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Safari Adventures...
The Great Sphinx is one of the oldest and most famous man-made monuments in the world (two of the Giza pyramids are in back), but, it turns out, its creators may simply have been building upon nature.

Article and photographs by Farouk El-Baz

Desert builders knew a good thing when they saw it

Ancient Egyptian structures and designs may have survived so long because they are close imitations of natural formations

The pyramids of Giza were already ancient, their origins shrouded in mystery, when Herodotus visited them about 450 B.C. Today, these colossal structures are around 4,500 years old, and yet we still ponder: Were they only tombs, or did they also function as geodetic markers, observatories or public works projects? And how is it that they are still standing centuries after other man-made wonders of the ancient world have disappeared? The answer to that may be even older than the pyramids.

Imhotep started it all. He served as minister, adviser, physician and astronomer at the court of Djoser, Pharaoh of Egypt circa 2630 B.C. Imhotep was known as a healer and master sculptor, but, more important, he was the architect of the Step Pyramid at Saqqara (p. 119, bottom).

Until the reign of Djoser, royal dwellings and tombs were built primarily of sun-dried brick. Imhotep selected a site in the desert overlooking Memphis and began planning something more ambitious. He built a mastaba, or tomb, of stone, about 26 feet high and
A similar feature at the Farafra Oasis is a natural erosional formation called a yardang. Its shape, and those of streamlined hillocks in background, are aerodynamically stable, last for centuries.

207 feet on each side. Upon it, with several modifications, he built five additions, each smaller than its predecessor. The result is a six-stepped structure, about 204 feet high, that resembles on the whole a pyramid.

Not long ago in Egypt, I pointed at a hill that looked similar to Imhotep's Step Pyramid. My companions from Ain Shams University in Cairo turned to the hill, which became visible only after climbing a 100-foot sand dune. Eyes squinting from the glare of the desert sun, but cameras clicking, we discussed the form of the hill. There was no good reason for its existence amid a sea of dunes. After driving for half a day from the sprawling Siwa Oasis toward the Great Sand Sea, we had not expected any topographic prominences. The terrain has been eroded to a plain by running water and desert winds.

As we continued our geological exploration near Siwa, we encountered other conical hills. These appear to have developed from mesalike elevations, which in turn separated from the large escarpment on the northern boundary of the Siwa depression.

An entry in my field notebook says: "numerous conical and pyramidal hills; I wonder if the ancient Egyptians had studied such natural desert structures before deciding on the form of their towering monuments!"

Why not? The ancient Egyptians had left their mark throughout the Western Desert. In fact, the sound of the word "desert" itself came to us from the pronunciation of a hieroglyphic word via Latin.

The Egyptians of the past appear to have learned more about the desert than their modern counterparts. They mastered desert exploration and exploitation of building materials. They combed the Eastern Desert and the Sinai for precious metals. No gold veins have been discovered there in modern times. Every known vein had been discovered long ago and worked first by the ancient Egyptians. Even the oldest known map is that of a gold mine in Wadi Hammamat, between the Nile at Qift and the Red Sea at Quseir.

Modern Egyptians are as impressed as anyone else when confronted with the extent of the ancients' knowledge of the desert.
"All the way out here to get a stone. It's incredible!" said Mahmoud El-Prince, governor of the New Valley province, who had joined one of our desert investigations in the bone-dry wasteland of the southern Western Desert.

"How in the name of heaven did they find out about that tiny rock exposure in the middle of nothing?" added the team's archaeologist.

"By being damn good geologists, that's how," answered Bahay Issawi of the Geological Survey of Egypt.

This conversation took place at what is called the Chephren Quarries, more than 200 miles southwest of Aswan, in one of the driest, most hostile and featureless tracts of desert anywhere. From an exposure of rock that is only a few feet high, the ancient Egyptians mined a rock and carved it in the likeness of Chephren, the builder of the second largest pyramid at Giza. This mysteriously dark statue was found virtually intact in the Valley Temple of Chephren's pyramid complex at Giza.

The ancient Egyptians not only knew where things were in the desert but, I believe, realized that the shapes they found were no accident. They must have wondered why—why, for example, is it that only tapered hills persist in the desert? Imhotep may have asked himself that question, as I did a few years ago. The great sage could have figured it out in no time at all. I had to work at it.

