In the coastal desert of southern Peru, sprawling figures etched on the land—a spider, a monkey, a strange flying animal, and more—have inspired wonder in air travelers since first spotted in the 1920s. Now scientists believe they know why ancient people created the designs, beginning more than 2,000 years ago.

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For the Nasca, the gods who brought rain asked a terrible price in return.

Likely a token of fertility, a severed head from Cahuachi hung from a rope of vegetable fiber. The victim may have been a local man sacrificed at a time of drought. A skull from Carrizales (above) shows a typical form of deliberate shaping, perhaps a sign of elite social status. Many buried corpses, including that of a man found at Ullujaya (left), were mummified naturally by the region’s arid climate.

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“Orca!” shouted Johny Isla, a Peruvian archaeologist, over the roar of the engine. He pointed down at the form of a killer whale. “Mono!” he said moments later, when the famous Nasca monkey came into view. “Colibrí!” The hummingbird.

Since they became widely known in the late 1920s, when commercial air travel was introduced between Lima and the southern Peruvian city of Arequipa, the mysterious desert drawings known as the Nasca lines have puzzled archaeologists, anthropologists, and anyone fascinated by ancient cultures in the Americas. For just as long, waves of scientists—and amateurs—have inflicted various interpretations on the lines, as if they were the world’s largest set of Rorschach inkblots. At one time or another, they have been explained as Inca roads, irrigation plans, images to be appreciated from primitive hot-air balloons, and, most laughably, landing strips for alien spacecraft.

After World War II a German-born teacher named Maria Reiche made the first formal surveys of the lines and figures—called geoglyphs—outside Nasca and the nearby town of Palpa. For half a century, until her death in 1998, Reiche played a critically important role in conserving the geoglyphs. But her own preferred theory—that the lines represented settings on an astronomical calendar—has also been largely discredited. The ferocity with which she protected the lines from outsiders has been adopted by their caretakers today, so that even scientists have a hard time gaining access to the most famous animal figures on the plain, or pampa, immediately northwest of Nasca.

Since 1997, however, a large Peruvian-German research collaboration has been under way near the town of Palpa, farther to the north. Directed by Isla and Markus Reindel of the German Archaeological Institute, the Nasca-Palpa Project has mounted a systematic, multidisciplinary study of the ancient people of the region, starting with where and how the Nasca lived, why they disappeared, and what was the meaning of the strange designs they left behind in the desert sand.

As our plane banked into another turn, Isla, a native of the highlands who works at the Andean Institute of Archaeological Studies, kept his broad, high-cheeked face pressed to the window. “Trapezoid!” he shouted, pointing out a huge geometrical clearing looming into sight. “Platform!” he added, gesturing with his finger. “Platform!”

Platform? He was pointing at a small heap of stones at one end of the trapezoid. If Isla and his colleagues are right, such unprepossessing structures...
A 1,200-year-old shipwreck opens a window on ancient global trade.
The world economy in the ninth century had two powerful engines. One was Tang dynasty China, an empire stretching from the South China Sea to the borders of Persia, with ports open to foreign traders from far and wide. The Tang welcomed diverse people to its capital, Changan, the site of modern-day Xian, and multiethnic groups lived side by side in a city of a million—a population unmatched by a Western city until London in the early 19th century. Then, as today, China was an economic powerhouse—and much of that power was built on trade.

The other economic engine was Baghdad, capital of the Abbasid dynasty from 762 onward. That dynasty inherited the Muslim world in the Middle East; by 750 it had spread as far as the Indus River to the east and Spain to the west, bringing with it trade, commerce, and the religion of Islam (the Prophet Muhammad himself had been a merchant).

Linking the two economic powerhouses were the Silk Road and its watery counterpart, the Maritime Silk Route. The overland road gets all the attention, but ships had likely been plying the seas between China and the Persian Gulf since the time of Christ. In tune with the cycle of the monsoon winds, this network of sea-lanes and harbors bound East and West in a continuous exchange of goods and ideas.

Tang China was hungry for fine textiles, pearls, coral, and aromatic woods from Persia, East Africa, and India. In return, China traded paper, ink, and above all, silk. Silk, light and easily rolled up, could travel overland. But by the ninth century, ceramics from China had grown popular as well, and camels were not well suited for transporting crockery (think of those humps). So increasing quantities of the goods from the Belitung ship exemplify the creativity and craft that flourished in Tang dynasty China (clockwise from upper right): An intricately engraved gilt silver flask, an ornate bronze mirror already antique when the ship sailed, a wine cup and bracelet shaped from pure gold, and the oldest intact cobalt-blue-and-white ceramic from China ever discovered.

