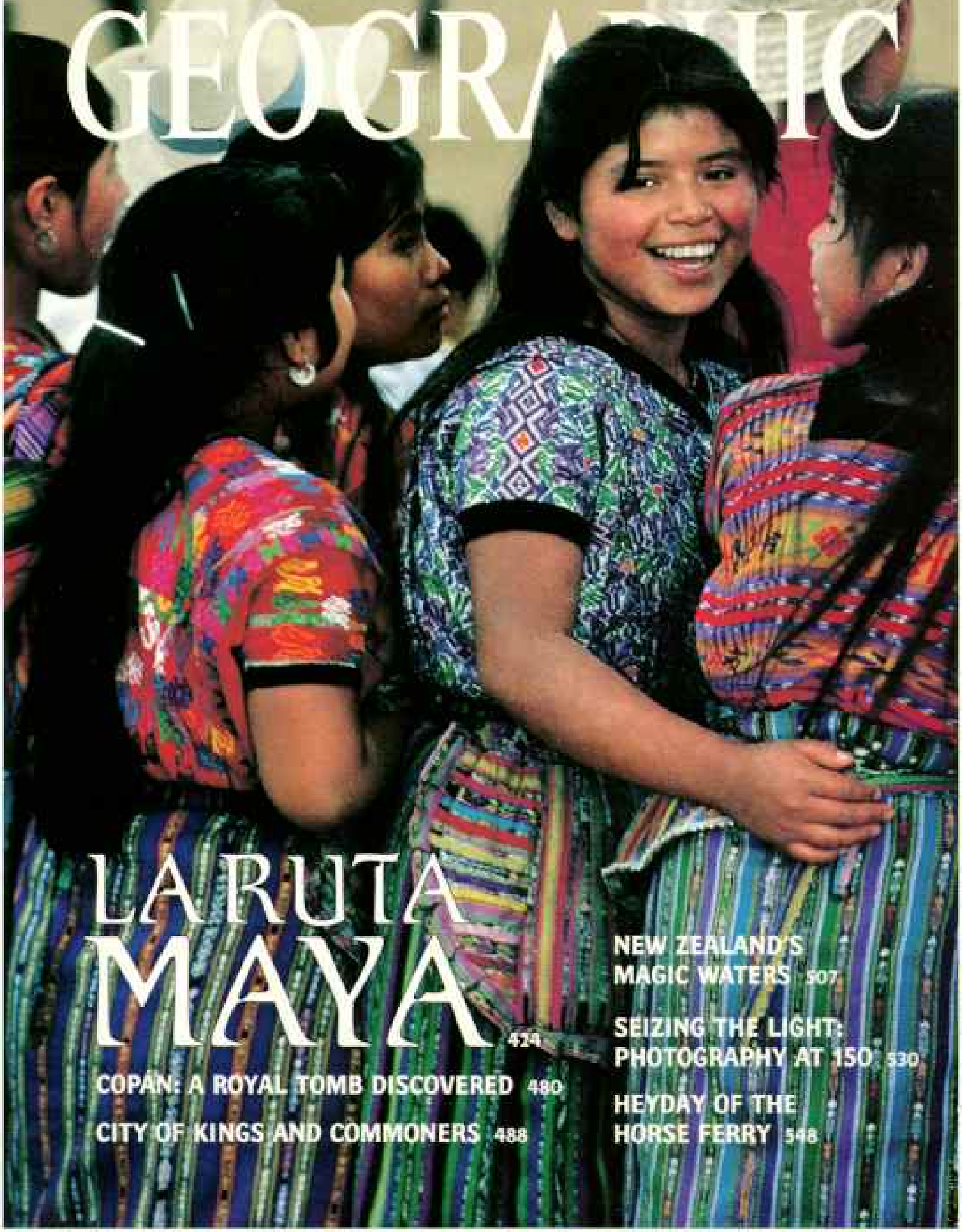
DOUBLE MAP SUPPLEMENT: LAND OF THE MAYA · ANCIENT MAYA WORLD

VOL. 176, NO. 4 OCTOBER 1989

NATIONAL GEOGRAPHIC



LA RUTA MAYA

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

NATIONAL GEOGRAPHIC

OCTOBER 1989

VILLAGER VIEWS MAYA RUINS

La Ruta Maya 424

From the buried cities of one of the greatest American civilizations, the ancient Maya still speak—if you can get close enough to listen. In a major report, Editor Wilbur E. Garrett traces the Maya culture and outlines an ambitious plan for a 1,500-mile tour route encircling the Maya realm. Photographs by Kenneth Garrett.

MAYA ROUTE CABLEWAY. PAINTING BY JOHN SERREY

Copán: A Royal Tomb Discovered 480

Last June, for the first time in a century of excavation at Copán, the tomb of a Maya nobleman was unearthed there. Archaeologists Ricardo Agurcia Fasquelle and William L. Fash, Jr., report on their find. Photographs by Kenneth Garrett.

City of Kings and Commoners 488

New discoveries at Copán in western Honduras help explain the mysterious "collapse" of this Maya capital a millennium ago. Archaeologist George E. Stuart and photographer Kenneth Garrett document the work of an international team of scholars.

Maya Traveler's Map

A double supplement, ***Land of the Maya*** *and* ***Ancient Maya World,*** *complements the issue's articles about this still living culture.*

NUDIBRANCHS COURTING

New Zealand's Magic Waters 507

A rich and beguiling tapestry of life fills the seas off New Zealand. Underwater photographer David Doubilet portrays this vivid world.

Seizing the Light: Photography's First Fifty Years 530

In the 150th year of the practical art of picture taking, historic images show the advances made in the opening five decades. With an evocative essay by Erla Zwingle.

DAGUERREOTYPE CAMERA, 1840

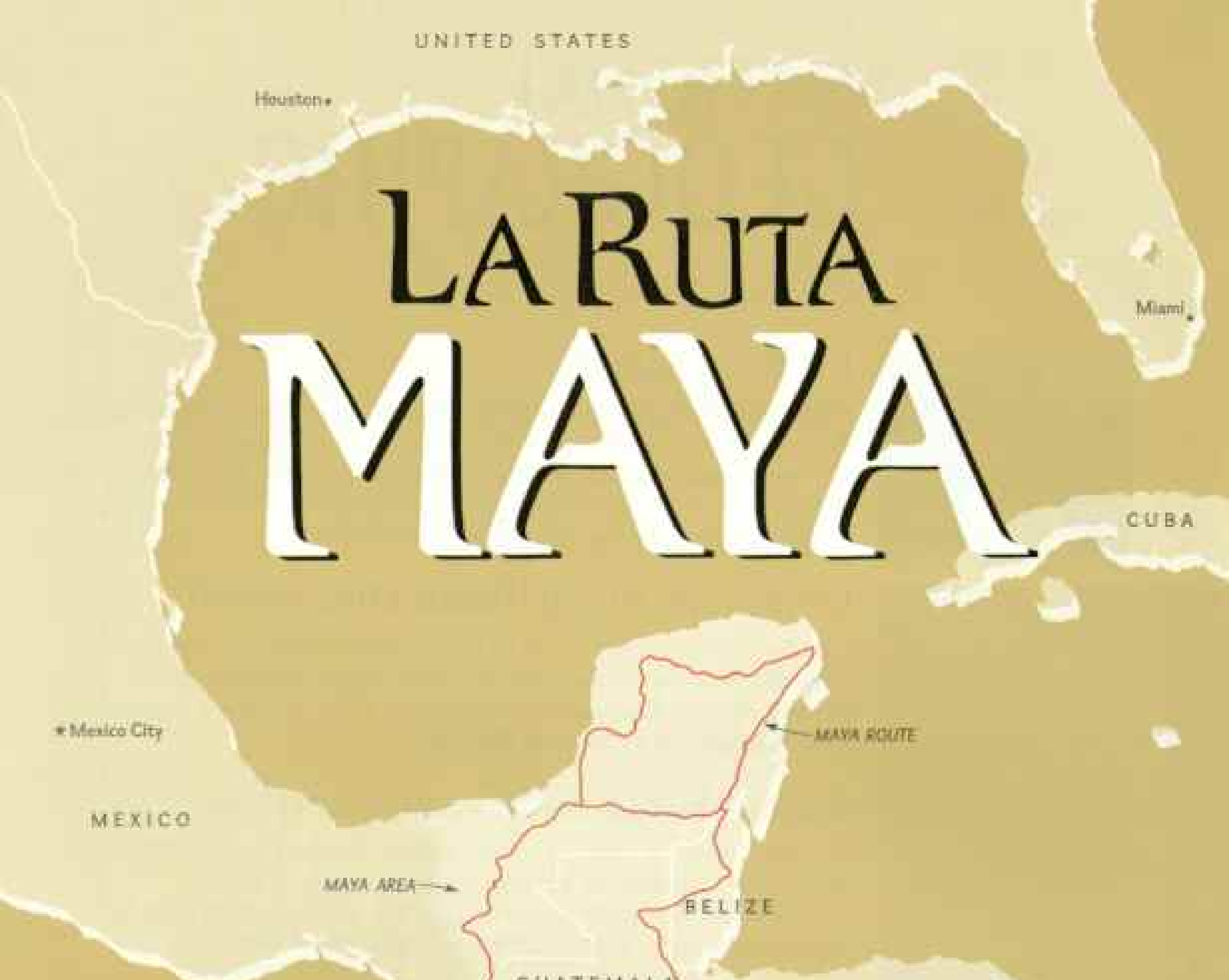
Heyday of the Horse Ferry 548

In the early 1800s ferries powered by horses and mules plied rivers and lakes of the eastern United States, though they were soon displaced by the steamboat. Marine archaeologist Donald G. Shomette reports on one such teamboat found sunk in Lake Champlain.

DIVER EXPLORES TEAMBOAT WRECK

COVER: *Wrapped in the dazzling colors of handwoven Maya dress, teenagers in the Guatemalan village of Sumpango attend festivities marking the Day of the Dead. Photograph by Kenneth Garrett.*

La Ruta Maya



A bold concept is taking shape in Middle America, as five nations put aside their differences to collaborate in establishing La Ruta Maya—the Maya Route—an ambitious regional project designed to showcase and preserve their shared cultural, historical, and environmental heritage. In this realm of the ancient Maya one discovers:

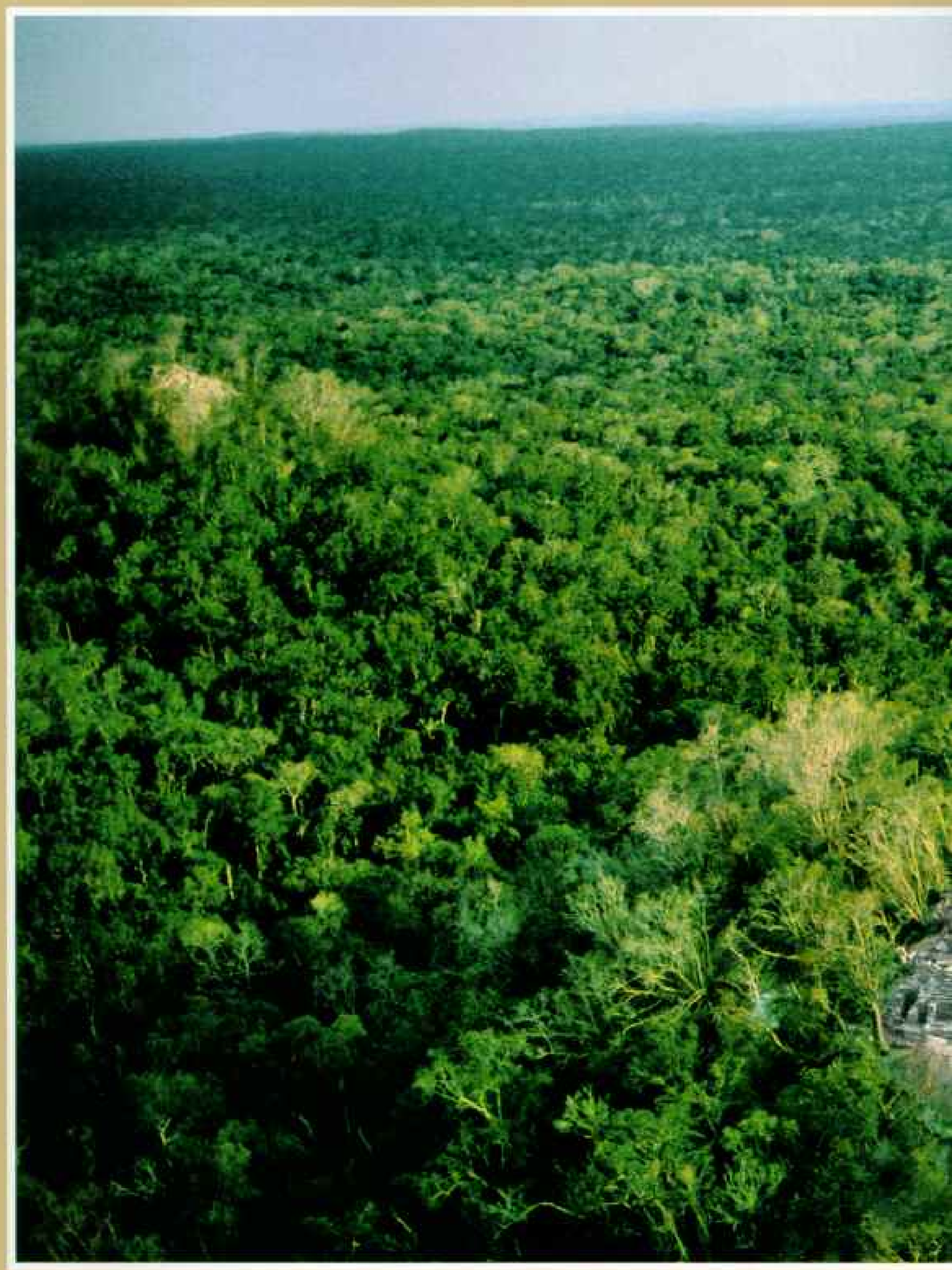
- More cities than in ancient Egypt
- Remote villages where traditions and crafts have survived for 3,000 years
- Endangered tropical forests and as many species of birds as the U. S. and Canada combined
- The longest barrier reef in the Americas
- Economic and population pressures that threaten all the above

By WILBUR E. GARRETT EDITOR
Photographs by KENNETH GARRETT

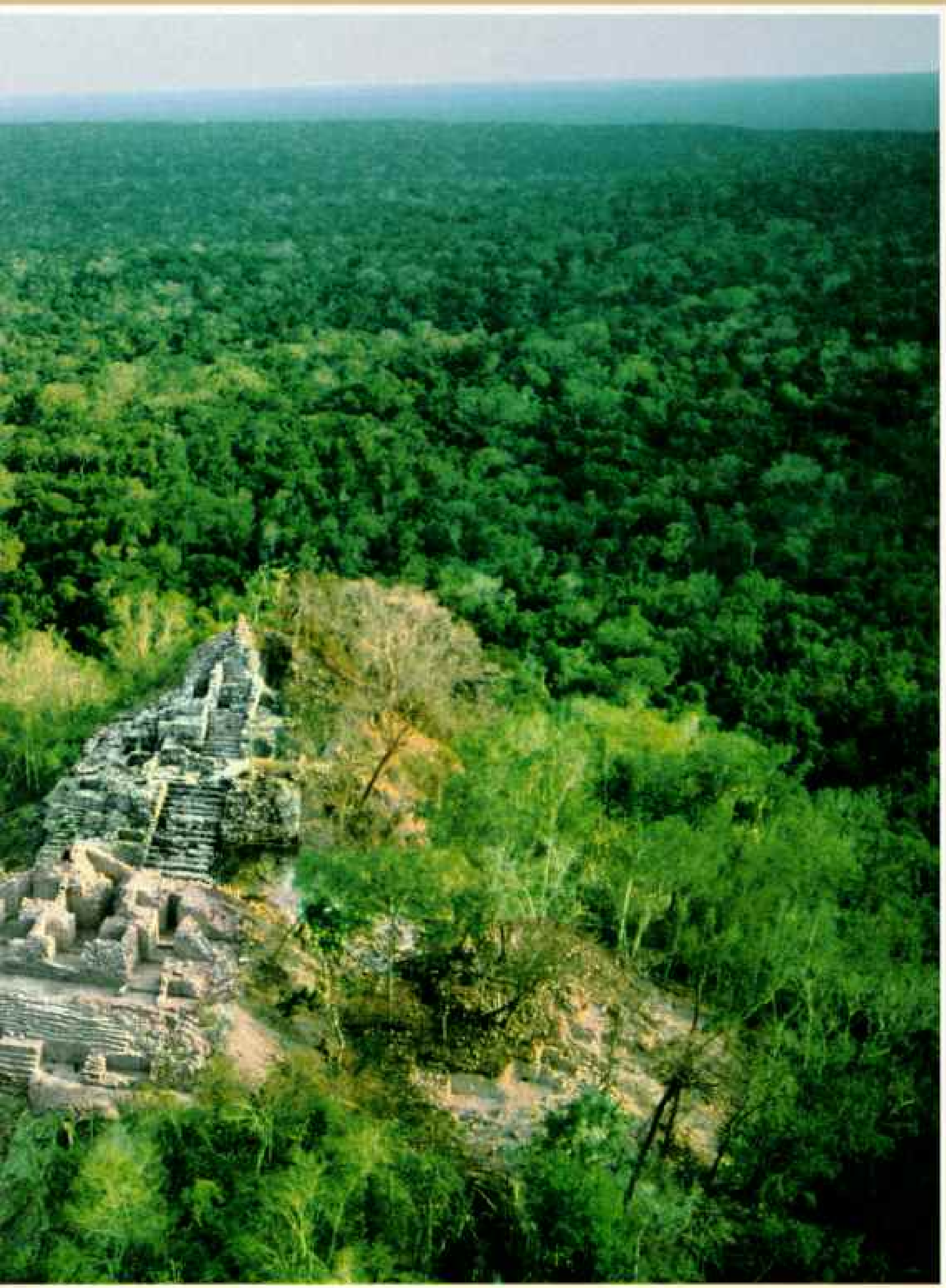
Six hours by dirt road from the nearest city, villagers of remote San Mateo Ixtatán in Guatemala blend ancient beliefs with Roman Catholicism as they celebrate Good Friday. Conquered and converted by Spaniards 400 years ago, the isolated Maya remain culturally distinct.

DAVID ALAN HARVEY

Stepping out of time, a young Maya bears the classic features of his forefathers. Though decimated by war and disease, Maya still outnumber European descendants in much of their homeland.



In the heart of the Yucatán Peninsula sprawl the ruins of the city in the 1.8-million-acre Calakmul Biosphere Reserve, created last what may be the most massive pyramid ever built by the Maya.



of Calakmul, once home to 60,000 Maya. Among 60 known sites
May by Mexico's President Carlos Salinas de Gortari, it boasts
rising 175 feet from a base covering five acres.

Cheerfully uniform in fashion, Guatemalan farm boys of Todos

Every Maya village has its unique style of dress, made from

DAVID ALAN HARVEY

Santos Cuchumatán hang out at the local store after a day's work. brightly colored textiles that are usually handwoven.

Atolls of coral and sand punctuate the waters of Glover Reef
by locals, the Yucatán Peninsula's reef system—longest in the

in Belize, luring divers from around the world. Fished for centuries
hemisphere—extends in a broken line along the east coast.

THERE IS A MONKEY in the Yucatán Peninsula that howls like an angry jaguar. He lives in a verdant rain forest alive with the singing of hundreds of species of birds. The forest canopy is so desert dry that Christmas cactuses thrive 150 feet above ground, and its dense foliage has buried more cities than existed in all of ancient Egypt. This monkey rarely comes down to earth from his high perch. Why should he? He once served as god of writing to the Maya, who ruled there and produced the most sophisticated written language native to the Americas.

Why a monkey for a god? As with many questions about Maya culture, no one has an answer. Like a mist in the night, the Maya appeared in this unforgiving land more than 3,000 years ago. They built a culture that flowered while Europe languished in the Dark Ages and that survived six times as long as the Roman Empire. They lived by a calendar the equal of ours, developed the concept of zero in mathematics, predicted eclipses of sun and moon, and traced the path of Venus with an error of only 14 seconds a year. In the 16th century the Spanish, with muskets and measles, applied the coup de grace to the ghostly remains of the Classic Maya culture, which was already fading as mysteriously as it had blossomed.

Screams of the black howler monkey are often mistaken by visitors for those of the jaguar. Considered sacred by the ancient Maya, the black howler is now threatened as rain forest habitats shrink.

KEVIN SCHAFER

It was several years ago that I first met the once sacred black howler monkey and became infatuated with the Maya world where he lives. Four of us had come to Guatemala to explore Naj Tunich—a newly discovered cave said to contain wall paintings. We landed by helicopter at a farm that was a nine-hour walk from the nearest road and camped on the edge of the forest that encircled it.

From the air the farm looked like a cigarette burn in a vast green carpet. As his ancestors had done for centuries, Maya farmer Bernabé Pop had burned and cleared a patch of forest to support his family. We awakened to sounds as certain as the sunrise in Maya farming country—the rhythmic slapping as wads of corn dough were flattened into tortillas, the rasping squeal of machetes being sharpened. Chickens scratched and pecked at moist earth around and inside the pole-and-thatch house.

Bernabé—who found the cave when his dog chased a deer into it—led us, slipping and sliding, a muddy mile into the earth. When we stopped for lunch, we doused our lights to save batteries. Soon Bernabé exclaimed with some urgency, "Listen! Voices."

In this darkest of dark I saw nothing and heard nothing except my heartbeat. Guerrillas? Armed looters? Bernabé, more sensitive than we that the caves are entrances to the Maya underworld, was hearing the *viejos*—ancient ones. He seemed slightly reassured when none of the rest of us heard them.

We found no paintings but dozens of charcoal drawings and hundreds of glyphs on smooth limestone walls. Scholars George Stuart—National Geographic staff archaeologist—and his son David declared the mint-condition 1,200-year-old writings a Maya equivalent of the Dead Sea Scrolls.

"They put names, dates, and cities together like a modern genealogy," George later told me. "It's one of the richest sources of Maya writing ever discovered." The viejos had talked to us after all.

I was learning that—like the howler monkey screams and voices in the

dark—many things in Central America aren't what they seem. First, the Maya people not only haven't left, throughout much of the region they outnumber the descendants of their European conquerors, though they live in poverty outside the economic, social, and political mainstream.

Second, the tropical forests are not the fearsome, snake-infested saunas that only an Indiana Jones could love, but ecological cornucopias that provided the ancient Maya a good living.

