# The Bent Pyramid

A Layman's Guide part 2

*Plus updates to previous papers*

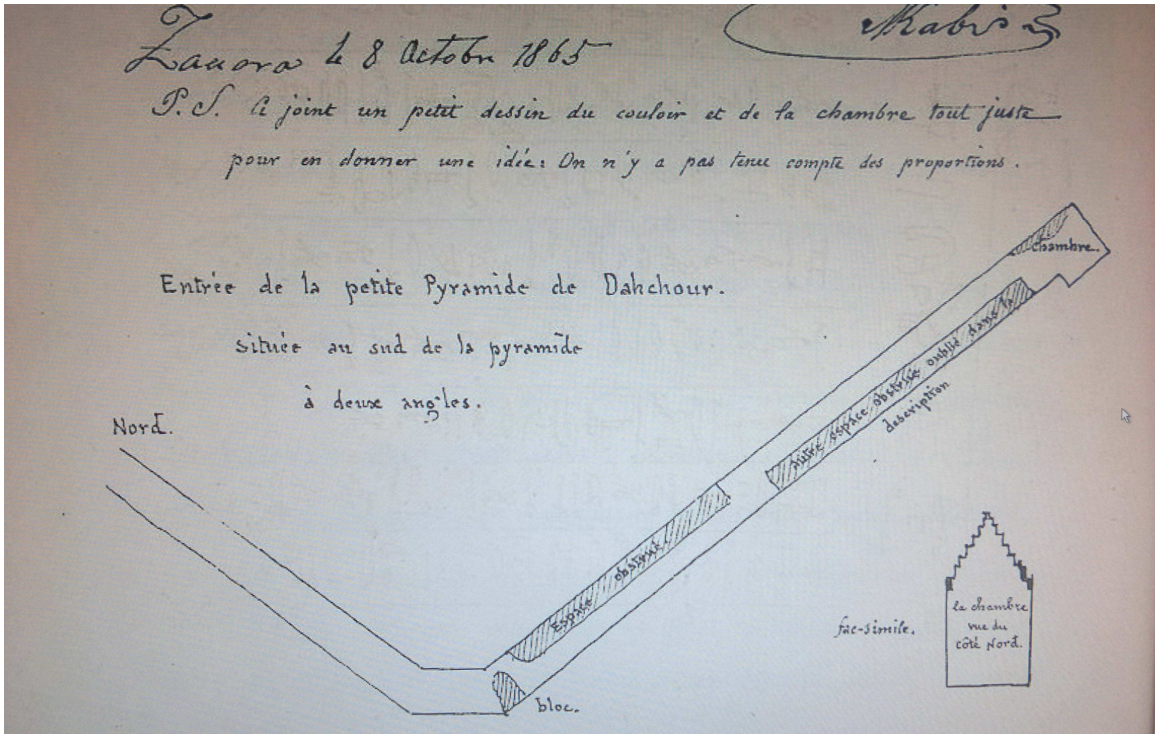
Keith Hamilton. 03 August 2017


**Subsidiary Pyramid**

The Subsidiary pyramid like the Bent pyramid still awaits thorough exploration. Our first view on the interior of the Subsidiary pyramid comes from Mariette who published a section of the pyramid given to him by a Greek called Kabus; this drawing is to be found in *Les Mastabas 1889, page 582.* Fakhry states;

*"In the year 1869, Kabis measured the interior of this pyramid and sent the result of his work in a letter to Mariette, which was published together with a sketch in Mariettes book"*

Further data on the pyramid has to wait until Petrie's arrival, where he provides some survey information on the pyramid and published in *A Season in Egypt 1887.* Unfortunately the entrance passage was blocked with rubbish so he could not furnish us with any details on the interior.



First view of subsidiary internals published by Mariette

It is not until 1947 when the interior and the northern side of the pyramid was cleaned by Abdulsalam Hussein; unfortunately Hussein's death in 1949 and subsequent loss of his notes has deprived us of valuable information, Fakhry can only add: *"but as far as I know nothing was found inside the pyramid except some fragments of pottery, as I was told by some of the workmen who were engaged in its cleaning."* Hussein's death is a sad loss, the course of pyramid research may have followed a different course, had he managed to publish his findings; Fakhry says of him *"He concentrated entirely on the pyramids themselves, searching only inside them and cleaning their corners."* Here was a rare Egyptologist who was prepared to do the necessary work inside the pyramids.

Fakhry's work on the pyramid, is limited to the clearing of the east side and part of the north side; for the interior of the pyramid he merely provides a description of it written by Herbert Ricke, amounting to one page of text and

two diagrams. As in the Bent pyramid, it is clear that Fakhry's attention's lay elsewhere; this may be down to budgetary constraints and what he thought he could best achieve in the time available, though his four seasons spans four years, actual days of work amounted to about eight months.

The more detailed description of the pyramid comes from V.Maragioglio and C.Rinaldi (M&R) in their *L'Architettura Delle Piramidi Menfite parte III 1964*. In their day the pyramid was accessible but with some difficulty.

A few photographs of the inside are published in Fakhry's volume 1. Once again I am indebted to ISIDA-PROJECT.ORG for their kind permission to use their images. All other 3D images are created by myself.

## Exterior

The pyramid is described as having a nucleus of local limestone with the backing and casing stones being in fine white limestone of equal quality to the Bent pyramid. As to the manner in which the nucleus was built M&R say; *"The state of conservation of the subsidiary pyramid is such that it is impossible to see whether the nucleus is in steps or not. In some points it is evident that some backing-stones in white limestone are partially covered by blocks of local limestone from the course above."* M&R provide a few possibilities of building sequence, but possibly only further clearance of debris and partial excavation can help settle the matter.

There appear to be no inclined courses, all courses were laid horizontally and different types of mortar appear to be used. M&R state;

*"the blocks were dressed only on the horizontal faces, while the vertical faces were left in the rough. The joints between the blocks, sometimes very big, were filled up with yellowish clay mortar containing limestone chips. The backing-stones and casing blocks are in fine white limestone equal to that employed in the major pyramid. They are mortared together as well as with the nucleus back of them by means of a pink chalky mortar. Some thick layers of mortar containing chips, placed between nucleus and backing-stones, are red instead of pink."*

The site was not leveled; M&R report that that the foundation consisted of three courses of blocks at the SW and SE corners and two courses of blocks at the NW and NE corners. They also report *"A low socle about 15cm wide*

*was cut on the upper face of the highest course of the foundation itself which was made with large white limestone blocks, regularly arranged.*

Images of  Socle

Image of surviving casing stone and socle

This image shows surviving casing stones on the east side and just visible in the right foreground are the stump remains of Stele discovered by Fakhry. M&R measured the first two courses on the north side, first course was 60cm and second course was 50cm. The casing stones themselves exhibit the same patching that we see present in the bent pyramid.

The dimensions of the pyramid by M&R are;

*"We measured the length of the north side of the pyramid base as 52.80m (100 cubits) and the measurement is precise because the casing still exists all along this side and is completely visible. The slope of the faces is about 44°30' and the height calculated according to this slope, was about 25.75m"*

The description by Ricke in Fakhry's vol 1 says;

*"On the east side, rather more than half the base line has been exposed; on the north it has been completely cleared. This base line is 52.40m (100 cubits) long. Above it, some traces of the outer casing remain, from which the inclined angle of 45° can be measured. The height of the subsidiary pyramid therefore attained 26.20m (50 cubits).*

Petrie's survey gives 2065.8 inches for the north side, or 52.47m, closer to Ricke's measure. Petrie's mean of the four sides is 2064.6 inches (52.44m). For the angle, Petrie states; *"The angle of the casing on a good block at the E.S.E. is 44°34'; and on a worse example, 45°3'; no other stone was in sufficiently good condition to be worth measuring. The height was therefore 2034 inches* (he probably means 1034 inches or 26.26m). Petrie also states that the subsidiary pyramid is exactly symmetric with the Bent, with a line joining their centres being -18°52′.

## Entrance

The entrance like the Bent pyramid has its axis aligned with the pyramids N-S axis, and according to M&R's drawing the entrance floor begins on top of the second course or 1.10m above pyramid base. A lot of the casing is missing around the entrance, but the walls of the entrance and descending corridor consist of two courses for a distance of approximately 6.3m, wherein the corridor walls in the lower part of the corridor consist of one course. A great quantity of sand prevented M&R from measuring the floor, but measuring from the ceiling they thought the original length of the ceiling to be 11.60m. The entrance corridor appears to be like the Bent's corridor in being a square section, but only larger, width is 1.20m and height of two courses is likewise 1.20m, however M&R thought that the paving stones inserted between the walls were laid down in the rough before being dressed as the joint line between the wall and paving is slightly higher, hence they give the corridor height as 1.21m.

The image above by Jon Bodsworth shows the current state of the Subsidiary pyramids entrance, the large stone over the doorway has a height of 1.45m and surviving casing stones can be seen top left.

