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Hetep-heres and the Satellite
Pyramid of Khufu

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DEUTSCHES ARCHÄOLOGISCHES INSTITUT
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VERLAG PHILIPP VON ZABERN · MAINZ AM RHEIN

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Abstract

Reisner's explanation for the burial assembly of Hetep-heres I (found intact, except for the queen's body, in an unmarked tomb) is contested and an alternative explanation is developed. The unfinished pyramid cutting immediately south of, and on line with, the queen's tomb was begun for a pyramid superstructure intended for Hetep-heres I, rather than having been abandoned because of her tomb as Reisner suggested. The first queen's pyramid, which was the initial member of the Great Pyramid's Eastern Cemetery, was moved to the location of GI-a so as to align with a satellite pyramid being prepared for Hetep-heres's son, king Khufu. The change in plan for the queen's pyramid may have resulted in the removal of the queen-mother's body from her original tomb and its relocation in pyramid GI-a or GI-b. The king's satellite pyramid is represented by the so-called "trial passages" which replicate the passages in the Great Pyramid in the same manner that the substructures of satellite tombs and pyramids copy the main pyramid in other royal funerary complexes. The layout of the Eastern Cemetery, including the substructure for the satellite pyramid, was coordinated with the base and internal features of the Great Pyramid by means of marked lines which were used in the layout of the Pyramid. The superstructure for the king's satellite pyramid was not built due to the development and elaboration of the mortuary temple and causeway. The construction sequence of the Eastern Cemetery is reconstructed with respect to the layout of the Pyramid and the mortuary temple. Suggestions are offered for the thematic function of the earlier layout of the Eastern Cemetery.

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I. The Pyramid Tomb of Hetep-heres I

A. The Tomb and Its Anomalies.

The tomb of Hetep-heres I is situated on the axis of north-south street G7000 in the Eastern Field of the Great Pyramid cemeteries (Fig. 21, B). This is one of the many streets and avenues forming a kind of grid network (Reisner 1942, 61–4) which organizes the cemeteries into a preplanned city of the dead, or, to use Reisner's phrase, a "community of kas" (Ibid., 27). Street G7000 begins on the south in front of the queen's pyramid, G1-c, where it was blocked off in the 21st Dynasty by the Temple of Isis, Mistress of the Pyramids – an extension of the mortuary chapel of G1-c (Jones and Milward 1982; Porter and Moss 1974, 17–19). From here the street slopes gradually to the north passing the two remaining queens' pyramids, G1-b and G1-a. This "Queens' Street", as Reisner called it, terminates at a high point beyond the NE corner of pyramid G1-a at the shaft tomb of Hetep-heres I (G7000x; Figs. 1, 9, 21, 22).

The tomb was discovered in February 1925 by the Harvard-Boston Expedition while its director, George Reisner, was on a visit to the United States. It consists of a vertical shaft 27.42 ms. deep, which opens at 25.50 ms. onto a rectangular rock-cut chamber, 5.22 ms. long, 2.67–2.77 ms. wide, and with a height of 1.95 ms. At the top of the shaft, on its northern side, a rock-cut stairway of 12 steps with a total length of 3.4 ms. and a width of 55 cms. enters the shaft at a depth of 3 ms. as a tunnel 95 cms. in length (Fig. 2).

The stairway and shaft were found completely filled with masonry and plaster blocking and their general location was covered with gravel. The funeral assembly of Hetep-heres I was found in the burial chamber. It included a sealed alabaster sarcophagus surrounded by disintegrated royal possessions such as a bed canopy, curtain box, armchairs, bed, carrying chair, boxes, and pottery. Inscriptions on the bed canopy and curtain box gave the name and titulary of King Sneferu, while those on other pieces of furniture, such as the carrying chair, inlaid box, bracelet box, and leather case for walking sticks, cited the name Hetep-heres as the "Mother of the King of Upper and Lower Egypt. . . ." (Reisner and Smith 1955, 17, 25–7, 33, 39). Mud seals retrieved from the deposits in the burial chamber were impressed with the *w'bt Hr Mddw*, "embalming house of Khufu". From these texts it was deduced that Hetep-heres (I) was the wife of Sneferu and the mother of Khufu.

This momentous discovery was characterized by two major anomalies: 1. the tomb was unmarked by any superstructure; and 2. the sarcophagus was found to be completely empty. The first anomaly violated a principle that Reisner had stated in *The Development of the Egyptian Tomb*, namely that "every substructure implies a superstructure which marks the site of the grave and provides a place where the offerings to the dead may be placed" (1934, 237). The violation of Reisner's principle was all the more radical in the case of G7000x in that this tomb contained the burial equipment of the queen-mother, perhaps the most important female of the court. The second anomaly would be all the more unusual if the sealed canopic chest had contained the queen's viscera. This would prove that her death did not result in the destruction of her body but that the body had initially been preserved in the process of mummification.

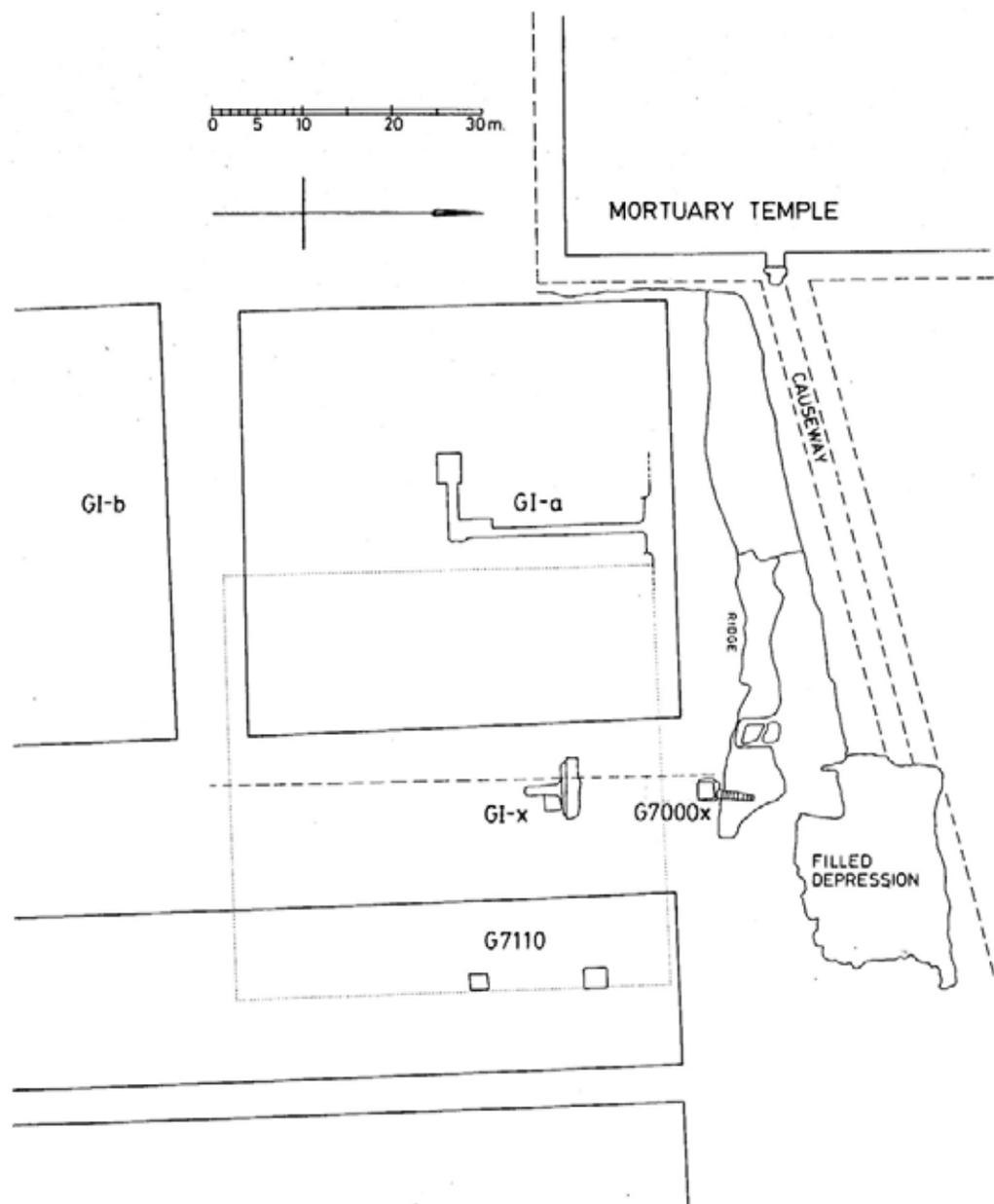


Fig. 1. The shaft-tomb of Hetep-heres I (G7000x) and the unfinished cutting for a pyramid descending passage (G1-x).

B. Reisner's Explanation.

In order to account for these anomalies, Reisner offered an "ingenious explanation" (Reisner and Smith 1955, 1) which reconstructed the events leading up to the burial of Hetep-heres's funerary equipment at Giza:

This lady outlived Sneferu and was buried by her son Cheops, probably beside her husband's pyramid at Dahshur. The tomb did not remain long undisturbed and the queen's body was destroyed by the robbers who broke into the chamber. A clever prime minister seems to have been able to convince Cheops that little damage had been done. He ordered

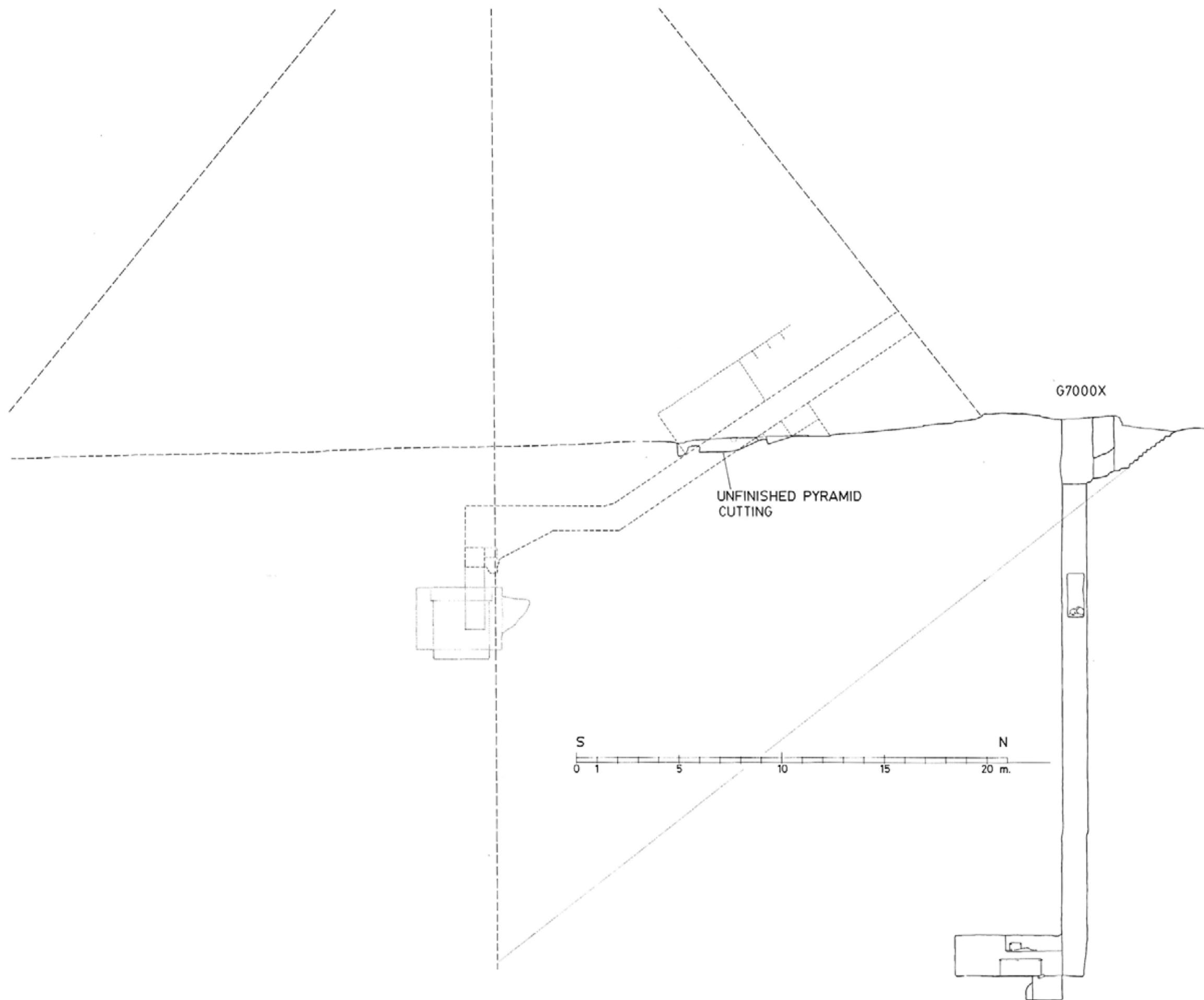


Fig. 2. Profile of G1-x and G7000x with pyramid G1-x reconstructed (patterned after queen's pyramid G1-a).

the lid of the alabaster coffin replaced to hide the absence of the queen's body, and the greater part of the unharmed burial equipment was moved to a secret shaft in front of the Great Pyramid in the new cemetery at Giza. Cheops apparently never discovered the ruse practised upon him by his minister, for he made an offering to his mother's spirit before the shaft was finally closed (Smith 1960, 26).

The offering was found in a niche cut into the west side of the shaft at a depth of 7.47 ms. (Fig. 2). It consisted of the horned skull and three legs of a bull, found in the remains of a decayed reed mat, and two wine jars. Two basalt fragments included with these remains suggested to Reisner that work was in progress on the basalt floor of the king's mortuary temple when the offering was made.

The hypothetical original tomb of Hetep-heres I at Dahshur has not been found (the only evidence for this queen's existence comes from G7000x). There is no textual evidence, contemporary with the 4th Dynasty or from later times, for the plundering of this tomb and the transfer of its contents to Giza. Reisner's reconstruction of events is based entirely upon the archaeological evidence gathered from G7000x. Nevertheless, his scenario was passed down in the literature, e.g. *The Cambridge Ancient History* (Smith 1971, 168), as historical fact.

Reisner's interpretation has important implications for the chronology of the Great Pyramid's Eastern Cemetery. These implications involve the bedrock cuttings for a pyramid which occur 12.7 ms. directly south of G7000x and, like the tomb, approximately on the N-S axis of "Queens' Street" (Reisner 1942, 70, Fig. 18; Maragioglio and Rinaldi 1965, 96, Tv. 11, Fig. 5). This cutting (Figs. 1, 2) is T-shaped in plan with the leg of the T pointing south. The leg is the beginning of a descending passage which would have entered the bedrock from the north, coming from the entrance in the outer face of the pyramid and sloping through its masonry core. It has been cut in the rock surface for a length of 3.75 ms., a depth of 54 cms., and a width of 85 cms. The bar of the T at the north end of the cutting is on a gradient from north down to south and has a width of 6.35 ms. This was to receive the sloping courses of masonry which would have carried the descending passage out and up to the pyramid's north face. When Reisner first cleared the cutting from under the 4th Dynasty street deposit of packed mud, limestone chips and powder, he found traces of plaster in the bar of the T in which had been set the first two of the sloping courses of masonry. These had been removed when the cutting was abandoned.

This pyramid, G1-x, was abandoned for a site 28 ms. to the west.¹ At the new site the queen's pyramid, G1-a, was built as the first in the row of three lined up east of the Great Pyramid (Reisner 1942, 70-2). The layout of these three small pyramids (Fig. 9) determined the position of street G7000, and subsequently the position to the east of the original twelve great mastaba cores built during the reign of Khufu. Of these twelve cores, which were probably not initially assigned to their owners, the eight northernmost were joined up, and the four remaining on the south received southern extensions, to make up the nucleus cemetery G7000 of eight main cores, around which were constructed ancillary mastabas in the following reigns.

The change from G1-x to G1-a brought the first queen's pyramid to within 1.5 - 2 ms. from the E wall of the Khufu mortuary temple in the corner formed by the temple and the

1 Reisner gives different values for this distance: 42 ms. (1942, 70), which might be a typographic error; 32-25 ms. "from the axis of the cutting (G1-x) to middle of G1-a" (Ibid., 71) and 28 ms. from the axis of the cutting (G1-x) to the passage

of G1-a (Ibid. 1927, 5). The distance of 28 ms. from the unfinished cutting (G1-x) to the passage of G1-G1-a agrees with our surveying to fix the location of both (see p. 102-6).

causeway (Figs. 1, 9). According to Reisner, this shift and the consequent crowding in this corner was made necessary when the shaft tomb of Hetep-heres I was begun. Assuming that GI-x would have been about the same size and approximately on the same E-W axis as GI-a, its northern base would have come to within a meter of the south edge of G7000x. Reisner thought that this was unacceptable to the ancient builders.

As GI-x would have covered about half the area now occupied by GI-a, and as its east face would have run nearly through the center of mastaba G7110 to the east, (Fig. 1), neither GI-a nor this mastaba could have been begun when the cutting was made for GI-x. The three queens' pyramids and the original twelve great mastaba cores were laid out according to a prearranged plan. Either this plan was not conceived when GI-x was begun, or the whole plan was originally intended to be situated further east by 28 ms. If G7000x was prepared before the shift of GI-x to GI-a, then none of the architectural members of the Eastern Cemetery had been built at the time Hetep-heres I died and her burial equipment was placed in the shaft tomb at Giza.

C. Questions Raised.

1. The queen's hypothetical original tomb at Dahshur is said to have been attacked very soon after the burial. Since the attack came so soon, would thieves, working in "frantic haste" and "deadly fear of discovery" (Reisner 1927, 32) have bothered to lift the heavy lid of the sarcophagus and entirely make off with the queen's body when there were many more portable objects of great value about in the tomb?

2. Even if the thieves had "made straight for the sarcophagus" (Id. 1928, 82) in their haste and fear, would they not have smashed through the lid rather than carefully prying it off and leaving it intact?

3. It is conceivable that the king would not have been told about the missing body by the vizier, that "the vizier could trust to the natural repugnance of the king to prevent his opening the coffin and looking upon the body of his dead mother" (Id. 1928, 83) all during the interval which must have elapsed between the discovery that the Dahshur tomb had been robbed and the new tomb prepared at Giza?

4. Why should the queen's tomb have been moved to Giza rather than measures having been to prevent further plunder of her original tomb at Dahshur which, according to Reisner, would have been "provided with an offering chapel and a funerary priest, and in all probability the necessary offerings to her spirit were maintained at the Dahshur tomb" (Id. 1928, 35)? If the Dahshur tomb of Hetep-heres I was in further danger, were not the other contemporary Dahshur tombs, like those of Prince Ka-aha-ef (deMorgan 1895, 12-13, Fig. 12), Prince Sneferu-nefer-her, Prince Qed-shepses, Prince Ka-nefer (deMorgan 1903, 14, Figs. 26, 32; 22, Figs. 50, 51; 23, Figs. 52-54 respectively), Prince Iy-nefer-ef (Barsanti 1902, 198-201), and that of King Sneferu himself in like danger?

5. After the transfer of the queen-mother's burial to Giza, why should the new tomb be a "secret tomb" in the sense that there was no superstructure nor offering place? If the secret tomb was to insure that no further violation took place, by this reasoning all the other tombs of members of the royal court at Giza should likewise have been secret - that is without a superstructure or offering place.

6. How secret could this tomb have been at the time it was cut and when the burial equipment was transferred since it is located less than 15 ms. from the Great Pyramid's causeway, "up which stone was still being dragged for the Great Pyramid" (Reisner and Smith 1955, 59)? Whether or not the causeway was an access route for the transport of

materials to the uncompleted Pyramid,² the general site where G7000x is located would, on a normal day, have been teeming with thousands of workers, no doubt staying in a nearby settlement with their families. Even if the site had been entirely cleared of personnel for the transfer to G7000x, it is hard to imagine the act being kept secret in such a setting. Were there not more obscure locations for a quickly prepared tomb to be kept truly secret? Why was the burial assembly not discreetly interred in the Western Cemetery of the Great Pyramid, further from the main construction project, where 43 mastaba cores were finished, according to Reisner (1942, 83–4), before year 15 of Khufu, the year estimated for the transfer to G7000x (Reisner and Smith 1955, 1)?

7. If the burial was transferred as an act of “filial piety,” why was there no restitution of the broken pottery and violated equipment which could have been resealed with the seals of Khufu’s mortuary workshop?

8. Why locate the secret burial shaft of the queen-mother almost exactly on the axis of a queen’s pyramid already begun, if such a position meant that the pyramid, and possibly a unified plan for the entire Eastern Cemetery, would have to be shifted 28 ms. to the west, thereby crowding the first queen’s pyramid, GI-a, up against the king’s mortuary temple?

D. G7000x and GI-x: The Tomb and the Pyramid.

Certain facts and observations about the position of the tomb of Hetep-heres I should be emphasized:

1. There must have been some degree of selectivity in choosing the place for the queen-mother’s tomb at Giza. Reisner suggested that “the king himself probably designated the place for the secret tomb, but the selection of the exact spot would have been left to the director of works and the stone cutters” (Reisner 1927, 31).

2. G7000x is situated near the E-W center axis of the Great Pyramid, if that axis were projected to the east (Fig. 9). The center of the tomb actually lies about 9 ms. south of this line.

3. G7000x lies on the north boundary line of the Eastern Cemetery (Fig. 9). While this might be coincidence, this line corresponds to the axis of the King’s Chamber in the Great Pyramid, if that axis is projected down and eastward parallel to the E-W axis of the pyramid.

4. Hetep-heres tomb was situated in a precinct that was shortly afterward zoned for the burial of queens (the three queens’ pyramids plus mastaba G7050 immediately south of pyramid GI-c; Reisner identifies the mastaba as that of Nefertkauw, “the eldest daughter of Sneferuw and fourth queen of Cheops,” (Ibid., 4).

2 The main supply ramp obviously must have run from the principle quarry to the pyramid.. It is likely that most of the stone for the core – the bulk of the pyramid – was quarried locally and the principle quarry is likely the great depression in the west part of the Central Field due south of Khufu’s pyramid. This could probably be reached by a straight ramp with a functional slope. The east end of the great wadi bordering the Giza promontory along the south could have served as an access for non-local materials, like granite and Turah limestone, to be brought to the end of the great supply ramp sloping down from the south side of the pyramid. Something like this arrangement has been visualized by Sporry and Tadema

(1982, 54). I would like to thank Peter Lacovara for this reference. There is no quarry of any significance within practical distance to the east, west, nor north of the Great Pyramid. Furthermore, since it probably grew to mammoth proportions, the main supply ramp could not have covered the east nor the west fields. Khufu’s royal cemeteries were begun there from the early to the middle part of his reign, and, therefore, most probably while the great ramp was servicing the construction in progress on his pyramid. There is no reason to struggle with the implausibility of a straight ramp reaching from the summit of the pyramid to the level of the Nile Valley to the east.

5. Hetep-heres tomb was situated almost directly on the N-S axis of unfinished queen's pyramid GI-x such that it would have been a few meters in front of that pyramid's north center base if it had been completed.

6. The queen's tomb would, therefore, have been situated with respect to the pyramid, GI-x, almost exactly in the place occupied by a north entrance chapel such as has been found attached to other royal pyramids dating from the 4th to the 13th Dynasties.³

3 At the Lisht pyramid complex of Sen-Usert I there are nine subsidiary pyramids, and one satellite pyramid at the SE corner of the inner enclosure, each with a small north chapel over a vertical entrance shaft (see pp. 14–15); Lansing 1934, 5, 9; Edwards 1961, 223, Fig. 44; Lauer 1974, 174–6, Fig. 47). Enough remained of a north chapel over the entrance to the sloping passage of the king's pyramid in this complex for Hayes (1934, 9–26, Figs. 11, 16–23) to offer a reconstruction. This was based, in addition to these remains, on evidence of north entrance chapels known at that time at other pyramids ranging in date from the 6th to the 13th Dynasty. These included the Saqqara pyramids of Teti (6th Dynasty: Firth and Gunn 1926, I, 8–9, Fig. 2, II, Pl. I), Queen Neit (wife of Pepi II, 6th Dynasty: Jequier 1933, 11–12, Pls. I–II), and Queen Iput (6th Dynasty: *Ibid.*, Pl. XXXVI). Traces of the north chapel were also found at the Pyramids of Sen-Usert II (12th Dynasty: Petrie, Brunton, Murray 1923, 5, Pls. VIII, XVII) and his queen at el-Lahun (*Ibid.*, 8, Pl. XVII; Petrie 1890, 5, Pl. XII), and at the pyramid of Khendjer at Saqqara (13th Dynasty: Jequier 1938, 15–18, Pls. II, III, V).

Hayes (1934, 18 n. 39) mentions the probability that the pyramid of Amenemhet I at Lisht also had a north entrance chapel based on the fact that a large granite stela was found beside the entrance to the passage. The pyramid of Pepi II probably had a north chapel, as indicated by relief fragments found near the entrance built into the girdle wall at the base of the pyramid. The chapel had apparently been soon dismantled when the girdle wall was constructed (Jequier 1936, I, 2–5, Figs. 1–4).

Since the time Hayes wrote, Ricke (1950, 123–4, Abb. 49) reconstructed a chapel over the entrance to the pyramid of Unas (5th Dynasty) at Saqqara. He suggested that this feature first made its appearance in the Unas complex, along with the texts on the walls of the burial chamber and the serdab, as a supplement to the burial chamber.

Fakhry found a small offering shrine or chapel near the north center base of the Bent Pyramid at Dahshur. This consisted of a small limestone offering table in the form of the *htp* sign, located 1.8 ms. west of the entrance axis and 5.7 ms. from the base of the pyramid. This was enclosed in

mudbrick walls which began 3.95 ms. from the base of the pyramid (Fakhry 1959, 41–6, Fig. 6, Pl. VII; cf. Maragioglio and Rinaldi 1964, 72–4, 110–13, Tv. 14, Figs. 1–4; compare with G7000x, located 3.9 ms. from the north base of pyramid GI-x as constructed in Fig. 2). The remains of a cult layout were also found at the north center base of the Bent Pyramid's satellite pyramid (see pp. 21f and Fig. 5 here).

No entrance chapels are known from the 4th Dynasty Giza pyramids, although Fakhry (1969, 258) mentions "remains of mudbrick walls and a great number of small chips of stone" found at the base of the Third Pyramid in front of the entrance during the 1968 excavations of Ali Hassan. Fakhry suggests these are probably the remains of an offering chapel. Further to the north, and on line with the entrance of the Third Pyramid, there exists a large mastaba-like construction which appears to have had its rubble fill excavated away, leaving the retaining walls freely standing.

Maragioglio and Rinaldi (1965, 60–1, 160–63) suggest that a north chapel may not be known for the Great Pyramid either because it was not looked for, or because it was destroyed. They point out a gap in the preserved pavement at the north side below the entrance which may indicate where a chapel once stood which was later robbed out. Jequier (1938, 17) and Hayes (1934, 12) suggest that more pyramids may have had north entrance chapels, but being located over or near the entrance, they were the first thing to be demolished by those who plundered the pyramids.

The north chapel may have had its precedent in the location of the mortuary temple of Zoser at the north side of his Step Pyramid (Jequier 1938, 17; Hayes 1934, 11–12). Ricke suggests that the function of the entrance chapel may correspond to the "blue chambers" in the substructure of the Zoser Pyramid, and that this function is extended to the upper cult layout by means of the entrance chapel in later funerary complexes (Ricke 1950, 124). The idea that the entrance chapel was lacking from the 4th Dynasty pyramids due to the fact that their entrances were higher on the pyramid face (Hayes 1934, 12), or because the solar cult moved the offering cult layout exclusively to the east face of the pyramid (Jequier 1936, 1, 2), is nullified by those northern cult layouts found at the Bent Pyramid complex. These are the precur-

Observations 4, 5 and 6 encouraged the hypothesis that *the unfinished pyramid cutting, GI-x, and the tomb of Hetep-heres I were intended to be part of the same funerary monument; in other words, pyramid GI-x was begun as the pyramid tomb of Queen Hetep-heres I.*

In order to ascertain how this pyramid tomb would have appeared in section, Fig. 2 was constructed on the basis of the actual profile obtained from GI-x and G7000x and on the model of pyramid GI-a (from Maragioglio and Rinaldi 1965, Tv. 11, Fig. 2; Tv. 12, Figs. 1, 5, 6). The shaft, offering niche, and burial chamber of G7000x are reconstructed on the basis of Reisner and Smith (1955, 13–14, Figs. 12, 13, 14, 15, 19, 21, 22). The reconstructed pyramid is shown in plan with a dotted line in Figs. 1, and 9.

GI-x would have come nearer to the tomb shaft had it been positioned exactly on the E-W axis of GI-a. However, when I drew the profile of the surface from GI-x to the north end of the stairway of G7000x, it was clear that the rock had been regularized, although not leveled, to a point 3.9 ms. south of the shaft. Here there is a very slight E-W cutting no more than 10–15 cms. deep which looks to be the most plausible line for the intended north side of GI-x. From here up to the mouth of G7000x the rock surface rises slightly, having been left unworked when the pyramid project was abandoned.

If the pyramid had been built, the rock foundation for the north side would probably have been cut deeper. At the same time, it is likely that the base of GI-x would have accommodated the NW-SE surface slope rather than levelling it off, as is the case with GI-a where the NW corner is only slightly set into a foundation cutting in the rock surface (Maragioglio and Rinaldi 1965, 78–9 give a difference in height of 2 ms. between the NW and SE corners of GI-a).

E. Parallels and Precedent.

The configuration of a vertical shaft substructure at, or near, the outside base of a pyramid may seem odd at first glance, at least for the 4th Dynasty. However, there are possible parallels. Although it cannot explain the precedence for GI-x/G7000x, a parallel might be seen in the 12th Dynasty pyramid complex of Sen-Usert I at Lisht. In this complex nine subsidiary pyramids presumably belonging to female royalty (two on the south belonged to a queen Neferu and a princess Itakayt) are located around the main pyramid between the inner stone and outer mud-brick enclosure walls. In addition there is a small satellite pyramid within the first enclosure wall at the SE corner of the main pyramid. Each small pyramid is entered by a vertical shaft located at the center of the north face. A small offering chapel was built directly over this entrance shaft in each pyramid – this is in addition to the usual mortuary chapel at the east side of each pyramid. A second shaft was constructed, usually to the east, which communicated with the first shaft at the bottom by a short horizontal passage. This may have been for the introduction of the sarcophagus after the offering chapel was built (Gautier and Jequier 1902, 20–21, Fig. 19; Lansing 1920, 3–11; 1926, 33–40; 1934, 4–9; cf. Lythgoe 1915, 145–53; Mace 1921, 5–19; 1922, 4–18; Edwards 1961, 223, Fig. 44; Lauer 1974, 174–76, Fig. 47).

Another pyramid with a vertical shaft for an entrance, also of the 12th Dynasty, (for

sors of the more standardized entrance chapels developed during the latter part of the Old Kingdom and retained through the Middle Kingdom. These small enclosed chapels, with a false door, reliefs, and an offering table, were built directly against the face of the pyramid over the entrance at the center of the north side (or at the tradi-

tional place of the entrance on the north side even where the entrance was placed elsewhere as at the pyramid of Khendjer). Being a smaller copy of the offering temple at the east face of the pyramid (Ricke 1950, 123–4), the entrance chapel provided a more immediate and logical connection with the deceased king.

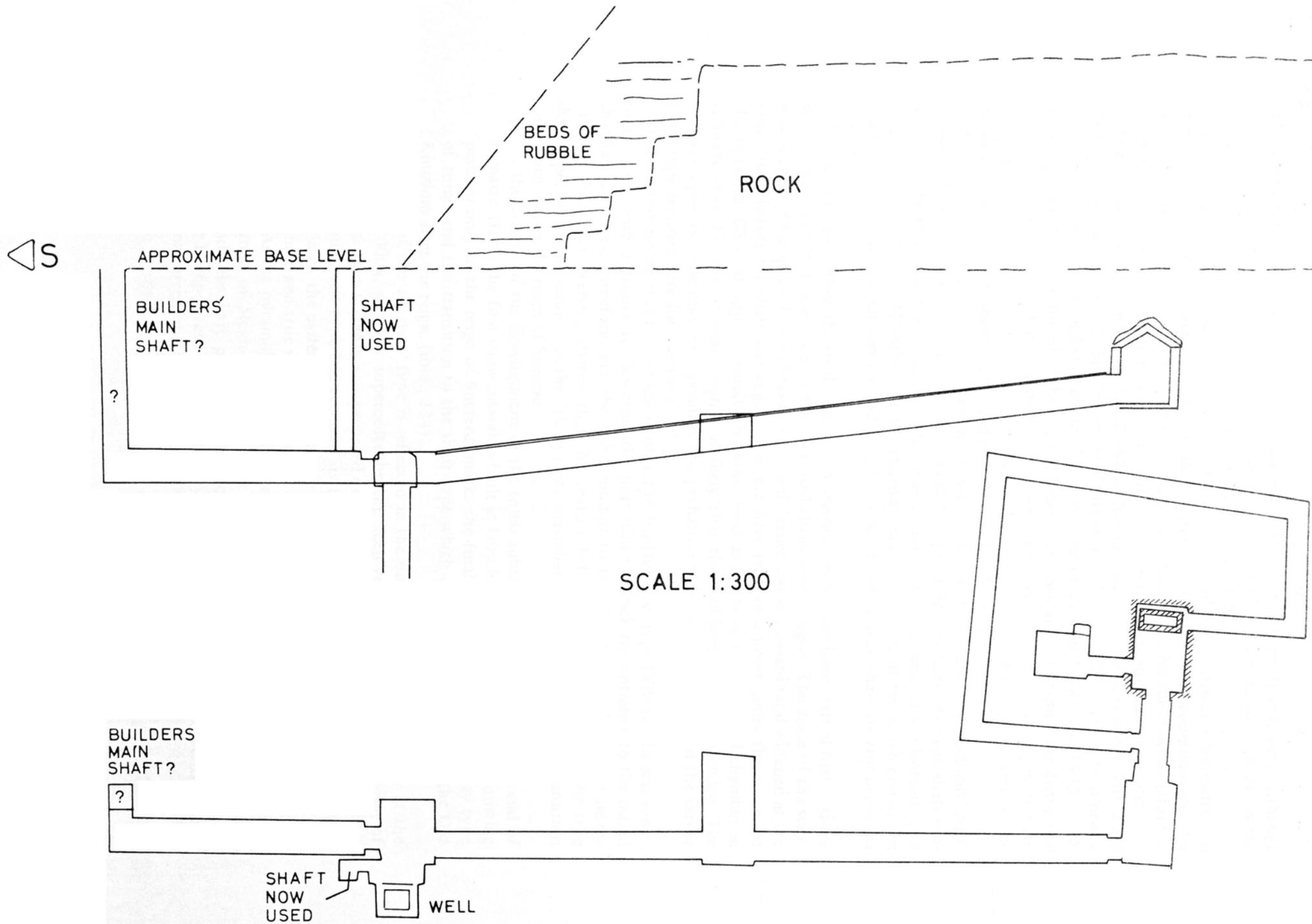


Fig. 3. The substructure of the pyramid of Sen-User II at Illahun. Plan and section (after Petrie 1890, Pl. II).

which a better section view has been published), is that of Sen-Usert II at Illahun, although here the arrangement, similar in other respects to the small Lisht pyramids, occurs at the south side of the main pyramid (Fig. 3; Petrie 1890, 1–2, Pl. II).

The arrangement of these 12th Dynasty Pyramids differs, of course, from the reconstructed pyramid GI-x/7000x in that the vertical shaft entrance of the former communicates, by horizontal or sloping passage, with a burial chamber(s) located under the superstructure of the pyramid. With GI-x/7000x there are two substructures which do not communicate.

The stairway at the north side of G7000x indicates that this tomb was begun with a 3rd Dynasty pattern in mind, as Smith suggested (Reisner and Smith 1955, 13). The stairway plus shaft approach to a single burial chamber is Reisner's type IVB(2) (Reisner 1935, 7–8). This type was first introduced in the reign of Khasekhemuwy and it became "the distinctive type of substructure used at Memphis in large tombs of Dynasty III" in which more than one chamber was cut – type IVB(1) (*Ibid.*, 154). In the latter part of the dynasty the tendency was toward a single large burial chamber – IVB(2) (*Ibid.*).

Because of the disproportion between the small stairs and the very deep rock-cut shaft, G7000x does not look quite like the ideal IVB(2) type of 3rd Dynasty stairway-shaft substructure. In this type the burial chamber was entered by a doorway at the bottom of a great vertical shaft, like G7000x, but the stairway ramp, beginning at the north end of the mastaba, descended much farther and deeper to meet the vertical shaft shortly above its bottom.

In the case of G7000x, the small and narrow stairway must have been started first – there would have been little use for it if the shaft had already been begun. The angle of the stairway is about 38 degrees. If it had been continued deeper and southward (and widened at the same time) before the shaft was begun, it would have reached a point under the center of the pyramid, GI-x, at approximately the same level as the floor of the burial chamber in G7000x (Fig. 2). Yet, it seems highly unlikely that this had been initially intended. The stairway appears to be only an appendage and perhaps is to be seen as a vestige of the earlier tomb type retained here for tradition.

It should be noted that the vertical shaft in the 3rd Dynasty (type IVB) tombs was sometimes fitted with a groove for lowering the portcullis to block the entrance to the burial chamber, and was, therefore, not the main conduit to the chamber but had a secondary function. However, Reisner affirms that this feature led to the development of the true shaft type, such as is common in the 4th Dynasty mastabas (*Ibid.*, 170–171). This transition took place within the reign of Sneferu:

... the course of the development of the tomb substructure is clear from the end of Dynasty III to the first stone mastabas built at Giza by Cheops. This period, consisting perhaps only of the reign of Sneferu, marks the final passing of the old stairway type of tomb and the transition to the shaft type which dominated the whole of the Old Kingdom after the reign. (*Ibid.*, 234)

This passing of the stairway type is reflected in the rude, stunted little stairway at the north side of G7000x, abruptly superseded by the deep vertical shaft. This may be one of several indications that G7000x was prepared early on in the reign of Cheops (see pp. 134–40) before the true shaft type had received its full development in the cemeteries begun in the western, and later, the eastern fields around the Great Pyramid.

The stairway-shaft and true shaft tomb so far discussed are those associated with mastaba superstructures. As for pyramids, the tradition of the long sloping passage was developed as early as the Pyramid of Meidum and was continued and embellished in the 4th Dynasty Dahshur main and subsidiary pyramids. Therefore, if a pyramid superstructure (GI-x) had been intended for Hetep-heres I's Giza tomb, why did the substructure incorporate the more archaic elements or correspond more to that of the mastaba tombs?

According to Reisner (1935, 6), the king's tombs present the main line of development, putting them ahead of the "private tombs" in substructure innovations. It should be noted that in the substructures of the Meidum and Dahshur 4th Dynasty pyramids, only the north entrance passage of the Bent Pyramid, and to a lesser extent that of its subsidiary pyramid, are cut for any length in the bedrock foundation. The lower part of the descending passage in the Meidum pyramid and its burial chamber are partly built into an open trench (Rowe 1931, Pl. X; Maragioglio and Rinaldi 1964, Tv. 4), as is the case with its subsidiary pyramid. Thus the 4th Dynasty pyramid substructures at Meidum and Dahshur are transitional from Reisner's royal tomb type V, sloping passage and tomb built in an open pit and trench — Zoser and the Unfinished Pyramid at Zawiyet el-Aryan⁴ (Reisner 1935, 7–8), and the Giza Pyramids where the sloping bedrock-cut passage was perfected (Ibid., 195).

If pyramid GI-x was intended to be associated with G7000x, two factors may have operated simultaneously to produce the amalgam of features which would have resulted had the pyramid with its sloping passage been completed: 1. G7000x may have been hastily prepared before a clear idea was formed of what type of superstructure the tomb should possess. 2. GI-x would have been the first subsidiary pyramid intended for a queen, those at Meidum and Dahshur being ritual pyramids of the King (see pp. 19, 23). Therefore the pyramid substructure reflected a vacillation between 3rd and early 4th Dynasty precedents and the innovation of the rock-cut sloping passage being developed in the King's pyramid (GI) then under construction.

In the development of the pyramid tombs, precedents to the arrangement shown in Fig. 2 might be seen in the Step Pyramid of Zoser and the Layer Pyramid of Zawiyet el-Aryan. During the first building phase of the Zoser monument, when the superstructure was yet a mastaba, the great central shaft was approached by a sloping ramp from the north (Lauer 1936, II, Pl. XIX). In the final step-pyramid building phase a stairway was constructed under the mortuary temple at the north base of the pyramid (Firth, Quibell, and Lauer 1935–36, II, Pl. 2). The stairway leads to a tunnel connecting to the original access ramp and tunnel which had been covered in the enlargements to the original mastaba.

