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THE STAR-SHAFTS OF CHEOPS' PYRAMID

By Robert G. Bauval

SUMMARY

It has been recently argued that the narrow shafts emanating from the two chambers within the core of the Great Pyramid at Giza were for ventilation <1>. A brief appraisal of engineering and ventilating factors will easily show that 'ventilation' was not the objective, but rather some other higher purpose to serve the rebirth rituals of the cult.

ENGINEERING CONSIDERATIONS

The four shafts have an average cross-section of 23 x 22 cm and length varying from about 24 ms (northern shaft of the Queen's Chamber) to about 65 ms (northern shaft of King's Chamber). They all are inclined to the horizontal plane of the pyramid, their slopes varying from about 32 degrees 30 minutes (northern shaft of the King's Chamber) to about 45 15' (southern shaft of the King's Chamber). The shafts were constructed in a step-by-step manner (and not drilled through as some have supposed) and reveal a very complex and sophisticated engineering and levelling techniques.

It has been suggested that the reason for their inclination was to find the 'shortest route' to the outside of the pyramid and this implied the ancient builders wanted to 'save' work and time. Such 'geometrical logic' goes, however, very much against engineering logic for, building shafts on an incline, would not save time or work at all -Quite the contrary, in fact. No construction engineer or builder could possibly agree that the 'shortest route' is the best route in this case, even though it seems so to those looking only at 'geometry'. The truth is that to build inclined shafts rather than to have simple horizontal openings leading to the outside of the pyramid would create many difficulties -especially when we consider the high precision of the inclinations. This point has been carefully made in the past by architect and Egyptologist Dr. Alexander Badawy <2>.

To build inclined shafts rather than horizontal ones entails five tedious operations. First the base course must be prepared; this entailed preparing special blocks having their upper face sloping to serve as 'floor' to the shaft (fig.1 A). Second, special block had to be cut, with the bottom face forming the profile of the shaft i.e. to make up the 'walls' and 'ceiling' of the shaft (fig.1 B). Third, special blocks had to be cut with their under-side inclined in order to cover the sides of the shaft. Fourth, the top of the shaft detail had to be covered with other special blocks having their under-side face sloping to rest on the top of the shaft (fig.1 D). Finally the main masonry course of the pyramids had to be integrated in this structural detail (fig.1 E).

If ventilation was the objective (i.e. practicalities rather than expressing ideologies), the question is: why opt for such complications and difficulties when a simpler solution could equally have provided 'ventilation' to the chamber ? It is clear, at least to me, that a far simpler solution to provide 'ventilation' would be to leave a masonry joint open -say 20 cms- running from the top of the chamber right to the outside of