This image shows how the wall courses, go from two to one single block.

It is interesting to note that in the descending corridor M&R provide detailed measures for each wall and ceiling joint; yet in the more contentious north corridor of the Bent pyramid, they provide zero detail on masonry makeup. Sadly for the rest of the corridor, horizontal and ascending they provide scant detail in their drawings on masonry makeup.

With the steel doors open we look down the descending corridor. On the floor M&R say; *"Along the middle part of the floor there are some small roundish notches (chiseled out in order to facilitate transit) which have been smoothed by long use."*

Looking up towards the entrance, the single course stones that make up the walls are visible in the foreground.

M&R say; *"The ceiling blocks were dressed before they were placed on the already smoothed side walls, since the ceiling plane coincides with the joint between the ceiling and side walls. However, we noticed that the side walls are dressed better than the ceiling. It is possible to see that some bits of stone broke away along the upper inside edges of the walls; the damage was patched with mortar and certainly it was due to the laying of the ceiling blocks."*

M&R say; *"The walls show clear signs of having been dressed with a chisel or pick-hammer."*

Looking down descending corridor and debris at bottom

The angle of the descending corridor is a quite steep 34 degrees; in fact it is steeper than the ascending corridor that held the limestone plugs which has an angle of 32°30′. At the bottom of the descending corridor we have a short horizontal corridor, measuring 1.50m (Ricke gives 1.45m) along the ceiling (floor not known due to debris, my CAD model suggests 1.97m) and vertical height of 1.305m. M&R appear to use a mix of Ricke's measures and their own in their drawings. A digging has been done on the west wall of the horizontal corridor; M&R thought it was the work of possible violators.

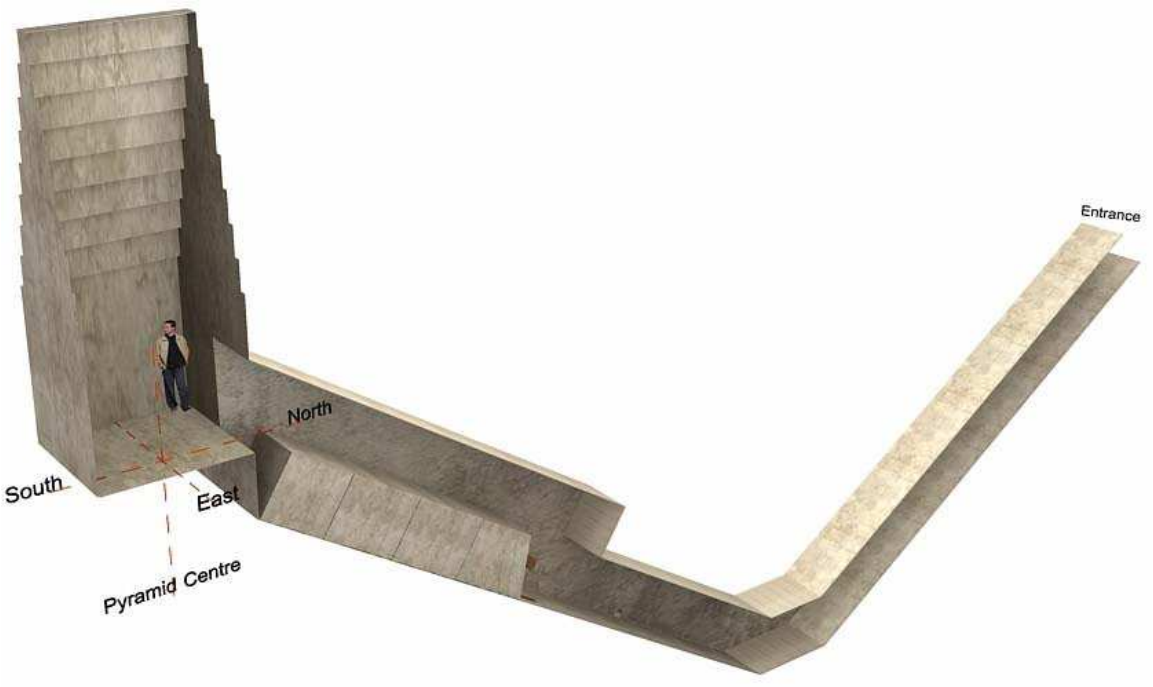
Looking up the ascending corridor, the walls appear to be made of single blocks. Note the holes at floor level, these holes have a diameter of about 22cm and their centres are 3.20m, measured from the start of the ascending

corridors ceiling. The western hole is deeper than the eastern hole, 29cm versus 14cm, which suggests that a beam was inserted at an angle into the west hole first and withdrawn to engage into the shorter east hole. Strangely the bottom part of the hole according to M&R's drawings is obscured by the paving stones; was this holes function used before the laying of the pavement, could a hidden shaft be under the floor? Again further scrutiny is required.

The ceiling of the ascending corridor some 5.65m from the start of the corridors ceiling suddenly increases by 1.10m to give a perpendicular height of 2.33m for the remainder of the corridor to the chambers entrance. The perpendicular height of the lower ascending corridor is higher than the descending corridor at 1.23m. The measures differ between Ricke's and M&R's drawings, Ricke gives 1.08m and 1.23m for a total of 2.31m. There are no individual measures for the surviving plug blocks, in Ricke's Fig 56, he suggests that the height of the plug stones was 1.185m and the space above to the ceiling is 1.125m.

Further up the ascending corridor floor a pair of grooves is to be found in the floor, 80cm in length and unknown depth, the north end of theses grooves starts 83cm from a line projected from the height extension of the corridor. The west groove starts 29cm from west wall and is 14cm wide; the east groove starts 77cm from west wall and is also 14cm wide, both grooves are therefore symmetrical about the corridor axis. M&R report small stones protruding out of the bottom end of these grooves that were deeply and strongly embedded, but did not feel that they were part of the original construction. These stones jutting out of the grooves are visible in Fakhry's volume 1, plate XLV.

Above these grooves in both walls are to be found holes 23cm wide and 19cm vertical, and centres 70cm from the floor; from M&R's drawing the centres appear to be in perpendicular alignment with the south end of the grooves. Like the holes lower down the corridor, they appear to have held a beam; the west hole is 15cm deep and east hole 38cm deep. This beam is thought to have restrained a possible 4 plug stones stored in the upper part of the ascending corridor. This higher upper part of the corridor is some 9.20m long, measured along the ceiling (my CAD drawing suggests total ascending corridor floor length to be about 13.86m).




These two images give an idea of the internal layout of the Subsidiary pyramid. The blocks are in the stored position.

One of the holes in the corridor wall

Looking down ascending passage, ceiling height is raised.


Same view further back with hole in left foreground


View of plug block, two blocks remain on the floor which failed to slide all the way down to the corridor end, they appear to have traveled a short distance and stopped, a further two are thought to have slid to the bottom,

and broken by violators, M&R could see no remains due to the accumulation of sand.

Top of plug block, the wall course joint gives a rough idea of height clearance afforded to the block on its journey down the corridor.

The width of the ascending corridor seems to vary, for the descending corridor M&R give one measure in their drawings of 1.20m, but in the ascending corridor two measures are given, one near the chamber entrance of 1.17m and the chamber entrance itself at 1.15m. In connection with these a red line is to be found on the ceiling, or bottom of the large stone that spans the entrance and full width of the chamber, that appears to denote the axis of the corridor as it is 58cm from the east wall.

The method of releasing these plug blocks is not clear, In Fakhry's Vol 1, fig 56, a drawing is produced showing oblique props, whose north end sits in the bottom of the groove with the south end of the prop, against the face of the leading plug. It is thought that the cross beam, inserted into the corridor walls restrained these blocks during storage, then come the day of closure the props would be fitted and the crossbeam removed; the props connected by ropes would then become a trigger to release the plugs when the ropes were pulled.

M&R thought that the two grooves at 80cm long appeared too long and that a simple notch in the floor would have sufficed. They say;

*"Therefore we think that the grooves contained two pieces of wood which projected just a little from the floor and lessened the initial friction of the blocks, allowing them to gain sufficient momentum in order to reach the bottom of the corridor. It may also be that the northernmost block had an oblique face, so that its lower edge already rested on the wooden pieces. The shape of this block would have helped it to pass into the lower part of the corridor: it would have also facilitated the transit of workman as well as the introduction of long objects into the pyramid, and finally it would have perfectly fitted the lower end of the ascending corridor. In this case the blocking system would have been put in motion by simply taking away the horizontal small beam in front of the blocks."*

M&R make a valid point on the long grooves, but I am not so sure on the idea of wood protruding above the level of the floor, would not the leading edge of remaining plugs run the risk of catching this wood and stall the plug from advancing down the corridor. Neither do they make it clear how this crossbeam is removed and the evacuation of workman who did it. Little details are available on the exact shape of these grooves, so it's hard to visualize how best they were utilized, but I think a trigger mechanism is likely required to enable workman to be clear of the area when the plugs were released. I suggest the following may have been done, the crossbeam may have held the plugs in storage, or wedges may have held the leading plug, with the crossbeam as backup; in the grooves oblique lengths of wood would be inserted to create a sort of ramp, with the bottom of the ramp facing the leading plug block, this ramp would rest on a beam at its north end, and this beam attached to rope. To load the trigger, workman may have levered up the leading plug, carefully removed any wedges and guided the leading plug onto the ramp made by the oblique pieces of wood; the crossbeam may have been a precaution to guard against any error in this operation. With the trigger set, the crossbeam could be removed, maybe liquid mortar or lubricant liberally applied, the rope would be pulled, the beam under the oblique pieces of wood removed, the pieces of wood would withdraw into the grooves, and the leading plug would start its journey down the corridor.

