

## Planning and building

I believe that a layer monument is an early stone building designed by architects who followed a canon, and was achieved by experienced masons. The project was supported and controlled by the religious and the ruling authorities. Spaced far apart from one another, the layer monuments are generally similar but have some differences in details.

They were built on level desert at Hebenu, Sinki, Nubt, and el Ghenimiya and irregular or sloping bed rock at Seila, el Kula and Elephantine.

The date of the layer monuments (minor step pyramids or archaic benbens) is no later than the reign of *Snfrw* thus in the early Old Kingdom. Little is known about their relationship to the famous pyramid tombs: stepped, bent, benben, and true forms? The properties of which, are:

- 1 - Correctness of shape,
- 2 - Stability of edifice,
- 3 – Maintenance of ancestral traditions and,
- 4 – Comprising: solar, Oserian, astral and royal cults.

While layer monuments of the early Old Kingdom are not tombs, and are missing those properties, namely:

- 1 -Their surviving shapes are faulty and we do not know how they ultimately looked,
- 2 - Their stability is questionable,
- 3 –There are no architectural forerunners,
- 4 – And there are a few signs of religious rituals.

Although the funerary pyramids of Egypt are close to perfection; nothing has been found concerning their: Planning, except for a remote one; logistics, building techniques, and administration.

The layer monuments have added very interesting information about:

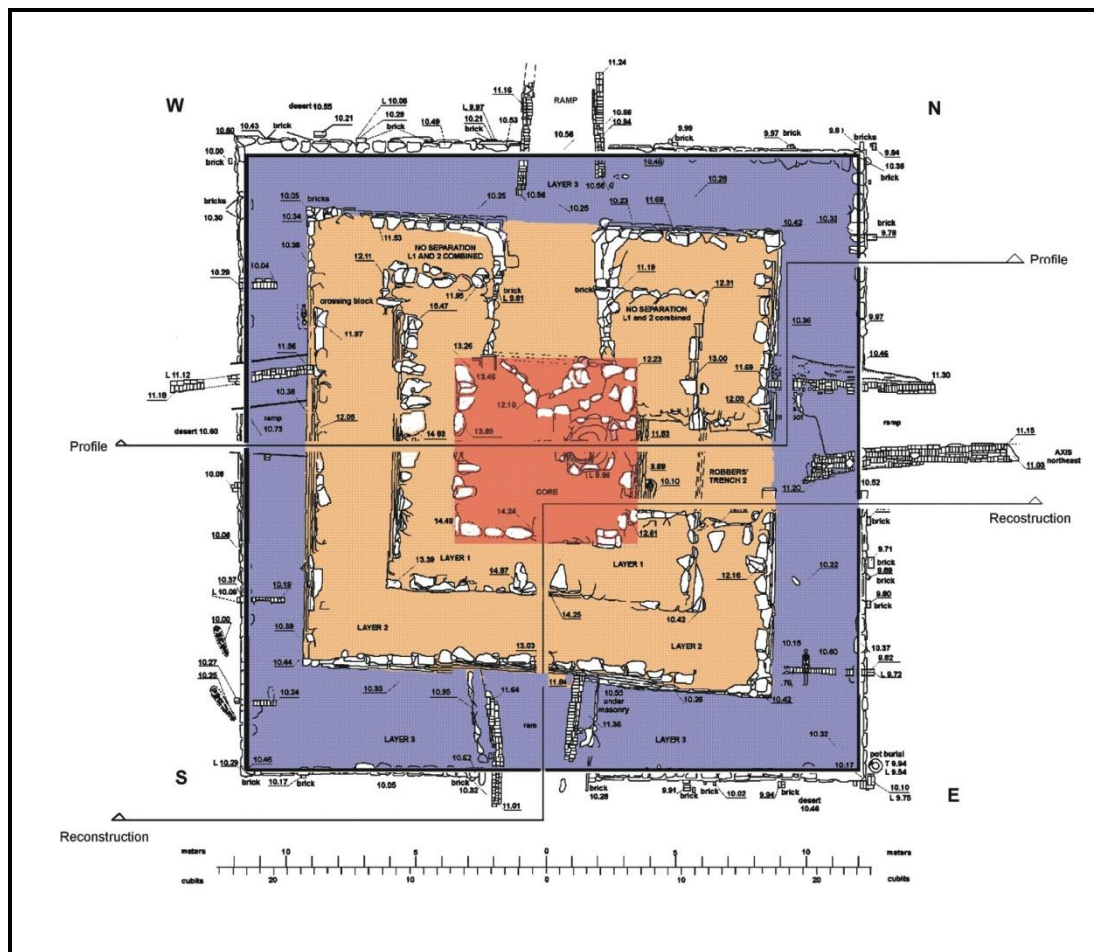
Construction on unlevelled rock and levelled desert  
Having no fixed orientation  
Planned with a nucleus (core and layers) and an outer facing  
They are locally supplied with material for building  
Setting brick markers for their plan  
Usage of ramps for building  
Making and correction mistakes  
Containing all errors within an outer facing

One cannot imagine however, that a layer monument just immersed out of the open desert with nothing around. We hitherto have no trace of a temenos wall or a pavement except at Seila where a north chapel shows the remains of a brick wall. Also at Seila the construction of an embankment across a small wadi was to create an artificial terrace for an east chapel. This construction shows similarities to the

archaic revetment at Hieraconpolis, the dam at Wadi Garawi, and the dike of the causeway of Unas. Moreover the idea of an artificial terrace was adopted east of the pyramid G2 of Khafra and around G3 of Menkura at Giza.