Third, life in the Yucatán is shaped by the rising of the land from the sea millions of years ago as much as by current political events. In that sea Cretaceous and Tertiary mollusks died and settled to form the porous limestone of today's landscape. Rain drains away quickly, leaving northern Yucatán with not a single river, few minerals, and topsoil as thin as the hair on a coconut. Only in the southern highlands do the farmers enjoy good soil, enriched by volcanoes that still fume and occasionally erupt.

On the limestone base nature spread a blanket of forest that recycles the sparse nutrients efficiently while hosting millions of plant and animal species. On the damp forest floor insects and fungi quickly convert every fallen leaf into mulch. Twisting slabs of tree roots that can't grow down reach out as much as 80 feet along the ground, like buttresses on Gothic cathedrals, to support the towering trees while feeding on this deepening litter. The forests serve even those of us who live far from the tropics by absorbing atmospheric pollutants that cause global warming and by providing between 10 and 15 percent of the natural medicines prescribed today.

Yet, in tropical forests you're more likely to hear the whine of chain saws than either a monkey or a jaguar—and that should really frighten us. In Central America alone, tropical forests the size of Norway have fallen since 1962—sentencing the black howler monkey to the list of threatened species. The ones I met at Naj Tunich years ago must be long gone. Their forest is only a memory, mostly burned and cleared. A road leads past the cave to a new settlement nearby.

Patron of writers in the Maya pantheon, the howler monkey is depicted writing furiously on this 1,300-year-old ceramic pot. More than just decorations, many codex-style vases also told stories, serving as manuscripts.

© 1985 JUSTIN KERR, COURTESY NEW ORLEANS MUSEUM OF ART, WOMEN'S VOLUNTEER COMMITTEE

At Naj Tunich we had been deep in the heart of the Classic Maya world, which extends from Mexico's Yucatán Peninsula and bordering states of Chiapas and Tabasco south through Belize, Guatemala, and into northwestern areas of Honduras and El Salvador—all or part of five countries, yet in total only half the size of Texas.

A 1,500-MILE, all-weather route I've come to think of as La Ruta Maya encircles this area like the drawstring on a treasure pouch (map, page 437). It crosses several international borders, parallels the longest coral reef in the Western Hemisphere, follows 250 miles of the original Pan American Highway, and passes within easy reach of thousands of Maya ruins as well as eight international airports. Yet drive a few miles off the main road, and you'll find steaming tropical forests little changed since the Pleistocene and villages that, for better or worse, stand as mementos of an earlier time. Centuries of isolation and poverty have preserved attitudes, architecture, and crafts lost to wealthier industrialized societies. As we approach the 1992 quincentennial of Columbus's arrival in the New World, no area better evokes the unique lands he found—lands that attracted the greatest migration the world has ever seen.

Unfortunately, the Maya's magnificent archaeological heritage and the tropical forest that enshrines it are at risk as population soars at a record pace. Moves are afoot to save both and still provide for the people.

A regional plan, also called La Ruta Maya, would increase environmentally oriented tourism and sustainable, nondestructive development to provide jobs and money to help pay for preservation. A regional meeting to discuss the Ruta Maya concept, hosted in Guatemala City by President Marco Vinicio Cerezo Arévalo last October,

The daily grind at the molino—or corn mill—provides a chance to socialize for Maya women in Mexico's Yucatán state. Kernels are boiled in a lime solution, then ground; corn-flour dough is shaped into tortillas, a traditional staple.

was the first time officials of all five nations met together to discuss common problems. They voted unanimously to support the Ruta Maya project.

In time, with a single regional Ruta Maya tourist visa and quality bus service with a Eurail-type pass that would allow passengers to come and go at their convenience, areas seldom visited now could be easily and efficiently reached. A cable way or monorail through environmentally sensitive areas could provide access to wildlife and Maya ruins (painting, page 422), while preventing the uncontrolled settlement and the forest destruction that typically follow new roads.

But as it must to land-poor people, conservation ranks a distant second to survival. Only if it can be proved that the forests, the endangered species, the fragile coral reefs, and the ancient Maya sites have more value intact than as plunder can they survive. No concept, however well conceived, can succeed that does not include today's Maya in both planning and profits—something that has seldom happened in the 500 years since the arrival of the Spaniards.

One man who has fought longest to save Mexico's tropical forests and assist the local people has grown cynical. Miguel Alvarez del Toro, director of the Natural History Institute in Chiapas, told me: "Even if an area is set aside for conservation, some future president could still give it to one of his relatives." Having fought alone for so many years, he may underestimate the power of the environmental movement that he helped launch.

Acknowledging that environmental problems respect no political borders, the five nations with a common Maya heritage are working to put aside long-standing animosities and short-term profits to cooperate. Carlos Hank González, Mexico's Secretary of Tourism, offered enthusiastic leadership. He tells me he has found support throughout the region for a Ruta Maya regional concept: "The Secretary of Foreign Affairs of Mexico as well as the Foreign Ministers of Belize and Guatemala with whom I have spoken are in complete agreement."

In actions that support these sentiments, the legislature of Guatemala recently approved 44 new parks and conservation areas, and Mexican President Carlos Salinas de Gortari and Guatemalan President Cerezo recently announced the formation of two adjoining biosphere reserves totaling 4.7 million acres. In May they signed an agreement to "cooperate in the conservation of natural areas of the border zone . . . to take the necessary steps to protect threatened and

Linking the Maya world

ENFOLDING a priceless wealth of Maya sites, La Ruta Maya would transcend political borders to unite five nations with a shared Maya heritage: Mexico, Belize, Guatemala, Honduras, and El Salvador. A key element of the project would be a 1,500-mile route connecting Maya sites and providing visitors with access to remote areas. To minimize road building, planners suggest supplementing existing roads with low-impact alternatives such as monorail, cable car, riverboat, mule, or foot trail. Another key step is to halt the indiscriminate cutting of endangered rain forest. Instead of ruining the land for short-term gain, properly managed biosphere reserves would yield long-term benefits by boosting local income through tourism and the harvesting of renewable rain forest products like fruits, cacao, coffee, oils, and medicines.

endangered species." This represents a bold, hopeful change from a few years ago, when only combative military units patrolled these borders and illegal loggers and tomb looters worked the forests undisturbed.

Both the Calakmul reserve in Mexico and the Maya reserve in Guatemala will be proposed for the UNESCO Man and the Biosphere program, which would place them under mandatory restrictions to guarantee permanence, protecting them from future political whims or greed. Under UNESCO rules, core areas must be established that permit no development, with buffer zones that may be used only on a sustainable basis not destructive to the environment.

With the establishment of the Rio Bravo Conservation and Management Area in Belize, a three-nation Maya Peace Park may be realized soon. At five million acres, it would encompass an area twice the size of Yellowstone National Park and could become the Serengeti of New World rain forests. Properly managed, it would be large enough to provide a safe habitat for most of the 65 threatened species in the area and provide protection for hundreds of Maya sites—including two of the largest and oldest cities known, Calakmul in Mexico and El Mirador in Guatemala.

The rain forests and the Maya culture the conquistadores tried so hard to destroy may prove to be the treasure they never found in the Yucatán.

LET'S APPROACH this Maya world from the Bay Islands, off the north coast of Honduras, now popular with reef divers. Here Columbus and his crew became the first Europeans to meet the Maya. In 1502, during Columbus's fourth voyage, his men went ashore at Guanaja Island and captured a seagoing canoe and its crew. An account of the incident records that "they were from a province called Maia. . . . Naked and yoked slaves drew [the canoe] along the shore with ropes as is done against river currents. On the orders of their master, the slaves indicated arrogantly to our men that they should make way and made threats when they offered resistance."

What a thrill this meeting must have been for Columbus's son, Ferdinand, 14. He wrote about the canoe coming alongside his father's flagship:

DAVID ALAN HARVEY

In a tragic cycle of destruction, farmers slash and burn the rain forest for field crops and pastureland. The blazing Honduran rain forest above will yield only three years of corn before a two-thirds drop in productivity drives farmers to destroy a new patch of forest. Such fires, burning out of control, leveled 2.5 million acres of rain forest in Mexico's Quintana Roo state this year. In a recently burned field in Chiapas state (left), Maya farmers sow corn as they have for centuries, using a pointed stick to pierce the ground. A Guatemalan hillside (right) shows the ravages of erosion on the denuded land.

. . . as long as a galley and eight feet wide, all made of one tree. . . . in the middle of it there was an awning of palm leaves, no different to the ones on the gondolas of Venice. . . . Under the awning were children, women, furniture and merchandise. As provisions they had roots and grains . . . wine made of maize . . . axes for wood cutting . . . made of good copper . . . and the crucibles to melt it in . . . and many almonds [cacao beans] that are used as coins in New Spain, which it appeared they valued much . . . when some of the almonds fell overboard . . . they would try to pick them up as if these were their eyes that had fallen off. . . .

© C. LOCKWOOD

Plucking a valuable crop from the seafloor, a Maya lobsterman at Punta Allen, which is located inside Mexico's Sian Ka'an Biosphere Reserve, retrieves a dozen spiny lobsters from an ingenious trap, at left. A concrete slab raised off the sand creates an inviting shelter for the lobsters; a tap on the slab sends them scurrying out. The local fishing cooperative freezes and exports most of the lobster tails to the United States.

EARLY TRAVELERS, dazzled by the culture of the Maya, compared them to Greeks because of their science, to Romans because of well-drained, paved roads, and to Egyptians because of their pyramids. An archaeologist studying Maya nautical trade routes dubbed them the "Phoenicians of the New World." One scholar estimates that perhaps 4,000 Maya canoes were at sea at any one time at the height of their culture, trading such diverse products as wax, honey, salt, furs, feathers, jade, cotton, and slaves.

Along the probable route of the captured canoe lay Nito—a Maya port near present-day Livingston, Guatemala, at the base of the Yucatán Peninsula. This was the site of the first European settlement on the peninsula. The Spanish captured Nito but fared poorly because they were unable to wrest a living from the jungle. In 1524 Cortés led an expedition from Mexico City to check on the area.

After a horrendous march through swamps and across swollen rivers, Cortés reported to King Charles I of Spain that he found the settlers "in such a plight it moved us to the greatest pity . . . had I not come, not one of them would have lived long, for in addition to being few and unarmed and without horses, they were very ill and wounded, and dying of hunger."

He rescued them, returned to Mexico by a different route—and Nito disappeared. Canadian archaeologist and part-time Guatemala farmer Rick Bronson invited me to join his search for the lost Nito. In retracing that part of Cortés's route down the Sarstoon River in a search for clues, we came to a Maya fishing village at the mouth.

The people knew nothing of Cortés or Nito but did show us Maya stone tools they had found nearby. A few minutes of searching along a collapsed riverbank produced pieces of obsidian knives and potsherds mixed with bits of blue-and-white porcelain. Nito? Probably not, but we had stumbled on a trash midden that suggested early Spanish presence.

In our enthusiasm we searched too long and left for Livingston that evening at low

tide. Our 50-foot ketch ran aground three times on mud banks. We freed ourselves each time, only to be confronted with a shallow reef as darkness came on. While pitching through offshore breakers, we snagged a fishing net with our propeller, spinning it into a 50-pound knot. We tossed at anchor all night like an abandoned surfboard. At first light the Maya we had met the previous evening arrived to haul their nets in dugout canoes that were smaller versions of the one Columbus saw. Although they didn't ask, we paid for the net that our propeller had fouled and left. The Maya—still excellent seamen—were too polite to ask what we were doing there.

As the gateway to new tourist stops along the Río Dulce—the "sweet river"—and Lago de Izabal, which it drains, Livingston looks to better days as a modern Nito. The Marimonte Reserve along the riverbank offers refuge for the golden-mantled howler monkey—rare in Guatemala.

Lago de Izabal—on whose shore some 25 Maya sites have been discovered—provides excellent freshwater anchorage for seagoing yachts and access to the ancient cities of Quiriguá and nearby Copán, across the border in Honduras (see article beginning on page 480).

Rick Bronson's experiments on the north shore of the lake have convinced him that the Asian water buffalo produces meat more efficiently in the humid tropics than cattle. Moreover, the buffalo thrives in swamps and land unsuitable for other uses. Since thousands of acres of rain forest have fallen to provide grazing area for cattle, Rick's experiments may prove important—providing a sound argument against continued forest destruction.

Most tropically grown beef ends up in convenience food or in dog and cat food. For such uses, which do not require prime cuts, buffalo meat should serve adequately.

NORTH FROM Livingston, about two-thirds of the way up the Yucatán coast at Punta Allen, Mexico, I joined lobsterman Billevaldo Guzmán on his 28-foot fiberglass workboat. In shallow water the color of apple jade, diver Luis Daniel emptied lobster "traps"—four-foot-square slabs of three-quarter-inch concrete with small log outriggers tied on to keep them a few inches off the bottom. The idea is old, the material new. The concrete traps replace ones formerly made from the now endangered chit palm.

Treading softly in a fragile land, visitors disembark from New Shoreham II, a cruise ship that sails the Belize coast and up Guatemala's Río Dulce. The ship promotes "eco-tourism," wherein passengers try to leave no trace of their journey. By contrast, tourism has left an indelible stamp on Cancún, Mexico, crowded with 140 hotels. Although the beach resort provides jobs, it is estimated that 70 to 90 percent of profits leave the area. The Maya Route plan suggests greater local ownership and management of more modest facilities.

Creatures of the Maya realm, jaguars, turtles, and bright-plumed birds are regular victims of human predation. In a Mexican lumber camp, a jaguar—Maya symbol of power—has been killed illegally for its skin, worth $80. Trappers routinely capture toucans and parrots for the international pet trade; cardinals such as this one (bottom) are sold locally. Devastated by human and animal enemies, sea turtles have found friends in the Mexican government and in Pronatura, a private organization. Eggs are gathered in chain-link enclosures and hatchlings carefully returned to the relative safety of the ocean. The green turtle at right was one of 103,000 saved last year.

C. C. LOCKWOOD (ABOVE)

Lobsters seeking shelter under the slabs end up as statistics in the ledgers of the local fishing cooperative. Luis taps on the concrete with his gaff. As fast as the lobsters crawl out to see who's there (page 440), he tosses them into the boat.

As our boat filled, I marveled at the simple efficiency of the system but wondered how there could be any lobsters left. Last year the co-op, employing 107 boats, packed and shipped 65 tons of lobster tails to the U. S. Billevaldo, treasurer of the co-op, assured me that officials monitor the harvest in efforts to maintain a sustainable level. By law they must, since Punta Allen lies within the 1.3-million-acre Sian Ka'an Biosphere Reserve. Nevertheless, fluctuations in the harvest concern biologists and fishermen alike.

North from Punta Allen we canoed through the mangrove forests and salt marshes of Sian Ka'an ("birth of sky" in Maya), home to some 350 species of birds and 30 known Maya sites. Of the six small structures we found in one day, the most unusual—shaped like a turtle—nestled in scrub forest a hundred yards from the Caribbean.

In Maya art the turtle symbolizes the flat earth surrounded by seas. In one repeating theme, corn grows out of a cleft carapace. In another, a king standing on a turtle performs ritual bloodletting by stabbing his penis with a stingray spine. It seems a painful price to pay for power, but perhaps no worse than that expected of queens—pulling a thorn-embedded rope through a hole cut in the tongue.

It was May, and the female green, loggerhead, hawksbill, and leatherback turtles were due. For almost as long as there has been surf, turtle females have come out of it on spring nights to bury their eggs in the sand, leaving their young to hatch and return to the sea alone.

Photographer Dave Harvey and I walked the beach closest to the turtle temple hoping to see them. The sand fluoresced under a gibbous moon. Gentle surf rolled up long

sand beaches and dissolved into ribbons of froth. As far as our eyes and our legs could reach in two hours, neither other humans nor their works disturbed the magic of the balmy night. Could it have been much different when Columbus sailed by? Yes. In two nights we didn't see a single turtle.

Their populations continue to decline because of illegal harvesting and the shortage of such undisturbed beaches. It doesn't help that legend says the eggs are an aphrodisiac.

North of Sian Ka'an at Rancho Tancah we met Verónica Juárez, a young Maya biologist working for the Research Center of Quintana Roo. When and if the turtles arrived, she would gather the eggs and rebury them in a chain-link enclosure to guard against predators—both animal and human.

"When they hatch after eight weeks in the sand, we carry the babies into the surf," Verónica explained. "Normally as many as 70 percent will be eaten by seabirds before they reach the water."

Not only turtles have trouble getting to and from these shores. The reef has snagged many a boat. But follow the route of a Maya captain of old at Tulum, and there'll be no problem. At the sea's edge stands Tulum's elegant Castillo—a temple once used as a lighthouse that guided boats through the reef

Gateway to the underworld of ancient Maya belief, the sacred cenote, or well, was a crucial source of water for the Maya of the northern Yucatán Peninsula, where no surface rivers flow. Humans were ritually sacrificed in such wells. At Dzitnup, in Mexico, bathers swim beneath stalactites in waters pure enough to drink.

and the first Maya structure ever reported by Europeans. Now Tulum is the most visited archaeological site in the Maya world.

Researcher Michael Creamer, helped by a National Geographic grant, discovered the long-lost secret of this pre-electronic navigational station. "We placed a lantern on shelves behind each of two windows located high on the face of the Castillo. At sea where the two beams can be seen at the same time, there's a natural opening in the reef."

The first Europeans to come ashore on this particular coast were 17 survivors of a Spanish ship that hit a reef and sank in 1511. All were either captured and sacrificed or died of disease except Brother Gerónimo de Aguilar and seaman Gonzalo Guerrero, who were kept as slaves. Eight years later a passing ship ransomed Brother Aguilar. Guerrero, by then married and the father of the first three mestizos—persons of mixed blood—in the Yucatán, chose to stay. He told Aguilar: "My face is painted [tattooed] and my ears are pierced. And how can I leave these three beautiful children?"

When Hernández de Córdoba attempted to land a Spanish force on the coast in 1517, Maya troops under the command of Chief Gonzalo Guerrero drove them off.

ON THAT SAME COAST visitors now arrive by the millions to a warm welcome. In 1974 the Mexican government opened the tourist city of Cancún on the northeast corner of the peninsula. It's about as Mexican as Tex-Mex chili, but it drew a million tourists in 1987, according to Antonio Enríquez Savignac, the former Secretary of Tourism who helped develop the resort. In 1988 the numbers were down because of Hurricane Gilbert and its damage.

"Computer studies showed that tourists wanted sand, sea, and weather," Enríquez told me. He hopes the foreign exchange and the jobs Cancún provides will slow the destruction of forest. "When I fly to Cancún, I see the denuded land. Every year forest disappears faster and faster."

Cancún expands at the rate of 25 percent a year. At last count there were 137 completed hotels and more under construction. Despite the promised income Mexican environmentalists, concerned with unrestricted development of coastal lands, crusade for more protected areas such as Sian Ka'an. "Eco-tourism" developers gamble that low-impact visits to such reserves will provide tourists with memories that will last longer and be healthier than a suntan.

Three cultures—Maya, Spanish, and modern Mexican—overlap at Izamal (above), home to 25,000 in Yucatán state. The modern city clusters around the church and monastery begun in 1553 by Diego de Landa, a fanatical Spanish priest, using stones plundered from an ancient Maya temple, in background. Once coerced into Catholicism by Spanish threats of violence, the Maya found their new religion remarkably compatible. Maya deities were easily translated into Christian saints, and Catholic ritual—though more abstract than the blood sacrifice practiced by Maya priests—seemed quite familiar.

In today's Yucatán, Maya girls receive first Communion in Telchaquillo (right).

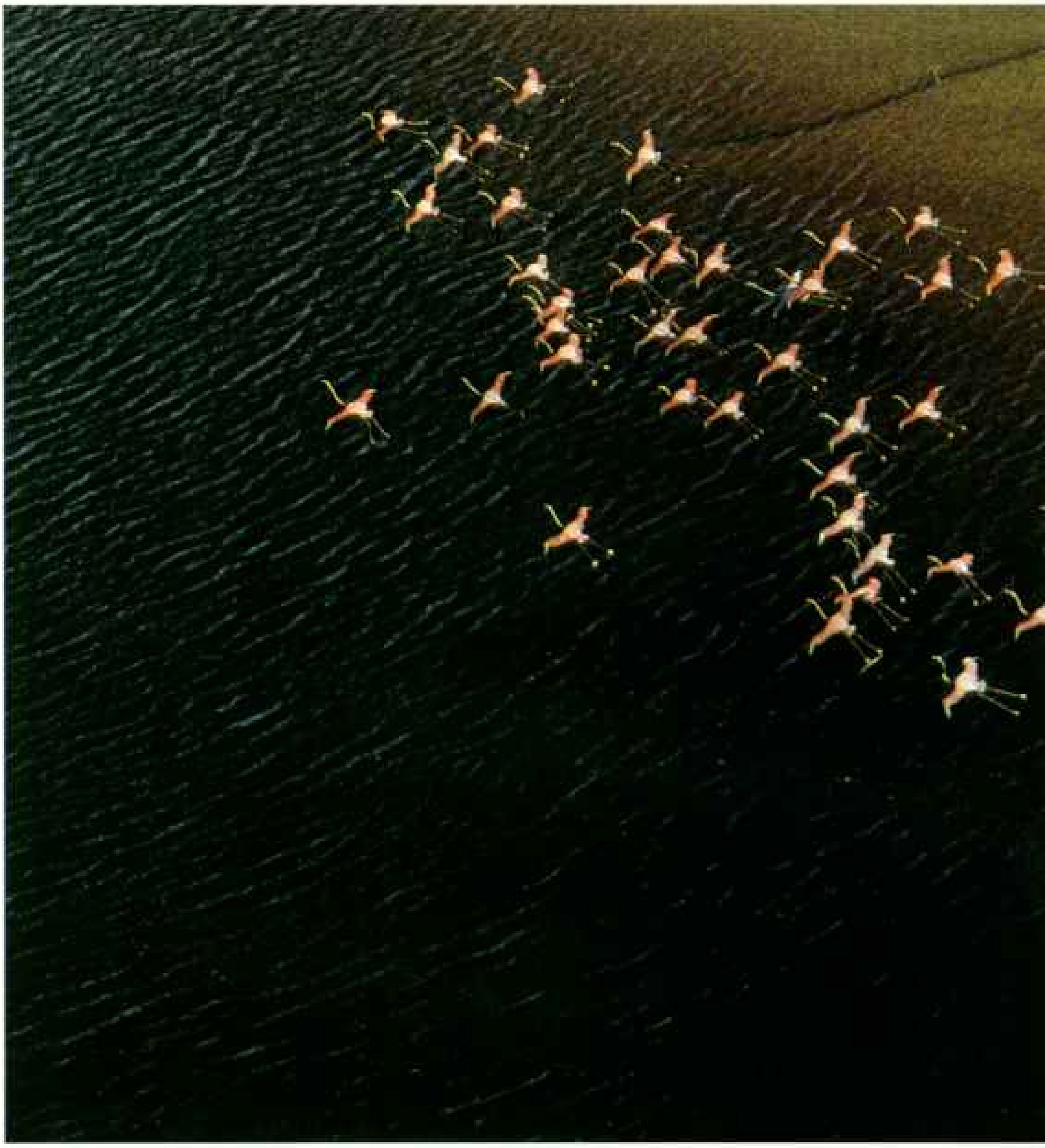
Arrow-straight roads west of Cancún led us across a flat, sparsely populated landscape. Even the "Yucatán houses" are monotonously similar. An elongated shape with a steep thatch roof, they remain basically unchanged from the pre-Columbian house depicted on a ninth-century wall carving at Uxmal.