A more specific parallel to GI-x/G7000x might be seen at the Zoser pyramid in the eleven vertical shafts sunk at the eastern base of the monument in its second building phase (Lauer 1936, I, 47–67, Figs. 22, 23; II, Pls. IX, XV, XVI, XX; see Fig. 4 here). These lead to long E-W chambers which appear to have been for the burial of royal family members. The shafts were later covered by the third and fourth expansions of the superstructure after which they could only be entered by a narrow stairway leading from the east base of the pyramid down to the northermost of these shafts. The resemblance to the configuration of GI-x/G7000x is striking.⁵

The 3rd Dynasty Layer Pyramid of Zawiyet el-Aryan, like G7000x, is entered by a flight of steps and gallery (here turned perpendicular to the N-S axis of the tomb and approaching

4 The owner, date, and even the dynasty of the Unfinished Pyramid at Zawiyet el-Aryan are still very controversial. Swelim (1983, 125–175) has collected together the facts and opinions concerning this monument.

5 According to Reisner (1935, 154) these are the earliest shaft graves. There is a vertical shaft in the pyramid of Sekhemkhet at Saqqara (Goneim 1957, 12, Pls. IV, XXVII–III; Maragioglio and Rinaldi 1963, 23, Tvs. 3–5). It begins in the masonry of the superstructure on its N-S axis about 10 ms. from the north side (Maragioglio and

Rinaldi correct the distance of 13.2 ms. given by Goneim). It descends to the bedrock and continues another 12.6 ms. to enter into the ceiling of the descending passage. This, however, looks not to have been a primary feature of the access to the burial chamber. The shaft looks much like the vertical shafts in the 3rd Dynasty mastabas, of which some were fitted with a groove for lowering the portcullis to block the descending passage. The Sekhemkhet substructure fits Reisner's (1938, 7–8 and passim) type IVB(1).

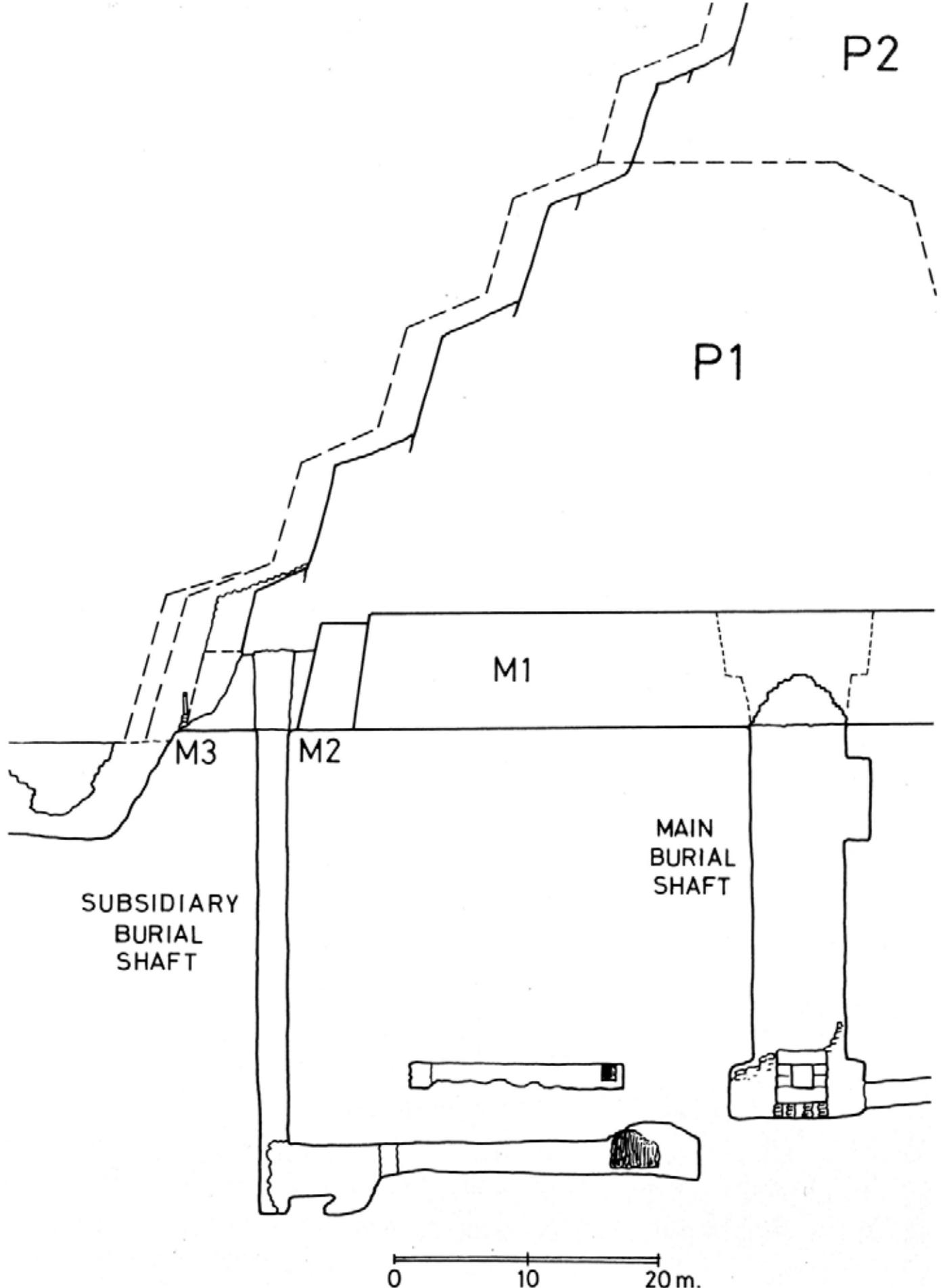


Fig. 4. Shaft-tombs at the eastern base of the Zoser Step Pyramid. Section (after Lauer 1936, Pl. XX).

from the east) which lead to a vertical shaft on the N-S axis of the pyramid superstructure and 10 ms. from its north base (Barsanti 1901, 92-4; Reisner and Fisher 1911, 54-9; Reisner 1935, 134-5, Fig. 57; Maragioglio and Rinaldi 1963, 41ff., Tv. 6; Dunham 1978, xi).⁶

No vertical funerary shafts specifically like that of G7000x are known immediately at the edges of the 4th Dynasty pyramids. At the satellite pyramid on the south side of the Meidum pyramid a vertical entrance shaft exists immediately at the south base of the superstructure and shifted slightly east of its N-S axis (Petrie, Mackay, Wainwright 1910, 10-12, Pl. VII, VIII, IX; Maragioglio and Rinaldi 1964, 28-9, 46-7, Tv. 7, Figs. 1, 2, 6, 7). This shaft descends 3.5 ms. from ground level to a horizontal passage with a slightly vaulted ceiling running north to the open bedrock-cut pit in which the burial chamber was built. The main entrance to the chamber is a masonry-built sloping passage from the center of the lower north face of the pyramid. Maragioglio and Rinaldi (1964, 46) suggest that the south entrance may have been necessitated by the enlargements of the main pyramid which brought its south face to within 5 ms. of the north side of the satellite pyramid (which had been built during the first building stage of the main pyramid). The north entrance may have already been closed, or the construction works on the main pyramid may have rendered the north entrance unusable.

The lower part of a relief-carved Horus-hawk was found at the east side of the small pyramid (Petrie, Mackay, Wainwright 1910, 11-12). This may have been part of a stela bearing the king's name such as those found *in situ* at the east side of the satellite pyramid at Dahshur. If so, it would indicate that the satellite pyramid was for the cult of the king rather than the burial of a queen (Maragioglio and Rinaldi 1964, 28-9, 46-7).

In the main pyramid of Meidum a small vertical shaft is located toward the bottom of the descending passage, about 3.9 ms. from where it meets the horizontal passage (Rowe 1931, 24-5, Pl. X; Maragioglio and Rinaldi 1964, 20-1, 42-3, Tv. 4). This shaft, like that leading up to the burial chamber, is mostly masonry-built but is sunk about 80 cms. into the bedrock. Its total depth is 2.93 ms. from the floor of the descending passage. It has the same width E-W as the passage (82-87 cms.) and is about 50 cms. wide N-S. Rowe (1931, 24-5) suggested that the shaft is for offerings. About 1.25 ms. further down the slope of the descending passage there is a groove cut into the sides, ceiling, and floor of the passage. Some wood fragments found embedded in the groove may indicate that this was the fitting for a wooden door which closed the passage at this point. If this was the case, it presents the configuration of the pit outside a pyramid entrance, albeit here the configuration is set down near the bottom of the descending passage rather than outside and below its opening in the pyramid casing.⁷

The connection between GI-x and G7000x would have been the disposition of the latter to the pyramid had it been completed. It is just this fact of disposition, and the need to assume intelligent selection on the part of those who prepared the queen-mother's tomb and began the pyramid on its axis, which suggests pyramid GI-x was intended for Hetep-heres I. A very similar configuration is seen in the cult arrangement at the base of the north side,

6 Maragioglio and Rinaldi (1963, 41, 44) point out that there are serious discrepancies between the plans, sections, and numerical measurements produced by Barsanti's investigations of this monument and those given by Reisner and Fisher.

7 Two small shafts are found in the horizontal part of the passage from the west face in the Bent Pyramid at Dahshur. The first is recorded by Maragioglio and Rinaldi (1964, 68-9, Tv. 13, Figs. 1,

10) as being situated at the juncture of the sloping passage with the horizontal corridor. It measures 1.36 ms. (E-W) X 1.48 ms. (N-S) and is only 1.98 ms. deep. The second shaft was recorded by Fakhry (1959, I, 52 n. 1, Fig. 19). It rectangular, 2.65 (E-W) X 1.46 (N-S) ms. with a depth of 4 ms. It is sunk into the floor of the horizontal corridor just beyond the first portcullis (cf. Maragioglio and Rinaldi 1964, 70-1, Tv. 13, Fig. 1).

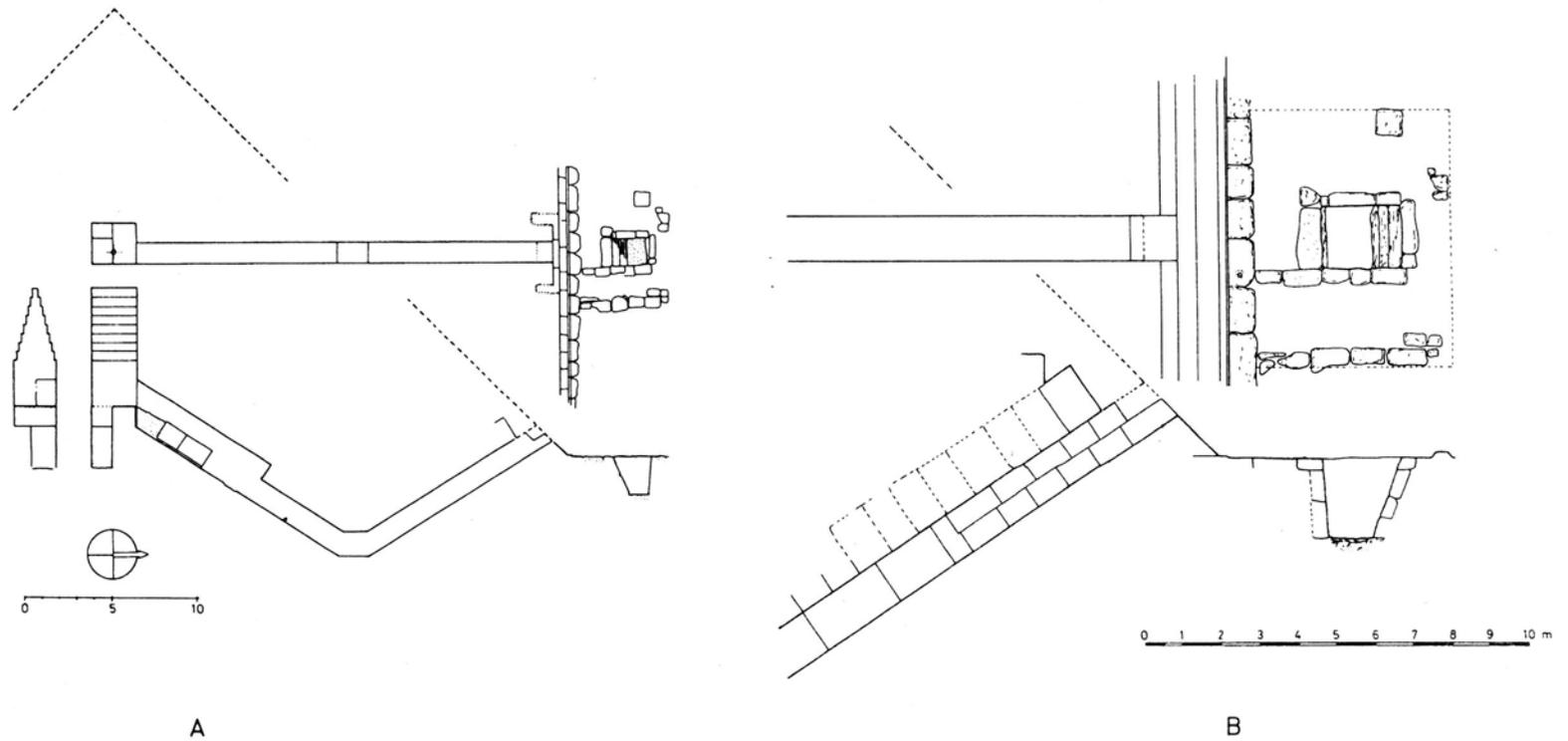


Fig. 5. Substructure and north cult layout at the satellite pyramid of the Dahshur Bent Pyramid. Plan and section, A: after Ricke (in Fakhry 1959, Fig. 55), B: after Maragioglio and Rinaldi (1964, Tv. 16, Figs. 1–2).

and on the center axis, of the subsidiary pyramid at the south side of the Bent Pyramid of Sneferu at Dahshur (Fakhry 1959, 90, Fig. 55, Pl. XXXVIII, Ricke in Fakhry 1959, 104–5; Maragioglio and Rinaldi 1964, 80–1, 116–19, Tv. 15, 16; Fig. 5 here). Immediately in front of the north entrance, which opens above the second casing course 1.10 ms. above the base of the pyramid, there is a shaft 2.5 ms. north of the pyramid socle. The shaft is rectangular in plan, 2.10 N-S X 1.60 E-W (Fakhry) and has a depth of 2.20 ms. (Maragioglio and Rinaldi give 2.25 ms. N-S X 1.70 E-W; compare G7000x: 1.70 ms. N-S X 2.37 ms. E-W). The pit is lined with slabs of yellow limestone laid on end and the north side has a batter which makes the pit narrower at the bottom than at the top. According to Fakhry the pit is built on sand; Ricke says it has no floor at the bottom but ends in the sandy *gebel*. Irregular limestone slabs are laid around the opening of the pit. Ricke sees these as the remains of a parapet wall which would have formed an enclosure 5.9 ms. N-S X 5.2 ms. E-W around the pit. He mentions a “narrow passage, irregular and only passable by crawling, that leads under the pit lining up to the horizontal part of the (pyramid?) passage” (in Fakhry 1959, 105), and suggests this may have been made by thieves. Maragioglio and Rinaldi (1964, 116–17) report that Fakhry later had no knowledge of such a passage. Nothing was found in the pit when it was first excavated by Abdulsalam M. Hussein in 1947.

Ricke noted that this is “an extremely rare layout that so far has no parallel” (in Fakhry 1959, 104). He suggests, however, that it may have developed from that on the north side of Zoser’s southern tomb at Saqqara (from which he sees the origin of the subsidiary pyramids of the Old Kingdom, Ricke 1944, 106–7; 1950, 125–6). The chapel on the north side of the Zoser southern tomb is, according to Ricke, a shrine for the cobra of the royal crown. On this basis he very tentatively suggests that the pit at the north side of the Dahshur satellite pyramid could have been for keeping live cobras, the pit having been covered by a grill, of course.

In plan and section (Fig. 5) the north cult layout with its pit immediately below the pyramid entrance and on the pyramid’s N-S axis is at least suggestive of the relationship between GI-x and G7000x. Could this pit have been started as a funerary shaft which was then abandoned? Had this been the case, this subsidiary pyramid of Sneferu would have been a near-perfect parallel with GI-x/G7000x (compare Figs. 2 and 5), combining both the sloping passage beginning in the pyramid masonry with the vertical shaft immediately north of the pyramid base.

It is ironic, therefore, that this had been proposed as the original Dahshur tomb of Hetepheres I on the basis of some cursive graffiti found on the blocks of the pyramid when it was excavated in 1947 (*Illustrated London News*, 22 March, 1947, 303). This was quickly refuted (Varille 1947, 11). Smith pointed out that the chamber of the Dahshur subsidiary pyramid is too small to have contained the burial equipment found in G7000x (Reisner and Smith 1955, 2) and according to Fakhry (1961, 88) the chamber is too small to have contained any burial at all.

The fact that the pit at the Dahshur satellite pyramid narrows, and yet is lined already with masonry, probably militates against it having been begun as a funerary shaft. Maragioglio and Rinaldi (1964, 116–19) suggest the pit could have been a stela or pillar socket. On the other hand, it might be compared to the shaft outside the apparent doorway deep within the descending passage of the Meidum Pyramid (see page 12). Finally, the remains of two round-topped stelae with the names of Sneferu found at the center east base of the small Dahshur pyramid (and which match the pairs of stelae found in the Bent Pyramid’s Offering chapel and Valley Temple) testify that this monument belonged to the king and was not a queen’s burial place (Fakhry 1959, 89–9x, Figs. 53–4, Pls. XL, XLI, XLII, XLIII). According to Ricke’s view, this pyramid would have been for interring wine and other offerings for Sneferu’s *ka* (in Fakhry 1959, 90; Ricke 1944, 106–7; 1950, 125–6).

At the same time, those who selected the location for the tomb of Hetep-heres I at Giza, and the unfinished pyramid on the same N-S axis, must have been aware of the configuration at the entrance to the subsidiary pyramid of the queen's husband; Sneferu, at Dahshur.

If the satellite pyramids at Dahshur and Meidum are ritual pyramids of the king, it would make GI-x the first pyramid prepared for the burial of a queen. If, further, this pyramid was begun for the burial of Hetep-heres I, the configuration presented by combining GI-x and G7000x might reflect uncertainties in the minds of the planners and builders about what form the substructure of a queen's pyramid should take. Should it take the form of a sloping passage to a burial chamber well under or within the superstructure of the pyramid itself, as with the King's main and satellite pyramids, or should it consist of a stairway ramp and deep vertical shaft as had been developed in the mastaba tombs of the preceding dynasty, with an emphasis on the shaft itself in the previous reign?

F. The Sequence of G7000x and GI-x.

The deep vertical shaft of G7000x and its rock-cut burial chamber may reflect, as Reisner surmised, conditions of haste and an impending time-limit (Reisner 1927, 31). This may have contributed to the form of Hetep-heres I's tomb as much as any precedent.

The characteristics of the ground at the site confirm that G7000x was begun prior to GI-x, and before much work had been done to regularize the rock surface in the near vicinity. The surface immediately around the shaft opening is very rough, and the shaft and stairway are cut into natural irregular ridges left by thin overlapping geological layers (Figs. 2, 22). The rock surface has been cut and made more or less uniform for the causeway of the Great Pyramid about 13.5 ms. N-NW of G7000x. This prepared surface gives way, about 7 ms. N-NE of G7000x, to a large depression that has been filled with irregular local limestone pieces (Fig. 9). Reisner (1927, 5–7; 1942, 11–12) sees this depression as the result of quarrying stone for the First Pyramid (GI). He noted the existence of removal trenches “cut to the depth of 30–50 cms. in preparation for the removal of large blocks of stone (as in the princes' mastabas)” (1927, 6) near the end of Queens Street. As with pyramid GI-x, Reisner decided work in the quarry was abandoned when Hetep-heres's “secret tomb” was prepared.

The stairway opening of the tomb is actually in the old quarry and was cut after the dressing away of the decayed crust of the native bed of stone; *but the mouth of the great shaft is in the top of the natural ridge south of the quarry.* (Ibid., 7; emphasis mine)

According to Reisner, this quarry extended from the Khufu mortuary temple for the length of the causeway to the east edge of the plateau. While most of this area, particularly at the east edge of the plateau, is sanded over today, an examination of the exposed rock surface in the vicinity of G7000x calls into question whether this was a quarry in the sense of that in the Central Field at Giza. There is, first, the illogic of exploiting this area for stone for the Great Pyramid, if the causeway of that Pyramid (or a satellite pyramid, see p. 88f.) would have been built directly over the quarry, thus necessitating filling it in almost immediately. Second, the rock here does not seem suitable for the large blocks needed at the time for the corework of the Pyramid, and, third, the rock surface over most of the area NW and NE of G7000x has not been deeply exploited – rather the rock has been regularized for the passage of the causeway up to the depression filled with stones (Fig. 9). The depression is probably the result of a vein of poor rock as much as quarrying.

As Reisner pointed out, the mouth of G7000x is cut into the original unworked rock surface. Beginning about 4 ms. to the south of G7000x (where the north side of the pyramid GI-x would have fallen according to the reconstruction in Fig. 2) the surface has again been worked. Here it has been regularized, but not levelled, in shallow panel-like cuttings. The

working of the surface to the north of G7000x, for the causeway, and to the south, for pyramid GI-x (and later for the mortuary chapel of GI-a), has contributed to the rise or mounding of rock with culminates at the mouth of G7000x.

If those surface preparations had been started first, it would have been reasonable to dress down the surface around the mouth of Hetep-heres tomb shaft. Reisner would respond that the surface around the shaft was left undressed to camouflage the position of the "secret tomb." However, a point of prominence like this seems an unlikely place to begin a shaft by any means, much less one for a secret tomb. The prominence around the shaft is due to the cuttings for the causeway and GI-x which were done *after* G7000x had been fashioned.

There was some cutting of the original rock surface for the stairway, hence Reisner's assertion that the stairway is "actually in the old quarry." As previously suggested, the stairway was probably cut first with the pattern of a 3rd Dynasty substructure in mind. It cannot be said whether, at this point, when the stairs were begun, a pyramidal or mastaba superstructure was planned. Circumstances may have already imposed the need for haste when the stairs were cut. They are narrow and crudely fashioned with an irregular N-S orientation.

The haste, and perhaps the ambivalence about the form of the queen's tomb, prompted the cutting of the shaft from the original rock surface. One reason the shaft was seen as quicker than continuing the stairway was the two vertical fissures which speeded its cutting:

The vertical shaft was begun along the face of an east-west fissure in the rock in a seam between the fissure and another which at the surface was about three meters north of the first fissure. Further down, the second or northern fissure sloped southwards and so came to form the northern side of the shaft which from thereon descended to the bottom through the crumbling rock between these two fissures. The workmen had probably been set a time limit, and descended rapidly through the easily broken seam of bad rock. The sides of the shaft were never well dressed, for all the effort seems to have been devoted to getting down to a sound stratum suitable for the chamber. The rock was generally bad and in places in a dangerous condition, especially in the south wall of the pit through which the chamber was to be cut in accordance with the custom of the time. A plain indication of the haste and pressure of time is the bend westward about two thirds of the way down and the decrease in the size of the horizontal section of the shaft. The pit was taking longer than planned. At last about 25 meters down the masons struck a good stratum of rock on the south and cut through to excavate a chamber (Reisner 1927, 31-2).

Considering that if the site had been chosen with some care to have a meaningful relation to the layout of the king's pyramid, and Reisner's principle that "every substructure implies a superstructure. . ." (Reisner 1934, 237), it is probable that a superstructure had been intended but, perhaps, not yet well planned. If, at the bottom of the shaft, a horizontal passage had been started toward the south, something quite like the substructures of the Zawyet el-Aryan Layer Pyramid, or the small pyramids in the Sen-Ustert I complex, would have been effected.⁸

Instead, the burial chamber was begun and the burial took place before it had been cut to its intended dimensions, as indicated by unfinished cuttings in the east and west walls and the floor pit in the NW corner (Reisner 1927, 32; Reisner and Smith 1955, 15). After the burial assembly had been placed in the chamber, it would have been blocked off and the

8 This, however, was probably never intended. The length of the chamber is 5.22 ms. or 10 cubits, a round number which may indicate the originally intended length of the chamber. The shaft-chamber configuration here is also similar to nearly

contemporary tombs at Dahshur, for example, that of Sneferu-em-mertef, No. 2, pit 2 (deMorgan 1903, 7, Fig. 12) and No. 3 (unknown), shaft P3 (Ibid., 8, Fig. 15), although the shaft of G7000x is much deeper.

shaft at least partially filled. Meanwhile, the rock surface to the south of the shaft was dressed, but not levelled. The cutting was begun for the sloping passage of a pyramid which, if it had been about the same size as GI-a, would have had its north base about 4 ms. from the tomb shaft. This configuration was known to the planners from the satellite pyramid at Dahshur – Hetep-Heres I's tomb shaft would occupy the same position with respect to her pyramid as the north chapel with its pit was situated with respect to the small Dahshur pyramid. The cutting for the sloping passage and the regularizing of the rock surface, as much as was done, could have been accomplished in a few days. Two courses of masonry had been mortared into place in the cutting for the sloping passage when the decision was made to abandon the pyramid project at this site in favor of a new layout 28 ms. to the west.

At this point the filling of the G7000x shaft was brought to the surface where the opening was laid with irregular local stones so as to camouflage its location. Somewhat later, the vicinity of the shaft and stairway was covered with limestone gravel and the mud packing of Queens Street. It was thought, *after the change in plan*, that without the protection of a superstructure the burial shaft must be so camouflaged and hidden. Also, as there was no body in the grave, it was not seen as necessary to have a superstructure specifically for the burial assembly left behind. It is possible that in the change in plan the queen mother's body was removed from the tomb before the final blocking of the shaft was effected. Could she have been buried in the first queen's pyramid tomb (GI-a) with an new uncontaminated set of funerary equipment?

G. The Evidence of the Burial Chamber and Shaft.

The principle conclusions, lines of evidence, assumptions and interpretations which make up Reisner's explanation are given in the following table (drawn from Reisner 1927; 1928; Reisner and Smith 1955). Reisner's 1927 report is, in some respects, the most detailed and insightful for the original state of the burial assembly, having been written by the excavator during, or shortly after, the excavation.

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
1. Hetep-heres died and was buried in her original tomb in the reign of Cheops.	a. Mud-seal impressions with w'bt of Cheops (1927, 23; 1955, 48–49).	i. Must have sealed containers of original burial prepared by Cheops's mortuary workshop.
2. G7000x was prepared and the burial assembly interred in the reign of Cheops.	a. Shaft-stairway was sealed by limestone gravel, mud layer over the street (1927, 8–9).	i. This is the 4th Dynasty "living floor."
	b. Presence of GI-x cutting 12.7 ms. south of G7000x (1927, 5, 9).	i. This is for the unfinished first queen's pyramid. ii. It was abandoned because of the location of G7000x.

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
		iii. The Eastern Cemetery, begun in the reign of Cheops, was not yet laid out.
	c. 2 small basalt fragments in G7000x offering niche (1927, 7, 9; 1955, 13).	i. These indicate Cheops mortuary temple (with basalt floor) was under construction when the offering was made.
3. G7000x was prepared in haste.	a. The shaft follows 2 parallel vertical fissures (1927, 31).	i. These facilitated quarrying the shaft.
	b. The sides of the shaft were not well dressed (Ibid.).	i. They would have been dressed under normal conditions.
	c. Cuttings in the east and west wall of the chamber, pit in the floor (Ibid.; 1955, 15–16).	i. These were begun to enlarge the tomb. ii. The cuttings were left unfinished.
4. The burial assembly was placed in the tomb in haste immediately upon stopping quarry work in chamber.	a. Limestone powder covered the floor of the chamber (1927, 20).	i. Left from the stone cutters' work in the tomb.
	b. Debris of broken local stone, workers' rubbish filled the pit in the NW corner and the floor nearby.	i. Left by workmen when work stopped in the chamber.
	c. Furniture fragments were found lying over this debris (1927, 10).	i. The furniture in this area was set on the debris.
	d. Copper tools found on the floor west of the coffin and on top of the deposit immediately south of the sarcophagus (1927), 20, 25; 1955, 34–5).	i. These tools do not belong to the funerary equipment of a queen. ii. They were left by the stone-cutters (or: gathered from original tomb where they were left by the thieves).

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
5. The canopic chest was the first thing put into the chamber.	a. Splashes of plaster on the floor nearby, under the rest of the deposit (1928, 81).	i. This was from the sealing of the recess in the west wall in which the chest was placed.
6. The deposit is a reburial from original tomb elsewhere which was violated by thieves.	a. The arrangement of the artifacts in the burial chamber (1927, 23; 1955, 16, cf. Figs. 19, 20; Figs. 6, 7 here).	i. This was the reverse of the arrangement in the original tomb: coffin in the SW corner, artifacts arrayed before it.
— Much of the assembly was brought to G7000x in boxes.	b. Wood associated with artifacts in south end of chamber (1927, 22; 1955, 20–1).	i. The artifacts had been placed in boxes before being deposited in the burial chamber.
— Boxes in the south end of the tomb contained linen.	c. Linen fragments, “grey muck” associated with wood (Ibid.).	i. This is the deteriorated remains of linen that had been packed in boxes in the south end of the tomb.
— The boxes contained, amongst the linen, objects broken up in the original burial.	d. Broken pottery, mud-sealing impressions, alabaster chips, plaster fragments associated with the linen and wood remains (1927, 23–4).	<p>i. Broken pottery was gathered up from the plundered original tomb and dumped in boxes containing linen.</p> <p>ii. The mud-seal impressions were broken from objects in the original burial by thieves, and dumped into the boxes for the transfer.</p> <p>iii. The plaster fragments were broken by thieves from the blocking of the original tomb and dumped in the boxes for the transfer.</p> <p>iv. The alabaster chips were broken from the coffin by thieves and like the above material, gathered up by those who made the transfer and dumped in the boxes with the linen.</p>

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
7. The sarcophagus was opened by thieves in the original tomb.	e. Parts of single pottery vessels were retrieved from different box areas; groups of sherds found together did not necessarily form single vessel(s) (1927, 24; 1955, 60).	i. The sherds formed complete vessels in the original burial. ii. The vessels were broken in the plunder. iii. The pieces were mixed up then and in transfer to G7000x.
	a. The join between the upper edge of the sarcophagus and its lid is chipped (1927, 9, 23, 32; 1928, 76; 1955, 16).	i. This was caused by a chisel to pry off the lid.
	b. The chipping occurs most along the east side of the sarcophagus which is only 30 cms. from the wall (1928, 82; 1955, 16).	i. The space between the east side of the sarcophagus and the east wall of the chamber is too narrow for work to pry off the lid. ii. This side of the sarcophagus stood facing out into the chamber of the original tomb. iii. Thieves worked to pry off the lid from this side in the original tomb.
	c. Chips from the sarcophagus were found associated with decayed linen and wood at the south end of the chamber (1927, 23; 1955, 16).	i. These chips had been placed inside the boxes at the south end of the chamber. ii. This was done in the original tomb for the transfer. iii. The chips were broken off the sarcophagus in the original tomb by thieves when they opened the coffin.

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
8. The sarcophagus had contained the embalmed body of Hetep-heres I in the original tomb.	a. There was a faint discoloration at one end of the interior of the sarcophagus (1928, 78).	i. This was caused by the original interment of the body.
	b. The sealed canopic chest contained 4 packages of viscera (1928, 81; 1955, 21–22).	i. These were the remains of a mummified human body.
	c. The canopic chest is of the same stone and workmanship as the sarcophagus (1928, 81).	i. It was made as a matching set with the sarcophagus.
		ii. The canopic packages contained the embalmed internal organs of the body originally interred in the sarcophagus.
9. Thieves completely removed the body from the sarcophagus and from the original tomb; the body was destroyed, perhaps dragged away by animals (1928, 81–2; 1955, 1, 59).	d. Inscriptions on the furniture give the name and titles of Hetep-heres I (1927, 14; 1928, 85; 1955, 17, 33).	i. The body originally in the sarcophagus and the viscera in the canopic chest are the mortal remains of Hetep-heres I.
	a. The burial chamber and tomb shaft of G7000x were found completely sealed.	i. The body could not have been removed since this sealing.
		ii. This sealing was done in the time of Cheops (see 2a–c).
	b. See 6 and 7 above.	
c. No body was found in the sarcophagus.		i. It would never have been removed by officials from the equipment intended for the use of Hetep-heres I's spirit (1928, 82).
		ii. It must have been removed before the burial assembly was placed in G7000x.
		iii. It must have been removed by thieves who plundered the original tomb.

<i>Conclusion</i>	<i>Evidence</i>	<i>Assumption or Interpretation</i>
<p>10. The king believed that Hetep-heres I's body was still in the sarcophagus at the time of the burial in G7000x.</p>	<p>a. At 7.47 ms. from the top of the shaft a sealed niche in the west side contained a crushed ox skull and 3 leg bones wrapped in a decayed reed mat, 2 wine jars, charcoal, a limestone boulder, and 2 basalt chips (1927, 7; 1955, 13).</p>	<p>i. This is a sacrificial food offering for the <i>ka</i> of Hetep-heres I (1927, 34).</p> <p>ii. Someone must have believed her body was still in the sarcophagus.</p> <p>iii. The vizier and his aids would have known the body was missing from an inspection of the vandalized tomb (1928, 82–3).</p> <p>iv. The king would be naturally repugnant to examine his mother's body for himself (1928, 83).</p> <p>v. It must be the king who was unaware that the body was missing and who ordered the offering to be made.</p>
<p>11. G7000x was intended to be a secret tomb without a superstructure.</p>	<p>a. No superstructure was found.</p> <p>b. The final course of masonry blocking of the shaft was of irregular local limestone which resembled the surrounding rock surface (1927, 34).</p> <p>c. The area of the shaft was covered with limestone debris and a mud layer (1927, 4–5, 6–7, 8–9).</p>	<p>i. This is the 4th Dynasty "living floor" or street surface.</p>

Comment

The following comments are referenced to the above tabulation of Reisner's explanation. The discussion is based on the state of the burial assembly as found by Reisner and the reconstruction of the original state of the burial assembly (before decomposition) as shown



Fig. 6. G7000x burial chamber with disintegrated burial assembly. Plan (Resiner and Smith 1955, Fig. 19).

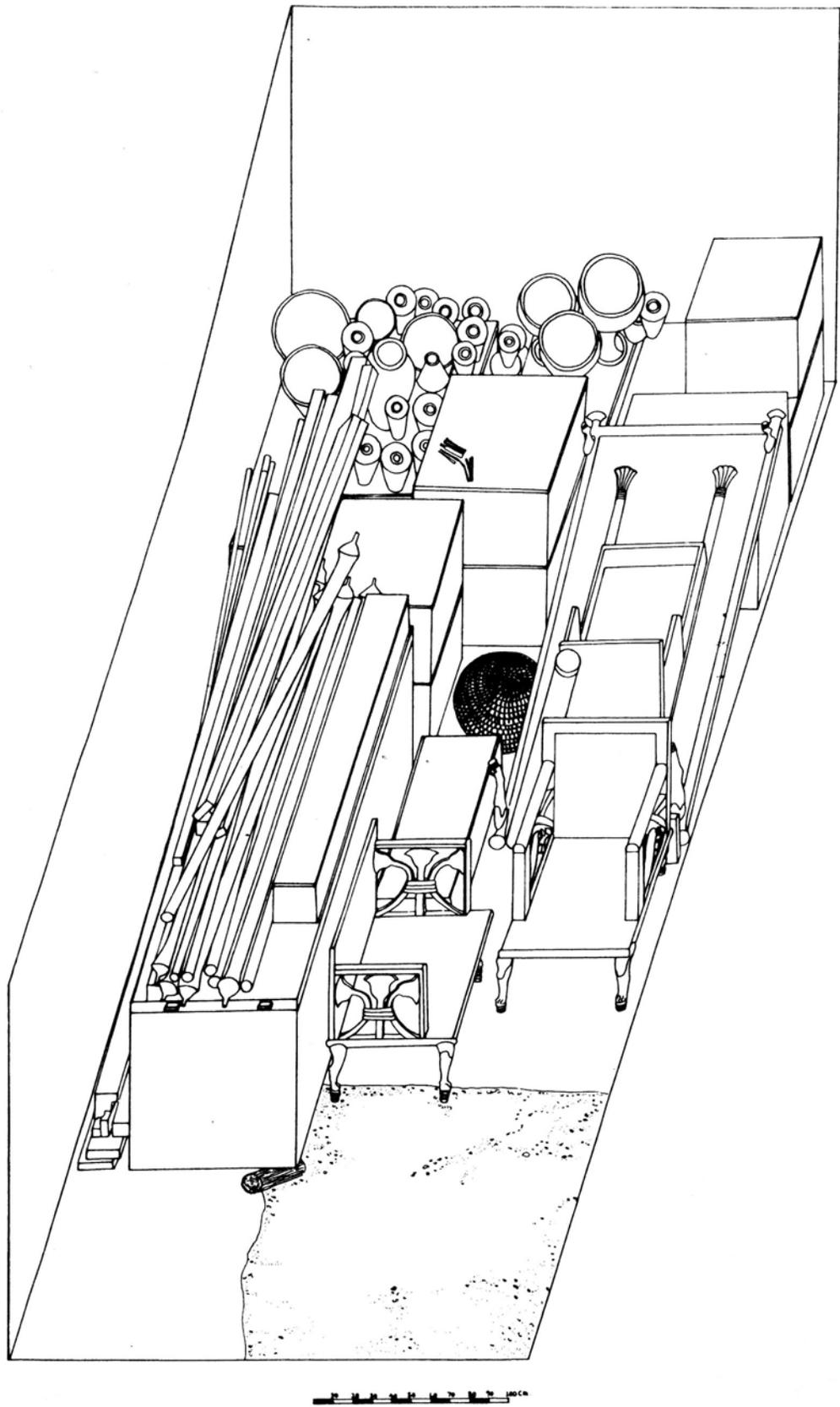


Fig. 7. G7000x burial assembly. Isometric reconstruction (Reisner and Smith 1955, Fig. 20).

in Reisner and Smith's (1955) Figs. 19 and 20 respectively. These illustrations are reproduced here as Figs. 6 and 7.

2bi: *Construction Sequence*

Contrary to Reisner, the hypothesis here is that the unfinished pyramid, GI-x, was intended for Hetep-heres I and was begun after the preparation of G7000x. At the same time, this agrees with the conclusion that it was begun before pyramid GI-a and was meant, therefore, to be the first architectural member of the Eastern cemetery. Either way, it supports the conclusion that G7000x was prepared and the burial effected in the reign of Khufu.

2ci: *Basalt Fragments.*

The two basalt fragments do not necessarily indicate work was begun on Khufu's mortuary temple at the time the offering was put in the niche. Fragments of basalt, like diorite, could have been used as tools (see below, 10a comment).⁹

4di-ii: *The Tools.*

The set of tools which lay on the floor and under the bed to the west of the sarcophagus included "a heavy copper punch in perfect condition. . . , a massive copper implement, perhaps a crusher equally well preserved as the punch. . . , and a copper knife blade with a rivetted wooden handle" (1927, 20; 1955, 20, 34, Figs. 19, 36, Pl. 30). Another, more deteriorated set of copper tools was found lying on top of the deposit just south of the sarcophagus.

From the reopening of the tomb, a mass of bright green powder nearly in the middle of the space south of the coffin and on top of the mass of pottery had drawn our attention. It gave a distinctive color note to all that part of the deposit, and invariably held the eyes of visitors to the tomb. (1927, 25).

From this mass, Reisner was able to make out two copper punches, larger than the one found on the floor, and a crusher. Smith identifies from this group a punch and two chisels, one with a narrower blade than the other (Reisner and Smith 1955, 32-35, Fig. 37, Pl. 30). In the isometric reconstruction of the burial assembly in its original state (1955, Fig. 20; Fig. 7 here), this second group of tools is shown lying on top of a second layer of boxes, one box away from the SW corner of the sarcophagus.

A careful examination of the mass of copper from all sides showed that it had originally lain on top of one of the boxes of pottery, and that the implements had been placed or thrown there without having been in any container either of cloth or of wood. (1927, 25).

Reisner was somewhat perplexed by the inclusion of these tools in the burial assembly, stating that "such implements are inexplicable as part of the funerary equipment of a queen" (1927, 20). He suggests that they were "either left in the unfinished chamber of our tomb by the stone cutters, or in the Dahshur tomb by the plunderers" (Ibid., 25).

