fig. 5).

As shown on figure 7b, the materials that had been used to infill the Approach consisted of weathered sands and gravels together with weathered marl, material that had been produced during the

[11] Petrie, *Medum*, 4.
[12] Petrie, *Medum*, 4.
[13] W. Petrie, *Meydum and Memphis*, 1.
[14] W. Petrie, *The Labyrinth, Gerzeh and Mazghuneh* (London, 1912), 25.
[15] Petrie, *Meydum and Memphis*, 1.
[16] Limited evidence for a final layer of limestone paving was also encountered; see Petrie, *Meydum and Memphis*, 2.
[17] Petrie, *Meydum and Memphis*, 2 and 6–9.
[18] Petrie, *Meydum and Memphis*, 7, n. 16; the approach did not lead to a large private tomb.

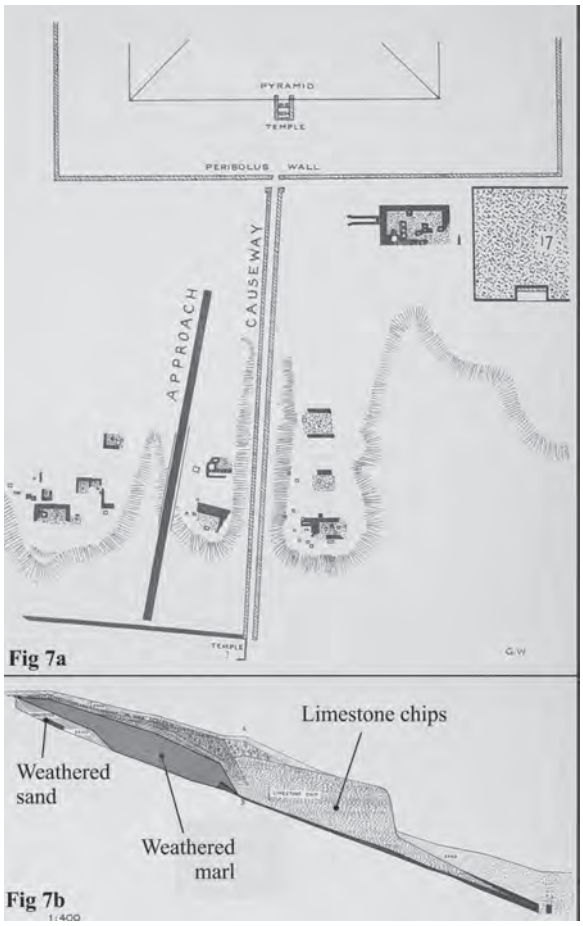

Fig. 7. Plan and section of the Approach (from Petrie, Meydum*, pls. 2–3).*

excavation of the shallow foundations of the inner, step pyramid. Within the Approach, these natural site clearance materials were then overlain by clean limestone chippings associated with the working of pyramid masonry.[19] On the basis of the materials that had been used to infill the Approach, Petrie's team concluded that this initial causeway had been abandoned at an early stage in the construction of the step pyramid.[20] Taking the evidence from the Approach and the shallow depression together, Petrie concluded that the Approach had led to the *Ka*-chamber of the "primal" mastaba. He speculated that as the design of the pyramid changed, the Approach had been abandoned and a new causeway had been built with a more westerly alignment.[21]

Petrie's team returned to Meidum late the following year (1910) to complete the tunnel under the pyramid. Although they reached the center of the pyramid, there is no further discussion of the postulated *Ka*-chamber or "primal" mastaba in the report on this additional work.[22] Petrie, therefore, appears to have drawn back from his previous assertions that the Meidum pyramid had initially been built as a smaller mastaba. If there was no "primal" mastaba, however, an explanation was still needed for the purpose of the abandoned Approach (with its weathered sand and marl infill) as well as the shallow depression on the upper, eastern face of the pyramid. If the Approach had served a structure that pre-dated elements of Petrie's step pyramid, what could this earlier structure have been?

Borchardt's Insight

Borchardt appears to have been drawn to the Meidum pyramid because of the two prominent bands of roughly finished masonry and what he hoped these would reveal about the sequence of construction. The lowest of these rough bands sits just above the top of the debris mound, with the narrower band somewhat higher. The two bands are separated by smooth-dressed masonry, similar in appearance to most of the other exposed faces of the surviving steep-sided structure (fig. 1).

Despite Petrie appearing to no longer favor the concept of the "primal" mastaba, Borchardt also considered that the Meidum pyramid had relatively simple origins. In Borchardt's reconstruction, the Meidum pyramid began as a two-stepped mastaba to which additional mantles of masonry had been

[19] Petrie, *Meydum and Memphis*, 7.
[20] Petrie, *Meydum and Memphis*, 8.
[21] Petrie, *Meydum and Memphis*, 8.
[22] Petrie, *The Labyrinth, Gerzeh and Mazghuneh*, 25.

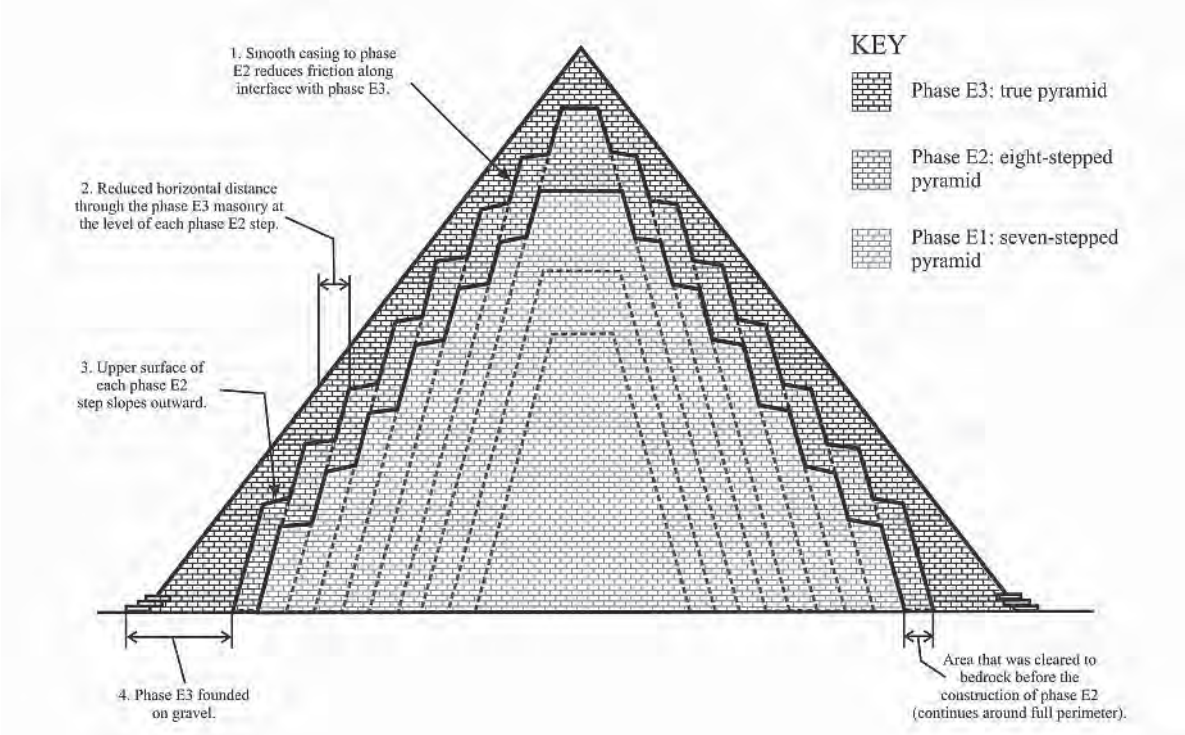

Fig. 8. Borchardt's model of a completed Meidum pyramid, showing three terminal phases, E1, E2, and E3 (with annotations identifying a number of construction features referred to in the text).

added, each of which had a dressed (or "cased") outer surface.[23] Where Petrie and Borchardt disagreed, however, was in their respective reconstructions of the terminal phases of the building programme. Whereas Petrie had identified only one phase of step pyramid construction, over which the smooth-sided outer structure had been built, Borchardt concluded that the pyramid building programme had culminated in three phases of construction, which he referred to as E1, E2 and E3 (fig. 8). Pyramid E1 consisted of a step pyramid with seven steps, E2 of a step pyramid with eight steps and E3 of a true pyramid with smooth sides. Significantly, each step pyramid phase (E1 and E2) appears to have been regarded (for a short time at least) as a finished form of the pyramid.[24]

Borchardt concluded that the current dilapidated form of the pyramid was the result of the removal of significant proportions of masonry from the structure. In Borchardt's model, as this dilapidation progressed, large areas of the outer cased masonry of phases E1 and E2 were exposed, as evidenced by the smooth, dressed masonry which can be seen across large parts of the steep-sided tower-like structure (fig. 1). Borchardt also concluded however, that this dilapidation had led to the exposure of sections of masonry that the builders had never intended to be viewed and which had not therefore been dressed or cased. It was these sections of more-roughly worked masonry that formed the pair of characteristic horizontal bands running around all four sides of the pyramid. Further explanation for the formation of these rough masonry bands is shown on figure 9.

