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Pyramids of Egypt

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Abstract

The Egyptian pyramids, notably those at Giza, are iconic icons of ancient civilisation and architecture. The Egyptian pyramids' construction, religious purpose, and legacy are examined in this article via historical, cultural, and technological lenses. It traces the development of pyramid architecture from stepped to smooth-sided marvels in the Old Kingdom, particularly under the Fourth Dynasty. Archaeological and scholarly perspectives examine the pyramids' royal tomb role, alignment with celestial bodies, and labor arrangements. How the Great Pyramids of Giza were built has remained an enduring mystery. In the mid-1980s, Davidovits proposed that the pyramids were cast in situ using granular limestone aggregate and an alkali alumino-silicate-based binder. Hard evidence for this idea, however, remained elusive. Using primarily scanning and transmission electron microscopy, we compared several pyramid limestone samples with six different limestone samples from their vicinity. The pyramid samples contained microconstituents (μc's) with appreciable amounts of Si in combination with elements, such as Ca and Mg in ratios, that do not exist in any of the potential limestone sources. The intimate proximity of the μc's suggests that at some time these elements had been together in a solution. The article also examines modern engineering and symbolic theories and controversies to explain why these structures remain popular. The pyramids' historical background and ongoing impact are examined in the article to fully grasp one of humanity's greatest architectural achievements.

Keywords: Ancient Egypt, Pyramids, Giza Plateau, Pharaohs, Archaeology

INTRODUCTION

Funeral Architecture

Egyptian pyramids are ancient buildings. Only one of the Seven Wonders of the Ancient World remains mostly intact. Pharaohs and their consorts were buried in the pyramids during the Old and Middle Kingdoms. Egyptian culture and civilisation are represented by them.

The pyramids epitomize ancient Egyptian monumental architecture. The design-phase architecture, construction-route planning, Egyptian calendar comprehension, and construction stages show a greater expertize.

HISTORICAL SETTING

Egyptian pyramids (pharaonic pyramids) were masonry buildings built during Egypt's Old and Middle Kingdom periods. Most pyramids were built as tombs for the country's most important rulers during the "Old Kingdom" ("Age of the Pyramids") and were the centre of a mortuary complex that included a valley temple near the Nile River, a causeway connecting the valley temple to the pyramid, and a funerary temple at the pyramid's base. Egyptian pyramids evolved from mastaba tombs to step pyramids to the "true" smooth-sided pyramid G Magli, (2003) [1]. The Great Pyramid of Giza, also known as Khufu's

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Horizon, is the largest and only remaining Egyptian pyramid and one of the Seven Wonders of the Ancient World Magli, (2007) [2].

Old Kingdom

In the stable Old Kingdom, pharaohs with strong administrations centralized policies. The fourth dynasty changed architecture, sculpture, and religion. The cult began in the Giza necropolis with the sphinx. The Giza pyramids were erected by Old Kingdom pharaohs. Pharaohs' tombs were built here. Inscriptions on several structures show the growth of rhinoceros, hippopotamus-trapping, and dancing in the Old Kingdom. The pyramid was the greatest construction for thousands of years. Inscriptions from the fifth dynasty confirm Heliopolis' administrative role. Insect gathering organization and northern forces' decline is also described.

The Bent and Red pyramids at Dahshur were among Sneferu's three pyramids. The step-sided design became smooth through trial-and-error. In the Bent Pyramid, the mastaba is visible via the false door and louvre window, which became the regulating stripes of the fourth-dynasty prismatic pyramids. Pottery is the genuine predecessor of the fourth dynasty pyramids. In the second half of the second dynasty, much appears to have happened, and a new wind of stability with a strong central power permitted Egypt to create the tetramy (T. Bendisari, 2022) [3].

Two architectural solutions for transporting massive construction blocks were identified: one for superstructure elevation and another for working platform distribution. First, a continuous construction covers the adjacent pyramid side. The Red and Bent Pyramids' loading ramps ran the length of the pyramid face and inclined uphill to match the course. Pyramid platforms cannot be simply extended assembly ramps; hence, a separate approach is needed. The second approach involves lowering a continuous stretch of construction to the platform using inclined planes.