It seems odd that those who sought to safeguard the burial assembly of the queen would have picked up the tools of those who desecrated her original tomb, and then left them on top of her linen boxes in the new tomb at Giza. As for the other possibility - that they were left in the chamber by the stone cutters when they stopped work on the chamber, the stratigraphic relations of the two groups of tools should be considered.

The first group of tools was found lying on the floor under the bed. They might have been left by the same workmen who had just swept their debris into the NW corner of the

9 Petrie (1883, 51-2) reported finding two pieces of pyramid casing stone of basalt and diorite with corner angles of $52^{\circ} 27'$ and about $52^{\circ} 30'$ in the area east of the Great Pyramid and near the queens' pyramids. These were sent to the British

Museum. He suggests that one of the small pyramids had arris lines of basalt and diorite. It is more plausible that these fragments are the remains of pyramid capstones.

chamber before they left (see p. 32, 4bi). Thereafter the furniture was placed partially over this debris which extended from the NW corner to the south along the west wall of the chamber (1927, 10). Just where the debris phased out, the first tool group lay on the floor under the bed and carrying chair. The second group of tools lay *on top* of the deposit immediately off the SW corner of the sarcophagus. They were the last item left on top of the deposit at this particular spot after the boxes of linen, stone vessels, and pottery had all been stacked into place. Going on the reconstruction by Reisner and Smith of the original state of the burial chamber (Fig. 7), these tools would have been left before this end of the chamber was blocked off by the carrying chair, bed, inlaid box and the two arm chairs.

These would have been the kind of tools used in getting initial leverage to pry off the lid of the alabaster sarcophagus, as Reisner recognized when he suggested that they may have been left by the plunderers in the original tomb.

Sai: Plaster Splashes on the Floor.

Reisner (1928, 81) stated:

The splashes of plaster on the floor proved also that the (canopic) chest had been placed in the recess and hidden with masonry before anything else had come into the tomb.

This evidence should be considered along with the remains of a basket "which had been used for carrying white plaster, and left in the middle of the room" (1927, 27). According to Smith (1955, 21, Figs. 19, 20, Pl. 42; see Figs. 6 and 7 here), the basket, "which Reisner states was left there by the workmen," was "in the rectangular space left by the boxes and the east side of the bed." The basket, therefore, lay very close to the first group of tools which were found on the floor just to the west.

If the plaster in the basket is, like the splashes on the floor, from the sealing of the canopic chest in the west wall recess, it may be that the first group of tools belongs with the basket. The tools and the basket were used for the blocking of the recess and left on the floor immediately prior to bringing the furniture into the chamber.

It would have been good to have just a little more stratigraphic detail of the basket in relation to the deposit around it. In Reisner and Smith's detailed plan of the deposit as they found it (Fig. 6), a mass of fiber is shown just SW of the SW corner of the sarcophagus at the spot where the basket was found (reconstructed in Fig. 7). If this is the remains of the basket, it appears as though it overlay a group of broken sherds and was partially under a complete vessel and one of the panels of the carrying chair. This situation can also be seen in Reisner and Smith's (1955) Pl. 6a, 25c, and 30a. The mass of fiber here does not look like the articulated bottom of the basket as shown in the close-up view in Pl. 42d. If the basket did overlay broken pottery, it would indicate that the basket was discarded, or shoved about, *after* the breakage of this pottery, and after the pottery had already been introduced into the tomb. Yet the plaster splashes on the floor indicate that the canopic chest was sealed in the west recess before anything (at that specific spot, at least) had been brought into the chamber.

Could there have been an opening and a resealing of the recess after the canopic chest had been introduced? In this regard it might be noted that the blocking of the recess was composed of "well dressed rectangular blocks of fine white limestone, but over half were of the local nummulitic stone and evidently quarried in the chamber itself" (1928, 80). From Reisner's photographs (1928, 79; 1955, Pl. 44b) of the recess before the plaster cover was removed from the blocking, it looks as though more of the rough local pieces were used as filling toward the south of the recess, behind which the canopic chest was stationed (Fig. 2).

The canopic chest was placed in the recess which was then blocked up and plastered over (causing the splashes on the floor). It is possible that later the south end of the blocking

was opened to check on the canopic chest. The tools used for the reopening were those left on the floor of the chamber under the bed and carrying chair. The opening was then resealed, using plaster in the basket that was found nearly on the floor (but overlaying broken pottery?) beside the tools. Perhaps the plaster fragments found associated with the disintegrated boxes at the south end of the chamber (1928, 28; 1955, 21) derive from this reopening of the recess. Reisner concluded that they were from the blocking of the original tomb, having been scraped up and transferred to Giza with the rest of the salvaged burial assembly. Stating that "this plaster was from a masonry blocking similar to that in the western cutting of our tomb" (1928, 28), he thought, nevertheless, that from the form of the fragments he could reconstruct a sloping passage with a vaulted roof for the original tomb of Hetep-heres I at Dahshur. This could not be confirmed by a reexamination of the plaster fragments by Smith and Dunham later (Reisner and Smith 1955, 21).

It should be stated that the stones of the loose and dry blocking in the much shallower eastern wall recess also included both squared fine white limestone as well as rough local limestone pieces.

6ai: *Burial Assembly in Reverse Order of Original Tomb.*

... the relative positions of the objects in our chamber represented approximately a reversal of the positions in the original tomb. That is, those things which had been nearest to the doorway of the original tomb had been taken out first and placed first in the Giza tomb. Thus the coffin which was in the southwestern quarter of the old tomb came to stand in the northeastern quarter of the Giza tomb, and was therefore the last thing to be moved from the old tomb (1927, 23).

While at first glance this idea seems reasonable, it would only be so if the old and new tombs were close beside each other and the transfer done in a day or two. It does not seem credible that the order of the artifact assembly could have been preserved, inversely, all the way from Dahshur to Giza and down the 27 meter shaft. The idea must assume that a line of carriers emerged in order from the Dahshur tomb, each with a parcel of grave goods collected from there in order, and marched in that order all the way to Giza where, in the same order each parcel was lowered down into the G7000x burial chamber.

It would better be assumed that:

1. There was a considerable delay between the hypothetical discovery that the hypothetical Dahshur tomb had been robbed and the transfer of the burial to Giza – so that G7000x could be prepared, for one thing. According to Reisner, there was no tomb at the location of G7000x prior to the violation of the Dahshur tomb. The time required to cut G7000x out of the bedrock must certainly be measured in weeks, if not months. As for the actual transfer of the burial assembly, Reisner estimated that this itself "would be measured by weeks" (1927, 33).

2. During this delay, the artifacts would not have been left in the Dahshur tomb in the confused and broken state left by the thieves. They would have been gathered up and put in some order – if not in the tomb, at some holding station before and/or after the transfer to Giza. Before he had opened the sarcophagus, Reisner did ask, "were the boxes, the furniture, and the body of the queen carried along stage by stage with the coffin? Or were they taken to some mortuary store-house at Giza to await the arrival of the sarcophagus?" (1927, 33).

3. The sarcophagus would have been the first thing put into the burial chamber. Reisner's idea implies, and he states, that the sarcophagus was the last item to be put into the chamber (Ibid.), except for the bed canopy and curtain box which were laid on top of the sarcophagus. Yet, according to Reisner and Smith's reconstruction of the original state of the assembly (Fig. 7), there would have been no room for maneuvering the sarcophagus from its west side, which was right against the arm chairs, inlaid box, bed, and carrying chair; nor

from its south end, which was up against the wood boxes and stacks of pottery. The east side of the sarcophagus was only 30 cms. from the east wall of the chamber, and there would have been no room for maneuvering here. Therefore, the sarcophagus would have to have been pushed in only from the north, which considering its weight, would have been impossible even with the aid of the floor boards and round hammer stone which were found under the sarcophagus (1928, 78; 1942, 166).

If the sarcophagus had been introduced last, except for the canopy poles and curtain box, it could only have been done by shoving and trampling the arm chairs, the inlaid box and its contents, and the pottery around the sarcophagus.

4. Given the delay of weeks or months between the discovery of the violation of the original tomb and the reburial, there would have been some attempt at restitution of the burial assembly. If the burial of Hetep-heres I was transferred because of the "filial piety" of the king, why were the broken vessels not restored or replaced, the boxes resealed with the seals of the mortuary workshop, and something like the original order of the tomb restored? Reisner stated: "At present we have no evidence that Cheops did anything to make good the loss or damage caused by the plunderers" (1927, 33). He suggests that all the broken material, may have remained hidden in the boxes during the transfer, and during the presumed examination of the king.

6b-d: *Broken Pottery, Plaster, Mudseals, And Alabaster Chips In The Storage Boxes.*

If broken pottery, plaster fragments, alabaster chips from the sarcophagus, and broken mudsealings with the name of Khufu were found to have been mixed with linen contained in boxes, it is almost conclusive that these were pieces of objects that had been complete and originally situated in another place. However, this need not have been another tomb; it could have been another context in the same tomb.

Reisner outlined quite clearly how it was ascertained that the mass of material at the south end of this chamber had once been boxes with linen (1927, 22). Since Reisner had access to the material itself, *in situ*, for months on end, it is only with trepidation that reservations be drawn about his specific interpretations of this line of evidence. Two observations are offered:

1. The boxes in the SW corner of the chamber, once stacked on the other, made up an original combined height of 80 cms. This, along with the linen layers, settled through decay to a height of only 15 cms. (Ibid.). The same must have been true for the other boxes at the south end of the chamber to the east of the first group. Many of the pottery vessels, sherds, and plaster fragments found associated with the remains of these boxes certainly measured more than 15 cms. in width or thickness. Therefore, the decayed wood and linen must have settled down around these objects. It would seem very hard to be certain, in such a situation, that the various items had actually been *in* the boxes at the time they were placed in the tomb.

2. This relates to the observation of Smith (1955, 20) that "the pottery found amongst the decayed linen seems to have been standing on top of the boxes and not contained in an upper layer of boxes as indicated in the restored drawing on Fig. 20" (see Fig. 7 here).¹⁰

7ai: *Chipping on the Sarcophagus.*

It was immediately noticed when the chamber was opened that a metal tool had been used across the upper edge of the box to pry off the lid (1955, 16).

Pl. 4 in Reisner and Smith (1955) gives the best view of this chipping which here occurs the along entire width of the north side at the seam between the lid and body of the sar-

10 Smith's statement may have been intended specifically for the boxes and pottery in the SW corner of the chamber. However, it would seem

that the same doubts might arise about the other boxes in the south end of the tomb.

cophagus. The small chips occur mostly on the rim of the box rather than on the underside of the lid. It may be questioned whether this kind of chipping would occur from a plunderer's frenzied attempt to open the sarcophagus by prying the lid off with a metal tool. In fact, such chipping would not be effective in opening the sarcophagus in any case. The coffin is designed to be hard to open; the rebate with which the lid fits the box makes it impossible for the lid to slid off (1955, Fig. 21). What is needed to pry up the lid is one spot of good leverage, not a series of little chips along the entire seam. This fine chipping would anyway not have been the tactic of thieves working in fear and haste. Would they not have been more expeditious and simply smashed the lid to pieces?

7bi—iii: In his first report on G7000x Reisner stated of the thieves who robbed the original tomb:

They were unable to lift the lid by the four short projections, two at each end, which served as handles, for they attempted to force the lid by driving wedges, probably of metal, between the box and the lid. *The edges are chipped on all four sides by these efforts, and one corner of the lid is broken off* (1927, 32; emphasis miné).

In his second report, after the sarcophagus was found empty, Reisner stated:

The thieves used metal chisels to start the lid, breaking off one corner and chipping both the lid and the box, *but only along one side, which was the eastern side, as the sarcophagus stood in that chamber* (1928, 82; emphasis mine).

In his later statement, Reisner wished to emphasize the chipping on the east side of the coffin because according to his hypothesis this side would have faced out into the chamber in the original tomb, and therefore would have been the side attacked by thieves. Also, in G7000x there was only a space 30 cm. wide between this side of the coffin and the east wall of the chamber which would indicate, that if this was the side attacked, it could not have occurred after the sarcophagus was introduced into G7000x.

In fact, Reisner's earlier statement is more correct — the sarcophagus does show these chips here and there, on all four sides, as a look at it today in the Cairo Museum will ascertain. There are no published photographs which give a clear view of the coffin's east side while it was *in situ*. Reisner and Smith's (1955) Pls. 7 and 13 show the seam between the lid and the box on the west side and it does not look badly chipped. Some few chips are observable along the east side, south end, in Pl. 43d which shows the box without the lid. However, it is pretty clear that the most extensive chipping occurs along the width of the north end, as shown in Pl. 4, and just this side would have been the most accessible when the sarcophagus was in G7000x as it faced out into the entrance of the chamber and was unblocked by any of the furniture.

Even so, as mentioned earlier, this small chipping does not look appropriate for gaining leverage to open the heavy lid. What is needed is one good place of leverage, and this is found at the SW corner of the sarcophagus where the corner of the lid is broken off (1955, Pl. 13). Once this corner had been broken with punches and/or chisels, the break would serve as a start for levering up the lid. The lid would have pivoted along the width of the north end, its underedge being pressed hard against the rim of the box. This might account for the small chipping along the north end — it results from the two sharp 90 degree corners being pressed together as the lid was raised from the south end. The lid might then have been pivoted and lifted along the west side to be turned up toward the east wall of the chamber, hence more of the chipping along the east edge.

If this reconstruction is correct, it cannot be only coincidence that a group of tools exactly appropriate for this job — punches and chisels — was found lying on top of the deposit just south of the forced SW corner of the sarcophagus (see p. xx). Could they have been left on top of the boxes or pile of pottery by those who removed the body of Hetepheres from the sarcophagus?

Even though this opening damaged the sarcophagus slightly, it does not appear the work of thieves who, as said earlier, would have taken the more expeditious approach of smashing the lid entirely. If not thieves, then it must have been officials who opened the sarcophagus. Had they used levers and supports under the projecting lugs of the lid, it might have been possible to open it without any damage. However, this would have required more room to maneuver than was given by the contents of the tomb which, nevertheless, may have suffered some damage as a result of this operation.

Before the sarcophagus was opened by Reisner, he had considered the possibility that the chipping was due to an official opening:

When I reached the conclusion that the deposit was a reburial brought here from another tomb, I assumed that the coffin had been opened by the officials in charge of the transfer. . . (1927, 23).

7ci–iii: *Alabaster Coffin Chips in the Linen Boxes.*

On September 2 (1926), in one of the linen boxes, we found a flake of alabaster which fitted one of the chipped places in the alabaster sarcophagus. This came as a shock. We already knew that the contents of the box had been gathered up from the original tomb, and that the original tomb had been broken into by thieves. The only plausible explanation of the presence of this chip of alabaster was that the thieves had opened the coffin, for it was in the rubbish left by the thieves. . . Later we found more of these chips of alabaster from the coffin and the lid, and they were all in the boxes in the *southern* part of the chamber, some with linen, some with potsherds and other rubbish. It seems probable, therefore, that they were in the rubbish left by the thieves as a result of attempts to open the coffin. If they had resulted from the official opening, these chips would probably have been found in the box or boxes near the doorway of the tomb (1927, 23).

Considering the meticulous work he accomplished with the mass of disintegrated material, it would almost seem unreasonable to ask for more detail from Reisner. However, it would help to know more about these alabaster chips. How many were recovered? Which exact parts of the sarcophagus did they fit? If these chips were mostly from the broken SW corner of the coffin lid, they could easily have been thrown to the south by the force of the blow which made the break.

There is, at the same time, the question of whether these alabaster chips, like the potsherds, plaster fragments, and broken mudseals, were originally in the linen boxes, or piled up on top of these boxes and subsequently settled down into the masses of decayed linen and wood over the centuries of deterioration (see p. 21).

8bi, ci–ii: *The Canopic Chest.*

The canopic chest was the only item, aside from several pottery vessels (1955, Pls. 50a, 52b, c, g, e), which was found with its sealing intact.

Upon the lid lay a perforated pot-lid of red pottery with a loop handle on its top. Later we discovered that this lid protected the original mud-sealing of Cheop's mortuary department and on the underside of the sealing was a print of the knot in which were tied the ends of a fine rope passing twice around the chest (1928, 81).

According to Smith (1955, 21–22) the surface of the mud-sealing was decayed and no impression could be read.

Could this fine sealing have survived intact the removal of the chest from the hypothetical Dahshur tomb, the transfer to Giza, and the introduction of the chest down the G7000x shaft and into the recess in the west wall of the chamber? If not, it must have been resealed at the time it was put into G7000x. If so, why would it have been the only item in the burial assembly to have received restitution?

The yellowish fluid found about 5 cms. deep in three of the chest's compartments was analyzed by Lucas to consist of a solution of 3% natron (Lucas 1932, 127; 1962, 271; Reis-

ner and Smith 1955, 21–22). According to Smith (Ibid.); “In this lay the remains of the canopic packages which contained the entrails of the queen...” However, no analysis is published of the disintegrated matter at the bottom of the fluid, or the dry caked material in the fourth compartment, from which the fluid appears to have evaporated through a vein of porous alabaster in the side of the chest (Lucas 1932, 127). Smith calls the dry material a “mass of decayed organic matter” (1955, 21–22; without linen wrapping?). According to Lucas, “in each compartment of the box is a flat package wrapped in woven fabric (presumably linen) *that almost certainly contains viscera*... *If it be accepted that the packages contain viscera*, it is proved that in the Fourth Dynasty the viscera of a royal personage were preserved in a natron solution” (1932, 127; emphasis mine).¹¹

If analysis of the canopic material has not been done, it cannot be stated with scientific certainty that the material is the remains of human viscera. The material, and the solution in the three compartments, has not been removed from the canopic chest and may be seen today under a glass cover in the Cairo Museum (J.E. 52452).

9ai–ii: *The Blocking of the Shaft*

The burial chamber of Hetep-heres’s tomb was sealed by the limestone-plaster blocking that filled the 27.42 meter shaft, and the stairway at the top, to the brim. A curious aspect of this filling is the fact that it included artifacts and pottery; in effect, the broken-up burial assembly continues from the burial chamber up through the packing of the shaft.

There was no special blocking of the entrance to the burial chamber itself; the blocking of the shaft simply continued to the bottom. According to Smith “near the bottom was found an uninscribed mud-sealing, and at the very bottom several fragments of another sealing inscribed with the name of the mortuary workshop of Cheops” (1955, 14, Fig. 47, Pl. 43). Reisner, in his first report (1927, 7) mentioned “lowest of all, a mud jar-sealing without any seal impression.” It seems that from the bottom up to the depth of 24.80 ms. (1955, 13) the packing consisted of well-laid masonry of squared blocks which concealed the entrance to the burial chamber. From the approximate 25 ms. depth up to the opening of the stairway into the shaft, the masonry “was more carelessly laid; in some places the stones seem to have been thrown in and the plaster poured down on them from the top of the pit” (1927, 7).

It was within this carelessly laid packing that most of the sherds and artifact fragments were recovered from the shaft. Smith stated (1955, 14) that “in the packing of the pit were found smashed fragments of pottery, these being particularly frequent near the bottom.” According to Reisner’s earlier report,

At twenty-two meters, the fragments of a red polished pottery bowl with spout were found; and from there down to twenty-five meters great quantities of potsherds of different vessels, many of the large tubs of coarse ware, also a dozen fragments of a white limestone slab – perhaps a coffin lid – five complete and several incomplete blocks of limestone, a flint flake, and lowest of all a mud jar-sealing without any seal impression (1927, 7).

Reisner pointed out that some of the large tubs and basins must have been used for carrying the plaster with which the shaft was blocked. At the same time, eight vessels which must have been part of the burial assembly could be reconstructed from this quantity of sherds. They included four wide basins with a spout (1955, 14, Figs. 72–4), a bag-shaped pot (Ibid., Fig. 59), a neckless shoulder jar with a flat base (Ibid., Fig. 63), a domed cover (Ibid., Fig. 78), and a jar stand (Ibid., Fig. 77).

11 Lucas mentions an alabaster canopic jar being found with liquid natron but no viscera (see Brun-

ton 1920, 20).

At 17 ms. depth, small wood fragments, one with gilding and some in the shape of small columns, were found along with some copper fittings (Ibid., Pl. 3). Smith sees these as the remains of a light canopy which served either as the 'purification tent' or for containing the burial equipment before it was placed in the tomb (Ibid., 14–15). Six meters lower in the fill of the shaft, between 22 and 24.5 ms., eight limestone objects were recovered which look like small truncated pyramids with a hole, 6 cms. in diameter, in the top (Ibid., Fig. 18, Pl. 3). On the top of each was a hieroglyph which may, according to Smith, indicate the position as a base for the light canopy structure. On the other hand, they might be supports for the legs of the two armchairs found in the burial assembly.¹²

Between 9 and 7.47 ms. the blocked offering niche was found in the west side of the shaft, and from here, nearly to the surface, the blocking again consisted of well laid masonry of 9 courses of squared blocks. Above this there was a heavy layer of white plaster, and finally, at the surface, the opening was closed by an irregular paving of local stone. The stairway was also blocked with squared blocks and the opening was sealed by white plaster (1955, Figs. 12–14; Pls. 1, 2). According to Smith (Ibid., 14), a few pieces of pottery were found in the blocking of the stairway.

How much pottery was found in the shaft between the 22 and 25 ms. levels? If there were "great quantities" of sherds as Reisner stated, then G7000x had two main concentrations of ceramic material: the greater at the south end of the burial chamber, and the other between 2.42 and 5.42 ms. up from the bottom of the shaft. These two pottery groups were separated by the north part of the burial chamber and the furniture it contained, and two and a half meters of well-laid blocking in the bottom of the shaft.

Reisner accounted for this, and the other artifact fragments in the shaft, by saying,

When the packing had reached a height of about a meter above the roof of the chamber, it appears to have been discovered that one box of potsherds and other rubbish had been forgotten and the contents were thrown down the shaft with the stones and plaster of the packing (1927, 33).

It is difficult to imagine that a box-load of material intended for the burial of the queen-mother could have been forgotten until the packing was thus far advanced (and it does not augur well for Reisner's idea that the objects were put into G7000x in the inverse order of the original tomb).

One gathers the impression that the pottery, while concentrated around the 22–25 ms. level, was more or less scattered with the artifact fragments from here up through the loosely laid and dumped part of the fill. The canopy fragments, for example, were found at least five meters higher in the fill of the shaft. If all of this had been dumped from a box at one time, it would have been clumped together. The disposition of the sherds and artifact fragments suggests rather that this material was lying scattered about the surface at the mouth of the shaft along with the limestone blocks, plaster, debris, and the crude basins for mixing and carrying the plaster. As the packing material gradually went down the shaft, so did this scattered material from the burial assembly.

The most curious inclusions in the fill of the shaft are the fragments of a limestone coffin lid (Reisner 1927, 7; repeated by Smith 1955, 15) – if that is what they are. Why should fragments of a second coffin be included in material salvaged from the queen's original burial chamber at Dahshur? Were there two coffins in that tomb, one of alabaster and one of limestone? If so, why was the rest of the limestone sarcophagus not found in G7000x? Perhaps the coffin fragments were lying about on the surface at the time the shaft was filled. It is hard to see why this would have been the case, since G7000x was the first tomb in the

12 Peter Lacovara, personal communication.

Eastern Cemetery (see p. 4–6). Equally peculiar are the blocks found with these fragments which have builders' or quarry marks on them (1955, Fig. 18). Smith noted "these blocks bear a resemblance to other builders' and quarry marks that are known, but contribute little to the understanding of their purpose" (1955, 14).¹³ These stones may have been initially used in some construction project nearby shortly before the shaft was filled.

The fact that pottery which looks to be of the burial assembly was found in the shaft fill, along with the fragments of the canopy would seem to confirm Reisner's hypothesis that the entire assembly was transferred from an earlier tomb. Certainly the body of Hetepheres I could not have been taken out of the sarcophagus after this fill had been effected. However, it is possible that the packing Reisner removed from the shaft had been put there for the second time.

10ai–v: *The Offering Niche.*

At a distance of 7.47 ms. there was reached the top of a niche in the west wall of the shaft, walled up with a blocking of plastered white masonry. This niche was 2.10 ms. high and 1.67 ms. deep, but the space inside the blocking had an area of only 92 x 67 cms. (Figs. 14, 15; Pl. 3). When the blocking was removed, the recess was found to contain the horned skull and three leg-bones of a bull which had been wrapped in a much decayed reed mat, as well as two wine jars (Type A-II; see Fig. 16). There was also a limestone boulder which Rowe thought had been thrown into the niche for the intentional purpose of ceremonially crushing the skull 'to release its spirit.' It might be suggested that if this were so one would have expected the jars to have been smashed too. A piece of metal which adhered to the jaw-bone of the bull was tentatively identified as silver. There were also two chips of basalt which seem to indicate that work was continuing on the pavement of the Cheops temple at the time this offering to his mother's spirit was made by the king. There were also some bits of charcoal. Pieces of burnt wood had worked down into the filling of the pit below the entrance to the offering niche. These may have formed the material for censuring the offerings with the smoke of fragrant wood (1955, 11).

It was principally the fact of this offering that led Reisner to conclude that the king must not have known his mother's body was not in the sarcophagus when it was reburied in G7000x — this, plus the fact of the reburial itself. Reisner noted, of his initial conviction that the body was in the sarcophagus:

It had seemed to me inconceivable that Cheops should have ordered the remains of his mother's burial transferred to Giza and hidden under a hundred feet of masonry unless the body, the most essential part of any burial, had been brought along with the coffin (1928, 78).

When the sarcophagus had been found empty, Reisner relied on the offering in the niche to sustain the argument that the king must have believed the body was still in the coffin:

It seems impossible to believe that he could have known that the alabaster sarcophagus was empty. The fact that Cheops placed a food offering in a niche in the shaft indicates the belief of the king that his mother's mummy rested in the alabaster sarcophagus below (1928, 82).

It certainly seems that someone believed the queen's mummy was intact with her burial goods at the time the offering was made. The fact of the offering in the niche strikes a contradiction with the lack of restitution of the burial assembly and the broken bits of the

13 Nos. 2, 6, 7, 8, and 9 of these marks in Reisner and Smith's Fig. 18 are found as notations marking the quadrants of the Khufu funerary boat (Abubakr and Youssef 1971, 12, Fig. 7). These

signs are also used in the identification of phyles into which work crews were organized in the Old Kingdom (Helck 1973, 1–7). I would like to thank Ann Roth for pointing this out to me.

funerary goods in the fill of the shaft. From these fragments, those in charge of filling the shaft certainly must have known that the burial had been violated, if not that the body was missing. Why would they then, when the fill reached the level of the niche, have made this offering?

According to Reisner, the offering was made on the order of the king who was ignorant of the fact that the body was gone, or even of the extent of the violation, and by the overseers, or the vizier himself, who were deceiving the king about this fact.

Those who deceived the king about the missing mummy could also have deceived him about the offering. It is not likely that the king himself climbed down the 10 meters into the shaft to personally make the offering (Smith 1955, 59 asks “could he have been away on some visit of state or military expedition when the offering to his mother’s spirit was placed in the niche part way down the shaft?”). If the king had personally witnessed the slaughter of the ox and the deposition of the offering down in the shaft, would he not also have seen more of the extent to which the original burial goods had been broken up? Reisner might have answered that by the time the fill of the shaft had reached the level of the offering niche, the major part of the broken pottery and the canopy fragments had already been concealed lower in the shaft.

But here it should be pointed out that the offering itself showed signs of disturbance. The bull skull was crushed by a boulder and the two wine jars were unsealed; one had its top completely sheared off.¹⁴

If the shaft had been filled twice — once when the original burial was placed in G7000x and again after the fill had been removed and the body taken out — the offering could have been placed in the niche during the original interment. A hindrance to this view concerns the burnt wood or charcoal found associated with the offering inside the blocking of the niche. According to Smith (see above), some of the charcoal was found outside the blocking of the niche, having “worked down into the filling of the pit below.” Why would the charcoal have been found in the blocked niche and in the fill of the pit just below unless the fill of the pit and the offering had been made at the same time?

The explanation may involve the fact that the bull or ox skull was found crushed, presumably with the limestone boulder and/or the basalt fragments that are otherwise inexplicable as part of a funerary offering for the queen. Was this seen as an attempt to annul the offering? Reisner and Smith’s (1955) Pl. 3b gives a good view of the offering *in situ*. In front of the crushed skull and spilling into the impression left by the removal of one of the limestone blocks which sealed the niche is a pile of dark material that must be the charcoal reported by Reisner and Smith. There looks also to be a stick of wood lying along the left side of the niche, and this is shown in the plan of the niche in their Fig. 15. This charcoal could be the attempt to burn some part of the original offering, or the result of a crude torch used to light the niche when the offering was later annulled by crushing the ox skull. The complete wine jar in the offering is without its seal, while the other had its top broken off (Ibid., Fig. 16) when its seal was removed.

The blocking of the niche would have been done when the offering was first made during the original blocking of the shaft. If so, some of it would have been removed, and then replaced, when the offering was annulled. In Reisner and Smith’s Pl. 3a the blocking as found

14 Concerning this point we should recall the ancient Egyptian ceremony of “the breaking of the red pots,” which was a final step performed during the funeral and just before the tomb was sealed. For a summary and references, see Kendall

(1982). While this may account for some of the broken pottery — deposited during the original interment — in the chamber and shaft, the jar in the niche appears to have had its top more purposefully and carefully broken off.

is shown. It appears as though, at the upper left corner, there was a break in the well laid and squared masonry which was later resealed and smeared with more plaster than shows on the outer face of the rest of the blocking. It is just below this suggested break, and inside the niche, that the pile of charcoal is situated. If this had been deposited from a crude torch, a burning piece of wood, or a stick, which was to give just enough light to crush the skull of the ox with the limestone boulder and empty the wine jars, it would explain why some of the charcoal was found in the fill of the pit outside the niche. Perhaps the basalt fragments were used as crude tools to break through the original blocking.

H. Alternative Explanation.

The possible alternative explanation – the official removal of the queen's body – which develops from a review of the data also raises serious questions.

How did the pottery at the south end of the burial chamber become displaced and broken to the point that “parts of one vessel were found in three different boxes” (1927, 24; cf. 1955, 60)? How did the mud-sealings of Khufu's mortuary workshop become broken so that none of the containers except the canopic chest were found with the seal intact? How did those who opened the coffin proceed to its SW corner and lift out the body when the route was blocked by the inlaid box, the two arm chairs, the bed and the carrying chair (Figs. 6 and 7)? What was done with the canopy poles, beams, and the curtain box, which were found lying across the top of the coffin, when the coffin was opened and the body removed? How did the broken pottery, fragments of a light canopy, and limestone furniture bases become deposited in the fill of the shaft above the entrance to the burial chamber?

In order to sustain the alternative explanation, these questions must be answered on the basis of evidence already cited in the critique of Reisner's hypothesis, plus a few assumptions and speculations beyond the limitations of the data – the kind of reasoning that was exercised with some license in Reisner's hypothesis.

If 15 mastaba cores had already been completed in the Western Cemetery by year 5 of Khufu (Reisner 1942, 83–4), it would seem that at least one of these would have been available when Hetep-heres I died early in the reign of her son. It is not known exactly when the queen-mother died, but the fact that there is clear evidence that none of the three queens' pyramids, and probably therefore none of the mastabas of the Eastern Cemetery, had been built when G7000x was prepared, suggests that it was before year 15 of Khufu (accepting Reisner's estimate of that year for the beginning of the mastabas in the Eastern Cemetery).

It may have been that the Western Cemetery was already designated for the different parties grouped according to blood affiliation with the royal wives (Reisner 1942, 28, 77–8), or according to administrative functions (Helck 1956, 62–5; O'Connor 1974, 21, Fig. 6). The Eastern Cemetery may have already been reserved for the principle queens and the more immediate royal relatives, although none of its architectural members had been begun. At the time Hetep-heres I died, the Eastern Cemetery with its blocks of mastaba cores organized by streets and avenues had not been laid out on the site. The area that would later be covered by this cemetery was still characterized by the natural crusty bedrock surface, dipping gently from NW to SE.

The circumstances of the queen-mother's death possibly demanded that the tomb and the burial equipment be prepared with some haste. This may be reflected in the fact that a deep vertical shaft was decided upon, the cutting of which took advantage of two parallel fissures in crumbly bedrock and the unfinished cutting of the burial chamber. The hurried condi-

tions may also be reflected by the “practically unfinished conditions of many of the pottery vessels in the tomb” (Reisner and Smith 1955, 67).¹⁵

In spite of the haste, some thought was given to the location of the tomb with respect to the unified plan that may have already been roughly conceived (but not surveyed) for the Eastern Cemetery. The site chosen was in the precinct that would be reserved for the principle queens, beyond which would be arrayed the tombs of chief royal relatives. Hetepheres I's tomb may have been planned as the first in a series stretching to the south, which meant it had to be fairly close to, or upon, the planned north limit of the Eastern Cemetery. This also set the tomb roughly 200 cubits from the east face of the Great Pyramid and near the extended line of its E-W axis. Obviously, this area cannot have been covered by construction ramps, a point to be considered in any complete discussion of the *baugeschichte* of the main Pyramid and its surrounding cemeteries.

The type of superstructure for the queen-mother's tomb may not have been chosen when the crude stairway was begun. If at this time it was to be a pyramid, the fact that the stairway was started first may reflect uncertainties as to the form which the substructure of a queen's pyramid tomb should take. In the beginning, it appears as though the planners had a 3rd Dynasty pattern in mind. Had the stairs been continued at their 38 degree gradient (and broadened at the same time), they would have reached the center of the planned (?) pyramid at the level of the burial chamber of G7000x (Fig. 2). The stairway, which in a typical 3rd Dynasty tomb would have sloped some greater distance down to the foot of a deep vertical shaft, was in this case superceded by the shaft begun in the natural rock surface after the stairway had been cut for a length of only 3,4 ms. It may be that this was decided upon the finding of the parallel fissures which would facilitate and speed the preparation of the tomb. The shaft was continued for a depth of 27.42 ms. At 25 ms. a burial chamber was cut out to the south. This had a length of 5.22 ms. (10 cubits), a width of 2.67–2.77 ms. (5 cubits), and a height of 1.95 ms. It had been intended to make the chamber wider and higher, as evidenced by a pit in the floor of the NW corner and unfinished cuttings in the east and west walls, but work stopped suddenly when the burial assembly was introduced. Limestone boulders and debris from the rough quarry work were shoved into the floor-pit in the NW corner and left strewn out along the west wall of the chamber.

The alabaster canopic chest and the sarcophagus, a matching set, were the first items introduced into the burial chamber. The chest must have been lowered down the shaft with enough care that the fluid containing the canopic packages did not spill – unless the fluid and packages were placed into the chest in the tomb. One wonders also whether the string and mud sealing of the chest could have remained intact while the chest was maneuvered down the shaft and into the south end of the recess in the western wall of the burial chamber.

Wood for runners or stretchers was then lowered down to the bottom of the shaft for the alabaster sarcophagus. The coffin was lowered first, levelled out at the bottom of the shaft and set onto the wood runners. With the aid of levers and ropes, and a round hammer stone under the bottom of the sarcophagus, it was pushed into the chamber a short distance and

15 In spite of the indications of haste in the Hetepheres burial – the cutting of the shaft and, possibly, the workmanship of the pottery, the body could have been kept for eight or nine months between death and burial, if the inscriptions on the chapel door of the tomb of Meres' ankh III are any indication. There the time between

death and burial was 273 or 274 days (Dunham and Simpson 1974, 8, Fig. 2, Pl. IIa). This would certainly be time enough to manufacture quality pottery if not to cut a good burial shaft. The circumstances of either Meres' ankh III's or Hetepheres I's death and burial may have been atypical.

left on its runners in the NE corner under the recess in the east wall. The lid was lowered down and probably set against the west wall of the chamber.

The queen-mother's embalmed body was then lowered down the shaft, placed into the sarcophagus and covered by the lid. During these operations, it is possible that the outside edges of the sarcophagus and the bottom of the lid were chipped here and there along the two long sides. Small rectangular stone blocks had already been gathered at the top of the shaft for its eventual blocking. Some of these were lowered down and used to block up the recess in the west wall, along with irregular limestone pieces probably picked up from the masons' debris just below the recess. These were set in plaster which was smeared over the face of the blocking. The sealing left splashes of plaster on the floor below the recess. The recess in the east wall was partially blocked with both irregular and cut stones, but not sealed with plaster.

Next, six or eight wooden boxes, each about 40 cms. in height, were brought down and set at the south end of the chamber, between the sarcophagus and the south wall. In the SW corner there were two layers of boxes, one above the other. In the center of the south end of the chamber some of the boxes may have contained some pottery and alabaster vessels. The bed, carrying chair, inlaid box, case with walking sticks, and the two arm chairs were brought down and placed in the remaining space along the west side of the sarcophagus. Parts of this furniture were set down over the masons' debris which filled the floor pit and was strewn out along the west wall. The bed canopy beams and poles, and the box for the canopy curtains, were brought down and placed on top of the sarcophagus. Since the quarrying of the chamber to its intended height had been interrupted, it was not possible to erect the canopy over the burial assembly, as had been intended (in which case, it would have been the first item brought down).

Thus far, the arrangement in the chamber is not much different than the reconstruction of Reisner and Smith's (1955 Fig. 20, Fig. 7 here). However, in order to account for the broken pottery in the south end of the chamber and in the shaft we must suggest that the pottery was the next item brought down into the burial chamber. Just as Reisner would have the pottery as the last thing placed in the hypothetical original tomb, situated before the furniture, linen boxes, canopy and sarcophagus, and arrayed around the doorway (1927, 32), so in G7000x the pottery would have been the last thing placed in the chamber, if it is, in fact, the original tomb. The pottery was brought down and placed at the north end of the chamber, over the debris-filled pit in the floor, and in the narrow space at the north end of the sarcophagus.

The shaft was then filled to the level of the offering niche. The slaughter of the bull may have been carried out at the surface beside the mouth of the shaft with the priests and officials, and perhaps the king himself, in attendance. Those parts offered to the *ka* of the queen-mother were wrapped in a reed mat and placed into the niche along with two filled and sealed wine jars.

Sometimes after the offering was made and the shaft was blocked, a pyramid superstructure, with a sloping entrance passage, was begun. This was, at the same time, the beginning of a second substructure, separate from G7000x. The surface of the rock south of the tomb shaft was dressed to regularize it, although it was not planned to make a level foundation as had been prepared for the perimeter of the king's pyramid. The cutting for the sloping passage was aligned to the shaft of G7000x, so that the shaft would lay on the N-S axis of the queen's pyramid. According to this layout, the finished pyramid would have its north base about four meters south of the tomb shaft (Figs. 1, 2). The shaft would then lay just below the entrance to the second substructure — the sloping passage — at the center north face of the pyramid. A very similar configuration was known to the planners from the small satellite pyramid of the queen's husband, Sneferu, at Dahshur. There the north chapel

contained a pit below the entrance to the sloping passage and on the N-S axis of the pyramid (Fig. 5). It is possible that, had the pyramid been completed, the surface around the G7000x shaft would have been dressed and an entrance chapel built with its pavement concealing the mouth of the shaft.

An emerging plan for the Eastern Cemetery may have already chosen the axis of pyramid GI-x and the position of G7000x as the N-S axis of the two additional queens' pyramids.

Not more than several days work had been done on the preparations for the queen's pyramid when it was abandoned because of a change in plan which would move the pyramid 28 ms. to the west. The reason for the change concerned calculations and measurements for the unified plan of the Eastern Cemetery (see, Part II) which was still being formulated.

When this unified plan was finally decided upon, the layout work was done and construction started anew on the first queen's pyramid. It was deemed inappropriate that the queen-mother's body should be left in the hastily prepared shaft-tomb which would now be covered by a street of the necropolis. Rather, Hetep-heres I should have her place under one of the large superstructures in the carefully reasoned layout of the royal tombs. The most likely and appropriate place would have been the first queen's pyramid completed, GI-a, since this had been started for her in the first place to articulate with her hastily prepared shaft-tomb.

When the substructure of the first queen's pyramid was completed, the blocking of the shaft-tomb was taken out and the stones were left stacked about on the surface. As the last blocking stones were removed from the base of the shaft, those who were to enter the chamber had before them the mass of pottery vessels packed between the lowest courses of the blocking and the north end of the sarcophagus and lying on the fill of the floor-pit just inside the entrance. Some of the vessels may have been broken as the bottom packing stones were taken out, and plaster fragments from the packing became mixed with the broken pottery.¹⁶

There may have been the thought to remove both the queen's body and her canopic chest. That the canopic chest was looked at by removing some of the masonry and plaster blocking may be indicated by an irregularity at the south end of the blocking as well as the basket and group of tools which lay on the floor just below this point. The basket had been used for carrying plaster and the tools lay under the bed and carrying chair. The basket and the tools could have been left when the blocking of the recess was originally done at the time the burial assembly was introduced. However, there is also the fact that the sarcophagus lid seems to have been levered up from its SW corner, when it would have been easier to do so

16 Concerning this point, it was disturbing that there was nothing in the published reports about pottery being in this area of the chamber, contrary to what one would expect if the reentry of G7000x meant that blocking stones and plaster spilled on to pottery left on the pit fill and between the north end of the coffin and the shaft. According to Smith (1955, 14), this area did not contain any objects. According to Reisner (1927, 10) "between the northern end of the sarcophagus and the blocking of the doorway lay two small scraps of gold sheet; and over the southern half of the pit were a good many sheets and strips of gold." When I had the opportunity to consult the original excavation log in the archives at the Boston Museum of Fine Arts, the gold objects are entered on pp.