Borchardt's interpretation of the structure may also allow us to understand how the Approach fits into the evolving building programme at Meidum. Although Petrie concluded that the Approach had

[23] L. Borchardt, *Die Entstehung der Pyriamide, an der Baugeschichte der Pyramide bei Mejdum nachgewiesen* (Berlin, 1928).
[24] V. Maragioglio and C. Rinaldi, *L'architettura delle piramidi menfite*, Part 3 (Rapallo, 1964), 12.

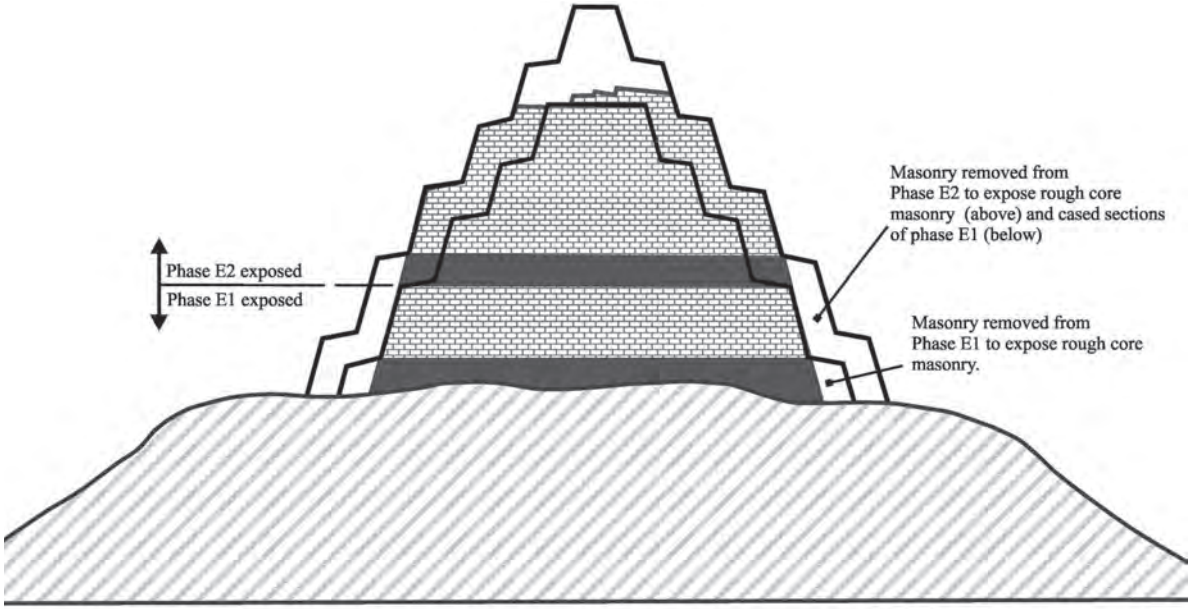

Fig. 9. Borchardt's explanation for the rough masonry bands.

been built to serve his "primal" mastaba, the current author considers that this conclusion is not supported by the evidence from the Approach infill. If the step pyramid had been formed by the enlargement of a "primal" mastaba, the area of site clearance will have been significant and will have generated substantial volumes of natural material for disposal. As figure 7b shows however, the volume of natural material within the Approach was relatively small and as such is considered to be more consistent with a limited stage in the development of the pyramid, such as the enlargement from Borchardt's phase E1 to phase E2.[25]

Although explaining much about the strange appearance of the Meidum pyramid, Borchardt's elegant solution does not address some of the other fundamental questions, such as why is the structure in such a ruinous state and for whom was the pyramid built?

Stone Robbing or Collapse?

Petrie concluded that it was only from the Nineteenth Dynasty that the Meidum pyramid was used as a source of building stone.[26] Furthermore, he concluded that the ruined state of the Meidum pyramid was wholly the result of the structure having been used as a quarry for the local villages:

> The pyramid of Medum is the quarry of all the neighbourhood. Large piles of stone are to be seen in the villages, all taken from there. The desert is furrowed with cart tracks in all directions from the pyramid.[27]

[25] The areas likely to have undergone site clearance when phase E1 was enlarged to E2 are indicated on the lower right of fig. 8.

[26] Petrie, *Medum*, 9.

[27] Petrie, *Medum*, 4.

It is also clear that Borchardt considered that the rough bands of masonry that had been at the center of his deliberations, had been exposed by the "stripping of blocks from the pyramid by modern and mediaeval builders."[28]

Although the current author would not dispute that the pyramid has been subject to stone robbing, it is difficult to accept that the dilapidated state of the Meidum pyramid is *entirely* due to such activity. This conclusion is based in part on the characteristics of the area surrounding Meidum and the greatly more dilapidated state of the Meidum pyramid when compared with other surviving Old Kingdom pyramids. The Giza pyramids for example, are known to have been used to supply masonry for the extensive urban area of nearby Cairo and yet the Giza pyramids still retain their basic pyramidal shape. By contrast, the less heavily urbanized surroundings of Meidum would be expected to have led to a reduced demand for building stone, and yet the shape and appearance of the Meidum pyramid has been substantially altered. In terms of settlement "density" the area around Dashur is comparable to that around Meidum, yet as is the case at Giza, the Old Kingdom pyramids at Dashur still also retain their basic shape. The view held by Petrie and Borchardt that the dilapidated shape of the pyramid is the result of stone robbing undertaken in relatively modern times, is also inconsistent with other evidence obtained from the site. Information contained in unpublished notes made by Wainwright and currently held in the library of the Pitt Rivers Museum in Oxford, record the discovery of Twenty Second Dynasty burials close to the top of the debris mound.[29] More recent work at Meidum has discovered Greco-Roman and Coptic period sherds in the upper sections of the debris mound.[30] If the formation of the debris mound *was* primarily the result of stone robbing, this evidence suggests that the mound was formed during the relatively brief period between the Nineteenth and Twenty-Second Dynasties, with only minor volumes of debris added subsequently. The assumption that the debris mound at Meidum is solely the result of stone robbing is therefore, not supported by the available evidence. Not only is the dilapidation of the Meidum pyramid more advanced than would be expected for a pyramid in a generally rural setting such as this, the timescales over which the debris mound accumulated appear to be limited to a relatively brief period between the Nineteenth Dynasty and the early parts of the post-pharaonic era. It is evident therefore, that additional factors are needed to explain the unusual form of the Meidum pyramid.

The focus of Kurt Mendelssohn's book, *The Riddle of the Pyramids*,[31] was to demonstrate that the Meidum pyramid had collapsed during its construction, a theory that was not generally accepted by Egyptologists. Mendelssohn's theories also present a number of difficulties from an engineering perspective. For example, Mendelssohn considered that the pyramid had undergone a process of plastic failure, however as he illustrates,[32] this mode of failure involves significant movement along the base of the pyramid, together with distortion of the lower elements of the structure. It is evident from site inspection in areas where the debris mantle has been cleared (fig. 2), that the Meidum pyramid has suffered no significant distortion of its lower masonry, with the baseline of the pyramid appearing to be largely as constructed over 4,500 years ago. Despite the evident limitations of his theory, however, the current author considers that after some modification, Mendelssohn's ideas may provide a more rigorous explanation for the highly dilapidated state of the Meidum pyramid than is available from other prevailing theories. Furthermore, it is possible that one of Mendelssohn's more speculative claims may be supported by discoveries made during recent excavation works at Meidum.

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[28] T. Peet, "Review of Die Entstehung der Pyramide, an der Baugeschichte der Pyramide bei Mejdum nachgewiesen by Ludwig Borchardt," *JEA* 16 (1930), 261–62.