We passed fields of henequen, which has become largely obsolete since nylon replaced the twine made from its fibers. But historically the trip is about as dull as a Coney Island roller coaster. Every few miles we reached another Maya ruin exotic in name and architecture—Balankanche, Chichén Itzá, Dzibilchaltún, Uxmal—and Spanish colonial towns such as Mérida and Izamal.

NO TOWN BLENDS Maya, Spanish colonial, and the present so gracefully as Izamal. Diego de Landa, who first arrived in Yucatán in 1549 at the age of 25 as a Catholic priest, later became a bishop. He made Izamal his headquarters and built the church and monastery that still form the core of the town. Nearby stands a massive 56-foot-high, 600-foot-square Maya ceremonial platform topped with a pyramid from which, according to Landa, "the eye can reach easily down to the sea." Perhaps it could when he arrived, but so much of the Maya stone went to build the church that the pyramid is now quite modest.

Landa enforced with inquisitional rigor the 1513 proclamation of King Ferdinand regarding the conversion of Indians. It required, as we would say, reading them their rights—even if it could only be done in Spanish. If they didn't recognize the church, the penalties would be severe: "We will enter your lands and make slaves of your wives and children. . . . We will do all the harm and damage that we can . . . to vassals who do not obey and refuse to receive their lord . . . and we protest that the deaths and losses . . . are your fault and not that of . . . the knights who come with us."

In a pious rage to destroy any vestige of the heathen culture, Landa burned all known Maya books, or codices. Only four survived, and three of those went to Europe. In time Landa's barbarities resulted in his recall to Spain. He was later reassigned to the Yucatán and died in Mérida in 1579.



National treasure, the 20,000 flamingos living along the northern coast of Yucatán make up one of the largest colonies in North America. The birds survived Hurricane Gilbert in 1988, only to renew their struggle against a longtime foe—the salt-extraction industry that has turned nesting habitat into evaporation ponds. On a smaller scale, ancient Maya made salt here using a similar technique.

Perhaps written as a defense of his cruelty, his classic, "Relation of the Affairs of Yucatán," stands as the finest scholarly report existing on Maya culture of the time.

A CITIZENS GROUP named Pronatura—"for nature"—leads Mexico's crusade for conservation. Joann Andrews, president of the Yucatán state chapter in Mérida, invited me to visit the largest flamingo flock on the North American mainland, in an estuary

near Celestún on the Gulf of Mexico. The protected waters provide a wintering home for thousands of North American ducks and a dozen species of herons.

Joann fears the flamingo will lose to developers in the competition for coastal lands. This flock of 20,000 birds would soon leave for Río Lagartos on the north shore of the Yucatán Peninsula—if they weren't too tired or too nervous to mate. One day this spring 40 boatloads of tourists—innocently curious—continually interrupted the feeding flamingos by approaching too close. Guides, eager to please, made noises to get them to fly for the cameras—not what is meant by low-impact eco-tourism. "Eco-terrorism" one environmentalist called it.

With approval of Mexico's Calakmul Biosphere Reserve imminent, I was eager to see the archaeological project there near the Guatemala border. Until recently Calakmul, the Maya site that gave the biosphere its name, was an overgrown ruin at the end of a 30-mile, deeply rutted tunnel-like road

through the rain forest that a giant mole might have chewed. Much of it is untouched by sunshine, and most of it is underwater during the rainy season (16 *feet* of rain were reported nearby in 1981).

Barry Bowen of Belize, Rick Bronson, and I left the highway at 3 a.m. in Barry's oversize, four-wheel-drive pickup truck and slithered and bucked for five hours. We stopped once, at the insistence of Mexican soldiers with cocked assault rifles who were sure that they had nabbed gringo drug runners. Convinced otherwise after a thorough search, they released us. We paused a second time when the stub of a tree branch shattered the windshield.

Soon after dawn we entered the camp of William Folan of the Universidad Autónoma del Sudeste in Campeche. In the past seven years Willie and his team have mapped 6,750 structures, excavated parts of three ceremonial sites, uncovered two tombs with magnificent jade masks, estimated a peak population of 60,000, and recorded more stelae than at any other Maya site—all the while crusading for the area to be declared a biosphere reserve.

OUR TOUR OF THE RUINS started with a climb of pyramid 7. As we broke out above the forest, Willie, with his trademark impish grin, suggested we look behind us. We had been set up! Already short of breath after the steep climb, we were confronted with a breathtaking sight. A thousand feet away, and looming far higher than we, stood the gleaming white tip of pyramid 2 emerging from its jungle cover. Astonishing! All the more so because 90 percent of its mass still lay under a canopy of forest. Nearly 500 feet square and 175 feet high, it may turn out to be the most massive Maya structure ever built.

Climbing pyramid 2, we could see the Danta Pyramid at Calakmul's sister city of El Mirador, 23 miles southwest in Guatemala. After Calakmul, El Mirador ranks as the second-largest Preclassic Maya city. Both cities pre-date Christ by a century. Their builders created complex political organizations, constructed massive temples, and developed sophisticated farming complexes. The cities survived for a thousand years; a prolonged drought may have forced their abandonment. *(Continued on page 463)*

Monuments mark a glorious past

Chronicles in stone of one of the world's longest-lived civilizations, a host of Maya ruins (overleaf) stretch from the scrubland of the Yucatán Peninsula through the rain forests of Belize, Guatemala, Honduras, and El Salvador. Spanning only a portion of the Maya's history—the 2,000 years they built with stone—the structures display a diverse architecture that remains a constant wonder.

Though most sites date from the Classic period (A.D. 250-900) or later, several—such as Seibal and Dzibilchaltún—had their roots in the Preclassic era, dating from 2000 B.C.

Under the lofty pyramids of Tikal (right), in Guatemala's Petén wilderness, lies the debris of untold generations. Before being abandoned around the ninth century A.D., the city had endured for nearly two millennia.

Fortifications at cities like Becan, which was surrounded by a moat, belie the notion of a peaceful Maya. Essentially city-states, these urban centers were run by warrior-kings.

Exemplified by the exquisite temple complex at Palenque, Maya culture would reach its florescence in the late Classic period, around A.D. 700. During this time of high cultural achievement the Maya refined their calendar and delved into astronomy, as evidenced by the observatory at Chichén Itzá.

In the centuries that followed, an influx of people from central Mexico influenced Postclassic cities like Tulum, already an important trading center for seagoing canoes when Spanish ships appeared on the horizon in 1517.

With each discovery our appreciation of Maya genius increases. And yet as soon as each monument is unearthed, it may be put into danger—threatened not only by looters with chain saws, but also by mold, lichens, bacteria, and acid rain, which crumble its surface and erase its beauty forever.

A tangle of tropical growth had been cleared from around the magnificent pyramids of Tikal when they were photographed in the 1890s by English archaeologist Alfred P. Maudslay. Viewed from the same vantage point last year, the north acropolis and its imposing temple of the Giant Jaguar show the results of one of the most ambitious archaeological projects ever undertaken in the New World. Begun in 1956 by the University of Pennsylvania, the excavations have uncovered parts of a 50-square-mile metropolis—home to as many as 55,000 people during the height of its power in the ninth century A.D.

UXMAL, GUATEMALA; PATRICIO ROBLES GIL

LABNÁ, MEXICO; RICHARD ALEXANDER COOKE III

BAYIL, MEXICO; C. C. LOCKWOOD

LOUTERS' TRENCH AT CHAN CHICH, BELIZE; DAVID ALAN HARVEY

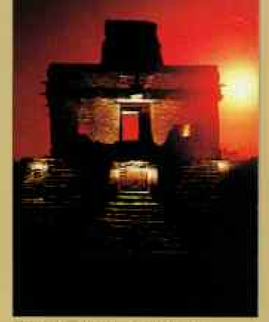
KOHUNLICH, MEXICO; DAVID ALAN HARVEY

TULUM, MEXICO; RICHARD ALEXANDER COOKE III

ALTUN HA, BELIZE; OTIS IMBODEN

UXMAL, MEXICO; PATRICIO ROBLES GIL

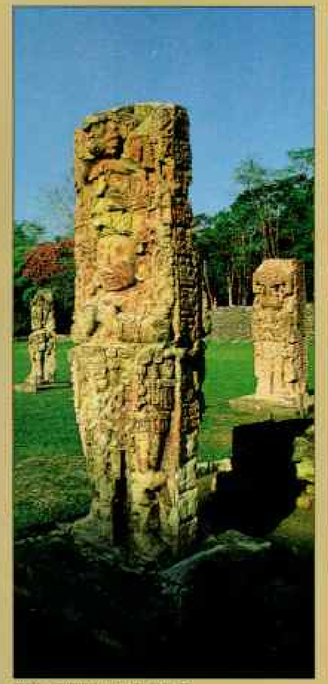
UXMAL, MEXICO; WILBUR E. GARRETT



ESTRUCTURA, MEXICO; C. C. LOCKWOOD

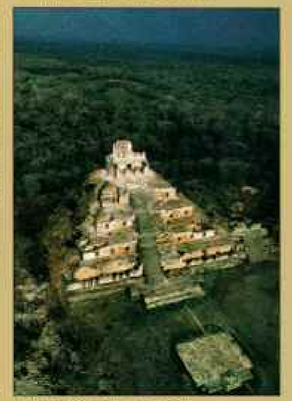
KABÁH, MEXICO; RICHARD ALEXANDER COOKE III

ZACULEU, GUATEMALA; KENNETH GARRETT

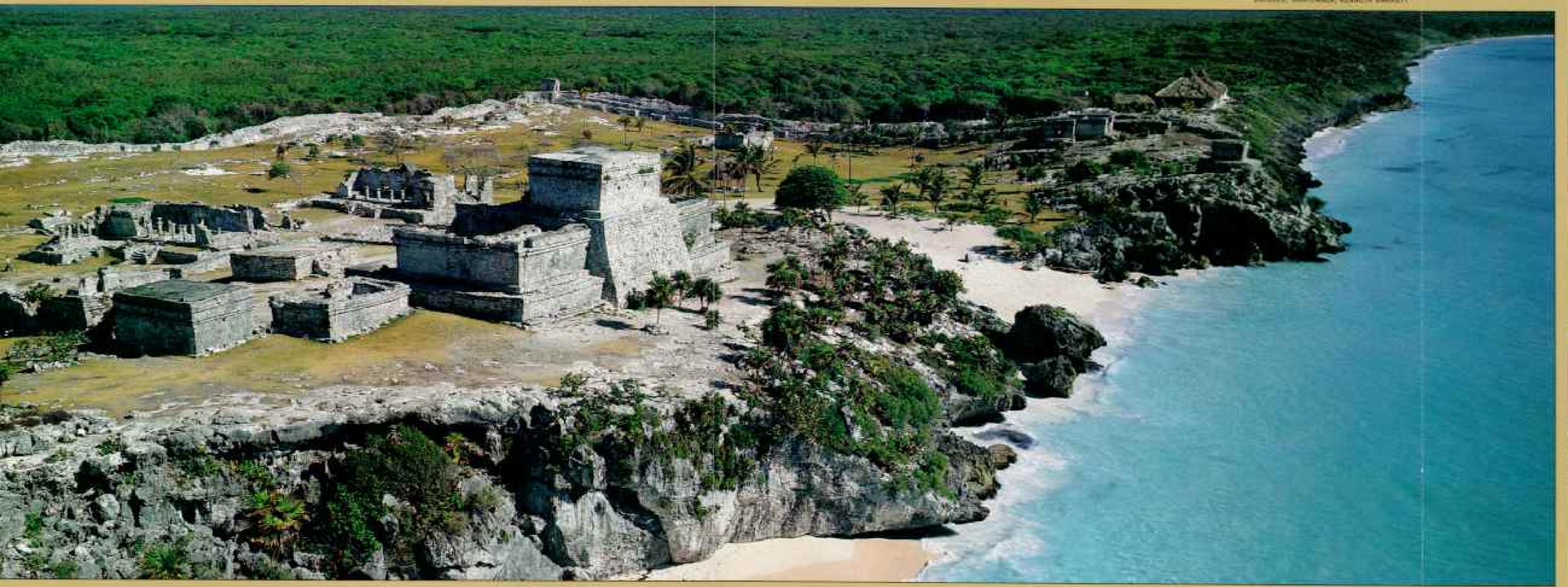


COPÁN, HONDURAS; KENNETH GARRETT

XUNANTUNICH, BELIZE; DAVID ALAN HARVEY



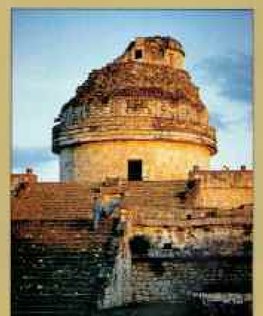
EDZNÁ, MEXICO; PATRICIO ROBLES GIL



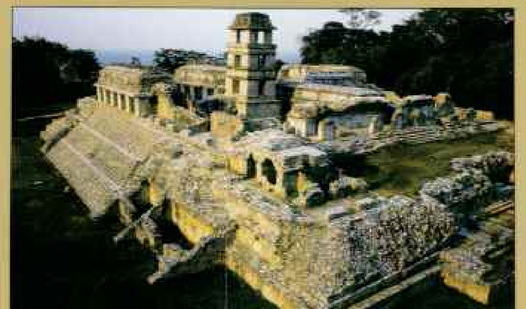
ARÉ, MEXICO; KENNETH GARRETT

YEUMIL, MEXICO; DAVID ALAN HARVEY

CHICHÉN ITZÁ, MEXICO; NATIONAL GEOGRAPHIC PHOTOGRAPHER BATES LITTLEHALES



NAJ TUNICH, GUATEMALA; WILBUR E. GARRETT



PALENQUE, MEXICO; DAVID ALAN HARVEY

HORMIGUERO, MEXICO; WILBUR E. GARRETT

Wildlife of a verdant land

Blessed with an abundance of life, the lands of La Ruta Maya are home to some 700 bird species—as many as are found in the United States and Canada combined.

Among the feathered multitudes is the ingenious acorn woodpecker, which transforms whole tree trunks into insect traps baited with fermenting acorns. National birds of Guatemala and Belize, the colorful quetzal adorns Guatemala's currency, and the keel-billed toucan is a popular cage bird in Belize. Far more popular abroad are the region's parrots and macaws, whose numbers are threatened by Mexico's illegal export trade. Facing loss of habitat, other species may follow the course of the Atitlán grebe—a once rare species endemic to Guatemala's Lake Atitlán and now considered extinct.

ACORN WOODPECKER; JIM CLARE, OXFORD SCIENTIFIC FILMS

Smallest of the region's spotted cats, the margay is under the same pressure from illicit skin traders as its cousins, the jaguar and ocelot. Slow of gait and nearly blind, anteaters are common traffic victims along the region's roads.

CLASSIFICATIONS:

- NON-THREATENED
- THREATENED
- ENDANGERED
- EXTINCT

ACORN WOODPECKER STORAGE TREE; JIM CLARE, OXFORD SCIENTIFIC FILMS

ATITLÁN GIANT PIED-BILLED GREBE; DAVID ALLEN

HORNED SUNA; FERNANDO GONZÁLEZ/FULVIO ECCARDI

KEEL-BILLED TOUCAN; KEVIN SCHAFER

CASQUE-HEADED FROG; CAROLYN M. MILLER

RESPLENDENT QUETZAL; FULVIO ECCARDI

MARGAY; CAROL FARNETTI, OXFORD SCIENTIFIC FILMS

REDDISH EGRET (WHITE PHASE); KENNETH GARR

OCELLATED TURKEY; PATRICIO ROBLES GIL

KINKAJOU; PARTRIDGE FILMS, LTD./OXFORD SCIENTIFIC FILMS

• TAMANDUA ANTEATER; RICHARD FOSTER, OXFORD SCIENTIFIC FILMS

• BAIRD'S TAPIR; PATRICIO ROBLES GIL

• JAGUARUNDI; FULVIO ECCARDI

• FER-DE-LANCE EMBUSHING LIZARD; MICHAEL FOGDEN

• GOLDEN SILKY ANTEATER; PARTRIDGE FILMS, LTD./OXFORD SCIENTIFIC FILMS

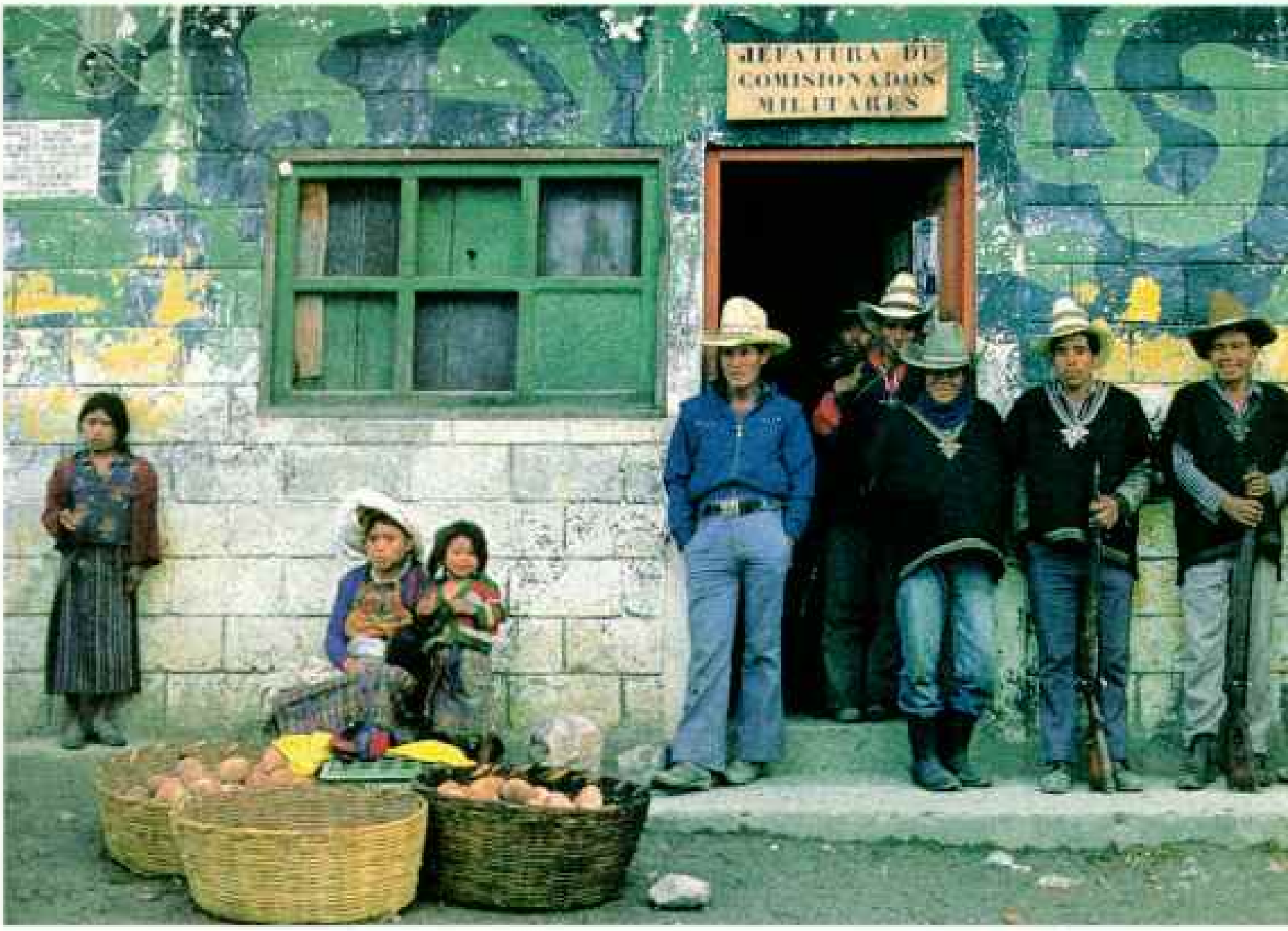
• RED-EARED SLIDER TURTLES; FRANÇOIS GOHIER

A rugged land yields its secrets

JUST GETTING TO CALAKMUL is like something out of an Indiana Jones movie. The ruins of this ancient Maya city lie overgrown by the dense rain forest of Campeche, Mexico, at the far end of a 30-mile dirt road that turns diabolical (right) every time it rains. But for anthropologist Willie Folan (below), getting there is worth the strain. During the past decade Folan and his "small army" of researchers—most of them Maya—have found some 6,750 structures at Calakmul.

Inside one tomb, Folan found a painted stucco peccary head (far left) and funerary pot adorned with a man wearing an owl, symbol of the underworld (left); in another, a jade mask depicting a seventh-century nobleman (above). From such clues Folan is creating a portrait of a city that dominated Maya life for a thousand years before fading in the ninth century. His theory for its demise: drought compounded by the destruction of rain forest for agriculture.

Turning his gaze to the future, Folan led the campaign to establish the Calakmul Biosphere Reserve—a cornerstone of the rain forest preservation envisioned by Ruta Maya planners.



Supplied by the Guatemalan Army with a few vintage carbines, the civil patrol of San Mateo Ixtatán, joined by villagers wielding machetes, recently drove out rebels who had attacked a federal road crew nearby. Caught in the cross fire of politics, the Indians have suffered at the hands of government and guerrilla alike. The Maya have taken up arms before. After Mexico began to suppress the Catholic Church in the 1830s, devout Maya in the Yucatán—already smarting from other grievances—rose up against ladino landowners in the War of the Castes. The two sides traded massacres (below) for a decade.

A BATTLE IN THE WAR OF THE CASTES, PAINTED ON CARDBOARD BY AN UNKNOWN ARTIST

(Continued from page 450) By A.D. 850 both Calakmul and El Mirador were dying. When the Spanish arrived, only 600 people were found in the area.

