How was the Great Pyramid built?

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Summary

A thorough investigation of the Grand Gallery shows, that this room was designed for transportation of building blocks. It is suggested how this transportation could be performed with use of levers. The peculiar walls of the ascending passage show that they were part of a similar transportation machinery. This leads to an understanding of the building process of the Great Pyramid. The extraordinary structure of chambers and corridors in the Great Pyramid can be explained as a consequence partly of Cheops´ religious reform and partly of traditional burial rituals.

The great pyramid at Giza was built by king Cheops about 2500 B.C. As far as I know there is no convincing explanation as to how the pyramid was built. In this article we will look at the interior corridors, shafts and chambers to see if we can learn something about the building method. In particular the biggest and most extraordinary room, the so-called Grand Gallery, may give some information.

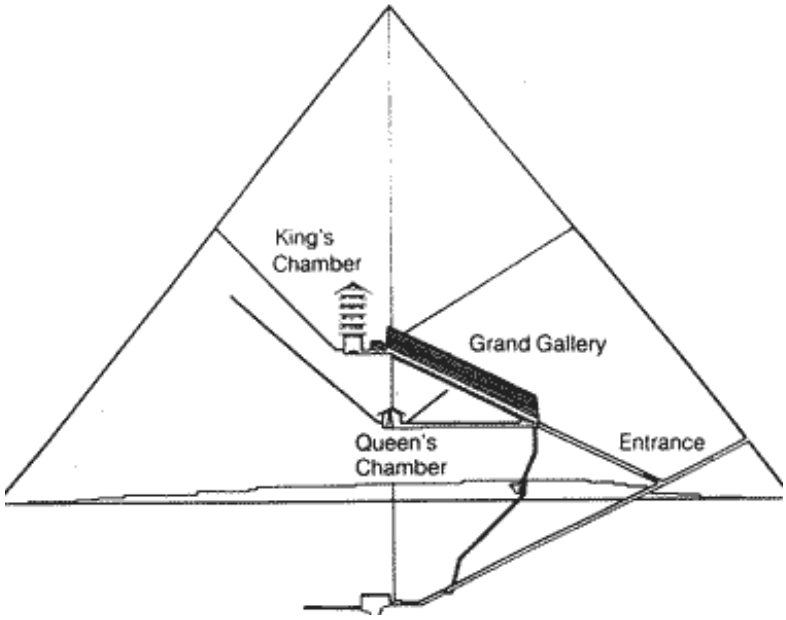

Figure 1. Corridors, shafts and chambers

The Grand Gallery is a 48m long corridor ascending 26.3 degrees. It does not seem to have been constructed for people to climb for there are no steps. The height, 8.6 m, is not designed for human beings. The Grand gallery is a very rough room without decorations or texts. It is difficult to imagine that it is the entrance to a king's tomb. In both sides of the corridor is a ramp 0.52 m. broad and 0.52 m. height, and the Egyptian cubit is exactly 0.52 m. The breadth of the floor between the ramps is 1.07 m. In the walls immediately above the ramps are inlaid stones which are 0,45 m. high. (See Figure 2.) There are 25 inlaid stones on either side and the distance between them is 1.67 m. In the ramps are holes close to the wall under each inlaid stone. There are two more holes in the lower end of the ramp and one more at the upper end, which means that there are 28 holes in each ramp. The wall above the holes is somewhat hollowed as if from wear.

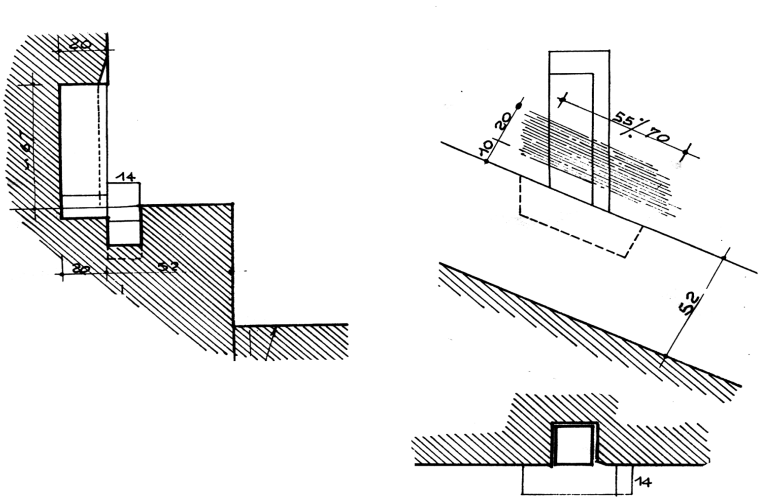

Figure 2. Holes in the Grand Gallery (Maragioglio/Rinaldi 1965, IV,Tav 2, Fig 1)

If the Grand Gallery had a function in the building process it could have been as an aid for transportation of building materials. The Egyptians did not have wheels or pulleys. We know that they moved heavy stones horizontally using sledges pulled by many men, probably with mud or water under the sledge. A few sledges have been excavated in Egypt. The biggest one 4.2 m. long was buried at Dahshur near the pyramid of Senwosret III from the twelfth dynasty. (De Morgan 1895, fig 204) The floor of the gallery could be used as a slide. The height of the gallery suggests the use of long levers. Balks made of cedarwood have been found in pyramids from the fourth dynasty. Cedrus Libani grew in Libanon and Cypres and the tree can grow to be 40 meters in height. A pair of parallel levers would be placed in the sides of the floor and pass through the opening in the top of the gallery, which was not covered at the first stage of the building process. (See Figure 3). The roof of the gallery has the same breadth as the floor. On the top of the levers there could be fastened a horizontal pole for two men to push back and forth. The levers could rest on beams mounted in holes of the two walls. The holes were apparently where the inlaid stones are now, which means that the distance between the levers were 1.67 m, which is a little more than three cubits.

