



ARCHAEOLOGY

The Pyramid Effect

The construction of Egypt's most famous monument spawned a social organization that changed the world

By Zach Zorich

NEW DISCOVERIES are revealing the people who built the famed monuments of Egypt's Giza Plateau, including the pyramids of Pharaoh Khufu (left) and Pharaoh Khafre (right).

LATE SUMMER IN EGYPT, around 2525 B.C., and the Nile is flooding. To a worker named Merrer, the deluge means it is time to bring stone to the site of Pharaoh Khufu's pyramid. The journey from the quarry in Tura southeast of the port at Giza is just eight miles. But the heavy cargo of gleaming white limestone, which will form the outer layer of the monument, makes the crafts difficult to maneuver. And the river seems as vast as an ocean when it rises over its banks. Merrer has sailed the open seas before, however. The fleet of barges and the 50 men under his command are in experienced hands.

He eyes their destination. In the distance he can see the floodwaters lapping against a massive limestone wall. Other boats carrying grain, lumber and livestock sail around the east end of the wall to unload their cargoes in the town there, but Merrer's barges aren't going that far. They make landfall north of the wall, where the golden bedrock of the Giza Plateau slopes down to the river, forming a natural ramp that will facilitate moving the limestone to the construction site.

From the river's edge, Merrer can see what will be the tallest building in the world for at least the next 3,800 years. Thousands of workers swarm across the construction site of the pyramid, which will eventually serve as Khufu's tomb, hauling the giant stones into position and checking and rechecking their alignment. The structure is nearing completion. Soon the upper layers of stone blocks will be in place, and the pyramid will be fully encased in polished Tura limestone and topped with a gilded capstone.

Who were the people who built Khufu's pyramid and the pyramids of Egypt's other pharaohs, and why did they devote their lives to the task? Greek historian Herodotus, writing in the fifth century B.C., thought that the pyramids had been built by armies of slaves motivated by the whips of their overseers. In the past few decades, however, discoveries of other written sources have shown that gangs of Egyptian citizens provided most of the labor. But these sources revealed next to nothing about the lives of those people. For all archaeologists knew, they could have been low-paid

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laborers who were treated little better than slaves—half-starved, bedraggled men lashed until the limestone was unloaded from the barges onto wood sledges and dragged up to the pyramid.

Now new findings, including a papyrus ledger that documents the activities of Merrer and his crew, are finally bringing the pyramid workers into focus—and showing the iconic monuments they built in an entirely new light. Excavations at two key sites suggest that the significance of the pyramids reaches far beyond being feats of engineering. It turns out the workers who built these structures did not just drag stone blocks. They were an elite labor force that also sailed trade missions to locales hundreds of miles away to bring back supplies and building materials. The development of the highly sophisticated labor organization and trade network needed to build the pyramids did more than make it possible to construct huge monuments; it set the stage for centuries of Egyptian prosperity and altered the course of later civilizations.

AIMING HIGH

PYRAMID BUILDING DID NOT BEGIN on the Giza Plateau. Pharaoh Netjerikhet, who ruled from 2650 to 2620 B.C., built the first

IN BRIEF

For years archaeologists who study the Giza pyramids in Egypt have focused on the engineering details of these monuments. But the real signifi-

cance of the pyramids lies in the social organization they gave rise to.

New finds in the ancient city of Heit el-Ghurab near Giza and a contempora-

neous Red Sea port known as Wadi el-Jarf are revealing the government, labor and trade infrastructures that the pharaohs developed to get the pyramids,

particularly the Great Pyramid, built. **These infrastructures** brought Egypt tremendous lasting wealth and enriched the economies of its trading partners.



EXCAVATORS at Heit el-Ghurab, an ancient city near the pyramids, have unearthed traces of the pyramid builders (*left*). Archaeologist Mark Lehner peers into an excavation pit in the livestock corral area (*above*).

such monument, a six-tiered step pyramid some 200 feet tall that still dominates the skyline at Saqqara, about 15 miles south of Giza. The trend of building large pyramids really took off with fourth dynasty Pharaoh Sneferu, who built three pyramids during his reign from 2575 to 2545 B.C. When Sneferu finally passed away, his son Khufu (sometimes known as Cheops) succeeded him. For Khufu, there was only one way to outdo his father: he had to build a bigger pyramid. And he would erect it on the edge of the Giza Plateau for all to see. Khufu's ambition led to the construction of Egypt's most famous monument, the 481-foot-tall, 756-foot-wide Great Pyramid of Giza.