The late, renowned Maya scholar Sir Eric Thompson, once invited to a seminar on the cause of the Maya demise, is said to have responded: "No need for seminar. Peasant uprising." With no evidence the Maya ever used the wheel, the labor required to build the massive temple cities would have been justification enough for revolt—especially if all the effort wasn't pleasing the gods. Recent studies by Richard Adams at Río Azul to the east and by Willie at Calakmul show malnutrition in the waning years. Could it be that population pressures, then as now, damaged the environment? Did the people, frustrated, revolt against the leaders, or were they overrun by enemies from central Mexico? Projects such as Calakmul bring us ever closer to the answer.

The Maya prophet Chilam Balam predicted that men with beards would come from the east. And so they did—starting in 1517. The "conquest" began in Guatemala with ruthless slaughter by Pedro de Alvarado. Francisco de Montejo received permission from King Charles to conquer Yucatán at his own expense. It proved to be very expensive and never completely successful. The first two attempts in 1527 and 1530 failed. The third and successful invasion began at Can Pech—now Campeche—the oldest surviving European settlement in the Yucatán. The official surrender took place at Ichcansiho—now Mérida—in 1542. But Maya guerrillas have held out for 450 years or so, and there are still towns that outsiders should leave before dark.

Physically and emotionally remote from Mexico City, the Europeans of the Yucatán struggled for identity in the 19th century. In 1840 they declared themselves a sovereign nation. They even hired the Texas navy to protect them from Mexico. In 1848 a delegation went to Washington to ask President Polk for statehood.

Racism was a basic fact of life. Caste distinctions determined rank in society and business. At the top: the Spanish. Stepping down: the *criollos*—white but born in the New World; *mestizos*—part white, part Indian; *mulatos*—white and black; *pardos*—black and Indian. At the bottom, like the Hindu untouchables: the Indians.

Were it not for odds so enormous that raw courage alone would not suffice, the Maya might still be ruling the Yucatán Peninsula. In the Caste War, as brutal and unforgiving a conflict as the Americas have witnessed, the Maya rose up against the Europeans and the mixed castes from 1847 until 1855, with the massacre of entire towns by both sides.

Rejection of the Catholic Church by the new Mexican republic triggered the war. The Maya, long converted and now very devout, were angry. Filling the spiritual vacuum, José María Barrera and a Maya ventriloquist named Manuel Nahuat created a "talking cross." Like a Maya ayatollah, the "cross" gathered thousands of followers known as Cruzob to its cult. The word itself, like the Maya form of Roman Catholicism, was a hybrid: *cruz*, Spanish for cross; *ob*, the Maya plural suffix.

In time the Cruzob retreated to the Caribbean coast, capturing Bacalar in 1858. They requested and then refused a 4,000-peso ransom for the life of the citizens. James Blake,

a gunrunner from British Honduras just to the south, arrived with the ransom money in time to stand by helplessly as hundreds of men, women, and children were killed with machetes. The Cruzob ruled the area as the Empire of the Cross until overcome by the Mexican Army in 1901.

JUST TO THE SOUTH the nation of Belize remains something of a secret and a good source of geographic trivia questions. Until independence eight years ago, it was British Honduras. No one even

Weaving Maya designs into the modern world, a woman in Totonicapán produces textiles on contract for a merchant in Guatemala City. Writes Mayanist Walter Morris: "Weaving has preserved the design of the Mayan universe."

knows for sure what Belize means. Some suggest it's a corruption of the name of the pirate Wallis. Less romantically, it may derive from the Maya words *belix*, meaning "muddy river," or *be likin*, "road to the east." Many Belize place-names are not so much mysterious as whimsical: Pulltrouser Swamp, Orange Walk, More Tomorrow, Double Head Cabbage.

Belize is the only English-speaking nation in the region—but just barely. Some 50 percent of the 170,000 people speak English as a first language, 30 percent Spanish, the remainder Caribbean Garifuna, Mennonite German, and several dialects of Maya.

Belize City's clapboard and corrugated-steel architectural style gives it a tentative, charmingly backward look. The loggers who settled the port in 1638 built on unprotected oceanfront that averages a mere 18 inches above high tide, making sewers difficult and hurricanes impossible to deal with. After the city was leveled by Hurricane Hattie in 1961, a new capital was built at Belmopan, 40 miles from the ocean. But Belmopan (population 3,500) hasn't caught on. Embassies still favor Belize City, and government workers commute or come home on weekends.

One Belizean told me, "We're poor but honest." Never a dictatorship, Belize lives properly under British law, enjoys a healthy trade balance, shows concern for its unspoiled wilderness, and optimistically feels that it's on the threshold of major economic growth.

Mostly out of habit British troops remain to protect Belize from Guatemala. That nation's maps have long included all of Belize, though its claims today are far more modest. As discussions seek to settle the problem, the borders of Belize remain so open that tourists, even driving rental cars, pass easily.

But half of Belize's tourists can't get where they're going by car and don't need one when they get there. Ambergris Cay, their destination, was a peninsula attached to what is now Mexico until the Maya built a canal a thousand years ago to avoid the coral reef that touches shore there. The canal cut Mexico out of a valuable piece of land. As an island, Ambergris Cay eventually became part of British Honduras.

Most visitors arrive at its only town—San Pedro—by plane from Belize City. I flew in with Barry Bowen, a seventh-generation Belizean businessman who commutes daily to his office in Belize City. Barry parked the plane, removed his shoes and socks, and, briefcase in hand, walked 200 feet across the sand to his beachfront home. "Never need shoes out here," he explained.

THE SAME JAMES BLAKE who tried to ransom the citizens of Bacalar paid $625 for Ambergris Cay in 1869. Today the island's reputation as an inexpensive hideaway is in danger. Three nights in an oceanfront suite at the Ramon Reef Resort costs more than Blake paid for the entire island.

With less trouble and time than it takes to commute from my Virginia home to my office in Washington, D. C., Barry flew us—complete with shoes—to his property in the forests of western Belize at Gallon Jug, named by loggers about 1920 in honor of a ceramic jug they found. Barry knows Belize from the air like a suburbanite knows his lawn. We saw marijuana fields tucked into tiny clearings in the forest in the hope of avoiding a dose of herbicide from antidrug spray planes. In a swamp we spotted a pair of jabiru storks—one of the largest flying birds in the world, with a wingspan of nearly eight feet. Barry pointed out ancient Maya raised fields, roads, canals, and ruins hidden under the trees.

"Wherever you see a stand of cohune palm trees, you can be sure there's a site." Oil from the palm nuts was one of some 175 forest products collected, hunted, or cultivated in the rain forest by the Maya.

We landed and drove to the Maya site of Las Milpas. Here we found the scars of recent looting. Arnold Brown, director of the Programme for Belize, a Belizean-American conservation group, showed us some 40 looters' trenches gouged into suspected burial mounds. A survey by archaeologist Anabel Ford determined that the site includes at least 18 plazas with 60 major structures.

Harriot Topsey, Belize's Commissioner of Archaeology, had told me earlier that at Caracol, the country's largest known Maya site, looters left a note for the caretaker warning him: "Stay away. Local archaeologists at work." It isn't easy to convince residents that artifacts, which find a ready market at high prices, aren't theirs to mine.

Not all looters are local. In Guatemala City I met one I shall call Jorge, who agreed to talk about his work. A simple man who felt no guilt, he said a prayer before we ate.

"We were taken to the sites by helicopter," Jorge said, "never fewer than 35 of us, sometimes 80. We brought flour and beans and shot game for meat. Sometimes we stayed for ten months. I worked for five years in Belize."

Jorge began looting in 1957. His employer, a well-known Guatemala businessman, paid the workers 50 quetzals ($50) a day. "That was like 500 now." They worked a little at

High heels and jeans may be gaining popularity in the highlands of Guatemala, but they pale beside the ancient patterns of Maya clothing. Village-bound women usually dress more traditionally than men.

Las Milpas but spent six years looting nearby Río Azul in Guatemala. "When we started, it was untouched. We found beautiful things—ceramic, jade—and many bodies. There are many sites in the jungle—not even a fourth have been found."

When Richard Adams arrived in 1983 to begin archaeological excavations at Río Azul, he found 31 tombs had been sacked.

Since such large-scale looting—like illegal logging—requires isolation, both will be impossible in the Programme for Belize lands. Brown's group, sponsored by the Massachusetts Audubon Society and the

Bird-watcher's paradise, the rain forests of Belize shelter hundreds of species, including many that spend part of their year in the United States. Ornithologist Bruce Miller (below), supported by the New York Zoological Society, is taking inventory in the Programme for Belize's Rio Bravo Conservation Area.

At Chan Chich, a Maya site in the rain forest, Belizean landowner Barry Bowen built simple cabanas amid the ruins (right) to accommodate birders and other "eco-tourists" while protecting the site from looters.

Nature Conservancy, is creating the Rio Bravo Conservation Area in a former British mahogany estate on the Guatemala border.

"We're planning sustained-yield projects and tourist attractions to protect the natural resource base and keep archaeological sites intact," Brown told me. "We are buying 110,000 acres of Barry Bowen's land. Coca-Cola Foods gave us another 42,000."

Barry agreed to place his remaining 130,000 acres under the same conservation restrictions as at Rio Bravo—which could soon become the third piece, along with the Calakmul and Maya Biosphere Reserves, in a tri-national Maya Peace Park.

At Chan Chich, a small Maya site in Belize, Barry has built a resort to serve bird-watchers—or birders, as they prefer—and those just needing a peaceful retreat in the rain forest. To the dismay of many Maya buffs, it fills the courtyard of the site itself.

"At least nobody will be looting here again," Barry said. "The site was being destroyed by trespassers while they waited for their marijuana to ripen." And no additional area had to be cleared. The thatch-roofed cabins of local wood were built with little damage to the site. The birders who've been there aren't complaining. The first group identified 199 different species in less than a week. Resident ornithologist Bruce Miller has recorded 260 species and netted and tagged 50—possibly including a subspecies of robin never reported before.

Ornithologists say that of the 500 species of birds in the Yucatán Peninsula, more than a third fly north to nest—the catbird, indigo bunting, redstart, wood thrush. Tragically,

the populations of many such songbirds are declining rapidly, according to a recent survey by the U. S. Fish and Wildlife Service. The probable culprit: tropical deforestation.

THE HOUR-AND-A-HALF DRIVE from the Belize border to the Maya site of Tikal took us through Guatemala's forested Petén region past a scattering of frontier settlements, dusted the color of the gravel road to which they cling like beads on a necklace. Forest still reaches away to the horizon on both sides, but with colonization as high as 250 people a day, short of a miracle it will soon give way to corn and beans. A tragedy, especially since sustainable, nondestructive uses of the forest would provide more income in the long run for these needy people than farming.

A recent study by environmental researchers Robert Heinzman and Conrad Reining shows that leaves of the *xate* palm, harvested from these tropical forests as greenery for floral arrangements, alone brought Guatemala two million dollars in foreign exchange in 1987—not bad considering local wages average only two dollars a day.

But to the new settlers, accustomed to field crops, forests stand in the way of development. In Guatemala as in many other

countries the homesteader mentality survives. Rewards exist for clearing forests—none for preserving them. Yet after three years of cultivation there occurs a two-thirds drop in corn production, and settlers have to burn and clear new forests. Doing so would be similar to the new president of a company tearing down and selling its prosperous factories for scrap, taking a tax loss, leaving with the money, and moving to another company to repeat the cycle.

In these tropical lowlands the Maya built an agrarian civilization that eventually supported one of the highest population densities in the pre-industrial Americas—at least 20 times that of today. Twelve hundred years ago this area was still densely populated. At its center stood Tikal, a prosperous city-state.

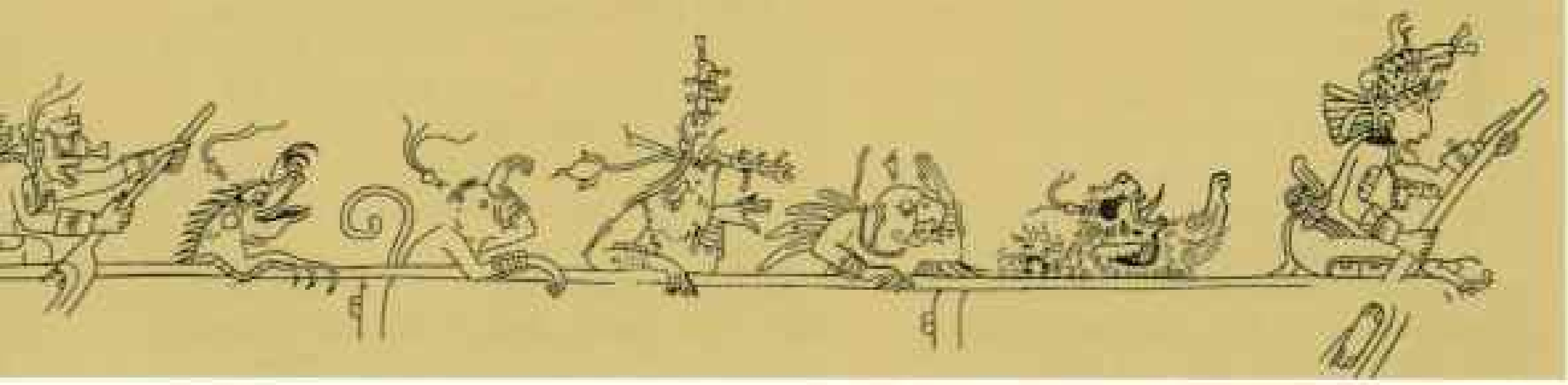
AS OLYMPIC ATHLETES measure performance against the record books, historians compare other lowland Maya sites with the Petén's Tikal. It had the largest ceremonial center, the tallest collection of pyramid-temples, the largest city area—50 square miles—and a population estimated at 55,000. In sophistication it rivaled any world capital of the time and held perhaps the greatest collection of artists, artisans, and architects ever assembled in the Maya world. It was the hub of a "Ruta Maya" the rival of today's, linking a trade area that stretched from Caribbean Sea to Pacific Ocean.

Until recently much of what we knew of pre-Columbian life in the Petén area came from mute stones, pots, and tomb treasure. Then Geographic archaeologist George Stuart came upon four faded sheets of paper in a private library. They were, it developed, folios five to eight of a 17th-century Spanish manuscript. When photographed with ultraviolet light, an amazing 300-year-old eyewitness report materialized on the film, like a friendly ghost, to tell wonderful things about the past—including a visit to Lord Can Ek, ruler of Tayasal and the last Maya king.

Tayasal, now the site of Flores, Guatemala, arose 25 miles from the ruins of Tikal. Centered on a round island half a mile across in Lago Petén Itzá, its quiet charm belies a

DAVID ALAN HARVEY (ABOVE); THE UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA, TIKAL PROJECT (BELOW)

DEATH VOYAGE OF A MAYA KING is depicted on a bone (above) that archaeologists found in the tomb of Double Comb, who ruled Tikal during the eighth century. As shown in the drawing below, Double Comb, center, is being taken to the underworld in a canoe guided by the "paddler twins," gods who appear prominently in Maya mythology. Other figures—an iguana, a monkey, a parrot, and a dog—accompany the dead ruler. Like him, they hold wrist to forehead in a traditional Maya death gesture. A second carving shows the canoe slipping beneath the waves—signifying death for Double Comb.



bloodsoaked history. The Itzá, driven from Chichén Itzá in the late 12th century by Maya rivals, escaped to Tayasal. Later joined by Maya fleeing the Spanish, they continued the practice of human sacrifice—the fate of many of the Spaniards unfortunate enough to reach there.

Grant D. Jones of Davidson College in North Carolina, the anthropologist who translated the four sheets, believes the writing is that of a Maya lay brother educated in a Franciscan monastery. The brother survived a visit to Tayasal in 1695 in the company of two Spanish priests and wrote with some awe and without the disdain usually reflected in the reports of Spanish priests:

> *There came from the direction of the rising sun a great wedge of canoes, all of them adorned with many flowers and playing much music with sticks and with drums and with wooden flutes. Seated in one larger than all was the king of the Itzás, who is Lord Can Ek, which means 'the star 20 serpent.'*
>
> *King Can Ek's golden head was very well adorned with a large crown of pure gold . . . and he wore his ears covered with gold disks. The disks have hangings that shake and fall over the shoulders like tatters. . . . They put down a long mat that he could walk on it. . . . And all the Maya soldiers who got out of the canoes came and positioned themselves along its edge.*

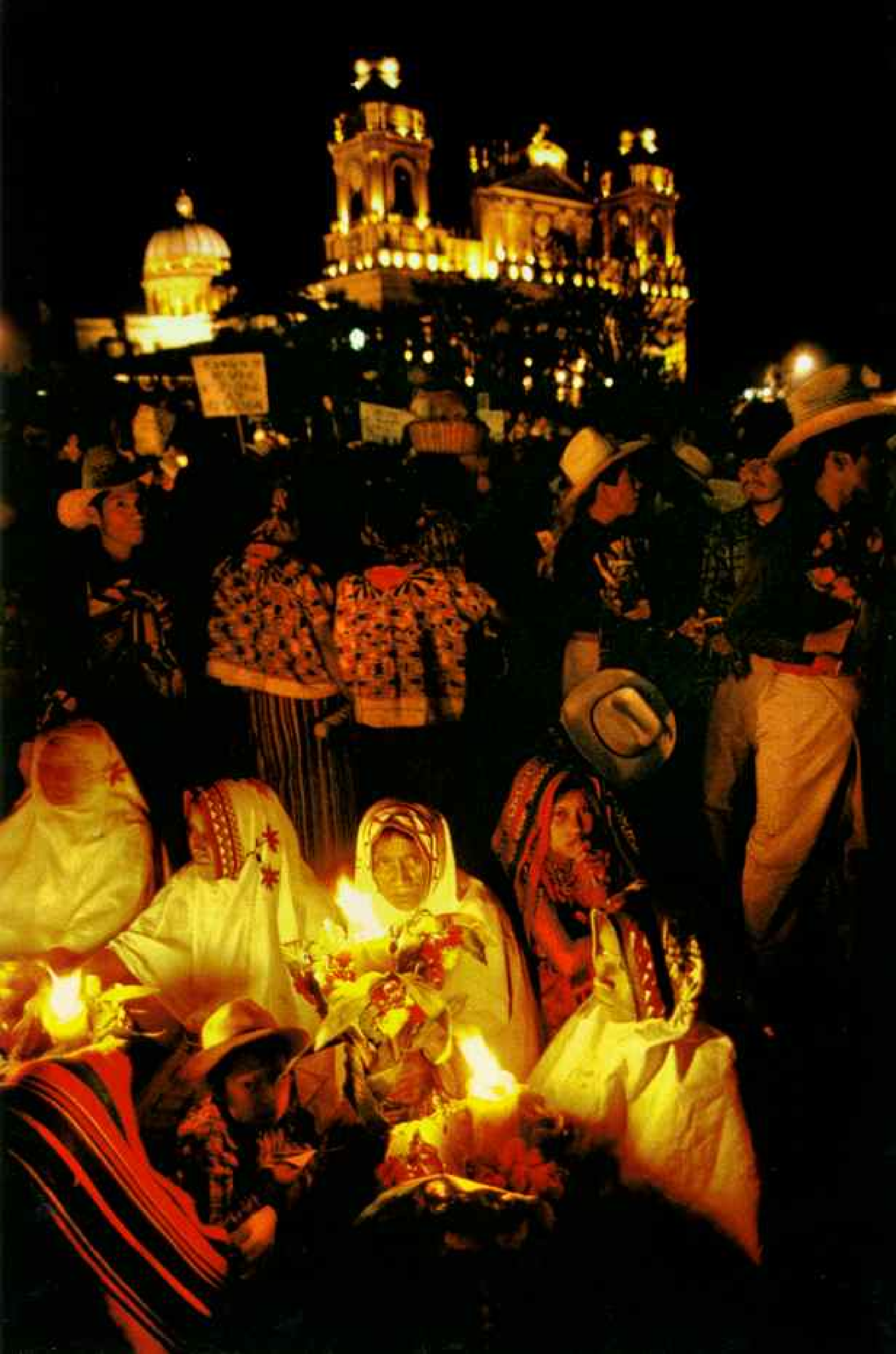
Can Ek sized up the visitors waiting on shore and agreed they could visit his island fortress. The Indians accompanying the three Franciscans were terrified. The last such group to reach Tayasal—one priest and 90 Indians—had all been killed at the hour of the Mass. This time 70 persons, mostly children, took the sacrament, and the lay brother survived to leave us his account.

When Cortés had passed Tayasal en route to Nito more than a century and a half earlier, he had left behind an injured horse. Upon its death, a stone effigy of the horse was carved and worshiped as the god Tzimin-Chac. Cortés had received a friendly welcome—perhaps because his force was so large. Later visitors were often less fortunate. A Spanish priest, reportedly angered at the sight of the graven image, smashed it. He escaped as the Maya stoned his canoe. In 1696, a year after the anonymous Franciscan lay brother and his group left, the golden Can Ek removed the hearts of two Dominican friars who came to convert him.

Aided by its remote jungle location and having nothing the Spanish wanted, Tayasal remained the last unconquered holdout in the Maya realm. In March 1697 it fell. Most of the survivors swam ashore and disappeared into the forest. The Spanish baptized Can Ek as Don José Pablo Canek. In 1699 the main Spanish force left, taking Can Ek with them. Tayasal became a backwater; only recently did it—as Flores—grow, to become the largest city in northern Guatemala.

As for Tikal, which had been largely abandoned by A.D. 900, its overgrown ruins were rediscovered in 1848, but a century more passed before University of Pennsylvania archaeologists excavated and reconstructed its majestic heart.

Columbus met Maya boatmen in larger seagoing versions of this cayuco, carved by a boatbuilder along Guatemala's Río Dulce. Maya trade routes stretched as far as Panama.



ON APRIL 15, 1988, Guatemala's capital rocked to perhaps the largest gathering of Maya since Tayasal fell. President Vinicio Cerezo invited leaders of the *cofradías*—lay religious organizations in Maya communities—and their wives to visit him to discuss their problems. For two days more than a hundred buses from all over Guatemala descended on the capital loaded with 5,000 Maya in their finest regional costumes. Maya dancers and 25,000 dollars' worth of fireworks filled the plaza with excitement for hours as the guests filed through the palace. The next day's newspapers, owned by conservative interests, ignored the event. "A cheap trick to get votes," one critic said.

The Maya I spoke with felt otherwise. Juan, a young teacher who had traveled for 24 hours by foot and bus to get here, told me, "We came to the capital because we want the people here to understand our culture."

Most Maya began returning home that night in aged yellow buses that had been U. S. school buses, many still labeled with their original Indiana or Ohio school districts. They huffed and smoked off into the Maya highlands as virtual time machines, leaving behind the urban world and dropping their passengers into villages little changed in hundreds of years.