The machinery that I have described here and outlined at Figure 3 will be called a conveyer-belt. This design is my suggestion, but there could be other designs based on the same principles. The conveyer-belt should be experimentally tested in order to see if it works, or if a modification can make it work. I would like to hear if someone is interested in such an experiment.

The movement of the lever from start position to end position will only move the bottom of the lever about 0.60 m. Consequently the sled has to be moved three times before the next levers could take over. This determines the distance between the beams on the sleds to be one cubit. The length of these beams must be two cubits in order to be shorter than the breadth of the floor. The beams project over the side of the sled.

The working method described here explains other peculiarities of the Grand Gallery. The so called Red Pyramid built by Cheops´ father immediately before the Great Pyramid had three chambers with corbelled walls like the Grand Gallery. They did not have a ceiling, which is only found because the Grand Gallery had no roof at first. Furthermore the chambers of the

Red Pyramid have vertical end walls, while the end walls of the Grand Gallery lean into the room. The reason for this construction probably was that the Grand Gallery had open ends at first.

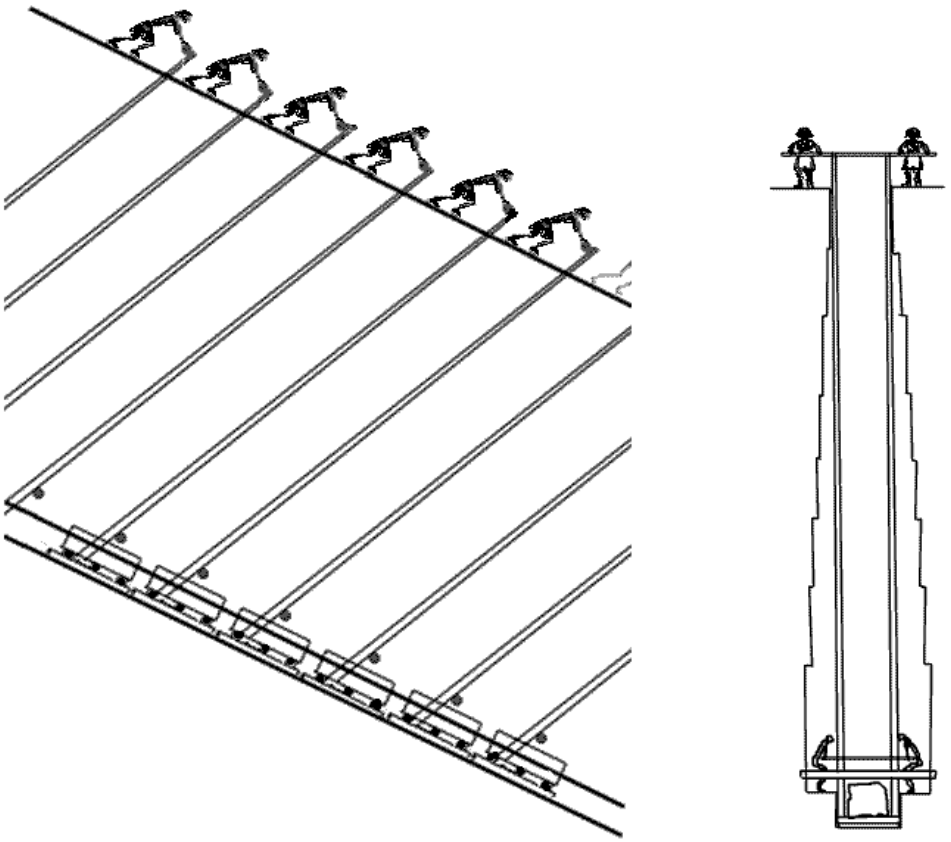

Figure 3. Suggested conveyer-belt in the Grand Gallery.

We now need to estimate the labour. Because the ascending angle of the gallery is 26.3 degrees, the friction will be sufficient for keeping a sled from sliding down even if water was used under the sled. An average block in the pyramid weighs 2.3 tons. Considering the angle and the friction, the necessary force on the block would be 2.1 tons. The two arms of the lever are 8 m and 0.85m. The force at the top end of each of the two levers consequently has to be 110 kg. A considerable part of this force will be performed by the weight of the lever. Probably the levers would be too heavy and difficult for the men at the top of the levers alone to lift across the beam of the sled. Consequently there had to be two men at the bottom of the levers standing on the ramps. The pair of levers would have to be connected with a pole to be lifted by these men. For the 25 pairs of levers there had to be 100 men working. The total weight of the great pyramid is 6.3 million tons. This means 2,7 million blocks. In 20 years of 365 days of 10 hours of 60 minutes there are 5 million minutes. That means two minutes for each block. This speed could probably be achieved by the suggested conveyer-belt.