On one of a dozen journeys into the Egyptian desert, 60 miles west of Kharga Oasis, I saw three hills (right, top) looming in the distance in a mirror image of the pyramids of Giza. The sight heightened my curiosity. This was the windy season, when the wind carried enormous quantities of debris, redistributing it as it eroded obstacles in its way.

With a strong gust of wind, much fine dust was lifted from among the pebbles and sand grains on the desert surface. The wind hurled the dust toward one of the conical hills. With the first collision, the dusty wind rose swiftly upward as it whirled about the hill.

Eureka! The conical shape evades destruction by leading the wind upslope and funneling its erosive power to the peak where its energy dissipates in the air. Inhabitants of windy terrain must have learned this a long time ago. Images of conical or cone-topped structures that I have seen all over the world flashed in

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The pyramids of Giza may have survived the millennia because their builders followed even older examples.

Origin of the Sphinx

Could the Sphinx reveal further knowledge? Its origins may even be more intriguing than we believe. Some scholars contend that the bulk from which the Sphinx was formed had been left by the quarrying for the Great Pyramid. But I favor another explanation. Let us imagine a “staff meeting” of the master architect of Chephren’s pyramid. The sun has already started to warm up the brisk morning air. Apprentice architects, quarry engineers and a transportation expert unroll papyrus, on which site drawings are meticulously drawn, and place it on the table for the ensuing discussion. Chephren’s pyramid was to be built next to its predecessor, the Great Pyramid, on the western bank of the Nile. Blocks of hewn stone would arrive by barge and then move over special roads or ramps to the building site.

The meeting progresses under the shaded, breezy shelter on the Nile bank near the pyramid hill. The transportation expert appears preoccupied, for he repeatedly draws with his finger a rectangle with equidistant lines ribbing it from top to bottom. He is drawing in his mind the hieroglyph isf denominating stone or rock.

“How about the elongate isf on the east side?” he finally asks the master architect.

“What of it?”

“It’s in the way. We really should think about removing it.”

“Well,” replies the aging master, “I have long enjoyed its streamlined contours. Such a carving of beauty should not be considered a sedjet, an obstacle that must be removed!”

“Yes, I agree,” says a young architect. “We can even enlarge it, dress it up and make a monument out of it—a monument to Pharaoh, of course.”

“Good, I like this idea. Let us learn from nature as the great Imhotep did. I am sure our friend the mover can find roads about the isf. I will speak to Pharaoh about this.”

What was the streamlined shape that the master architect spoke of? For clues to the original form of
Natural limestone formations like these may have been the inspiration for circular tents around the world. Mongolian yurts, American Indian tepees and Bedouin tents in the Sahara have worked for centuries.

that elongate rock, we go back to the close of the 19th century, and journey into the desolate wastelands of central Asia. The tour guide is a rugged Swedish explorer named Sven Hedin. For nearly 25 years, starting in about 1890, he roamed the virtually unknown lands of the Asian interior.

In the rocky desert near Lop Nur at the east end of the Taklimakan Desert, he ran into a landform that was unknown to him: endless numbers of ridges arranged in parallel rows with gullies in between. His guides called the ridges yardangs, from the Turkeic word yar meaning steep bank.

"With amazing regularity and without the slightest interruption," Hedin wrote in 1905, "this dry clay soil is furrowed throughout by pretty deep gullies, which separate the yardangs one from another. The only variety they present arises out of the consistency of the surface, that is to say, out of the varying resistance which it has offered to the corrosive, abrading force of the wind. . . . Each ridge was broken off pretty abruptly on the north-east, but had a gentle slope towards the south-west."

Yardangs became a topic of investigation by three of my colleagues and fellow desert travelers—Carol S. Breed, Maurice J. Grolier and John F. McCauley of the U.S. Geological Survey in Flagstaff, Arizona. Their measurements and observations of yardangs in deserts around the world indicate that the critical morphological characteristic of a yardang, streamlined by the wind, is that its length greatly exceeds its width, by a ratio of about three to one or more.

Many such yardangs exist in the Western Desert of Egypt. In fact, one of the largest fields may be that north and east of the Kharga Oasis, where the wind-carved hills extend for hundreds of miles. The hills look like inverted boat hulls with prows pointing into the wind. "Mind you," said McCauley, "these yardangs are not carved of soft silts or sandstone, but incised in hard, crystalline limestone."