In the weeks that followed, I visited many of them. Everywhere, I found Maya determined to preserve their culture and regain control of their own destiny. At Sumpango, in the highlands 30 miles west of Guatemala City, Mayor Juan Ixtamazic told me the men had formed the Tikal Club to "rescue old traditions." On the first of November I watched as they launched half a dozen elaborately decorated kites that weighed an average of a hundred pounds apiece. The ceremony, used by Maya to communicate with their ancestors, was revived in 1978.

The mayor introduced me to four villagers who recently visited Nashville, Tennessee, to discuss marketing their town's produce. "Our cooperative harvests and ships to the U. S., Japan, and Europe," he said. "We grow four crops a year: beans, radicchio, squash, and snow peas."

In Belize, Primitivo Coq heads the Toledo Maya Cultural Council, dedicated to preserving Maya culture and benefiting Maya people. "With the help of the University of Albany we're training our people to run hotels and restaurants and to act as guides."

To honor the Maya, Guatemalan President Vinicio Cerezo (below, at right) sponsored a meeting of his country's cofradías, organizations that preserve Maya social and religious traditions. Cofradía members from nearly every Maya village—some 5,000 people—gathered for a festival in Guatemala City's central plaza (facing page). "Today we begin to feel part of the same nation," Cerezo told the Maya, who historically hold little economic or political power. "God did not say ladinos and Indians were different." A prime mover behind La Ruta Maya, Cerezo is the first Guatemalan president to meet with Maya leaders.

WILBUR E. GARRETT (ABOVE); PAUL DAVID ALAN HERSEY

The village of San Juan Chamula in Mexico charges tourists to take pictures during Easter ceremonies. But photography is not permitted in the church or during processions. Maya with sticks—and eager to use them—enforce the rules.

In nearby San Andrés I was arrested, along with five companions—the only outsiders in town on Easter morning—for disturbing the peace by photographing in the market. We were given the choice of jail or paying a 100,000-peso fine. I favored not paying, since we had done nothing wrong.

Walter "Chip" Morris, one of our group who had lived there while studying the local textiles, had seen the jail. "Pay the fine," he warned. "You won't like the jail." The fine was not much more for the six of us than

the fee at Chamula—just collected with more drama.

The *regidores,* or town captains, who arrested us shared their rum and said, "ten years ago we threw all the Mexicans out of town, so it is now all Maya."

ONE OF THE JEWELS of the Maya highlands of Guatemala has always been Lake Atitlán. As long as there have been Maya, they have fished here and washed their clothes and their bodies in its clear water. Ecologist Anne LaBastille returned this year to update a study she started in 1960.

"It's so sad," she said. "In 29 years there's been a 1,600 percent increase in vacation homes on the lake and more tour boats and hotels—all dumping sewage into the lake. There's been an 80 percent loss of wildlife habitat. Most depressing is the silence—no birds singing." Among the missing: the giant pied-billed grebe. Once found only on Atitlán, it is now extinct.

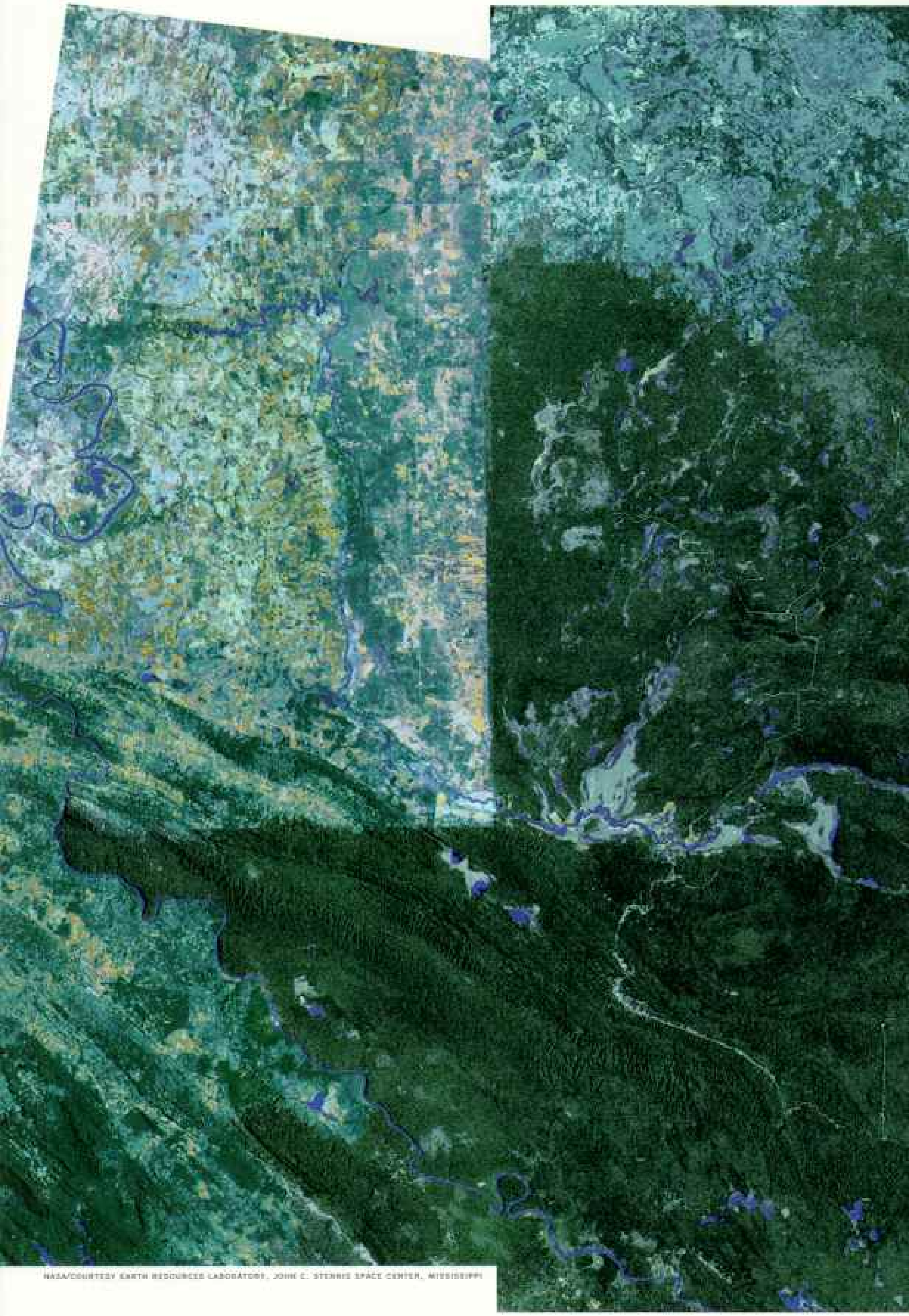
Every year thousands of species become extinct, but, like the victims of car wrecks in

Curves of the original Pan American Highway whisk past hills quilted with wheat, sown by the Maya in rich volcanic soils near Quezaltenango. To the east, giant kites soar above Sumpango, where the Maya custom—a way of sending messages to ancestors—has been revived during Day of the Dead festivities.

newspaper accounts, unless you know them, they are only statistics. I could understand now why the quiet of Atitlán I had found so relaxing was for Anne so depressing.

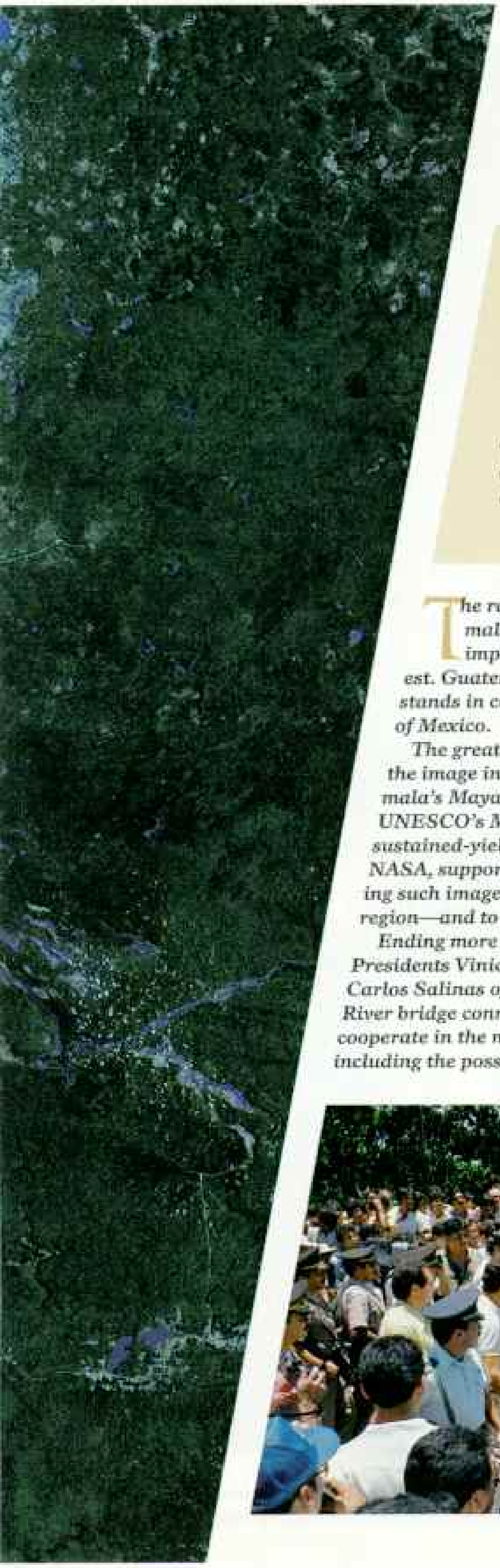
A similar lesson came as I was riding through the Mexican states of Chiapas and Campeche with architect and environmentalist Héctor Ceballos-Lascuráin. Avid birders like Héctor see a different world. I saw approaching trucks, narrow shoulders, and steep drops off curving mountain roads. Héctor, his eyes skyward, saw motmots and chachalacas. I was impressed with what he saw, but it's what he didn't see that bothered both of us. When Héctor first came here 30 years ago as a boy, fields we were passing had been forests filled with birds—the great curassow, scarlet macaw, even the rare and spectacular harpy eagle.

In Belize, a devout birder had said that if that nearly extinct eagle, largest in the world, survives in Belize, the whole country should be made into a park. After months of traveling La Ruta Maya, I now know that the whole region should conform to the UNESCO biosphere reserve rules—selected



NASA/COURTESY EARTH RESOURCES LABORATORY, JOHN C. STENNIS SPACE CENTER, MISSISSIPPI

Protecting the heart of Maya land



The razor-sharp border between Mexico and Guatemala, as seen in Landsat imagery (left), shows the impact of high rural population upon the rain forest. Guatemala's sparsely populated Petén district stands in contrast to the stripped and tilled landscape of Mexico.

The great swath of forest in the upper three-fourths of the image includes parts of Mexico's Calakmul and Guatemala's Maya Biosphere Reserves—both proposed for UNESCO's Man and the Biosphere program, which allows sustained-yield lumbering and agriculture. Tom Sever of NASA, supported in part by National Geographic, is creating such images for environmental land-use planning in the region—and to assist in detecting still hidden Maya ruins.

Ending more than 150 years of tension along their border, Presidents Vinicio Cerezo of Guatemala (below, at left) and Carlos Salinas of Mexico embraced in August on a Suchiate River bridge connecting the two countries. They agreed to cooperate in the management of lands along the border—including the possibility of joint national parks.

A free-for-all on horseback marks the celebration of All Saints' Day in the Guatemalan village of Todos Santos. Local daredevils pay about 40 cents to rent

JESÚS LÓPEZ

a horse for a gallop through town. "The winner," said photographer Jesús López, "is anyone who lives through it."

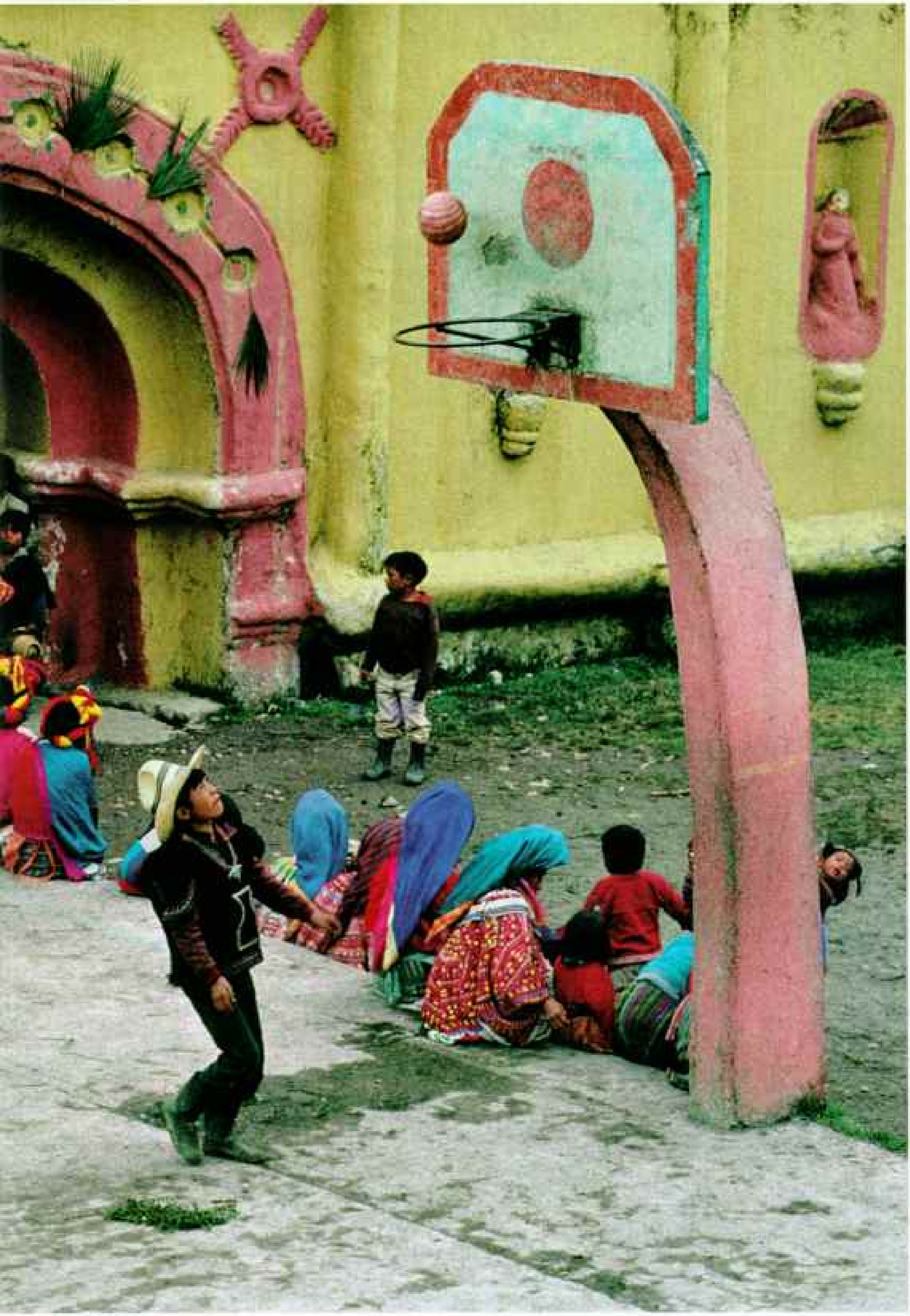
The soul of the Maya finds expression in all they touch, even things borrowed from other cultures. In San Mateo Ixtatán, a basketball backboard and Catholic icons are colored by a distinctively Maya hand. By promoting limited cultural interaction, La Ruta Maya aims to ease the burdens of poverty and isolation while keeping the true Maya colors from fading away.

areas preserved intact and the rest managed on a sustainable basis. Generations to come shouldn't have to visit museums and zoos to learn about this amazing Maya world that residents and visitors alike now take for granted.

ON AUGUST 17 Mexico and Guatemala made a bold move in that direction, when ministers of both governments met in Tapachula, Mexico, to finalize agreements that included working together to protect their shared heritage. The next day the two nations symbolically embraced—ending more than 150 years of border tension—when the two presidents met and literally embraced in the middle of the bridge over the Suchiate River that defines their southernmost border.

Guatemalan President Vinicio Cerezo then escorted President Carlos Salinas of Mexico to La Virgen Ranch in Guatemala, where they signed the agreements. In a meeting with them at that time, I was told by President Salinas that, unlike the river border we had just crossed, in the tropical forests of the Calakmul Biosphere Reserve that he had recently established on Guatemala's northern border "you see no border because the forest is the same on both sides." Both men smiled when I noted that under the Maya there had been no political border. Both concurred that with these bilateral agreements the process had begun that would lead to coordinated management of this and other shared border areas and perhaps the establishment of joint national parks.

Stopping the destruction of their cultural and environmental wealth, with population pressures growing rapidly, may be akin to braking a runaway train on a mountain slope. But with such international cooperation, you can feel the brakes beginning to take hold. □



A Royal Maya

ARCHAEOLOGICAL FIELD WORKERS, CLOCKWISE FROM CENTER: JOSÉ ALBERTO VELIZ (WITH POLE), RAMÓN GUERRA, RICARDO AGUILA PASQUELLE, BARBARA FASH

COPÁN

Tomb Discovered

By RICARDO AGURCIA FASQUELLE
COPÁN ACROPOLIS ARCHAEOLOGICAL PROJECT AND HONDURAN INSTITUTE OF ANTHROPOLOGY AND HISTORY

and WILLIAM L. FASH, JR.
COPÁN ACROPOLIS ARCHAEOLOGICAL PROJECT AND NORTHERN ILLINOIS UNIVERSITY

Photographs by KENNETH GARRETT

IN AN ACCIDENT of sorts, we discovered the first royal tomb—complete with mysterious remains and rare artifacts—in a century of exploration at the ancient Maya city of Copán in Honduras.

We had met at Copán as skeptical graduate students in 1978, a Honduran and an American with the same idea—to join a team whose focus was not on Maya royalty but on the commoners of 1,200 years ago.

So up the hills, down the valley we went, digging test pits, uncovering trash piles, mapping and excavating house sites. We learned what the ordinary Maya ate—corn, beans, squash, iguana, rabbit, deer—and looked at their skeletons to discover their heights and weights, what diseases they had, how they died.

At the same time specialists in deciphering Maya writing were making breakthroughs. Others advanced in symbology of art, ceramics, bone pathology, botanical and ecological analyses.

Our own lives and careers diverged—some of our graduate-student cockiness being chipped off along the way. We joined forces at Copán again this year as project directors.

Support from the Honduran government has been steady.

Copán was designated a world heritage site by UNESCO in 1980 and a national monument two years later. Scholars of goodwill from many countries have shared their data, insights, and techniques.

This past June 4, the day we first looked into the tomb (left), our find was as puzzling as a vase within that showed a noble under a rim of undeciphered glyphs (above).

Digging into perplexity

A RESEARCH PROJECT SUPPORTED IN PART BY YOUR SOCIETY

A MAIN TASK in recent years has been to free from muck and mire fragments of sculpture fallen from Copán's 12 principal structures. Because the pieces were jumbled together, we have been sorting them and, with the help of project artist Barbara Fash, assigning each to its proper place.

A second task has been to work on the Hieroglyphic Stairway on Structure 26, beyond the smaller edifice of the Ball Court (right). Huge glyph-covered blocks that made the stairway's risers had also fallen in a disorganized jigstone puzzle. We wanted to reassemble the stairway and see what lay beneath.

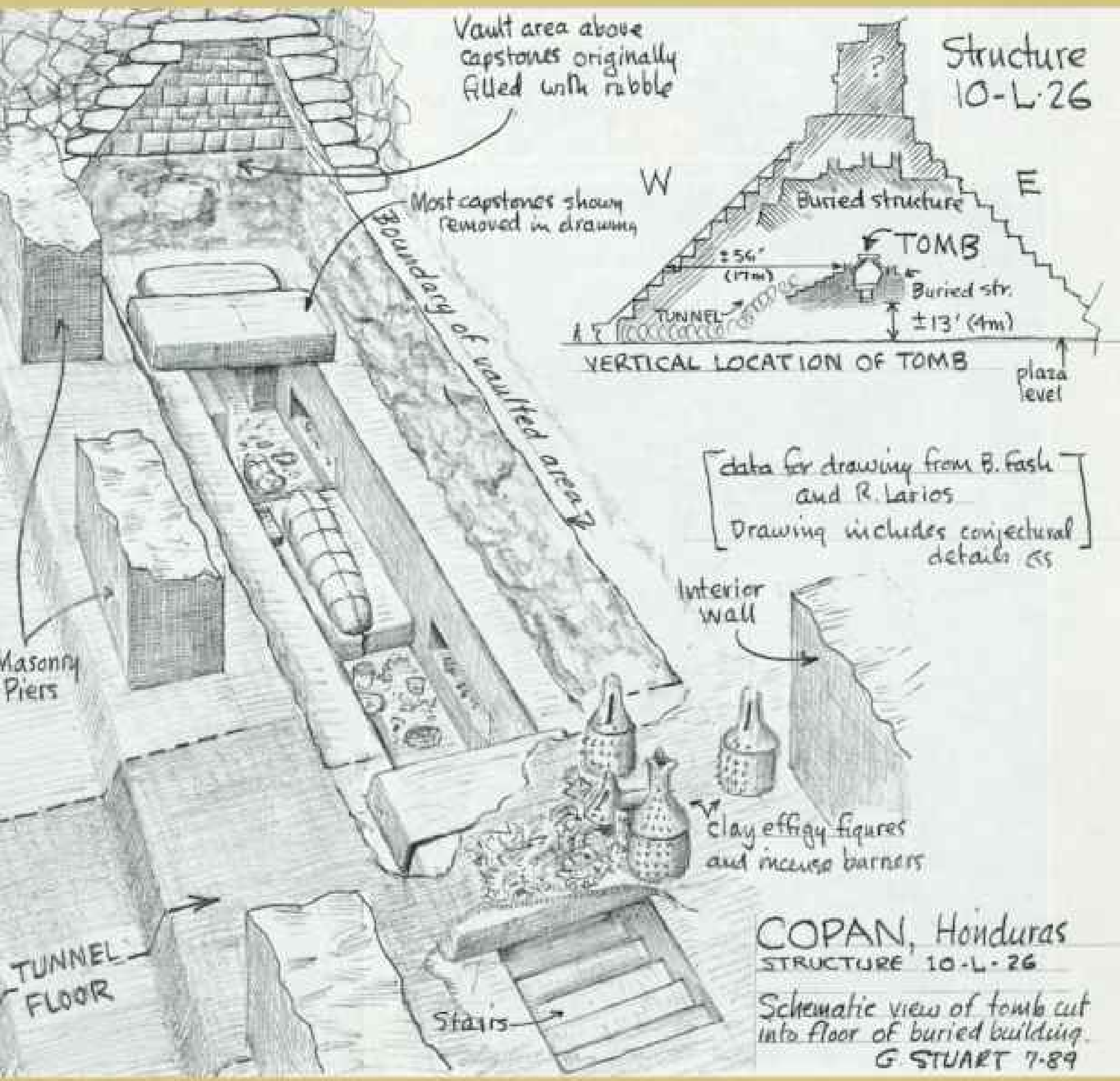
Large Maya structures are often the outermost of a nest of smaller ones. One would be built, partly destroyed, and a new one built atop it—then another and another. So we were looking not for burial places but for details of the interior of Structure 26 when we came upon the royal tomb.