The levers described here could not be used at the lower end and the upper end of the Grand Gallery. This could explain the absence of two holes in the wall at the lower end and one hole in the upper end. The suggested conveyer-belt might have been used for transportation of all the building materials for the levels between the Queen's Chamber and the King's Chamber. The conveyer-belt had to be gradually extended for every layer of stones in the pyramid. The easiest way to build a layer would probably be to start by placing the polished corner stones carefully, then place the rest of the polished casing stones. Then the rest of the layer could be filled up with non-polished blocks except the area above the conveyer-belt.

How were the blocks brought up to the start of the conveyer-belt in the Grand Gallery?.

We don't know how, but we can see that the ascending passage leading up to the Grand Gallery has the same direction and the same breadth as the floor of the Grand Gallery. The length of the ascending passage is 39 m and the transversal height is1.20 m. It is possible that the ascending passage is the remains of a former conveyer-belt, which we will call the first.

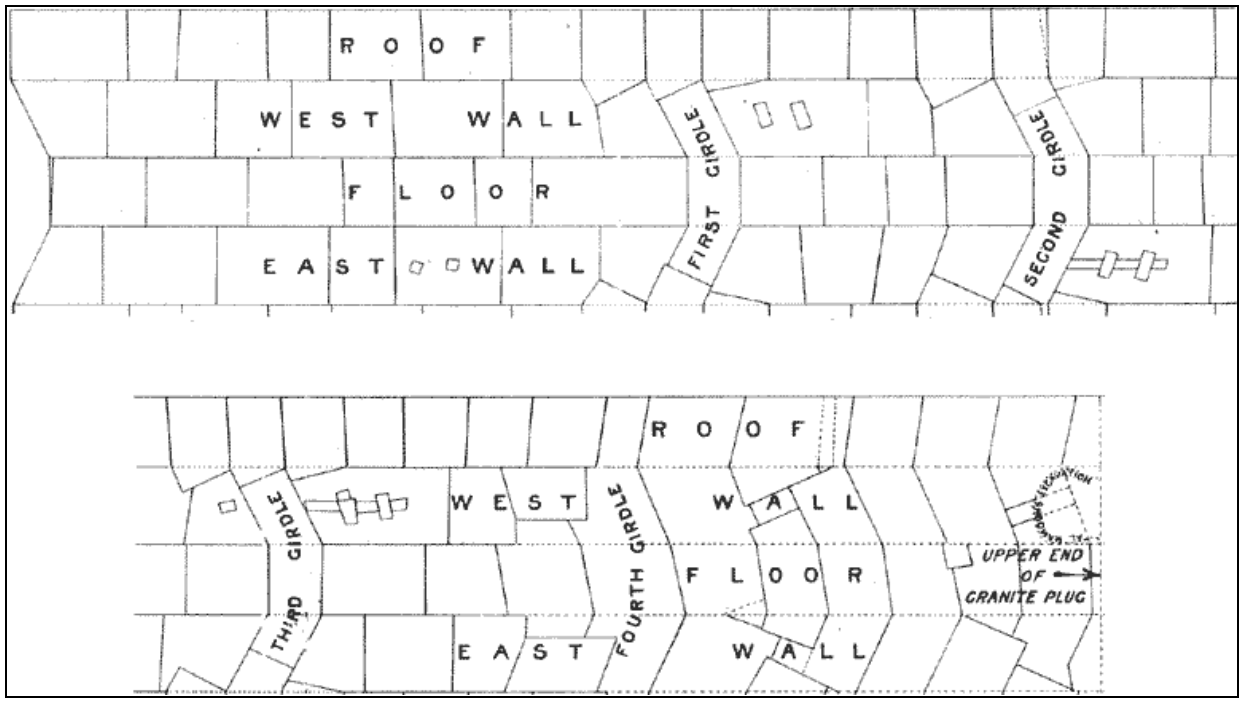

Figure 4 The ascending passage. (Edgar 1910 , Plate CX.)

Figure 4 shows a diagram of the ascending passage. We see that the upper part is regularly built, but we have to look at the irregular parts, which are remains from the previous function of the passage. In the walls we find twelve inlaid stones in the same distance from the floor as the inlaid stones of the Grand Gallery. The inlaid stones are mainly placed in blocks so large that it would be more work to remove the block and make a whole new block than to inlay stones in the holes. It is probable that the holes with the inlaid stones were used for beams just like the holes in the second conveyer-belt in the Grand Gallery. Apparently the two conveyer-belts were different. There were no ramps in the first one. The wall stones with vertical edges are probably original, and they all have a horizontal edge besides. This gives us a hint that the walls of the conveyer-belt were originally built on top of these stones. The fourth girdle probably resembles the original look of the girdles the best. It is formed out of a single stone in order to stabilise the construction. Another purpose could be support for the beams or for a bridge. The top of the girdle was more narrow to make room for the levers. In both sides part of the fourth girdle is replaced with stones with slanting edges. The reason for the repair could be to remove the holes for the beams. The inlaid stones show that there were two beams beside each other. In this way, the people pulling on top of the conveyer-belt could control the lever. Because of the lack of a ramp, there would not be room for people working at the bottom. Between the third and the fourth girdle there are indications of two pairs of levers. The distance between the girdles is 5.2 m., a little less than 10 cubits. At the first conveyer-belt every pair of levers had to pull 5 cubits of the conveyer-belt, which is considerably more than the 3 cubits at the second conveyer-belt. Probably this could be done

by four men at the top of every pair of levers. Since the men at the bottom were saved, the total amount of labour was the same.