[29] "Now we know that in the XXII period the rubbish was practically as deep as it is now as we found burials of this date quite in its highest parts, just a foot or two under the surface." The archive of G.A. Wainwright, Pitt Rivers Museum, University of Oxford. This currently uncatalogued archive was accessed by the current author on 5 June 2015.

[30] The Greco-Roman and Coptic material was found when "distributing spoil to create a level area corresponding to the height of the first great 'step' of the pyramid." A. el-Khouli, *Meidum*, ACE Report 3 (Sydney, 1991), 12.

[31] K. Mendelssohn, *The Riddle of the Pyramids* (London, 1974).

[32] Photographs of plastic failure were given in Mendelssohn, *The Riddle of the Pyramids*, pls. 21–23.

Mendelssohn argued that the collapse of the Meidum pyramid occurred during construction and for this reason he expected that if the debris mound around the base of the pyramid was ever removed, evidence for Old Kingdom activity would be found.[33] In the early 1980s, the Egyptian Antiquities Organisation (EAO) decided to make the Meidum site more readily accessible to visitors and a programme of works was undertaken under the direction of Dr. Ali el-Khouli. One of the first tasks was to clear the debris mantle from the northwest corner of the pyramid to expose the cased masonry behind (the results of this work are shown partly on fig. 2). In the report on this fieldwork programme,[34] el-Khouli describes the removal of this section of the debris mound and after discussing the Greco-Roman and Coptic material that was encountered initially,[35] makes reference to a number of mostly worked limestone blocks of the same size as the pyramid masonry, that were scattered in a haphazard manner in the debris.[36] In a separate paragraph, el-Khouli then describes the recovery of more than three thousand blocks of masonry from an area approximately one quarter of the length of the northern base of the pyramid. This masonry consisted of both Tura-quality casing stones and locally won blocks for use as backing stones and in the core of the pyramid. Notably in the same area, fragments of Old Kingdom pottery and wood were found, together with plant remains and limestone chippings. Importantly, el-Khouli notes that further site clearance along the adjacent western face of the pyramid encountered no similar masonry or artifacts at the base of the debris mound, just chippings and sand.

El-Khouli is clear in his conclusion that the three thousand or so blocks of masonry that were recovered at the base of the pyramid close to its northwest corner were from an Old Kingdom workshop, in which stone was received from quarries and prepared for use in the building of the pyramid.[37] It is unfortunate, however, that more detail is not available regarding the precise archaeological context in which these three thousand blocks of stone were found.[38] Although el-Khouli concludes that they were part of an Old Kingdom workshop, there are potential difficulties with this interpretation. A small proportion of the three thousand blocks bore graffiti which, with one exception, were applied in red ochre.[39] Of these marked blocks, forty-two appear to include dates amongst the graffiti,[40] with the earliest dates confirmed in el-Khouli's publication as being the "year of the 13th occasion" (of the cattle count),[41] a date that was found on two masonry blocks. Other dates were reported as follows:

- the 15th or 16th occasion (5 examples)
- the 17th occasion (fourteen examples)
- the 18th occasion (1 example)
- the "year after the 18th occasion" (one example)
- possibly "the 23rd occasion" (1 example)

[33] Mendelssohn, *The Riddle of the Pyramids*, 109.

[34] A. el-Khouli, *Meidum*.

[35] See n. 30.

[36] El-Khouli, *Meidum*, 12. During his excavation of the pyramid temple on the eastern face of the pyramid, Petrie also reported the presence of blocks of pyramid masonry within the debris mound (Petrie, *Medum*, 3), however he makes no reference to such blocks when excavating the corners of the pyramid during survey work (Petrie, *Medum*, 5), suggesting that there may be an uneven distribution of masonry within the mound.

[37] El-Khouli, *Meidum*, 12–13. A quarry was identified some 5 km north west of the pyramid.

[38] M. Verner, "Archaeological Remarks on the 4th and 5th Dynasty Chronology," *Archiv orientalní* 69 (2001), 369.

[39] El-Khouli, *Meidum*, 21, Graffito E.

[40] El-Khouli, *Meidum*, 20. The blocks found bearing dates were classified as Group A, with the highest number given as A42. There are however, a number of gaps in the numbering sequence as discussed in the publication, with only 24 dates actually published.

[41] El-Khouli, *Meidum*, 20.

Given that cattle counts in this early period are generally understood to have been held every two years, this spread of dates equates to a period in the order of twenty years,[42] which may be considered as too broad for an active construction workshop, in which stones could be expected to have been prepared for use relatively quickly. Miroslav Verner considered that the range of dates identified by el-Khouli at Meidum may indicate that the blocks were prepared elsewhere and moved to the northwest corner of the pyramid prior to being used in the construction. Less plausibly (for reasons presented below), Verner also suggested that these blocks may have been assembled at this location during stone-robbing activities.[43] Of the twenty-four dated blocks found at Meidum that have been published, the majority are dated to the period between the 15th and 17th occasions (19 in total, or 79 percent). Discounting the others as "outliers," these nineteen blocks represent a reduced period of up to five years, which can be extended up to eight years, if the examples from the 18th occasion and "year after the 18th occasion" are also considered to be part of the main data set. Given that these blocks represent stone from local sources, together with casing brought to the site from the more distant Tura quarries,[44] and assuming the dates to have been applied by the quarry workers,[45] it is considered that this range of dates is not inconsistent with what could reasonably be expected for an active Old Kingdom construction workshop. In terms of whether it is appropriate to regard the remaining dated blocks as outliers, it should be noted that the reference above to the 23rd occasion is a tentative reading. Furthermore, given the lack of detailed context provided in el-Khouli's report, we cannot exclude the possibility that some of the blocks were from other sources. For example, the blocks dated to the 13th occasion may have fallen from the pyramid and become lodged in the lowest lying section of the debris mound. As such it may have been difficult for el-Khouli's team to differentiate between these and the blocks from the underlying workshop area.

If as Petrie, Borchardt, and others have suggested, the dilapidated state of the Meidum pyramid is largely the work of stone robbing, with the gradual accumulation of debris around the base of the pyramid being a byproduct of this activity, it is considered highly unlikely that the three thousand blocks of stone found by el-Khouli and his team would have survived in situ. If as suggested by Verner, this significant quantity of stone had been gathered at the base of the pyramid by stone robbers, we must assume that their activities were interrupted and they were unable to remove the prepared "stockpile." It seems unlikely however, that later bands of stone robbers would have left this significant resource untouched, choosing instead to engage in what must have been the difficult and dangerous task of prying additional masonry from the adjacent towering pyramidal structure. Similarly, if these blocks of stone had been left by the Old Kingdom masons, as el-Khouli concluded and as the associated finds of Old Kingdom pottery shards, etc., appear to confirm, it seems reasonable to expect that those blocks would have been the easiest, and therefore the first, to have been removed from the site during subsequent stone-robbing activities. When the practicalities of stone-robbing at Meidum are considered in this way, the three thousand or so stone blocks and related Old Kingdom finds that were revealed by el-Khouli's excavations can be seen to take on a particular significance. To have survived the depredations of stone-robbers of any era, the Old Kingdom workshop must have been rendered inaccessible over a relatively short timescale, raising the possibility that, as first suggested by Mendelssohn, the construction of the

[42] The 23rd occasion minus the 13th occasion gives ten cattle counts, which, assuming two years between each, gives twenty years. A discussion on the evidence that cattle counts may not have been held every two years is given later in the paper.

[43] Verner, "Archaeological Remarks," 369.

[44] See el-Khouli, *Meidum*, 17.

[45] El-Khouli, *Meidum*, 21. However, see R. Stadelmann and H. Sourouzian, "Die Pyramiden des Snofru in Dahschur. Erster Bericht über die Ausgrabungen an der nördlichen Steinpyramide," *MDAIK* 38 (1982), 379–93, in which the concept of the graffiti having been applied in the quarry is questioned on the basis that only some one in ten of the blocks studied had graffiti. As also noted in R. Stadelmann. "Die Pyramide des Snofru in Dahshur. Zweiter Vorbericht über die Ausgrabung an der nördlichen Steinpyramide," *MDAIK* 39 (1983), 225–41, however, if the graffiti were applied at the quarry, some marks may have been damaged in transit and hence may have become lost. Furthermore, from Petrie, *Meydum and Memphis*, 2 and 9, it is evident that some limestone chips carried graffiti, suggesting that some examples had been removed once the stone were received at the construction site. This suggests that the graffiti was placed at the quarry.

Meidum pyramid was indeed interrupted by a sudden and unplanned event, such as a collapse or partial collapse of the structure.

