Pyramid Construction Techniques

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Abstract: Pyramids of Giza are the most popular pyramids of the World. Whenever there is a talk of the Pyramids, Pyramids of Giza strike our mind. Only the Great Pyramid of Giza remains out of the seven great wonders of the ancient world. The largest of the three pyramids in Giza was built by Pharaoh or King Cheops. Cheops was the name given to Pharaoh Khufu by the Greeks. The pyramid of Giza was the first one to be built at Giza and is also the largest, so it is called the Great Pyramid. Approximately 1.9 million limestone blocks weighing up an average of 2.4 tons were used in its construction. It was built in the year 2547-2524 B.C. Its construction was supervised by Khufu's brother, Hemienu. Hemienu looked after the construction of all the Projects of his brother and in the process had become the right man of his Pharaoh. Hemienu’s tomb is one of the largest in a burial ground adjoining to the pyramid. The thing which is not known to us is that exactly how it was built, a question in controversy for millennia.

Key Words: Pyramid, Egypt

1. INTRODUCTION

Pyramid is a massive construction faced with stone or brick and having a rectangular foundation and four inclined sides meeting at an apex. Pyramids have been constructed at various places and at various times in Egypt, The Sudan, Ethiopia, western Asia, Greece, Cyprus, Italy, India, Thailand, Mexico, South America, and on some islands of the Pacific Ocean. But the main places in Egypt and Central and South America. The pyramids of ancient Egypt were funerary structures. They were built over a period of 2,600 years. But the time at which pyramid building reached its peak, was that commencing with the 3rd dynasty and ending at roughly the 6th (2686–2325 BCE). During those years the pyramid was the usual kind, a sort of royal tomb. It was not an isolated structure but was always part of an architectural complex. The essential components, at least during the Old Kingdom, were the pyramid itself, containing or surmounting the grave proper and standing within an enclosure on high desert ground; an adjacent mortuary temple; and a causeway leading down to a pavilion (usually called the valley temple), situated at the edge of the cultivation and probably connected with the Nile by a canal. Scores of royal pyramids have been found in Egypt, but many of them were reduced to mere mounds of debris and long ago plundered of their treasures.

There are about 110 pyramids currently known in Egypt, many in a state of great disrepair and almost unrecognisable. Some were built as burial places for kings and others for queens. A pyramid also may have represented a stairway for the king to ascend to the heavens. Another possibility is that it was symbolic of the primeval mound on which the sun god/creator was born.

How the Egyptians managed the complex organisation of labour and the physical movement of large stone blocks is still a matter for debate. Pyramid construction may have involved ramps being erected around the pyramid. Blocks of stone would have been pulled up on sledges and the ramps dismantled later. It is believed that most of the labour for the construction of the pyramids would have come from farmers who were available during the inundation season when the Nile River flooded and farmland was underwater. It would also have been an ideal time for the transportation by boat of large stone blocks from their quarries to the pyramid sites.

2. THEORIES RELATED TO CONSTRUCTION OF PYRAMID

Several Theories attempt to explain how pyramids were constructed, but for now, the mystery has yet to be solved.

The Ramp Theory

One theory suggests that RAMPS were used to haul the stone blocks on wooden sleds up the side of the pyramids. The ramps were lubricated with water to reduce friction when hauling the blocks. As few as 10 men were needed to drag a stone block up a ramp. May have been several ramps on each side of the pyramid at different levels, and a ramp may have been coiled around the pyramid as it grew in height. Once a stone block reached its desired level, wooden rockers may have been used to maneuver it into position.
The Wooden Crane Theory

It suggests that a wooden crane with a counterweight on one end may have been used to lift the blocks from one level to the next. This theory has been disputed, since the Egyptians did not have access to trees that were strong enough for this type of work. The average weight of the Stone Blocks used to build the Great Pyramid at Giza has been estimated at 2.5 Tons. Such an enormous weight would undoubtedly break a wooden crane before the block could be lifted.