Our colleague and student Richard Williamson oversaw the tunneling. He was following a stairway deep within the outer structure and came upon a column, a ceramic offering, and a vaulted chamber filled

with rubble (drawing below).

After much hard work clearing the fill, we exposed the first capstone and pushed it back. The huge space beneath was the tomb of someone of great significance—but who?

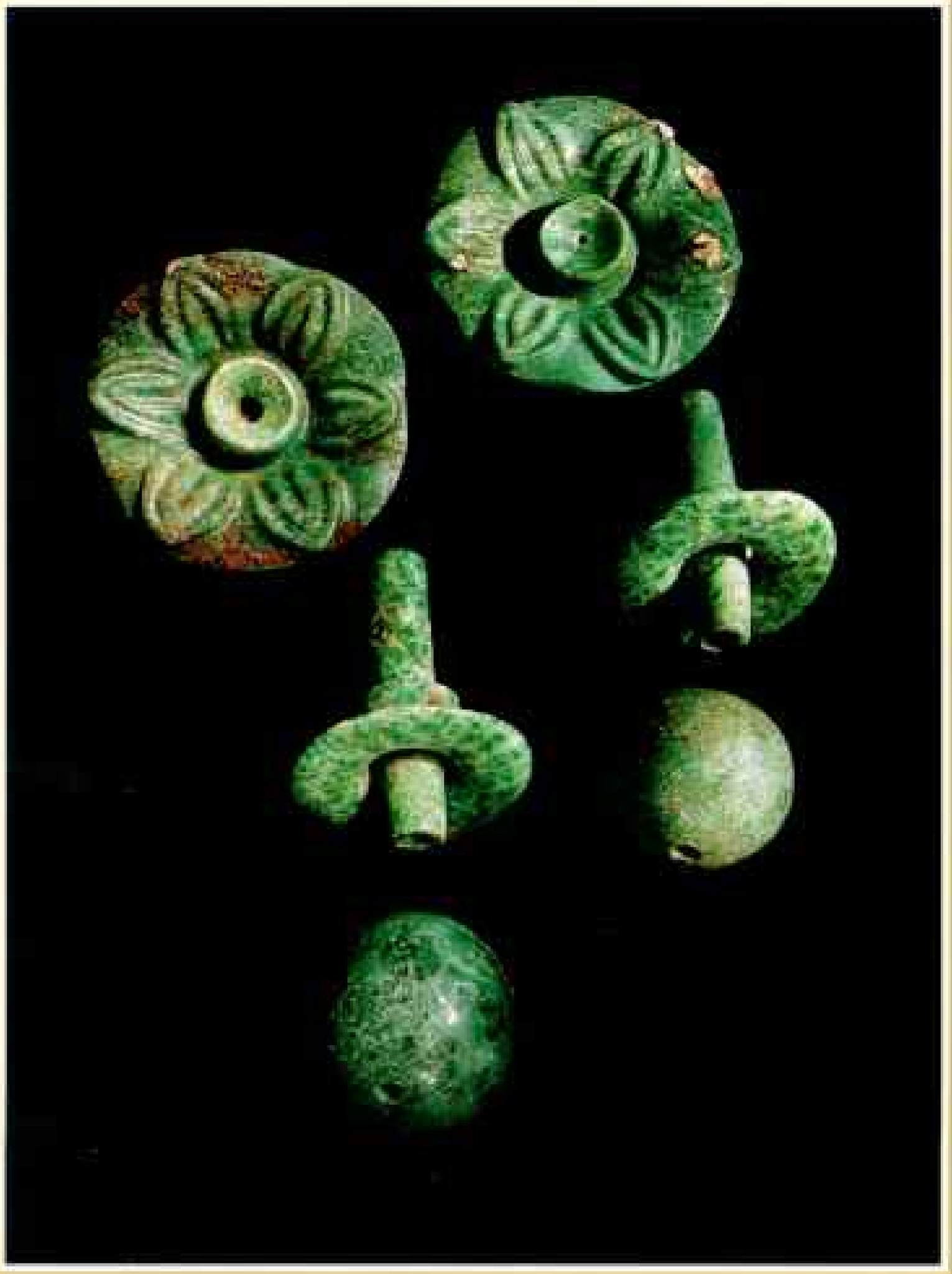
What we could see (below left) was red plaster, scattered pottery vessels, some bones and bone fragments, remnants of a bark-paper book, or codex, and a far wall with no plaster—a wall built to seal the tomb.



COPAN, Honduras
STRUCTURE 10-L-26

Schematic view of tomb cut into floor of buried building.
G STUART 7-89

The search for evidence



FIRST THOUGHT: Anything this grand must be the tomb of a king—but there was no direct evidence of it. We went on looking for the smallest clues, as Bill Fash does at left. One came from bone specialist Rebecca Storey. Her analysis of skeletal fragments showed that the person buried was likely a man of 35 to 40 years.

That meant the remains could not be those of the only kings of the era—Smoke Imix, who lived into his 80s, or 18 Rabbit, who died in his 60s (see article that follows). Remnants of bones from the tomb bore no signs of arthritis or even of hard wear. Whoever we had found had lived the comfortable life of a noble. That conclusion and the tomb's location behind the Hieroglyphic Stairway led us to believe that here lay a brother or son of Smoke Imix.

The remains of a boy found in the tomb were another indicator of high status. His teeth showed evidence of arrested growth, a mark of the commoners we had studied years before. This boy had probably been sacrificed to accompany the nobleman into the next world.

Also going to that world was Copán's largest assemblage of fine jade: ear ornaments (below left) and pieces of a jade necklace depicting noble figures and an owl, symbol of the underworld. As with all else, the jades will remain in Honduras.

Final clues

FOREMAN of our 110 superb workers, Ramón Guerra cleans a cache of splendid pottery left outside the tomb as an offering. But it was the utilitarian pottery inside the tomb (right) that gave us our final clues.

The smaller pot in the foreground is filled with pigment, mark of a painter's trade. The larger, chipped bowl shows a man wearing a headdress (opposite) decorated with the visage of the patron god of scribes; the god's mouth holds two brushes. The younger sons of Maya kings were often trained as scribes. They not only painted and kept historical records but also arranged state ceremonies.

A critical piece of the puzzle had fallen into place. Everything points to the noble as a royal scribe and son of Copán's greatest king, Smoke Imix. □

City of Kings and

COPÁN

By GEORGE E. STUART
NATIONAL GEOGRAPHIC STAFF ARCHAEOLOGIST

Photographs by
KENNETH GARRETT

ON OR ABOUT OCTOBER 14, A.D. 652, Lord Smoke Imix, the Sun King, 12th in the royal succession, ordered that four carved stone monuments be placed at widely separated points on the upper slopes of the Copán Valley in what is now western Honduras. His reason for this action is unknown. Some experts believe that the stelae marked astronomical alignments; others, that Smoke Imix wished to reinforce his ancestral identity with the sacred mountains surrounding his capital; and still others, that they simply helped to define the king's domain.

One—labeled Stela 12 in the catalog of the monuments of ancient Copán—stands solitary on the heights about two miles east of the modern town. Whenever I am there, I make the trek to that windblown summit, for I know of no other place in the realm of the Maya where one can behold in a single sweep the loveliest of landscapes and so many tangible reminders of the 3,000 years of human culture that have played out upon it.

Here, inscribed in stone, is the most complete chronology of a Maya royal house. And here, as nowhere else, continuing work in deciphering the hieroglyphs and artistic symbolism of the Maya has been matched by that

Battered by the ages, a stone portrait of the Maya ruler known as 18 Rabbit shelters the nest of a great kiskadee, a flycatcher. The eighth-century reign of this powerful lord saw the metropolis of Copán in its full flowering.

Commoners

seeking to unveil the finer points of their society and its everyday life.

If you stand by Stela 12 and know just where to look, you will spot Stela 10 across the widest part of the valley, about level with the eye. Like a tiny grain of rice on end, it appears all but lost amid the fields and foliage. Lower, near the river, red-tile roofs and white stucco define the living town of Copán Ruinas.

The clump of dark forest on the near side of town shrouds the most extraordinary feature of the whole valley—the soaring Acropolis of ancient Copán, a royal city of the Classic Maya (A.D. 250 to 900), whose ornate buildings and sculptures, even in ruin, make it one of the greatest treasuries of art and architecture in all the Americas.

Archaeologists refer to the Acropolis and the platforms, pyramids, stairways, and plazas that adjoin it as the Main Group of Copán. The Main Group also holds what art historian Linda Schele calls "a forest of kings"—stone figures, larger than life, of Copán's greatest rulers, portraits sculptured almost in the full round and so laden with the symbols of ancient power politics and the complex ideology behind it that, even to the layperson, Copán's art seems unique.

It was the famed American traveler John Lloyd Stephens and his companion, English artist-architect Frederick Catherwood, who brought the first widely popular notice of Copán—and the first accurate drawings of its intricately carved monuments—to the outside world. The pair came across the ruin in deep forest in the rainy winter of 1839:

"It lay before us like a shattered bark in the midst of the ocean, her masts gone, her name effaced, her crew perished, and none to

The spectacle of the ball game packed thousands into Copán's ceremonial center. More than a sport, it was a metaphor for contesting mythical beings and concepts. Yax Pac, who ruled from A.D. 763 to 820, watches with his family (below) from a temple terrace now in ruins. The buildings and monuments around him proclaim his power and divine lineage.

PAINTING BY H. TOM HALL

tell whence she came, to whom she belonged . . . or what caused her destruction."

Since 1885, when Englishman Alfred P. Maudslay began to document and excavate Copán in earnest, four generations of scientists have sought to answer the questions posed by Stephens.

BY THE LATE 1940s archaeologists from Harvard University and the Carnegie Institution of Washington, D. C., in association with the Honduran government, had excavated and restored some buildings, while others had deciphered dates on the monuments. The half century of effort at Copán was paced by investigations at other sites ranging from northern Yucatán to the Pacific coast and from the Chiapas jungle to the Caribbean. The Maya image was that of a peaceful stargazing people obsessed with the grandeur of time; a society of farmers ruled by astronomer-priests; a people without written history, largely untouched by trouble. In other words the Maya were like no other civilization on earth.

The picture began to change dramatically about 1960. Carnegie Mayanist Tatiana Proskouriakoff demonstrated that the hieroglyphic passages on the monuments dealt with human history, and epigraphist Heinrich Berlin isolated the "emblem" glyphs of Maya polities or lineages. About the same time, Soviet scholar Yuri Knorozov showed that elements of the writing stood for syllables in the spoken language.

The last decade or so has witnessed a giant step in our knowledge of the Maya, and Copán has played a primary role in the process. Under the continuing guidance of the Honduran Institute of Anthropology and History, a series of international efforts has focused not only on the Main Group but also with equal intensity on the surrounding landscape. The National Geographic Society has provided support for several of these projects.

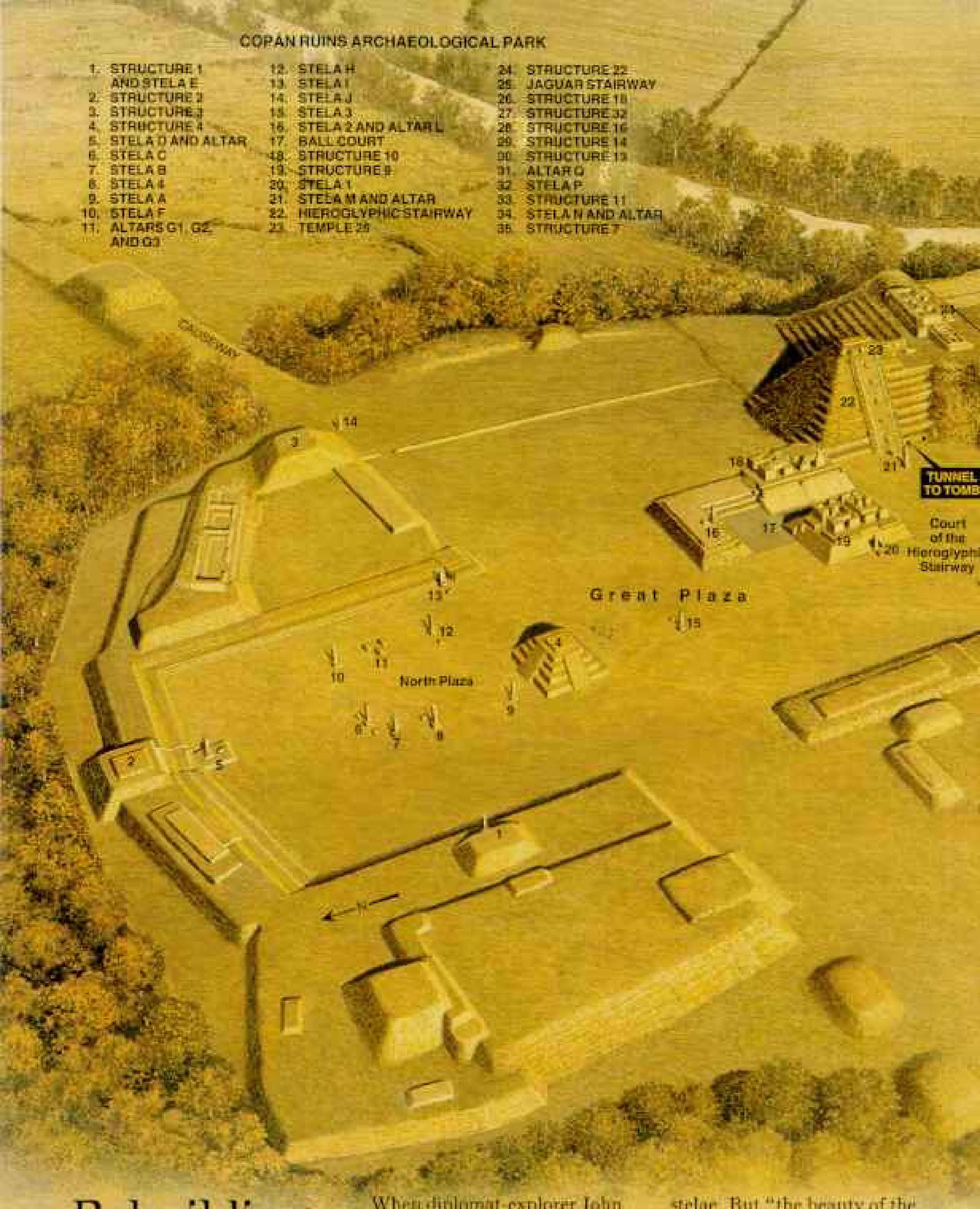
The Copán River follows a tortuous course through the region, bisecting a valley of about 80 square miles. Some of the valley is fertile flatland, as prized by the modern Copanec farmer as by his ancient counterpart. The rest, between the plain and the ridge summits—a vertical distance of around 3,000 feet—is an amphitheater of slopes interrupted by tributaries and ravines that carry the rainwater between May and November.

To archaeologists the 9.25-square-mile heart of the valley bottomland is the "Copán pocket." It holds some 3,500 mounds—the overgrown ruins of buildings—including the great mass of the Main Group. Up and down the valley lie at least 1,000 other mounds.

In this microcosm of the Maya world anthropologists, epigraphists, art historians, and many others whose specialties range from pollen study to bone pathology have wrested a saga of power and pomp, of the lives and labors of the humblest corn farmers, and of everyone in between. Perhaps the most important discovery of all is that the story of Copán's nobility, artists, merchants, craftsmen, and farmers is more pertinent to our times than we could ever have imagined—for it illustrates the folly of the misuse of land.

Razor-sharp edges of chert lance heads found in a cache dating from A.D. 755 show profiles of human faces (detail, right). Each piece, about a foot tall, must have taken hundreds of hours to produce. Brandished by the king, the lances probably were emblems of his authority.

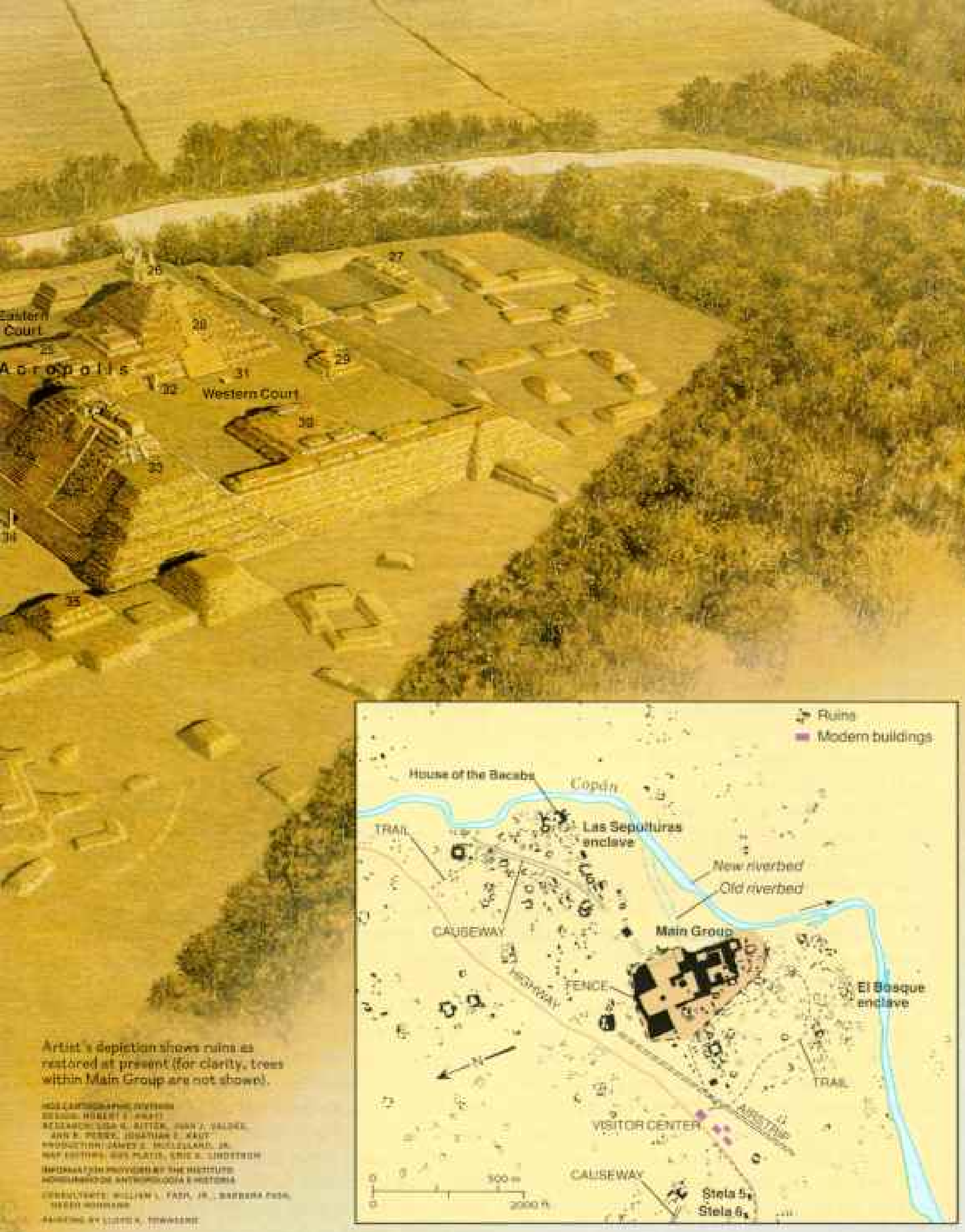
THE COPÁN ACROPOLIS rises 100 feet off the old riverbed to dominate the Main Group. Its whole east edge was cleanly sliced off by more than a millennium of erosion after the site was abandoned. In the late 1930s archaeologists rechanneled



Rebuilding Copán

When diplomat-explorer John Lloyd Stephens bought Copán from a local farmer for $50 in 1839, "an immense forest shrouded the ruins." Tree roots had tumbled stones from buildings, vines had invaded cracks, and earthquakes had toppled stelae. But "the beauty of the sculpture, the solemn stillness of the woods . . . and the mystery that hung over [the site]" intrigued him — and the generations of archaeologists who followed.

Over the past century a series



Artist's depiction shows ruins as restored at present (for clarity, trees within Main Group are not shown).

of campaigns at this site in western Honduras has cleared and restored what we see today. Early work investigated the ceremonial structures and royal residences of the Main Group (above). Recent projects have studied houses in the areas of Las Sepulturas and El Bosque.

Farmers moved to this fertile river valley about 1000 B.C. In its glory, from A.D. 600 to 800, Copán was a major center of Classic Maya civilization. Its graceful art and architecture were almost unrivaled in the New World. But the city fell victim to its own success. The growing population covered farmland with houses and leveled the forest. The political hierarchy collapsed at the start of the ninth century, and the site was slowly abandoned.

the river to prevent any further damage.

The exposed cross section is every archaeologist's fantasy—once the sense of loss over what has vanished is overcome. The cut reveals a profile of successive plastered floors, masonry walls, vaulted cavities, and other features that show the whole to be the sum of many parts. The growth of the Acropolis coincided with the long golden age of royal Copán, for its heights served as the seat of power of at least 16 kings.

What meets the eye is merely the last set of buildings. The Maya, ever conscious of architectural relationships as statements of power and ancestry and as mirrors of the layout of their cosmos, often built time and time again on the same spot.

Consider Structure 11 on the north edge of the Acropolis. Its stairway of cut stones the size of sofas provided the sole access to the heights of power. Erected in the late eighth century by the last major ruler of Copán, Yax Pac—whose name means Rising Sun—it conceals, among other things, part of a deeply buried stairway that once led to one of the first buildings on the site. That remnant, revealed by an exploratory tunnel, is inscribed with the name of Mah K'ina Yax K'uk' Mo', Great Sun Lord Quetzal Macaw, the founder of the dynasty early in the fifth century.

Or contemplate Structure 22, built by the famous 18 Rabbit, who ruled Copán between 695 and 738. On the summit of the Acropolis, it faces south, across a courtyard dedicated to the planet Venus. The ornate facade, now fallen except for its basal "porch" with stone teeth, once depicted a huge monster mouth.