Khufu's striving did not end there. A mortuary temple was built on the east side of the pyramid where priests could communicate with the deceased pharaoh and make offerings to support him in the afterlife. On either side of the temple enormous pits were dug to hold full-sized boats, probably for Khufu to sail in the afterlife. Two more boat pits were dug on the south side of the pyramid. And three smaller pyramids that served as tombs for important royal women stand just south of the mortuary temple. All told, the complex was a colossal undertaking.

For years archaeologists have obsessed over the engineering of the pyramids. Experts estimate that construction of the Great Pyramid alone would have required about 26,000 people to set the blocks at the bottom of the structure. As the pyramid rose and the surface area at the top diminished, the number of individuals working at the site would have decreased. Theories for how workers moved the hefty stones into place abound. The leading idea holds that they built an internal ramp to cart the

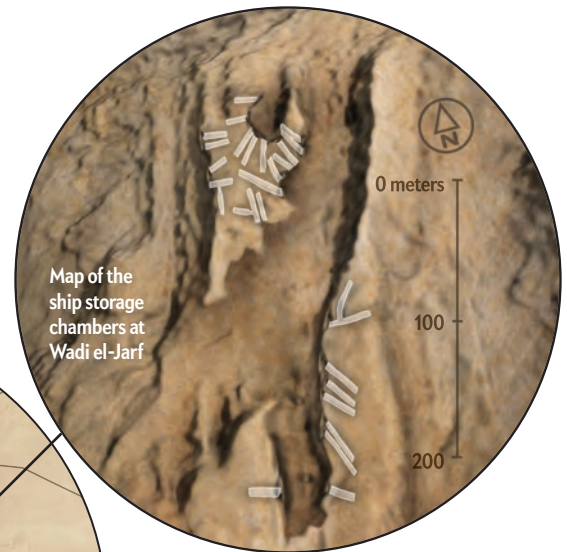
limestone to successively higher positions in the structure. But in focusing on practical details of construction, scholars missed the greater importance of the pyramids. Until now.

Mark Lehner is shaking hands and exchanging warm Arabic greetings with visitors next to Heit el-Ghurab ("Wall of the Crow")—a 30-foot-tall barrier half a mile east of the Great Pyramid. In Merrer's day, the wall would have stood north of the town, which is also called Heit el-Ghurab. Today, with the river having moved east, Cairo's urban sprawl, rather than Nile floodwater, sloshes up against the wall. When people take photographs of the pyramids, they always turn their backs to this area, preferring the vastness of the open desert to Cairo's unruly skyline. Archaeologists, too, long ignored this place—an expanse of sand wedged between the escarpment of the Giza Plateau and the encroaching city. Lehner, an Egyptologist at the Oriental Institute at the University of Chicago and director of Ancient Egypt Research Associates, based in Massachusetts, began working here in 1988 with a very specific goal in mind. He realized that the mystery of the Giza pyramids is not how so many big stones were cut and stacked; the mystery is the people. "We see the human touch everywhere," he says. "So where are the humans?" He came to Heit el-Ghurab to look for them.

Lehner is equally at home in modern Cairo and ancient Heit el-Ghurab. Today he is dressed for fieldwork in blue jeans, a

A Tomb for a God

Pharaoh Khufu's Great Pyramid was not the first pyramid built in Egypt, but it was the biggest. Its construction, on the edge of the Giza Plateau, required a national effort. Excavations in the ancient city of Heit el-Ghurab, next to Giza, and the one-time port of Wadi el-Jarf, 120 miles away on the Gulf of Suez, are revealing how Khufu managed to realize his ambition. The evidence indicates that he employed elite laborers who not only set the pyramid's stones but also sailed trade missions to faraway lands. The project fostered the development of a highly skilled workforce and an extensive trade network (map on left). This infrastructure, combined with a system of government in which the pharaoh held all the power and was considered a god, was the secret of Egypt's success in building the Great Pyramid and in generating immense wealth for centuries to come.



Wadi el-Jarf: Red Sea Harbor

Workers needed copper tools to build the pyramids. Obtaining that copper was extremely laborious, however. Most pharaohs managed to mount only a single copper expedition. Khufu, however, amassed the resources to send at least two. He launched these expeditions from Wadi el-Jarf. Excavations are yielding an incredibly detailed picture of what happened there during Khufu's reign.

One excavation area a mile from the water's edge has turned up the remains of the expedition boats, which were stored in chambers (white bars in map above) when not in use. Workers had to take the boats apart to store them between missions. When it was time to sail again, they had to put the vessels back together.