The Pulley and Fulcrum Theory

Another possibility involves the use of pulleys to hoist the blocks up the ramps and fulcrums to manipulate the blocks into place. Pulleys were used on ships at the time. The pyramids were probably not built by slaves because slave labor was not widely used in Egypt at the time. Peasant Farmers, however, were required to spend a number of weeks working on construction projects. This provided the paid labor needed to build these gigantic structures. Since the fields were under water during the summer, wages earned in building the gigantic pyramids supplemented the family income. Pyramids did not stand alone; they were part of a funerary complex. The complex includes a Processional causeway that links a funerary temple to the pyramid, solar barques buried on the four sides of the pyramid, and mastabas and smaller pyramids where the family of the king and nobles were buried.

The Internal Ramp Theory

A fundamental new idea has recently been forwarded by Jean-Pierre Houdin, a French architect who has dedicated the last seven years of his life by creating detailed computer models of the Pyramid at Giza. Using 3-D software developed by Dassault Systems, pooled with an initial Pyramid at Giza. Using 3-D software developed by Henri Houdin, his father who was an engineer, the architect has arrived to the conclusion that a ramp was used to lift the limestone blocks to the top, and that the ramp is still in existence--inside the pyramid!

The theory suggests for the lower 3rd of the pyramid, the blocks were kept using the external ramp. The ramp was shorter than the one required reaching the top. These blocks were formed of limestone, which was slightly smaller as compared to those used to build the bottom third of the pyramid. The bottom of the pyramid was made through the external ramp; another ramp was being built, inside the pyramid, on which the blocks for the top two-thirds of the pyramid would be dragged. According to Houdin, the internal ramp begins at the bottom, is about 6 feet broad, and has a grade of approximately 7 percent. This ramp was put into use after the lower third of the pyramid was finished and the external ramp had served its rationale.

The plan of the internal ramp was somewhat determined by the design of the centre of the pyramid. Hemiu knew all about the problems encountered by Pharaoh Sneferu, his and Khufu's father. Sneferu had considerable difficulty building a suitable pyramid for his burial, and ended up having to construct three at sites south of Giza! The first, at Meidum, which may had structural troubles and was never used. His second, at Dashur--known as the Bent Pyramid because the slope of its sides changes midway up--developed cracks in the walls of its burial chamber. Huge cedar logs from Lebanon had to be wedged between the walls to keep the pyramid from collapsing inward, but it too was abandoned. There might have been a crazy rush to finish Sneferu's third and successful pyramid, the distinctively coloured Red Pyramid at Dashur, before the aging ruler died.

From the beginning, Hemiu planned three burial chambers to ensure that whenever Khufu died, a burial place would be ready. One was carved out of the bedrock beneath the pyramid at the beginning of its construction. In case the pharaoh had died early, this would have been his tomb. When, after about five years, Khufu was still alive and well, the unfinished underground burial chamber was abandoned and the second burial chamber, commonly called the Queen's Chamber, was begun. Sometime around the fifteenth year of construction Khufu was still healthy and this chamber was abandoned unfinished and the last burial chamber, the King's Chamber, was built higher up--in the centre of the pyramid. (To this day, Khufu's sarcophagus remains inside the King's Chamber, so early explorers of the pyramid incorrectly assumed that the second chamber had been for his queen.)

Huge granite and limestone blocks were needed for the roof beams and rafters of the Queen's and King's Chambers. Some of these beams weigh more than 60 tons and are far too large to have been brought up through the internal ramp. Thus the external ramp had to remain in use until the large blocks were hauled up. Once that was done, the external ramp was dismantled and its blocks were led up the pyramid via the internal ramp to build the top two-thirds of the pyramid. Perhaps most blocks in this portion of the pyramid are smaller than those at the bottom third because they had to move up the narrow internal ramp.
3. REFERENCES


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