It is thought only two plugs made the journey, with the remaining last two plugs only moving a short distance before stopping on the floor, today

anyone lucky enough to gain access has to climb over these plugs to enter the chamber. What caused them to stop is not known, maybe a build up of dust and chippings from work on the chamber above found its way into the wall clearance gap and created enough friction to halt the last two plugs. The leading plug may have had an oblique face as M&R suggest, maybe even bosses left on it for levering, but even without an oblique face there appears ample room to introduce items into the chamber, which is only some 2.62m N-S. The distance from the crossbeam hole to the step at the chambers entrance is similar to the length of the lower part of the ascending corridor, so four plugs would fill its length.


Looking down the ascending corridor, crossbeam holes visible in walls and faint outline of grooves on floor. The embedded pieces of stone in Fakhry's Vol 1 photograph appear to be missing; maybe they were fitted in ancient times, by people worried that the remaining plugs might be dislodged. Like in the Bent pyramid, a more thorough exploration is required also on the subsidiary.

## The chamber

The chamber is a small size M&R say its floor is 2.62m (5cubits) N-S, and E-W is 2.40m (4.5 cubits); height from floor to first corbel is 2.70m (though by their course measures its 2.74m). Only the east and west walls are corbelled, which becomes the normal construction method in the Red pyramid; there are a total of 8 corbels with a combined height of 4.20m (8 cubits). Total height from the floor therefore is 6.90m. Corbel displacement is given as projecting about 15cm or two palms.

The small size of this chamber has concerned some Egyptologists, Fakhry in his *The Pyramids* book says, *"the chamber inside is so small that it could never have contained a burial"*. Likewise, Lehner says *"the burial chamber of the satellite pyramid is far too small to have contained a human burial. It may instead have been for the ritual interment of a statue of the king."* Another view from I.E.S. Edwards pyramid book, says of the subsidiary pyramid *"In this instance it seems likely that it was intended to fulfil the same function as the South Mastaba in the Step Pyramid enclosure, and consequently it has been conjectured that it was built as a tomb for the king's entrails, which were removed from the body during mummification, and perhaps also for his ka."*

Though the chamber is small, it cannot be said that it is too small for a human burial. A sarcophagus the size of Khufu's has a footprint of 2.28m by .98m and can easily be accommodated against the chambers south or west walls and take up about 1/3$^{rd}$ of the available floor space; though granted, it does not allow much for funeral equipment, but neither does the granite chamber under Djoser's step pyramid which has even less floor area at 4.9m², subsidiary has 6.4m².

The early pyramid complexes appear to have small subsidiary structures/pyramids with small chambers; I see nothing in the structures that could have prevented larger chambers being built, they sort of appear child size, but why bury a child? In Sekhemkhet's pyramid complex a mastaba was built south of his pyramid about midway between the pyramid and enclosure wall, Edwards says;

*"The substructure, which has been excavated by J.-P. Lauer, consists of a vertical shaft under the western end of the superstructure, a sloping corridor and a level passage leading to a small tomb-chamber measuring 11 ½ feet in*

*length and 8 ½ feet in breadth. The shaft, sunk through rock to a depth of about 95 feet, penetrates the roof of the level passage near its junction with the sloping corridor. It was filled with sand and rubble when the tomb was closed. Nevertheless, the ancient robbers were able to bore a tunnel through the blocking of the sloping corridor, skirt the base of the shaft and reach the tomb-chamber. No doubt they removed most of its contents, but they left a few fragments of gold foil embossed with a reed- mat pattern, some stone vases, pottery, animal bones and a badly decayed wooden coffin of a IIIrd Dynasty design. The gold foil may have been the overlay of an inner coffin of wood or of a box containing jewellery which had been reduced to dust. Inside the coffin, which measured only 3 feet 11 inches in length and 2 feet 4 inches in breadth, lay the skeleton of a child of eighteen months to two years, perhaps a son of Sekhemkhet, but it is improbable that the mastaba was built to be his tomb. Unfortunately the discovery leaves the questions raised by Zoser's South Mastaba still unanswered."*

I add the above excerpt from Edwards to the other theories as clearly there is an unsolved mystery to these small chambers and though Edwards thought it improbable, I feel it needs to be kept in mind.

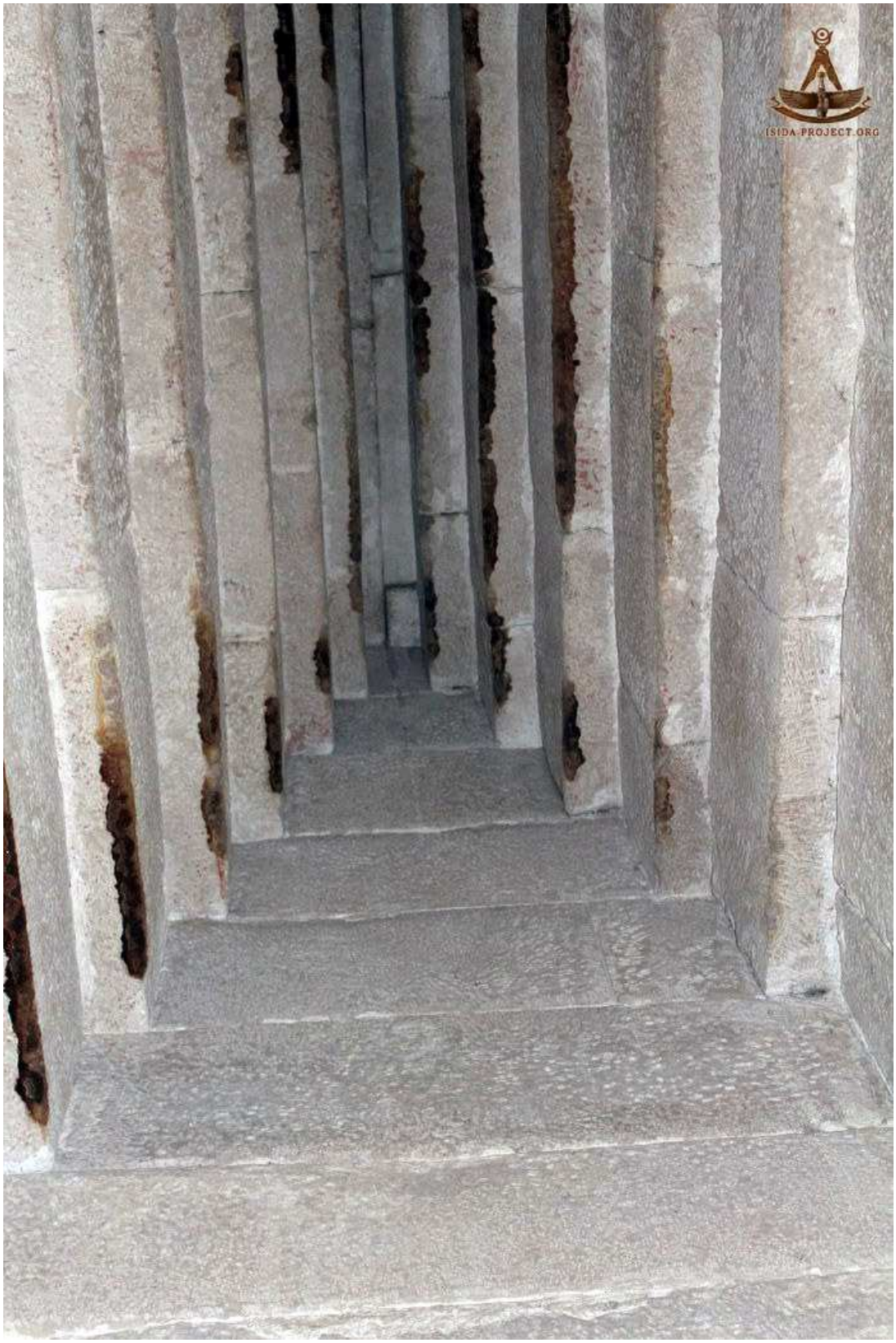
The entrance to the chamber is in the north-east corner, and is some 1.60m (3 cubits) high by 1.15m wide. The architrave above the door is a particularly large stone, spanning the full width of the north wall and having a height of 1.80m. M&R state that the remaining courses above the architrave are also monolithic. Also by the entrance at are two holes in the side walls, the east one is a few centimeters deep and at floor level; the west hole follows a curve that exits in the north wall of the chamber. Today a rope is fixed to this curved hole, to help visitors ascend into the chamber.