Who Built the Meidum Pyramid?

The current consensus within Egyptology appears to be that the Meidum pyramid was entirely the work of Snefru, the founder of the Fourth Dynasty.[46] This position has been strengthened in recent years by the analysis of quarry marks, not only the dated examples discovered at Meidum that have been discussed above, but also from the two large stone-built pyramids at Dashur that are securely attested to Snefru.[47] Prior to this debate on the quarry marks, the idea that a single pharaoh could have built three large pyramids (the Meidum pyramid and the two at Dashur) was regarded by some authorities as implausible and a range of alternative theories were put forward to explain the evolution of the Meidum structure. These earlier theories all involved Snefru's predecessor, Huni to a greater or lesser extent. According to the Turin Cannon, Huni (as last king of the Third Dynasty) and Snefru (as first king of the Fourth Dynasty) reigned for similar lengths of time,[48] and yet no funerary monument has been securely attested to Huni. Given that the structure at Meidum incorporates elements of the Third Dynasty tradition of burial in step pyramids (Borchardt's phases E1 and E2) along with an outer phase of the later true-pyramid tradition (phase E3), attribution of the Meidum structure to Huni, a pharaoh whose reign stood at the watershed of these two traditions in royal mortuary architecture, seems appropriate. Given however, that no reference to Huni has yet been found at Meidum and several references to Snefru have been recorded, the attribution of the Meidum pyramid entirely to Huni is generally regarded as unsafe.

A number of theories have been presented in which both Huni and Snefru were associated with the building works at Meidum, with the step pyramid phases (E1 and E2) being built by Huni and the true-pyramid (phase E3) being built by Snefru as an act of piety to his royal predecessor. Given that such a pious act on the part of Snefru appears to be unprecedented, the concept that both pharaohs had been involved in construction at Meidum is also regarded by some authorities as unsound.[49] The current author considers however, that given the clear involvement of Djedfre in the burial of Khufu at Giza,[50] the concept that Snefru may have undertaken work at Meidum is not altogether implausible. If Snefru did undertake construction at Meidum, there remains the issue of what his motivation may have been. The numerous incomplete pyramids that have survived from ancient Egypt suggest that Snefru is unlikely to have been driven to complete his predecessor's tomb at Meidum simply as an act of piety. It is well-recognized, however, that there was a fundamental shift in the architecture of pyramid complexes during the late Third and early Fourth Dynasties.[51] Prior to Meidum, the early step pyramids of Netjerikhet and Sekhemkhet at Saqqara and Khaba at Zawiet el Aryan, included a pyramid temple at the foot of the northern face of the structure and no discernible causeway. The final phase of the Meidum pyramid (as with most subsequent pyramid complexes), included a pyramid temple on the eastern face of the struc-

[46] R. Stadelmann, "Beitrage zur Geschichte des Alten Reiches," *MDAIK* 43 (1986), 236.

[47] R. Stadelmann, "Snofru und die Pyramiden von Meidum und Dahschur," *MDAIK* 36 (1980), 437–49; R. Stadelmann and K. Mysliwiec and H. Sourouzian, "Die Pyramiden des Snofru in Dahschur: Erster Bericht über die Ausgrabungen an der nördlichen Steinpyramide," *MDAIK* 38 (1982), 379–93; R. Stadelmann, "Die Pyramiden des Snofru in Dahschur: Zweiter Bericht über die Ausgrabungen an den nördlichen Steinpyramide, mit einem Exkurs über Scheintür oder Stelen im Totentempel des AR," *MDAIK* 39 (1983), 225–41; idem, "Beiträge zur Geschichte des Alten Reiches: die Länge der Regierung des Snofru," *MDAIK* 43 (1987), 229–40, and idem, "Pyramiden und Nekropole des Snofru in Dahschur: Dritter Vorbericht über die Grabungen des Deutschen Archäologischen Instituts in Dahschur," *MDAIK* 49 (1993), 259–94.

[48] Stadelmann, "Beiträge zur Geschichte des Alten Reiches," 232.

[49] Maragioglio and Rinaldi, *L'architettura delle Paramidi Menfite*, 8.

[50] Albeit Djedfre's involvement appears to have been limited to work on Khufu's boat burials, see N. Jenkins, *The Boat Beneath the Pyramid* (London, 1980), 50 and fig. 30.

[51] R. Stadelmann, "The development of the pyramid temple in the Fourth Dynasty," in S. Quirke, ed., *The Temple in Ancient Egypt* (London, 1997), 2.

ture and a causeway which was generally aligned east–west;[52] adaptations that are generally associated with the increasing importance of the cult of Ra in a royal context at this time.[53] The current author considers that it may have been these evolving concepts in mortuary architecture that led to Snefru's involvement in the final phase of building at Meidum. Certainly, this seems a far more plausible interpretation of the evidence, than to assume Snefru was solely responsible for the construction of three of the largest stone pyramids built in ancient Egypt.

Much has been made of the evidence from the quarry marks at Meidum to strengthen the case for Snefru's involvement with the building of the Meidum pyramid. These quarry marks appear to repeat many of the dates that have been found on similarly inscribed blocks of masonry from Dashur.[54] The fact that the same,[55] or similar,[56] years have been recorded has led a number of authors to conclude that construction activities at the two sites were underway at the same time and that both sites were therefore, developed during the reign of Snefru. Stadelmann notes that the quarry marks at Meidum appear to be associated only with phase E3, leading him to the conclusion that Snefru returned to Meidum to complete the pyramid in the later part of his reign, when he was also involved in the construction of the Red Pyramid at Dashur.[57] When assessed in detail, however, the number of dates repeated at both sites is remarkably small. Working from the assumption that the Meidum pyramid was entirely the work of Snefru, Verner lists all of Snefru's known regnal dates and it is remarkable that from this extensive list,[58] only the 15th and 16th occasions (of the cattle count) appear with certainty at both sites.[59] It is also noteworthy that whilst a number of well-attested examples of quarry marks from Dashur have been found to contain Snefru's cartouche, Snefru's name does not appear on any of the quarry marks found at Meidum.[60] After completing a detailed assessment of quarry marks from Meidum, Paule Posener-Kriéger, concluded that "Despite some similarities between the graffiti of Dashur-North and Meidum ... the identical signs do not appear with sufficient frequency."[61]

As discussed below, the current author does not rule out the involvement of Snefru at Meidum. The fact that the lists of dates which have been compiled from both Meidum and Dashur appear to overlap only marginally, makes it difficult to accept that the only valid interpretation of this data is that the dates must all be attributed to the reign of Snefru. The use of bi-annual cattle censuses to mark the length of a king's reign appears to have been commonplace in this period, but was complicated by occasional use of cattle counts at other irregular intervals. An example of this irregularity is provided by the Palermo Stone, which records that Snefru's eighth cattle count was held in the year immediately following the seventh count.[62] If it could be shown that such specific irregularities in cattle censuses were a unique

[52] It is interesting to speculate on the possible presence of an early pyramid temple on the north of the Meidum pyramid. If the remains of such a pyramid temple existed, they would be beneath the debris mantle (the central section of debris on the northern face was not cleared during el-Khouli's work) or beneath the masonry of the northern section of Borchardt's pyramid phase E3.

[53] Stadelmann, "The development of the pyramid temple," 2.

[54] See references in n. 47. It is perhaps noteworthy that Stadelmann and Souruzian, "Die Pyramiden des Snofru in Dahschur," item 6, appear to suggest that some of the dates found at Snefru's pyramids do not refer directly to the cattle count ("Les pyramides de Snefru étant les seules à avoir livré des nombres d'années sans aucune mention de recensement, la question reste ouverte quant à l'année de règne que cette date représente."). This issue has not been revisited in subsequent discussions of the quarry marks. As the authors of the paper indicate, this leaves some uncertainty whether the graffiti represent occasions of the cattle count or true regnal years.

[55] Y. Harpur, *The Tombs of Nefermaat and Rahotep at Maidum* (Oxford, 2001), 25.

[56] I. Edwards, *The Pyramids of Egypt* (London, 1993), 96.

[57] Stadelmann, "Beiträge zur Geschichte des Alten Reiches," 234–35.

[58] Verner, "Archaeological Remarks," 365–68. It is noteworthy that Verner does not agree fully with the primary source (see El-Khouli, *Meidum*, 20) when interpreting a number of the dates. For example, using the reference system presented by El-Khouli, Verner interprets graffiti A20 as the "seventh occasion' whereas this is given as the "seventeenth occasion' in the primary source. In the absence of a detailed justification for these differences, the current author has used the dates given in the primary source.