An objection to the theory could be that some of the original wall stones don't have inlaid stones where they should have. The answer to this is that some of the original stones have been cut again and even moved to another place when the ascending passage had been built. An example of the new cutting is a wall stone in the upper part of the east wall. The stone is regularly cut, but it has two inlaid stones. Between the fourth girdle and the granite plug, two inlaid stones give a clear indication of a pair of levers. The rest of this part of the ascending passage is not accurately investigated because extensive exfoliation has taken place. (Edgar, 1910, page 232).

From the upper end of the Grand Gallery the materials had to be brought further up. A way to do this would be to have a third conveyer-belt with the same ascending angle. The upper end of it would be near the south surface of the pyramid. The height of the end is about 50% of the height of the pyramid, but the volume is 87.5% of volume of the pyramid. Except for the small part on top of the conveyer-belt all this building material could be brought up with the interior conveyer-belts. The remaining 12.5% had to be brought up on the surface of the pyramid. Probably the transportation at the surface began at an early stage and was responsible for much more transportation. The first reason for building the Grand Gallery was the transportation of the huge blocks for the King's Chamber. Nevertheless the interior conveyer-belts are responsible for far the most of the transportation of building material. The Great Pyramid could not have been built without the use of them

How was the King's Chamber built?

The granite blocks for the King's Chamber weigh up to 50 tons. If this weight should be pulled up a ramp it would need more than 500 men, and this is impossible in a site for building. Levers must have been used. When they built the King's Chamber, they had to change the construction of the conveyer-belts. This was necessary because the stones for the King's Chamber exceeded the normal thickness of 0.75 m. In fact some were as high as 2.9 m. Consequently the beams in the holes of the walls were removed, and the holes in the walls were inlaid. Now beams could be placed on the ramps along the walls secured by the holes in the ramps. Blocks were fastened to these beams above the ramp-holes. A horizontal shaft was fastened to the pair of levers and this shaft should be placed by the pulling people to rest on the blocks. The wear marks on the walls seen in Figure 2 may be due to this working method. Now the short arm of the lever was only about 60 cm., which means that every move of the sleds would be only 35cm, but the push on the lever would be able to move more weight. The huge granite beams from the top of the Kings Chamber are up to 1.9 m broad. They can just pass through the Grand Gallery, but only if they are loaded on a high sled. In the west wall of the Grand Gallery there is a groove in a distance of 3.9 m from the floor. This groove is obviously an effect of transportation. The transportation of the heavy blocks for the King's Chamber is a possible explanation.

The first conveyer-belt at the ascending passage was unfit for building the King's Chamber because it was too narrow. Consequently a new conveyer-belt had to be built on top of it reaching from the ground level to the bottom end of the Grand Gallery. We don't know how this fourth conveyer-belt was built, but we can assume it was similar to the second one. The difference in elevation of the two conveyer-belts should be small where they met. This meant that the south part of the first conveyer-belt was removed. We can see that this part of the ascending passage is newly built and differs from the rest of it. The top of the three first girdles had to be cut off, but the fourth girdle could stay because the new conveyer-belt would

pass over it.

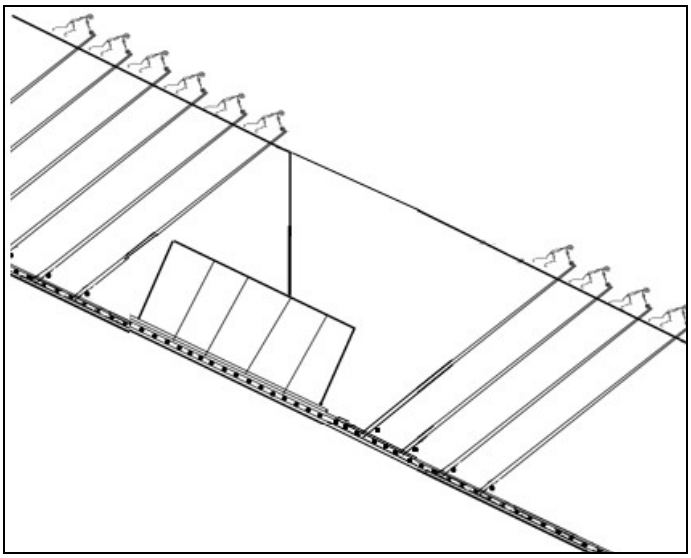

Figure 5. Transportation of a heavy granite block for the King's Chamber.

Figure 5 shows the suggested way of transportation in principle. Two ore three conveyer-belts could be built together. Some levers are pushing and others are pulling. There are strong beams connected to the sled. For every cubit a transverse beam is fastened on the strong beam. The levers push on the transverse beams.

We can only guess at how these heavy blocks were mounted at the King's Chamber. One way would be first to raise them all to the appropriate level. When they built new layers with the third conveyer-belt, they could leave some "shelves" on the west side. The first shelf would be left for the blocks for the walls of the King's Chamber, the next shelf for the blocks for the roof, and so on. When they came to the upper end of the third conveyer-belt they could bring up the blocks for the King's Chamber, starting with the top, and place them at the appropriate shelf. At the same time the west wall of the conveyer-belt would be removed. The east wall could stay and be part of the pyramid, because the King's Chamber is placed on the west side. Then the heavy blocks could be pushed horizontally into their right position in the King's Chamber.