On all four walls a red line is to be seen running around the chamber 52cm (1 cubit) above the floor. The floor is especially made of large blocks, which form the step into the chamber and is 1.18m thick. The purpose of the red level line running around the chamber is not clear, it may have denoted an original floor level, was paving 1 cubit thick placed above the current floor? Such flooring may probably have been torn up by violators.

In the south-east corner a shaft appears to be cut down to a depth of about 4.20m from the current floor, again possibly by violators.

Entrance into chamber, the red level line can be seen on north and east walls, also visible are the two holes.


Monolithic stones that make up the north wall. The staining visible on the corbels is common in the pyramids; I have not found a clear explanation on what causes this.




Looking up north wall

Looking up east wall, some mason graffiti can be seen on bottom face of corbels


Looking up south wall


The large floor stone 1.18m thick can be seen in the foreground, also note the red level line running 1 cubit above this stone

The floor stone and start of shaft in south-east corner

Level line along west wall and missing flooring


Looking down into shaft from floor stone

View of southern part of chamber and missing flooring

View down shaft, N-S distance about 1.25m


Against the west wall, a block next to the surviving large block has been cut in a sloping direction from north to south, about 25cm deep and 37cm wide.


Inside the shaft markings are visible

Another example of markings found in shaft

Red guide lines visible over top edge of chamber doorway and a vertical line running down the east wall

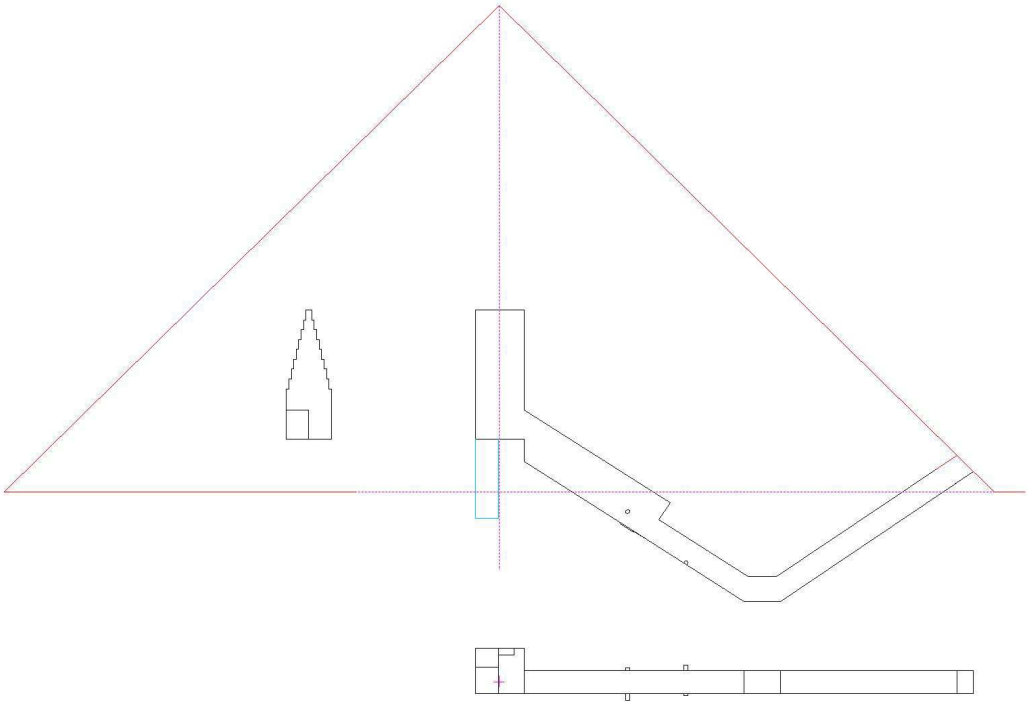
The stone under the large architrave and west edge of chamber entrance appears to have a portion of its surface well smoothed

The dressing of the walls M&R say, *"The north wall is very well dressed, while the western one is dressed up to the course under the first overhang and afterwards left in the rough. The east and south walls are well smoothed even after the first overhang but not up to the ceiling."*

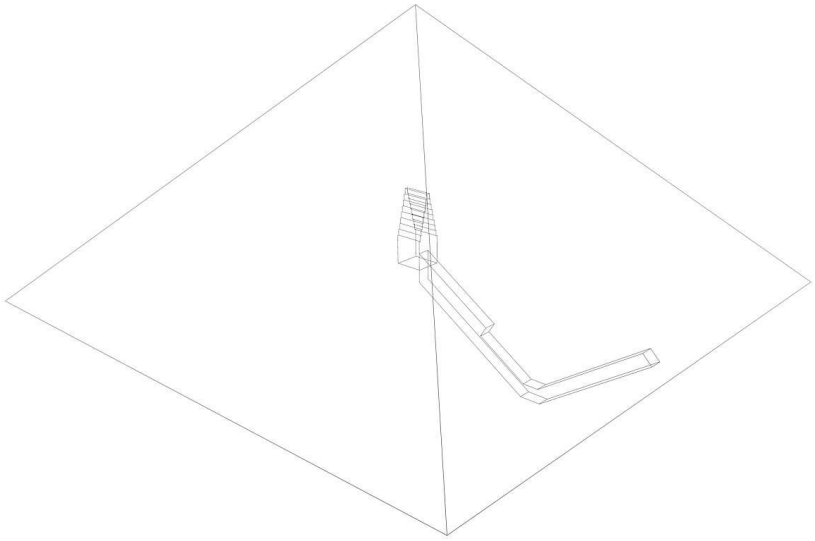
The depth of the shaft is uncertain; M&R thought the chamber was built on the bottom of the rock trench, or on a foundation platform built on it. Debris in the bottom of the shaft prevented them from exploring further. The masonry in the shaft M&R say, *"The pavement of the room is very thick (1.18m) and rests on a masonry built with blocks of white limestone in different dimensions and roughly squared. Instead the walls of the room under the floor consist of well squared blocks whose visible faces are not completely dressed. Some red level lines drawn by the builders appear on these walls."*

There may be a particular interest in the south-east corners of chambers, as the shaft visible in the massif of the Bent pyramids upper chamber is also in the south-east corner. Kabis reports the shaft in S-E corner as 1.0m long by .60m wide, suggesting that it has been enlarged since his time.

A thorough exploration of this small subsidiary pyramid is also overdue.



Elevations, the chamber appears to be placed under the Pyramids apex




Plugs in lowered position, leading plug face has been inclined

## Cult layouts / Temples

The cult layouts and temples of the Bent pyramid complex, I do not intend to go into much detail as these structures have been quite well documented and explored in comparison to the poorly explored pyramids.


## East cult layout

In the image above we can see the remains of stele stumps in the middle foreground, Fakhry states that they were 2.03m apart and they stood in the middle of the east side of the subsidiary pyramid. No inscribed parts of the north stele were found, but fragments of the south were found. These fragments in fine bas-relief also incorporated Sneferu's names and titulary. They were about 5m tall, 1.30m wide and .65m thick. Fakhry says that they stood 1.10m (2cubits) from the pyramids baseline and 3.45m from the enclosure wall; the distance he gives between the pyramid and enclosure wall is 5.24m (10 cubits). Also found between the two steles was a kind of pedestal built of mud brick, which Fakhry thought may have supported a slab of stone.


**North cult layout**

In front of the subsidiary pyramid entrance, a strange pit is to be found; this pit is aligned with the pyramid axis. The pit is lined with limestone slabs standing on edge, and the floor is described as sand, the depth of the bedrock

under the subsidiary pyramid is not known. The pit depth is about 2.1m, the south, east and west walls of the pit are vertical, whereas the north wall is inclined; it has been suggested that this incline may have been made to help erect a stele or pillar. The pit size is about 2.25m, N-S at surface and 1.70m wide (Ricke reports 2.10 by 1.60m and 2.20m deep, with the pit being 2.50m from the pyramids socle). Surrounding the pit are some limestone blocks that may have been the foundation of a wall, M&R's drawing suggest the foundations to the socle as 6.08m, N-S and 6.84m, E-W, measures are to the outside of foundation blocks.