To achieve a level base for the monuments built on irregular or sloping bed rock (Seila, el Kula, Elephantine and the later pyramids G1a-c and G2) an infrastructural foundation had to be built. This was done to achieve a base for the monument's datum level and its pavement. On the other hand monuments built on desert surface (Hebenu, Sinki, Nubt, el Ghenimiya, the pyramids of Meidum, and Dahshur) a shallow pit had to be prepared.

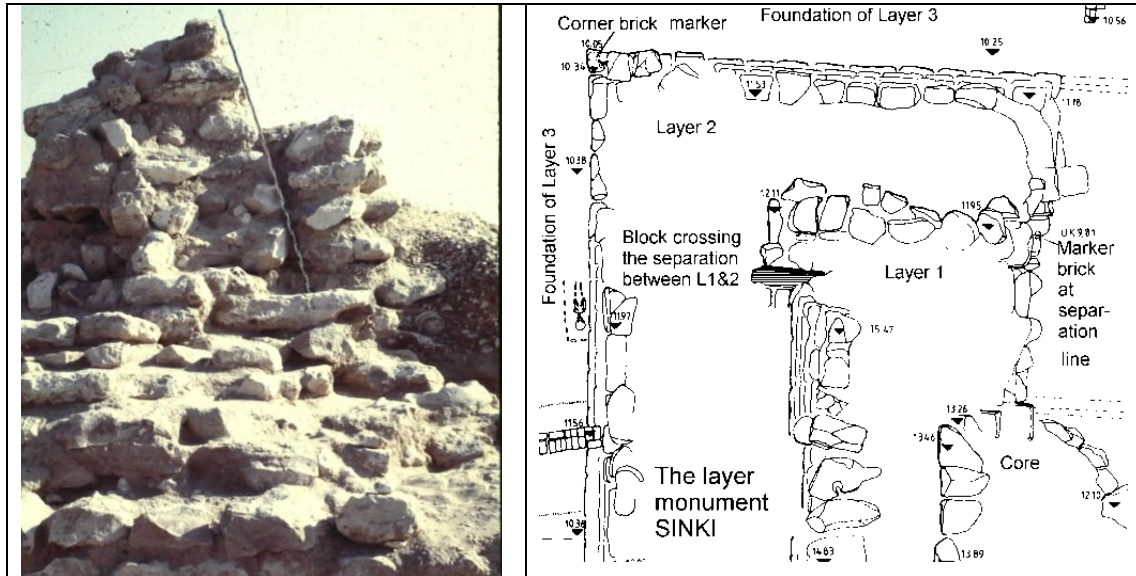
## AN OVERALL VIEW OF SINKI



The aerial view tells us the principal plan at Sinki was laid out with accuracy of measurements and in orientation by corners. The diagonals of the ultimate square base and of the core coincide. The faulty setting are at layers 1 and 2, they have distorted nucleus, and while the builders tried to maintain a 5 cubit width for these layers, the side angles were not uniform. Thus the layers swayed and concaved as their height increased.

The north and south corners are in a correct position; but the east and west corners are a little off in an anticlockwise direction. Consequently there is a slight deviation on the north-west and south-east sides. This perhaps could have been rectified had the outer facing had been built, as suggested in my drawing.

The same anticlockwise deviation is seen at the east and west corners of layer 2. This caused the south east and the south west sides to concave. Layer 1 deviates at the east corner, the west corner and no separation of layers on the northwest side; between layers 1 and 2, they merge in one block of masonry.