The Middle Kingdom

The Middle Kingdom, the "Classical Age" of the Ancient Egyptian state, includes an ethnographic period and a Middle Kingdom/Subordinate group in the cemetery's development. The 11th Dynasty's accession and stability enabled Qubbet el-Hawa's rock-cut tombs to evolve, inspired by their colorful culture. They were larger and had burial supplies. In contrast to the Old Kingdom, Middle Kingdom monarchs actively participated in the state cult of their deceased predecessors, according to Christoffer Theis. Inscriptions show piety and a desire for immortality, akin to the Seco-Saite period at the other end of the Middle Kingdom.

The Middle Kingdom ethnography's Coffin Texts depict death from below, speaking of the deceased in the third person. The freshly unearthed coffins, which break with the Old Kingdom form, depict the deceased's protectors' ceremonies and carry a virtually full Book of the Dead, indicating their origin. A Statistical Analysis of the Decoration of the Middle Kingdom/Secost-Saite Coffin Group at Qubbet el-Hawa illuminates the publication and coffin design.

The New Kingdom

Ecclesiastical, commemorative, and religious buildings – temples of burned ash – loom above palatial architecture, which is fleeting. Besides sheltering the gods, temples are hearths for believers who still worship them as guardians of their identities. The New Kingdom is the Egyptian Empire – a Mosaic empire of empires. The Amarna heresy shows new intolerance. The epimachic armistice and tribute flow start the finish. Palaces become villas and necropolizes under the West Bank.

The non-royal private households, whose architecture follows strict regulations and whose villas show a fine love for gardens, are distinct in design, concept, and symbolism. Amun-Re, the lodestar of Thebes, thrives in recognition and in the Peasant's Valley. Seasonal floods ensure food supply and national development. Elites flaunt their riches and influence by supporting the monarch's northern campaigns. The old-style figurative repertory and architectural decor focused on the aristocratic

classes indicate the new empire's successes but also its weakness and potential demise. Amenhotep III's lavish lifestyle and diplomatic pride hint at a thriving nation.

DESIGN AND ARCHITECTURE

The Great Pyramid of Khufu's slope was 51º52'. The shaft was oriented to the rising of stars north and south to "fuse" the heavens, King Khufu's soul, and the Pharaoh's mortal flesh. The hieroglyph akhet, the "horizon" God of the afterlife, and the Royal horizon of ancient Egypt are also reflected in the remarkable layout of the two main pyramid complexes at Giza, which were likely designed together from the outset. Finally, the Giza pyramid complex was designed as a celestial reproduction of the Duat (the country of the dead) where the ruler was intended to "ascend" to endless life. Time-determination qualities are seen in several design elements Morishima K, 2017 [4].

Methods of Construction

Construction methods have been debated since ancient times. Although many methods and tools have been proposed to build the Pyramid of Khufu, the core design has not changed across the dynasty (Okon E, 2016), [5]. Hydraulics and contractors' calculations showed how to store and transport materials onsite and finish the structure on time. Since it fits time, space, and technology restrictions, the proposed design approach is more plausible than alternative leveraging methods in the literature.

Materials Used

Stones from the Giza Plateau were used to build the Great Pyramid of Giza, but other stones were also used. The core's inner two-thirds were limestone. Tura limestone from the Nile was polished to reflect light for external casing stones and some inside chambers. Aswan granite was used in internal rooms. To be believable, construction methods must meet time, space, material, technology, and historical evidence restrictions (Coetzee D, 2017) [6]. The pyramid's mortar was as important as the stone. In the Georges Valley Pyramid at Khufu, the mortar's tensile strength allows smaller blocks to be used, allowing the casing stones to span hundreds of meters with a slight inward slope (Amel Chaabane et al., 2022) [4]. The design and construction of the Great Pyramid used material attributes and technical techniques to meet time constraints. At Giza, clay fillings of 61.9% $CaCO_3$ and 30.3% $CaMg(CO_3)_2$ helped process local lime mortars, allowing rapid setting and shortened curing time due to the geology's high kaolinite clay concentration. The Great Pyramid's components are unknown; however, the clay type is plausible in the environment. This combination of materials and methods shows how ancient masons combined engineering needs with local resources.

Design and Positioning

Egyptian pyramid layouts were based on architectural-astronomical criteria (Zalewski F, 2016) [7]. The valley temple-pyramid-tomb causeway connects the complexes on the west bank of the Nile. At Giza, the causeways connect the easternmost valley temples to the pyramids in well-defined orientations.