Menkaure's pyramid

Khafre's pyramid

Khufu's pyramid

Heit el-Ghurab: Nile River Port

Archaeologists expected to find a slapdash workers' town when they first started excavating the area next to the Wall of the Crow. Instead they found a carefully planned city, complete with lodging, bakeries, breweries, grain silos and corrals for livestock. Artifacts recovered from the site suggest that it was the center of the nation's extensive trade network that supplied all the goods needed to construct the pyramids. Contrary to the popular image of the pyramid laborers as slaves, they appear to have lived quite comfortably at Heit el-Ghurab.

Western town
(royal and religious
officials' lodging)Gallery Complex
(workers' lodging)

Wall of the Crow

Corral

Eastern town
(bakeries, breweries)

multipocketed vest, broad-brimmed hat and a dusty pair of boots; all have absorbed the color of the desert sand. He has an air of friendly authority and is something of a local celebrity: throughout the day random onlookers shout, “Doctor Mark!” hoping to attract his attention. One of the women he is chatting with unlocks an iron gate, and Lehner leads the way into the old town.

When Lehner and his team began excavating the site, they expected to find a modest encampment at most—a handful of nondescript buildings where poor, low-status laborers would have eked out their miserable existence each night before trudging back to the pyramids in the morning to drag more stones. Instead the team uncovered something far more elaborate—a city whose layout and architecture had been carefully preplanned by Khufu’s regime. Next to the wall the excavators found where the work crews lived, an area Lehner named “the Gallery Complex” because it is made up of long, narrow buildings with streets between them. The buildings each contained hearths and sleeping platforms for 20 people—the number of men in a work team—plus an extra room that may have been for their overseer.

Mud-brick walls mark the spots where the buildings stood; they are only about two feet high now, probably eroded by the desert wind. South of the Gallery Complex stood the bakeries and breweries, as evidenced by the bread ovens and beer jars found in the remains of the buildings there. South of the bakeries lies a large building next to what appear to be silos for storing grain and an enclosure wall that may have been used as a corral for livestock. West of the bakeries is a neighborhood that boasted big houses. The garbage dumps in this area showed that the residents here were eating a lot of very expensive veal, and clay sealings found in the vicinity bear the titles of high-ranking individuals, suggesting that the buildings served as the homes and offices for the city’s administrators.

Far from being treated little better than slaves, Merrer’s crew and the rest of Heit el-Ghurab’s estimated 6,000 residents appear to have lived quite comfortably. The findings suggest that after a long day’s work of unloading the barges, the pyramid builders would have headed into town to eat. The smell of baking bread and brewing beer would have wafted from the bakeries a few hundred feet away, advertising what was on the menu. Meat would have been offered, too—probably goat for the crew, beef for the foreman. And remains of distinctive ceramic shipping containers suggest that they may have had access to olive oil imported from the Levant, at the eastern edge of the Mediterranean, a frill unavailable to most Egyptians.

Why did Pharaoh Khufu invest so heavily in Heit el-Ghurab

and its residents? At the time the pyramids were being built, the positioning of the Nile along the north and eastern sides of the city would have made it a prime location. Lehner believes that Heit el-Ghurab was not a ramshackle “workers’ town” but a Nile port that was at the nexus of a vast trading network used to bring in all the supplies for building the pyramids. Those supplies included far more than just stone: much of the food and clothing for the work-

ers, as well as the tools that were used in the construction. Even the luxury items owned by the priests and officials overseeing the project may have come through Heit el-Ghurab. The city was essential to pyramid operations. And the workers themselves were a precious resource. Not only did they haul the limestone from Tura, they were capable of sailing far longer trade missions, too. An analysis of the charcoal found in the workers’ quarters showed that a small amount of the wood they burned was from trees—cedar, olive and pine—that grew only in the Levant, hundreds of miles away. That exotic wood may have come from bro-

ken ship parts, and it suggests to Lehner that the crews living at Heit el-Ghurab were sailing trade missions as well as setting stones.

ALL FOR ONE

KHUFU EXPLOITED GOVERNMENT, labor and trade systems that his predecessors implemented before he came to power. But his pyramid project, unprecedented in its scope, drove the development of these infrastructures to dizzying new heights and in so doing primed Egypt to flourish in the centuries to come. Excavation of another site is also yielding insights into how Khufu realized his grand vision.

About 120 miles southeast of Heit el-Ghurab, Gregory Marouard looks like he is walking on the surface of the Gulf of Suez. In reality, the archaeologist treads an ancient stone pier that lies right at the water’s surface here at the site of a long-ago port, now known as Wadi el-Jarf. The pier curves hundreds of feet into the sea, and Marouard is taking advantage of an extremely low tide to make precise measurements of it. Project leader Pierre Tallet of Paris-Sorbonne University stands on the beach in the battering wind, explaining the significance of the site.