When the King's Chamber was finished, the floor of the fourth conveyer-belt was removed to make room for the construction of the ascending passage. Then the descending entrance passage had to be built. Then the empty room above the ascending passage and the descending entrance passage could be filled up with unpolished blocks. Polished blocks were only needed at the surface of the pyramid. The third and fourth conveyer-belt are hypothetical. Their remains are hidden for the human eye, but may be seen by some detector.

Could the conveyer-belt technique be used other places?

The engineering of the conveyer-belt seems quite effective, because many blocks are moved simultaneously. A similar technique was probably used in other places in this and other pyramids. In order to build the upper levels and other parts of the pyramid, a machinery for raising the blocks had to be used on the outside surface. We don't know what this method was, but the conveyer-belt technique may give us an idea. The inclination is 52 degrees, which

means that the friction is almost insignificant. Thus measures must be taken to prevent the sled from sliding down, when the levers are lifted. One way to solve this problem would be to let the levers on one side hold the sleds, while the other levers were moved to the next position.

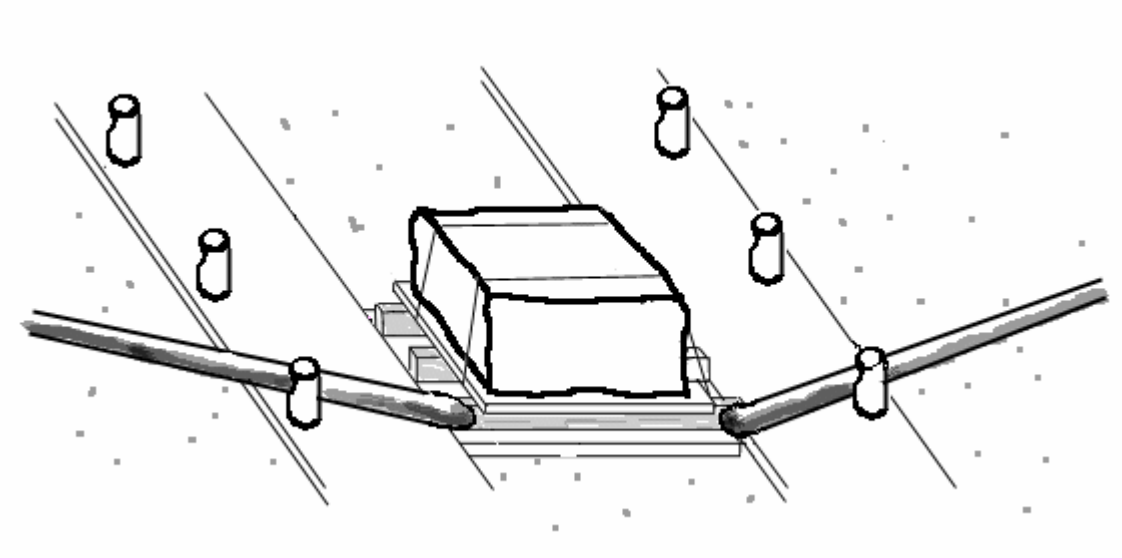

Figure 6. Suggested lever machinery at the surface of the pyramid.

Figure 6 shows a suggestion for a lever-machinery. The principle is similar to the conveyer-belt, but here the levers are almost parallel to the surface of the slide. The horizontal levers are just poles, and each one could probably be handed by one man. The length of the levers was probably the same as the vertical levers of the Grand Gallery. Only part of the levers is shown in Figure 6. Only one sled and one pair of levers are shown in Figure 6, but many could be added to make a conveyer-belt. The blocks were secured to the sleds but even so it would be impossible to use the outside conveyer-belt for tall blocks. We can only guess where this outside conveyer-belt may have been placed at the Great Pyramid. In order to place the top stone it would have to be placed at the middle of one side. If it was placed at the middle of the north side, it would explain why the inside conveyer-belt is not placed in the middle of the north side. From the photos I have, there seems to be a trace in the masonry in the middle of the south side of the pyramid. Could it be a trace of an outside conveyer-belt there? Perhaps a careful study of the preserved masonry could give an answer.

Why was the King's Chamber lifted up?

All pyramids except the Great Pyramid have the burial chamber on the ground level or below. In many cases a well is found in connection with the underground corridors. This probably shows that the grave belongs to the underworld from where the new life grows. The entrance to the pyramid is normally from the north side sloping downwards at an angle of about 30 degrees. Seen from the burial-chamber, the entrance corridor would be sloping upwards pointing towards the North Pole. That would make it possible for the king's spirit "ba" to ascend to the immortal star world. The celestial North Pole was regarded as a gate to the stars, probably because the stars here are always above the horizon and they move slowly. Edwards has pointed out (Edwards 1993, page 284) that the northern shafts from the King's Chamber and the Queen's Chamber were substitutes for the sloping corridor. The northern shaft from the King's Chamber has a slope of 32 degrees. The northern shaft from the Queens Chamber has a slope of 37 degrees. These shafts were necessary because of the exceptional design of the Great Pyramid with the chambers lifted up.