Pyramid entrances face north like Saqqara. Many attempts have been made to explain this orientation, but only the circumpolar stars seem to fit. The star sees this as the sole indisputably "north" direction, making it the natural orientation for the "imperishable" northern realm emblem. Most temples in front of pyramids face east, as at Saqqara. This pattern also matches the Age of the Pyramids beliefs that the eastern horizon was the location of birth and regeneration; the Egyptians stressed this orientation east of the Nile.

MAJOR PYRAMIDS

Pyramids have adorned Egypt for almost four millennia. These monuments to power and status continue to raise questions about their construction and social function. They were part of the necropolis, above-ground burial grounds for the elite of Egyptian cities. Pyramids can be found in Giza, Saqqara, Dashur, Çunufru, and Abusir.

Khufu, who ruled from 2509 to 2483 BC, erected the Great Pyramid of Khufu in the fourth dynasty. The Giza Plateau-based structure is 230 meters wide and 139 meters tall. The pyramid weighs 6.55 million tonnes and has 2.6 million cubic meters. The core is made of 2.3 million local limestone pieces, and the surface casing of pure white limestone. The pyramid's slope of 51º52' results in a considerable reduction in volume from base to peak, with 19% of the total volume in the first 10 meters (Abdall R, 2017) [8]. An entry on the northern face, 13 courses above the base, leads to a descending and ascending corridor. The Grand Gallery leads to the King's room beyond the Queen's chamber.

Cosmic-ray muon tomography has imaged known and unknown spaces inside the Great Pyramid without excavation. The "ScanPyramids Big Void" was found above the Grand Gallery. At least 30 meters long, the emptiness has a Grand Gallery-like cross-section. It was first seen using nuclear emulsion films in the Queen's chamber, then with scintillator hodoscopes at KEK and gas detectors outside the pyramid. The Great Pyramid has three chambers: the basement, Queen, and King. Both the Queen's and King's rooms feature two air shafts that robots have mapped.

Great Pyramid of Giza

The Great Pyramid of Giza Was Meant to be Egypt's Most Famous

The Great Pyramid is one of the largest buildings ever constructed. It originally stood about 482 feet (147 meters) tall, but erosion and the removal of most of the polished limestone casing stones—which made the structure smooth and caused it to gleam in the sunlight—have lowered the pyramid's height to 449 feet (137 meters). The base and three sides each measure 755 feet (230 meters) in length. The pyramid's sides rise at an angle of 51.87° and are accurately oriented to the four cardinal points of the compass. The Great Pyramid's core is made of yellowish limestone blocks, and the inner passages are of finer light-colored limestone. The interior burial chamber is built of huge blocks of granite. Approximately 2.3 million blocks of stone were cut, transported, and assembled to create the 5.75-million-ton structure, which is a masterpiece of technical skill and engineering ability. The internal walls, as well as those few outer-casing stones that remain in place, show finer joints than any other masonry constructed in ancient Egypt (Ivashov S, 2023) [9].

The Khafre Pyramid

The Pyramid of Khafre operates. Khafre, who ruled Egypt from 2558 to 2532 BC, erected this enormous pyramid during the IV dynasty (Morishima et al., 2017) [5]. The Giza Plateau houses the pyramid. It has a limestone core, white limestone casing, and a tens-ton limestone (Sparavigna AC, 2023) [10]. The pyramid is 143m tall and 215m broad. The pyramid's north–south plane has three chambers: the lowest underground chamber, the Queen's chamber, and the King's chamber, which is the tallest. The Grand Gallery connects the ascending path to the King's room. These rooms are arranged from bottom to top, like Khufu's pyramid and three funerary shafts under the pyramid, lead to the subterranean chamber. Formerly the only entry to the pyramid, the 78-meter-long, 1-meter-wide subterranean tube leads to the chamber level by an Oak shaft. The Queen's room contains 2 air shafts. Four stabilized air shafts in the King's chamber ventilate his slave rooms: three horizontal and parallel to the floor, and one vertical.

The Menkaure Pyramid

The third and smallest Giza pyramid, the Pyramid of Menkaure, is 65.5 meters tall and 108.5 meters long (Tasellari & Kaiku, 2013 [11]. Built mostly of limestone and granite, it has the geometric accuracy of 4th Dynasty Giza architecture. Although less thoroughly examined than the Great Pyramid, the Pyramid of Menkaure was erected contemporaneously and presumably used advanced construction methods.