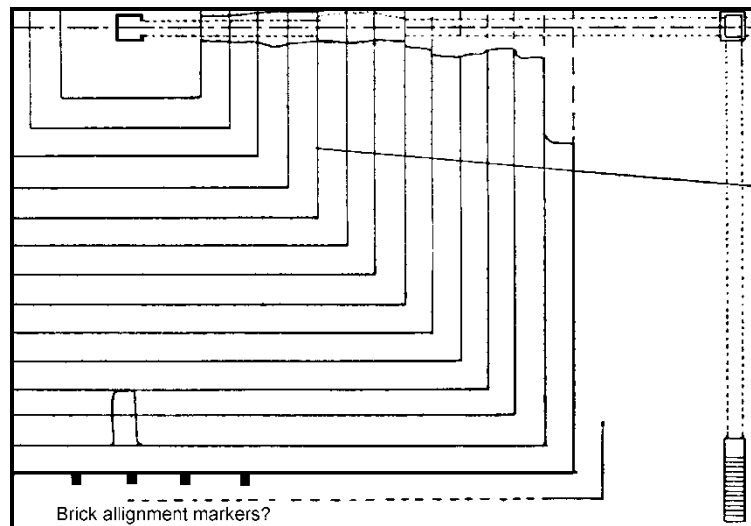


A reminder of the erroneous retreat of layer 2 at Sinki

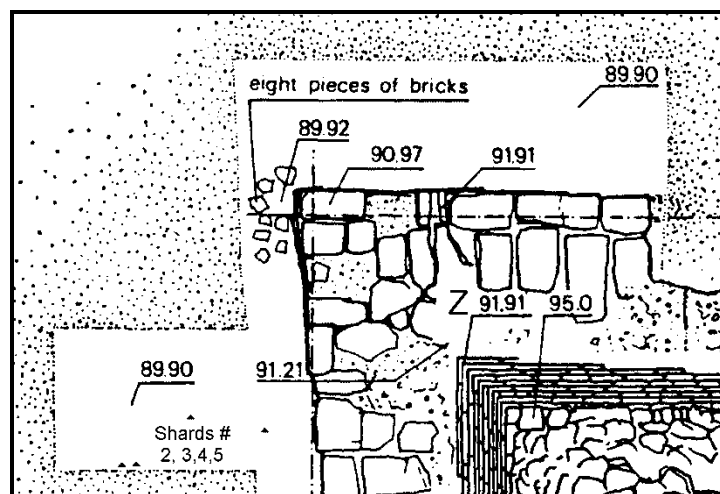
At the southwest side towards the west corner a single elongated block projects out of layer 1 into layer 2 as a reminder of the confusion created by the builders. It looks as if the builders were aware of an increasing error of their growing edifice. It shows how far back the face of layer 1 was receding.

## MARKERS AT DATUM LEVEL

Sinki revealed that before the actual building; brick markers were set on the ground as reference points for: the alignment of layers and lines of separation, orientation of the whole monument, the inclination of courses of layers. During the building process, other markers were set to indicate the alignment of the imbedded layers. Furthermore some markers do not seem to have clear connections though some of them were at regular distance of about 4 cubits on the western half of the northwest side. Bricks were used as markers at the Layer pyramid at Zawyet el Aryan.<sup>1</sup> Four protrusions east of layer 13 noted 'mud brick walls' by Dunham should be regarded in relation to the pyramid section as markers<sup>2</sup>; and some scattered bricks discovered at the infrastructure of the northwest corner of Seila.



Brick markers at the layer pyramid at Zawyet el Aryan



<sup>1</sup> Dunham D. *Zawiyet El-Aryan* MFA, Boston 1978, Plan of Pyramid p XI.

<sup>2</sup> D. Dunham, *Zawiyet el Aryan the Cemeteries Adjacent to the Layer Pyramid*, Boston 1978

## Brick fragments at Seila at the conglomerate level

### Alignment marker at Sinki

#### Alignment of the layer sides

More bricks were set on the ground level around the foundation of layer 3. They apparently revealed the alignment of the imbedded core, layers 1 and layer 2. Such markers were found:

At least 3 alignment markers on the northeast side revealing:

The north-west side of layer 2.

The south-west side of the core.

The south-west side of layer 1.

At least 4 alignment markers on the south-east side revealing:

The north-east side of layer 2.

The north-east side of layer 1. Figure 5/4.

The south-west side of the core.

The south-west side of layer 2.

At least 1 alignment marker on the south-west side revealing:

The north-west side of layer 2.

At least 2 alignment markers on the north-west side revealing:

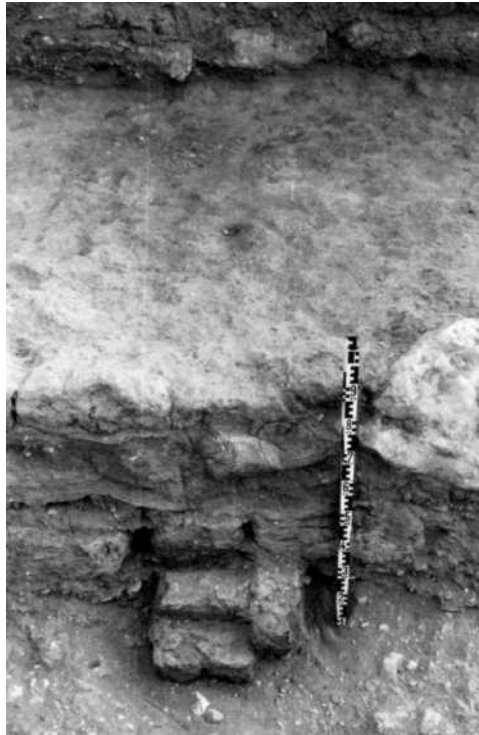
The south-west side of layer 2.