Crouching supernatural figures flank the door of its inner chamber. They share the burden of a two-headed monster representing the heavens. The "front," or east end, of the monster bears symbols of Venus; the "rear," or west, those of the sun. Not surprisingly, the whole building is oriented so that its long axis is in perfect alignment with distant Stela 12. The outer corners of Structure 22 are decorated with stacked countenances of "Cauac monsters," representing mountains. According to Yale art historian Mary Miller, the whole is nothing less than a celebration of rulership frozen in stone.

So palpable was the power of the imagery of Structure 22 that Yax Pac later constructed an annex perfectly aligned on its major axis, and he made sure that his own mortuary memorial, Structure 18, was placed in the same aura of power on the south edge of the Acropolis in special relationship to the monster-mouth facade of his revered ancestor.

Thus, by means of decor and positioning, the Main Group served as a stupendous architectural metaphor for power derived from real and supernatural ancestors and from the very earth and sky. The images, in effect, composed an artificial landscape with pyramids as mountains and doorways as caves. The stelae complete the replication of nature's visible world, for they are labeled in hieroglyphs with the term *te-tun*, or tree-stone.

While the royal saga of Copán is at least partly recoverable from the carved texts of the "official" histories, that is only part of the story. Data on the lives and ways of the rest of the valley people are equally crucial—and infinitely more difficult to come by. Hence the formation in 1977 of an interdisciplinary archaeological project by the Honduran government in collaboration with a series of eminent Maya scholars.

Gordon Willey of Harvard was instrumental in the new effort, calling upon his decades of experience in the analysis of settlement patterns—the reconstruction of the nature of a society through study of the ways in which its remains are arranged on the landscape. To create a control for a valid sampling, he

designed a progression of categories based on the size and complexity of the mound groups that dotted the valley. A Type 1 group was smallest, no more than a few low simple structures around a courtyard. At the other end of the scale were Type 4 groups, those with dozens of mounds and occasional structures exhibiting such hallmarks of distinction as vaults, sculptures, or unusual height.

When the anthropologists applied the scheme to the completed map of the valley, certain patterns emerged. Type 4 complexes in the Copán pocket were clustered in two areas. One of these "urban enclaves," called El Bosque, or the Woods, filled the flats just southwest of the Main Group. The other, Las Sepulturas, the Tombs, lay to the east and north, the largest aggregation of mounds outside the Main Group itself.

In effect the map supplied two dimensions of the Copán Valley study area. Intensive excavation at Las Sepulturas under William T. Sanders and David Webster of Pennsylvania State University refined what was known of the third necessary dimension. Digging down, layer by layer, and dating the material found in each, it was possible to establish the dimension of time.

"Las Sepulturas was linked to the Main Group by a causeway," archaeologist Bill Fash remarked as he guided me through the place in 1987, "so we knew it was important. What we didn't count on was the depth of the deposits here. They provided us with much of what we know of Copán in the Middle Preclassic period, about 1000 to 300 B.C."

Incense swirls around a jaguar sacrifice. As in many important ceremonies, attendants dress as aspects of Chac, the god of rain and lightning. Central figures wear plumes and jades of privilege.

On the sides of the altar, the 15 predecessors of Yax Pac, Copán's last major ruler, sit atop their name glyphs or descriptive signs (top). On the front, facing his own accession date, Yax Pac receives insignia of office from the city's first king.

Behind the altar archaeologists found small crypts with macaw bones and a larger one with the remains of 15 big cats—perhaps killed in honor of Yax Pac's royal ancestors.

PAINTING BY M. TOM HALL

"PEOPLE CAME here around 1000 B.C.," says Fash, "and probably the reasons were simple. The valley had water and good bottomland—everything you needed to be a good Maya farmer."

Little is known of those earliest Copanecs, save for the information afforded by a Preclassic cemetery seven feet beneath the surface of Las Sepulturas. A necklace of jade jaguar claws placed with one burial of about 900 B.C. indicates trade in luxury raw materials, for the jade came from the Motagua River Valley of Guatemala. And the decoration on the accompanying pottery suggests affiliations with the Olmec people, who, centered on Mexico's Gulf coast some 500 miles northwest of Copán, exerted their still little understood influences up and down the Pacific coast. Other burials of the same time proved devoid of goods, suggesting, even then, a thriving village population with a growing differentiation between elite and commoner.

We know even less of Copán during the several centuries around the time of the birth of Christ. As a frontier settlement between the Maya area and various other groups to the east and south, it was situated in a locale propitious for trade. The archaeological record, however, is without evidence of any public buildings or ceremonial precincts. Perhaps the clues still lie buried deep in the very lowest levels of the Acropolis or under the present town, where several important Early Classic monuments have been found. Or maybe such remains were simply razed by later builders.

At any rate, while the burgeoning Maya centers at El Mirador, Tikal, and Uaxactún, in the lowlands of Guatemala's Petén, immortalized their powerful Late Preclassic elite in painted stucco adorning great public buildings, and while such highland centers as Kaminaljuyú in Guatemala and Chalchuapa in El Salvador passed through spectacular periods of prosperous state formation, Copán remains almost mute until the fifth century A.D.

Around A.D. 450 a shaman died and was buried at Las Sepulturas with all the trappings of his office—tortoiseshell rattles and a ritual "kit" containing divining stones, a codex, and animal teeth and bones. The accompanying pottery, lidded vases with slab legs, is typical of Early Classic times, reflecting relationships with the Maya highlands to the west and, ultimately, with the metropolis of Teotihuacan in Mexico's central highlands.

This burial of such an important person away from the Main Group suggests that power in the valley may have been shared among several lineages. And, according to Sanders and Webster, the population was still relatively low—perhaps no more than 3,000.

The origins of these Early Classic families of power is still a matter of debate among the Copán investigators. Sanders and Webster

Erected by the ruler who founded the royal line, Copán's oldest dated monument captures the attention of epigraphist David Stuart, the author's son. The glyphs for December 11, 435, appear at the top of the stela, which was found last spring in a building buried under Structure 26 and its Hieroglyphic Stairway (right). Just enough text remains below the break to read the king's name, Mah K'ina Yax K'uk' Mo'.

believe that the families may have entered the valley shortly before this time. Fash thinks that a Maya elite simply developed in place.

Whatever the answer, all agree that the power of one lineage accounts for the monumental record of the Main Group that begins in the fifth century.

THE DYNASTIC LINE of royal Copán, whose span of existence virtually defines the Classic period there, is frozen on the four sides of Altar Q, a great block of greenish andesite set at the base of the ruined staircase to Structure 16. Near it lie the fallen stone skulls that once graced that building—the tallest in the Main Group.

The sides of the altar hold the portraits of 16 individuals, the rulers of the dynasty, each in full regalia and seated upon his name glyph (pages 496-7). The group is positioned so that Yax Pac—who commissioned the altar—is receiving the trappings of office from the long-dead founder of the dynasty.

Few details of the lives of these men are known until the reign of Smoke Imix (628 to 695), whose long life and reign witnessed the first great period of the city. During his time the valley population increased as never before both in numbers and in complexity, as the sprawl of buildings and clearings slowly moved outward from the Copán pocket.

The sampling of rural mound groups of the time indicates a diversity of activity. Some householders manufactured pottery, blending the old traditions of the Pacific littoral of El Salvador with Maya styles of the western highlands to create what archaeologists call Copador ware. Others may have been woodworkers, for they left behind a great number of razor-sharp bladelets made of obsidian, mainly from the Ixtepeque quarry in Guatemala. Still others drew upon the geologic bounty of the slopes and ridges at hand, manufacturing *metates*, or corn grinders, of durable rhyolite.

Smoke Imix's power as ruler was apparently matched by his prowess as warrior, and it may not have been limited to the valley. Altar L at Quiriguá, a site on the Motagua River in Guatemala—some 30 miles north of Copán and the center of a city-state ruled by a rival lineage—bears the image of a lord seated cross-legged Copán style beside the name Smoke Imix. If it is indeed the Copán ruler's name, as epigraphist David Stuart of

Vanderbilt University believes—and a date on Quiriguá Monument 12, readable as May 30, 653, is certainly right for this—then it is possible that the eroded relief marks a Copán takeover of the smaller Quiriguá polity.

When the powerful Smoke Imix died at Copán in June 695 in his 80s, 18 Rabbit inherited the Copán throne.

On Stela B, his accession monument in the Great Plaza, 18 Rabbit is depicted in full glory. His costume bears all the symbols of Classic Maya power—the jade belt of miniature ancestor heads and dangling trios of sacred mirrors; the loincloth blending elements of the holy countenance and the sacred tree that centers the universe; and the great headdress dominated by indicators of place and lineage, giant macaw heads and tiny figures amid the swirls of stone corn foliage.

Such monuments depicting 18 Rabbit as a god fill the Great Plaza, but it was his role as warrior that seems to have been his undoing and that led to one of the most disastrous days in the history of Copán—May 3, 738. On that day, according to passages carved on the graceful sandstone Stela E at Quiriguá, King Cauac Sky of that neighboring polity captured 18 Rabbit and had him beheaded.

Ironically that day fell in the midst of what would normally have been a season of high hopes in the Copán Valley—the time of the burning of fields for the planting. Shortly after the first rains, the new ruler, Smoke Monkey, took office. In the wake of the catastrophe he appears to have run the course of his reign (738 to 749) without distinction.

His son, Smoke Shell, a contrasting personality, acceded to the Copán throne in February 749. Soon afterward he instigated a renaissance of construction such as Copán had seldom witnessed. Among his works is that which has become to Mayanists and laypeople alike the most memorable feature of Copán—the great Hieroglyphic Stairway.

AWESOME even by Copán standards, the stairway rises wide and steep up the west face of the pyramid that supports the vestiges of Structure 26, between the Ball Court and Structure 11, creating a plaza designed to impress. This, indeed, may have been the primary reason for its construction.

"I see the Hieroglyphic Stairway as a sort of rally cry for the dynasty," says Bill Fash. "A real building spree that Smoke Shell hoped would reinstate the good old days of Smoke Imix."

The 50-foot-wide stairway once consisted of 72 steps, each a foot and a half high, between ornate balustrades. Its risers hold a text of more than 1,250 hieroglyphs chronicling the entire dynastic history of Copán to the year 755, when the stairway was dedicated. As epigraphist Berthold Riese noted, the content of the Hieroglyphic Stairway text equals that of perhaps 20 stelae. Punctuated by five life-size seated figures of stone, it stands as the longest single written inscription from all pre-Columbian America.

Unfortunately the Hieroglyphic Stairway collapsed in the 1800s. As a consequence only 30 of its risers are in their original order. The rest are jumbled, and, even now, detached stones from the original come to light in nearby piles of fallen rubble.

This state of affairs with regard to what surely must be one of the prime cultural monuments of the world impelled the Honduran government to approve the Copán Mosaics Project in 1985, an endeavor taken on by Bill Fash and his wife, Barbara, staff artist for the project. With the aid of epigraphists Linda Schele, David Stuart, and Nikolai Grube, they will try to restore the stairway text to its original state—at least on paper.

"Casts of the whole thing should be made," says Bill, "and the original stones placed in a protected environment. The old photographs tell all too clearly how much the stairway has suffered from rain and groundwater. It's a sad case and a big, big job."

Perhaps the largest task facing the Fashes is the sorting of the piles of sculpture that have fallen from the carved facades of the old buildings.

"We're getting pretty good at this," Barbara told me as we wandered through an alleyway of stone monster noses. "Each building had its set, its system of adornment, and lucky for us no two were quite alike."

"Of course, we still have our GOK piles," Bill adds. "Those are the stones whose original locations God only knows."

A great cache beneath the Hieroglyphic Stairway was uncovered a couple of seasons ago by David Stuart. It proved to be one of the most sumptuous ever found in the Maya area. Two elaborate carved jades—one a pectoral, or chest ornament, the other a short

PAINTING BY H. TOM HALL

In sight of the palaces and public buildings, valley residents pursued livelihoods that supported the city's ruling elite. Most farmed corn, beans, and squash and lived in thatch-roofed dwellings. Tradesmen, artists, and nobles built more elaborate homes. Far from being an empty religious center, as researchers first thought, Copán had a population as large as 20,000 at its peak.

standing figure—were among the talismans of sacred power carefully placed inside a clay incense burner, along with a sacrificial knife, bloodletting lancets of stingray and sea anemone spines, and a spiny oyster shell full of red pigment.

Beside the sealed cache vessel lay three of the finest "eccentric flints" ever found—delicately flaked silhouettes of translucent chert, each depicting seven Maya profile faces (pages 492-3).

The archaeology of the valley suggests that even as the stairway was dedicated, shadows lay over the region. Rebecca Storey's analysis of Copán skeletal material shows hints of malnutrition and disease as the farmsteads pushed the forest farther and farther toward the ridges around the time when the next king, Yax Pac, took office on July 2, 763.

Yax Pac continued the frantic building, perhaps to reinforce the power he must have felt was rapidly slipping away. To emphasize his position in the dynasty, he commissioned the carving of Altar Q and dedicated it by sacrificing jaguars, the ultimate symbol of Maya royalty.

LIFE IN SUBURBAN COPÁN in the era of Yax Pac is best mirrored by the unusually complete record found buried at Las Sepulturas. From the very beginning Gordon Willey had suspected that the site was an elite residential zone, and Bill Sanders and David Webster's excavations beginning in 1980 confirmed that. There were, however, a fair share of surprises.

The largest compound in the zone is composed of 40 to 50 buildings arranged so as to create 11 courtyards. The compound is dominated by what Webster calls "the House of the Bacabs," or officials. The palace boasts a massive hieroglyphic bench and facades, now

Transforming the back of Structure 22, workmen remove rubble and restore fallen walls. Inside, a hieroglyphic frieze beneath a step (bottom) has eroded dramatically since 1885, when Alfred P. Maudslay took the photograph laid beside it. Efforts to stop such deterioration include plans to set up a museum nearby for the major pieces of sculpture. Reproductions would replace originals at the site.

partly restored, that once featured ten life-size male figures with elaborate feather headdresses, each seated on a giant hieroglyph *na*, or house. Eight of these adorned the upper facades. The two lower ones, flanking the front door, appear to be scribes, for each holds a cut conch-shell "ink pot."

The man who lived here—archaeologists see him as the patriarch of a powerful lineage of scribes and artists—held tremendous power, perhaps exceeded only by that of Yax Pac himself.

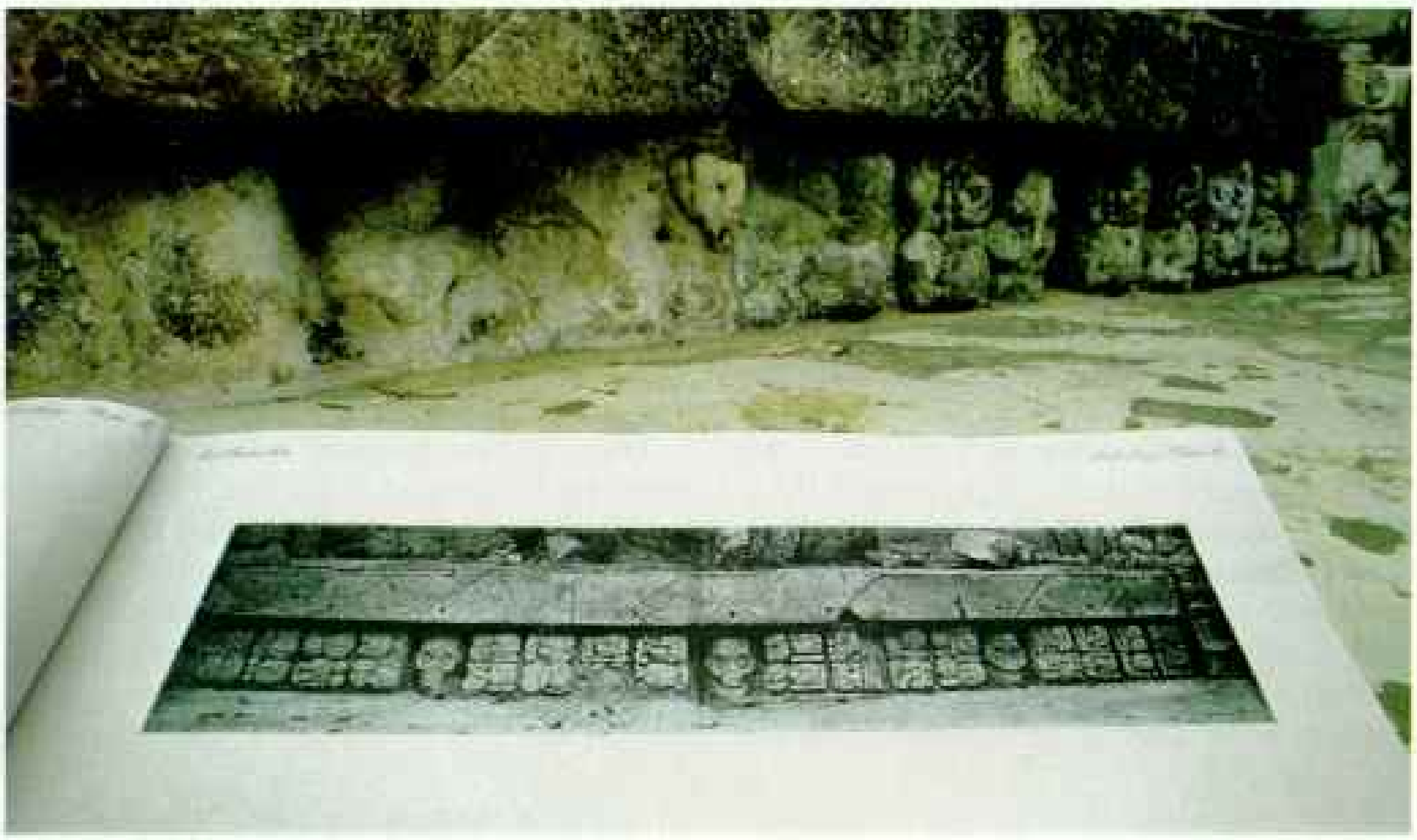
The domain of the patriarch at Las Sepulturas around the year 800 held a population of some 250, counting kin and others. Its buildings, arranged around courtyards of varying size and prestige, include houses for young men (one seems to have been a dressing room for ball players), temples, shrines, storage rooms, kitchens, and workshops. Some of the residential quarters—distinguished by sleeping and sitting benches and refuse dumps—may have served as quarters for women, others as men's dormitories. Refuse in nearby rooms suggests that professional craftspeople also lived at Las Sepulturas. Judging by the character of associated burials, "foreigners"—perhaps tradesmen from central Honduras—may have been part of the patriarch's extended household as well.

ON JUNE 28, 810, the Long Count—the elegant mechanism by which the Classic Maya counted the passage of days through eternity—rested at the station 9.19.0.0.0, the all-important ending of the 20-year-long *katun*. And it was only seven days off the solstice. The city, without doubt, observed the occasion with all the pomp it could muster, and it is logical to believe the celebration took place in the plaza of red plaster embraced by the Ball Court, the pyramid of the Hieroglyphic Stairway, and the brooding bulk of Structure 11.

Yax Pac died during the winter of 820. By then the Main Group stood complete, as we know it today. The population of the Copán Valley had reached its all-time peak, an estimated 18,000 to 20,000, scattered over every available farm plot. It is at this point that the fortune of the once powerful Copán lineage took its fatal turn as competition from valley nobles, overpopulation, and growing problems of land misuse negated the relevance of the royal power centered in the Main Group.

A single undistinguished sculpture, Altar L, suggests the moment, if not the nature, of the end of the last chapter in the royal history of Copán.

Linda Schele and University of Hamburg epigraphist Nikolai Grube made the discovery. "Here were two people shown in royal regalia, just as on Altar Q," explains Linda.



"They're even sitting on their name glyphs. The one on the right is Yax Pac. The other is someone we've never heard of—one U Cit Tok', meaning perhaps 'the father of flint.' And there's an accession glyph."

According to the best possible reconstruction of the date, the event depicted on Altar L took place on February 10, 822, the very last date set to stone in Copán.

"The clincher," notes Linda, "came when Barbara Fash drew the thing and realized that the carving had never been finished! In other words, one day the sculptor of Altar L picked up his tools, walked away, and never came back to finish the job. For me that single episode marks the end of royal Copán."

And how did the valley fare after the demise of the royal court? Not too badly, if we accept the startling findings of Ann Freter, who specializes in dating obsidian, and David Rue, who studies the implications of old pollen deposits.

Dates from thousands of obsidian blades found in the course of the sampling of valley mound groups make a consistent line on a graph that ends not around A. D. 800 but four centuries later. And the pollen profile of the Copán pocket substantiates these findings: The forest did not begin its recovery there until about 1200.

"What we have, then," notes Webster, "is the fascinating conclusion that the Maya 'collapse' at Copán is much more complex than we formerly envisioned."

In short, Copán did not die suddenly, as a study of its royal monuments alone would indicate. Rather it was a slow process, the logical result of exhausted forest and farmland, that saw the population in slow decline. Population remained relatively high, even in the rural areas, well after 800, and there was continued elite activity for another couple of centuries in the area surrounding the abandoned Main Group. But after 1200 the valley was without population, as it had been in the beginning, vulnerable to the encroaching forest.

THE WORK GOES ON. Barbara and Bill Fash continue to supervise the Copán Mosaics Project, and many of the GOK piles have shrunk as the isolated pieces of sculpture, numbered and removed to the safety of the laboratory facility, await possible reassembly.

Meanwhile Rudy Larios applies a genius that even the master architects of ancient Copán would have envied. On my last visit he was supervising the consolidation of the complex masonry walls behind Structure 22.