Menkaure's edifice used a lot of granite, a resource-intensive material that predicts a shorter construction time than the Great Pyramid. The pyramid's saddle-like shape, typical of step pyramids, may indicate a design changeover. A thick coating of limestone casing gave its saddle form smoother sides and a polished appearance. About half of this exterior shell remains, showing the original finish.

The pyramid complex includes a mortuary temple, a valley temple, three satellite (or queen's) pyramids, and two boat pits, demonstrating the extent of royal burial locations in this era. Due to its higher granite content and structural design, the Pyramid of Menkaure may have been built in 10 years, demonstrating a substantial improvement in technical efficiency.

The Djoser Step Pyramid

The Third Dynasty built the Step Pyramid, also known as the Pyramid of Djoser. This pyramid is a highly developed raised tomb or stepped pyramid with a close-set rectangular enclosure wall. Like its predecessor, it had a flat enclosure and a step pyramid. The Step Pyramid was a funerary complex in the north–middle of the Saqqara Pyramid field. With at least eleven steps, it ascended 62 meters and had a 125 by 105-meter base.

The enclosing area was greater than earlier pyramids, measuring 540 × 278 m². The enclosing wall was formed of several small limestone columns to resemble a fabric tent. Additionally, a complicated underground chamber network was built. Blue faience walls in the pyramid's basement rooms glitter like stars. Imhotep created the Djoser funerary complex, pyramid, and underground rooms.

A Bent Pyramid

The Bent Pyramid was built. Probably his father, Huni, had begun building a massive step pyramid at Meidum,22 which Sneferu completed and raised. This building was initially a step structure, but Mudbrick smoothed the surfaces to make it a pyramid. The six-step structure remained after the Mudbrick covering was removed. Thus, the first attempts to make smooth pyramids were perfected in Meidum.

We also know that Sneferu built two truly smooth pyramids, the enormous Bent Pyramid and the Red Pyramid at Dahshur. The Bent Pyramid is named for its unusual shape: the lower section has the step pyramid angle of 54°6', while the upper part has the smooth pyramid angle of 43°. The angle change is unexplained, but fissures in the pyramid's lower half necessitated lightening the upper part. This view doesn't justify ongoing construction when it should have halted. Other ideas suggest a massive loose stone mass at the base or a change in intention, but none are supported by physical evidence.

The Red Pyramid

Pharaoh Sneferu built the Red Pyramid before the Great Pyramid at Giza. Three chambers are accessible by a descending corridor.

The 43°-sloped pyramid is 104 meters high and 220 meters broad at the base. The only Egyptian pyramid with a similar slope is the Bent Pyramid at Dahshur.

Medium-sized substructures were installed around the limestone bedrock to start construction. The pyramid placed on it prevented the excavation of larger rooms directly into the limestone, leaving the substructure incomplete.

Therefore, the chambers must be raised where the passageway runs parallel to the lowering corridor floor.

CULTURAL IMPORTANCE

The pyramids were part of a complex dedicated to the monarchs' divine and happy lives. Kings, like Narmer, started Old Kingdom royal cults in the Early Dynastic Period. The religion of royalty was strongest in the Old Kingdom, when monarchs were called "gods of dignity, living kings," and their dignitaries were secondary characters. Kingship was seen as maintaining cosmic order in Egyptian culture. Egyptian culture emphasized the king's bond with his forefathers. This made the king's cult a prominent religious focal point. Therefore, the Third and Fourth Dynasty rulers' mortuary cults were very successful.

Religious Faith

Since the Early Dynastic Period, various gods have fixed roles in the king's rule and afterlife. Egypt's rigorous regulations and regular celebrations allowed the pharaoh to return to the solar cycle and give immortality as the ultimate prize for loyalty.

Burial Customs

Ancient Egyptians believed in a soul-sustaining afterlife. They created intricate burial ceremonies to prepare the deceased for their journey. Mummification preserved bodies forever. Kings were buried in enormous temples, like those used to build the pyramids, while commoners were buried in local cemeteries. Colorful scenes of daily life were painted on tomb walls. these traditions, based on respect for custom and faith, still evoke awe after thousands of years.