However the southern shafts must have another explanation. The southern shaft from the King's Chamber has a slope of 45 degrees. The southern shaft from the Queen's Chamber has a slope of 40 degrees. Twice a day they will point at Ecliptica, where all the planets including the sun and the moon move around. Twice a year they will even be directed towards the sun. The pyramid texts often describe the king as mounting to heaven on the rays of the sun (Edwards 1993, page 282). If we take into consideration that Cheops was an incarnation of the sun-god Ra, we can assume that the southern shafts made it possible for the king's spirit to ascend to and descend from the heavenly sea-route of the sun. Heaven was conceived as a sea. On walls in burial chambers in the Kings' Valley from about 1450 B.C. we see the sun-god in the underworld sailing in his ship pulled by many helpers. Pictures show that the sun-god sailed in the daytime as well. This explains why there are boats buried beside the Great Pyramid and a few other pyramids. The spiritual aspect of these boats was meant for Ra, the spirit of the deceased king.

Egyptian religion can be regarded as a special case of African ancestor worship. The Egyptians believed that their ancestors had influence on the life of the living human beings. Nowadays we might explain this influence as a result of inheritance and milieu. We know that they wrote letters to ask for help from the spirit of a deceased member of the family and put the letters in the grave. The grave was the point where the living and the dead could enjoy the company of each other. The preservation of the dead body was essential because it was a home and resting place for the spirit of the deceased. A statue or portrait could be used for the same purpose. If the descendant didn't take care of the deceased and didn't let him take part in the life of the living, the deceased would suffer a second death. A human being had three invisible spirits. The ”ka” had the same shape as the body and represented the personality and life force. The ”ba” could have any shape and represented the mind. It could fly far away and was therefore depicted as a bird with human head. The “akh“ is the immortal soul made of light who lives in the world of the gods. When the ka and the ba go to heaven, they are assimilated in the akh.

The creator gods were the first ancestors. They were treated like the ancestors but they were more powerful. For instance Chnum formed every human being out of clay in two similar copies: a body and a ka. Then they were put in the mother's womb. It seems that he had to do a lot of work, but the idea was that all human beings received a creative force from him. Every morning Chnum also formed an egg, from which the Sun came out. The gods were animated natural forces. It is interesting that Cheops´ Egyptian name was “Chuefui Chnum”, which means ”Chnum protects me”. Cheops was regarded as an incarnation of Ra. Even the sun-god Ra was dependent of the constructor god, Chnum.

The true pyramid is an abode on earth for the heavenly god Ra. The step pyramids don't have the lines pointing up or down. The steps seem to be useful for human beings to dwell on. Furthermore the top stone of a pyramid was called "benben", meaning ”(great) seed”. In the sun-temple in Heliopolis stood an old benben stone, and according to the myth it came from heaven. The benben stone is a model of the primeval hill that Ra created. The true pyramid was introduced as a symbol for the divine royal power when Cheops was crown prince. Cheops carried out a religious reform. Now the sun had to be the symbol of the supreme god, Ra. Ra created the daylight and life every day, he came down to earth every night, he represented stability and eternal life. He was worshipped in open air at altars and pyramids and not in the dark rooms of temples. The people who built the Great Pyramid probably had a religious motivation. They created the eternal life and were part of a high spiritual fellowship. The Egyptian word for pyramid is "mer" meaning “place of rising”. The Great Pyramid was called “Cheops´ Horizon” meaning a place for Cheops to rise from earth to heaven and to

descend from heaven to earth. In that way the pyramid was a manifestation of Cheops´ divine nature. Small pyramids were placed several places in the Kingdom in connection with the royal storehouses and grainhouses. Small pyramids with a statue of the sitting king on the top has been found (Stadelmann, 1990, pages 77-78). The taxes were regarded as sacrifice for Ra, the creator of the land and the people. The king was an incarnation of Ra and would take care of the redistribution of the goods. This centralised system had fatal consequences for the traditional religious authorities, which can be seen from Herodotus' remark (Herodotus 450 B.C. chapter 124): "Cheops, according to the Egyptian priests, on ascending the throne, plunged into all manners of wickedness. He closed the temples, and forbade the Egyptians to offer sacrifice, compelling them instead to labour one and all in his service; viz. in building the Great Pyramid."

The exceptional and impressive construction of the Great Pyramid makes sense because Cheops more than any other Egyptian king insisted on the kingship to be divine. His first son, Djedefre, assumed the title son of Ra, and all kings afterwards had this name. Cheops´ father Snofru, had an enormous building program including step pyramids and the first true pyramid. These projects have given experience and education to architects and workers, and made them able to create more impressive works. An essential part of the Giza build-up area established by Cheops, is the Great Sphinx, a demonstration of his royal and divine power. Stadelmann has explained that all evidence supports the theory that the Great Sphinx is the work of Cheops(Stadelmann 1998, page 75). The written evidence is poor, but can be interpreted in favour of Cheops as well as of Chefren. Evidence in Cheops´ favour is the facial expression, the lack of ceremonial beard and the style of the head-dress. The Sphinx is the greatest sculpture ever built. The lion is a symbol of the sun-god. The Sphinx is heading straight east. The Sphinx temple in front of the Sphinx is build according to the same principle as the east temple of the Great Pyramid. They both have an open yard for burnt offerings. The east temple has a sanctuary to the west, but the Sphinx temple has two sanctuaries: one to the east and one to the west. This temple was for the sun-god, with his three aspects Khepr the rising sun, Ra the noonday sun and Atum, the sinking sun.