The north-east side of layer 2.

Brick marker references were a primitive form of references found at later pyramids. At Giza all around the pyramids G1 and G2 of Khufu and Khafra are shallow holes cut into the bed rock, and into the artificial terrace, for orientation, levelling, alignments and surveying these projects.<sup>3</sup>

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<sup>3</sup> M, Lehner, *The complete Pyramid*, AUC press 1997. 220



Unexpectedly layers 1 and 2 were integrated as one solid block of masonry at the north-west side of Sinki. In the robber's trench which had penetrated it, bricks were set on the ground and under the masonry, at a position where a separation of the two layers should have normally been.

Separation markers were unexpectedly found at the position where layers 1 and 2 were integrated as one solid block of masonry at the north-west side of Sinki. In the robber's trench which had penetrated it, bricks were set on the ground and under the masonry, at a position where a separation of the two layers should have normally been.

### **Orientation of the corners**

At Sinki over the roughly levelled desert surface brick markers were set at the layer corners.

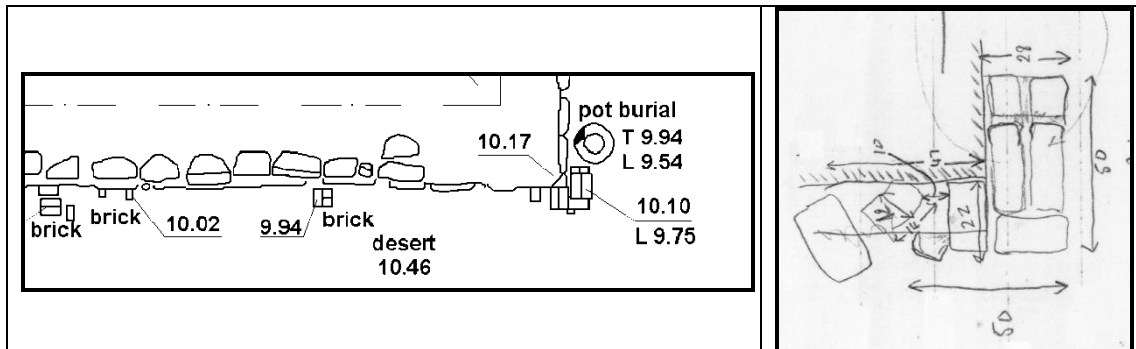
With markers set at the corners of the foundation of layer 3 the final orientation of Sinki was set:

A few remains at the north corner.

Traces at the south and west corners.

4-5 well preserved courses at the east.

Markers were absent at 3 corners of layer 2. The 4<sup>th</sup> west corner was built over 2 bricks markers. Thus it is not surprising that the nucleus is distorted in orientation and shape.



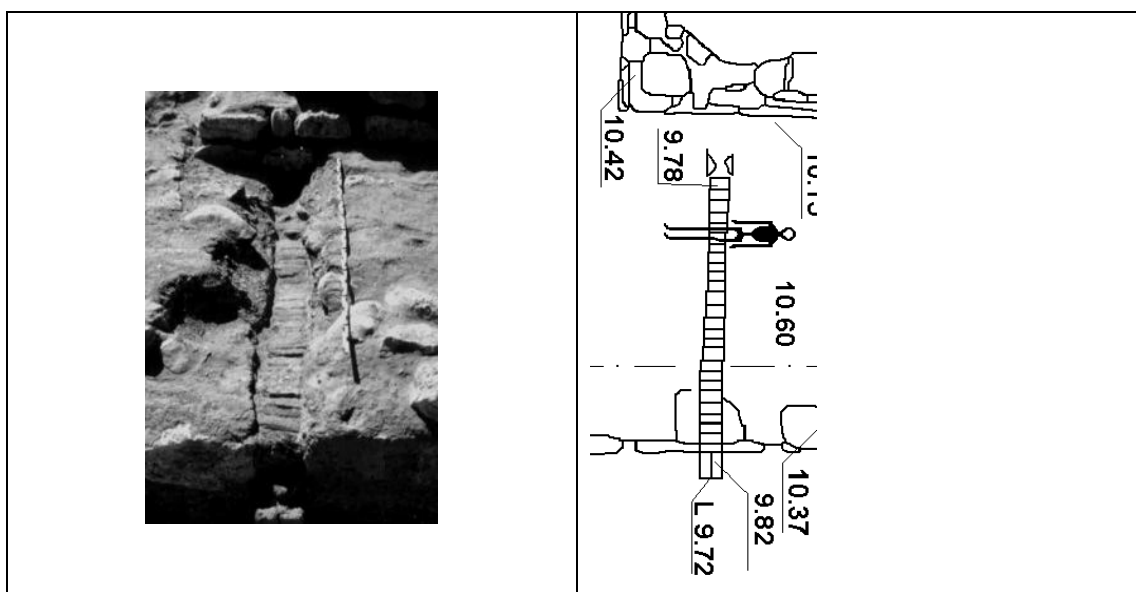
Corner marker of layer 2 at Sinki

### Inclination of the courses of masonry

At Sinki several inclination brick markers were set:

One of them was uncovered on the north-east side.