Literary and Artistic Symbolism

Egyptian culture has shaped world history for almost 4,000 years, from ancient Persia to modern Europe and America. Ancient Egyptian art has been important since 3000 BC. The ankh, Coptic cross, and other Egyptian symbols have global significance. Greek, Roman, and early Christian art were heavily influenced by Egyptian iconography. Egyptian and Israelite temples had corner-horned altars. The famed eye of Horus from Kom Ombo, a symbol of good omen, appears on Greco–Roman ceramics, jewellery, and daemon eye paintings. Pope Gregory commissioned Egyptian painters in Egypt to paint and sculpt Roman Christian churches in 604 BC, introducing Egyptian iconography to Europe. Egyptian symbols, like the ankh and the Coptic cross, were widely used in Christian art and culture later.

Ankh, sun-disk, and Wadjet eye (Eye of Horus) symbolism and iconography are present in many remains of modern ("western") civilisation and in commercial and esoteric circles. The Ankh, also known as the "Crux Ansata" or "key of life", has long been a powerful symbol and motif. The design is one of the most famous in Ancient Egyptian art and a symbol of life, and its influence has endured. The ancient Egyptian ankh symbol, adopted by Copticism and the Roman Catholic Church, symbolizes "life", "immortality", and "resurrection" to millions. The sun disc, or circle, and the eye have broad, often specific meanings and similar prevalence. They also have significant cultural symbolic potential, revealing the past and fostering respect for numerous civilisations' art and architecture.

ARCHAEOLOGY DISCOVERIES

Cosmic-ray muon observation revealed a big gap in Khufu's Pyramid. The Great Pyramid, also known as Khufu's Pyramid, is an ancient monument on the Giza Plateau from the Fourth Dynasty. The oldest and greatest monument on Earth is undisputed, yet its construction is unknown. Muon imaging uses cosmic-ray muons that partially penetrate stone to visualize known and unknown gaps inside a construction. An at least 30-meter-long gap above the Grand Gallery had a cross-section like the gallery. ScanPyramids Big Void was originally detected with nuclear emulsion films and subsequently confirmed with scintillator hodoscopes and gas detectors elsewhere in the pyramid. Three separate observations using distinct technologies have revolutionized our understanding of Khufu's Pyramid's internal architecture.

The monument has a 230-meter base and 139-meter height. Subterranean, Queen, and King apartments along the north-south axis. Both top chambers had two air shafts, which robots investigated from 1990 to 2010. Near the Great Pyramid's entrance, the optical survey found four enormous triangles etched into its faces. The sides of each triangle are tens of meters long and span multiple stone levels. Blocks make a simple, well-defined isosceles triangle.

EXCAVATIONS AND RESULTS

By the mid-19th century, excavations confirmed the existence of a large chamber partially filled with granite blocks discovered in 1765. The southernmost end of the descending passage was still

open when this chamber was unearthed; however, signs of various sorts had been detected inside the pyramid. Archaeological evidence for early activity inside the Great Pyramid (IV Dynasty pyramid) is the descending passage between the entrance and chamber. We can confidently rebuild this segment of the pyramid and the bottom of the descending tube.

IV Dynasty pyramid activity records are rare and uncertain. The traces in the basement room and corridor are vague, and accounts do not indicate a Khufu period date. The 1837 side-chamber and spiral corridor remnants are also ambiguous. The sole structure inside the IV Dynasty pyramid with significant archaeological evidence of early activity is the 71-meter-long descending passage connecting the entrance to the lower chamber. The huge chamber discovery likely concluded the clear phase of activity. Despite years of inquiry, no further chamber or passage in the IV Dynasty pyramid has been found that is related to early activity. The descending route alone can safely extract all architectural data related to such a phase of activity.

Preservation Work

The great chambers of the Pyramids of Egypt were never robbed, but their contents were eternally destroyed when the Nile flooded the burial mummies before the desert arose. Despite the secular infrastructure's durability, the pyramids were not forgotten. The building was utilized for burial by later kingdoms; Ramses II used face stones to build his monuments.

The Pyramids were already in situ during the Roman conquest; therefore, any other ancient civilisation direction has been lost to time. Without the pyramids, funerals were like a religion that changed every few decades. After the Pyramids were built, Arab invaders turned the Nile Valley into an Islamic bastion, using local limestone for practical uses and destroying prior structures.