From this point of view the King's Chamber is a room for Ra. It is lifted up in order to be near heaven. The building material is granite symbolising eternal solidity like in heaven. The five roofs may symbolise five spheres of heaven connected with different celestial bodies. The red colour is the traditional Egyptian colour for the sun and for heaven. The deceased king's spirit, ba, will be an aspect of Ra, and the King's Chamber will be a resting place for the spirit. King Menes from the first dynasty had a burial complex with three large graves: one for the mummy in the underworld, one for a statue of the king on earth, and one empty, probably for the invisible god in heaven. In the red pyramid made by Cheops´ father, Snofru, there are also three large chambers. The Queen's Chamber in the Great Pyramid has a niche probably meant for a statue of Cheops and his terrestrial spirit, ka.

Why was the Grand Gallery preserved?

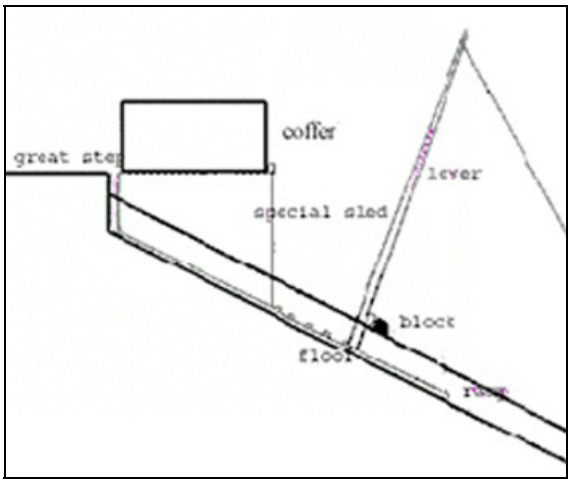

Figure 7. Possible construction of a sled for transportation of the coffer.

When the transportation of building materials inside the pyramid was finished, the Grand Gallery was just covered, presumably because it was going to have a new function. This function is probably the transportation of the coffer that was found empty in the King's Chamber. The coffer is 0.98 m broad, 1.05 m height and 2.27 m long. It is possible to conceive a special sled for moving the coffer up or down the gallery keeping it horizontal. Such a sled is shown in Figure 7. We have to take in consideration that there is a step at the top end of the Grand Gallery 0.90 m in height. One pair of levers would be sufficient. Because the Gallery is now covered, the levers had to be pulled from below by ropes fastened to the top of the two levers. The horizontal shaft connecting the two levers has been mentioned above.

The coffer is made of red granite, but compared to the fine work of red granite in the King's Chamber it is very poor. No kings before Cheops were buried in a sarcophagus. Nevertheless most Egyptologists believe that Cheops was buried in the coffer. In that case the special sled with the coffer could be used for a funeral procession. Whatever the ritual transportation of the coffer, it had to pass through the Antechamber, and the structure of this chamber might give some idea of the rituals.

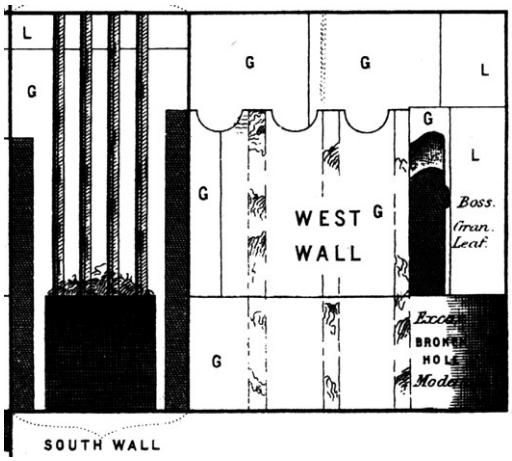

Figure 8. Sides of the Antechamber (Smyth 1880,Plate XV)

The Antechamber is only 6 cm broader and 6 cm higher than the coffer. The passage from the Antechamber to the King's Chamber is only 20 cm longer than the coffer, which means that the coffer fits in this passage. The walls of the Antechamber have three opposing pairs of vertical slots, which look like arrangements for lock-gates or pistons. Egyptologists assume that the slots have held thick portcullis slabs. The purpose of the portcullises was to stop grave robbers. But the portcullises here are not of the traditional type. Robbers could easily climb over them. Besides, the four slots in the south wall probably gave room for ropes for pulling up the portcullises. This indicates that the rituals were repeated. The length of the coffer is the same as the length of the Antechamber from the south wall to the so-called granleaf. The coffer could be placed there as part of the ritual.

It seems strange that the funeral procession would have to pass the narrow ascending passage, where the coffer could not pass. If the conveyer-belt number four described above existed, then it might have been used directly or in a rebuild shape, for the funeral ritual. The funeral procession could pass the conveyer-belts number four and two from the ground level up to the

King's Chamber. Only a small part of the pyramid on top of the fourth conveyor-belt was unfinished. Not until the rituals inside the pyramid was finished could the rest of the passages be built. The ascending passage was built in place of the fourth conveyer-belt. The entrance to the ascending passage was locked with three big granite blocks. As far as I know, there is no satisfactory explanation of how these blocks could have been placed after the ascending passage was built. The ascending passage was consequently not planned for human beings, it seems to be built for the ka to move in and out. The sealing corresponds with the sealing of the shafts.