## The Offering temple

The image above shows some of the remains of the offering temple found in the middle of the east face of the Bent pyramid, it had been subject to many alterations in its history. Ricke in the appendix to Fakhry's Vol 1, says; *"In its earliest form, this at first completely open cult place cannot be characterized as a temple, if we are to understand by that term a cult building with roofed-over rooms: it became thus later on by alteration. The*

*built remains make it possible to discern six different building periods with great certainty, of which the first falls in the time of Sneferu. The second and third are to be dated to the time immediately after his death, the fourth and also the fifth to the Middle Kingdom, while the sixth building period belongs to a late age that cannot be precisely recognized."*

Fakhry says; *"The cult of Sneferu was certainly much neglected after the Middle Kingdom but it had continued till the XVIIIth dynasty and after this date the neighbourhood of Dahshur was neglected and stone cutters were demolishing the monuments of Sneferu in order to take their stones to be used in other monuments. …We know that during the Late Period, in the Saitic times and even in Ptolemic times, there are monuments which mention names of priests related to the cult of Sneferu;"*

The original first phase of the offering temple is thought to have consisted of an altar that was flanked by the large stele; this open space is described by Ricke as;

*"The open space on which this offering place was raised is paved with limestone blocks. Yet this paving appears not to have remained visible, since wide joints had been left open between the blocks, so that from the beginning a plaster floor lay above it. It appears rather to have been built in order to level the unevennesses of the building ground. It makes a smooth join with the pyramid, and equally so with the stelae, which have a surround of small worked blocks. Above the pavement two layers of Nile mud plaster have been preserved, of which the lower layer appears to date from the time of Sneferu."*

The altar was made of three limestone blocks resembling the *'hotep'* sign, Ricke thought it remarkable that the orientation of the altar was to be read from the offerer as opposed to the deceased. He also says; *"At the spot on which the offerings were to be deposited, an alabaster slab was inserted, quite evidently at the beginning."* It appears that the original offering temple was just a larger version of what we see at the subsidiary pyramid.

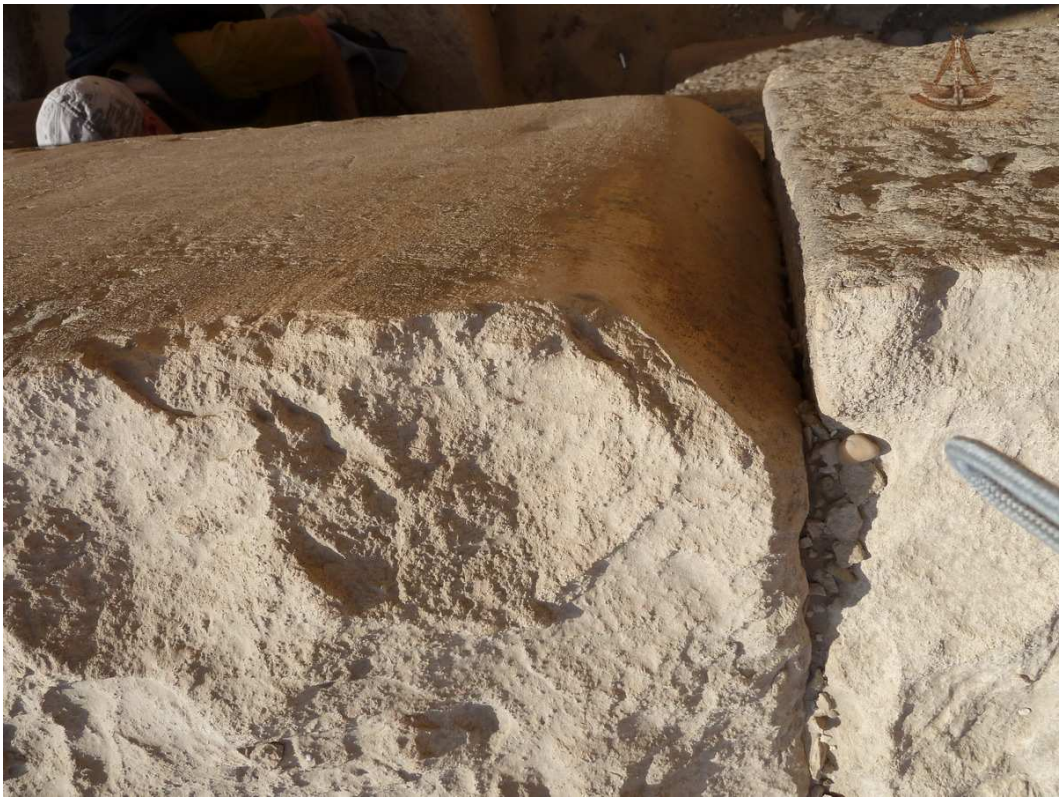
The stele are particularly large, Ricke gives the stumps as about 3m high and inferred that originally they may have been 9 m high; to this we have to add an unknown amount as M&R say that they "*were deeply inserted into a foundation of big limestone blocks"*. Ricke gives their breadth as 1.90m and 1.15m wide. The stele appear to have been erected not fully finished, but

appear to have been shaped, smoothed and decorated with relief's after they were installed. The uninscribed steles at Meidum appear to have got to the stage of shaping and smoothing, before work at the temple ceased.

Ricke thought that very soon after the above construction, that a limestone protective roof was fitted above the altar; he also mentions that the most western block of the roof was a reused block from another building.

This picture taken from the pyramid shows the hotep altar under the limestone roof. The limestone walls supporting the roof are 2.50m E-W, .58m thick and 2.02m high, with the roof blocks about .47m high. The distance between walls is 1.57m and thickness of altar stone is .50m, it may have been intended that the space above the altar of 1 cubit was intended to have a square section of 3 cubits.

Views of reused western roof block



Mud brick walls belonging to later alterations

## North cult layout Bent pyramid

Fakhry states; *"Almost in front of the entrance, about 1.80m to the west of the axis of the entrance, and at a distance of 5.70m from the base of the pyramid, there was found an offering table of limestone broken to three pieces."* This hotep offering table like the eastern one faces towards the pyramid; the table was between two mud brick walls .85m thick and proceeded by a small mud brick platform 3.95m from the pyramid base. The layout is not built at the level of the pyramid base, but raised 30cm in two layers; the layers Fakhry describes as; *"The undermost layer is of sand mixed up with small votive vases, some of them complete, and many broken fragments; and over this layer there was put a thin layer of limestone chips."*

Fakhry thought this layout was an obvious later addition, *"perhaps near the end of Sneferu's reign"*

## Valley temple

The Valley Temple of the Bent pyramid is a bit of a misnomer in that the temple is some way from the cultivation, indeed a lower causeway was made of massive mudbrick walls that was covered with a mudbrick vault. This lower causeway was some 140m long and opened into a large U-shaped structure that could have been a harbor basin. In comparison to the bent pyramid there is a massive amount of information on the Valley temple, be it from Fakhry's volumes to more recent work done by the German Archaeological Institute; so I would direct the reader to the copious resources available on the Valley temple.

The Valley temple like the Bent pyramids Offering temple displays many alterations throughout its history, for example during Middle Kingdom restorations, the stele of a 4$^{th}$ dynasty prince was reused as a door jamb! South of the lower causeway a sledgeway was discovered made of crudely arranged limestone blocks that originally came from the valley temple and about 50 of these blocks contained relief's. This sledgeway is thought to date from the Ramesside period and used to transport large blocks robbed from the temple.

The Valley temple was not constructed on a virgin site, for part of it was constructed over an earlier construction. This earlier structure just north of the Valley temple was a massive brick enclosure wall about 80.5m N-S and 55.8m E-W and much of the area inside was occupied by a garden.

## Causeway

The temple is unusually aligned in an N-S axis and a stone causeway left the west wall of the temple and made its way to the Bent pyramids north enclosure wall. The causeway ran in a south west direction from the temple and its length was about 704m and for the last 75m it kinked slightly to the south and joined the north enclosure wall about 51.50m from the enclosures NE corner. M&R say the walls of the causeway were made of white limestone about 1.90m high and had a pronounced batter, with the top of the wall consisting of bevelled blocks. The bases of the walls are described as 4 cubits thick and the distance between walls about 6 cubits. The route of the causeway may have been necessitated by the locations of the quarries that supplied stone for the pyramid; these quarries are thought to exist to the north and east of the pyramid, leaving the north-east free for the causeway.

The pyramid end of the causeway is about 27.5m higher than the Valley temple end and had an average gradient of 4 degrees; before the causeway enters the pyramid enclosure wall, it curves slightly and then travels for a short distance at right angles to the pyramids enclosure wall. In this area on the north side of the enclosure wall are two entrances east and west of the causeway that open into two small rooms of about 2.0m N-S and 5.0m E-W.

View of curved end of causeway

The location of the entrance of the causeway through the enclosure wall appears to align with the pyramids east face and afford a clear line of sight to the offering temple.