196-8 February 1926 along with "fibrous and organic matter," "fibrous wood," "potsherd, decayed wood and fragment of brown fabric". At the end of this entry for G7000x Reisner summarized: "The debris of dust, limestone chips and organic (material) under the above objects overlies the filling of rough stones of the lower pit. In it, potsherds, bits of plaster and charcoal are visible. Dunham and M. Tammam removed this debris sorting out plaster, potsherds and charcoal into a tray and exposed its coarse filling or rough stones." Reisner sketched the stratification in the pit on pp. 183-4 of the same journal. I would like to thank William Kelley Simpson for access to Reisner's journal.

from the north end near the entrance. It may be that this indicates there had been some rearranging of the furniture along the west side of the coffin on the part of those who reentered the chamber. The SW corner of the sarcophagus was levered because the chamber had already been penetrated to check on the canopic chest.

In order to penetrate the chamber, the pottery had to be walked over and/or cleared away. Some of the pottery was sent up the shaft to the surface. A way was cleared leading into the chamber by moving the armchairs over in front of the entrance and by shoving the bed and, on top of it, the carrying chair against the west wall of the chamber and southwards with the south ends of these pieces leaning on the boxes stacked in the SW corner of the chamber. This would have just given access to the south end of the recess where the canopic chest had been stationed (Fig. 2). If the eight limestone objects found in the shaft fill (see p. 27) are bases for furniture, perhaps the chairs, they may have been sent up the shaft along with some of the pottery when the furniture at the north end of the chamber was moved about.

At the same time, boxes and other containers were opened, their seals broken, to check for contents, some of which may have been removed. The rest of the pottery, some whole and some broken, was gathered up from around the north end of the chamber. Some of the pottery might also have been thrown into the unsealed boxes with the linen. Mixed with the pottery were plaster fragments from the re-entry and a few mud-sealings from the opened boxes.

When the approach to the south ends of the west wall recess and the sarcophagus was cleared, some of the blocking in the recess was removed with punches and chisels which were left on the floor. Rather than remove the chest, it was decided to leave it with most of the rest of the original burial assembly. The break in the blocking was resealed, for which a basket of plaster was brought down and left on the floor after the job had been done.

The poles and beams of the bed canopy and the curtain box were removed from the top of the sarcophagus. As the poles and beams were more than a meter longer than the height of the chamber, some were pushed down between the sarcophagus and the east wall of the chamber. After the curtain box had been placed on the floor against the west wall, just before the bed and carrying chair, the rest of the poles of the canopy were stacked over the box and leaned against the bed and carrying chair. The lid was started at its SW corner, which was chipped off. The chips were tossed over to the pottery piled on the boxes just behind the coffin to the south. The copper punches and the chisel which had been used for this job were left on top of one of the boxes nearby. The lid was raised from the south end and this caused the rim of the coffin and its lid to press together at the north end and chip. The lid was then turned back against the east wall of the chamber and the queen's mummy was removed from the sarcophagus.

In order to get back out of the entrance of the chamber, the furniture had to be put back in much the same order as it had been. The lid was replaced on the coffin. The beams and poles of the canopy which had been stacked over the bed and carrying chair were put back on top of the coffin, as was the curtain box. The bed and carrying chair were left, however, leaning up on the boxes in the SW corner of the chamber (Fig. 7). The arm chairs were moved aside from the entrance and, as the queen's body was taken out, pushed back into the space remaining between the coffin and the west wall of the chamber.

The packing of the shaft began for the second time. As the blocks were lowered and set with plaster, some of the pottery fragments and a couple of mud sealings that had been taken up the shaft came down with the plaster and stones and were sealed up in the packing. When the blocking reached a height slightly above the entrance to the chamber, much of the pottery that had been taken up to the surface was dumped back into the shaft where, from the 22 to 25 ms. depth, it was gradually mixed with discarded tubs for carrying the plaster as

the filling material was gradually brought down. There may have already been some broken pieces of these crude pottery basins or tubs mixed with the material from the first blocking. At the 22 to 24.5 ms. depth eight limestone furniture bases were dumped back into the fill. These had been among the few objects removed from the burial chamber when it was re-entered; they may have been discarded when the armchairs were moved about. Some small fragments of a light canopy, left amongst the debris at the surface, came to be included in the dumped fill along with some copper fittings at the 17 ms. depth. Certain blocks with builders' or quarry marks were also included in the fill. These may have come from the construction work in progress on the queen's pyramid, GI-a, immediately beside the shaft.

When the filling of the shaft reached the level of the offering niche in the west wall about 9.5 ms. from the surface, some of the plastered masonry blocking of the niche was removed at its upper left corner. The niche was entered by crawling over the remaining blocking, a crude torch being used for light. The seals were removed from the pottery wine jars, which resulted in the rim of one being entirely broken off. A limestone boulder was used to crush the ox skull which had been left, with three leg bones, as an offering. In this way the offering was considered annulled. The break in the blocking of the niche was resealed. The crude torch had left charcoal in the niche and some of this was dropped in the shaft fill below.

The blocking was taken up to the surface and also filled the stairway at the north side of the shaft. The opening of the shaft was filled with irregular local limestone paving so as to camouflage it with the surrounding natural rock surface. This was plastered over. Since much of the original burial assembly had been left behind, and there would be no superstructure to guard the shaft, it was now seen as necessary to make it a "secret tomb". Later it became covered with the limestone gravel and packed mud of the 4th Dynasty street. Ironically, precisely because it was not guarded by a superstructure, the disused royal burial assembly was the only one of its dynasty to survive the ages and be delivered over to systematic archaeological scrutiny.

I. Reservation.

When Reisner mentioned (1927, 81) that other explanations for G7000x had been offered, he quickly said that they all left "some known fact out of account. Usually it was the indisputable fact that the original tomb had really been plundered" — which is not a fact, Reisner is here begging the question — "or that the body is the essential part of any burial and its separation from the equipment intended for the use of its spirit would have been in itself a sacrilege."¹⁷

17 Among those offered at the time of the excavation was one from Cecil Firth which has some similarities to the alternative explanation offered here. The following letters from Firth to Reisner are in the Boston Museum of Fine Art archives:

"VIII 6. Saqqara Bedrashein
Sunday

Dear Reisner,

It is possible that when Sneferu's Queen died, Sneferu's Pyramid was still in the hands of the builders and he could not put his wife in it or near it. So he buried her temporarily at Giza. When Cheops wanted the Giza site for his Pyramid, he or Sneferu removed the queen's body to the Sneferu

Pyramid at Meydum (or near to it) which was by then ready to receive it. Cheops then removed the superstructure of the Queen's temporary tomb and used the site for his own buildings.

This may explain the damage and signs of moving of the objects in the tomb. Perhaps a fresh funerary equipment was provided for the reburial, or the Queen may have been buried at the same time and with the same ceremony as Sneferu himself.

Probably it was impossible to reuse such a tomb for any of Cheops Queens and all that could be done was to fill the shaft up so that it could be built upon if necessary. The alabaster coffin could not be moved and only the inner wooden coffin

The last part of Reisner's statement reflects the most serious question raised by the alternative hypothesis. Would the queen-mother's body have been removed from G7000x while the greater part of her burial equipment was left? Most serious is the fact that the canopic chest, presumably containing the queen's viscera, was also left behind. Considering that the canopic chest is usually close beside the sarcophagus in the same burial chamber, or an annex thereof, would it have been conceivable to leave it when the body was transferred? If Hetep-heres I was reburied in pyramid GI-a, immediately beside her shaft tomb, perhaps this close proximity was enough of a connection, in the view of those in charge of Khufu's mortuary affairs, between the G7000x substructure and the new tomb and its superstructure.

Finally, one must judge the merits of the two hypotheses – that of Reisner and the alternative – on the basis of which is the simplest explanation, remains closest to the facts at hand, raises the fewest problematic questions, and stays within what is known of the outlook and motivations of the 4th Dynasty Egyptians. The truth may lie somewhere between the two explanations. It might, for example, be argued that Reisner is correct about an earlier plundered tomb and the transfer of the burial. Even if the body had been lost, it could still be argued that the unfinished pyramid, GI-x, had been intended as a superstructure for the burial of Hetep-heres I.

J. The First Queen's Pyramid: GI-a.

If GI-x had been intended for Hetep-heres I, then GI-a, the completion of this project, must likewise have been intended for the queen-mother. This queen's pyramid has been assigned to a Merytyetes, thought to be the daughter of Sneferu and Hetep-heres I and the chief wife of Khufu, on the basis of the stela Mariette found in the Eastern Cemetery, and three small fragments giving her name, the titles of a queen, and a relationship to Khufu,

would be taken out. If the amulets were in a box or wrapped up they may have been simply overlooked in the dim light.

Yours very sincerely,
Cecil Firth"

Firth responded to Reisner's reply with a second letter:

"Saqqara
March 20" 1927

Dear Reisner,

I had not seen your articles on the tomb and so did not know about the evidence you mentioned in your letter.

That Hetep-heres survived her husband and was buried by Cheops seems clear, both from the position of the tomb and the disturbed state of the contents it seemed to me possible that there had been a subsequent reburial when Cheops wanted the site for his Queens' and childrens' tombs and that this reburial would be in or near the Sneferu Pyramid. The basalt fragments would have got with the shaft when it was finally filled up, i.e. at the second closing of it – at the first filling of the

shaft there was perhaps no basalt pavement. At any rate Hetepheres was not in her sarcophagus and that can surely only mean that if she had ever been in it someone must have cleared the shaft – gone down and taken her out. Could not most of the damage, moving of the boxes, etc., have been done on this occasion? The meat bones in the shaft and the pottery in the tomb chamber looked as if this tomb was the first burial place. Perhaps the daughters-in-law of Hetepheres did not get on well with the old lady and preferred that she did not share the same cemetery as themselves. Perhaps she is somewhere else in the tomb, but the blocked up places, unless covered with plaster closely matching the rock, would surely tempt anyone who found the coffin empty.

Yours very sincerely,
Cecil Firth"

Again, I would like to thank William Kelley Simpson for access to the Reisner archive and the use of these letters which were called to my attention after the alternative explanation offered here had been formulated.

found in the chapel of Kawab's mastaba (G7110–20), just across the street from GI-a (Smith 1952, 114, Fig. 2; Reisner and Smith 1955, 6–7, Figs. 8a, 9; Simpson 1978, 3–4, Fig. 13, Pl. VIIc–e). Merytyetes' claim to the first queen's pyramid is thought to be strengthened by the loose principle of familial proximity – that tombs of immediate family members are situated close by one another (Smith 1971, 168). Since the large mastaba directly east of GI-a belongs to Kawab, and if the fragments assigned to his chapel do establish Merytyetes as his mother, the first queen's pyramid could be that of Merytyetes. Smith states this with some certainty: “the position of Kawab's tomb makes it certain that he was the son of Cheops's chief queen buried in the Pyramid GI-a. The above evidence strongly suggests that this chief queen was Merytyetes. .” (1955, 6).

The same reasoning has made the southernmost queen's pyramid, GI-c, that of the mother of Khufu-khaf, whose mastaba is the one just to the east (G7130–40; *Ibid.*, 7). A glance at the map of the site shows that this reasoning pinches out the middle queen's pyramid. To which adjacent mastaba does it correspond? Smith suggests this pyramid belongs to the mother of Djedefre (*Ibid.*). Djedefre, of course, became king and moved to Abu Roash for his own pyramid tomb. But this was well after the layout of the Eastern Cemetery, and therefore after the modification to the original 12 mastaba cores which resulted in eight, leaving three queens' pyramids directly opposite only two large double mastabas.¹⁸ The name of the owner of the middle pyramid is unknown, and that of GI-c is known as Henutsen only on the basis of a 26th Dynasty text found in the Isis Temple (Porter and Moss 1974, 18). Clearly, the evidence is sparse enough to admit the possibility that if GI-x had been intended for the queen-mother, GI-a, the completion of the project, may likewise have been her pyramid tomb.

The burial chamber of GI-a certainly would have been appropriate for the assembly left behind in G7000x. Its dimensions look to have been designed for just such an assembly, as shown in Fig. 8 where the main items of Hetep-heres I's furniture have been fit into the floor space of GI-a's burial chamber (on the basis of dimensions given by Reisner and Smith 1955 for the pieces of furniture and the 1:50 plans and sections of the chamber given by Maragioglio and Rinaldi 1965, Tv. 12, Figs. 5, 8). The chamber's dimensions give just enough room for the bed canopy to have been set up (it would have been brought into the chamber in pieces and reassembled). The floor space of the chamber, within the masonry lining of the walls, is 3.55 ms. (E-W) X 2.97 ms. (N-S) according to Reisner (1942, 129, Fig. 63), or 3, 57 ms. (E-W) X 2.72 ms. (N-S) according to Maragioglio and Rinaldi (1965, Tv. 12, Figs. 5, 8). The canopy measures 3.20 ms. X 2.50 ms. with a height of 2.20 ms. (Reisner and Smith 1955, 23). This leaves about 18.5 cms. clearance between the assembled canopy and the east and west walls of the chamber and about 11 cms. clearance to the north and south walls (according to Maragioglio and Rinaldi's dimensions for the chamber). The clearance to the ceiling of the chamber would be 15 cms. according to Maragioglio and Rinaldi's measurements for the chamber height, or 29 cms. according to the height given by Reisner.

Because it takes up practically the entire space in the chamber, all the burial goods as found in G7000x, if placed in the burial chamber of GI-a, would have necessarily been placed inside the canopy. In fact, as Fig. 8 shows, they would have made a near-perfect fit. In this reconstruction, the coffin (1) has been placed in the SW corner with the bed (2) and carrying chair (3) on top of it. Eight boxes, each 40 cms. high but otherwise of varying

18 The initial layout of twelve mastaba cores in the Eastern Cemetery would have left a balance of three mastaba cores opposite three queens' pyramids. Reisner stated: “These twelve original cores,

as far as can be seen, were never assigned but were probably intended for the same persons who were afterwards buried in the twin-mastabas constructed later” (1942, 72).

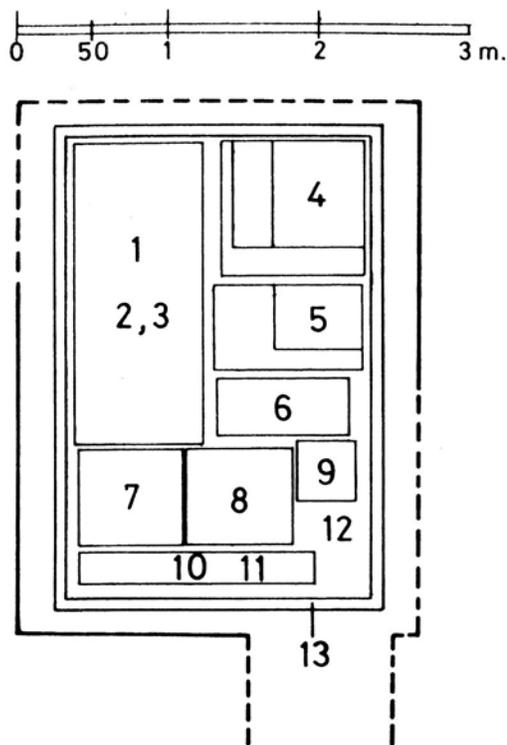


Fig. 8. Fit of Hetep-heres I's funerary equipment in the burial chamber of GI-a. 1. alabaster sarcophagus, 2. bed and 3. carrying chair lying on the sarcophagus, 4. stack of five boxes (each 40 cms. thick leaving 20 cms. clearance to the top of the canopy), 5. stack of three boxes, 6. inlaid box, 7. arm chair, 8. arm chair, 9. Canopic chest, 10. curtain box, 11. case with walking sticks lying on the curtain box, 12. pottery, 13. canopy.

dimensions (Reisner and Smith 1955, 20-1), could have been stacked in the NW corner, the first stack of five boxes (4) leaving a 20 cms. clearance with the top of the canopy. The second stack (5), immediately east of the first, would be three boxes, leaving a 1 m. clearance to the top of the canopy. Beside this stack of boxes is the inlaid box (6). At the north end of the enclosure would be the two arm chairs (7, 8), canopic chest (9), the curtain box (10), and on it, the case with walking sticks (11). A small space is left in the NE corner for the pottery (12), which could also have been placed on the second stack of boxes or, if necessary, on the other objects.

The equipment could not have been introduced if the canopy had been completely set up first, since it opens on one of its long sides which would have faced the north or south wall of the burial chamber. However, given the tenon and socket joining between the canopy parts (Ibid., 24-5), this problem could be overcome as follows: The heaviest item, the sarcophagus, could have been introduced first and situated so as to reserve a space between it and the walls for the canopy. The canopy could then have been assembled in the chamber except for the "tent" poles and roof beam of the side facing the entrance to the chamber. The rest of the furniture could then be neatly stacked inside the canopy enclosure (the body having been put in the coffin first). The final items introduced were the curtain box and the pottery. The curtains would have been hung on the first three sides when they were initially erected, as they could not be hung after the introduction of the tightly fitted furniture (the curtains hung from hooks on the inside of the canopy). The three "tent" poles of the last side were then set into their sockets in the floor beam. The roof beam was joined to the tops of these poles and the perpendicular roof beams of the two long sides of the canopy. The

curtain was then hung over this side. The last three poles and the roof beam would have been put on in a very tight working space, but this might have been managed if the only furniture here was the low curtain box. Perhaps the pottery was introduced last, though the beams of the canopy, to avoid stepping on it during this last operation.

The chambers of the other two queens' pyramids vary only slightly in their dimensions from that in GI-a¹⁹ which suggests that they also accommodated an assembly like that of Hetep-heres I. This implies, further, that her assembly was standard for queens of this time. The idea is reinforced by the relief-carved depiction of a queen's burial assembly, nearly identical in its major elements to that of Hetep-heres I, in the chapel of Queen Meres'ankh III under her mastaba in the Eastern Cemetery (G7530; Porter and Moss 1974, 197–99, Pl. XXX). The scene occurs in the main room, on the south wall (16), lower right section (Dunham and Simpson 1974, 16, Fig. 8, Pls. VIII–IX). Included are a bed canopy, bed, carrying chair, throne-like arm chair, and curtain box, all similar to the pieces reconstructed from the remains in G7000x.²⁰

19 The chamber of GI-b measures 3.12 X 3.88 ms., height 3.35 ms.; and that of GI-c is 2.89 X 3.73 ms., height 2.90 ms. (Reisner 1942, 103–1, Figs 64–5).

20 Among the items depicted in the Meres'ankh relief there is one that is not wholly represented in the burial assembly found in G7000x. This is a small canopy or shrine carried by two women in the lower part of the register. Although it is smaller, the canopy shown here is very similar in form to that found in the "serdab" at the end of the blind sloping passage 4 ms. west of the subsidiary pyramid, GII-a, of the Second Giza Pyramid (Abd el-'Al and Youssef 1977, 103–20, Pls. I–XV; 1979, Pls. I–II). A canopy of similar form and closer in size to that found under GII-a is also shown in Meres'ankh's chapel, in the third register down from the ceiling on the east wall of the main room and south of the entrance (Dunham and Simpson 1974, Fig. 5). The "serdab" passage at GII-a is aligned to the E-W axis of that pyramid, and might be considered a part of its substructure, or an annex thereof, separated from the main substructure (cf. Maragioglio and Rinaldi 1966, 90–3, 130–1). The canopy found in it was systematically dismantled, perhaps ritually broken, and placed in a box which was carefully buried as the sole

item in the "serdab." Perhaps the canopies in both the Meres'ankh III relief and that associated with GII-a had a particular function in the burial rites. The larger canopies, like that found under GII-a, were sometimes used for transporting statues (Lehner and Lacovara, forthcoming). Those mentioned above have the general form of the *sh ntr* (Gardiner 1957, 495, Sign-list 021). The canopy represented by the small fragments found in the shaft of G7000x must have been of somewhat different form, since it looks to have had very light, thin, and fluted columns which were gilded (see p. 63–4; Reisner and Smith 1955, 14–15, Fig. 18, Pl. 3). However, it might have served a function similar to that of the canopies shown in the Meres'ankh III relief and found under GII-a. The latter are, of course, too small to have served as a cover for all the burial equipment, as Smith suggested for the canopy represented by the fragments in the G7000x shaft. The eight limestone objects, and the fragments of the small columns, comprised the only remains of tomb furniture found in the shaft. Was the canopy alone taken from the furniture of G7000x for the transfer of the body of Hetep-heres I because of some special function, to be ritually broken later after which some of the pieces were left in the shaft fill?

II. The Satellite Pyramid of Khufu

A. The "Trial Passages."

Reisner gave a specific reason for the change in plan which moved the first queen's pyramid from the site of GI-x 28 ms. to the west for the passage of GI-a. Had GI-x been completed, its north base would have fallen very close to the mouth of Hetep-heres I's tomb shaft, which was positioned after GI-x had been started. Having put this obstacle in their plans, the ancient builders decided the pyramid must be moved to the side.

If, on the contrary, pyramid GI-x had been started for Hetep-heres I, purposefully located on the same axis as her tomb, it nullifies Reisner's explanation for the change in plan. It has been suggested (see p. 36 seq.) that the change involved the emerging unified plan for the layout of the Eastern Cemetery.

Not far from the tomb of Hetep-heres I there is another set of rock-cut passages which are yet another violation of Reisner's principle — a substructure without a superstructure. These have been called the "trial passages" because it is thought they were kind of practice model of the principle parts of the passages in the Great Pyramid. They are cut into the bedrock about 87.50 ms. from the east face of the Great Pyramid, and extend from 30.50 to 54 ms. northward from the projected E-W axis of the Pyramid. This puts their south end 11 ms. from the north edge of the great boat pit which lies paralleled to the causeway ("C" in Fig. 9, 21, 23). These passages were examined by Perring and Vyse (Vyse 1840-42, I, 189, II, 130n.) who thought they may represent the beginning of a fourth subsidiary pyramid. It was Petrie who saw them as models of the Great Pyramid passages and so designated them "trial passages." He carefully measured them and produced a section at 1:100 (Petrie 1883, 15-16, Pl. II). Maragioglio and Rinaldi (1965, 68-71, 170-71, Tv. 9, Figs. 1, 6) comment on these features, reproduce Petrie's section, and render the passages in plan.

The passages (Fig. 10) have a total length of 22 ms. and a total vertical depth of 10 ms. They appear to be accurately oriented north-south. At the north end there is an opening in the bedrock which is cut in steps. This becomes a sloping passage 1.05 ms. wide and 1.20 ms. high, which continues at a mean angle of $26^{\circ}32'$ for a slope distance of about 21 ms. to its end. 11 ms. down from the north edge of the north opening, another passage, of nearly the same dimensions in cross-section begins from the top of the descending passage. The second passage runs up and southward at approximately the same angle as the downward slope of descending passage. At the lower end of this ascending passage, its cross-section narrows by about 13 cms. At 5.8 ms. up the slope of the floor, the ascending passage widens into a corridor which has been cut open to the sky. The ascending passage continues in the floor of this corridor with the same width of 1.05 ms. It is defined by ramps on the east and west cut into the walls of the corridor. These ramps are 47 cms. (east) and 50 cms. (west) wide and have a mean height above the floor of 60 cms. The total width of the corridor (passage plus ramps) is 2.02 ms. at the bottom. A vertical square shaft, with a mean width of .727 ms., has been cut from the bedrock surface down to the juncture between the ascending and descending passages.

As Petrie recognized, these passages clearly are a kind of foreshortened copy of the pas-

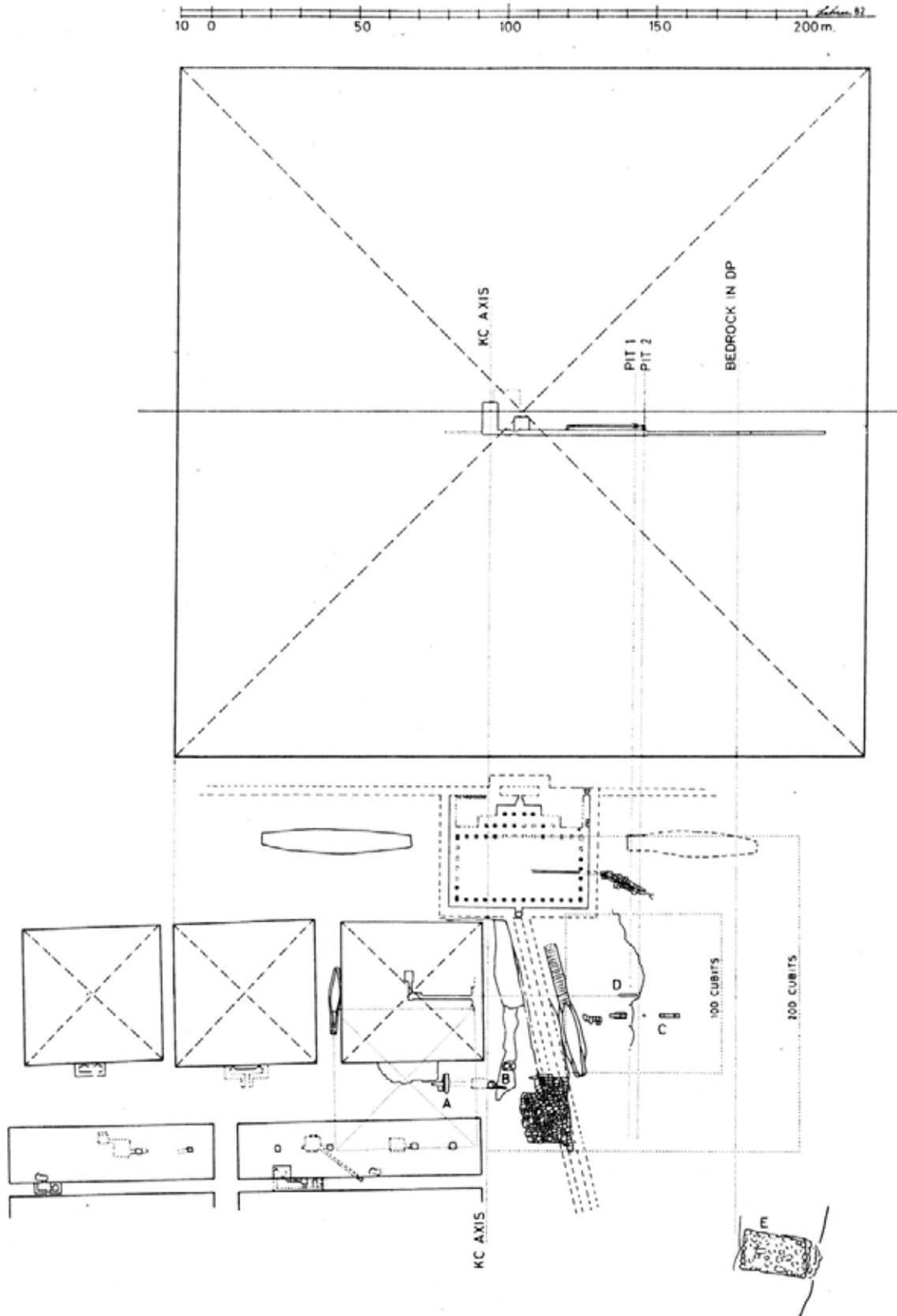


Fig. 9. Alignments between the Great Pyramid and Eastern Field. Plan. A: unfinished pyramid cutting, GI-x, B: tomb of Hetep-heres, C: replica passages, D: trench marking north-south pyramid axis, E: block of masonry at the NE corner of the escarpment.

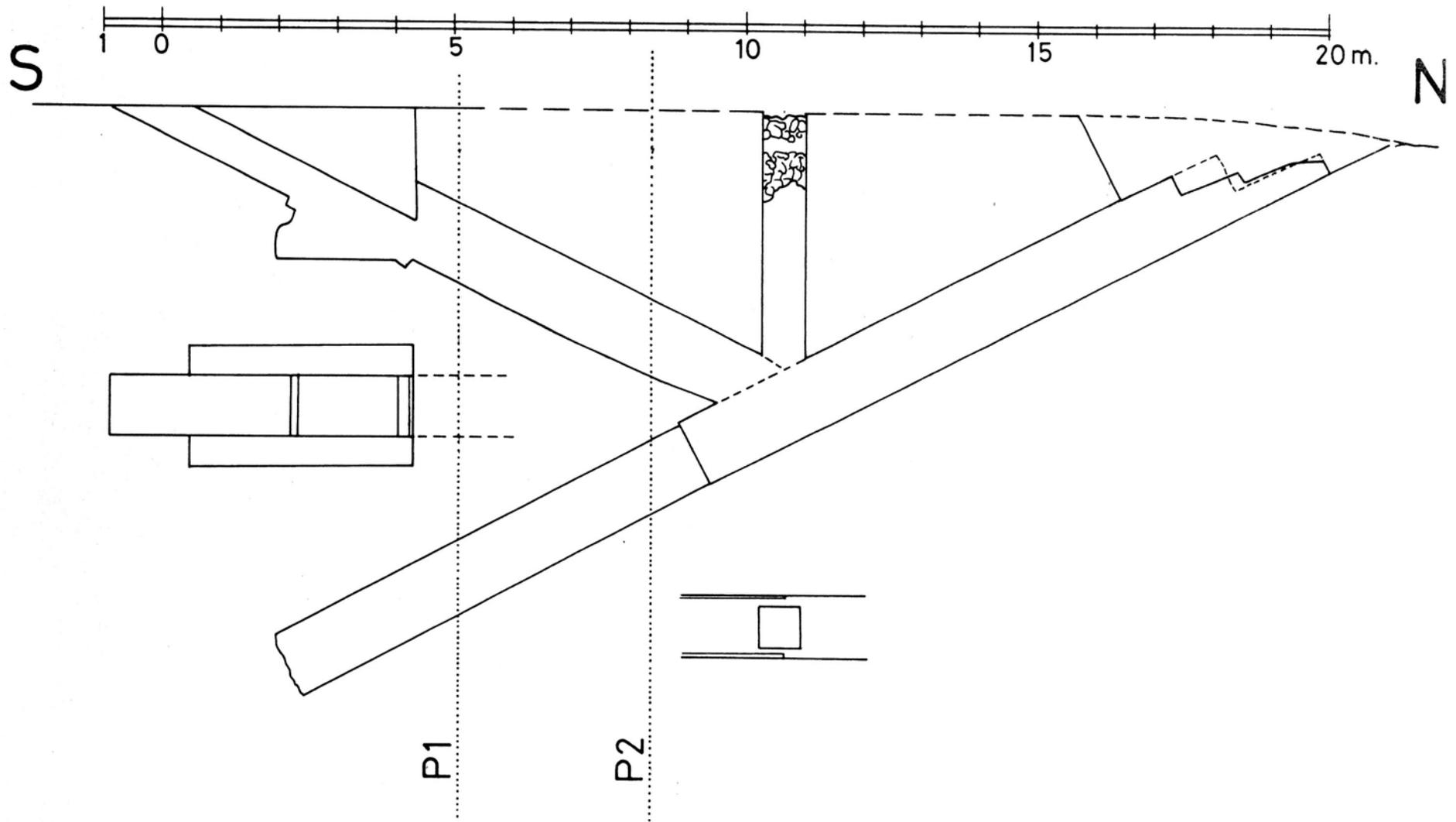


Fig. 10. Replica or "trial passages" with alignments to Pits 1 and 2 in the "service shaft" of the Great Pyramid. Section (after Petrie 1883, Pl. II).

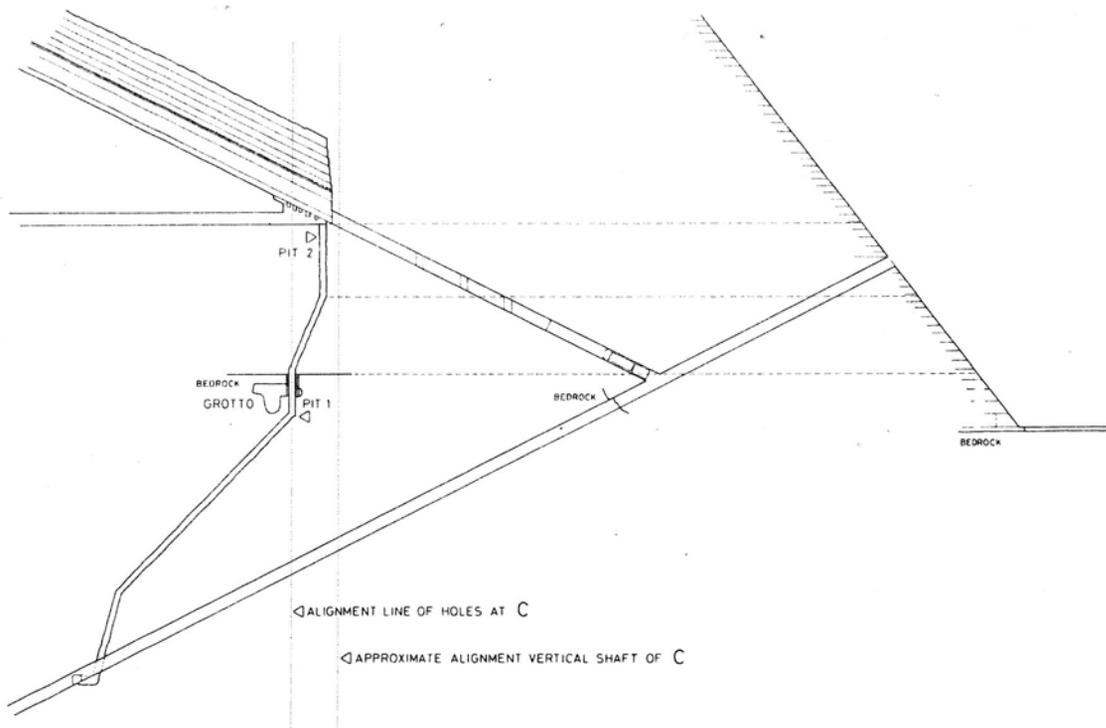


Fig. 11. Great Pyramid passages up to the juncture of the ascending passage with the horizontal passage, the Grand Gallery, and the "service shaft." Section (after Maragioglio and Rinaldi 1965, Tv. 3: Fig. 1).

sages in the Great Pyramid (Fig. 11). The features to which they correspond in the Pyramid are the descending passage, the ascending passage, and the beginning of the Grand Gallery, represented by the corridor which opens to the surface at the south end of the replica passages. Details including the ramps at the sides of the Grand Gallery and the narrowing of the lower end of the ascending passage (for the plug blocks) are reflected here. The "trial passages" have a cutting at the beginning of the "Grand Gallery" which corresponds to the beginning of the horizontal passage in the Great Pyramid leading to the so-called Queen's Chamber. The vertical shaft in the replica passages appears to correspond to the "service shaft" in the Pyramid, although in the model it is located differently with respect to the other passages. However, it has about the same cross-section dimensions as the Pyramid service shaft (71–72 cms.) where the latter descends from the Grand Gallery's lower west wall, and again where it is cut vertically, and lined with masonry, into the bedrock at the "Grotto" (Fig. 11, Pit 1 and 2). The correspondence between the slope angles of the replica passages and their heights and widths with the same values in the Pyramid is striking. The accuracy and care reflected in the execution of the model is just barely surpassed in the Pyramid, as Petrie's (1883, 15–16) table of the mean values and deviations for both reveals.

To the west of the replica passages there is a long and narrow trench cut in the rock surface, 5.7 ms. from the west edge of the southern ("Grand Gallery") opening of the passages. It is 7.40 ms. in length, an average of 70–71 cms. in width, 27 cms. deep at the north end and 44 cms. deep at the south end ("D" in Figs. 9, 21, 23, compare Maragioglio and Rinaldi 1965, 70–1: 7.35 ms. length, 71 cms. average width, 15 cms. deep at the north end, 43 cms. deep at the south end). The trench looks to be as carefully oriented north-south as the

replica passages which lie parallel to it. It is well cut at the south end, while at the north end the edges give way to rough and crumbly rock. Even at first glance, the trench appears to belong to the replica passages in some way. It should be noted that its width is almost exactly equal to the width of the vertical shaft in the replica passages.

A series of four small holes describes a line from 2.5 ms. west of the north end of the trench, D, to about 10 ms. east of the "Grand Gallery" (Fig. 9). These are not evenly spaced, the distances between them from west to east being 6.27 ms., 3.32 ms., 3.43 ms., and 7.90 ms. There appear to be many more such small holes and other cuttings in the rock surface from the replica passages to the south and to the west as far as the foundation cutting for the mortuary temple. Much cleaning would have to be done in order to properly and exhaustively study this evidence. The replica passages themselves cannot be studied today, as for several years they have been used as an incinerator for burning trash and recently they have been entirely filled up.

It is rather curious that there should be a model of the passages in the Great Pyramid. It brings to mind the story on the Westcar Papyrus wherein the magician brought before Khufu "knew the number of the secret chambers of the sanctuary of Thoth" (Gardiner 1925, 2–3). The story relates that the king "had spent much time in searching for the secret chambers of the sanctuary of Thoth in order to make the like thereof for his horizon" (Ibid.), i.e. his pyramid tomb. In commenting on this passage, Gardiner observed:

And indeed, what ambition could have fired Cheops more than to possess in his own pyramid a replica of the mysterious chambers in the hoary sanctuary of the god of wisdom? The temple of the Great Pyramid is utterly destroyed, but the inner chambers of the pyramid itself remain a marvel down to the present day (Ibid.).

Maragioglio and Rinaldi (1965, 154–55) cite this legend as one of many indications which they marshal to refute the commonly accepted idea that the main chambers of the Great Pyramid — Subterranean Chamber, "Queen's Chamber," and "King's Chamber" — correspond to two changes in plan for the burial chamber of the king (first developed by Borchartd 1932). The legend seems to indicate a search for a preconceived plan which may have included these major elements.

If the replica passages are, in fact, a kind of trial run for those in Khufu's pyramid, it would mean they were fashioned before those in the Pyramid. This would necessitate the conclusion that the elements which the replica exhibits were all part of a preconceived plan in hand before the initiation of their likeness in the Great Pyramid. The model includes the descending passage which implies the intention to cut the subterranean chamber, the ascending passage and the beginning of the horizontal passage to the Queen's Chamber, indicating that this chamber would also have been planned, and the beginning of the Grand Gallery. Lauer (1971, 133–41) has argued that the Grand Gallery was constructed as part of the second, "Queen's Chamber," phase in order to store the granite plugging blocks before the King's Chamber had been conceived. If this were true, it could not be argued on the basis of the "Grand Gallery" in the replica passages that the third chamber had been conceived when they were cut.

The model passages are important for the theory of three building phases in the Great Pyramid if the replica was built before the Pyramid. If, however, it was cut after, or during the construction of the passages in the Pyramid, this would not refute the arguments against three building phases, but it would withdraw the replica passages from this specific issue. It would also mean that these are not exclusively "trial passages" but had some other function. One of the functions which must be considered is that they were intended as the substructure for a pyramid that was not built, as was first suggested by Perring.

Maragioglio and Rinaldi (1965, 170–71), agreeing with Petrie that the model was executed as a trial for the passages in the Great Pyramid, declare that the model was "excavated by

the architects to define plastically and practically the characteristic points of the internal passages of the pyramid." But while the replica passages are entirely cut into bedrock, most of the points to which they correspond in the pyramid are entirely fashioned from masonry – plastically and practically quite a different situation.

The indications that a superstructure, presumably a pyramid, had once been planned for the replica passages are:

1. According to Perring (Vyse 1840–42, II, 130n.), flaws in the sides of the passages have been made good with plaster, which would not have been necessary if these were only a practice model for their counterparts in the Pyramid.

2. The lower part of the 'ascending passage' narrows as though it was meant to retain plugging blocks, like its counterpart in the Pyramid. Plugging would only have been required if there was to have been an interment of some kind in the upper chamber implied by the 'ascending passage' and 'Grand Gallery.' This, in turn, implies a superstructure.

3. The opening of the north end of the passage is cut in steps (Petrie 1883, Pl. II; Fig. 10 here), as though to receive masonry for carrying the passage up through a superstructure.

4. The trench, D, as will be discussed, appears to mark the N-S axis of a pyramid superstructure off-set from the axis of the passages, like the N-S axis of the Great Pyramid.