Simon Worrall has contributed to both National Geographic and National Geographic Traveler. This is Tony Law's first assignment for this magazine.
Turning back the clock by four centuries, ecologists reveal how Manhattan Island appeared on the September afternoon Henry Hudson and his crew sailed into New York Harbor.
TIMES SQUARE  Long before it became a symbol of Manhattan’s hectic pace, the intersection where Seventh Avenue crosses Broadway (right) was once a quieter place. Two creeks met here in a red maple swamp and fed a beaver pond.
O
f all the visitors to New York City in recent years, one of the most surprising was a beaver named José. No one knows exactly where he came from. Speculation is he swam down the Bronx River from suburban Westchester County to the north. He just showed up one wintry morning in 2007 on a riverbank in the Bronx Zoo, where he gnawed down a few willow trees and built a lodge.

"If you'd asked me at the time what the chances were that there was a beaver in the Bronx, I'd have said zero," said Eric Sanderson, an ecologist at the Wildlife Conservation Society (WCS), headquartered at the Bronx Zoo. "There hasn't been a beaver in New York City in more than 200 years."

During the early 17th century, when the city was the Dutch village of New Amsterdam, beavers were widely hunted for their pelts, then fashionable in Europe. The fur trade grew into a natural wonder Hudson had looked upon, for "island of many hills"), is an effort to turn back the clock to the afternoon of September 12, 1609, just before Henry Hudson and his crew sailed into New York Harbor and spotted the island. If people today could picture what a natural wonder Hudson had looked upon, Sanderson figured, maybe they'd fight harder to preserve other wild places. "I wanted people to fall in love with New York's original landscape," he said. "I wanted to show how great nature can be when it's working, with all its parts, in a place that people normally don't think of as having any nature at all."

Long before its hills were bulldozed and its wetlands paved over, Manhattan was an extraordinary wilderness of towering chestnut, oak, and hickory trees, of salt marshes and grasslands with turkey, elk, and black bear—"as pleasant a land as one can tread upon," Hudson reported. Sandy beaches ran along stretches of both coasts on the narrow, 13-mile-long island, where the Lenape feasted on clams and oysters. More than 66 miles of streams flowed through Manhattan, and most of them sheltered a beaver or two—making José's appearance, in Sanderson's eyes, a rare glimpse of the way things used to be.

"You might find it difficult to imagine today, but 400 years ago there was a red maple swamp right here in Times Square," he said one day not long ago, as he waited for the light to cross Seventh Avenue. Dressed in black jeans and a Windbreaker, he didn't look much different from the tourists beside him on the curb. But unlike them, in his mind he was following a trail along a swampy creek that disappeared beneath the entrance to the Marriott Marquis Hotel at the corner of Broadway and West 46th Street. "Just over there was a beaver pond," he said, as a bus rolled by. "It would have been a good place for deer, wood ducks, and all the other animals associated with streams. Brook trout probably, as well as eels, pickerel, and sunfish. It would have been much quieter, of course, although today's not so bad."

Sanderson conceived the Mannahatta Project one evening in 1999, after buying a coffee-table book of historical maps of the city. A recent transplant to New York from northern California, he was curious about how the city had evolved. "The landscape in Manhattan is so transformed, it makes you wonder what was here before," he said. "There are views in this city where you cannot see, except for a person or maybe a dog, another living thing. Not a tree or a plant. How did a place become like that?"

One map in particular caught his eye: a beautifully colored print from 1782 or 1783 that showed the hills, streams, and swamps as well as roads, orchards, and farms on the entire island—something no other contemporary map had done. More than ten feet long and three feet wide, the map had been created by British military cartographers during the eight-year occupation of New York during the American Revolution. Later called the "British Headquar ters Map," it showed the island's topography in unusual detail because British officers needed that information to plan their defense of Manhattan. To Sanderson the map presented a unique opportunity to strip away the city's skyscrapers and asphalt and look at least partway back to the island's original landscape.

What would happen, he wondered, if he laid a street grid of today's city over this 18th-century rendering? Would anything line up? To find out, Sanderson enlisted family and friends, starting with his wife, Han-Yu Hung, and their young son, Everett, to join him on weekend expeditions to ... (Continued on page 136)
DIVINING ANGKOR

After rising to sublime heights, the sacred city may have engineered its own downfall.

Icon of Khmer civilization, Angkor Wat in Cambodia endures as a revered religious shrine.

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rom the air, the centuries-old temple appears and vanishes like a hallucination. At first it is no more than an umber smudge in the forest canopy of northern Cambodia. Beneath us sprawls the lost city of Angkor, now in ruins and populated mostly by peasant rice farmers. Clusters of Khmer homes, perched on spindly stilts to cope with flooding during the summer monsoon, dot the landscape from the Tonle Sap, the “great lake” of Southeast Asia, some 20 miles to the south, to the Kulen Hills, a ridge jutting from the floodplain a roughly equal distance to the north. Then, as Donald Cooney guides the ultralight plane over the treetops, the magnificent temple comes into view.