[59] Verner, "Archaeological Remarks," 365–68.

[60] El-Khouli, *Meidum*, 18 and n. 5.

[61] El-Khouli, *Meidum*, 21.

[62] T. Wilkinson, *The Royal Annals of Ancient Egypt* (London, 2000), 143–44.

feature of Snefru's reign, and if evidence for this was recorded at Meidum as well as at Dashur, this may strengthen the assumption that the quarry marks from both sites can be attributed to the reign of Snefru. The current author is not aware that such characteristic dating evidence is available, nor does there appear to be any significant discussion in recent literature to address (or indeed discount) the possibility that the regnal dates from Meidum and Dashur are from different reigns, albeit reigns of similar lengths such as those indicated by the Turin Canon for Huni and Snefru. The quarry marks from Meidum and Dashur only appear to provide an indication that Snefru was engaged in construction at both sites, *if* it is assumed that *all* the quarry marks refer to Snefru—an evidently circular, and therefore, arguably unreliable line of reasoning.

Much of the evidence for the presence of Snefru at Meidum was recovered by Petrie, particularly during his first season at the site in 1891. Amongst the graffiti Petrie recorded from inside the pyramid temple were a range of inscriptions which made reference to Snefru. These were:

1. The inscription on the base of a female statue, some of the text of which Petrie translated as "... who are in Dad-Seneferu, for the ka of (the lady) Seneferu-Kheti, deceased ...";[63]
2. A graffito from the northeast corner of the temple, which Petrie translated as "Thrice beautiful is the name of the King Seneferu";[64]
3. A graffito from the reign of Thutmose III, which Petrie translated as containing the following references to Snefru: "The scribe Aakheperkara-senb ... came here to see the beautiful temple of the Horus Seneferu: he found it like heaven within when the sun-god is rising in it: and he exclaimed, "The heaven rains with fresh frankincense and drops incense upon the roof of the temple of the Horus king Seneferu..." and "... to the ka of the Horus king Seneferu ...";[65]
4. A graffito of a bird (dated to the New Kingdom), over which the name of Snefru is present;[66]
5. A graffito from the Eighteenth Dynasty, part of which is translated by Petrie as: "May the king give an offering, and may the Horus king Seneferu, and Amen-Ra ..."[67]; and
6. A graffito from the reign of Amenhotep III, part of which Petrie translated as: "The scribe Mai came to see the very great pyramid of Horus the soul(?) of king Seneferu."[68]

The base of the female statue (No. 1 above) was tentatively dated by Petrie to the Fourth Dynasty,[69] but has since been attributed to the Middle Kingdom.[70] It is notable that the name of Snefru is not enclosed in a cartouche and as Yvonne Harpur notes, rather than being a reference to the king, this is a geographic reference, probably a reference to an estate established to serve the cult of the dead king.[71] It is not clear on what basis Petrie ascribed the graffito described in No. 2 above to the Fourth Dynasty. The inscription appears to be complete because it includes the entire cartouche ring. There are, however, only three characters inscribed within the cartouche, of which only two are commonly found in Snefru's name (fig. 10), casting some doubt over the identification of Snefru in this case. It is clear from the other graffiti referred to above (Nos. 3 to 6) that by the time of the New Kingdom, the pyramid temple at Meidum was considered to have been the work of Snefru, though this evidence provides no reference to Snefru as the builder of the pyramid.[72] Furthermore, what the New Kingdom officials who

[63] Petrie, *Medum*, pl. 39, no. 6.
[64] Petrie, *Medum*, pl. 32, no. 1.
[65] Petrie, *Medum*, pl. 33, no. 5.
[66] Petrie, *Medum*, pl. 34, no. 6.
[67] Petrie, *Medum*, pl. 35, no. 14.
[68] Petrie, *Medum*, pl. 36, no. 17.
[69] Petrie, *Medum*, 34.
[70] Y. Harpur, *The Tombs of Nefermaat and Rahotep* (Oxford, 2003), fig. 29.
[71] Harpur, *The Tombs of Nefermaat and Rahotep*, 23–24.
[72] Harpur, *The Tombs of Nefermaat and Rahotep*, 23.

left these inscriptions, could know with certainty about events that took place over one thousand years earlier, remains a valid issue of debate.[73]

The Old Kingdom mastabas of Nefermaat and Rahotep are located some distance to the north of the pyramid of Meidum.[74] The limestone slabs that lined the tomb chapels of these nobles and of their wives Atet and Nofret, are remarkable in that they were decorated with deeply incised hieroglyphs that had been inlaid with polychrome paste. This form of decoration was not widely used and in the context of tomb decoration, was perhaps limited to tombs at Meidum. An inscription on the architrave to the entrance to Rahotep's tomb chapel describes him as "King's son of his body," however, the name of the relevant king is not given.[75] Nefermaat is described on his tomb as "eldest royal son, chief justice,"[76] though again there is no direct reference to a specific king. It is generally accepted that members of the royal family would construct their tombs in the vicinity of the tomb of their father or of the pharaoh under which they had served.[77] Given that Petrie attributed the Meidum pyramid to Snefru, he also attributed these nearby mastabas to the reign of the same king, an attribution that was strengthened by the presence of Snefru's cartouche in the upper left-hand corner of one of the large decorated limestone blocks from the tomb chapel of Nefermaat.[78] As Harpur has noted, however, the cartouche is carved in raised relief in a form that is quite different from the polychrome inlay used to decorate the rest of this limestone slab.[79] According to Harpur, during the evolution of the Nefermaat tomb, the narrow passage leading to the original tomb chapel was blocked, resulting in a revised shallow niche for tomb offerings. The walls of this shallow niche were formed from the outermost section of the original limestone slabs, with the polychrome decoration cut back to a uniform surface in order that raised relief decoration (which included the Snefru cartouche) could be added.[80] Not only is the cartouche not an original part of the decoration therefore, Harpur has also pointed out that it is once again a reference to an estate established to maintain the cult of the dead king.

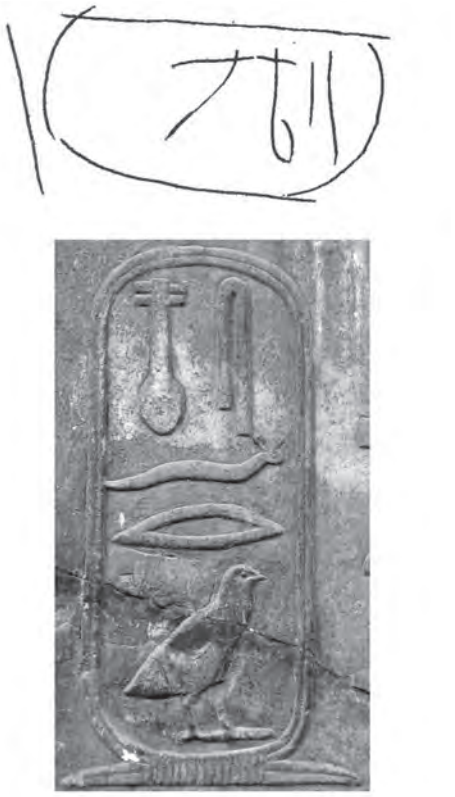

Fig. 10. Above: the cartouche found by Petrie in the pyramid temple at Meidum, which was attributed to Snefru (from Petrie, Meydum, pl. 32). Below: Snefru's cartouche from a funerary stela from Dashur (JE 89289C, Cairo Museum).

While the second phase of the Nefermaat tomb with its raised relief decoration would appear to be from Snefru's reign or associated with his later cult, the quite distinct polychrome inlay elsewhere suggests earlier origins for the tomb chapel. Although there would appear to be little direct evidence to securely date the first phase of the tomb construction, Harpur has used genealogical evidence to

[73] Harpur, *The Tombs of Nefermaat and Rahotep*, 24.

[74] Nefermaat's mastaba is approximately 700 m north and Rahotep's mastaba is some 1000 m north of the Meidum pyramid.

[75] Petrie, *Medum*, 37.

[76] Petrie, *Medum*, 39.

[77] Harpur, *The Tombs of Nefermaat and Rahotep*, 22–23.

[78] Harpur, *The Tombs of Nefermaat and Rahotep*, fig 32. A second fragmentary cartouche, which appears to be that of Snefru was found during excavations undertaken under the direction of el-Khouli, also on the outer reworked section of what had most likely been a polychrome inlay panel. See el-Khouli, *Meidum*, pl. 47, and Harpur, *The Tombs of Nefermaat and Rahotep*, 27.