3 were uncovered on the south-west side. They consisted of rows of mud bricks set on the ground across the width of layer 3 sloping at an angle of 7-10°. The rows consisted of stretchers, which in some cases exceeded the layer width. Two courses of stone masonry and mortar filled in-between.

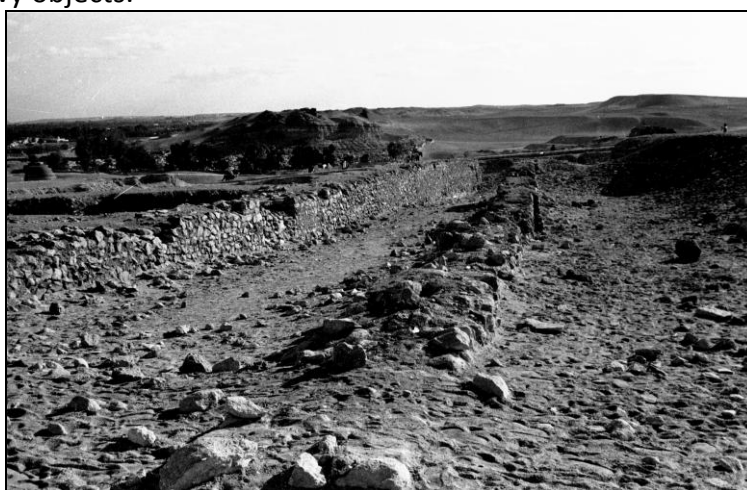


Inclination marker at Sinki



## RAMPS

Though one may think that ramps come under another heading, I consider them as important as the markers in maintaining the plan already laid out by the brick markers. The sites of the layer monuments allowed enough space for straight ramps to be built; except Seila and perhaps Elephantine. The clearance around Sinki has supported this idea. On all four sides of its nucleus, running from the surrounding desert over the foundation of layer 3, were the remains of construction ramps. These ramps were composed of a filling between 2 walls. In all walls the brick courses sloped upward toward layer 2 at an angle of about  $15^{\circ}$ - $16^{\circ}$ , i.e. a ratio of a distance of  $<4$  to a rise of 1; and consequently it were thought that this was the ascending angle of the ramps.<sup>4</sup> I believe, however, that such a slope would be too steep because these slopes were suited for climbing on foot, and not for dragging heavy objects. A more gentle slope is, a ratio of  $6:1 = 10^{\circ}$  or even  $10:1 = 6^{\circ}$  for dragging heavy objects.



At Giza the remains of a great ramp south-west of the pyramid G1c was built having 2, rough stone walls 5.5 metres apart. The eastern wall was in 2 layers because the desert sloped in that direction. The filling in-between had unknowingly been cleared.<sup>5</sup> As it is directed to the unfinished pyramid G1x it is logical to assume that the ramp was there to serve the project and others close by on the plateau. If the height of G1x was to be equal to the pyramids G1a, b, and c, the ramp, would have rose at  $6^{\circ}$ . The stone blocks at Giza were heavier and this ramp was larger than the modest ones of Sinki. Nothing discovered would have obstructed building longer and gentler ramps. Consequently I consider that the remains of the ramps at Sinki were denuded, unfinished or were for building the lower courses of the monument.

The builders of Sinki abandoned their project short off finishing the 1st step. If they had begun building it, they would have constructed other ramps further away from the monument. Consequently they would have had 2 sets of ramps:

1. The nucleus-ramps were constructed for supplying stone blocks and building material to construct the lower part of the nucleus (i.e. core, layers 1 and 2).

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<sup>4</sup> D Arnold, *Building in Egypt Pharaonic Stone Masonry* Oxford 1991, 81.