Preliminary evidence suggests that Khufu’s father, Sneferu, built the harbor, which offers the shortest possible crossing of the Red Sea to the Sinai peninsula’s copper mines. Mining copper was a major undertaking that involved taking perhaps 1,000 workers to the mine, provisioning them for two to three months while they extracted the metal and then transporting the copper to the cities that needed it. Most pharaohs, including apparently Sneferu, launched only one copper expedition during their reigns. Khufu, however, had the money, the manpower and the will to mount at least two such expeditions, utilizing the harbor



ARTIFACTS recovered from Heit el-Ghurab include items such as bread molds (top) and flint knives (bottom). They are helping archaeologists piece together how the pyramid builders lived.

far more intensively than his father ever had. He needed to do so to obtain enough copper to make the many chisels, saws and other tools required to build the Great Pyramid. Wadi el-Jarf is a rare find. “We know nothing about harbors in the ancient Egyptian period,” Tallet reflects. “This is probably the oldest harbor ever found.”

Evidence linking the harbor to Khufu’s expeditions is everywhere at Wadi el-Jarf. For example, a few hundred feet from the water’s edge, excavators are working on two long, rectangular buildings that are separated into cells of equal size. One building is made up of five cells, and the other is made up of 10. Tallet says that the cells may have housed both the cargoes and the crews of ships. Dozens of clay sealings have been found throughout these buildings. Goods were often shipped in bags that were tied with rope and sealed with a blob of clay that was impressed with the seal of whoever owned the bag’s contents. Many of the sealings bear Khufu’s name.

Other finds document the activities that took place at Wadi el-Jarf in startling detail. Tallet’s team has focused much of its energy on excavating a series of chambers that were dug into a hillside about a mile from the beach. In between copper expeditions the boats were disassembled and stored in these chambers. Many of them still contain pieces of rope from the rigging and even some small pieces of wood with red-ink inscriptions indicating how to reassemble the boats.

Even more remarkable, the excavators discovered the papyrus records that Merrer had written some 4,500 years ago during one of the final years of Khufu’s rule. It has taken Tallet years to conserve and reassemble the bits of papyrus, but the fragments clearly contain the best records available of the day-to-day activities of ancient Egyptian laborers. After delivering the Tura limestone to Giza, Merrer took his crew north to build a port on the Mediterranean Sea. When that mission was completed, they were sent to Wadi el-Jarf, from which he would transport copper at the end of Khufu’s reign in 2525 B.C. Merrer’s first order of business at Wadi el-Jarf would have been to have his men open the chambers where the dismantled boats were stored, carry them to the beach and begin putting the 80-foot-long vessels back together, following the instructions inscribed on each piece in red ink. They then spent a few months ferrying food from Egypt to Sinai for the miners and bringing back the newly mined copper to Wadi el-Jarf.

Nearly everything Merrer’s crew did, according to the papyrus, was in service to the construction of the Great Pyramid. What, if not slavery, motivated these men to apply their many skills to this project and not some other venture? Clues come from the history of Egyptian government. From its beginning in 2950 B.C., Egypt was different from other states that existed at the time. The first pharaoh, Narmer, had brought all of Egypt from the Mediterranean coast south to the granite quarries at Aswan under his control through sheer military might. At the same time, Mesopotamia was ruled by dozens of small city-states, each governed by its own king, who shared power with other religious figures and wealthy families, says Pascal Butterlin of Pantheon-Sorbonne University in France. Egypt was probably the largest area controlled by one ruler in the world at the time, and the ulti-



mate authority for all things within its borders was the pharaoh.

The concentration of all religious and political power in the hands of the pharaoh meant that Egyptian society operated in a different way from other kingdoms, such as the Mesopotamian city-states, that existed at the time. Whereas Mesopotamian kings claimed a close relationship with their gods, the Egyptian pharaohs believed they actually were gods. Bob Brier, an Egyptologist at Long Island University, thinks the divine kingship of the pharaohs allowed them to command the obedience of their subjects in a way that the rulers of other states could not. Egyptian texts support this idea, according to Henry Wright, an expert in the formation of early states at the University of Michigan. They show that the laborers were religiously motivated and were probably coming to work on the pyramids out of an ideological commitment, not just a need to perform a certain amount of labor that they owed to the nation under Egyptian law. “They are not just building a tomb for some guy,” Wright observes. “They are building a tomb for a god.” That distinction may have been what made the pyramids possible.