[79] Harpur, *The Tombs of Nefermaat and Rahotep*, fig. 32.

[80] Harpur, *The Tombs of Nefermaat and Rahotep*, 27.

examine whether the identification of Nefermaat as the eldest son of Snefru is secure. Assuming that the children illustrated in the decoration of the tomb of Nefermaat and Atet were all direct descendants, Nefermaat appears to have had fifteen offspring, of which nine had reached adulthood by the time the tomb was decorated.[81] Assuming that there were no twins or triplets and assuming the age of fifteen as the minimum age of adulthood in ancient Egypt, Harpur suggests that the eldest child of Nefermaat and Atet was at least twenty-four years old at the time of Nefermaat's death. By applying the same fifteen year minimum gap to the preceding generations, Harpur derives a minimum age for Nefermaat at death as thirty-nine, and if Snefru is assumed to be Nefermaat's father, a minimum age of fifty-four for Snefru at this time.[82] According to several scholars, Snefru started to build at Meidum, but in year 15 of his reign he transferred his resources to Dashur to commence construction at that site.[83] Harpur argues that as a son of Snefru, for Nefermaat to have been buried at Meidum, he must have died before this year 15 transfer to Dashur. By this assessment therefore, Snefru was in his mid-fifties when he began construction at Dashur, yet it seems highly unlikely that he would have commenced such a substantial construction project at this relatively advanced age. Furthermore, given that the latest attested regnal date for Snefru is year 46,[84] or year 48,[85] this suggests that Snefru survived the death of his eldest son by more than thirty years, making Snefru at least 85 at his death; an implausibly high age for an individual of this period.[86]

Given the problems revealed for the generally assumed succession by these genealogical considerations, Harpur explored the potential family relationships if Nefermaat and Snefru were assumed to be brothers. Although Nefermaat is described on his tomb as "eldest royal son," Nefermaat's mother may not have been the principal royal wife and so Snefru may have been regarded as crown prince. Alternatively, Snefru may have become pharaoh as a result of marriage to Huni's daughter, Hetepheres.[87] When the implications of this on the possible genealogy of the period are reexamined using the same fifteen year minimum generational gap as that used by Harpur, but assuming Nefermaat and Snefru as being from the same generation, Nefermaat's death at an age of at least thirty-nine (which is assumed to coincide with regnal year 15 of Snefru) places Snefru in his early twenties when he came to the throne and in his mid-thirties when construction began at Dashur.[88] The highest-known regnal year of 48, indicates that Snefru will have reigned until he was in his mid- to late 60s; a far more reasonable age.

These genealogical considerations suggest that Snefru and Nefermaat are more likely to have been contemporaries than father and son. If this was the case, Nefermaat's father will have been the preceding king Huni, the last king of the Third Dynasty. If as "eldest royal son," Nefermaat was buried at the same site as his father, this presents a reasonable basis to consider that elements of the Meidum pyramid can indeed be attributed to Huni.

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[81] Harpur, *The Tombs of Nefermaat and Rahotep*, 28. It is also assumed that the decoration of the tomb was interrupted when Nefermaat died.

[82] Harpur, *The Tombs of Nefermaat and Rahotep*, 29.

[83] The transfer of Snefru's building activity to Dashur in year 15 of his reign is generally taken from evidence provided by the Palermo Stone and by the view of Stadelmann that the reason for holding what had previously been biannual cattle counts, on consecutive years, was to raise revenue for the construction work at Dashur (see Harpur, *The Tombs of Nefermaat and Rahotep*, 279, n. 33). As Harpur notes, there is little evidence to support Stadelmann's assertions and the references to construction contained on the Palermo Stone for the relevant years of Snefru's reign do not explicitly allow a transfer of resources from Meidum to Dashur to be assumed (see Wilkinson, *Royal Annals*, 144–46).

[84] Harpur, *The Tombs of Nefermaat and Rahotep*, 29.

[85] Stadelmann, "Beiträge zur Geschichte des Alten Reiches," 238.

[86] Harpur, *The Tombs of Nefermaat and Rahotep*, 29. It is noted, however, that Pepi II of the Sixth Dynasty is credited with a particularly long life.

[87] See Maragioglio and Rinaldi, *L'architettura delle ParamidiMenfite*, 54.

[88] Forty years for Nefermaat, less fifteen years for the point in his reign when Snefru is believed to have moved resources to Dashur, gives twenty-five years. As Snefru was younger than Nefermaat, Snefru must have been less than twenty-five at his accession.

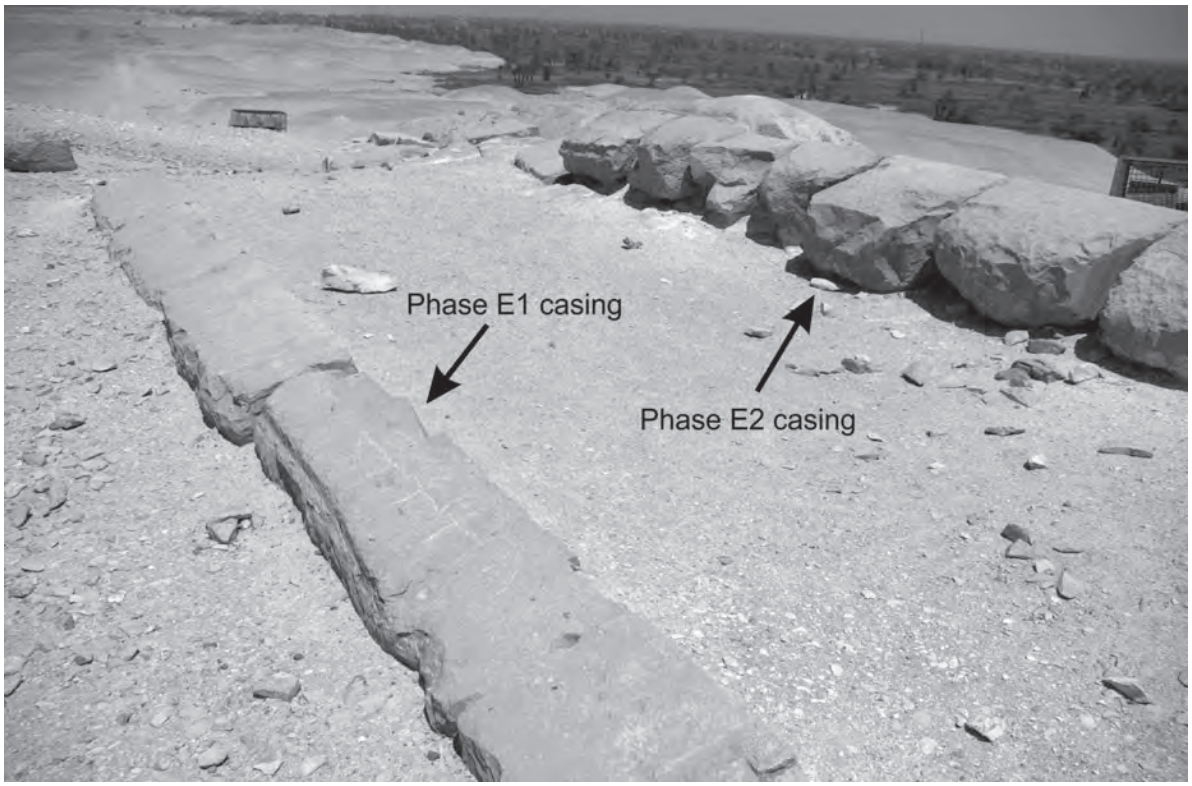

Fig. 11. General view of the two sections of casing exposed at the top of the debris mantle on the east face of the Meidum pyramid. Not visible to the left is the base of the tower-like remains of the pyramid. The casing at the left is from Borchardt's phase E1 (seven-stepped pyramid) and the casing at the right is from E2 (eight-stepped pyramid).

The Sequence of Construction and Destruction at Meidum

During a site inspection undertaken in August 2012, the current author noted that two sections of casing were exposed at the top of the debris mound above the pyramid temple (fig. 11). By comparison with Borchardt's reconstruction of the terminal phase of construction at Meidum (fig. 9), these sections of casing can be interpreted as being from stepped pyramid phases E1 and E2. Whilst the exposed casing of phase E1 (nearest to the steep-sided tower-like remains of the pyramid) has been carefully worked and dressed (fig. 12a), the exposed casing of phase E2 shows none of this refinement, with handling bosses still in place on the outer face of the masonry and significant gaps between each block of stone (figs. 11 and 12b). The current author considers that the very different standards of workmanship revealed in these two sections of exposed casing are extremely significant in terms of understanding the sequence of development and the attribution of the Meidum pyramid.