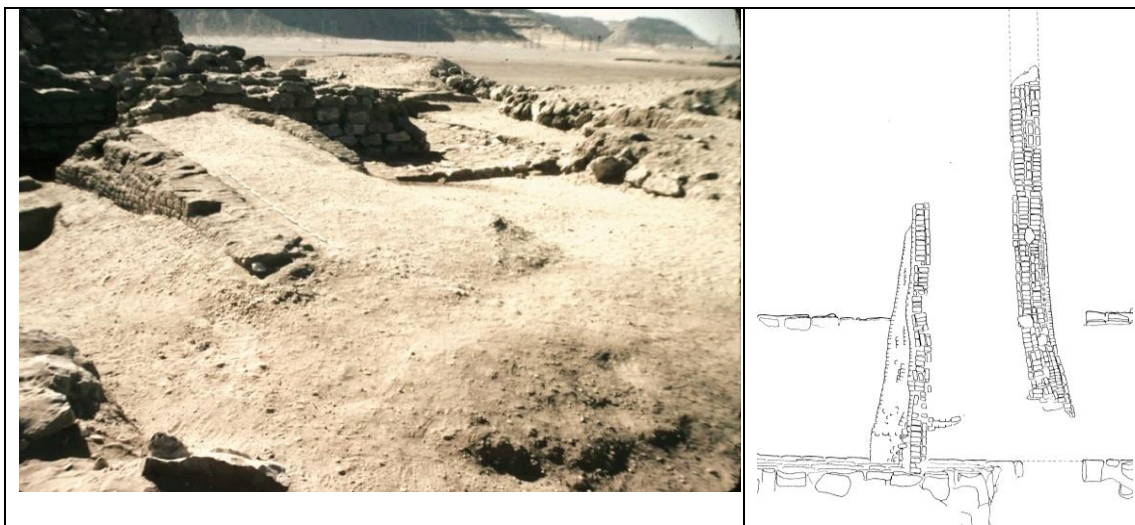
<sup>5</sup> Arnold, Ibid, fig 3.33, in this photo the direction to G1x, is clear; A. Saleh, Tafl 25 a, *MDAIK*, 30.

2. As the need for the quantity of building material decreased, Fewer and fewer ramps would be used, ultimately be imbedded in a step pyramid or a benben shape.

Although the remains of nucleus-ramps are not well preserved, it appears that those on the northeast and southeast sides were supported and built better than those on the northwest and southwest sides. This perhaps could indicate that the latter ramps were only used at the beginning of construction. While the former ramps were used until the nucleus was completed.

#### **Ramp on the north-east side**

The best-preserved ramp is the one on the northeast side. It has a height of 1.35 meters bringing it to the sixth course of masonry of layer 2. It could be traced over a length of 12 meters. The walls and fill widen from 3 meters on the surrounding desert surface to an estimated 5.25 meters where it would have rested on layer 2. The fill near layer 2 measures 3 meters and at a distance of 3.50 meters away from it, measures 2.20 meters. The north brick wall are one header and one stretcher thick, 0.40 meters, while the south brick wall is 2 header and one stretcher thick, 0.60 meters. It is built on stone courses over the foundation of layer 3. Brick supports reinforce the sides of the ramp. The robbers destroyed part of the southern wall while digging their northeast trench



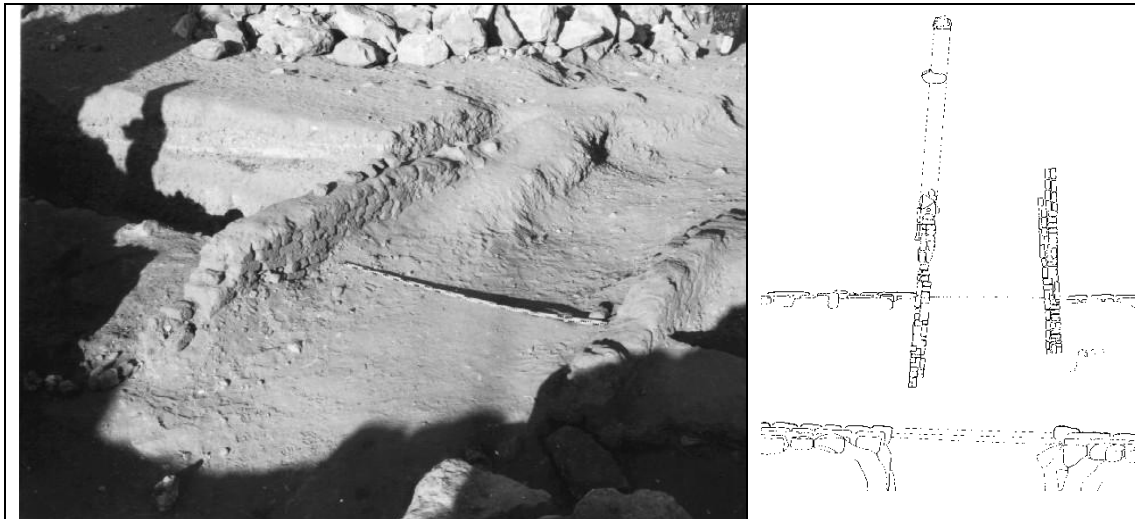
The ramp on the north-eastern side of Sinki

#### **Ramp on the north-west side**

Two mud brick walls stand with no support or filling between them on the northwest side. At the beginning of our work in 1980 they were completely buried. It is surprising that during the visit of Wilbour in 1883 they were clear enough to be identified.