A TIPPING POINT

IN TURN, THE PYRAMIDS and the infrastructure they necessitated made other things possible. Although Wadi el-Jarf was abandoned just 50 years after it was built, having served its purpose, it paved the way for the building of another, far more successful port farther north. Called Ayn Sukhna, this port was closer to the capital city of Memphis and other places where copper was needed, including Giza and later the funerary complex at Abusir, located about eight miles south of the Great Pyramid. Ayn Sukhna would play a lasting role in building Egypt’s wealth, sending and receiving cargo ships from across the Red Sea for nearly 1,000 years.

For its part, Heit el-Ghurab continued to be a major focal point of trade through the rest of the fourth dynasty, when Khufu’s successors Khafre and Menkaure built their own pyramids. But after Menkaure was laid to rest, the age of the Giza pyramids was over. In 2450 B.C., when the fifth dynasty began, funerary monuments became much more modest, and the city at Heit el-Ghurab was abandoned. At first glance, these changes might seem to signal a downturn for Egypt. Large building projects



AT THE SITE of Wadi el-Jarf on the Red Sea, archaeologists have found remnants of the oldest known harbor (left). Artifacts include such fragile remains as the fragment of inscribed papyrus above.

such as the pyramids are often considered general indicators of a society's wealth. Indeed, for decades many Egyptologists have thought that the pharaohs stopped building gigantic monuments to themselves because the nation had grown poorer.

Lehner makes a different argument. He thinks priorities shifted at the beginning of the fifth dynasty and the trade and labor infrastructure that earlier pharaohs had created to build the pyramids were redirected to build projects in the provinces that helped to sustain the nation's prosperity for centuries. This infrastructure was a hugely powerful tool, one with coordinated supply chains of resources that spanned hundreds of miles beyond Egypt's borders and organized the efforts of more than one million people under a single authority. "The network became more important than the reason that created the network in the first place," Lehner asserts. "It was a tipping point toward modernity."

Modernity, in Lehner's view, is the development of a more complex bureaucracy with distributed organization that fosters local control over labor and resources, rather than direct control by the pharaoh's family. Evidence for this complex bureaucracy comes from the Palermo Stone, a piece of a carving discovered

sometime before 1877 that recorded the achievements of pharaohs from the third through fifth dynasties. Entries made during the reign of Userkaf, the first pharaoh of the fifth dynasty, show that he increased the number of plantations being created and made tremendous donations of land to the cult of the Sun God Ra as ways to spur development in the countryside. Overseeing this expansion required more bureaucrats, who then wanted to show off their status with luxury goods and big tombs. Supplying these new rural populations, meanwhile, increased demand for basic goods. The result was a self-sustaining feedback loop of demand and supply that not only created wealth for Egypt but also lifted the economies of its trading partners abroad.

Wright agrees with Lehner up to a point. "It's certainly a tipping point," he allows. "It is an organizational revolution." But he balks at calling it modernity. In Wright's view, Egypt in the fifth dynasty was missing one of the defining characteristics of a "modern" society: a change in thought systems. Modern societies, he argues, have rapidly growing bodies of technical knowledge and systems confirming and verifying that the information is true. Although the ancient Egyptians certainly had an important body of technical knowledge, much of their knowledge was ritualized and obtained through divination.

Disagreements over what constitutes modernity notwithstanding, scholars agree that Egypt's sophisticated system of control was a significant advance. Future excavations should reveal exactly how this development played out. Tallet plans to continue scouring Wadi el-Jarf for more evidence of the extent of Egypt's trade network. He also continues to translate Merer's records of the work that his crew completed. Tallet suspects that trade missions to the land of Punt, which is believed to be in modern-day Sudan, sailed out of Wadi el-Jarf, but he has yet to establish that connection. Meanwhile Lehner will continue the enormous job of excavating Heit el-Ghurab and analyzing the emerging clues about life in the city long ago.

Yet the best evidence of the economic revolution that the pyramids wrought may not be in Heit el-Ghurab or Wadi el-Jarf or on the Giza Plateau. Lehner points to outposts in Egypt's Western Desert and estates at Shaykh Sayed in middle Egypt as places that may yield further indications that it was the small communities far from ancient Egypt's urban core that benefited from the wealth that poured into the nation as a result of its centralized bureaucracy under a divine king. In the end, Khufu's true achievement was not erecting the Great Pyramid but rather building a network of trading partners and organizing the labor of an entire nation. "It wasn't a technological wonder," Brier says of Khufu's monument. "It was a sociological wonder." ■

MORE TO EXPLORE

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