B. Points Surveyed.

As some of the observations which follow depend upon the accurately established positions of features at the north end of the Eastern Field, it is pertinent to explain what preliminary surveying has been done for this study and how Fig. 9 was prepared.

During the 1981–82 season of the ARCE Sphinx Project, the survey grid within the Sphinx precinct was expanded with control points as far as the east side of the Great Pyramid and the SE corner of the Second Pyramid. Other points were established for geological mapping of the plateau. One of these was placed immediately at the north end of the rock-cut trench, D (Fig. 9, 21, 23, 24), in the north end of the Eastern Field.

From this point the locations of several features shown in Fig. 9 were established including: the north and south end of the unfinished pyramid cutting, G1-x (A); tomb shaft G7000x (B); the NE and NW corners of G1-a as indicated by the foundation trench; the axis of G1-a's entrance corridor where it emerges from the core masonry; the NE and SE corners of the Khufu mortuary temple as indicated by cuttings in the rock surface; the east and west ends, and the axis, of the boat pit paralleled to the causeway of the Great Pyramid; the opening of the south end, and the vertical shaft, of the "trial passage" (C); the north and south ends of the rock-cut trench (D); and three points on the block of masonry at the NE plateau escarpment (E) to fix its position and orientation. These points were each established by an angle and a distance measurement from the single survey station. The instrument used was a Kern DKM 2-A theodolite with a Kern DM 501 Distance Meter.

The surveyed features were plotted at scale 1:1000 and Fig. 9 was completed on the basis of Reisner's plan of the Eastern Field (as published in Simpson 1978, Fig. 3 where the plan is reproduced at 1:1000). Fig. 9 differs somewhat from Reisner's plan in the relative positions of the main features for the reason that our surveyed points could not be brought into perfect agreement with this plan. For example, a major discrepancy occurs between points west and east of the center axis of G1-a. The points surveyed west of the N-S axis of G1-a can all be brought into agreement with the same points in Reisner's plan, but then the points east of this axis are off with respect to the same points in Reisner's plan, and vice

versa. This appears to reflect, in part, ambiguities about the size and position of GI-a. Reisner gives the size of GI-a as 49.5 ms. sq. (1942, 71). Measuring off his map at 1:1000 the length of the north side is slightly more than 48 ms. Maragioglio and Rinaldi (1965, 78–80) point out that the foundation of this pyramid (like those of GI-b and GI-c) is not level but accommodates the slope of the surface from NW to SE, which results in the ground plan of the pyramid not being a true square. According to their measurements, a horizontal plane passing through the NW corner would produce a square of 47 ms. to a side (90 cubits). According to our survey of the NW and NE corners of this pyramid, as indicated by the foundation trench, the north side is 46 ms. and this was confirmed by tape measure on site. Reisner gives 61 ms. for the distance “from the back of GI-a to the front of GI” (1942, 71) and this is repeated by Maragioglio and Rinaldi (1965, 76–7). However, measuring off Reisner’s map, this distance should be closer to 56 ms. (slightly more than 100 cubits). The ARCE Sphinx Project surveying to fix the SE, NE, and NW corners of the Great Pyramid was run several times. The distance between GI and GI-a in our plotting agrees with that measured off of Reisner’s map. A very rough tape measure of this distance on-site gave the value 56.20 ms.

This illustrates some of the difficulties faced when working from our surveying and Reisner’s map. As I was unable to do an exhaustive survey of the area in question, I fixed only those points most pertinent to the relationships discussed in this study (listed above). The remainder of Fig. 9 was produced by shifting Reisner’s map to make the best agreement in the main areas of the plan, keeping to the points surveyed by the Sphinx Project. The base and internal passages of GI-a were plotted on the basis of Maragioglio and Rinaldi (1965, Tvs. 11, 12). The remaining two queen’s pyramids and the mastabas shown are plotted from Reisner’s plan by bringing the north and east sides of GI-a in his map into agreement with the plotting from our survey and that of Maragioglio and Rinaldi. This makes GI-b and GI-c slightly skewed with respect to the main Pyramid in Fig. 9. More surveying is necessary to determine the extent to which this is true. The outline of the Great Pyramid was produced by our survey of the SE, NE, and NW corners and on the basis of the 1925 Cole Survey. The internal passages and chambers of the Pyramid were plotted from the sheets of Maragioglio and Rinaldi (1965, Tvs. 2–8).

The relationships between the internal features of the Pyramid and the features on the plateau to the east were drawn from the resulting 1:1000 map. This is, of course, less than satisfactory but might point the way to more thorough surveying concerning some of the questions raised.

C. Relationships Between the Great Pyramid and the North Precinct of the Eastern Cemetery.

In the north precinct of the Eastern Field there were begun two pyramid substructures which lack any superstructure — GI-x and the replica passages. The following relations were obtained from plotting these and other features in the area (see Fig. 9):

1. The axis of the trench D, aligns with the west side of the entrance passage of the first queen’s pyramid, GI-a. This projected line, between D and the GI-a entrance passage (Fig. 24), strikes a perpendicular with the projected E-W axis, or the orientation of the Great Pyramid.

2. The axes of the three queens’ pyramids, therefore, nearly align with the west side of the trench, D. The exact axes of these pyramids are hard to determine because their bases are not true squares. Also, as mentioned, the orientation of GI-b and GI-c may be slightly

off in Fig. 9. However, even given the limitations of this plotting, the alignments rendered could not be so far off as to nullify the relationship between the N-S axes of these pyramids and the trench, D. With GI-a the alignment to trench D is closer to the passage which is offset a little under 2 ms. from the pyramid axis. According to Maragioglio and Rinaldi's plan of all three queens' pyramids (1965, Tv. 11, Fig. 2), the center of GI-b is about 1.6 ms. west of the trench D – GI-a alignment, while the passage of GI-b is 4.2 to 5.2 ms. west of this alignment. The west side of the GI-c passage aligns with the center of this pyramid, which is about 3.2 ms. west of our alignment (Trench D and west side GI-a passage). It should be noted that GI-c is about 3.65 ms. less in width than the other two pyramids, with its east face lying westwards by this amount from the east sides of GI-a and GI-b. The N-S alignments of these pyramids with respect to each other, and with respect to trench D is an ideal that was approximated. As the small pyramids lack the accuracy of levelling and orientation found in the Great Pyramid, this may account for the deviations from the ideal.

3. The distance between the axis of the trench, D, and the axis of the replica passages, C, is 7.055 ms. The distance between the N-S axis of the Great Pyramid and the axis of its passages is 7.269 to 7.31 ms. (Petrie 1883, 17: 287.0 plus or minus .8 in.). This is nearly matched in the distance from the axis of the replica passages to the west side of D: 7.40 ms. As C replicates the passages in the Great Pyramid, the relationship between C and D appears to reflect that between the axis of the Pyramid passages and its N-S axis.

4. The E-W alignment of the four holes, which crosses D and passes about 75 cms. north of the replica 'Grand Gallery,' aligns with Pit I, at the bedrock surface, in the service shaft of the Great Pyramid (see figs. 9, II). This alignment is parallel to the E-W orientation of the Great Pyramid.

5. The vertical shaft at C nearly aligns with the beginning of the Grand Gallery in the Pyramid, being about 80 cms. north of the gallery. This puts the C shaft about 1.75 ms. north of an alignment with Pit 2 of the service shaft in the Pyramid which opens in the lower west wall of the Grand Gallery (Fig. 11). The Grand Gallery in the Pyramid thus begins about 5.45 ms. (a little over 10 cubits) further north than the replica 'Grand Gallery' at C.

6. Therefore, the shaft at C, cut in the bedrock surface, nearly aligns with the beginning of the Grand Gallery in the Pyramid, while Pit 1 in the Pyramid, also cut in the bedrock surface, nearly aligns with the beginning of the replica 'Grand Gallery' at C. Within the limitations of the plotting, the former alignment looks to be off by about 80 cms. (pit C north of the Grand Gallery) and the latter is off by about 75 cms. (Pit 1 north of the 'Grand Gallery').

7. The axis of the King's Chamber in the Great Pyramid, extended to the east down onto the rock surface, aligns with the tomb shaft of Hetep-heres I. This line also corresponds, almost exactly, to the north boundary of the Eastern Cemetery as laid out during the reign of Khufu.

The relationships described between the Great Pyramid and the replica passages in 2 through 6 above are illustrated by Fig. 12 where the plan of the Great Pyramid has been laid over the replica passages while keeping the orientation of the Pyramid. At the scale 1:1000, with which Figs. 9 and 12 were plotted, the difference of about 10 cms. in the distances between the axis of the Pyramid and its passages, on one hand, and between the west side of trench D and the axis of the replica passages on the other hand, disappears. The alignment of the pyramid axis, transposed over trench D, with the approximate axes of the three queens' pyramids is clear.

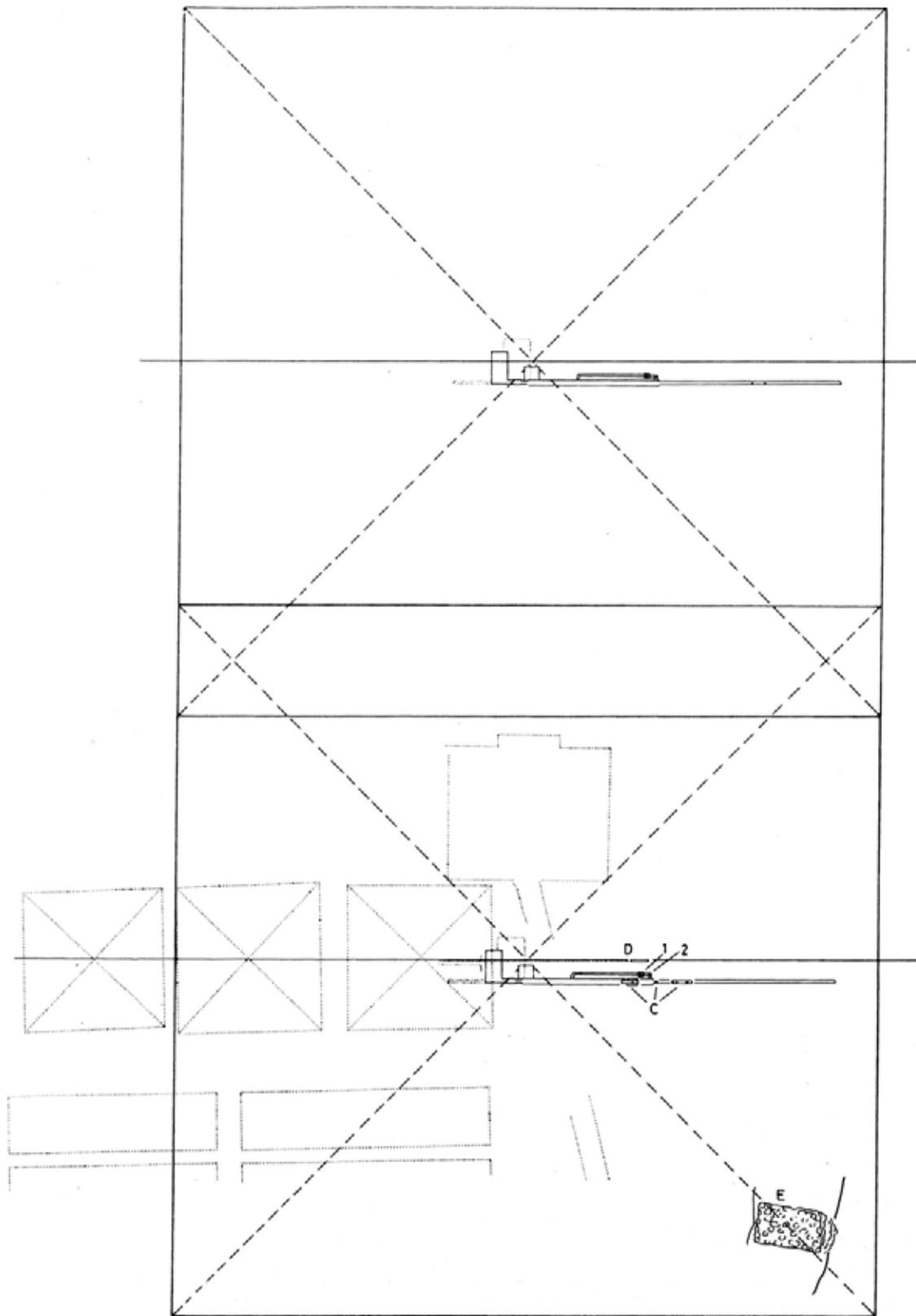


Fig. 12. Plan of the Great Pyramid transposed over the replica passages. North-south axis of the Pyramid is aligned to trench D.

D. Coordination of the Pyramid with its Cemeteries.

How could features of the Great Pyramid's passages, enclosed in masonry high up inside the superstructure, be aligned to features cut into the bedrock some 195 ms. down to the east?

One must remember that when the Pyramid passages and chambers were under construction they would have been open to the sky at the given course of masonry being added to the top of the then truncated pyramid. By extending data lines across top of the course being laid, the builders could have back-sighted to points down on the plateau. However, this would have been done across the tops of supply ramps and/or foothold embankments which probably surrounded the pyramid on all sides. These would not have been a problem for back-sighting down to the surface, at least for the first several courses of the pyramid, according to Clarke and Engelbach. They suggested points on the ground outside the base of the pyramid for controlling the correct slope of the faces and orientation of the corners.

Twist in the pyramid could have been avoided by a very elementary method, namely, by establishing points outside the base of the pyramid in line with both the diagonals and axes, and projecting these lines up the embankments on to the course under construction by sighting poles or plumb lines. Great accuracy is possible by such methods (Clarke and Engelbach, 1930, 125).

The angle of the faces could have been further controlled during the rise of the pyramid and its ramps, according to these authors, by facing surfaces (to which the whole plane of the faces would later be dressed) established in the lowest courses. They diagram two points of facing surface established on each face, near the base and about 12 ms. in from each corner (Ibid., 127, Fig. 136). At the top of any given course under construction, with these eight points plus eight additional points on the ground and on line with the axes and diagonals,

... a square can be established which can be checked by measuring its sides (and sometimes its diagonals) and by ascertaining if it lies on the diagonals of the pyramid which have been projected up on to the course... The accuracy of the square can be further checked by ascertaining, by measurement, if the axes of the pyramid base, when also projected up on to the course... pass through the middle of each side, and thus avoid the possibility of the would-be square becoming a rhombus (Ibid.).

In the 53 years since Clarke and Engelbach wrote, the bases of the two largest Giza pyramids have been almost entirely cleared of debris and sand. In the exposed bedrock floor of the courts of these pyramids, series of holes and other cuttings have been found which form a pattern not dissimilar to Clarke and Engelbach's diagram (Ibid., Fig. 136) of back-sighting and control points for the pyramid construction.

Around the Khafre Pyramid there are two lines of small holes (30–40 cms. diam.) with roughly 10 cubit spacings, parallel to the base of the pyramid on all four sides (Fig. 13). The most distinct of these lines occurs along the line of the outer edge of the enclosure wall, 13.5 ms. from the pyramid base, where the holes occur in staggered pairs. Another line of holes, less regular than the first, occurs along the line of the inner side of the enclosure wall. At the four corners of the pyramid court, spanning the distance between the two lines of holes (and/or the width of the enclosure wall), are 6 m.-long trenches whose ends facing into the court are directly in line with the diagonals of the pyramid.

Although these features were noted by Maragioglio and Rinaldi (1966, 72–4), the possibility that they are the traces of the original survey and layout of the pyramid was missed, except for a brief note by Goyon (1969, 66–7). It appears that the holes describe a great layout square around the pyramid base, both square and base being determined with increasing accuracy over several runs by a method of successive approximation. As the layout

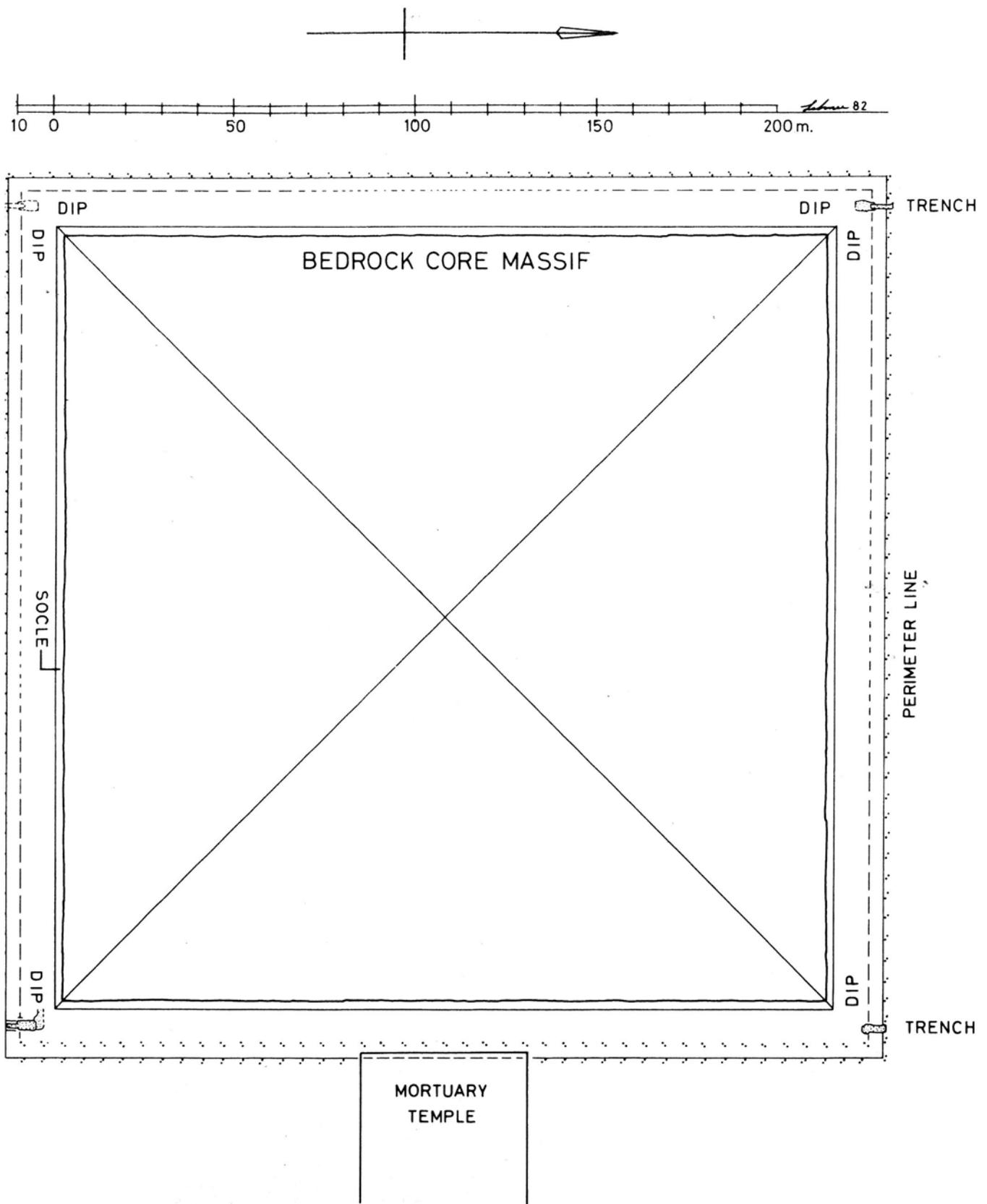


Fig. 13. System of layout lines, holes and trenches at the Second Giza Pyramid. Schematic plan.

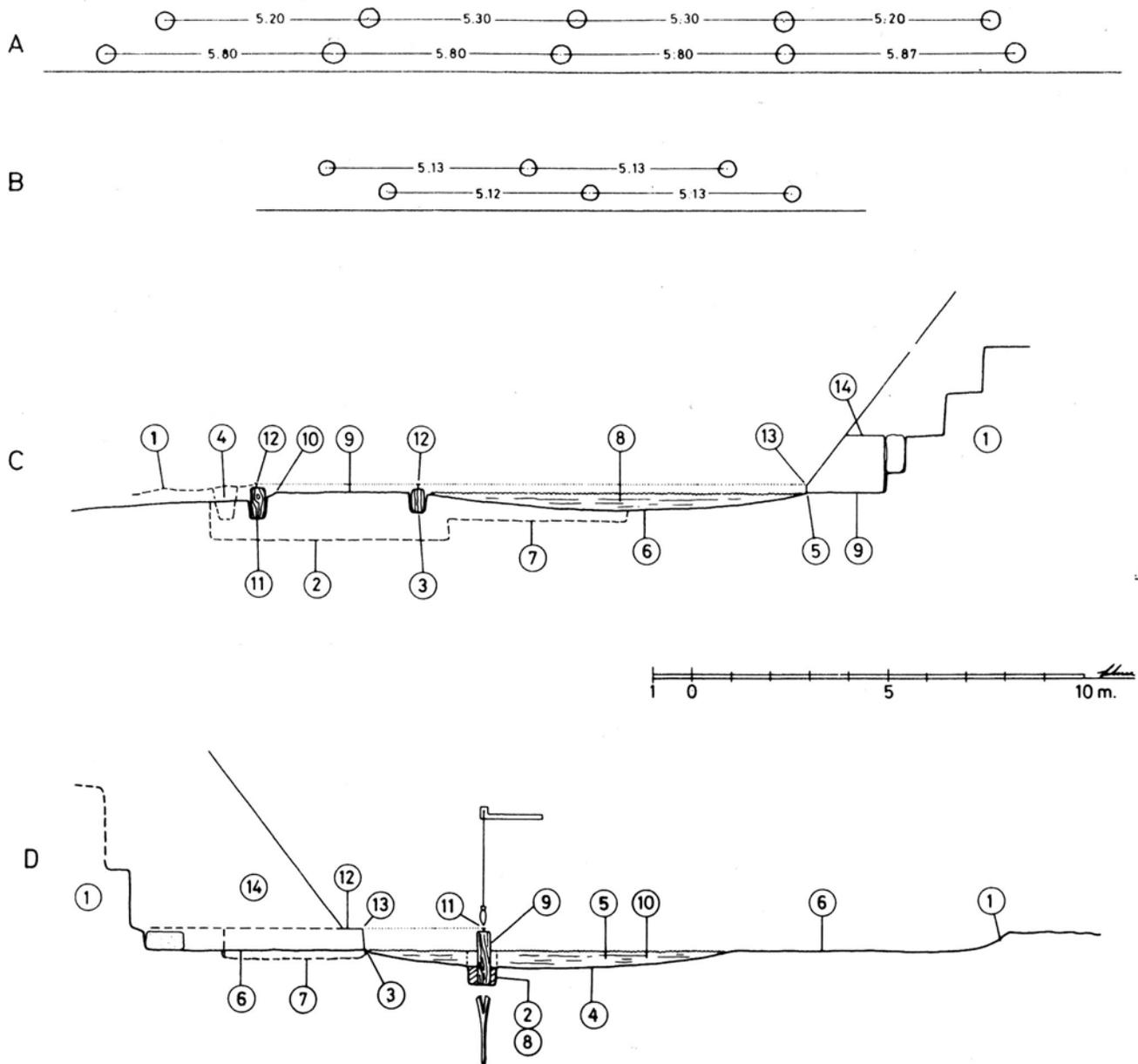


Fig. 14. A: spacing of holes along the perimeter of the court at the south side of the Second Pyramid; B: spacing of holes along the perimeter of the court at the north end of the west side of the Second Pyramid; C: NW corner of the Second Pyramid (looking east) showing the steps in the layout and levelling of the base, profile; D: NE corner of the Great Pyramid (looking west) showing the steps in the layout and levelling of the base, profile.

square was refined, so was the baseline of the pyramid made more accurate by offset measurements (Fig. 14c).

Around the base of the Great Pyramid there is also a square described by a series of holes 3 ms. from the foundation platform and spaced, on the average, at 7 cubit intervals (Fig. 26). Like the holes at the Khafre Pyramid, these may have been fitted with posts in which pins allowed a taut and levelled layout line to be carried around the entire perimeter of the pyramid. From this line the base of the pyramid could be accurately determined on a level plane by means of traditional offset measurements (Figs. 14d, 15). Again these features were noted by Maragioglio and Rinaldi (1965, 66–7) and their function in the pyramid

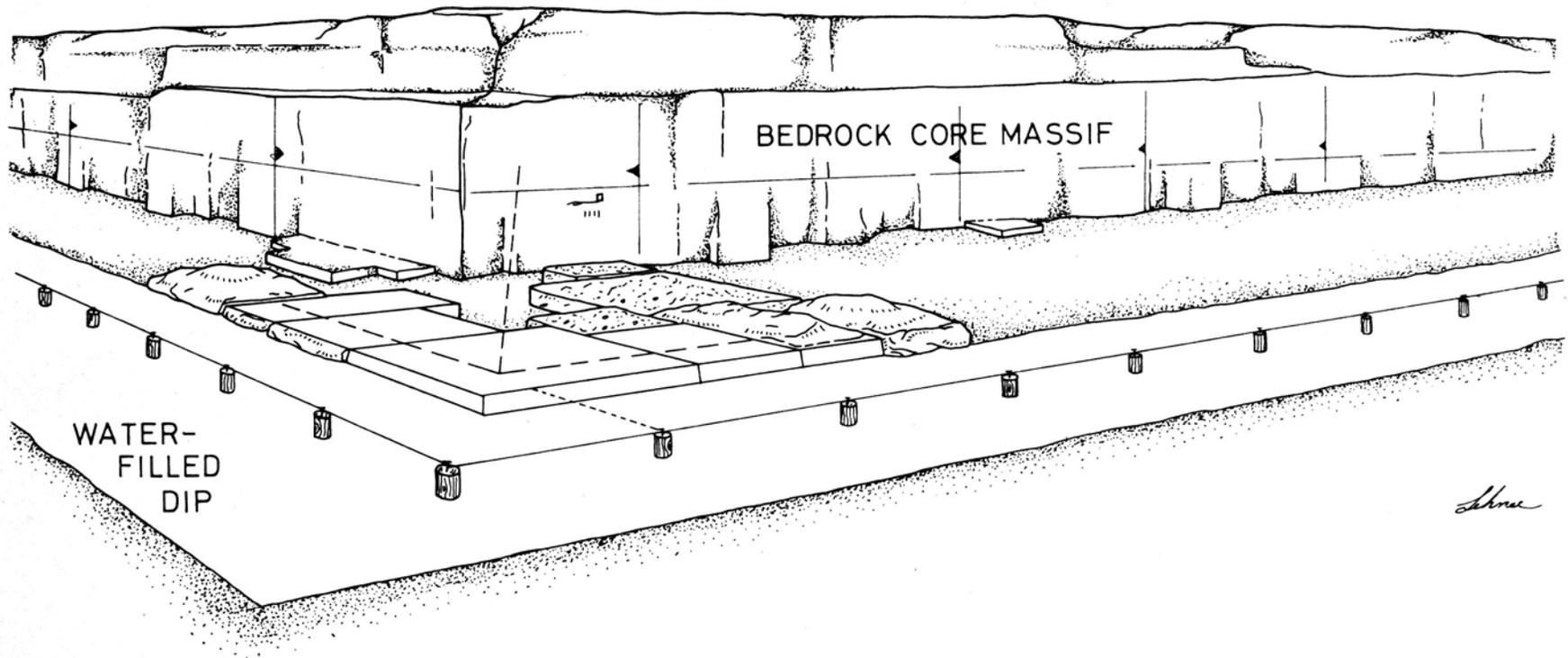


Fig. 15. Great Pyramid layout and levelling operation. Perspective reconstruction.

layout was suggested by Goyon (1969, 71–77). A more complete description, and an attempt to reconstruct the function of these features in the original layout of the Khufu and Khafre pyramids is given elsewhere (see Lehner 1983).

Something like the control points for the sides, axes, and diagonals of the pyramid suggested by Clarke and Englebach may be represented by the layout lines, holes, and diagonal trenches which occur around the bases of the two largest Giza Pyramids. However, these features are not so far from the base of the pyramid as to remain visible for back-sighting for very long as the construction of the pyramid progressed. Rather, after they had served the accurate layout and levelling of the pyramid base, they would have been covered by supply ramps, foothold embankments, and debris from the construction.

Therefore, as the pyramid rose, the layout system could have been transferred up as squares within squares, each square one course higher, by means of plumbing and offset measurements; for each course, the layout square would be plumbed up and brought inward from the previous course. At the base of the pyramid offset measures were taken from the layout square inward to determine the baseline. At the top of each course under construction offset measures would be taken from the reduced layout square outward to determine the desired square, or horizontal cross-section, described by the rise of the four faces. If the builders knew the appropriate size of the square for any given height, this method would insure control of the orientation, the slope of the sides, and the angles of the corners to the summit.

At this point the method diverges from that suggested by Clark and Englebach. They rejected the idea that “the size of the square at the height of the course was calculated, and a square of the calculated dimensions was described on the already established diagonals and axes,” mainly because levelling lines as have been found “show no great pretensions to accuracy” (Clarke and Engelbach 1930, 125). They went on to object that “if the angle of the casing for each of the 200 courses had been separately obtained by plumbing, the observed accuracy would never have been obtained” (Ibid., 126). They suggested as an alternative means of controlling the angle of the faces, plumbing in, at the proportion of 11 to 14, from the facing surfaces established in the undressed casing near the base of the pyramid. This would have necessitated pits sunk into the supply ramps down to the lower points. The ramps and pits would have been brought forward and upward at intervals of fifty-one feet (15.54 ms.) for a total of 10 intervals to establish the pyramid face for its total height during construction (the actual dressing of the face would be done as the ramps were removed).

One might ask how the plumb bob could have been accurately positioned over the point at the bottom of a fifty-one foot pit in the supply ramp. It should also be pointed out that when levelling lines and cubit notations are found, as at the Khafre Pyramid,²¹ on the sides

21 See for levelling lines and cubit notations (a selection): Relieving chambers in the Great Pyramid (Perring 1839–42, I, Pls. V–VII), the funerary boat pit south of the Great Pyramid (Abubakr and Youssef 1971, 6–12, Figs. 3–6), queen’s pyramid G1-a (Maragioglio and Rinaldi 1965, 78–9, 176–7, Tv. 12, Figs. 10–11); the core of the Second Giza Pyramid (Maragioglio and Rinaldi 1966, 46–7, 100); the mortuary temple of Men-kau-Re (Reisner 1931, 76–9, 273, Pls. XI–XII); Step Pyramid complex at Sakkara (Lauer 1938, 554f); Meidum Pyramid (Rowe 1931, 23, Pl. X); mastaba No. 17 at Meidum (Petrie 1892, 12–13, Pl. VIII); Userkaf Sun Temple (Haeny 1969, 27–8, 39–40, Abb. 4–

5); Pyramid of Sahu-Re (Borchardt 1910, 86–92); Pyramid of Ne-user-Re (Borchardt 1907, 153–5, Abb. 129, Bl. 18). At queen’s pyramid G1-a, the levelling lines and cubits notations were found on a small retaining wall which seems to have served as a control for the height, and angle at the corner, of the second step in the core masonry. Reisner found that the vertical distances between cubit lines at the Men-kau-Re mortuary temple varied by as much as 50–54 cms. But these occurred on the crudely fashioned core blocks by which the layout and levelling of the temple walls would have been only approximated.

of core work, one would not expect to find great accuracy. The core is merely the roughing out of the form in the successive approximation of the correct value. The most accurate levelling on the upper courses was probably controlled by temporary lines (in red), on the bedding and rising joints of the fine stone casing, and on its outer face which was later dressed away.²² That the builders controlled the size of the square at any given course under construction may be indicated by the position of the King's chamber within the superstructure at the Great Pyramid. Petrie noted:

The form and size (of the Pyramid) being fixed, the floor of the main chamber of the Pyramid – the King's Chamber – was placed at the level where the vertical section of the pyramid was halved, where the area of the horizontal section was half that of the base, where the diagonal from corner to corner was equal to the length of the base, and where the width of the face was equal to half the diagonal of the base.

The Queen's Chamber was placed at half this height above the base; and exactly in the middle of the pyramid from north to south (Petrie 1983, 93).

Whether or not the size of the square at any given course was calculated, the layout square around the base of the pyramid could have served to coordinate features in the pyramid with the cemeteries outside. Reisner pointed out that for the Khufu cemeteries "the ancient Egyptian masons measured on a fixed baseline (*nfrw*) in which they coordinated the measurements of the mastabas of each group" (Reisner 1942, 56).²³ These cemetery baselines could have been coordinated to the layout square around the base of the Pyramid by perpendiculars surveyed off the layout lines before they were covered by ramps and debris. If, as the pyramid rose, it was desired or useful to have internal features align with points in the cemetery, it could have been roughly achieved by simply back sighting with poles over the ramps and down to those points, as Clarke and Englebach suggested for the diagonals and axes of the Pyramid. If any lines, including those for the diagonals and axes, had been projected and marked on the cemetery floor as well as up to the course under construction, a more precise alignment could be effected by simply measuring equal amounts off a given line at both the top of the course and down on the necropolis floor.

In this way Hetep-heres I's tomb, or the north boundary of the royal cemetery, could have been aligned to the King's Chamber axis, or vice versa. The line of holes which crosses the location of the replica passages (see p. 49 seq.) and aligns with Pit 1 in the Pyramid (Figs. 9, 11) may be a perpendicular surveyed off the original layout square in the pyramid court.

E. Vertical Control Shafts: Replica Passages and Pits 1 and 2.

The principle relationship between the positions of the replica passages and their counterparts in the Pyramid is an approximate alignment between the beginning of the Grand Gallery (GG) in the Pyramid and the model 'Grand Gallery' ('GG'). In both cases the juncture of three passages occurs at this point – that between the GG, the ascending passage (AP)

22 For an example of how the levelling and slope of individual casing blocks could have been controlled, see Haeny (1969, 39–40, Abb. 3).

23 *Nfrw*, when found in builders' graffiti, often in association with levelling lines, may indicate more strictly a reference for vertical measurements, rather than 'foundation' or 'baseline' (Borchardt 1907, 155 n. 2). Reisner seems to use the term for

the associated idea of 'layout line' when he says that the mastabas were coordinated along a fixed baseline (*nfrw*). Cf. Borchardt (1910, 90–1); Petrie (1892, 12–13, Pl. VIII); Reisner (1931, 77 n. 1); Gardiner in Carter (1917, 110 n. 1); Lauer (1938, 555–6, Fig. 75); and Haeny (1969, 42, Abb. 4–5).

and the horizontal passage (HP) to the Queen's Chamber (which has only begun to be indicated in the replica). The actual distance N-S by which the north ends of the GG and 'GG' are off alignment is about 5.46 ms. It is just within this zone of alignment in the Pyramid that the vertical shafts, Pits 1 and 2, occur (Fig. 11). If there is any significance, rather than just coincidence, in more exact relationships between the Pyramid and the replica, it would concern the relationship between the GG, 'GG', Pit 1, and the vertical shaft at the replica (C). To reiterate, the shaft at C is about 80 cms. north of an alignment with the beginning of the GG in the Pyramid, while Pit 1 in the Pyramid is about 75 cms. north of an alignment with the beginning of 'GG' in the replica (Figs. 9, 10, 11). Further, the line of holes which crosses the opening of 'GG' aligns with Pit 1 in the Pyramid.

These relationships must involve the functions of the vertical shafts. Clarke and Engelbach (1930, 125-6) suggested that vertical pits left in the masonry of the pyramid could have served as a control for the height of any given course, but doubt that this was done because no such shafts were known to them. Goyon (1977, 184-5, Fig. 68) suggested that a vertical shaft and plumb line were used to maintain the vertical axis of the Great Pyramid as it was under construction. While no such vertical shaft is known there, a vertical shaft approximately at the center of the pyramid occurs in the Bent Pyramid at Dahshur, just off the south side of the lower chamber (Fakhry 1959, I, 47, Figs. 16, 33-4, 36). Maragioglio and Rinaldi (1964, 64-7, 102-5, Tv. 9: Fig. 3, Tv. 11: Figs. 1-2, Tv. 12: Fig. 2) give a more detailed description of this feature and comment that the shaft is shifted slightly to the north of the pyramid vertical axis. The shaft is built up into the core masonry and also descends into the bedrock base where the end of it has not been reached in excavations to date. There may be more vertical shafts in the pyramids that were blocked up and concealed during the construction.²⁴

In the replica passages (C) the vertical shaft is located on the axis of the passages at an intermediate point between the north and south openings from the bedrock (Fig. 10). Once the N-S axis of the passages had been established on the surface and the locations of the north ('descending passage') and south ('Grand Gallery') openings determined, the vertical shaft could have been cut and dressed straight with reference to a plumb line. The plumb line could then have served as a control for the subsurface alignment and the juncture of the descending and ascending passages.

Pits 1 and 2 in the Great Pyramid do not occur on the vertical axis of the pyramid and are offset from the axis of the passages by about 2.2 ms. This puts them around 5.07 ms. east of the N-S horizontal axis of the Pyramid. It appears as though Pits 1 and 2 were built in opposite directions. (Fig. II).

Pit I must have been dug from the top down when the massif of bedrock which was left in the core of the Pyramid was free of masonry. The surface of the bedrock here is about 7 ms. higher than the base of the Pyramid. From the top of the massif, pit I was cut for a depth of 4.40 ms. (Maragioglio and Rinaldi 1965, Tv. 3: Fig. I, Tv. 5: Fig. I) at a natural ferruginous pocket in the bedrock which was filled with cobbles. This pocket required that the shaft be lined with masonry; the pocket was later hollowed out to form the so-called "grotto."²⁵ The first course of masonry laid over the top of the bedrock massif had the shaft built in (Ibid.), giving it a total depth of 5.20 ms.

24 The small vertical shafts in the Bent Pyramid's western passage and off the lower chamber were only found when Hussein lifted *in situ* limestone slabs or flooring (Fakhry 1959, I, 52 n. 1).

25 A similar natural ferruginous deposit filled with cobbles, perhaps part of the same vein as that

into which the "Grotto" has been formed, can be seen at the bedrock escarpment just below the modern road to the north of the Pyramid in the great pit dug into the construction debris by Petrie (1883, 85).

Pit 2 was built from the bottom up, starting in the core masonry some 7–8 ms. above the top of Pit 1. According to Maragioglio and Rinaldi (1965, 56, Tv. 5: Fig. 1) “the vertical part of this shaft is made with limestone blocks and its sides are quite flat and regular: therefore, it was built and not hewn into the already existing masonry.” This shaft was built up to the juncture of the ascending passage (AP) with the horizontal passage (HP) and the Grand Gallery (GG). Access to Pit 2 is gained in an opening in the ramp at the lower west wall of GG, 55 cms. from its north wall. This opens to a shallow pit which, at a depth equal to 66 cms. below the floor of the GG, leads to a passage running west for 88 cms. to the edge of Pit 2. The shaft descends vertically for a depth of 7.96 ms. with straight sides and a width of 71 cms. — practically the same width as the vertical shaft at the replica passages (Ibid., 54–7).

The communication between the bottom of Pit 2 and the top of Pit 1 is a very rough hewn passage chopped through the already laid core masonry which intervenes (Ibid., 56; Petrie 1883, 87). This suggests that Pits 1 and 2 were not originally built as part of the continuous “service shaft” that connects the two pits and leads all the way down to the lower part of the descending passage. Yet this must have been done soon after the construction of the two shafts as those who forced the communication between them seemed to know their exact positions with respect to each other as well as their offset from the passages.²⁶

Having been built separately, what was the original purpose of Pits 1 and 2? Just as the C-shaft leads to the juncture of the replica descending and ascending passage, it is to be noted that Pit 2 connects with the juncture of AP, HP, and GG. These shafts may have served as a vertical control for the establishment of junctures between passages. The shaft offered a place for a plumb line and a determination of height — a datum which rose course by course with the pyramid body. The AP also gradually rose with, or, being built as a separate structural entity, slightly ahead of, the pyramid body. Since unlike the C-shaft, Pit 2 is not aligned on the axis of the passages, the datum would have to be referred to by a planned offset to the desired juncture. The point at which the planned juncture would be built was where AP met Pit 2, offset from the planned passage axis. The juncture between AP, HP, and GG would determine the height of HP and the “Queen’s Chamber” in the pyramid body, hence the need for some vertical control in addition to the control offered by simply measuring desired lengths of the slope of the passage system.²⁷

The fact that Pits 1 and 2 are on the same north-south plane, yet are shifted about 3.5 ms. with respect to each other, may indicate that Pit 1 was initially set to mark the juncture

26 The forced “service shaft” in the Great Pyramid is comparable to the irregular winding passage in the Bent Pyramid which connects the top of the lower chamber with the horizontal corridor leading to the upper chamber. In both cases, the passage looks to have been an afterthought, forced through already laid masonry, by those who knew the relative positions of the connected features. Maragioglio and Rinaldi (1965, 184–7), citing the difficulties faced by modern researchers in the pyramid passages and galleries due to lack of air, suggest that the service shaft in the Great Pyramid was cut to allow the circulation of air down to the lower part of the descending passage and the unfinished subterranean chamber. The forced passage in the Bent Pyramid might have been cut for the same purpose, in this case to

allow the flow of air from the already built north entrance and lower chamber to the western passage and upper chamber. This would have been necessitated if work in the upper chamber continued after it had been sealed off by the core masonry of the pyramid.