Each of the remaining parts of the 2 walls measure 3.75 meters long, crossing the edge of the foundation of layer 3. There are 2 stone blocks in line with the western wall 8.5 meters from the nucleus. An empty area 2-2.5 meters wide separates the walls. The thickness of the walls is a mixture of headers and stretchers measuring 0.50 meters

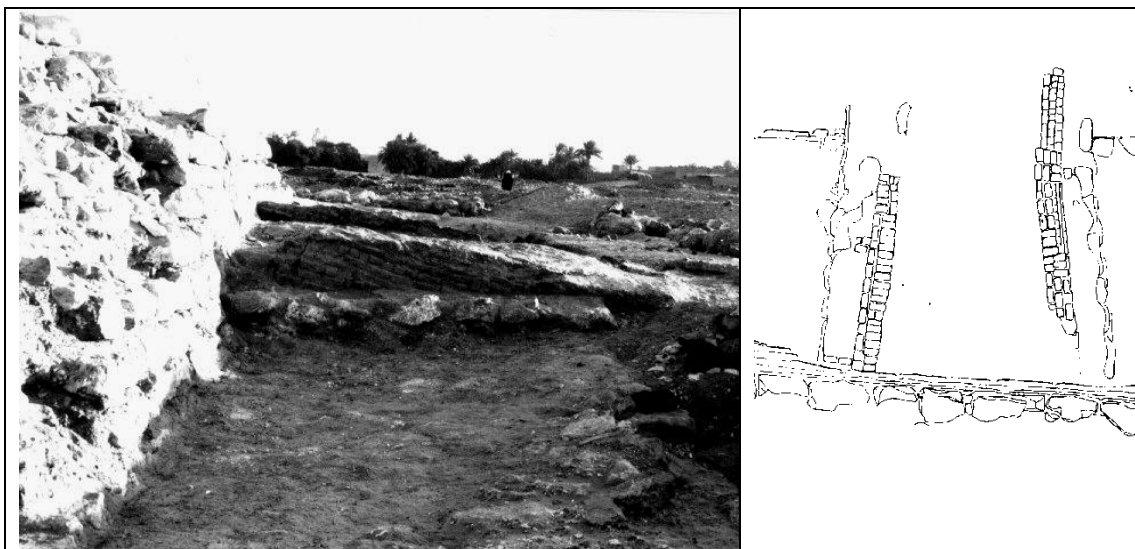
This was probably the earliest plundering of Sinki. After the filling between the 2 walls was removed, the destruction continued into the nucleus creating the robbers northwest trench.



Ramp on the north-western side of Sinki

### Ramp on the south-east side

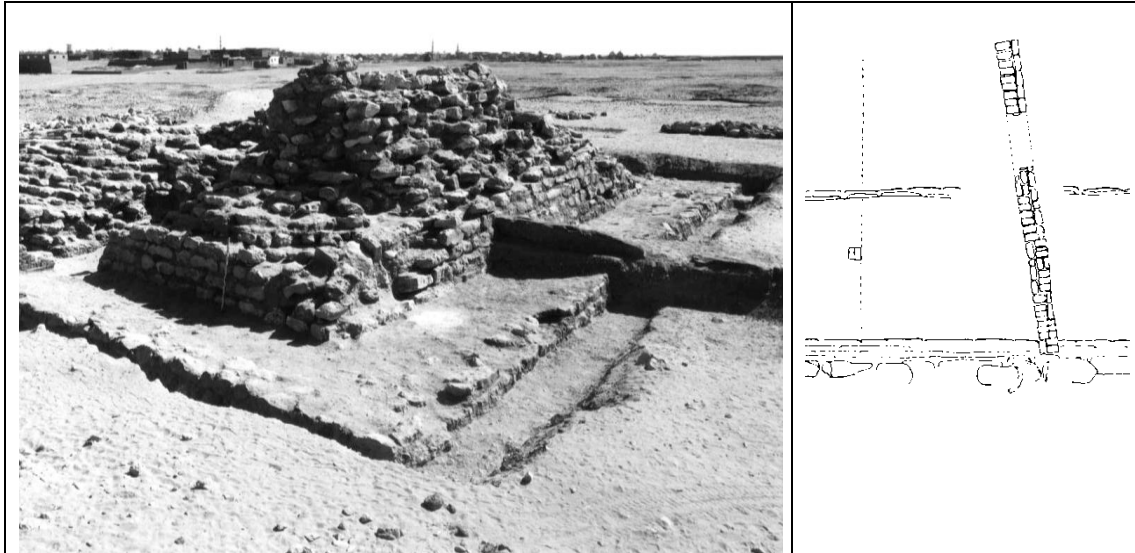
The ramp on the southeast side was completely buried at the beginning of our work it runs over the foundation of layer 3 also. It is reinforced by stonework, 3 courses on the east side and 2 courses on the west side. The brick walls above are only one header and one stretcher thick about 0.45 meters. The width of the ramp between the walls widens: 3 meters wide at layer 2 and 2.35 meters wide, 3.5 meters away.