Restored in the 1940s, the 12th-century Banteay Samre, devoted to the Hindu god Vishnu, recalls the medieval Khmer Empire at its height. The temple is cloistered inside two sets of concentric square walls. These may once have been surrounded by a moat symbolizing the oceans encircling Mount Meru, mythical home of Hindu gods. Banteay Samre is just one of more than thousands of shrines the Khmer erected in the city of Angkor during a building spree whose rate of the city’s temples and the world’s largest shaped towers of Angkor Wat—the most elaborate religious monument—the once resplendent capital of the empire was in its death throes. Scholars have come up with a long list of suspected causes, including rapacious invaders, a religious change of heart, and a shift to maritime trade that condemned an inland city. It’s mostly guesswork: Roughly 1,300 inscriptions survive on temple doorjambs and freestanding stelae, but the people of Angkor left not a single word explaining their kingdom’s collapse.

Recent excavations, not of the temples but of the infrastructure that made the vast city possible, are converging on a new answer. Angkor, it appears, was doomed by the very ingenuity that transformed a collection of minor fiefdoms into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire. The civilization learned how to tame Southeast Asia’s seasonal deluges, then into an empire.

The bas-reliefs also reveal trouble in paradise. Interspersed with visions of earthly harmony and sublime enlightenment are scenes of war. In one bas-relief, spear-bearing warriors from the neighboring kingdom of Champa are packed stem to stern in a boat crossing the Tonle Sap. The scene is immortalized in stone, of course, because the Khmer were successful in battle. Although Angkor won that clash, the city was riven by rivalry, which heightened its vulnerability to attacks from Champa to the east and the formidable kingdom of Ayutthaya to the west. Khmer kings had several wives, which blurred the line of succession and resulted in constant intrigue as princes vied for power. “For centuries, it was like the Wars of the Roses,” says Roland Fletcher, an archaeologist at the University of Sydney and co-director of a research effort called the Greater Angkor Project.

Some scholars believe that Angkor died the way it lived: by the sword. The annals of Ayutthaya state that warriors from that kingdom “took” Angkor in 1431. No doubt the prosperous Khmer city would have been a rich prize: Inscriptions boast that its temple towers were clad in gold, as Zhou’s breathless account confirms. To reconcile tales of Angkor’s wealth with the yellow sands of the floodplain.
ITS VAST WATER SYSTEM WAS A MARVEL OF ENGINEERING—AND A CAUTIONARY TALE OF TECHNOLOGICAL OVERREACH.

At its height in the 13th century (depicted in this reconstruction), the capital of the Khmer Empire was the most extensive urban complex in the world. Using imaging radar and other tools, researchers have learned that Greater Angkor covered almost 400 square miles, roughly the area of the five boroughs of New York City, with as many as 750,000 inhabitants. Most were rice farmers and laborers who worked the giant jigsaw of fields. In the city center, perhaps 40,000 people—elites and farmers alike—lived close to the walls of Angkor Thom, a 3.5-square-mile enclosure with temples and a royal palace. Though the rainy season usually brought ample water, the ability to store water in great reservoirs called barays and control its flow gave Angkor an edge in times of drought or flood. But this engineered landscape required constant maintenance. When the water system faltered, so did Angkor’s power.

ANGKOR’S COMPLEX PLUMBING

In Southeast Asia, months of monsoon rains are followed by months of near drought. To ensure a steady water supply, stabilize rice production, and control flooding, Khmer engineers built a network of canals, moats, ponds, and reservoirs. Massive earthworks slowed the wet-season deluge flowing from the Kulen Hills, directing it into canals that fed the barays and temple moats. Spreading across the gently sloping land, the water drained freely into the Tonle Sap, the largest freshwater lake in Southeast Asia.

SACRED SOURCE

The Kulen Hills sheltered the headwaters of the Siem Reap River and were quarried for rock to build Angkor’s temples. The hills were logged for timber and firewood and to clear land for farming; deforestation may have caused floods that choked some of Angkor’s canals with sand and silt.

LIFE IN A SEA OF RICE

On raised ground between fields, Angkor residents built timber houses on stilts. They planted palms and other trees to provide shade, fruit, and fronds for annual roof replacement. Ponds collected water during the wet season; during dry months water from the main canals fed the fields. Each community had a shrine (at bottom left), where priests may have helped mediate water use.

ANGKOR’S VAST WATER SYSTEM WAS A MARVEL OF ENGINEERING—AND A CAUTIONARY TALE OF TECHNOLOGICAL OVERREACH.

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