

How Pyramids Work

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The Egyptians took pyramid design to new heights, culminating in the construction of the pyramids of Giza in the 26th century B.C. Laborers used 2.3 million blocks of limestone and granite to build the **Great Pyramid of Khufu**, which stands 146 meters high, has a 230-meter-square base.



The stepped pyramid of Djoser. See more pictures of **Egyptian pyramids.**

BETHANY CARLSON, [SXC](#)

A number of pyramids, including the Great Pyramid of Khufu, have survived thousands of years of exposure to the elements, a tribute to the ancient architects, engineers and workers who built them.

In the next section, we'll learn more about the pyramids of Egypt and the evolution of pyramid design.

HEAVY BUILDING MATERIALS

Laborers used 2.3 million blocks of limestone and granite to build the Great Pyramid of Khufu, which stands 146 meters high, and has a 230-meter-square base.

Building the Pyramids



on the Giza plateau in Egypt.

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Obtaining building material

The pyramids were built of limestone, granite, basalt, gypsum (mortar), and baked mud bricks. Limestone blocks were quarried at [Giza](#) and possibly other sites. Granite likely came from upriver at Aswan. Alabaster came from Luxor and basalt from the Fayoum depression.

[Iron](#) tools were not available, so

workers used copper and stone-cutting tools to carve out the blocks in the quarries. They then used levers to move the stone blocks away from the quarry site.

Transporting building materials

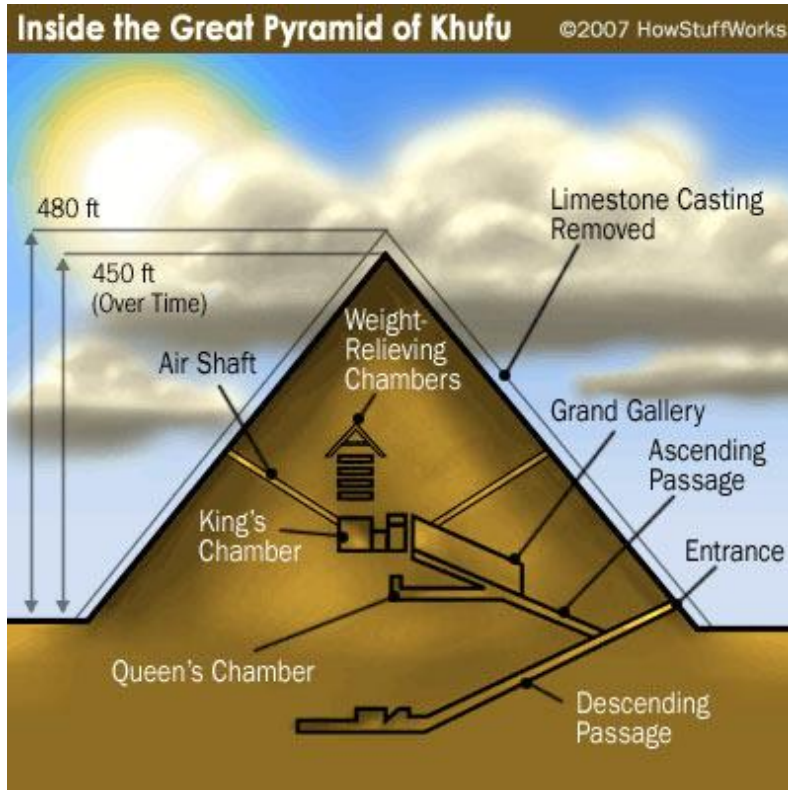
Again, no one knows how laborers were able to get the 2.5-ton stone blocks from the quarries to the building site. Wheels wouldn't have been useful on the desert sand and gravel, so they most likely dragged the blocks with wooden sleds and ropes. Some think that workers used quarter-circle wooden sleds that fit around a rectangular block. They attached the sleds to the block, and a crew of about eight men rolled them along the ground. Others say the laborers used wooden rollers.

For long-distance transport, the blocks were loaded on barges and transported down the Nile. Workers dug canals to get the barges nearer to the site.

Egyptologists estimate that workers placed about 300 stones a day during pyramid construction. Several theories -- lever systems, ramps and kites, for example -- attempt to explain how the huge blocks got into place. Those in the know generally accept the ramp idea, but they debate the exact ramp configurations. The ramps could have been long and straight, perpendicular to the sides or wrapped around the core.

While laborers placed stones in the core, stone cutters were making the chambers, passageways and shafts in the pyramid's interior. Artists inscribed the designs that adorned the chamber walls.

The Great Pyramid of Khufu



The [Giza](#) pyramid complex, on the west bank of the Nile, is the most famous group of pyramids in the world. As we discussed earlier, the grandest pyramid was built for Sneferu's son, Khufu, in 2540 B.C. The two smaller pyramids nearby were for Khufu's son, Khafre, and his grandson, Menkaure. After this dynasty, great pyramid building stopped, probably because of the time and expense of these massive state projects.

The **Great Pyramid of Khufu** on the Giza plateau in [Egypt](#) is the largest and most elaborately constructed pyramid in existence, representing the most

advanced aspects of pyramid construction. Khufu's pyramid has the following features:

- The **primary burial chamber**, or king's chamber, contains the **sarcophagus** (tomb) that held Khufu's body, and the walls are adorned with **hieroglyphs** (writing) depicting various aspects of [ancient Egyptian history](#) and religion.
- The smaller **queen's chamber** (mis-named -- *it was not intended for the queen*) lies within the pyramid, while an unfinished **secondary burial chamber** lies under the pyramid.
- **Weight-relieving chambers** above the king's chamber distribute the weight of the overlying rock and prevent the king's chamber from collapsing.
- The **gallery** is a large passageway with a vaulted, corbelled ceiling (the walls are layered upward; each vertical layer sticks out further than the one below to form a primitive arch).
- **Passageways** connect various chambers to each other and to the outside.
- **Air shafts** connect the king's chamber to the outside. They may have been designed as a way for Khufu's spirit to exit the pyramid and rise to the heavens.
- The **entrance** was sealed after the pharaoh's body was placed inside.
- **White limestone rocks** line the pyramid's exterior, giving it a smooth face. These rocks have eroded away over time, but we know they existed because the Pyramid of Khafre still has some on its peak.

Pyramid Workforce

The Greek historian Herodotus described the building of Khufu's pyramid by more than 100,000 slaves. But when Harvard archaeologist Mark Lehner led an expedition to uncover clues about the people who built the pyramids, he found no evidence of housing for such a large population.

Instead, his group discovered housing and food storage places for small gangs of workers. It appears that at any one time about 2,000 workers were on site, divided into two large divisions and smaller groups of about 200 men. The evidence indicates that they were probably paid and well fed. The working groups were periodically rotated over the years of pyramid construction, and the total workforce may have been about 30,000 [source: [Harvard Magazine](#)]. No slaves were used in the building of the pyramids.