The descending entrance was built as a lengthening of the descending passage. The descending passage is cut out of the rocky ground. It has approximately the same height and breadth as the ascending passage. The ka of Cheops had to have a connection to the underworld and the water because the new life and reincarnation began there. Only after a break in the underworld, the ka could travel from the underground chamber through the descending passage to the circumpolar stars. From the unfinished underground chamber a horizontal passage leads southwards, and a well leads vertically down. The impression is that the underground chamber had no practical purpose, but was a symbol of the underworld.

One reason that the Grand Gallery was preserved could be that the rebuilding would be difficult because the Grand Gallery was covered. Another reason could be that the Grand Gallery was the most important route when ba, the spirit of Ra, moved from the Kings Chamber to ka, Kheops´ statue, in the Queens Chamber.

What kind of ritual took place at the Great Pyramid?

It seems that some exceptional rituals were planned for the Great Pyramid. The revolutionary design of the pyramid makes it difficult to expect the traditional rituals. Most pyramids had a mortuary temple at the east side of the pyramid. Every day there was the same ceremony in the temple. One of the statues of the dead king was revealed, washed, combed, dressed and adorned by the priests. Incense, food and drink was offered and there was music and recitations. The ka was supposed to take up residence in the statue and enjoy the meal. The temple east of the Great Pyramid, however, does not seem to be a typical mortuary temple. It consists mainly of an open court surrounded by a cloister and there would not be room for the ceremonies described. The trapdoor facing the grave typical of mortuary temples could not be found. Traces of a drainage originating from the middle of the yard suggests that there was an altar for burnt offerings or libations. This temple seems more like a temple for the rising sun.

The idea of the rituals was to please and honour Ra, the creative force in life. Ra´s ba was in Cheops´ mummy. It was essential that Ra should come back to the pyramid regularly and create life in Egypt. The traditional funeral of the Egyptian king included the so-called “mouth opening ceremony”. The mouth of the mummy was opened at the grave in order to let the ba come out. The oldest son of the king carried out the opening with a special crowbar made of meteoric iron. Probably a ceremony like that was performed at Cheops´ funeral, possibly in the King's Chamber.

Worshipping of the dead king must have been carried out a number of years at the entrance to his pyramid at the North-side. It is difficult for me to say how, but I would like to draw attention to the fact, that if the porcullises in the Antechamber was lifted up, the coffer with the mummy could be taken out of the King's Chamber and moved to a lower level in order to take part in the ritual. In this way Ra descends from heaven to earth. The most important time for his presence would probably be at the Opet festival, when the life of the next year was

created. The Opet festival took place at the beginning of the year at the time of the annual inundation. Many statues of gods were taken out of the temples, carried on ritual boats. The gods could be carried to visit another temple.

Whatever the rituals inside the Great Pyramid were, they were only performed for a limited period after Cheops´ death. When these rituals were abandoned, the entrance was sealed up and the passages made ready. Above the descending entrance was built a portal with a trapdoor. It can be seen from outside the pyramid, and the purpose of it could be that believers could get in contact with Ra and sacrifice.

Herodotus saw a causeway by which they had to pull the stones for the pyramid. He stated that it was built of polished stone on which was carved pictures of animals. (Herodotus 450 B.C. chapter 124). Today only fragments are left. 500 m east of the Great Pyramid was a harbour and a valley temple and the causeway started there. It is assumed that the causeway ended at the east side of the pyramid. If we talk about the transportation of the granite stones and limestone for the outer facing, the end of the causeway could have been at the north side of the pyramid. Perhaps this causeway was rebuilt in order to be used for rituals taking place at the North-side of the pyramid. The rest of the material for the pyramid was local stone taken from a quarry south of the pyramid. Remains of a ramp have been found leading from the quarry up to the south-west corner of the pyramid (Hawass).

A much disputed question has been where to find the final burial place of Cheops. The present study does not give an answer to that question. The study here indicates that the divine part of Cheops had a funeral in the King's Chamber and a special funeral for the ba. The earthly shape of him, the ka, had a statue in the Queen's Chamber. His corpse had a symbolic traditional tomb underground for a king. But that does not tell us what finally happened to the mummy and the grave presents. Most archaeologists believe that the King's Chamber was the final burial chamber. But I would like to mention an alternative theory. Herodotus has the following statement: “On the plateau where the pyramids stand, Cheops built in a subterranean region, on an island there surrounded by the waters of the Nile, some chambers, that he wanted to arrange for a burial place for himself." (Herodotus 450 B.C., chapter 124). Smyth has examined the Giza plateau and even found a tomb, about 15 m deep, about 50 m north-west of the tail of the Sphinx.(Smyth 1880, plate XIX). Even if this is not Cheops' tomb it shows the possibility of this kind of final burial for Cheops.

Bibliography.

De Morgan: Fouilles à Dahchour, Mars-Juin 1894. Vienna 1895.
Edgar,J./ Edgar, M.:The Great Pyramid Passages. 1910
Edwards,I.E.S.:The Pyramids of Egypt. Penguin Books 1993.
Hawass: http://www.guardians.net/hawass/pbuildrs.htm
§ Herodotus: Euterpe. 450 B.C.
Maragioglio/Rinaldi: L’architettura delle Piramide Menefite.1965
Smyth, P.:The Great Pyramid.1978. Originally published in 1880.
Stadelmann, R: Die grossen Pyramiden von Giza. Graz 1990.
Stadelmann, R.: Kongegrave fra pyramidetiden. in Ægypten faraonernes verden. Könemann 1999.German edition 1998.