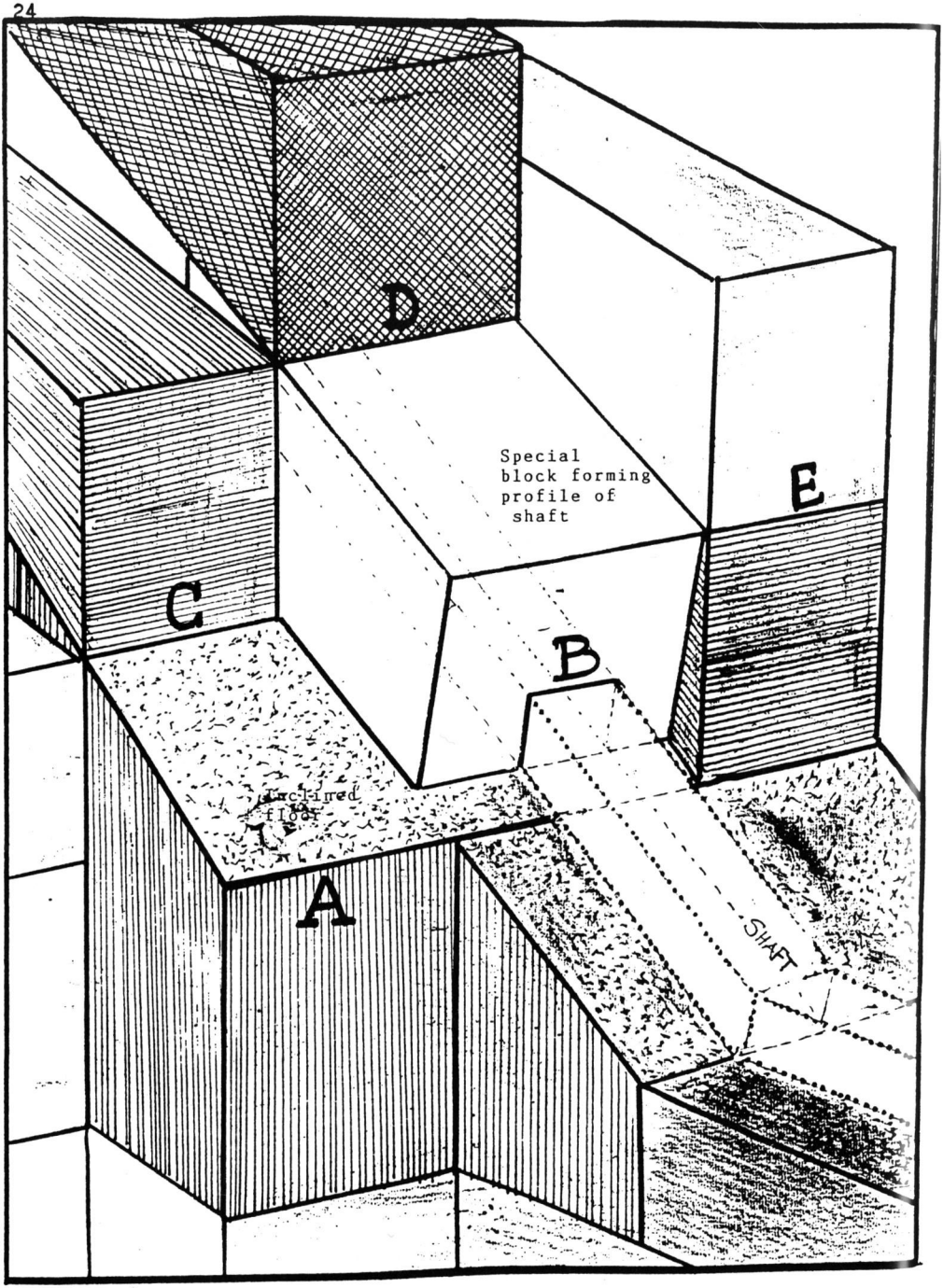

D
Special
block forming
profile of
shaft
E
C
B
Brick-lined
floor
A
SHAFT

FIGURE 1

the pyramid, as indeed Badawy suggested in 1964 (fig.2). No special cutting of blocks would be needed nor, indeed, any tedious alignments and levelling work.

It is therefore obvious that the 'shortest route' created far more complex and tedious operations and was not, by any means, the best option for the practical purpose of ventilation. The reality is that the ancient builders did not seek 'time/energy' saving schemes -if this was the case, they would not have built a giant pyramid needing 6,300,000 tons of rock to be raised 147 metres high in the first place. We surely must see the various features of this monument expressing very powerful religious ideas using the medium of symbolic architecture and not as as time/energy saving attempt based on quaint geometrical figures.