As discussed above, the prevailing view within Egyptology appears to be that the construction of the Meidum pyramid was wholly the work of Snefru. On this basis, it has been argued that Snefru began to build at Meidum (phases E1 and E2), only to transfer his efforts to building the Bent Pyramid at Dashur from year fifteen of his reign.[89] Subsequently, while building the Red Pyramid at Dashur, it has been argued that Snefru returned to Meidum to finish phase E3 of the pyramid. While it is not possible for modern observers to understand fully the thinking or the motivation of the ancient Egyp-

[89] Stadelmann, "Beiträge zur Geschichte des Alten Reiches," 235.

Fig. 12a. Detail of the phase E1 casing with the base of the tower-like remains of the pyramid visible to the upper left. This phase E1 casing is carefully worked with a smoothed outer surface and tight joints.

Fig. 12b. Unfinished phase E2 casing with handling bosses on the outer face and very wide joints. See also fig. 11.

tians, the evidence presented on figures 11 and 12 for different standards of workmanship at Meidum is not considered to be consistent with this sequence of development or with the concept that the entire Meidum structure was the work of Snefru. The hypothetical transfer of Snefru's focus between Meidum and Dashur throughout his reign, together with the evidence that Snefru enjoyed a relatively long reign,[90] would suggest that only at the end of this prolonged and disjointed building programme, would Snefru's workmen have come under any pressure to hurry the construction at Meidum. Given the timescales available under this currently accepted theory, therefore, Snefru would have had time to complete phases E1 and E2 at Meidum, transfer to Dashur and return to Meidum to add phase E3. With ample time to complete phases E1 and E2, there was no need for Snefru's workmen to work hurriedly on the casing of phase E2, in the manner suggested by the masonry shown on figure 12b.

While this evidence for poorly worked and unfinished masonry is considered to conflict with the prevailing theory that the Meidum pyramid was entirely the work of Snefru, it presents no difficulties for the theory that Huni built phases E1 and E2, as previously suggested by others and as also supported by the genealogical arguments presented above. If Huni had been responsible for the construction of phase E1, but he had died before phase E2 was completed, this would explain the poor-quality, unfinished masonry seen in figure 12b. Furthermore and as also argued above, if Snefru was responsible for the transformation of his predecessor's step pyramid into a smooth-sided pyramid to reflect the evolving cult of Ra, Snefru would have had no need to finish the casing to phase E2, as this would be buried beneath the masonry of phase E3. Although no reference to Huni has yet been identified at Meidum, the current author considers that when the genealogical arguments that Snefru and Nefermaat were

[90] Harpur, *The Tombs of Nefermaat and Rahotep*, 278, n. 23, states year 48.

from the same generation, are considered alongside the evidence that sections of the phase E2 casing were left unfinished, a strong case can be developed for the involvement of both Huni and Snefru at Meidum.

The sequence of development of Dashur during the reign of Snefru is beyond the scope of the current paper. Although the current author has been critical of the use of graffiti and quarry marks found at both Meidum and Dashur to strengthen the attribution of the Meidum pyramid to Snefru, this criticism does not preclude Snefru's involvement at the Meidum site. The current author considers that having developed a method of constructing smooth-sided pyramids at Dashur, Snefru did indeed return to Meidum to remodel his predecessor's unfinished step pyramid as an act of piety, as other researchers have suggested. Snefru's intention was to cloak the unfinished phase E2 structure in a mantle of masonry to transform it into a true pyramid (phase E3) and to construct a new pyramid temple, causeway, etc., with an east–west orientation, consistent with the form of pyramid complex that had been perfected at Dashur and which reflected the emerging solar associations of the royal mortuary complex. That the construction of phases E1 and E2 drew from a different tradition of pyramid building from the later phase E3 may also be evident in the manner in which the pyramid masonry was laid. In phases E1 and E2, the courses of masonry had a slight inward fall towards the center of the pyramid.[91] A similar treatment of the masonry can be seen at each of the preceding step pyramids at Saqqara and Zawiet el Aryan as well as the lower steep-sided sections of masonry at the Bent Pyramid at Dashur.[92] The upper section of the Bent Pyramid,[93] as well as all of the Red Pyramid at Dashur, however,[94] is built from horizontally laid masonry, similar to that used in the building of phase E3 at Meidum.[95] The different methods used to lay the masonry courses at Dashur and Meidum suggest that Snefru did not undertake works at Meidum until many of the construction issues experienced at Dashur had been resolved.

It is considered that at some point during the construction of phase E3, the Meidum pyramid collapsed. The extent of this collapse cannot currently be established, however whether widespread or more localized, the three thousand blocks of stone in the workshop area that was identified by el-Khouli, were rapidly buried and put beyond the reach of subsequent stone-robbing activities. That the Meidum pyramid was susceptible to collapse may have been brought about by the phased manner in which it had been built and as shown by the annotations to the left of figure 8, there are considered to be a number of features of the construction that may have led to inherent weaknesses in the structure:

1. The extensive areas of dressed casing on the exposed upper sections of phase E2 (see fig. 1) may have provided a zone of reduced friction along the interface between the phase E2 and E3 masonry.
2. Relatively narrow horizontal sections of phase E3 masonry will have been present at the level of each phase E2 step, which may have provided localised horizontal planes of weakness within the phase E3 structure.
3. The upper surfaces of each phase E2 step slope downward. Any tendency for movement along the cased phase E2/E3 interface (point 1 above) will have been directed along these downward sloping steps and then directed toward the narrow horizontal sections of masonry at the lower end of each step (point 2 above).
4. As discussed above, phases E1 and E2 were founded on marl bedrock after the stripping of superficial and weathered materials from the surface of the plateau, whereas phase E3 was founded on gravels. Although foundations on sand and gravel can be adequate, it is possible that the use of different founding strata at Meidum may have had consequences not anticipated by the ancient builders.

[91] M. Isler, *Sticks, Stones and Shadows* (Norman, 2001), 113 and fig. 5.3.
[92] D. Arnold, *Building in Egypt: Pharaonic Stone Masonry* (Oxford, 1991), 110, fig. 4.1.
[93] Edwards, *The Pyramids of Egypt*, 81.
[94] Isler, Sticks, *Stones and Shadows*, 119.
[95] Isler, Sticks, *Stones and Shadows*, 115, fig. 5.5b.

In isolation, these issues may not have led to the development of a significant weakness in the structure and even when combined, these factors may not have been sufficient to cause the pyramid to collapse. Perhaps, it was something as unpredictable as the seismic activity from which Egypt is known to occasionally suffer,[96] that exploited the inherent weaknesses in the structure and ultimately triggered the collapse of the Meidum pyramid. While the exact cause and extent of the collapse may remain undetermined, rather than being a plastic-type failure as suggested by Mendelssohn, the collapse at Meidum is considered to have been a predominantly sliding/overturning failure, most likely along the plain of weakness that existed along the phase E2/E3 interface. Under this sliding/overturning mode of failure, masonry will have fallen from the upper sections of the structure, whilst the lower masonry remained relatively unaffected (fig. 2).

Whatever the cause of the misfortune that befell the Meidum pyramid, it was at this point that construction activity at the site is considered to have ended. Possible confirmation of this is provided by el-Khouli, who notes that across the cleared northwest corner of the pyramid, much of the exposed casing was unfinished. Furthermore, el-Khouli's description of some blocks at the level of the first great step being "practically destroyed,"[97] may provide evidence for damage resulting from the collapse of parts of the overlying structure. The debris mound that currently surrounds the base of the Meidum pyramid and has puzzled observers for centuries, may therefore be a composite structure that may include the remains of construction ramps, chips from the building of the pyramid, and debris from the collapse of the upper parts of the pyramid. At the northwest corner of the pyramid, an Old Kingdom masons' workshop was buried in the collapse debris. In the years since the site was abandoned, limited stone robbing activities have taken place, with stone removed from the more-readily accessible areas above the level of the debris mound, contributing to the addition of further limestone chips and other material to the mound itself.