Study Technology Advances

Modern technology has changed pyramid research. Accurate mass density calculations are needed to distinguish an anomaly from natural stone heterogeneity. The ScanPyramids project used direct measurements and non-invasive geophysical investigations using cosmic-ray muons and infrared thermography. The little Queen's chamber's shifted internal stones have been Earthed using thermo-hygrometry to find their origins. Using photogrammetry charts and augmented-astronomy reconstruction, a displaced block was found, and neutron scans showed a slight addition of a viscous substance in the ascending open-sliding fan-like walls, resembling the Pyramid of Djoser. In combination with data from the 3-meter Table of Chaos, bulk-emission tomography helped geoelectrical measurements map the overlaid pyramid. Early investigations monitored the internal structure with grouting and high-resolution 3D reconstructions using photogrammetry and radar.

IMPACT OF TOURISM TODAY

The Pyramids of Egypt are one of the first tourist sites in the world, and the Great Pyramid of Khufu's annual destruction shows its sensitivity to the many tourists. For ages, guides have repeated historians' descriptions and facts, and many Egyptian experts continue to study these ancient works to better understand their construction and purpose.

Visitors Stats

Cairo and the Pyramids attract most international tourists to Egypt, while Giza is the second most popular tourist attraction after Sharm el-Sheikh, with 7 million visits annually. Most international flights flying into the country fly directly over the pyramids, giving passengers a bird's-eye perspective. Besides the Suez Canal and oil exports, tourism is Egypt's main cash source.

Egypt's Central Agency for Public Mobilisation and Statistics reported around 14 million tourists in 2010. With global tourism recovering, Egypt is predicted to see a significant rise in travellers in 2011. Some projections predict 23 million tourists per year by 2020. New seaside resorts, luxurious hotels, an extensive air network, and vigorous Ministry of Tourism marketing will drive this rise. Egypt is a

hub for exploring the Middle East, with direct flights from Cairo and Sharm el-Sheikh to Europe, the Americas, the Persian Gulf, and much of Africa.

Economic Impact

Pyramids' indirect economic stimulation must be considered. The pyramids might be a massive Keynesian project. Public infrastructure spending has a large multiplier, say economists. Construction will increase due to aggregate demand from those expenditures. Capital formation occurs in the public and private sectors, where greater demand for goods benefits everyone involved in capital goods manufacturing. The multiplier idea of Keynesian economics governs the large-scale effects of public constructions like the pyramids. The economic impact of public spending on Sneferu's pyramid construction vendors may be seen in their expenditures.

Challenges in Conservation

The Egyptian pyramids and their archaeological sites pose major conservation and management difficulties. An overall strategy for preserving and conserving the selected sites and their wider context is the first step. A thorough and sophisticated approach is needed to preserve these large monuments.

MISCONCEPTIONS

Misconceptions about the pyramid exist from the start. Pyramid soil is special in fostering flower development quickly, say gardeners. Motivational speakers often place aphorisms on pyramids, but ancient Egypt knew about their potency. The structure and construction processes are shrouded in mystery and mythology. Although slaves are said to have built the Great Pyramid, archaeologists disagree. The men who built the pyramids from gigantic limestone blocks a mile across the river were well-organized, skilled workers with plenty of food, shelter, medical care, and entertainment (Building the Great Pyramid). Since modern science began, the goal has been to resolve pyramid arguments. If a model is the only one that fits the historical and archaeological record, time, geography, materials, and technology, it is more credible than other levering approaches.

Aliens Theories

Pyramid builders used relatively new methods, according to some theories. The edifices show that the claimed ancients had a much more advanced technology than is widely accepted and that their knowledge was passed to mankind early on. Thus, aliens brought it to Earth. This view ignores the enormous amount of constructional expertize the ancients may have acquired before building the pyramids; both Egyptian and foreign museums contain many specimens of stone working, implying the practical use of pyramid-construction materials and techniques; and a set of constructional techniques and practices, of which the essential part represents a further development of what.