27 Left unanswered here is the question of how the datum for the height could have been transferred from Pit 1 to Pit 2 through the intervening masonry. We could speculate that there were more control shafts built into the core as the pyramid rose. These could have served for transferring datum heights. Pits 1 and 2 maybe the only such shafts known because they were later connected as part of the “service shaft” which was used for air or an escape route by those who closed the pyramid’s ascending passage.

AP-HP-GG by being built up into the core masonry. According to Petrie's (1883, Pl. V) section of the Pyramid passages, the bottom of Pit 1 is at the same absolute level as the baseline (top of the foundation pavement) of the Pyramid. Maragioglio and Rinaldi (1965, 12–13) state that the surface of the bedrock at the top of Pit 1 is about 7 ms. above the baseline of the Pyramid, yet their detail section of the shaft (Tv. 5: Fig. 1) shows the bedrock surface to be only about 5.65 ms. above the Pyramid baseline as determined by Petrie. This leaves the bottom of Pit 1 about 1.25 ms. above the Pyramid baseline. Pit 1 may have been cut in the bedrock initially to establish a vertical control from what the builders thought was the zero level (nfrw) of the Pyramid. Had it been continued up into the core, it could have served as an approximate measure for the height of chambers and passages above the Pyramid baseline. More surveying might better determine the degree to which the bottom of the pit is off the base level of the Pyramid.

Early on, it seems that there was a decision to shift the point where AP, HP and GG would meet, and Pit 2 was begun to determine the new point of juncture. The change in plan may have come about the time that the lower juncture between the descending passage and AP had been established. This lower juncture is at about the same absolute level as the top of the bedrock in Pit 1 (Fig. 11), and therefore may have been fashioned about the same time as the decision was made to abandon Pit 1 during the construction of the pyramid. Why do 7–8 ms. of core masonry intervene between the time Pit 1 was abandoned as a control shaft and the beginning of Pit 2? During this time, the lower to middle part of AP was under construction. It may be that the builders had yet to finalize calculations as to the exact beginning of HP and GG. This may have been decided about the time the descending passage was completed all the way out to the exterior face of the Pyramid. The vertical extent of Pit 2 projected across the pyramid body takes in the entrance to the descending passage, which was therefore probably masonry-built into the outer face of the Pyramid at about the same time.

Need this imply that the DP, and therefore the subterranean chamber, were planned at the same time as the AP, and therefore the HP and the „Queen's Chamber?" Not if the entire bedrock part of the DP and the subterranean chamber had been executed prior to the location of Pit 1 to mark the eventual juncture AP-HP-GG, which would, therefore, have been prior to any masonry being laid over the massif of bedrock in the core of the pyramid. Accepting Lauer's (1971, 133–41) argument, all three of these upper passages were part of the second phase plan for the burial chamber.²⁸

If DP and AP were planned together, then the first cuttings in the top of the isolated bedrock core massif of the Pyramid were the mouth of DP and the opening of Pit 1 (Fig. 11). The positions of these openings might have been established with the aid of back-sights on perpendiculars run off the layout lines around the levelled perimeter of the Pyramid. By the same means, the position of Pit 1, i.e. the originally intended N-S position of the AP-HP-GG juncture higher in the pyramid body, could also have been linked to the site of the replica passages.

28 Pits 1 and 2 appear to have been joined up by the forced passage after both had been separately built. Pit 2 leads up to the beginning of the Grand Gallery. If they had been joined up as part of the forced "service shaft" to provide air for the lower part of the descending passage and subterranean chamber it would imply that work was still in progress on that chamber at the time the Grand Gallery and the horizontal passage to the "Queen's

Chamber" had been started. This would argue against the idea that the subterranean chamber was the original tomb for the king, abandoned when work started on the ascending passage and upper chambers. The unfinished condition of the subterranean chamber, accepting the hypothesis that the service shaft was for conducting air down to it, would indicate that it was the last of the chambers to be under construction.

The layout and construction sequence of the Pyramid and replica passages can be summarized as follows.

1. The bedrock core massif of the Pyramid was isolated. The perimeter layout lines were established.
2. Points were set at the surface of the core massif for the Pyramid center axis, the passage axis, and the beginning of DP.

Pit 1 was located about 2.22 ms. west of the passage axis as an offset control for the north-south position of the AP-HP-GG juncture higher in the Pyramid body, perhaps some 75–80 cms. south of the pit itself. Pit 1 was cut down into the bedrock to a depth nearly equal to the baseline of the Pyramid, perhaps to establish an internal zero reference.

3. An alignment with Pit 1 was sighted down to the location of the replica, C, on a perpendicular to the east layout line of the Pyramid. It was intended to cut the beginning of 'GG' 75–80 cms. south of this line, which would bring it into alignment with GG in the Pyramid.
4. The outside of the Pyramid's core massif was lined with masonry and cased to make a truncated pyramid covered with construction ramps.

The juncture of DP-AP was established.

Pit 1 was built into the first course of masonry laid over the top of the core massif.

5. As AP was built up into the Pyramid, calculations made for a change in the planned juncture of AP-HP-GG. It was to be moved slightly to the north, hence a bit lower given the already established angle of AP.
6. 7–8 ms. of core masonry were built over the top of Pit 1 closing it off.
7. As new control shaft, Pit 2, began to be built into the core masonry at the same offset, 2.22 ms., from the axis of the passage.

Pit 2 and AP were built upward to meet in the construction of the AP-HP-GG juncture.

8. About the same time, on the layout lines that had been surveyed for the replica passages, a point was measured which would roughly align with the new AP-HP-GG juncture in the Pyramid.

This point was taken as the location of the vertical control shaft of the replica which was midway between the two openings of the substructure from the bedrock. The replica 'GG' still fell close to the E-W alignment originally intended for the GG in the Pyramid.

F. Reconstruction of the Replica Pyramid.

The originally intended size and position of the unbuilt pyramid depend, in part, on the completion of the internal passages and chambers, and the extent to which they would have risen in the superstructure. In the reconstruction of the passages in Figs. 16, 17, 18 it has been assumed that the original intention was to complete the model of the Great Pyramid passages and chambers, given the fact that the ways of access to the three principle chambers are all represented in the model.

In order to complete the model, an attempt was made to find a constant of proportion by which lengths in the Pyramid passages were to have been foreshortened in the replica. The only complete unit length in the replica is the total length of the ascending passage. In the Pyramid this is 39.288 ms. along the floor (Petrie 1883, 21–2: 1546.8 inches) from the upper south end of the passage to the point where it would meet the floor of the descending passage. Petrie does not give an exact value for the same length in the replica, but measuring

off his 1:100 section it is about 7.10 to 7.15 ms. (Ibid., Pl. II). This divided into the length of the Pyramid AP gives 5.533 to 5.49. The lengths of the 'Grand Gallery,' the 'horizontal passage,' and the 'descending passage' have all accordingly been completed by dividing the lengths of the Pyramid GG, HP and DP by 5.533 (the 'DP' in the replica was taken from its juncture with the 'AP').²⁹

As noted, the cross-section dimensions of the replica passages correspond, without reduction, to those of the Pyramid passages to a remarkable degree of accuracy. There was, then, the question of whether to keep the foreshortening while retaining the cross-section dimensions in reconstructing the replica chambers. This would have produced a 'Grand Gallery' at once very short and tall (Fig. 17), which may have been feasible considering the corbelled antechamber to the Dahshur Bent Pyramid's lower chamber. The antechamber is as narrow as the passage (1.08 ms.), only 4.90 ms. long, and 12.60 ms. high (Maragioglio and Rinaldi 1964, 62-3, Tv. 11). However, to foreshorten the widths of the chambers by 5.533 while retaining their height in the Pyramid would have been ridiculous as shown in Fig. 17 where the heights of the chambers in the Pyramid are indicated by a lighter line.

A different scale was needed for the reduction of the chambers. This was taken from a comparison of the Dahshur Bent Pyramid and its satellite pyramid where the width, length, and height of the chamber in the small pyramid was divided into the same dimensions of both of the main chambers in the large pyramid (based on Maragioglio and Rinaldi 1964, 62-3, 78-9, Tv. 10: Fig. 2, Tv. 11: Fig. 1, Tv. 12: Fig. 6, Tv. 16). The resulting six values of proportion ranging from 2.06 to 3.04 were averaged for a scale of 1:2.43. The dimensions of the Great Pyramid chambers, including their heights, were divided by 2.43 to reduce them as shown in the replica.

There were four exceptions to this procedure:

1. The short horizontal passage and antechamber leading to the King's Chamber were reduced by 2.43 since reducing these by 5.533 would have made the construction impossible.

2. The horizontal passage and recess leading to the Subterranean Chamber were reduced by 5.533 up to the recess, and by 2.43 from there to the chamber.

3. The passage to the Queen's Chamber was rendered at a height of 60 cms. To have kept to the actual cross-section dimension of the horizontal passage (Fig. 17, dashed line) would have cut away the lower part of the 'Grand Gallery' floor which, in what is preserved of the replica, is carefully cut to match the drop, or recess, in the GG floor level at this end (Figs. 10, 11). In the start made on the horizontal passage in the replica, it looks as though a height of about 60 cms. was intended.

4. The great step at the top of the 'Grand Gallery' has been reconstructed to its dimensions in the Pyramid. Had this been reduced it would not have properly articulated with the side ramps of the 'Gallery', which are cut in the bedrock part of the replica to the same dimensions as the Gallery ramps in the Pyramid.

This may seem somewhat arbitrary, but it gives some indication of what the builders may have had in mind. The model of the Pyramid passages reconstructed in this way does array the chambers in about the same relative positions as the original. An exception is that the 'Grand Gallery' is slightly south, rather than north, of the vertical axis of the 'Queen's Chamber' which in the Pyramid is on the vertical axis of the Pyramid.

29 The heightened gallery leading up to the chamber in the Dahshur satellite pyramid has a length of 9.20 ms. (Maragioglio and Rinaldi 1964, Tv. 16, Fig. 1) which, divided into the length of the Grand Gallery in Khufu's pyramid (47.84 ms.

Petrie 1883, 24), gives 5.20. This is very near the scale by which the passages of the reconstructed replica pyramid have been reduced from those in the main pyramid.

The north boundary of the Eastern Cemetery serves as a south limit for the size of the unbuilt pyramid, assuming it was planned after the preparations for the queen's pyramid, GI-x. If the satellite pyramid had extended beyond this line, it would have encroached on that queen's pyramid. The reason for the change in plan which moved this queen's pyramid from GI-x to GI-a was the establishment of a new long north-south axis to which all the subsidiary pyramids would be aligned. Perhaps initially it was the desire to have only GI-a align with the N-S axis of the king's satellite pyramid as marked by the trench, D (Figs. 9, 24). The replica pyramid, therefore, would not have encroached upon the area of GI-a.

Lauer (1947, 254) pointed out that those who laid out the main baselines of Khufu's complex worked in round numbers of cubits which are multiples of 10 (20, 50, 80, 100, etc.). They also defined enclosures by juxtapositioning squares of equal sizes in these multiples.

The line which corresponds to the King's Chamber axis, extended perpendicular to the east side of the Pyramid, falls very near the north boundary of the Eastern Cemetery. No tomb was allowed north of this boundary except the replica passages. From this line to the vertical shaft in the center of the rock-cut part of the replica passages there are about 52 ms., or 100 cubits. For the moment, in order to conceptualize what the ancient surveyors may have intended, this is taken as half the length of a layout square, which gives a square of 200 cubits to a side (Fig. 9).³⁰ This is a little less than one quarter the size of the base of the Great Pyramid, which had an intended 440 cubits to a side. The N-S center axis of the square would be the long trench, D, which was set to mark the pyramid axis. Since the layout square has been arrayed from the central shaft of the replica passages, this marks its E-W axis.

This large square could not have served as the baseline for the replica pyramid since it falls too close to pyramid GI-a. The actual base of the pyramid would have been determined within this enclosure by offset measures from the layout square, like those which established the base of the Great Pyramid (see p. 103f). The following points warrant consideration of the idea that a pyramid approaching this size might have been initially intended as the replica superstructure:

1. The distance between the N-S axis of the pyramid, as marked by trench, D, and the axis of the replica passages would be proportional in a pyramid of at least such a size since this is nearly the same distance between the pyramid axis and passage axis of the Great Pyramid which is four times larger.³¹

2. A pyramid of this size might account for the large block of masonry, E, which builds

30 This size is seen in the Third Pyramid at Giza, which had a base length of about 200 cubits (105 ms.) and a height of about 125 cubits (65 to 66 ms.; Lauer 1974, 343-4). Other pyramids with a base length of 200 cubits: Nefer-ir-ka-Re at Abusir, Sen-Usert I at Lisht, Sen-Usert III at Dahshur, and Amenemhet III at Dahshur (Ibid.).

31 This question of proportion in the amount by which passages are offset from the axis of the superstructure in 4th Dynasty pyramids is, perhaps, only relevant when the issue involves two extremes, as here, either a pyramid approaching the size of the queens' pyramids or one four times larger (see pp. 162, 168). At the Second Pyramid, the passage is offset from the N-S axis by 12.45 ms. (Petrie 1883, 34). The entrance to the north

Dahshur pyramid is about 4 ms. east of the center of the north face (Fakhry 1969, 97). The north entrance of the Bent Pyramid is on the center of the north face, while its western entrance is 13.70 ms. south of center (Fakhry 1959, 46, 49, 67). The entrance to the Meidum pyramid is 14.59 ms. east of center (Petrie 1892, 10). The entrance passage of the Third Pyramid at Giza, which has a base length of 200 cubits, is on the N-S axis of the pyramid (Edwards 1961, 160, Fig. 32). This puts the burial chamber considerably to the west of the axis. The entrance passage of the Bent Pyramid's satellite pyramid is on the N.S. axis of the superstructure (Maragioglio and Rinaldi 1964, Tv. 15, Fig. 2).

up the edge of the escarpment near the point at which the NE corner of the pyramid would have fallen (Figs. 9, 21, 25).³²

3. If the layout for the replica pyramid had been started before the change from GI-x to GI-a, there would have been some orderly spatial arrangement with respect to GI-x. The layout square of 200 cubits to a side would have left pyramid GI-x, had that one also been finished, situated at its SE corner. In Fig. 9 it can be seen that the layout square would have run over Hetep-heres's tomb shaft. However, if the builders had measured in from the layout square by 3 ms. offsets for the base of the pyramid, as they did for the layout of the Great Pyramid's foundation platform (Lehner 1983), the edge of the pyramid would have missed the tomb shaft and been appropriately spaced from the edge of GI-x. The east sides of both unbuilt pyramids would have been aligned.

As indicated on Fig. 9, a pyramid laid out from a square of 200 cubits would have covered much of the mortuary temple, the upper causeway, and the boat pits north of the temple and parallel to the causeway. Yet this need not exclude the possibility that early on in the layout of Khufu's mortuary complex this large a subsidiary pyramid was intended here. It could be argued that initially a much smaller mortuary temple and a different route for the causeway were intended.

In the early 4th Dynasty the size of the pyramid superstructure grew to enormous proportions at the expense of the mortuary temple. The elaborate temple at the north side of Zoser's Step Pyramid is represented only by the small offering chapel at the center east base of the Meidum pyramid, and the even smaller shrine initially constructed at the east base of the Dahshur Bent Pyramid.³³ In the reigns of Khufu and Khafre, and culminating in the reign of Men-kau-Re, a certain balance between the size and elaboration of the mortuary temple and the size of the pyramid was achieved. The trend went backward in the 5th and 6th Dynasties when the temple was enlarged and elaborated at the expense of the pyramid

32 This rectangular patch of masonry is composed of locally quarried limestone pieces, laid in at the edge of the escarpment. It extends part of the way down the steep slope to the valley. At the top it measures 14 ms. (E-W) X 24.50 ms. (N-S). Goyon (1969a, 77-9, Fig. 4, Pl. IXa-b; 1977, 231-33, Fig. 90) has suggested this patch of masonry is the remains of a *déversoir à déblais*, a kind of platform or subsidiary causeway which assisted the dumping of construction debris over the edge of the escarpment. However, it appears that debris was dumped over the whole length of the north edge of the escarpment, as Petrie's trenching off to the front of the Pyramid revealed (Petrie 1883, 85). It might be questioned, therefore, why such a *déversoir* had only to be constructed at this point. Although it may not elucidate its function, it is worth pointing out that this construction lies approximately at the far NE end of a great SW-NE alignment of the following features of the Giza Necropolis: the SW-NE diagonal of GIII-a, Men-kau-Re's first subsidiary pyramid; the SE corner of Men-kau-Re's main pyramid; the SE-NW diagonal of the main part of mortuary temple; the SE corner of the Khafre Pyramid; the SW-NE diagonal of the foretemple — that part constructed of monolithic locally quarried limestone blocks — of Khafre's mortuary

temple; the SE corner of Khufu's pyramid; and the SW-NE diagonal of GI-a, the first queen's pyramid in the Eastern field. This alignment is nicely illustrated in Smith and Simpson (1981, 96), an aerial photograph looking toward the SW along this great diagonal. Some of these points align more exactly than others; the SE corner of the Khafre Pyramid falls slightly NW of the diagonal, while GI-a lies slightly SE of the line. The best possible alignment of all the above points appears to run just to the SE corner of the large block of masonry in question. This has been noted in aerial photographs and the preliminary survey of the pyramids for the ARCE Sphinx Project. More exhaustive survey would reveal the accuracy, and deviations, from this alignment which certainly cannot be due to chance alone.

33 The so-called Valley Temple of Sneferu located to the northwest of the Dahshur Bent Pyramid and attached to the pyramid by a causeway (Fakhry 1959, 1961) may have carried some of the functions of the mortuary temple. The current excavations of Stadelmann at the Dahshur North Pyramid (see Stadelmann 1980; 1982b) are very important for determining the relations between the mortuary temple and pyramid superstructure in the development of the pyramid complex.

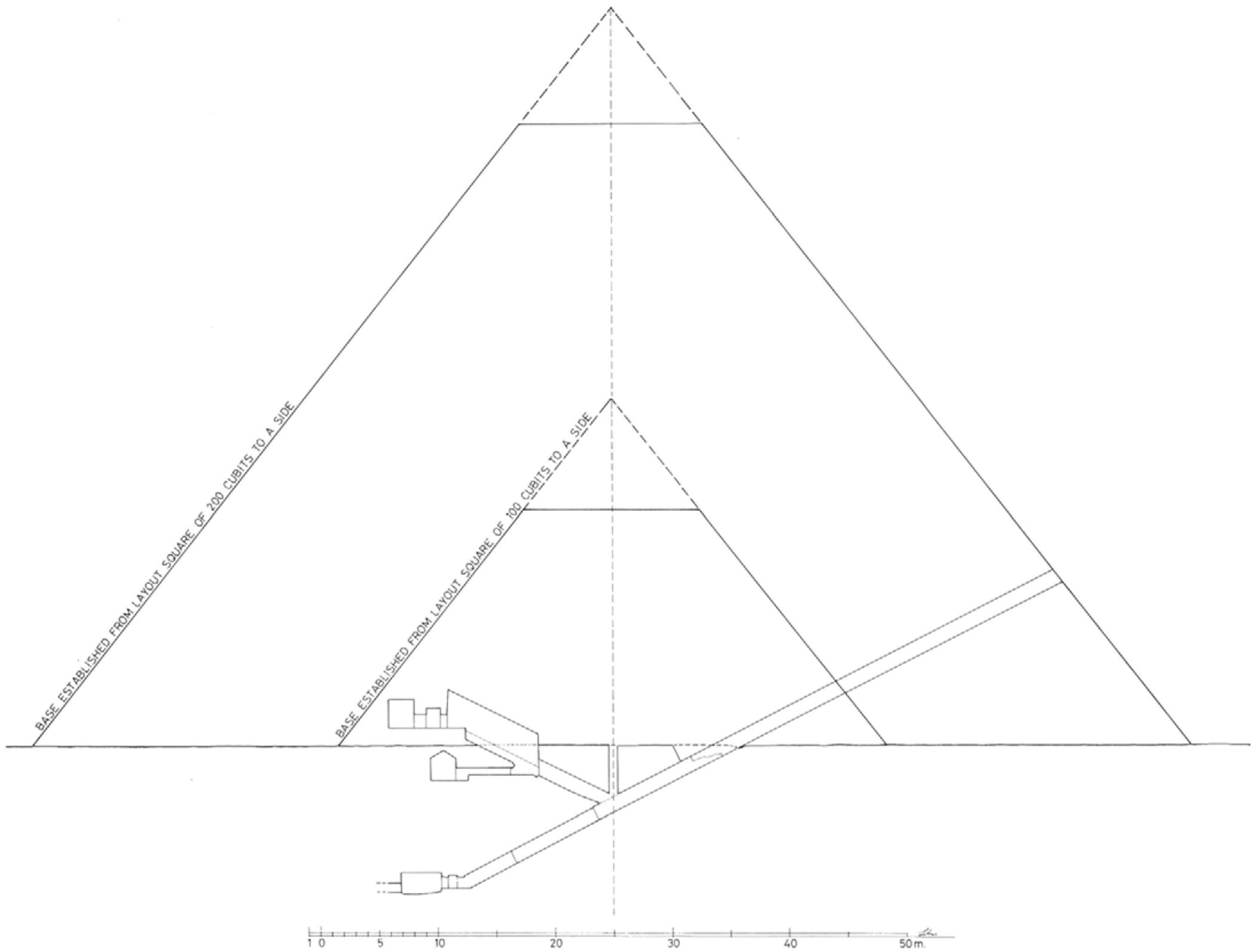


Fig. 16. Khufu satellite pyramid reconstructed with east-west axis of superstructure aligned to vertical shaft. Section.

superstructure (Lauer 1936, I, 6). The pivotal point in the pyramid-temple balance is found in the complex of Khufu. Here the decision for a larger mortuary temple at the east base of the pyramid may have come just when the plan for the large satellite pyramid was abandoned.

The Meidum mortuary temple measures about 9 ms. at the sides and 9.18 ms. along the front (Rowe 1931, 30). The first three building stages of the mortuary temple at the Dahshur Bent Pyramid, which were done in the reign of Sneferu or shortly thereafter, left a chapel approximately 10 ms. (E-W) X 13 ms. (N-S) (Fakhry 1959, 78–81, Figs. 42–44; Ricke in Fakhry 1959, 98–103, Figs. 57–8 and frontispiece). An offering chapel of these size ranges would have easily fitted against the east face of the Great Pyramid if the large replica pyramid had been built.

Just beyond what had been the recessed west wall of the mortuary temple court there exists a roughly rectangular cutting in the rock, about 19.50 ms. long (N-S) X 9.25 ms. wide (E-W) and 60 cms. deep on the average (Maragioglio and Rinaldi 1965, 62–5, Tv. 9; Fig. 1). It lies evenly on the E-W axis of the temple and the Pyramid and extends about 4 ms. beyond the inner side of the enclosure wall (within this cutting, a deeper and narrower irregular shaft was excavated in Saite or Roman times): Lauer (1947, 251; 254–5; cf. 1949, 116–23) understood this as the substructure of the sanctuary or offering room of the temple; the original design of this inner room is open to several possibilities (Ibid.). Could this, at the same time, be the vestiges of an earlier small mortuary chapel comparable in size to those at Meidum and Dahshur?

If a large replica pyramid and, therefore, a small offering chapel had been initially intended for the Great Pyramid complex, the causeway might have been planned to depart from near the NE corner of the pyramid court, as was the case at the Bent Pyramid of Dahshur (Fakhry 1959, 36, Fig. 5). Immediately outside the NE corner of the Pyramid court there is a series of cuttings in the rock floor, the most prominent being a long trench one meter wide and oriented N-NE (Fig. 27). The combined width of the cuttings is about 9.30 ms. The dressed bedding for the actual Pyramid causeway is about 8.20 ms. wide where it passes the NE corner of the pyramid GI-a. It might be argued that the dressings of the NE corner of the Pyramid court are preparations for the causeway of the earlier plan and that the long trench was cut first as a “lead” to establish its orientation. If the causeway had departed from this point and run to the NE, it would have necessitated a massive foundation built on to and extending from the high escarpment. Such a foundation ramp was built anyway for the extension of the causeway at the edge of the plateau, carrying the causeway out over the flood-plain at a NE angle of about 14° (Lauer 1947, 246; cf. Goyon 1969a, 49–63, 67, Pls. v–vii).

At some point after the replica passages had been cut, but before the ritual pyramid had been built, a change in design called for the larger mortuary temple. It should be noted that the layout square of 200 cubits to a side, *when positioned with its N-S axis over trench D and its E-W axis over the vertical shaft of the replica at C*, has its west side on a line to which the two boat pits parallel to the east side of the Pyramid, and the west row of pillars in the mortuary temple court, were positioned (Fig. 9). The east side of the large layout square falls on a line which corresponds to the longitudinal axis of the first row of mastabas (G7010–20, G7030–40) in the Eastern Cemetery. This probably reflects the master layout lines that were run off the layout lines of the Great Pyramid and spaced, as Lauer (1947, 254, Fig. 17) pointed out, in round numbers of cubits. Lines that might have originally been laid for the replica pyramid came to be used for the mortuary temple and the Eastern Cemetery.

A layout square of 100 cubits to a side,³⁴ if positioned like that of 200 cubits with its

34 The satellite pyramid of the Bent Pyramid at Dahshur has a base length of 100 cubits (Lauer 1974, 342–3).

axes over trench D (N-S) and the vertical shaft at C (E-W), would have just about fit into the open area north of the causeway and east of the temple (Fig. 9). Being only slightly larger than the queens' pyramids it would have left a space of about 28 ms. (the same distance by which the first queen's pyramid was shifted from GI-x to GI-a) between its south side and the north side of GI-a – just enough for the causeway to pass through. The west side, south end, of the square would have just about left enough room for the east wall of the mortuary temple, although there would have been a slight overlap. If the base of the replica pyramid had been established by offsets of 3 ms. from this 100 cubit layout square (like the offsets from the layout square around the large Pyramid to its platform), it would have a side of 46.5 ms, (88–89 cubits) making the pyramid almost exactly the size of the queen's pyramid GI-a. In this case, the replica pyramid would have fit perfectly into the corner between the upper north side of the causeway and the north end of the east wall of the mortuary temple.

However, at this reduced size and location the superstructure could not have contained the passages and chambers as reconstructed from that part of the replica left in the bedrock (Fig. 16). The 'King's Chamber,' would have broken through the south face of the pyramid. Even if this had not been built, the 'Grand Gallery,' if completed according to the reconstruction, would have been too near the south face. It, therefore, became impossible to practically fulfill the original plan for the internal features in the reduced superstructure.

This line of argument might be concluded by saying that the large pyramid superstruc-

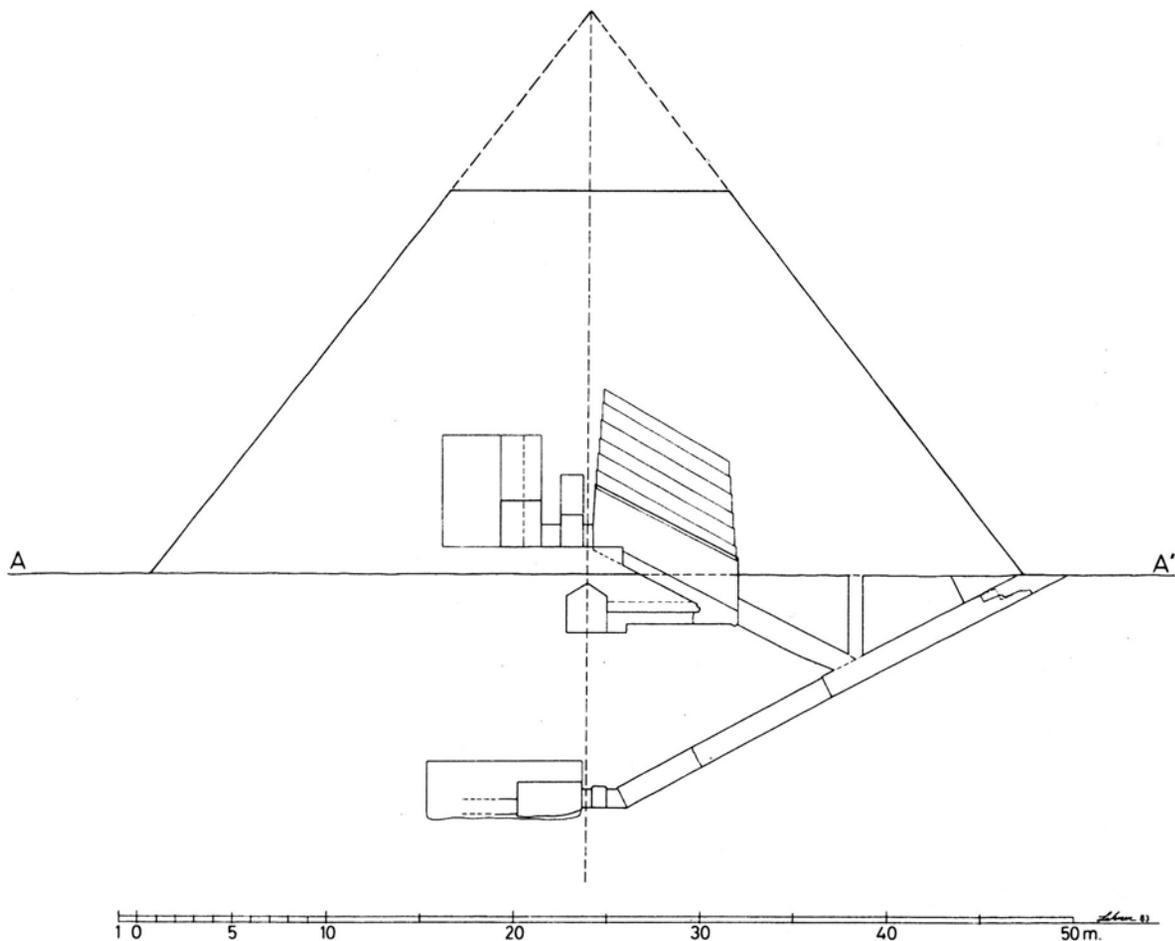


Fig. 17. Khufu satellite pyramid reconstructed with east-west axis aligned to 'Queen's Chamber.' Section.

ture, which would have adequately contained the passage-chamber system (Fig. 16), was reduced in size in the plans when they came to include the larger mortuary temple and causeway departing from the east face. A reduction would have made the superstructure inappropriate for the intended replica passages and chambers. The superstructure and completion of the internal features, therefore, were never built. Instead, the decision was made to locate the large boat pit parallel to the causeway about where the south edge of the pyramid would have been.

There is another possibility for what the ancient surveyors and builders may have intended as a pyramid superstructure for the replica passages. The alternative line of argument departs from the reconstruction of the passages and chambers, rather than from the surface layout in the north precinct of the Eastern Field.

In spite of the fact that it is exactly midway between the two openings of the rock-cut part of the replica passages, it might well be questioned whether the vertical shaft was meant to be on the E-W center axis of the replica pyramid. As shown in Fig. 16, this leaves a very long descending passage in the larger pyramid (just under 200 cubits to a side) and puts all the chambers far to the south of the pyramid's vertical axis. If it was meant to be a copy of the Great Pyramid, it would be more reasonable to expect the vertical axis of the

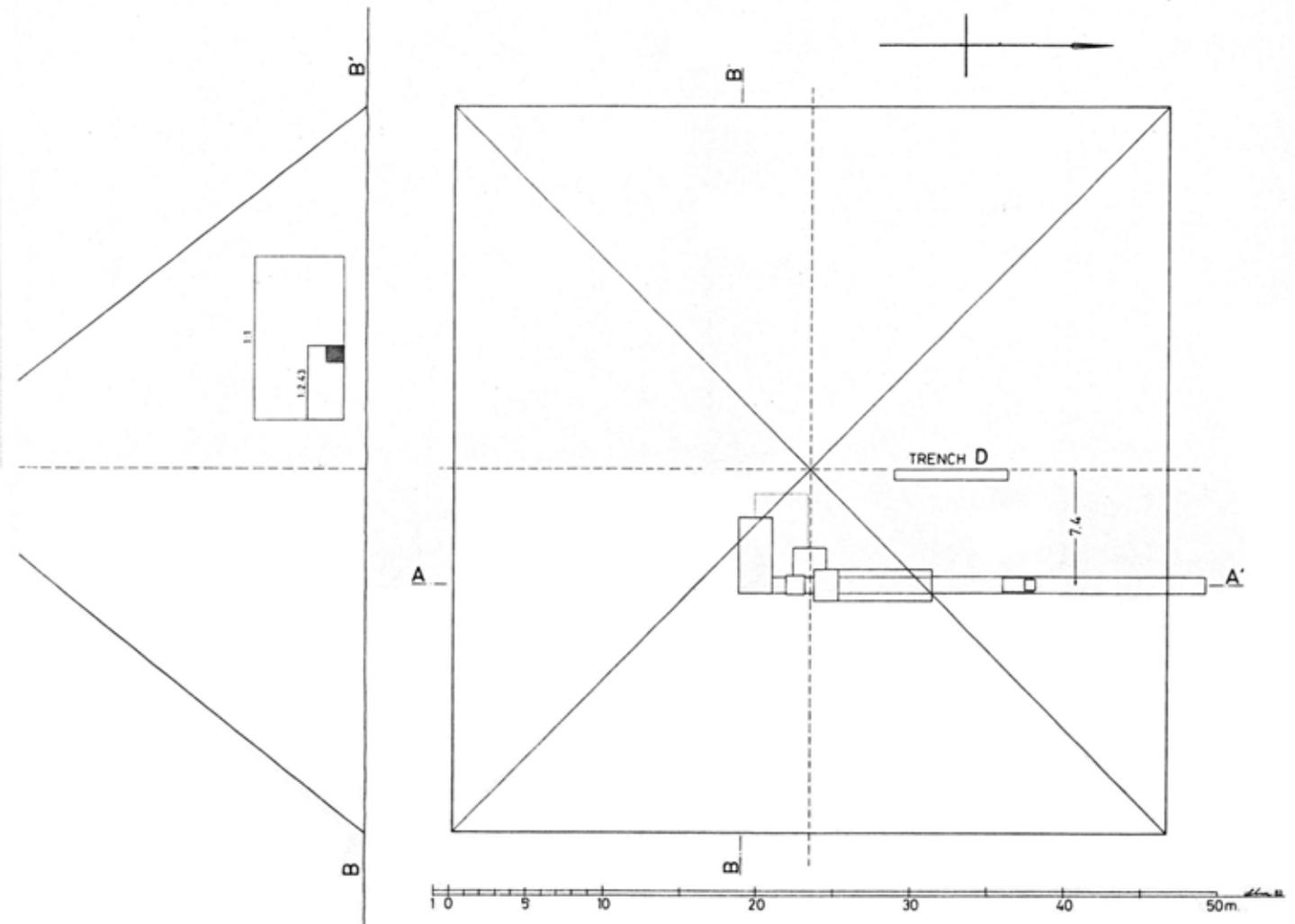


Fig. 18. Khufu satellite pyramid reconstructed. Plan and cross-section.

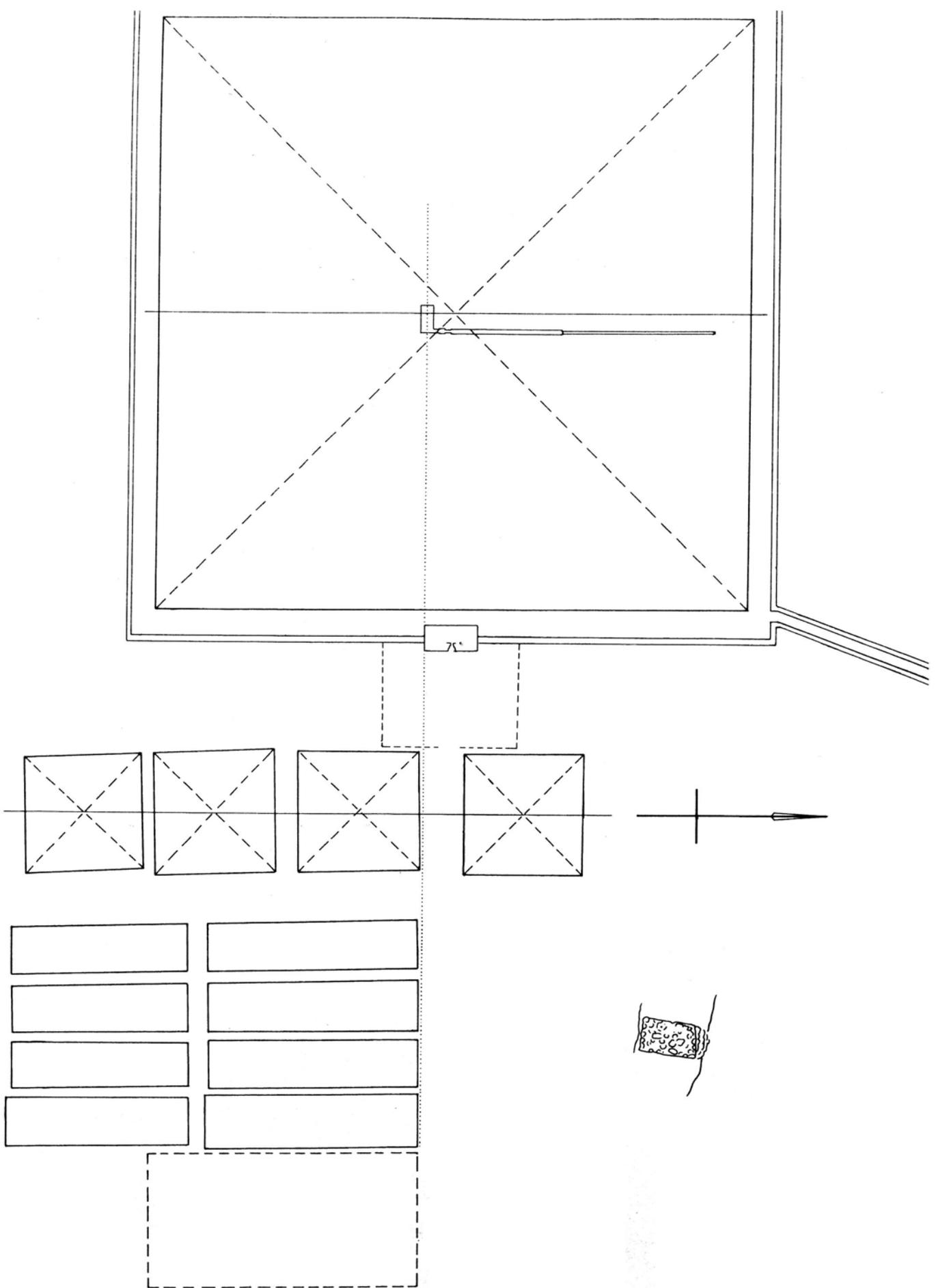


Fig. 19. Eastern Field with Khufu satellite pyramid reconstructed. Plan.

replica pyramid to have been in line with that of the 'Queen's Chamber,' and therefore near the higher end of the 'Grand Gallery' and the north side of the 'Subterranean Chamber. Such a reconstruction is shown in Fig. 17. In this case the internal structure could have fit nicely into a pyramid of 46.5 ms. to a side, i.e. the same size as the queen's pyramids. The empty space for the 'King's Chamber' and 'Grand Gallery' (even at its size in the main Pyramid) would have been situated in the lower center of the superstructure insuring adequate masonry above and on all sides (Figs. 17 and 18, sections A-A' and B-B'). The floor of the 'King's Chamber' would have been about 1.4 ms. above ground level. The roof of the 'Queen's Chamber' would have been only about 40 cms. below the rock surface. If this was inadequate, an additional opening in the surface could have been made and the gabled roof constructed entirely from masonry, had the passages been completed. The entrance to the 'descending passage' would fall exactly at the north base of the pyramid.

In this position, with the N-S axis retained over trench D, the small pyramid would not have infringed on the mortuary temple, although it would have covered much of the causeway and the boat pit (Fig. 19). The south edge of the satellite pyramid would have been 15.5 to 16.5 ms. from the north base of GI-a, which would have left space for the causeway to pass through had it departed in a straight line due east, rather than at its angle to the NE, from the entrance to the mortuary temple. The E-W center axis of the pyramid, which is nearly on line with the north wall of the mortuary temple, would have passed about 2.9 ms. from the south edge of the 'Grand Gallery' opening from the bedrock. Exactly at this point there is a patch of limestone masonry which looks like pavement (Figs. 9, 23). This runs nearly to the edge of the boat pit and measures 6.36 ms. (N-S) X 1.66 to 2.81 ms. (E-W). Could this be the remains of a foundation platform?