Comments on the Internal Layout of the Meidum Pyramid

As discussed above, Petrie fully cleared the internal features of the Meidum pyramid during his earliest expedition in 1891. Although Petrie did not find any new internal spaces, he considered that "there are still some interesting matters awaiting a future explorer in that place." At the World Congress of Egyptology held in Cairo in Spring 2000, Gilles Dormion and Jean-Yves Verd'hurt presented the findings of investigations they had undertaken within the Meidum pyramid.[98] Their work had developed from a series of astute observations made during an initial visit to the pyramid, particularly their observation that at a little over 2 m span, the ceilings of the two antechambers in the pyramid were remarkably intact (marked X and Y on fig. 13). Limestone is a relatively weak stone and, as Dormion and Verd'hurt noted, would not normally be expected to span such distances without the need for intermediate support. In order to investigate this further, they undertook an endoscopic investigation of the masonry overlying the antechambers, which revealed a pair of hitherto unexpected corbelled relieving chambers above the ceiling slabs (identified as Xr and Yr on fig. 14). Additional investigations using similar techniques also revealed a corbelled relieving space above the lower sections of the descending passage.

Although not previously suspected, these relieving spaces are extremely interesting from an engineering perspective and reveal a level of understanding on the part of the ancient builders that is quite

[96] R. Kebeasy, "Seismicity," in R. Saad, ed., *The Geology of Egypt* (Rotterdam, 1990), 51.

[97] El-Khouli, *Meidum*, 12. Though other causes of this damage, such as weathering and erosion of the casing blocks at this position, cannot be discounted.

[98] G. Dermion and J-Y. Verd'hurt, "The Pyramid of Meidum. Architectural Study of the Inner Arrangement," *Proc. World Egyptology Congress, Cairo, 28.03–03.04.2000*. Noted also in R. Stadelmann, "Builder and Unique Creator of the Pyramid of Seila and Meidum," in O. el-Aguizy and M. Sherif Ali, eds., *Echoes of Eternity. Studies Presented to Gaballa Aly Gaballa* (Wiesbaden, 2010), 38, n. 24.

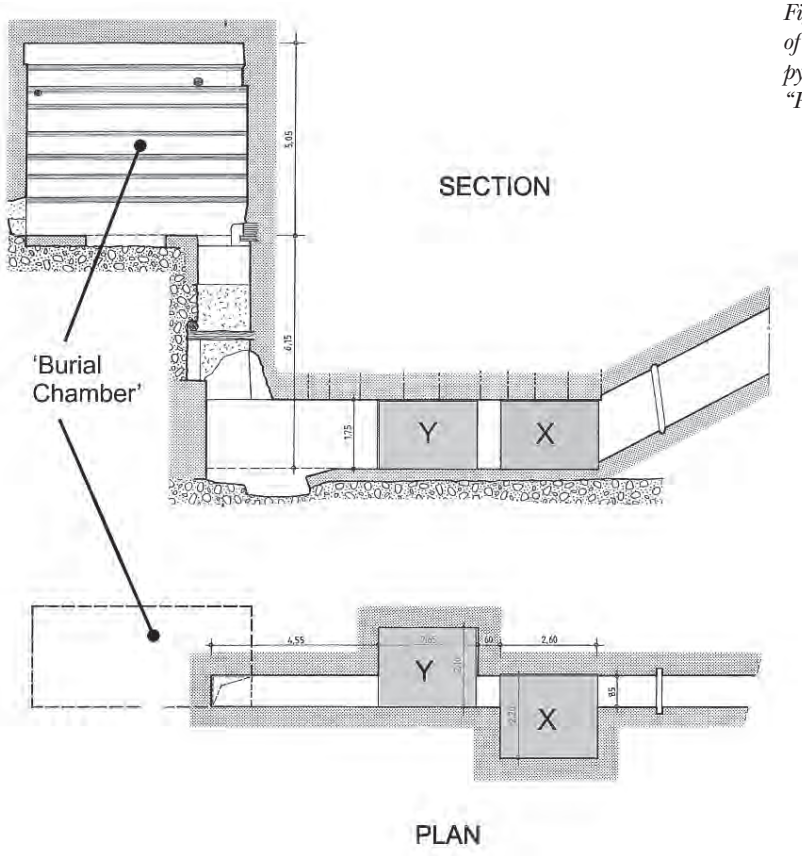

Fig. 13. Plan (below) and section (above) of the inner chambers of the Meidum pyramid (after Dormion and Verd'hurt, "Pyramid of Meidum," pl. 1).

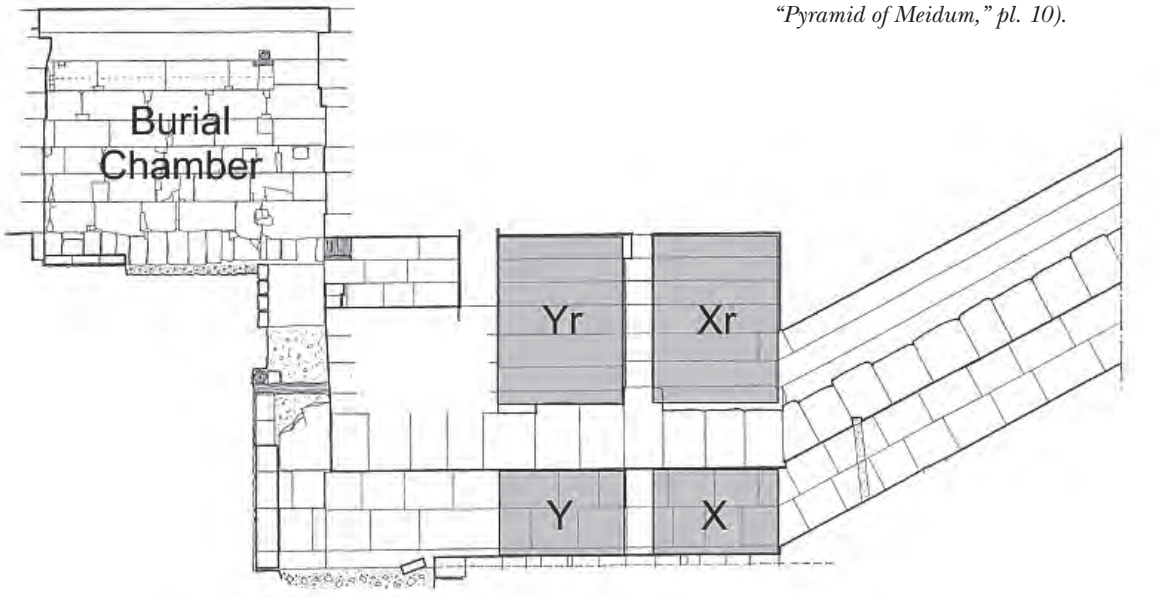

Fig. 14. Antechambers X and Y with overlying corbelled relieving chambers (Xr and Yr) (after Dormion and Verd'hurt, "Pyramid of Meidum," pl. 10).

remarkable. As well as congratulating the authors on their keen observation, the current author would like to raise one issue that Dormion and Verd'hurt do not appear to have mentioned in their publication. As shown on figure 14, when the findings of Dormion and Verd'hurt are considered in the context of the antechambers, the higher-lying corbelled chambers appear to have been sealed off at the time of the pyramid's construction, with the clear intention that it was the underlying chambers with their originally flat ceilings, that were intended as the "usuable space." The findings of Dormion and Verd'hurt are, therefore, extremely interesting when the third, innermost chamber at Meidum is considered.

This inner chamber has traditionally been referred to as the "burial chamber," however, unlike the two antechambers, it is the corbelled element of the *burial chamber* that is regarded as the "usable space." The current author is not aware of any studies that have investigated the masonry underlying this corbelled "burial chamber," however, if the findings of Dormion and Verd'hurt were extended to the innermost part of the Meidum pyramid, it would not be unreasonable to expect a chamber with a flat ceiling to be present beneath the corbelled space. Furthermore, it would not be unreasonable to expect that this hitherto undisclosed internal space was originally intended as the burial chamber of the pharaoh for whom the Meidum pyramid was built—potentially the burial place of king Huni.

There remain, therefore, a number of unresolved issues associated with the Meidum pyramid. Despite recent unexpected discoveries associated with the internal layout of the pyramid, it is remarkable that over a century after Petrie's work at Meidum, the precise attribution of the pyramid has not been determined. It is also remarkable that there is still no explanation for the shallow depression that was identified by Petrie in 1891, high up on the exposed casing of the steep tower-like remains of this most unusual and perplexing structure.

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