What do yardangs have to do with the Great Sphinx of Giza? Breed, Grolier and McCauley agree that the Sphinx was fashioned from a hillock of limestone that had already been streamlined by the wind.

You may think that the distinctive shape of the Sphinx must be quite different from a wind-eroded knoll of rock. Not true. As early as 1909 the British geologist H. J. L. Beadnell described in the Kharga depression "thousands of isolated hummocks, disposed with their longer axes parallel and in the direction of the prevailing north winds." These same structures were described in 1924 as sphinx-like by the German geomorphologist Johannes Walther. Furthermore, in 1939 the British explorer Ralph Bagnold characterized similar forms between Kharga and the Gilf Kebir in southwestern Egypt as "mud-lions."

Thus, the reclining lion body of the Sphinx could have originally been shaped by the wind.

I proved the point to my own satisfaction when I was able to convince a skeptical graduate student. On a visit to the Farafra Oasis, I called him over to see the best example I had yet found. He stood there for a few minutes transfixed by the sight. Mesbah Khalil had heard us speak of yardangs and sphinxes, but he thought the analogy was farfetched. Even when I
These tents, used by the Geological Survey of Egypt, follow traditional North African design, which in turn seems to follow nature's. Their success over the centuries cannot just be a matter of chance.

showed him yardangs in Faiyum and Kharga oases, he shrugged his shoulders, "I don't see the Sphinx in these; they have all been beheaded!"

The one he stood by in Farafra Oasis was not. It was complete with a neatly carved head in the shape of a dog's (p. 117).

"My God!" he exclaimed. "The first thing I am going to do when we get back to Cairo is to revisit the Sphinx and pay respects to my ancestor engineers."

He walked toward the silent statue of limestone rock that dramatized the wind as a sculptor. For after the wind had created the inverted boat hull, it acted upon its prow, pruning it as it swirled in vortices.

The architects of Chephren could have studied such forms thousands of years ago, and decided to dress up in his image the yardang on the east side of their Pharaoh's pyramid. It looks this way to me.

We owe much of our understanding of ancient Egypt to Jean François Champollion, the philologist who in 1821 completed the decipherment of the Rosetta stone and thus founded the science of Egyptology. Jacques Champollion, an archaeologist and a descendant of Jean François, wrote: "The total length of the monolithic sphinx is one hundred seventeen feet; the contour of the head at the forehead is eighty-one feet; the height from the stomach to the top of the head is fifty-one feet." He also says: "its height of forty feet above the ground is the witness and measure of the quantity of stone removed from the surface to leave this elevation on the plain."

Such a monumental task would not have been necessary if they had started with a yardang.

The evidence indicates that when they embarked on perfecting the form to make it more convincingly lifelike, they dug more rock from its sides. The farther west they went, the deeper they had to dig in the pyramid hill. The resulting moat was later filled by blown sand after years of neglect when civilization in Egypt declined. Most of the "addition" to the natural form remained buried until unearthed in 1926.

One writer has even suggested that in addition to decorating the head and shaping the paws, the ancients engineered the Sphinx to make it usable as a geodetic marker and that the Sphinx once had an obelisk between its paws whose shadow could be used to compute the Earth's circumference.

Today, the Sphinx is showing signs of old age; part of its surface is slowly wasting away. One reason may be the unusual rise of the water table.

"We can trace this to the Aswan High Dam," says Bahay Issawi. "The enormous Lake Nasser and the year-round irrigation of crop fields has caused a dangerous rise of water levels throughout the country."

As water seeps through the porous limestone rock of the Sphinx, it brings with it salts in solution that expand as they crystallize at the surface, flaking off bits of the ancient Sphinx.

This is perhaps ironic. If the Sphinx is a symbol of the ancients' understanding of the environment, a monument in harmony with nature, then it is now being adversely affected by a modern symbol of our control of nature. In our rush to "develop" the Earth, we may neglect to learn valuable lessons from what the ancients left for us, sometimes carved in eternal rock.
Looking for all the world like some heroic sculpture, this limestone form was carved by winds in Egypt’s Western Desert near Farafra Oasis.