## The Enclosure Wall

The pyramid enclosure wall like the causeway walls are mostly quarried away, the height may have mirrored that of the causeway or higher as Fakhry reports that remains of the enclosure wall base where wider than the causeway walls base. The enclosure wall was built on a foundation of local limestone blocks some 1.56m high. The pyramid appears to be in the centre of this enclosure wall, Petrie took several measures of the wall that varied somewhat, though he believed the space between the pyramid and wall to be some 100 cubits, (2067±4 inches).

The wall takes a break and detour to surround the subsidiary pyramid, with the west side of the enclosure wall being closer to the subsidiary pyramid, than the east side, as that wall had to allow for the offering area and steles.

The subsidiary pyramid Petrie believed was 100 cubits from the Bent pyramid, he provides two measures for this distance; 2055.4 inches at NE corner and 2044.2 at NW corner, mean 2049.8 inches. The mean cubit for the subsidiary pyramids base, Petrie gives as 20.646 inches; or closer to 99 cubits. Likewise Petrie gives a mean length for the Bent pyramid as 7459 inches, or 360 cubits of 20.72 inches, though it could also be close to 362 cubits.

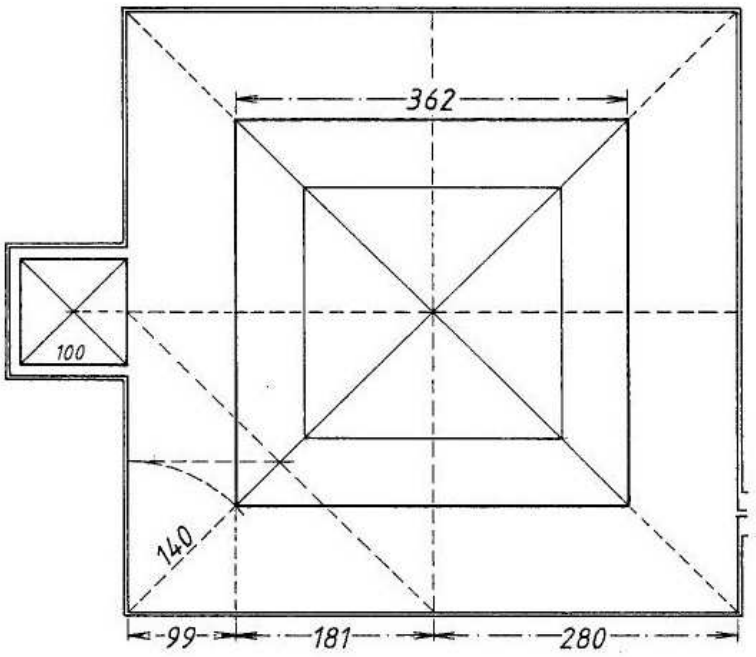



Fig.1 Plan of Bent Pyramid and Enclosure. Dimensions in Cubits.

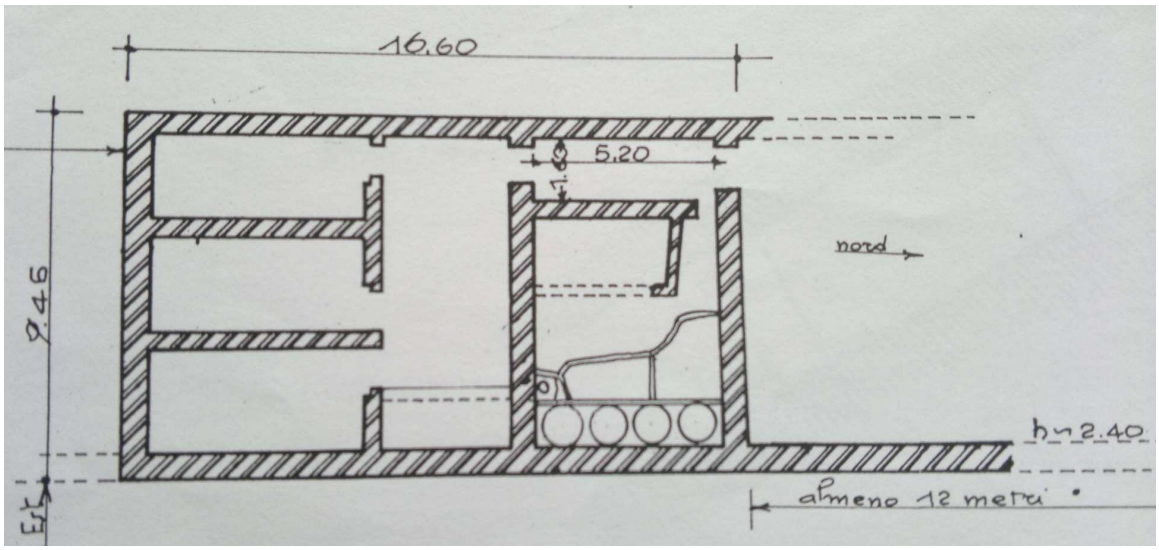
| | Length in Metres | | Length in Cubits | |
|---|---|---|---|---|
| Side | Petrie | Dorner | Petrie | Dorner |
| North | 189.57 | 189.41 | 361.95 | 361.64 |
| East | 189.32 | 189.75 | 361.47 | 362.29 |
| South | - | 189.71 | - | 362.21 |
| West | 189.49 | 189.57 | 361.79 | 361.95 |

From Dorner's survey, therefore, the mean side is 189.61 metres, or 362.02 royal cubits.

Above is a possible solution of the relationship between the enclosure wall and pyramids which was developed by John Legon. GM 116 (1990).

# Old Kingdom Storehouse

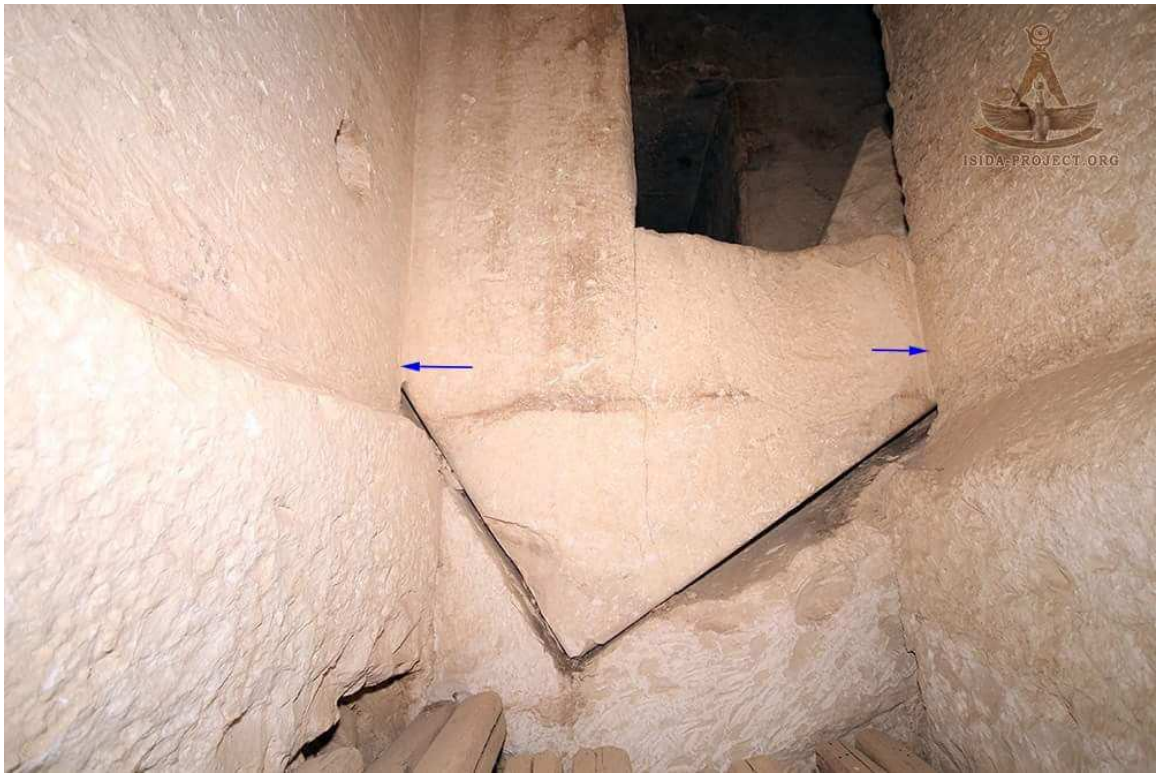
Fakhry discovered what he thought to be an Old kingdom storehouse inside the enclosure wall, located near the south east corner of the pyramid court. The floor of this structure was found to be about 3 metres below the present level of the pyramid court; the brick structure was oriented north-south with its SE corner according to M&R's drawing being approximately 7m from outside face of east enclosure wall and 38m from outside face of south enclosure wall. The main part of the structure that was excavated was 16.60m by 9.45m; M&R say that the buildings were not fully excavated and that the eastern wall continues for at least another 12m. Fakhry says that the east wall also extends to the south "*and it is possible that this discovered storehouse is one of a series which are still awaiting excavation."* I am not aware of any further excavations on this structure.