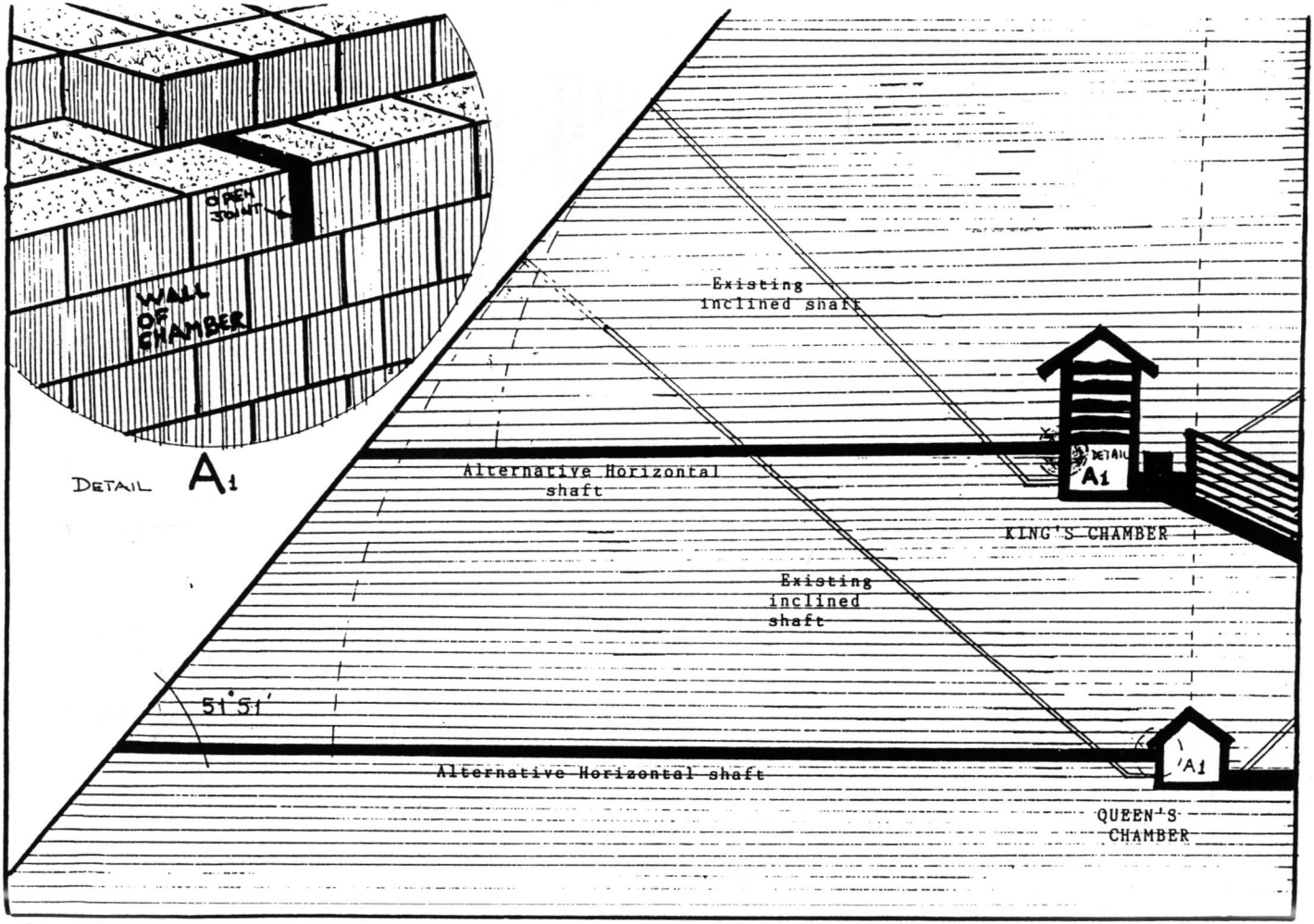
The shafts from the Queen's Chamber were, in any case, closed up at both ends, thus making ventilation impossible. Even so, it has been suggested, however, that these shafts, although were 'planned' for ventilation, they were somehow kept in 'reserve' just in case they would be needed at a later time. The serious flaw in this hypothesis is that the construction of these shafts, for one, was started in the lower part of the wall of the chamber -before the roof was closed- and thus before any ventilation problems (if there were any) could be experienced. So if ventilation problems were experienced, then why did the builders not cut through the shafts into the Queen's Chamber ? <3> The argument that this was because the chamber was 'abandoned' in not tenable anymore, for if this was the case, then why did they carry on building these shafts deep into the core of the masonry some and taking the southern one some 19 metres above the floor of the King's Chamber ?

Another flaw with the 'ventilation' theory is why have two shafts in each Chamber ? The Queen's Chamber is still unventilated yet at this very moment there is a group of workers in it every day, engaged since several months to remove the 'graffiti' by the EAO <4>. In any case, one shaft in each chamber (preferably going south) would have been more than enough to create ventilation, if such an effect was needed <5>.

The fact is that the slope of the shafts were kept so accurate, within about 1 degree of variations, that they strongly imply careful alignments -only possible with stellar sightings. Although the shafts were not 'observatories' for stars, they were directed to important star systems for religious reasons. In the north Draco and Ursa Minor seem to be the targets in c. 2500 BC. In the south, Orion's Belt and the star Sirius (fig.3). All these star systems were, as we know, vital to the astral rebirth rituals expressed in the Pyramid Texts <6>.