At this size and position the replica pyramid would have been the first in a series of four similarly sized subsidiary pyramids aligned to a long north-south axis along the east side of the Great Pyramid. There is still the question of why in so small a pyramid, the passage axis is offset from the N-S pyramid axis by such a wide measure, 7.4 ms. — roughly equal to the same relationship in the Great Pyramid. A pyramid of 120 cubits to a side could have been built in the same position and still would have left about 8 ms. between its south side and the north side of GI-a (Fig. 19). This is about the same as the distance from GI-a to GI-b. However, this does not answer the question of proportion in the offset of the passages from the N-S axis, since the same distance is seen between the passages and N-S axis of the Great Pyramid, still about 14 times larger in terms of area.

A small replica pyramid with sides of about 46.5 ms. (88–89 cubits) is what the ancient builders most probably intended. In summary, it is generally the same size as the three queens' pyramids and the reconstructed replica passages and chambers fit in and under the center of the superstructure. Its passages are foreshortened over those in the Great Pyramid at a scale near one to 5.5 as determined by the length of the ascending passage in the Pyramid and the replica. If the intended length of the sides of the replica pyramid had been exactly 88 cubits, this is one-fifth the length of the sides of the Pyramid (440 cubits). The idea may have been to foreshorten the major lengths in the Great Pyramid by one-fifth.³⁵

It is clear that any pyramid larger than 88 to 89 cubits which contained the replica passages and chambers would have infringed on the mortuary temple, causeway, and boat pit parallel to the causeway. A replica pyramid the size of the queens' pyramids would not have infringed on the mortuary temple, and would have just left room for the causeway if the causeway had been constructed on a straight line to the east from the temple (Fig. 19). The

35 Jequier (1936, I, 8) mentioned that the sides of the satellite pyramid of Pepi II are exactly one-

fifth the length of the sides of his main pyramid.

north side of the causeway would have been almost on the south baseline of the replica pyramid, and the south side of the causeway would have run over the stairs leading down to the tomb shaft of Hetep-heres I. Was the causeway angled to the NE to miss her tomb? More likely it was so routed because of the character of the rock surface further east, which is now largely covered with sand and debris, or because it leads to a more favorable point to depart from the escarpment out over the flood plain. Since it is likely that the causeway and temple were prepared about the same time, it still holds that the replica pyramid, even at 88 cubits, was abandoned when the plans for the large mortuary temple were finalized.

G. Construction Sequence in the North Precinct of the Eastern Cemetery.

The change in plan which moved the first queen's pyramid, GI-x, 28 ms. to the west for the construction of GI-a looks to have been prompted by the desire for an alignment with the N-S axis of the replica pyramid, as marked by trench D (Figs. 9, 17, 19). It is reasonable to assume that this shift was effected as soon as the replica passages and trench D had been cut. The replica passages were laid out almost at the beginning of the layout of the main Pyramid and cut early on during its construction, as indicated by the alignments with Pits 1 and 2 and juncture AP-HP-GG in the Pyramid. This gives a rough indication of when GI-a was positioned and built, which, in turn, roughly limits the period during which GI-x was begun and (accepting or rejecting Reisner's hypothesis about the burial) when G7000x was prepared and the burial equipment of Hetep-heres I interred. The foregoing evidence and interpretation would date the deposit in G7000x to very early in the construction of the Great Pyramid, when it had just been laid out and its bedrock core massif isolated. One would expect this to have been in the early years of Khufu's reign.

If GI-a was positioned to align with the replica pyramid, and if, as indicated, the large mortuary temple and present route of the causeway were not planned when the replica pyramid was laid out, then when GI-a was begun the mortuary temple, or at least its final plan, had not yet been started. This sequence is evidenced on-site by the bedrock cuttings for the foundations of GI-a, the mortuary temple, and the causeway.

As discussed earlier (see pp. 15 seq.), the tomb shaft of Hetep-heres I (G7000x) was sunk into the natural bedrock surface. When the surface just to the south was later dressed and regularized for unbuilt pyramid GI-x and that to the north cut away and dressed for the causeway, the top of the G7000x shaft was left at a rise where the original unworked surface was preserved. This surface can be traced as a ridge of bedrock which runs from G7000x to the west parallel to the north side of GI-a (Fig. 21). The ridge continues to the NW corner of GI-a where it turns to run a few meters to the south. The ridge is left from the cuttings of the foundation trench of GI-a and, on the other side, the deeper cutting for the causeway. At the NW corner of GI-a this left a panel of raised bedrock about 2.5 ms. wide (Fig. 20). Here the foundation trench of GI-a is cut about 30 cms. deep, while from the top of the ridge there is a drop of about 1.60 ms. to the level of the causeway bed and floor of the mortuary temple. On the west side of this corner the residual bedrock is even thinner as the SE corner of the mortuary temple comes to within little more than a meter of the pyramid.

If GI-a had been founded after the mortuary temple was already laid out and the rock prepared for it, why was this ridge, left by the surface dressing for the mortuary temple, not simply cut away for the NW corner of the foundation of GI-a? This way, the base of GI-a would have had to accommodate less than the two meters of slope from its NW to its SE corner. It would seem more reasonable to interpret the cuttings and the ridge of natural rock along the front and NW corner of GI-a as follows:

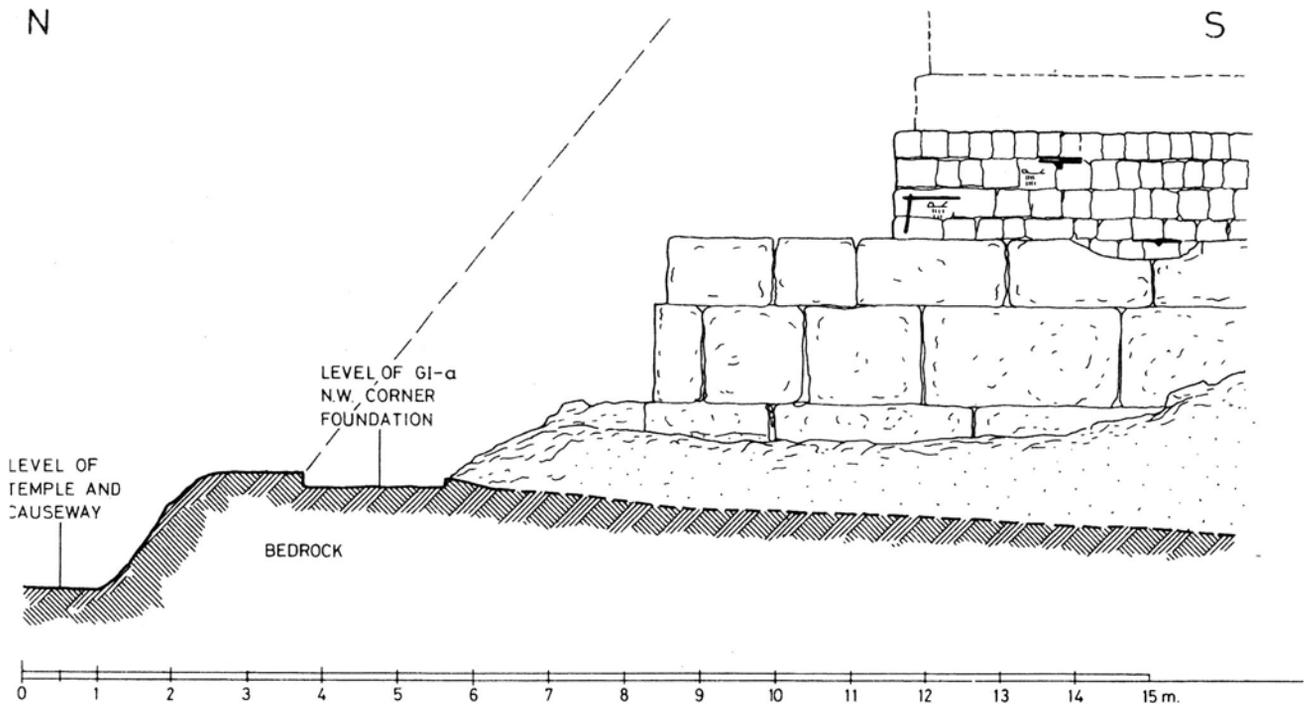


Fig. 20. Bedrock cuttings at the NW corner of queen's pyramid GI-a. Profile (after Maragioglio and Rinaldi 1965, Tv. 12: Fig. 10).

When GI-a was founded, there had been little dressing of the rock surface in the area, except for the regularizing around the abandoned pyramid cutting, GI-x. In lieu of the fine levelling as was planned for the base of the main Pyramid, the foundation trench of GI-a was cut into the natural rock surface for a depth of little more than 30 cms. at the NW corner and along the north face, while the opposite SE corner was founded 2 ms. lower on the natural dip. At this time, the mortuary temple had not been laid out to its final dimensions. When the large temple was finally designed and measurements taken for it on the unprepared surface, it was found that its SE corner would fall little more than a meter from the NW corner of GI-a. As GI-a had already been started, the rock surface was levelled for the mortuary temple to within a meter of the pyramid's NW corner, which left that corner more than a meter and a half higher than the floor of the temple. The rock surface along the route of the causeway was then deeply dressed passing along the front of GI-a and past the location of G7000x. This left a ridge of original rock surface passing from G7000x along the front of GI-a.

The building sequence in the north part of the Eastern Cemetery can now be summarized:

1. The bedrock core massif of the Great Pyramid was isolated from the *gebel*. The perimeter layout lines were established (see p. 54 seq.).
2. Perpendiculars to the layout lines along the east side of the Pyramid were projected for the location of the replica passages and for offsets to establish the north limit of the first queen's pyramid and the Eastern Cemetery.
3. Before these offsets had been accurately measured, G7000x was prepared on the baseline for the north boundary of the Eastern Cemetery. This would later align with the long axis of the King's Chamber high up in the Pyramid body. The tomb shaft of Hetep-heres I penetrated the original undressed rock surface.
4. GI-x was begun as an additional substructure of the intended pyramid superstructure

for the burial of Hetep-heres I. The King's mortuary temple had not been laid out to its final dimensions. Instead, at this stage a small offering chapel, like those of the pyramid of Meidum and the Bent Pyramid at Dahshur may have been planned, while the causeway was to depart from the NE corner of the Pyramid court.

5. The replica passages were laid out and cut as foreshortened copies of, and aligned with, the Pyramid passages which had reached the juncture of the ascending passage, the horizontal passage, and the Grand Gallery. The distance between the intended N-S axis of the replica, as marked by trench D, and the axis of its passages, may indicate that a large pyramid superstructure was intended at first.

6. The location of the first queen's pyramid was shifted 28 ms. from GI-x to the passage of GI-a so that GI-a would align with the north-south axis of the replica pyramid as marked by trench D.

7. The original rock surface was only slightly cut into for the foundation of GI-a. The construction of GI-a was followed shortly by that for the other two queens' pyramids, GI-b and GI-c. It is possible that all three queens' pyramids were constructed simultaneously during the construction in-progress of the King's main pyramid. Work on the replica pyramid, meanwhile, was suspended.

8. After the main pyramid was mostly finished and the supply ramps removed, a larger mortuary temple was planned. The plans for the replica pyramid superstructure may have not yet been cancelled, since at the size of the queens' pyramids it would not have appreciably intruded on the area of the larger mortuary temple.

9. The rock surface was levelled for the foundation of the mortuary temple. Work proceeded from the levelled perimeter along the east base of the Pyramid. The causeway was now planned to run from the temple entrance at an angle to the east-NE. The surface dressing for the temple and the causeway left the north side and NW corner of the base of GI-a one to 1.6 ms. higher than the temple and causeway foundation.

10. It was seen that if the replica pyramid was built along its alignment with the queens' pyramids while still containing the passages that had been started in bedrock, it would obstruct the route of the causeway. The replica pyramid was abandoned. Later, the large boat pit was cut paralleled to the causeway where the south side of the replica pyramid would have been.

H. Khufu's Satellite Pyramid.

The replica passages are a curiosity because they accurately copy parts of the passages in the Great Pyramid, and the arrangement of those passages is unique in several respects, even given the variation of internal features from one pyramid to another from the late 3rd to the end of the 4th Dynasties when the pyramid complex was under the greatest development (Lauer 1962, 133, n. 2). At the same time, the existence of a smaller tomb which replicates the features of the larger pyramid certainly has its precedent, beginning with the south tomb of Zoser, built as a mastaba into the south part of the enclosure wall of his Step Pyramid complex at Saqqara (Firth, Quibell and Lauer 1935-36, 18-20, 54-64; Lauer 1936, 94-112). The internal features of this subsidiary tomb are the same in many ways, with some modifications and omissions, as the principle substructure in the Step Pyramid, one difference being the southern tomb has a smaller burial chamber (Ibid., 98).

The southern tomb of the Sekhemkhet complex at Saqqara, like that of the Zoser complex, is in the form of a mastaba oriented east-west (Lauer 1968, 97-107, Fig. 1; 1976, 138-9, Fig. 9). While the substructures of both the Sekhemkhet step pyramid (Goneim 1957, 12-20; Maragioglio and Rinaldi 1963, 21-4, Tvs. 3-5) and its southern tomb are

unfinished, both have a sloping entrance corridor which meets a deep vertical shaft, a typical 3rd Dynasty configuration (see p. 10–11). The mastaba, as far as is known, is missing the galleries and side chambers off the burial chamber in the pyramid, although these might yet be found (Lauer 1968, 104).

It has long been thought that the small satellite pyramids, situated within the enclosures of the pyramids of the 4th through the 6th Dynasties, may have developed from the southern tomb of Zoser and carried a similar significance (Jéquier 1936, 9 n. 2; Ricke 1944, 106–7; 1950, 125–6; Lauer 1955, 167–9; 1962, 132–3 n. 2). The internal features of the satellite pyramids of Meidum and Dahshur, have “le même aspect que la tombe royale principale, mais a une échelle réduite” (Lauer 1968, 106). In these cases the small pyramid has certain modifications, omissions, and foreshortened passages due to the reduced size of the superstructure.

The substructure in the Meidum satellite pyramid (Petrie, Mackay, Wainwright 1910, 10–12, Pls. VII, VIII, IX; Maragioglio and Rinaldi 1964, 26–9, 44–8, Tv. 7: Figs. 1–3, 6–7) was mostly destroyed, but enough evidence exists to indicate that, like the main pyramid (Rowe 1931, Pl. X; Maragioglio and Rinaldi 1964, 16–25, Tv. 2: Fig. 2, Tv. 3: Fig. 5, Tv. 4: Figs. 2–7), the small pyramid had a sloping passage from the north leading to a horizontal corridor and a square or rectangular chamber built into a rock-cut pit. In addition, the chamber probably had a corbelled roof like that in the chamber of the main pyramid (*Ibid.*, 48–9).

The internal arrangement of the satellite pyramid in the Dahshur Bent Pyramid complex also follows the developments incorporated into the passages and chambers of the main pyramid (small pyramid: Fakhry 1959, 89–96, Fig. 55; Maragioglio and Rinaldi 1964, 74–83, 116–17, Tv. 15: Figs. 1–2, Tv. 16; main pyramid: Fakhry 1959, 46–59, 67, Figs. 16–21, 33–6; Maragioglio and Rinaldi 1964, 58–73, 94–111, Tvs. 9–13). The passage system in the small pyramid is more like the north or lower system than the western or upper system in the large pyramid. Like the passages in the small pyramid, the northern arrangement has a passage descending from the north face of the pyramid and rising again to a corbelled chamber. The rise in the latter is by means of the corbelled antechamber, which may have contained stairs (*Ibid.*, 62–5), while the ascent to the chamber in the small pyramid is by means of an ascending passage which, with a heightening to store plugging blocks, looks to have had a function similar to that of the Grand Gallery in the Great Pyramid. Situated in or close by the south end of the chambers in both the satellite pyramid and the northern arrangement in the main pyramid is a vertical shaft.³⁶

It is entirely expected that these satellite tombs were modelled after the larger tomb of the king, considering that the king's tomb carried the main line in the developments of new types and features (Reisner 1935, 6). The satellite tomb or pyramid would be the first, after the main pyramid, to incorporate those developments.

The satellite tomb or pyramid is situated in or near the south part of the pyramid enclosure and, in the late 3rd to the middle 4th Dynasties, shows a relation to the north-south center axis of the main pyramid. At Zoser's Step Pyramid complex it was in the form of a long east-west, round-topped mastaba built into the southern part of the enclosure wall in such a position that the granite burial chamber is near the projected north-south center axis of the pyramid – although it is more in line with the burial chamber in the pyramid (see Brinks 1979, 25, Abb. 5). In the Sekhemkeht enclosure, the free-standing mastaba was

36 Maragioglio and Rinaldi (1964, 80, 116) point out that the walls of the chamber appear to extend down to the 4.20 m. depth of the bottom of the shaft from the floor level. Thus the shaft in

this case was left in the masonry which otherwise filled the base of the chamber up to the pavement of the floor.

parallel and close to the south face of the pyramid and positioned, like its counterpart in the Zoser complex, so that the end of its subterranean gallery, which was being widened into a chamber when work was abandoned, is on line with the north-south center axis of the pyramid (Lauer 1968, 101, Fig. 1; 1977, 135, Fig. 9).

At Meidum the satellite pyramid is on the south, and shifted slightly west, of the main pyramid's north-south axis, while at Dahshur the satellite pyramid is on the south and aligned with the north-south axis of the Bent Pyramid (Maragioglio and Rinaldi 1964, 26–7, 74–5, Tvs. 2, 8). At Djedefre's Abu Roash complex a small subsidiary pyramid was started at the SW corner of the main pyramid (Lepsius 1897, 23; Maragioglio and Rinaldi 1962, 17–18; 1966, 26–7, Tv. 2).

A subsidiary pyramid (GII-a), now almost entirely destroyed, stood at the south side of the court and on the north-south axis of Khafre's Giza pyramid. Hölscher (1912, 34–5, 64, 57, Bl. XIII), Reisner (1942, 131, Fig. 66) and Maragioglio and Rinaldi (1966, 90–1, 130–1, Tv. 17: Figs. 1–4) considered this a queen's pyramid, while Ricke (1950, 125–6), Lauer (1968, 98), and Stadelmann (1982a, 1234) accept it as a "cult pyramid" or satellite pyramid of the king. It should be noted that no trace of an offering chapel was found by this pyramid (Hölscher 1912, 35, 69). Furthermore, it appears as though a small square pit was begun immediately at the base of the pyramid, in the center of the north side, and just below the point at which the entrance passage would have opened (Ibid., Ab. 57, Bl. XIII; Maragioglio and Rinaldi 1966, 90) – a very similar configuration to that on the north side of the Dahshur satellite pyramid, which is more assuredly tied to the king.

The Third Giza Pyramid had three subsidiary pyramids on its south side which Reisner assigned to queens of Men-kau-Re, partly on the basis of the mudbrick offering chapels built against their eastern faces (Reisner 1931, 55–68). The chapel, and a granite sarcophagus found in the burial chamber, indicate that the easternmost and largest of these three pyramids, GIII-a, was used for a burial, although Ricke (1950, 126), Lauer (1955b, 168), and Stadelmann (1982a, 1237–8) consider this a secondary function, after it had served as a cult pyramid of the king. This is indicated by the fact that GIII-a is located nearly on line with the north-south axis of the main pyramid, and because the "Gang und Korridor haben die normale T-Form der Nebenpyramiden" (Ibid.), as does the Khafre satellite pyramid. The other two subsidiary pyramids, GIIIb–c, have burial chambers more characteristic of those of the queens' pyramids east of the Great Pyramid. They were left as step pyramids, either intentionally or because they were unfinished, while GIII-a was cased off as a true pyramid.

The traditional place for the king's satellite pyramid in the 5th and 6th Dynasties was on the east side of the main pyramid and south of the mortuary temple (Lauer 1955, 169; 1974, 166–71), although Ne-user-Re's satellite pyramid is just off of the far east end of the south side of the main pyramid (Borchardt 1907, 25, 108–9, Bl. 18, Abb. 86–7). At the Userkaf Saqqara complex the satellite pyramid is at the SW corner of the main pyramid. This puts it to the right of the mortuary temple when facing away from the pyramid (Firth 1929, 66–7; Lauer 1955a, 119–33), like the other 5th and 6th Dynasty examples. The difference is that in those examples one faces the entrance to the temple in that direction while here one faces the sanctuary since the plan of the temple is inverted with respect to the main pyramid.

Remains of the original contents were found in some of the satellite tombs. In the Zoser southern tomb a large magazine opens south from the descending entrance stairway. Like the chambers of satellite pyramids GII-a and GIII-a at Giza, the magazine has the T-form, although here the chamber, at 18 ms., is much longer. On the floor of the magazine were large pottery jars, which may have contained liquids like milk and beer, and some alabaster vases (Firth, Quibell and Lauer 1935–6, 20, 62–3, Pl. 37; Lauer 1936, 99–100). With the pottery and alabaster vessels were the remains of a wooden box which was once gilded; a

bier (Ibid., 99, Fig. 84), perhaps for carrying a shrine; and nine gilded poles of a canopy similar to that of Hetep-heres I (Ibid., Figs. 6–7). More alabaster jars, a piece of gold sheet, and a diorite bowl with the name and titulary of the 2nd Dynasty king Khasekhemui were found in a short room connecting to the tunnel and passage running east from the central pit (Firth, Quibell, and Lauer 1935–6, 18, Pl. 36). Nothing of the original contents was found in the granite burial chamber itself. It did contain many alabaster chips, some fragments of polished diorite paving stones which had been reused as hammer stones, fragments of a black and white granite vessel, also reused as a hammer stone, a piece of limestone with a star in relief, and one small piece of gold foil. This material had mostly worked down from the upper antechamber which was for lowering the granite plug of the burial chamber (Ibid., 19–20, 56, 58). Many of the alabaster chips had flat worked surfaces with a dark stain which suggested a broken up pavement. The pieces with relief-carved stars suggested a broken ceiling (other reused blocks of limestone bearing stars were found elsewhere in the tomb and in the Pyramid). Some of the minute diorite pieces were “set in a kind of bitumen” (Ibid., 20). Firth suggested that these materials might be the remains of a chapel for the large mastaba which was converted into the Step Pyramid or for the Archaic tomb under the Unas mortuary temple (Ibid.). Lauer (1936, 102 n. 1), on the other hand, pointed out that the star motif is found frequently on other parts of the Zoser complex. On the basis of the broken materials, he reconstructed an earlier burial compartment with ceiling blocks studded with stars on both sides (Ibid., 103–4, Fig. 86). According to his idea, this was destroyed when the decision was made to construct a more inviolable compartment of red granite.

Among the most notable features of the South Tomb are the blue-tiled chambers, imitating mat-patterned facades, and the three relief carved scenes of the king, similar to those tiled chambers and reliefs found under the Pyramid. In the South Tomb they are found in the subterranean galleries east of the burial pit. The scenes include signs well-known in representations of the Heb-Sed ritual. The king's tunic in the two southern stélæ and his striding position in the northern stela are also familiar to the Heb-Sed (Firth, Quibell, and Lauer 1935–36, 18–20, 58–61, Pls. 38, 40–2; Lauer 1936, 105–9, Pls. XXXI–XXXVI; cf. Spencer 1978).

In the gallery of the Sekhemkhet subsidiary tomb, about 5 ms. inward from the vertical pit, Lauer found the remains of a square wooden sarcophagus, 1.18 ms. in width and 82 cms. high. This was associated with the badly disintegrated skeleton of a small child, thought to be about two years of age (Lauer 1968, 101–2, Pl. 6a). Vestiges of gold leaf, with the impressed matwork design so common in the Archaic and early Old Kingdom, were found between the pit and the sarcophagus. Also from the debris between the bottom of the pit and the entrance of the funerary apartment came several dozen vessels of alabaster, diorite, and schist (Ibid., Fig. 3), as well as numerous fragments of pottery, and some “ossements d'animaux sacrifiés.” In the funerary apartment itself were five more stone vessels, one cylindrical vase, two small vessels of alabaster, three large pottery vases, and two small pottery vessels with blackened interior – perhaps the lamps of those who violated the tomb.

In the burial chamber of Khafre's satellite pyramid Hölscher found some ox bones, fragments of wood, two necklaces of carnelian beads, and fragments of jar sealings, including one with Khafre's name (Hölscher 1912, 64, Pl. XIII). This chamber and its entrance passage do not exhaust the substructure of this satellite pyramid. Four meters west of the small pyramid, and aligned to its east-west axis, a sealed passage was found by Abdel Hafez Abd el-'Al during the Egyptian Antiquities Service's cleaning of this area (Abd el-'Al and Youssef 1977, 103–20, Pls. I–XV; Maragioglio and Rinaldi 1966, 90–4, 130–1, Tv. 17: Figs. 5–8). The passage has a height and width of 80 cms. and slopes for 6.70 ms. at an angle of 35 to

37 degrees. At the end of the passage a small niche, 1.19 ms. long, about 62 cms. deep and from 49 to 62 cms. high, opens in the south side. The niche contained a wooden box sealed with string. The box contained three layers of wood pieces which made up a wooden frame in the form of a shrine. Its form is very similar to shrines shown in Old Kingdom tomb reliefs, such as in the chapel of Queen Meres'ankh III, where it is used for transporting a statue of the queen (Dunham and Simpson 1974, 12, Pls. IIIb, Va, Fig. 5; Lacovara and Lehner, forthcoming).

At the pyramid complex of Pepi II in south Saqqara, each of the three queens' pyramids has its own satellite pyramid at the SE corner of each enclosure, as does the pyramid of the king. In the satellite pyramid of Queen Neit, which Jequier called a "reproduction en miniature du tombeau de la reine," the floor of the burial chamber was strewn with fragments of pottery vessels and three vessels of alabaster, one of which bore the queen's name (Jequier 1933, 10–11).

These remains of the contents of the satellite tombs do not go far in clarifying the significance of these monuments. Certainly offerings are indicated, but the same or similar contents might be expected to have been put in the main pyramid of the various complexes. The wooden bier "for carrying a shrine(?)" (Firth, Quibell, and Lauer 1935–36, 62) found in the Zoser South Tomb magazine and the shrine found under the Khafre satellite pyramid could suggest a statue burial.

As mentioned, it has been thought that the small satellite pyramids of the later Old Kingdom have their origin in the South Tomb of Zoser (however, see Altenmüller 1972, 4 n. 22). Several suggestions, not all of them mutually exclusive, as to the meaning of the South Tomb have been forwarded:

1. The South Tomb was a burial place for the royal placenta which may have been associated with the king's *ka* as a kind of "stillborn twin" (Firth, Quibell, and Lauer 1935–36, 57; cf. Borchartd 1937, 110, no. 5; Frankfort 1948, 70–3, 364–65 nn. 44–52).

2. The South Tomb was a fictive burial connected with the Heb-Sed ritual (Firth, Quibell, and Lauer 1935–36, 20; and so for satellite pyramids, Firth 1929, 67; Brinks 1979, 76–94 and passim for the place of the "Sedfestlange" in his structuralist analysis of funerary layouts of the Old Kingdom which consistently identifies the satellite pyramids as the sed-fest grave). This is suggested, in part, by the proximity of the South Tomb to the great open court south of the Pyramid.

3. The South Tomb was a provisional sepulchre for the royal burial until the main pyramid was completed (Firth 1929, 67; Firth, Quibell, and Lauer 1935–36, I, 20; cf. Ricke 1950, 125–6 for a similar explanation of the Men-kau-Re satellite pyramid).

4. The South Tomb was the *ka* grave, or in some sense especially connected with the royal *ka* (Jequier 1936, 9; Borchartd 1937, 110 n. 5; Ricke 1944, 106–7; 1950, 125–6).

5. The South Tomb was for the interment of a *ka*-statue of the king (Ricke 1944, 56; 1950, 13; Altenmüller 1972, 3–5; Brinks 1979, 79 where the statue would be a "Sedfest-statue;" Stadelmann 1982a, 1225 suggests the Bent Pyramid's satellite pyramid at Dahshur may be for a statue burial).³⁷

6. The South Tomb was for the interment of the Canopic chest containing the King's viscera (Lauer 1936, 110–12; 1955b, 168; 1962, 140; Ricke 1944, 106–7; 1950, 125–6).

7. The South Tomb was for the interment of the crowns. Ricke (1950, 106–x) places the crowns in the sanctuary surmounted with a frieze of uraei against the north side of the

37 According to Altenmüller (1972, 4–5) the *ka* statue was later placed in one of the chambers of the main pyramid, a practice which he sees as fully developed by the reign of Sneferu. Cf. Stadelmann

(1980, 449) who suggests the pyramids of Meidum and Dahshur South may have been for cult statues of the king.

South Tomb. Lauer (1962, 136–7) argues against this, but suggests the crowns might have been put in the substructure of the South Tomb.

8. The South Tomb, complementing the main pyramid, is a vestige of the Archaic practice of making a royal tomb in both Upper and Lower Egypt, at Abydos and Saqqara, which reflects the duality of the Egyptian state and its unification under the king. Ricke (1944, 56–8; 1950, 9, 13, 105, 117, 127) makes a curious inversion whereby the South Tomb represents the North and the Pyramid represents more the South. Lauer (1955, 166–171; 1962, 135, 139–142; 1968, 105–6) points out that the Pyramid is the tomb of the king of Upper *and* Lower Egypt, but sees the South Tomb as “un rappel symbolique” of the cenotaph (?) erected by the first kings in Abydos (cf. Kaiser 1969, 20–1).

Both Ricke and Lauer see a change in the function of the satellite tombs from the 3rd to the 4th Dynasties, when it became a small pyramid, and particularly in the 5th and 6th Dynasties, when the burial chamber was often left crudely fashioned, showing no further development (Ricke 1950, 125; Lauer 1955b, 169). At this time its traditional place was south of the mortuary temple (with exceptions, see above). The change is attested, in part, by the findings in the satellite pyramid of Queen Neit in the Pepi II complex at Saqqara. Her small satellite pyramid cannot have been for her Canopic chest, since this was found in the burial chamber of her main pyramid (Jequier 1933, 10–11). Jequier suggested that, in addition to receiving offerings, the satellite pyramids stood as representations of the *ben-ben*, the Heliopolitan solar symbol (Ibid.; 1927, 59–60; 1936, 9). Remains of the Canopic burial, including one of the four wrapped packages, were also found in the burial chamber of the main pyramid of Pepi I (Lauer 1974, 133).

For Ricke, the satellite pyramids came to the repositories for offerings and, in some special way, they were connected to the royal *ka* (he raises the question of where the *ka* was placed in those pyramid layouts which lack a satellite pyramid) (Ricke 1950, 125–6). Lauer (1955b, 169) suggests, as did Firth (1929, 67), that the burial chamber of the satellite pyramid could have served as a provisional depot during the mummification process or the ceremonies in the temple. Lauer (1962, 137–9) went on to point out that it is nonsense to think that the satellite pyramid or tomb was exclusively reserved for the *ka* of the king, since the main pyramid, its temple, the other elements of the layout, and the offerings would all have been intended for the royal *ka*. However, since the royal *ka* is sometimes imaged as a twin of the pharaoh (Frankfort 1948, 69–70), Lauer (1962, 133 n. 2) does allow that the small satellite pyramids, while not functioning as the tomb *per se* of the *ka*, could have been seen as its material symbol, just as the main pyramids could be personified and identified with the king himself.

In summary, the satellite pyramids might have symbolized the king’s *ka* and they could have contained a statue burial, for which food offerings may have been presented. A salient characteristic is their position southwards in the funerary layout: south of the main pyramid and on its north-south axis (Sneferu’s Bent Pyramid, Khafre, Men-Kau-re, burial chambers of the Zoser and Sekhemkhet south tombs), or toward the southwest corner of the pyramid enclosure (Meidum, Abu Roash, entrance to Zoser’s South Tomb). During the 5th and 6th Dynasties, the temple, and presumably the cult, are greatly elaborated. Perhaps the social processes of building a huge pyramid are transferred to the social process of the cult and its maintenance, for as the pyramid decreases in size, the temple layout expands. The satellite pyramid, while retaining that meaning given by its southwards position, moves into a counterpoise with the temple, more than with the pyramid.

The replica passages east of the Great Pyramid and north of its Eastern Cemetery indicate that a pyramid was planned for this place. Had it been built it would have been a kind of scale model of Khufu’s main pyramid, with sides and passages reduced by about one-fifth. The parallel trench D indicates a north-south axis for the unbuilt pyramid. What was the

meaning behind the original plan? It would have erected, precisely speaking, a satellite pyramid. However, it would have been anomalous with respect to all those satellite tombs that came before and after insofar as it was a northerly, rather than an southerly, direction that was being emphasized.³⁸

On the other hand it might be questioned whether any variation should be considered truly anomalous for the 4th Dynasty, when the pyramid complex was in its most formative stages and given the number of variations for the limited number of pyramids. One feature that had stabilized through the 4th and into succeeding dynasties was the offering chapel, and later the mortuary temple, on the center of the east side of the pyramid. Then we find Userkaf's mortuary temple laid out on the south side of his Saqqara pyramid, and inverted, so that the oper court, rather than the sanctuary, faces the pyramid (Firth 1929, 66; Lauer 1955a, 119–33). Ricke (1950, 68–9) tried to explain this by making a special thematic case for Userkaf: given the penetration or emphasis of the solar cult into the funerary establishment during his reign, the west-east cult axis was transferred to one south-north on the south side, making the temple serviceable to the king and the sungod in the solar barque during its entire dailey course across the sky – the temple would never be in the shadow of the pyramid as it would have been on the east side during the afternoon.

Ricke's explanation for the Userkaf 'anomaly' could be seen as *ad hoc* and tendentious. Firth (1929, 68) and Lauer (1955a, 132) suggest rather that topographical reasons may have caused Userkaf to depart from tradition. The ground to the east of the pyramid may have been unsuitable, or there may have already been a road to the necropolis passing at this point. The topography of a site is certainly a constraint to any architectural expression of a thematic function. However, it would seem that Userkaf's planners could have chosen a site better suited to the traditional layout, as Edwards (1961, 178) suggested. Or, if the surface to the east of the pyramid was poor, it could have been built up as a foundation for the temple, as had been done for the Men-kau-re mortuary temple at Giza (Reisner 1931, 25). Edwards, alluding to an emphasis on thematic function in Egyptian architecture, observed: "architecture and religious belief in Egypt were generally complementary and it would be strange if the peculiarities of this complex did not reflect some change, albeit short-lived, in the royal mortuary creed" (Edwards 1961, 178; cf. Ricke 1970, 39). It need not have been a major innovation in the mortuary creed as much as a shift in emphasis to suit certain criteria, one of which may have been topographical or other physical constraints. Such flexibility in traditional patterns might have been possible given "the peculiar quality of Egyptian thought which allows an object to be understood, not by a single and consistent definition, but by various and unrelated approaches. . . What appears usually as subordinate may suddenly, under the influence of a narrower but concentrated attention, gain the weight of an independent entity. It may even absorb the whole of which it once formed a part" (Frankfort 1948, 61–2).

38 About 400 ms. northeast of the North Dahshur Pyramid there lies the remains of what Lepsius took as a small pyramid (L50) without any superstructure (see Stadelmann 1982b, 382–3, Abb. 1). This lies immediately to the north of one of two long roadways of limestone chips running from the northeast of the North Pyramid toward the valley. Thus L50 lies with respect to the North Pyramid in a direction similar to the position of Khufu's replica passages with respect to his pyramid; the latter being north of the causeway and northeast of the main pyramid's center

axis. Although a small offering bowl and crude ware sherd typical of the Old Kingdom were found in sand filling the area of the L50 depression, the date of this pyramid is open to question (Ibid.). It is also much farther from the North Dahshur Pyramid than the replica passages are from Khufu's main pyramid, although the entire pyramid arrangement, including the royal cemetery, appears to be arrayed over a much wider space than the tight arrangement around the Khufu pyramid.

It has been said that topographical reasons caused Khufu to shift his three queens' pyramids from the south (as they are situated at the Men-kau-re pyramid) to the east side of his large pyramid. If so, the same may be true for the king's satellite pyramid. The so-called *Nebenpyramide* found by Junker (1951, 9–12, Ab. 6) 21.50 ms. from the south base of the Great Pyramid and 42 ms. from its SE corner takes the form of a very short sloping corridor with a cross-section of about 1 m. in width and 90 cms. in height. It slopes to the south for 4.3 ms. along its floor and opens to a small rectangular chamber, 1.5 X 1.2 X (height) .80 ms. (Ibid.; Maragioglio and Rinaldi 1965, 74–5, Tv. 11: Fig. 4). The top of the chamber is only 1.3 ms. below the bedrock surface.

Junker suggested that this passage represented the beginning of a queen's pyramid which was never built. Reisner (1942, 72) accepted this suggestion and stated that the queens' pyramids may have originally been intended for the south side of the Great Pyramid. The plan was abandoned because "on this side the terrain was judged unsuitable owing to the proximity of the great quarry" south of the Great Pyramid (Ibid.). According to Maragioglio and Rinaldi (1965, 174–5), this small passage could not be the beginning of a southern ritual pyramid because it is not located on the axis of the main pyramid, and because the reserved space is too small for such a pyramid. Brinks (1979, 113, 122, Tf. 5) reconstructs a satellite pyramid on this spot which fills the slot of the "Sedfestgrabmal" in his structuralist analysis.

It has been argued here that the first queen's pyramid in the Eastern Cemetery was begun almost from the beginning of the construction of the Great Pyramid. This leaves little time for a layout for the first queen's pyramid yet earlier than GI-x and GI-a. The diminutive size of the so-called *Nebenpyramide* passage and chamber make it unlikely that this was the substructure for a queen's pyramid. The great quarry that Reisner mentioned was likely opened for the core material of the Great Pyramid. Bedrock so close to the Pyramid would probably have been exploited very early in the construction of Khufu's complex. In the middle to later stages of the construction the south side would have been covered by the main supply ramp sloping out much further to the Central Field quarry. If this so-called *Nebenpyramide* had been planned from the beginning of the layout of the Khufu complex, the bedrock would not have been quarried so close to the south side of the main pyramid. By the time the supply ramps were taken down at the completion of Khufu's Pyramid, the replica passages and three queens' pyramids on the east had certainly been constructed.

All this suggests that it was both topographic reasons and a certain thematic emphasis that caused Khufu to place, not only his queens' pyramids, but also his satellite pyramid to the east side of the Great Pyramid. Here it should be pointed out that a north-south axial alignment has been maintained, and even magnified – three subsidiary pyramids lined up on the north-south axis of the satellite pyramid, according to the original plan. As Lauer (1955b, 166; 1962, 141) has pointed out, the ancient builders took great care in laying out such alignments, and they must carry special significance.

We can never be certain what that significance was in the minds of those who designed these layouts. Particularly for a period in which extensive textual sources are lacking, complete empirical verification of a "thematic function" is not possible. This is to say nothing of the ambiguity very possibly present in the ideas of the 4th Dynasty Egyptians themselves, as in any culture. It is with these severe reservations in mind that the following suggestions are offered as to what the Eastern Cemetery layout might have meant to the court of Khufu.

According to the well-known ancient Egyptian notion that a model or representation can stand for an actual entity, termed the idea of consubstantiality, and the ensuing principle called substitution, by Wilson (1946, 62–71), the replica pyramid at the northern head of the three queens' pyramids might have substituted for the actual pyramid tomb of the king.

In this case, for those who built the Eastern Cemetery, the satellite pyramid had all the efficacy of the king's main Pyramid. The three queens' pyramids could not practically have been aligned to Khufu's main Pyramid on a north-south axis given the requirement of an adequate local quarry, and therefore a supply ramp, to the south. Such an arrangement would anyway have been exceedingly strung out. By shifting the layout to the east, and having the king's satellite pyramid substitute for the main Pyramid, an ancient theme (although not the duality of the Egyptian state) might have been architecturally expressed in a unique way.

At the outset of this monograph the unified plan of the cemeteries east and west of the Great Pyramid was noted. The rows of 4th Dynasty tombs for the royal relatives and officials are carefully keyed to the orientation of the Great Pyramid with an organization that is unique, except, perhaps, for the subsidiary graves around the Archaic royal tombs at Abydos (see Kaiser and Dryer 1982). Reisner (1942, 27) interpreted the orderly layout at Giza by saying that "the whole was to be a great city of the living *kas* of all members of the royal family and court."