The three southern rooms were covered by a vault, while the room containing the granaries had no ceiling. M&R say the walls are in good condition for a height of 4m and are a mix of black and yellow brick, Fakhry thought it was contemporary to the 2nd phase of the offering temple, M&R say; *"However the greater part of the building was reconstructed in later times and we do not know whether the original plan was followed or not. As a matter of fact, it is possible to see many yellowish bricks in the walls and they are similar to the ones used in the latest additions to the upper temple. Some black bricks among the yellowish ones are also visible and they are probably reused bricks from older walls."*

## Updates to Previous Papers

In the *Bent pyramid guide part 1, page 81;* I questioned whether the western portcullis was plastered on both sides. I am very grateful to Olga Kozlova from the ISIDA project for providing me with new images of the western portcullis.




In the image above the blue arrows are pointing at what appears to be neat pointing of the gap between the portcullis and the horizontal corridor walls. This neat pointing would be a requirement to help conceal the presence of this portcullis and help it blend in with the corridor walls; the lower part of the portcullis would be concealed by the original paving. This neat pointing could only have been done when access was available through the connecting tunnel that connects both chamber systems.


Another view showing the filled gaps

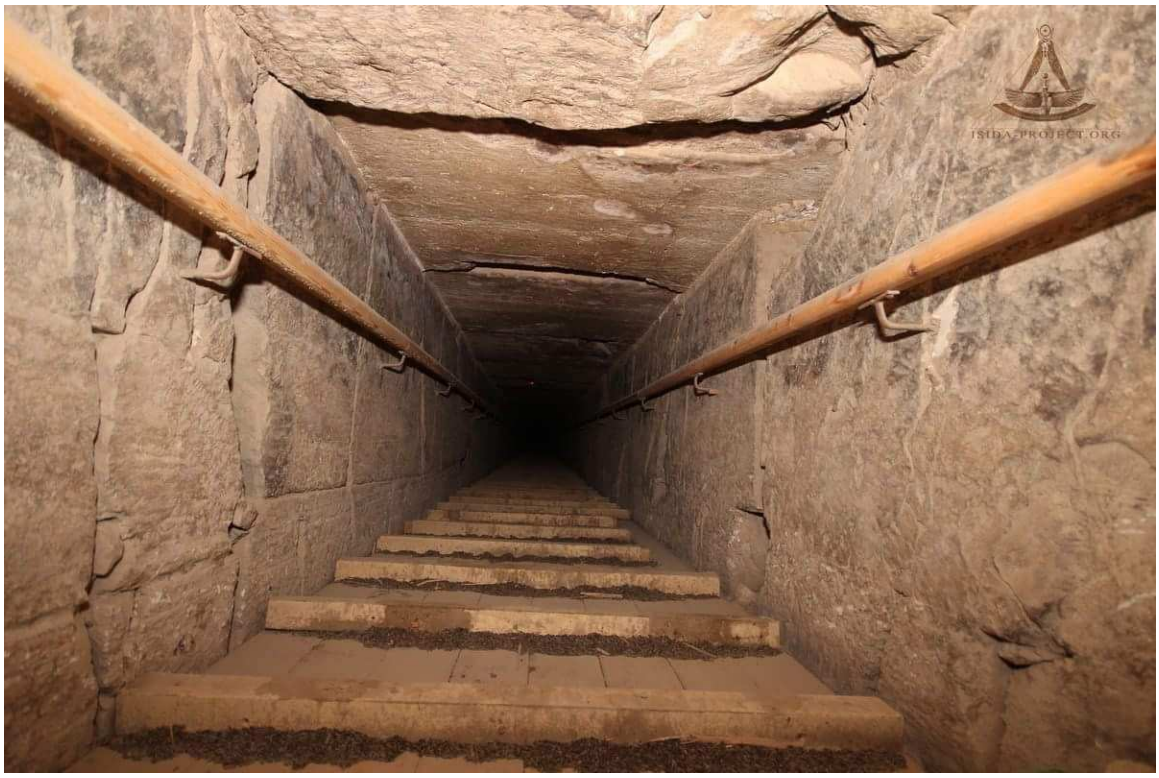
In part one I suspected that the connecting tunnel was made by violators, so this would suggest that the portcullis was lowered after this event; it might have some connection to the mummy box found in the western corridor, or some other intrusive burial in this corridor. If organic matter can be found in surviving mortar/plaster and dated, it may provide an answer.

This neat pointing visible on the east gaps of the portcullis block appear not to be present on the west side of the portcullis, indeed we can only see two areas of mortar/plaster which could be explained by the oozing of previously laid mortar through the gap when the portcullis was lowered. Obviously a much closer inspection of the portcullis block is required, but these new images do suggest that only the east face was neatly concealed, while the west exhibits excess mortar displaced when the portcullis block was lowered.


In the image above the arrows point at what appears to be excess mortar that may have been displaced by the lowering of the portcullis. The hole in the block is new to me and I have not seen it reported before. Just visible on the east wall of the portcullis housing are two oblique red guide lines, which appear to mirror the angle of a stored portcullis.

In part one, page 59, I also cast doubt on the settlement just south of the western corridor continuous joint, in that M&R's drawing of it seems not to appear in the corridor. The floor is smooth and shows no settlement and from the image above the course joints also appears level with no sign of settlement.

In Monnier and Puchkov's paper they confirm the floor as level and in describing the settlement in this corridor they say *"The subsequent leveling of some floor stones, just where the ceiling has collapsed, probably shows that this settlement occurred during the construction of the upper part."* They make no comment on why M&R drew the settlement in the floor on their drawing; neither do they make any comment on the wall course joints, which surely should display this settlement. They have also provided no evidence to substantiate that some floor stones have been leveled; I am more than happy to see these floor stones lifted to see if they display a uniform thickness and if any dressing down has been done to them, until then it is just a theory. Let us compare a similar so-called settlement just south of the continuous joint in the north corridor, said to be 8cm.



In the image above looking down the northern corridor from the continuous joint we can clearly make out the left walls horizontal course joints at the area of so-called settlement, they clearly are not level. The roof displacement is also visible, the floor is not visible, but M&R drawings show a corresponding displacement on the floor.

Looking up the northern corridor we can see the displacement of the roof block. In the western corridor I can find no similar images for the so-called settlement of its roof block. But from the front the western corridor roof block does display a noticeable displacement.


The above image shows the continuous joint, the square holes and the area of so-called settlement. Damage to the roof in front exaggerates the displacement, which M&R say is 5cm.

Looking up the western corridor we can see how the line that defines where the walls and ceiling meet, appear to be displaced higher pass the area of so-called settlement, which is what we should expect if the ceiling block had dropped 5cm. However there is another possible option, if the floor is smooth and level and the wall course joints appear level, can we instead be looking at the roof west of the so-called settlement being raised 5cm. In the Meidum pyramid, phase E2 entrance had a raised ceiling, which is thought to assist the closure of this entrance should it be required at that stage.

In my *curious case of the 60 degree pyramid* paper, I suggested that these small so called settlements, both below their respective continuous joints may have been remnants of the step pyramid phase and were built in as stops for closing blocks if required. Further scrutiny is obviously required, a detailed structural analysis of these areas is required; joints of all the blocks need to be determined and measured, M&R strangely left us with a blank sheet of paper when it came to masonry layout in these areas, could we even have more continuous joints?

## Old or New Plaster?

Repairs appear to have been done to the interior of the pyramid, which have the potential to create confusion amongst future researchers; one can only hope that modern era repairs are properly recorded to prevent confusion.