The ramp on the south eastern side of Sinki

### Ramp on the south-west side

One wall and a few bricks of the other were found during our investigation. They were completely covered with pebbles thrown at a particular concretion during the ritual. The length of the preserved wall was 5 meters; its width was 0.45 meters and the distance between the two walls was 2.80 meters. It had a height of 1.20 meters reaching the fourth course of layer 2



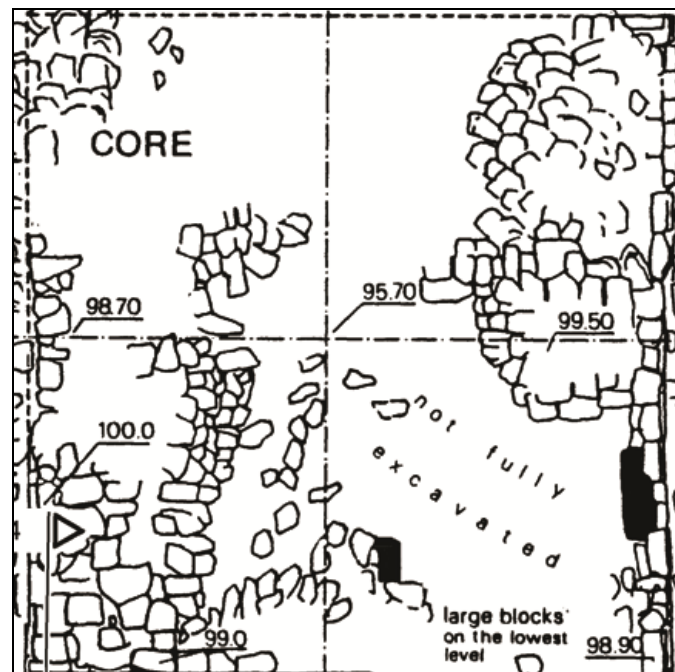
The ramp on the south-west west side at Sinki

### Ramps for the final-monument-ramps

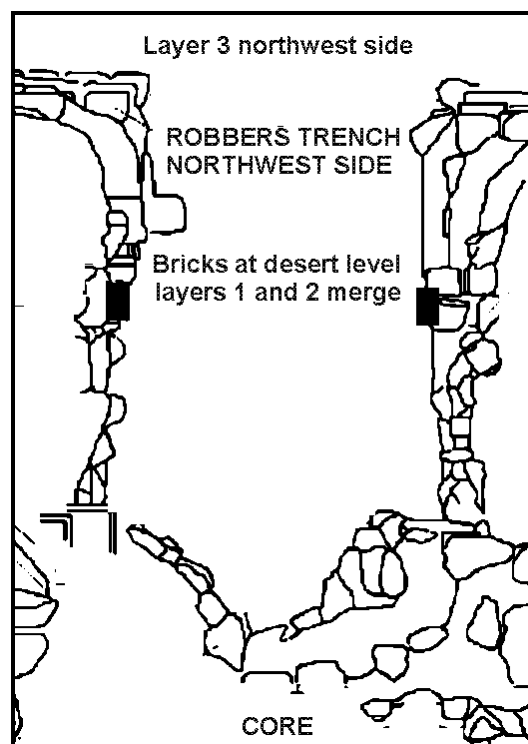
The nucleus-ramps, resting on layer 2, had to be cleared off the foundation of layer 3 and final-monument-ramps would replace them. The new ramps would have rested on the final monument.

If layer 3 had been built, the lower courses would have been laid by manual lifting; the upper courses would have been laid by means of gentle sloping ramps. Layer 3 will grow constructing the 1st step and the faces would be cased. The uppermost parts of the final monument, 25 cubits high, will need one ramp, which may have been 250 cubits long.

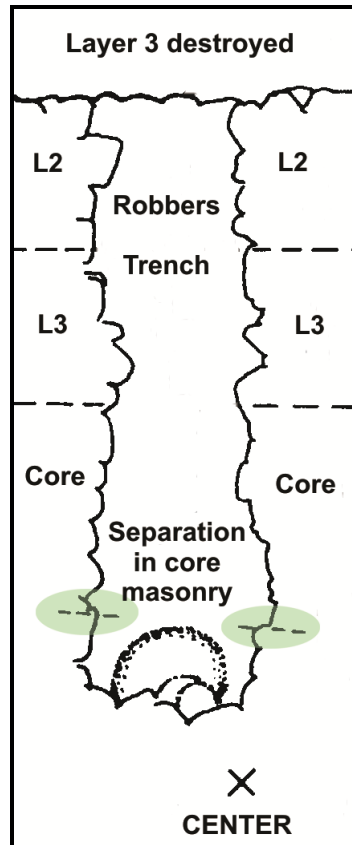
## Other unexplained observations on planning



The robber's trench penetrates into the core of Seila exposing 2 megaliths at a depth of 5 metres



The robber's trench on the northwest side of Sinki reveals that layers 1 and 2 are not separated and of the bricks set on the desert level at the position of the separation



The robber's trench penetrating the core of Elephantine, on the north side; it reveals a separation in the masonry. The line of this separation is not parallel to the monuments axis.