Construction Labor Myths

The ancient Egyptians built pyramids with 2,400 workers in three eight-hour shifts, with four groups of 200 men working two hours and one hour. Each of the three 12-hour shifts employed 3,600 individuals, totalling 10,800 daily. Several ideas explain how the Egyptians used levering systems to move large stone blocks. Egypt is known for its levelling skills, and the pyramids and Giza Plateau have many ramp and workshop barriers made of rough stones mistaken for core blocks. Even within the Egyptianologists' stringent constraints, one design is the only way to move the blocks in the specified timeframe, given the materials and technology available. This levering mechanism is more probable than others since it matches the historical and archaeological record.

COMPARATIVE ANALYSIS

Comparative investigations of Fourth Dynasty Egyptian pyramids show that archaeological data does not support their chronological order. Astronomical inverse chronologies are compatible with archaeological evidence. Future research on dendrochronological dating of extant wood samples, systematic comparison of Sphinx and Khafre's Valley Temple orientation data with pyramid data, and comprehensive geological analyses of the Giza quarries may yield conclusive results.

The layout of the Khafre pyramid complex (Giza 2) is well preserved. This configuration includes a large limestone-block funerary temple with a rectangular court, a Valley Temple with a T-shaped hall, and a sloping causeway from the funerary temple to the Valley Temple. The latter structure is connected by a granite corridor. The Temple of the Sphinx, hewn from a rocky outcrop, flanks the Valley Temple and features a lion's body with a human head. The Sphinx may have linked the king to Ra. The planned eastward placement of the three buildings strengthens this relationship. Khufu pyramid complex (Giza 1) layout knowledge is fragmented, preventing a full appraisal.

Administrative archives and inscriptions show that the two royal kingdoms negotiated Giza quarry resource management (PM VII, 294). Post-opposition theories textual references describe both pyramids' construction and furnishing. Later discourse seems to separate these materials from the chronological discussion, often excluding them from integration.

Pyramids in Other Cultures

The most famous pyramids are the Egyptian ones, but ancient societies built many more. Pyramidal temples and tombs with square bases and sloping sides were created in ancient Mexico, Central and South America, China, Europe, Sudan, other African countries, and Asia. As with the Egyptian pyramids, many of these constructions were burial places or sacred complexes.

Sudan has many more ancient pyramids than Egypt. Pyramid tombs were built by kings of ancient civilisations in Sudan, including the Egyptian New Kingdom, Kerma culture, Kingdom of Napata, and Kingdom of Meroë. Numerous Nubian pyramids at Meroë are older than the oldest Egyptian pyramids. Most of these pyramids are smaller and steeper than the Egyptian ones. In pyramid tombs, jewellery, ceramics, utensils, and royal ornaments were buried with them.

Construction Style Differences

Later pyramids differed from the Great Pyramid due to religious beliefs such as temple initiations of the Sun God. Later designs reduced the slope angle to 53 or 51°, resulting in the door no longer being at the top of the triangular overlay plane. The design stabilized at 51° 50′ after several attempts, providing a clear view of the north and the Sun rising on most days. The Great Pyramid is famous for its high construction standard and apparent scientific – particularly mathematical – knowledge.

CONCLUSIONS

The Great Pyramid of Giza (GPG), also known as the Pyramid of Khufu, is a marvel of ancient engineering that has been studied for over a century. This 4,500-year-old pyramid on the Giza Plateau amazes specialists and government officials. Many theories have been presented, but the exact methods used in this massive building remain a mystery that captivates the world.

Local limestone formed the pyramid's core, while pure white limestone, polished for its look, formed the casing. This mix of materials shows the builders' superior skills and ambitious ideas. The pyramid's geometric shape, with an original height of 146.6 meters and side slopes of 51°52′, creates a sharp tapering of cross-sectional area from base to summit. About 2.6 million cubic meters equals 6.55 million tonnes. The first 10 meters of height make up only 19% of the entire volume, demonstrating a great balance between mass and profile.

An opening in the northern face leads to a short descending passage in the 13th course of masonry from the base. Located somewhat below ground level, the lower part has a pointed, gable-shaped roof with an inclination of 28°12′. Following a severe descent, the route ascends at 26°18′ towards the interior after 30 meters of horizontal progress. A horizontal tunnel leads to the Queen's Chamber, and the Grand Gallery opens onto a corbelled-roof chamber aligned with the pyramid's vertical axis. A huge antechamber with a sunken ramp at its centre floor complements the King's chamber, showing superb spatial organization.

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