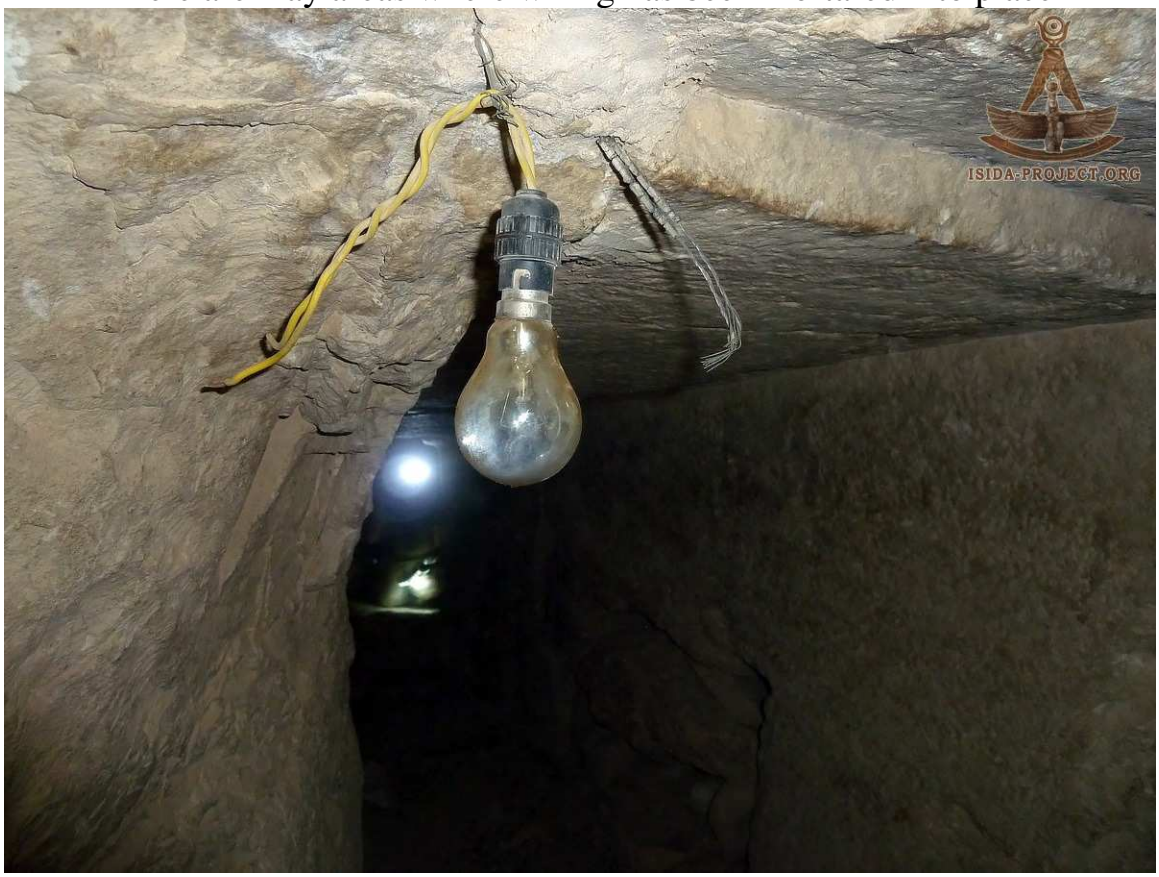
In the images above we see a modern beam mortared to the wall of the upper chamber and massif

Similar mortar can be seen around some beams in the massif, is this new or old?

In the next two images of the western corridor on page 55, there appear to be lots of area's that are covered in white mortar, are these modern era repairs, done after the removal of the plugging blocks?


ISIDA-PROJECT.ORG


There are may areas where wiring has been mortared into place




There are many traces of what appear to be ancient pink/red mortar adhering on the walls. These images of the lower chamber may be connected with the massif in this chamber. The ancient repair under the lintel stone is whiter in comparison.

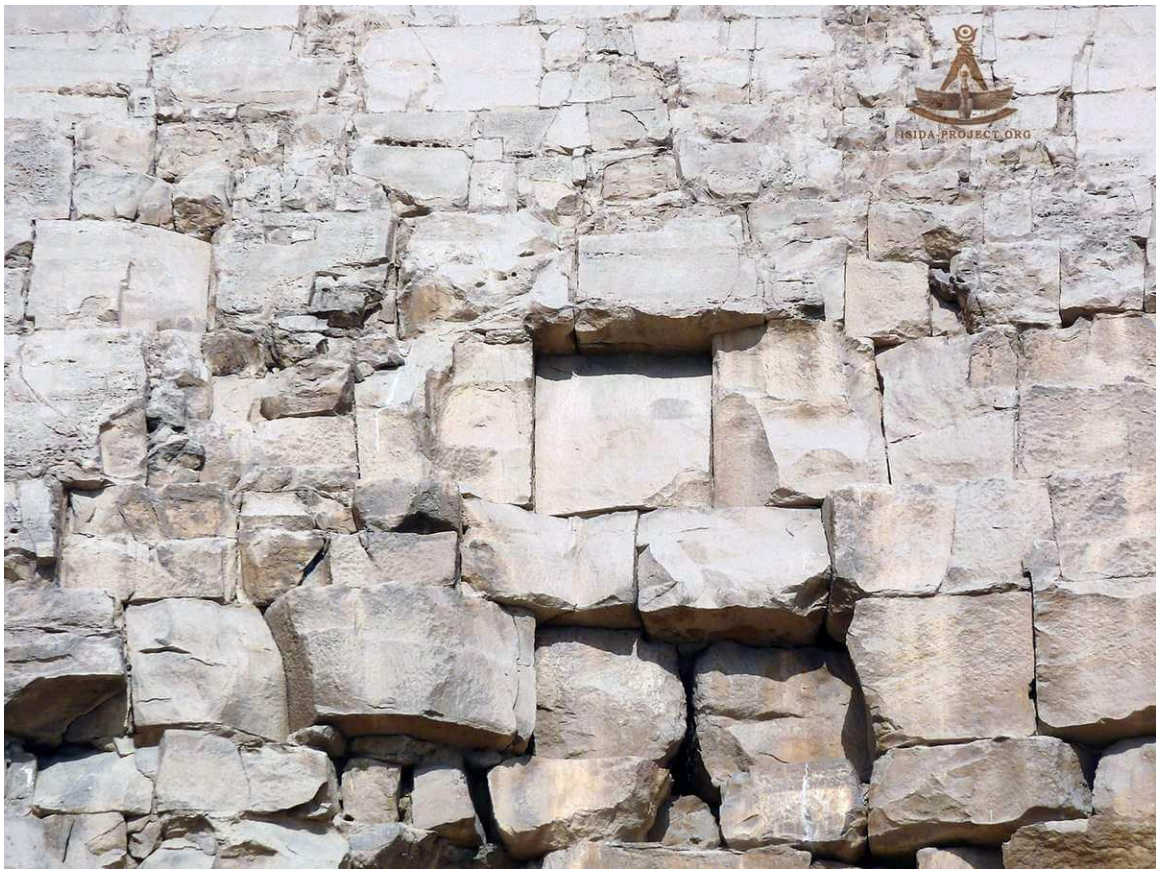

In this image we have what appears to be a mix of different mortars


Traces of pink/red mortar in upper chamber

All this mortar/plaster needs closer scrutiny; we see in the temples connected with the pyramid, numerous modifications, it may well be the case that modifications/repairs where carried out inside the pyramid too.


Looking up the western corridor, we have the recess on the south wall and a modern beam has been inserted. This part of the western corridor is particularly damaged and the paving has been removed in ancient times, the lip of surviving paving can be seen further up the passage.

Olga Kozlova from the ISIDA-project brought my attention to masonry on the south face, which at first glance gives the impression of an entrance.




A close up image of the area in question, the south face having the full glare of the sun is particularly damaged. It is worth closer examination, to see if there is a large fractured lintel stone above this block and to measure the space to see if it conforms to cubit units, the presumed paving joining in the middle under the block, is not of concern, for in Meidum Phase E3 we see a similar deception at work, to disguise the entrance and make it blend in with the neighbouring casing.

In my Meidum pyramid guide, I questioned the provenance of the pyramid to Sneferu and the quarry marks. At the time I was unaware of a paper by Colin Reader on the Meidum pyramid which sheds more detail on these marks and the provenance of the structure, which I would recommend to the reader.

www.academia.edu/29056364/The_Meidum_Pyramid

This concludes part 2 of the Bent pyramid guide. It seems clear that the Bent pyramid complex was of particular interest throughout Egyptian history; a mixture of benevolent activity and violation. The lines between the two may have crossed over several times, but it seems clear that Sneferu was mostly endeared for the greater part of Egyptian history.

A more detailed analysis of the structure is required to allow us a better view of what may have gone on inside the structure; but with what little information we have, I feel the evidence is suggestive that the structure was always intended from the outset to have two independent passage systems, the question is why?

There is evidence in Old Kingdom pyramid complexes, where scenes pertaining to Upper and Lower Egypt are separated; generally Upper Egypt scenes tend to be on south walls with Lower Egypt scenes on the north walls. In the Valley temple of the Bent pyramid which has an unusual N-S orientation, we have in the hall of nomes, the Upper Egypt nomes on the west wall and Lower Egypt nomes on the east wall. Was a separation between Upper and Lower Egypt planned for the pyramid itself? The idea first proposed by Varille is generally dismissed by Egyptology, Fakhry says of it;

*"Such an explanation might appeal to certain persons, but the greater number of Egyptologists have reasonably refused to accept it..."*

As a layperson I have no issues with Varille's view; however given the poor exploration of the structure I wonder how Egyptology can form an opinion on any theories including my own, but I do find it interesting that in the Bent pyramid we have a chamber prominently in the east and another in the west, as well as north and south. The views I have expressed in the papers I have done on the Bent pyramid may well turn out to be incorrect, however it would be nice to see them dismissed by evidence and not opinion.