CONCLUSIONS

The shafts in Cheops' pyramid were carefully designed to serve as ritualistic contraptions, as is the whole monument, the northern one 'linking' the chambers with the circumpolar stars associated with stellar rebirth, and the southern ones as 'channels' for the Ba-soul of the dead king to direct it towards the precise stellar destiny <7>. This conclusion complies with the textual evidence of the Pyramid Texts, the archaeological and engineering evidence and, more relevant here, with engineering and construction logistics. The previous definition of


OPEN JOINT
WALL OF CHAMBER
DETAIL A1
Existing inclined shaft
Alternative Horizontal shaft
DETAIL A1
KING'S CHAMBER
Existing inclined shaft
51°51'
Alternative Horizontal shaft
A1
QUEEN'S CHAMBER

'air-shafts' must be replaced by 'star-shafts' in order to provide the correct terminology to these important design features of the Great Pyramid.

NOTES

1. J.A.R. Legon. 'The Air-shafts in the Great Pyramid' in Discussions in Egyptology (DE) 27, 1993, pp.33-44.
2. A. Badawy. 'The Stellar destiny of Pharaoh and the so-called Air-shafts in Cheops' Pyramid' in Mitt. Inst. Orient. zu Berlin Band 10, 1964, pp. 189-206.
3. I.E.S. Edwards. The Pyramids Of Egypt. Penguin 1993 ed. p.104.
4. This was confirmed to me by Dr. Nouredin, Chairman of the EAO in Cairo, in December 1993. A team of restorers are removing the modern graffiti on the walls.
5. The eminent engineer, Dr. Jean Kerisel of Paris, who originally proposed to the EAO the scheme to ventilate the chambers in view of the thousands of tourists that enter the pyramid every week, is of the opinion that no circulating ventilation through shafts was needed during construction, as natural flow in and out of the chamber occurred sufficiently for a dozen workers to spend long hours without any serious discomfort. This is, in any case, today well proved by the work carried out in the Queen's Chamber with the shafts still closed at their upper end.
6. R.G. Bauval & A.G. Gilbert. The Orion Mystery. Heinemann 1994 ed. pp.86-91.
7. A. Badawy. Ibid.

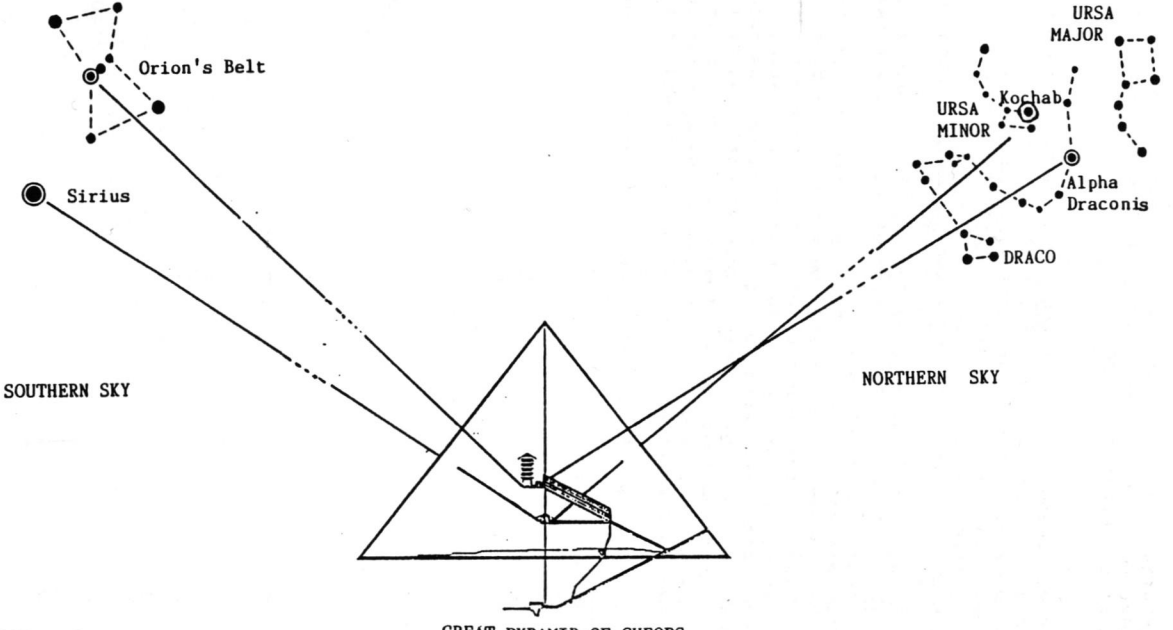


FIGURE 3

Stellar alignments of shafts at epoch c. 2450 BC