In the original layout of the Eastern Cemetery, no pyramid or mastaba tomb was allowed north of the line forming the north limit of the cemetery except the replica pyramid. The tomb of the queen-mother was begun on this line, which appears to align with the burial chamber of the king inside the Great Pyramid (Figs. 9, 19). The king's replica pyramid, therefore, would have stood at the northern head of that cemetery for the immediate royal family. What may have been emphasized was the approach of the king in the afterlife to the circumpolar stars, often referred to in the Pyramid Texts (Faulkner 1966; Badawy 1964, 195–8, 199–203).

The three queens' pyramids lined up behind the replica pyramid all possess the traditional passage sloping down from the north face, which is thought to have symbolized, in part, a conduit toward the circumpolar stars (Ibid., 192; Edwards 1981, 56). According to Badawy (1964, 191–2), the stellar destiny of the pharaoh and, in suit, of the court, was emphasized in the reign of Khufu by apertures or channels in the blocking slab at the bottom of the funerary shaft in the mastabas – to allow passage of the *ka*, by the northward position of the shaft with respect to the burial chamber, and the custom of setting a sculpted "reserve head" facing north before the blocked passage at the bottom of the shaft (see Junker 1929, 42, Ab. 4).³⁹ This emphasis may also be indicated by the so-called "air shafts" in the King's Chamber of the Great Pyramid (see Edwards 1981).

The king's satellite pyramid, as a material symbol of the king or his *ka*, would have stood at the head of a train of tombs of the royal family, the "community of *kas*," instilling vital force (Frankfort 1948, 61–78) and leading his entourage to an association with the northern heaven. This architectural expression, had it been completed, may have received ritual emphasis with the burying of a wooden statue of the king, or his *ka*, in the subterranean chamber of the replica pyramid. Suitable offerings would have been provided, thereby fulfilling the dictate of the Pyramid Text, "You shall set the king as a magistrate among the spirits, the Circumpolar Stars, in the north of the sky, who rule over offerings and protect oblations" (Pyr. 1220; Faulkner 1966, 156).

To the extent that it expressed this theme, the replica pyramid of Khufu may have functioned much as Zoser's serdab, attached to the north side of the Step Pyramid, which

39 To see the north stellar destiny of the deceased in a possible reconstruction of the original position of these "reserve heads" at the bottom of the funeral shaft is admittedly one of the "more elaborate interpretations" of this class of artifacts.

However, the fact that they may have been created first and foremost as sculptor's prototypes (Millet 1981, 129–31) does not necessarily negate the possibility of a magical function for the "reserve heads" in the tomb.

contained the royal image tilted up toward the northern sky (Firth, Quibell, and Lauer 1935–6, 50–1, Pls. 27–30; Lauer 1936, 78–81, Pls. XXII–IV).

We might further speculate that another idea was expressed in the connexion between the tomb of Hetep-heres I and the satellite pyramid of Khufu. As the king was Horus, the queen mother may have been associated with Hathor, or Isis, the mother of Horus, the living king, or Nut, the mother of Osiris, the dead king. Frankfort (1948, 171–80) pointed out that “the mother image fullfills a distinct function in the Egyptian belief of a life after death—— it holds out the promise of immortality” (Ibid., 174). In effect, the king’s rebirth invokes the image of a return to, and passage through, the mother.⁴⁰ As was spelled out in the Pyramid Texts (Pyr. 616 d–f) and pictorially represented in the 18th Dynasty, the sarcophagus chamber, and the coffin, could be identified with Nut; “thus the dead king is put to rest in the body of his mother, and rebirth is assured” (Ibid., 176). Could this be the reason for the location of the tomb of Hetep-heres I, the queen-mother of Khufu, at the head of the whole royal family cemetery, and on line with the king’s burial chamber up in the superstructure of his main pyramid (see p. 51 seq.; Fig. 9)? The same theme may likewise have prompted the change in plan which moved Hetep-heres I’s pyramid tomb, GI-a, over to the west so that its entrance passage (and the approximate north-south alignment of the three queens’ pyramids) would line up with the north-south axis of the king’s replica pyramid, which stood as a substitute for his larger pyramid tomb. For the divine mother theme to have been played out in the cemetery layout, the transference of mythical roles would have to have been extended to the queen-mother, in addition to the king. Thus we would have to assume that Hetep-heres could have been identified with Nut, who is beseeched: “Mayest thou put this Pepi into thyself as an imperishable star” (Pyr. 782; Frankfort 1948, 176–7).

It seems that onto this great north-south layout of queens’ pyramids and king’s replica pyramid, an east-west layout intruded. The new arrangement included the mortuary temple with its pillared court, first elaborated in Khufu’s complex (Ricke 1950, 44), the central western sanctuary, and the long causeway running down to the Valley Temple. The whole departed from a carefully surveyed position on the center east-west axis of the main pyramid. Whether this elaboration of the east-west cult layout reflects an emphasis on the theme of the “First of the Westerners” and the Osirian destiny of the king (Ricke 1950, 42–7), or the preponderance of the solar over the stellar theme in the funerary program (Breasted 1912, 100–117; Edwards 1961, 291–3; Badawy 1964, 193, 197–8; cf. Schott 1970, 59–67), it appears as though it forced the abandonment of the satellite pyramid of Khufu. One would imagine that, as close as it is to the main Pyramid, any small chapel or the larger mortuary temple could only have been built after the pyramid was largely completed and the ramps and debris were taken away. The indications that the expanded mortuary temple was begun after queen’s pyramid, GI-a, had been founded have already been pointed out (see p. 67 seq.). The shift in plan for the northern part of the Eastern Cemetery could have been effected in the final stages of work on the Khufu complex.

The expansion of the temple, may have acted, in certain respects, as an equivalent force or symbol in opposition to the satellite pyramid. This might have been seen in the general sense of both being depots for offerings, those in the temple being continually renewed (Ricke 1950, 125), and in servicing, and identification with, the royal *ka*. As the satellite pyramid might have been, in one sense, a material symbol of the *ka* (Lauer 1962, 133 n. 2), so the temple might have been personified as the king’s *ka*, if a New Kingdom representation is indicative (Frankfort 1948, 67). In the funerary temple of Seti I at Gurneh the king

40 Frankfort (1948, 174–5) goes on to cite Pyramid Text 809 as a disclaimer for the actual

earthly, as opposed to divine, parentage of the king.

is shown before a female figure with the *ka* arms on her head embracing the name of the temple. The association with the mother, and by implication the king's rebirth, is also here. The words of the personified temple are: "Behold, I am behind thee, I am thy Temple, thy mother, forever and forever (Nelson 1942, 131–32).

Ricke (1950, 45–6, 60f., 198f.) explains the recess and the narrow niche leading back into the sanctuary of the mortuary temple as the "Door of Nut," and he interprets it as the rebirth (i. e. re-entry into the mother as the sky-goddess) of the king as a star. Arnold (1977, 9) pointed out that the scenes on the walls of this niche in later mortuary temples never show the goddess Nut, although they do represent the king being suckled by other goddesses (Borchardt 1910, Abb. 21, 23; Jequier 1936, II, Fig. 2, Pls. 30–3). This might support the interpretation that the king's rebirth, and not just his divine origin (Frankfort 1948, 174) is being emphasized.

Finally, while it was never completely superceded, the north-south alignment to the north was further intruded upon by the program of burying great boats alongside the main pyramid; two on the south, facing east and west respectively, and two on the east, flanking the temple and facing north and south. Černý (1955) has pointed out that the purpose of these boats may have been to enable the king to depart in any of the four cardinal directions. The fifth pit was for the burial of the boat which brought the king's body to his pyramid and was, therefore, placed just at the termination of the causeway outside the entrance to the funerary temple, which is where the satellite pyramid would have been situated, had it been built. The set of boat pits must have been the very last element fashioned into the Khufu funerary layout, as attested by the cartouches of Djedefre found with the quarry marks on the underside of the roofing blocks of the eastern boat pit on the south side of the Pyramid (Abubakr and Youssef 1971, 9–11; Figs. 4–6).

One final possibility might be considered, although it will be placing one possibility upon another. When the king's replica pyramid was abandoned, could GI-a have been taken over as his satellite pyramid? Until now it has been argued that GI-a was prepared for Hetepheres I after a start had been made on a pyramid substructure, GI-x, just south of her original shaft tomb. The shift in the axis of GI-a was made to align with the king's replica pyramid. Certainly the burial chamber of GI-a is like those of GI-b, GI-c, and generally similar to those of GIII-b and GIII-c in the Men-kau-re complex. The latter arrangement has two queens' pyramid lined up behind the satellite pyramid of the king, GIII-a (which was later used for an actual burial, perhaps of a queen).

As Reisner suggested (1942, 71–2) GI-a was begun first, followed closely by the other two in the Khufu layout. It would have been logistically very practical to have built all three queens' pyramids simultaneously. When the king's replica pyramid was abandoned in favor of the expanded mortuary temple and final route of the causeway, GI-a might have been taken over for the king's purposes, even though it had been built for the queen-mother. Had she been transferred from G7000x to GI-b, and GI-a taken as the king's satellite pyramid, the north-south sequence of king, queen-mother, queens, and the flanking princes' mastabas would have been preserved.

In addition to the fact that GI-a was left at the northern head of the Eastern Cemetery, and its proximity to the mortuary temple, one striking feature prompts one to consider that the king took over GI-a for his satellite pyramid: the absence of any trace of a mortuary chapel, contrary to the remains at the center east bases of GI-b and GI-c (Reisner and Smith 1955, 3–4). Smith (*Ibid.*) states that the chapel of GI-a "has been completely destroyed, leaving only the surface of the rock that had been cleared to take the foundations." It is true that the bedrock surface at the center east side of GI-a has been regularized. However, it seems strange that if a chapel had been built, no trace of its ground-plan would exist on the surface. It is also hard to explain why this chapel would have been selectively and total-

ly removed, while those of the other queens' pyramids were left.⁴¹ Certainly Khufu's own mortuary temple was almost totally denuded down to the bedrock, but enough traces remain in the surface for much of the ground plan to be reconstructed. If G1-a had finally come to serve as the king's cult pyramid, we might expect that a pair of stelae, like those found at the east center base of the Bent Pyramid's satellite pyramid at Dahshur, would have been erected on the flattened bedrock surface at the east center base of G1-a. Yet no traces of a chapel nor stelae were found at Khafre's satellite pyramid (Hölscher 1912, 35, 69), and the satellite pyramids of the 5th and 6th Dynasties, like those of Userkaf (Firth 1929, 67) and Pepi II (Jequier 1936, 9) are lacking their own chapels. Perhaps, as in the cases of the 5th and 6th Dynasty satellite pyramids, the fact that G1-a is immediately adjacent to the mortuary temple itself obviated the need to attach a special chapel.

41 The chapel of G1-c is the best preserved probably because it was incorporated into the small Temple of Isis, Mistress of the Pyramid in the 21st Dynasty (see Jones and Millward 1982).

Enough remains of G1-b's chapel to get an rough idea of its general form, although the walls are almost completely removed down to the original floor level.

References Cited

- Abd el-Al, A.H. and A. Youssef (1977). An Enigmatic Wooden Object Discovered Beside the Southern Side of the Giza Second Pyramid. *Annales du Service des Antiquités de l'Égypte* 62, 103–20, Pls. I–XV.
- (1979). *Annales du Service des Antiquités de l'Égypte* 63, Pls. I–II.
- Abubakr, A.M. and A. Youssef (1971). The Funerary Boat of Khufu. *Beiträge zur ägyptischen Bauforschung und Altertumskunde* 12 (Festschrift Ricke), 1–16, Tf. 1–9.
- Altenmüller, H. (1972). Bemerkungen zur frühen und späten Bauphase des Djoserbezirks in Saqqara. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 28, 1–12.
- Arnold, D. (1977). Rituale und Pyramidtempel. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 33, 1–14.
- Badawy, A. (1964). The Stellar Destiny of Pharaoh and the So-Called Air Shafts of Cheops Pyramid. *Mitteilungen des Instituts für Orientforschung der deutschen Akademie der Wissenschaften zu Berlin* 10: 2–3, 189–206.
- Barsanti, A.M. (1901). Ouverture de la pyramide de Zaouiét el-Aryān. *Annales du Service des Antiquités de l'Égypte* 2, 92–4.
- Borchardt, L. (1907). *Das Grabdenkmal des Königs Ne-user-Re*. Leipzig.
- (1910). *Das Grabdenkmal des Königs Sabu-Re I*. Leipzig.
- (1926). *Längen und Richtungen der vier Grundkanten der Grossen Pyramide bei Gise*. Berlin.
- (1932). *Einiges zur dritten Bauperiode der grossen Pyramide bei Gise*. Berlin.
- (1937). Zur Geschichte der Pyramiden VIII: Weiteres zur Baugeschichte der Stufenmastaba bei Saqqara. *Zeitschrift für ägyptische Sprache und Altertumskunde* 73, 106–14.
- Breasted, J.H. (1912). *The Development of Religion and Thought in Ancient Egypt* (Harper and Row 1959 ed.). New York.
- Brinks, J. (1979). *Die Entwicklung der königlichen Grabanlagen des Alten Reiches*. Hildesheim.
- Brunton, G. (1920). *Labun I, The Treasure*. London.
- Carter, H. (1917). A Tomb Prepared for Queen Hatshepsut and Other Recent Discoveries at Thebes. *Journal of Egyptian Archaeology* 4, 107–14.
- Černý, J. (1955). A Note on the Recently Discovered Boat of Cheops. *Journal of Egyptian Archaeology* 41, 75–8.
- Clarke, S. and R. Engelbach (1930). *Ancient Egyptian Masonry*. London.
- Cole, J.H. (1925). *The Determination of the Exact Size and Orientation of the Great Pyramid of Giza (Survey of Egypt, Paper No. 39)*. Cairo.
- Dunham, D. and W.K. Simpson (1974). *The Mastaba of Queen Mersyankh III*. Boston.
- Edwards, I.E.S. (1961). *The Pyramids of Egypt*. Harmondsworth, Middlesex: Penguin ed.
- (1981). The Air-Channels of Chephren's Pyramid. *Studies Ancient Egypt, the Aegean, and the Sudan*. Boston, 55–7.
- Fakhry, A. (1959). *The Monuments of Sneferu at Dahsbur I: The Bent Pyramid*. Cairo.

- (1961). *The Monuments of Sneferu at Dabshur II: The Valley Temple*, 2 pts. Cairo.
- (1969). *The Pyramids*. Chicago.
- Faulkner, R.O. (1966). The King and the Star Religion in the Pyramid Texts. *Journal of Near Eastern Studies* 25, 153–61.
- Firth, C.M. (1929). Excavations of the Department of Antiquities at Saqqara: October 1928 to March 1929. *Annales du Service des Antiquités de l'Égypte* 29, 64–70.
- Firth, C.M. and B. Gunn (1926). *The Teti Pyramid Cemeteries I*. Cairo.
- Firth, C.M., J.E. Quibell, and J.P. Lauer (1935–36). *The Step Pyramid I–II*. Cairo.
- Frankfort, H. (1948). *Kingship and the Gods*. Chicago.
- Gardiner, A. (1925). The Secret Chambers of the Sanctuary of Thoth. *Journal of Egyptian Archaeology* 11, 2–5.
- (1957). *Egyptian Grammar* (3rd ed.). London.
- Gautier, J.E. and G. Jequier (1902). *Fouilles de Licht*. Cairo.
- Goneim, M.Z. (1957). *Horus Sekhem-khet, The Unfinished Step Pyramid at Saqqara I*. Cairo.
- Goyon, G. (1969a). Quelques observations effectuées autour de la Pyramide de Khéops. *Bulletin de l'Institut Français d'Archéologie Orientale* 67, 71–86.
- (1969b). La Chaussée monumentale et le temple de la pyramide de Kheops. *Bulletin de l'Institut Français d'Archéologie Orientale* 67, 71–86.
- (1977). *Le Secret des Bâisseurs des Grandes Pyramides Khéops*. Paris.
- Haeny, G. (1969). Die Steinbruch- und Baumarken. *Das Sonnenheiligtum des Königs Userkaf. Beiträge zur ägyptischen Bauforschung und Altertumskunde* 8, 23–47.
- Hayes, W.C. (1934). The Entrance Chapel to the Pyramid of Se'n-Wosret I. *Bulletin of the Metropolitan Museum of Art, New York* 29: 2, 9–26.
- Helck, H.W. (1956). Zur Entstehung des Westfriedhofs an der Cheops Pyramide. *Zeitschrift für ägyptische Sprache und Altertumskunde* 81, 62–5.
- (1973). Die Handwerk- und Priesterphylen des Alten Reiches in Ägypten. *Die Welt des Orients* 7, 1–8.
- Hölscher, U. (1912). *Das Grabdenkmal des Königs Chephren*. Leipzig.
- Jéquier, G. (1927). Rapports préliminaire sur les fouilles exécutées en 1926–27 dans la partie méridionale de la nécropole Memphite. *Annales du Service des Antiquités de l'Égypte* 27, 49–61.
- (1933). *Les Pyramides des reines Neit et Apouit*. Cairo.
- (1936). *Le Monument funéraire de Pepi II, Vol. I*. Cairo.
- (1938). *Deux pyramides du Moyen Empire*. Cairo.
- Jones, M. and A. Milward (1982). Survey of the Temple of Isis, Mistress of the Pyramid, at Giza, 1980 Season: The Main Temple Area. *The Journal of the Society for Study of Egyptian Antiquities* 12: 139–50.
- Junker, H. (1929). *Giza, Grabungen auf dem Friedhof des Alten Reiches bei den Pyramiden von Giza I*. Vienna and Leipzig.
- (1951). *Giza, Grabungen auf dem Friedhof des Alten Reiches bei den Pyramiden von Giza X*. Vienna.
- Kaiser, W. (1969). Zu den königlichen Talbezirken der 1. und 2. Dynastie in Abydos und zur Baugeschichte des Djoser-Grabmals. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 25, 1–21.
- Kaiser, W. and G. Dryer (1982). Umm el-Qaab: Nachuntersuchungen im frühzeitlichen Königsfriedhof 2. Vorbericht. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 38, 211–69.
- Kendall, T. (1982). Ritual Pottery from El-Kurru. *Ancient Egyptian Ceramics* (Colloquium on Ancient Egyptian Ceramics: Nontypological Approaches to Ceramic Material). Boston: Museum of Fine Arts.

- Lacovara, P. and M. Lehner (forthcoming). An Enigmatic Object Explained.
- Lansing, A. (1920, 1926, 1934). The Museum's Excavations at Lisht. *Bulletin of the Metropolitan Museum of Art*, New York 15, 3–11; 21: 2, 33–40; 29: 2, 4–9.
- Lauer, J.P. (1936). *La Pyramide à degrés I–II*. Cairo.
- (1938). Restauration et transfert au Musée Égyptien d'un panneau orné de faïences bleues extrait de la Pyramide à Degrés à Saqqarah. *Annales du Service des Antiquités de l'Égypte* 38, 551–66.
- (1947). Le Temple funéraire de Khéops à la grande pyramide de Guizeh. *Annales du Service des Antiquités de l'Égypte* 46, 245–59.
- (1949). Note complémentaire sur le temple funéraire de Khéops. *Annales du Service des Antiquités de l'Égypte* 49, 111–23.
- (1955a). Le Temple haut de la pyramide du roi Ouserkaf à Saqqarah. *Annales du Service des Antiquités de l'Égypte* 53, 119–33.
- (1955b). Sur le dualisme de la monarchie égyptienne et son expression architecturale sous les premières dynasties. *Bulletin de l'Institut français d'archéologie orientale* du Caire 55, 153–71.
- (1962). *Historie monumentale des pyramides d'Égypte*. Tome 1: *Les pyramides à degrés (III^e dynastie)*. Cairo.
- (1968). Recherche et découverte du tombeau sud de l'Horus Sekhem-khet dans son complexe funéraire à Saqqarah. *Revue d'Égyptologie* 20, 97–107.
- (1971). Raison première et utilisation pratique de la "grande galerie" dans le pyramide de Khéops. *Beiträge zur ägyptischen Bauforschung und Altertumskunde* 12 (Festschrift Ricke), 133–41.
- (1974). *Le Mystère des Pyramides*. Paris.
- Lehner, M. (1983). Some Observations on the Layout of the Khufu and Khafre Pyramids. *Journal of the American Research Center in Egypt* 20 (in press).
- Lepsius, R. (1897). *Denkmäler aus Aegypten und Aethiopien, Text I*. Leipzig.
- Lucas, A. (1932). The Use of Natron in Mummification. *Journal of Egyptian Archaeology* 18, 62–66.
- (1962). *Ancient Egyptian Materials and Industries*. (4th ed., revised by J.P. Harris). London.
- Lythgoe, A.M. (1915). Excavations at the South Pyramid of Lisht in 1914. *Ancient Egypt* 1915, 145–53.
- Mace, A.C. (1921, 1922). Excavations at Lisht. *Bulletin of the Metropolitan Museum of Art*, New York. Nov. 1921: Part 2, 5–19; Dec. 1922: Part 2, 4–18.
- Maragioglio, V. and C. Rinaldi (1962). *Notizie sulle Piramidi di Zedefra, Zedkara Isesi, Teti*. Turin.
- (1963). *L'Architettura delle Piramidi Menfite II: La Piramide di Sechemkhet, La Layer Pyramid di Zauiet el-Aryan, e le minori piramidi attribuite alla III dinastia*. Rapello.
- (1964). *L'Architettura delle Piramidi Menfite III: Il Compresso di Meydum, la Piramide a Doppia Pendenza e le Pietra di Dabsiur*. Rapello.
- (1965). *L'Architettura delle Piramidi Menfite IV: La Grande Piramide di Cheope*. Rapello.
- (1966). *L'Architettura delle Piramidi Menfite V: Le Piramidi di Zedefra e di Chefren*. Rapello.
- (1967). *L'Architettura delle Piramidi Menfite VI: La Grande Fosse di Zauiet el-Aryan, la Piramide di Micerino, il Mastabat Faraun, la Tomba di Khentkaus*. Rapello.
- Millet, N.B. (1981). The Reserve Heads of the Old Kingdom. *Studies in Ancient Egypt, the Aegean, and the Sudan*. Boston, 129–31.
- Morgan, J. de (1895). *Fouilles à Dachour, Mars–Juin 1894 (I)*. Vienna.
- (1903). *Fouilles à Dachour en 1894–1895 (II)*. Vienna.

- Nelson, H. (1942). The Identity of Amon-Re of United-with-Eternity. *Journal of Near Eastern Studies* 1: 2, 127–55.
- O'Connor, D. (1974). Political Systems and Archaeological Data in Egypt. *World Archaeology* 6: 1, 15–37.
- Perring, J.E. (1839–1842). *The Pyramids of Giza (From Actual Survey and Measurement)* (3 pts.). London.
- Petrie, W.M.F. (1883). *The Pyramids and Temples of Gizeh*. London.
- (1890). *Illahun, Kabun, and Gurob*. London.
- (1892). *Medum*. London.
- Petrie, W.M.F., G. Brunton, and M.A. Murray (1923). *Labun II*. London.
- Petrie, W.M.F., E. Mackay, and G.A. Wainwright (1910). *Meydum and Memphis* (III). London.
- Porter, B. and R. Moss (1974). *Topographical Bibliography of Ancient Egyptian Texts, Reliefs, and Paintings* III. 1: *Memphis, Abu Rawash to Abusir*. Oxford.
- Reisner, G.A. (1927). The Tomb of Hetep-heres. *Bulletin of the Museum of Fine Arts*, Boston. Special supplement to Vol. XXV (May), 2–36.
- (1928). The Empty Sarcophagus of the Mother of Cheops. *Bulletin of the Museum of Fine Arts*, Boston 26, 76–88.
- (1931). *Mycerinus, the Temples of the Third Pyramid at Giza*. Cambridge, Mass.
- (1935). *The Development of the Egyptian Tomb Down to the Accession of Cheops*. Cambridge, Mass.
- (1942). *A History of the Giza Necropolis I*. Cambridge, Mass.
- Reisner, G.A. and C.S. Fisher (1911). The Work of the Harvard University Museum. *Bulletin of the Museum of Fine Arts*, Boston 9, 54–9.
- Reisner, G.A. and W.S. Smith (1955). *A History of the Giza Necropolis II: The Tomb of Hetep-heres, the Mother of Cheops*. Cambridge, Mass.
- Ricke, H. (1944). *Bemerkungen zur ägyptischen Baukunst des Alten Reiches I. Beiträge zur ägyptischen Bauforschung und Altertumskunde* 4. Zurich.
- (1950). *Bemerkungen zur ägyptischen Baukunst des Alten Reiches II. Beiträge zur ägyptischen Bauforschung und Altertumskunde* 5. Cairo.
- (1970). Der Harmachistempel des Chepren in Giseh. *Beiträge zur ägyptischen Bauforschung und Altertumskunde* 10, 1–43.
- Rowe, A. (1931). Excavations of the Eckley B. Coxe Jr. Expedition at Meydum, Egypt, 1929–30. *The Museum Journal*, Pennsylvania 22: 5–47.
- Schott, S. (1970). Ägyptische Quellen zum Plan des Sphinxtempels. *Beiträge zur ägyptischen Bauforschung und Altertumskunde* 10, 51–79.
- Simpson, W.K. (1978). *The Mastabas of Kawab, Kbafkbufu I and II*. Boston.
- Smith, W.S. (1952). Inscriptional Evidence for the History of the Fourth Dynasty. *Journal of Near Eastern Studies* 11, 113–28.
- (1960). *Ancient Egypt as Represented in the Museum of Fine Arts*, Boston. Boston.
- (1971). The Old Kingdom in Egypt and the Beginning of the First Intermediate Period. *The Cambridge Ancient History* 1: 2 (3rd ed.), 160–79.
- Smith, W.S. and W.K. Simpson (1981). *The Art and Architecture of Ancient Egypt* (Penguin ed.). Kingsport.
- Spencer, A.J. (1978). Two Enigmatic Hieroglyphs and their Relation to the Sed-Festival. *Journal of Egyptian Archaeology* 64, 52–5.
- Stadelmann, R. (1980). Snofru und die Pyramiden von Meidum und Dahschur. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 36, 437–49.
- (1982a). Pyramiden, AR. *Lexikon der Ägyptologie* 32, IV: 8, 1205–63.
- (1982b). Die Pyramiden des Snofru in Dahschur: Erster Bericht über die Ausgrabungen

- an der nördlichen Steinpyramide. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 38, 379–93.
- Swelim, N. (1983). *Some Problems on the History of the Third Dynasty*. Alexandria.
- Varille, A. (1947). *À propos des pyramides de Sneferu*. Cairo.
- Vyse, H. (1840–42). *Operations Carried on at the Pyramids of Gizeh* (3 vol.). London.
- Wilson, J.A. (1946). Egypt. *The Intellectual Adventure of Ancient Man* (with H. and H.A. Frankfort, T. Jacobsen and W. Irwin). Chicago.



Fig. 21. North precinct of the Eastern Field, from the top of the Great Pyramid. A: unfinished pyramid cutting GI-x; B: tomb of Hetep-heres (G7000x); C: position of the replica passages; D: trench for marking the north-south axis of the satellite pyramid; E: block of masonry built onto the NE corner of the escarpment.

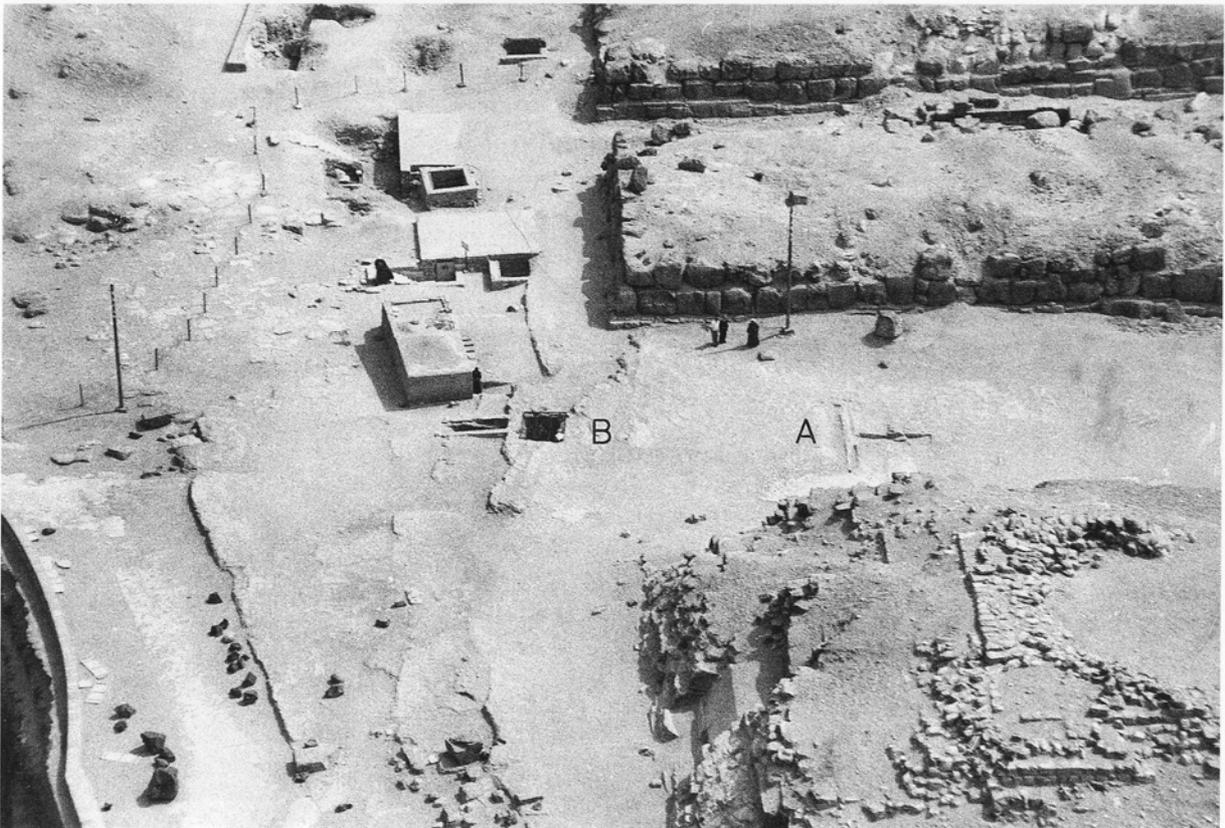


Fig. 22. Unfinished pyramid cutting GI-x (A), and the tomb of Hetep-heres (G7000x) (B).

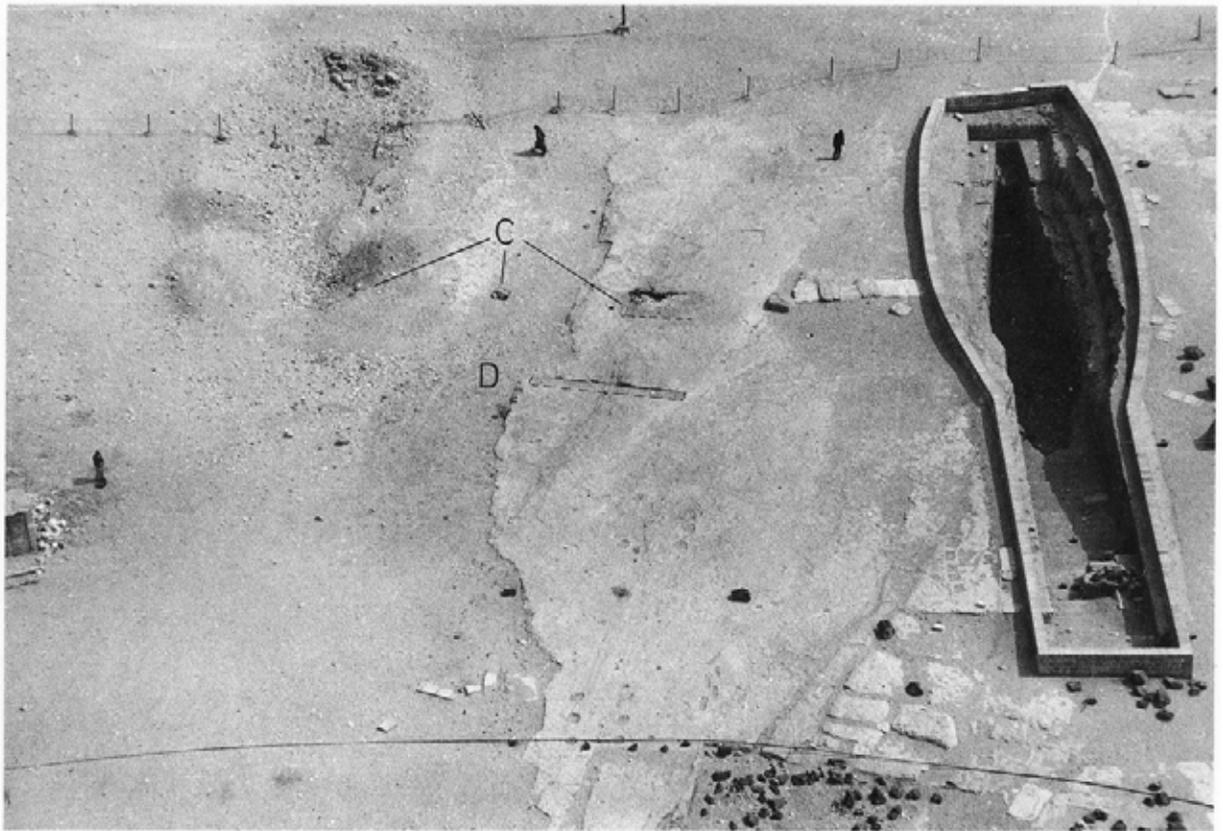


Fig. 23. Position of the replica passages (C) and the trench (D) to the north of the boat pit which lies parallel to the causeway of the Great Pyramid.



Fig. 24. Block of masonry built onto the NE corner of the escarpment.

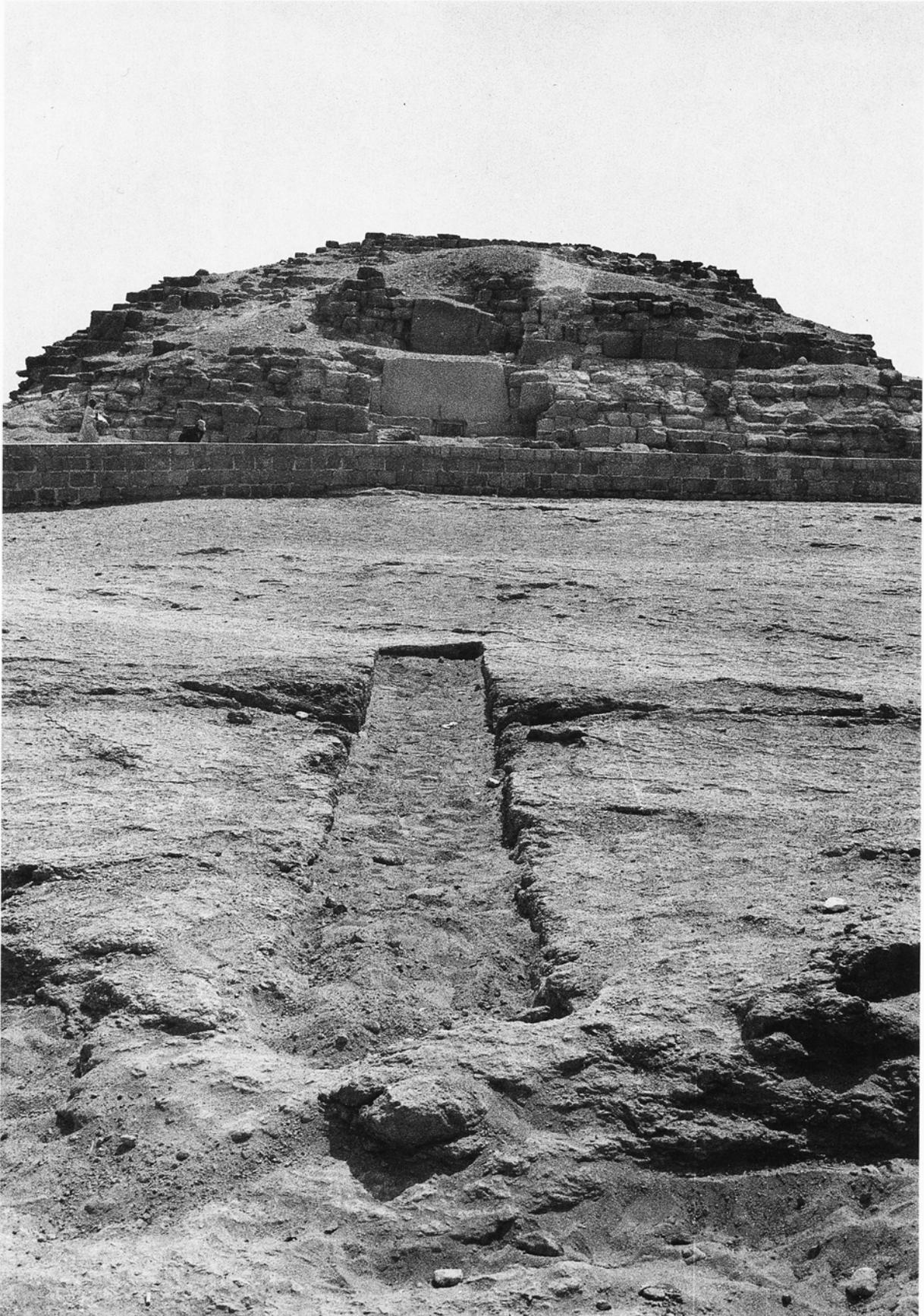


Fig. 25. Alignment of trench D with GI-a entrance passage and axis, looking south.

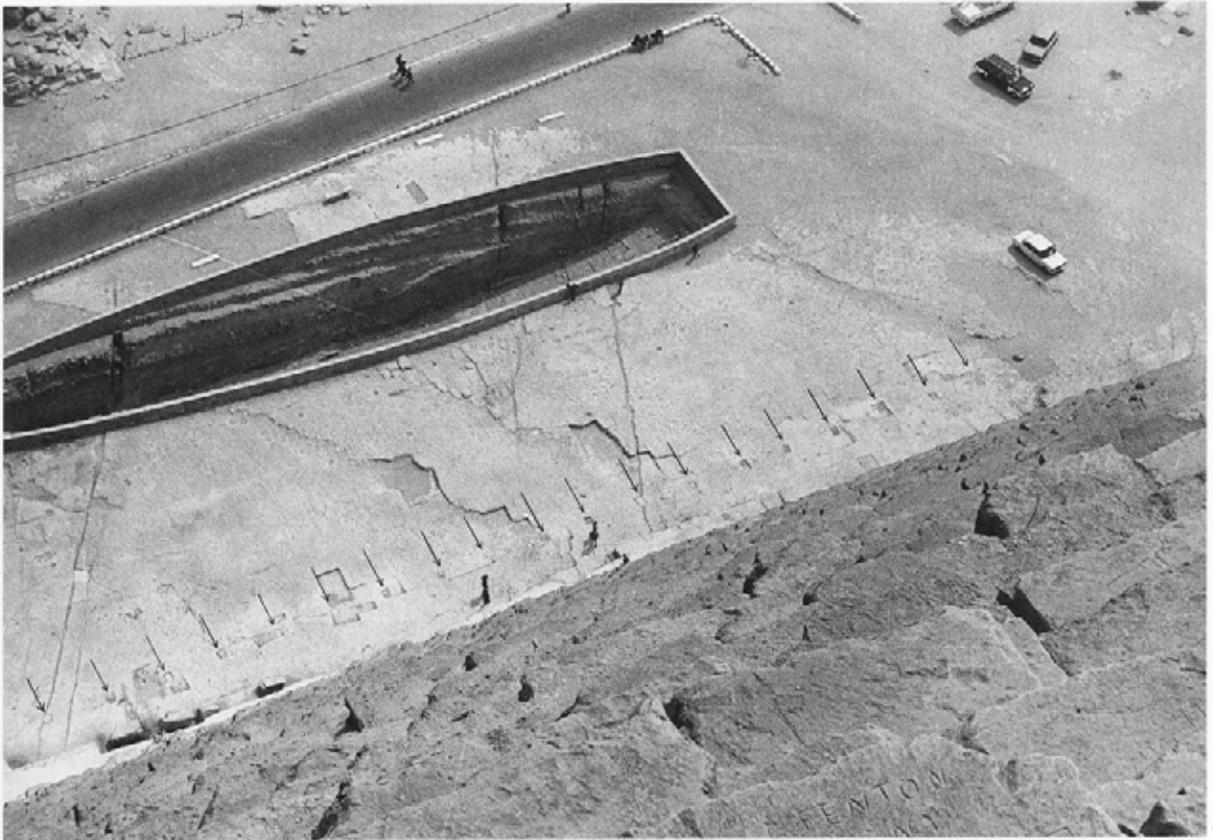


Fig. 26. Layout line of holes, east side of the Great Pyramid.



Fig. 27. NE corner of the Great Pyramid court.