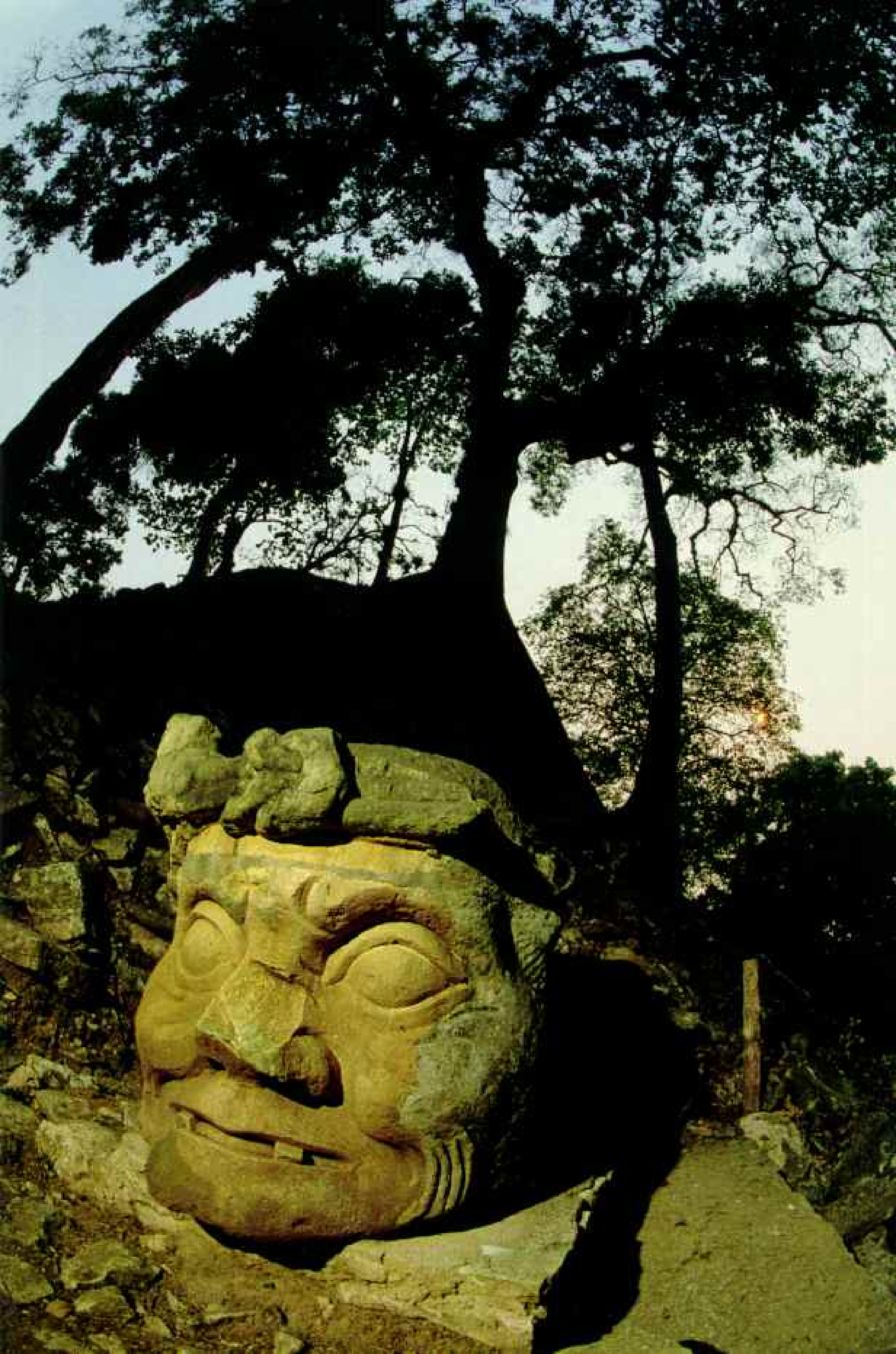
Wendy Ashmore of Rutgers University has completed her second season of excavating two elite house sites on the slope above the lab and storage facility. She is testing the idea that at least some such elite compounds were deliberately arranged in accordance with the ancient notions of sacred geography that, even to this day, pervade the Maya belief system.

With each sun that sets behind God N (right), we learn more about glyphs like this one representing the ruler's title, Divine Lord of Copán, and confirm John Lloyd Stephens's belief that the people of Copán "published a record of themselves, through which we might one day hold conference with a perished race."

And Bill Fash, along with his colleagues Ricardo Agurcia Fasquelle of the Honduran Institute and Bob Sharer of the University of Pennsylvania, continues to pick away at the secrets of the Acropolis, helped by the large team of Copanecs whose skills range from photography and drafting to the flawless excavation of the fragile cache deposits.

Recently the tunnels into the dense rubble behind the Hieroglyphic Stairway yielded what Bill Fash calls the "founder's stela"—a near pristine monument from the early fifth century, the era of the shadowy Mah K'ina Yax K'uk' Mo', who started the royal city on its journey to immortality.

Truly, as Fash has said, quoting another noted for his skills of deduction, "The game is afoot." And who can guess what further discoveries await at Copán, where an extraordinary archaeological richness is matched by the extraordinary and continuing teamwork of scientists from many disciplines. □



New Zealand's Magic Waters

Text and photographs by DAVID DOUBILET

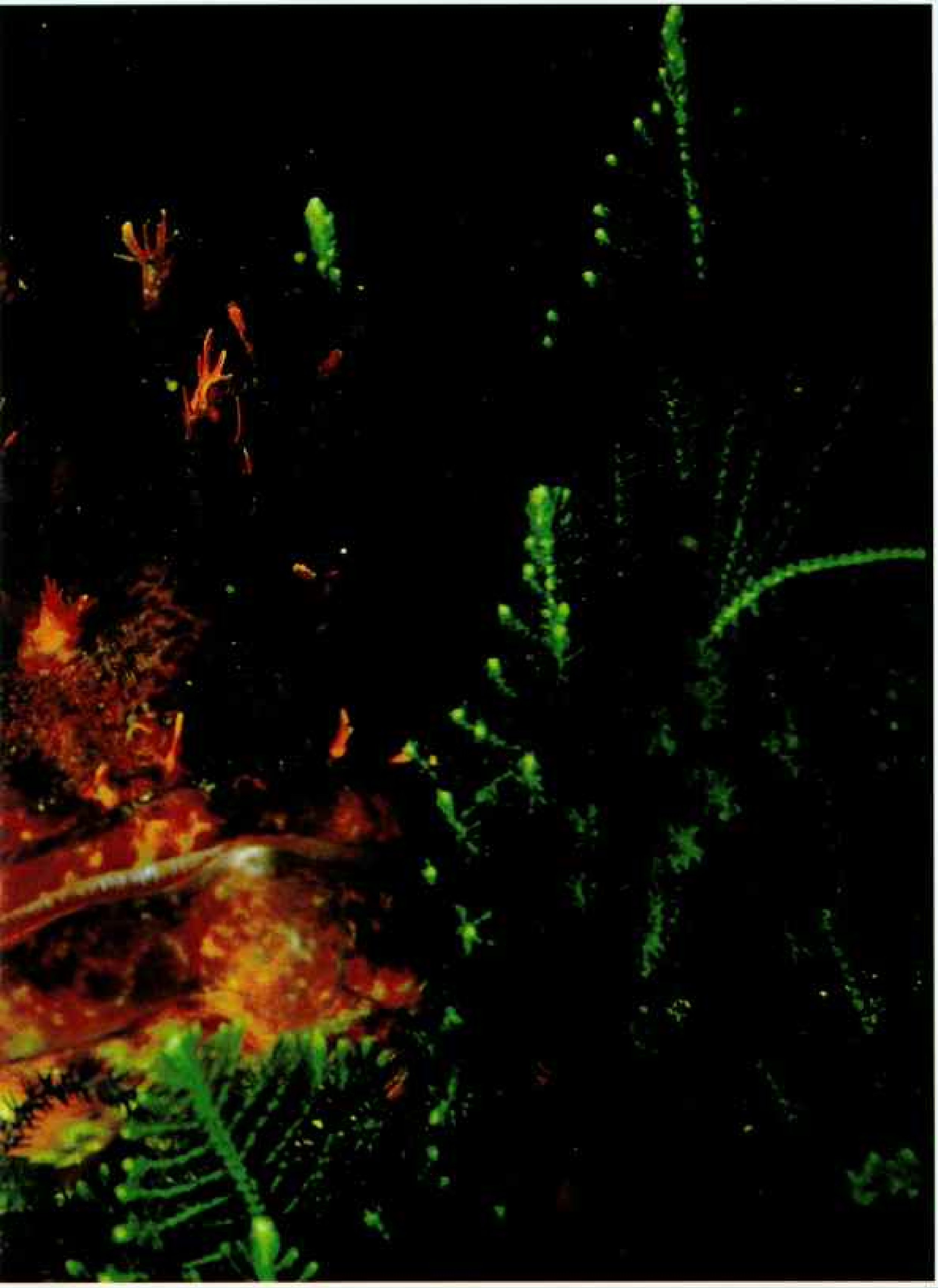
Ghostly guiding spirits, a pair of bottlenose dolphins ride the bow wave of the research vessel *Renown*. We are in Doubtful Sound, some 20 miles from the open sea, yet still in the ocean—a secret ocean, bounded by the alpine walls of a winding, ice-carved fjord on the west coast of New Zealand's South Island.

In my time underwater I have felt that there are whole countries in the sea. Their borders are currents instead of rivers, open ocean in place of deserts, temperature variants instead of mountains or seasons. The rich and varied undersea life of New Zealand is matched by few places in the world. Sandwiched by two great ocean systems—the South Pacific and the circumpolar sea, which some call the Southern Ocean—its waters are a peaceable, temperate region lying between the lush coral tropics to the north and the cold roaring seas to the south. This is a portrait of that magic realm.

Once again diver DAVID DOUBILET surfaces with portraits of the colorful and curious denizens of the deep he began photographing for the GEOGRAPHIC in 1972.

DOLPHINS, TASMAN SEA

THE VIGILANT EYES of a scorpionfish can detect the slightest movement. With lightning speed the seemingly lethargic fish lunges at such passing prey as shrimp and small fish. Body fringes aid its camouflage in a thicket of *Caulerpa* seaweed.



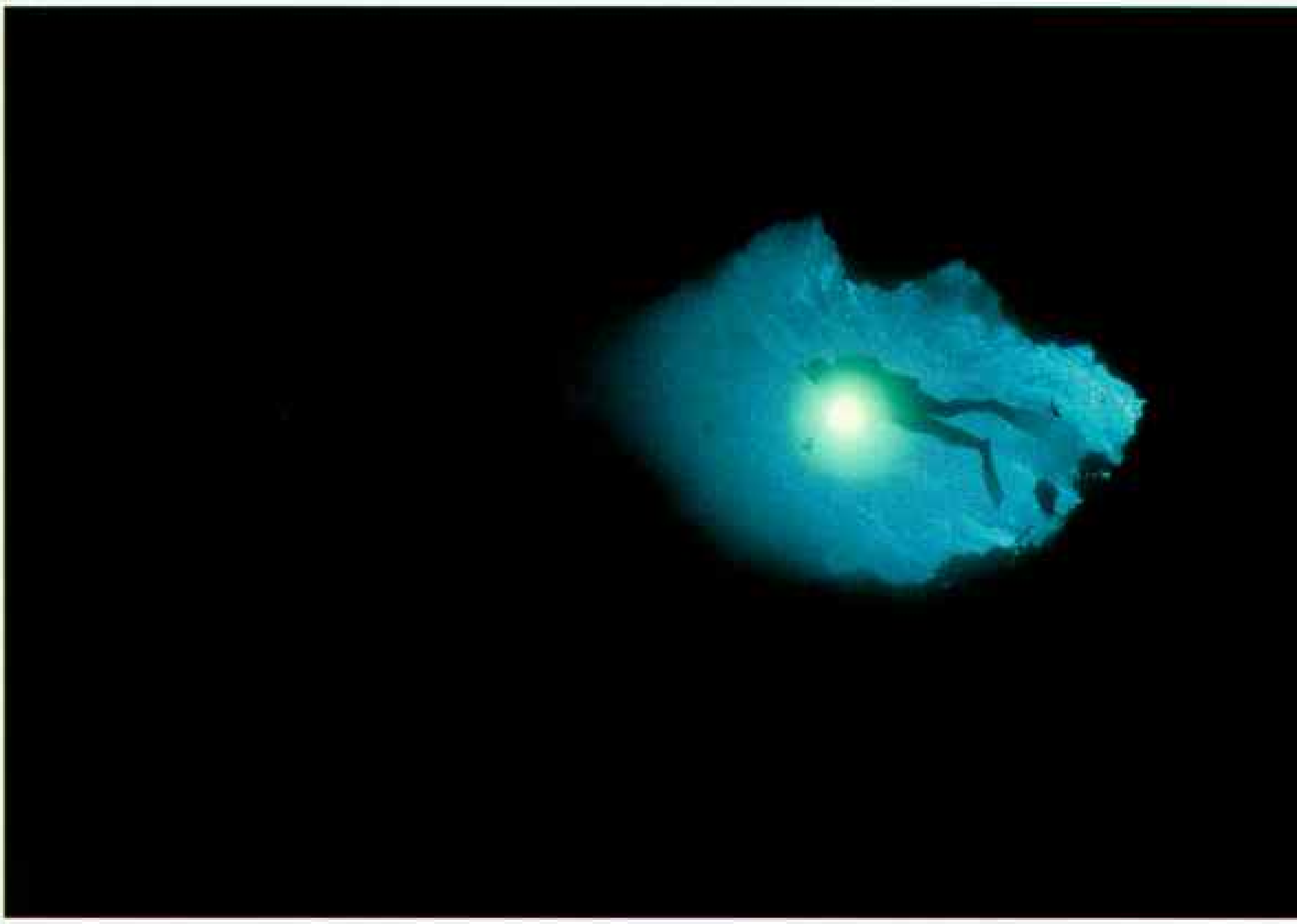
Dorsal-fin spines carry a powerful venom that can paralyze and kill small creatures and cause painful injury to humans. I caught the baleful glare of this *Scorpaena cardinalis* in the Poor Knights Islands off the North Island's northeast coast.

Poor Knights Islands

I DREAMT I WAS SLEEPING on the belly of a giant. The giant was breathing deeply, softly. *Pegasus II*, all 55 feet of her, was anchored inside Rikoriko Cave in the Poor Knights Islands. A destroyer could fit here, yet I felt claustrophobic in the darkness. A swell pushed into the cave and struck the back wall, compressing the air. There was a breathing sound, deep and soft. As I stood on deck with my guide, marine biologist Roger Grace, Eric Gosse, master of *Pegasus II*, let loose a trombone reveille: "When the Saints Go Marching In."

The Poor Knights are full of ancient volcanic tubes eroded into caves and archways—exquisite marine habitats. Swimming with ever shifting schools of blue maomao in one cave was like being woven into a tapestry. As the fish filed out in head-to-tail procession to feed, the tapestry unraveled strand by strand.

BLUE MARLIN, SCRIPPS INSTITUTION



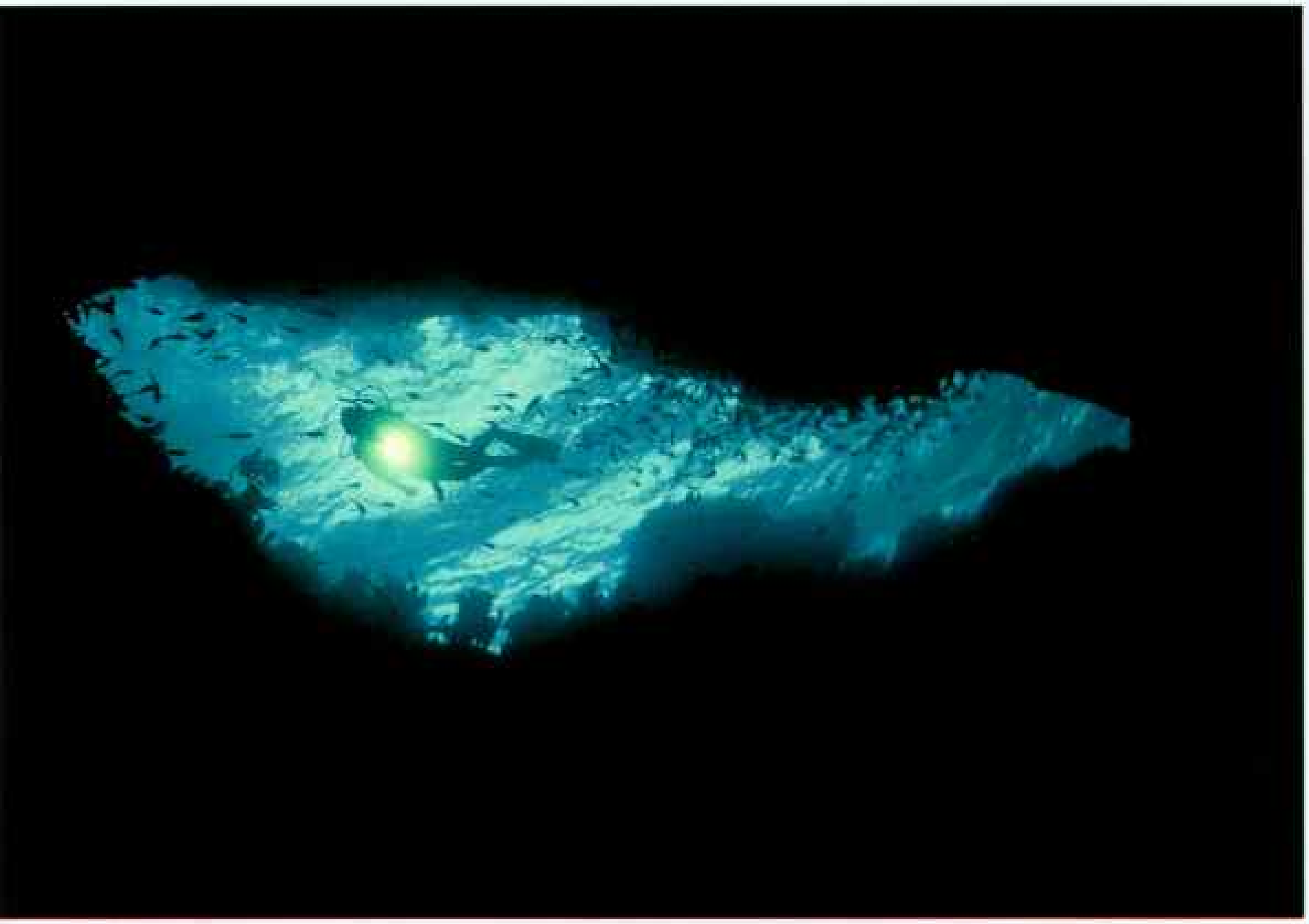
LIKE CAT EYES, cave doors glow with the lamps of Roger Grace and his diving partner, Linda Ingham. Inside I watched the snail's-pace courtship of two clown nudibranchs. About an inch and a half long, these mollusks are hermaphroditic, possessing both male and female organs. The animal on the right is laying eggs.

A bit larger than nudibranchs, two blennies share a rock pocket to mate in a less complicated fashion. The pink blush on the head of a flying fish may indicate that it's also in the mood for love.

It's not known how the 18-inch-long John Dory fish got its name. Related fish are found in Europe, and, according to one legend, its spots are the fingerprints of St. Peter. Feisty hunter of worms and crustaceans, the tiny blue-eyed triplefin lives only in New Zealand waters.

CLOWN NUDIBRANCH, CHROMODORIS ANDERSONI

FLYING FISH, CYPSELURUS LINEATUS



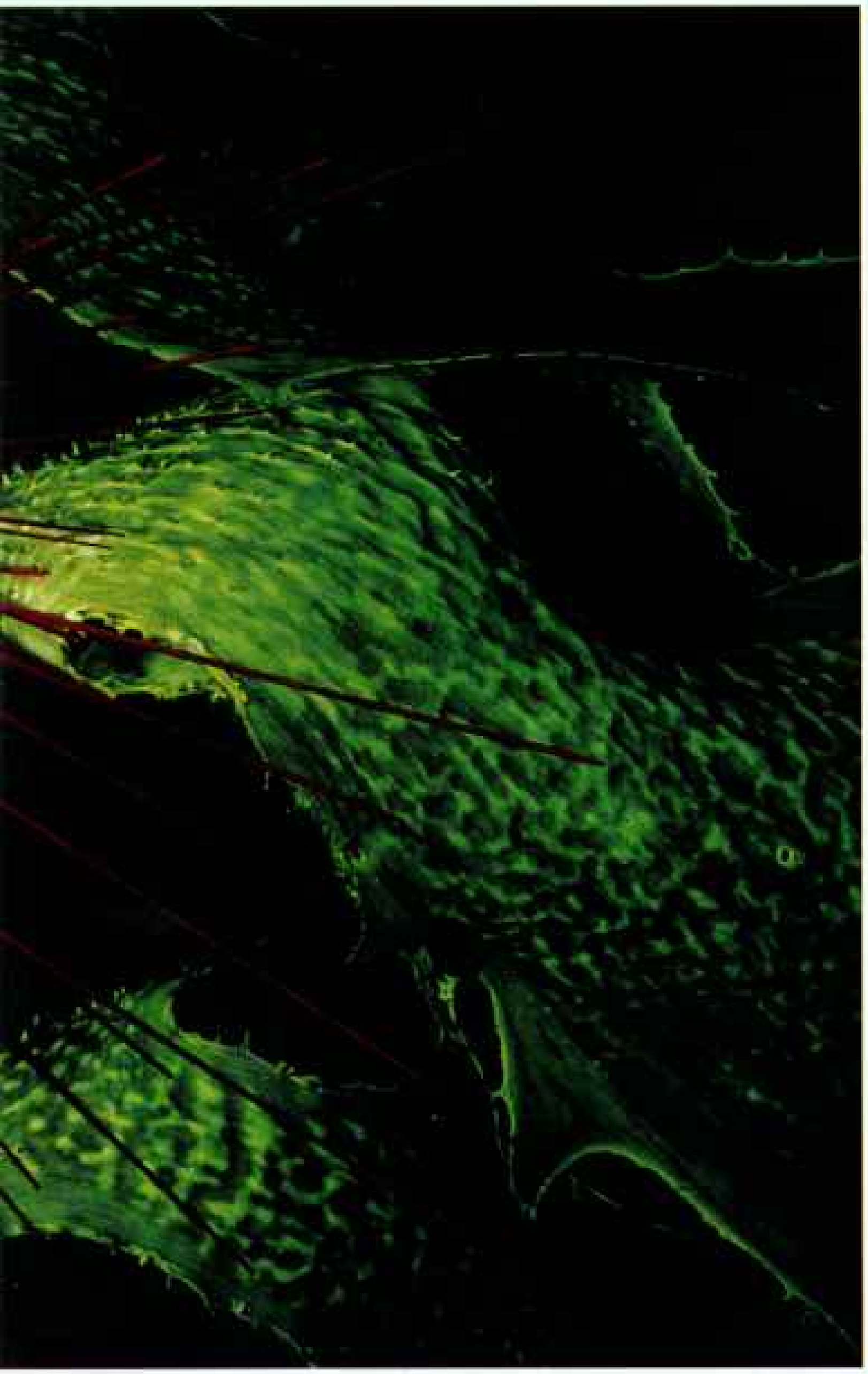
BLUE-EYED TRIPLEFIN, *ACROCOMOPS SEQUIDENTATUS*

JOHN DORY, *ZEUS FABER*

CRESTED BLENNY, *PARABLENNIUS CRISTATUS*

Leopard's wrasse, Cirrhilabrus leopardus, Banda Islands, Indonesia

JEWEL ANEMONE, CONTRACTIS NADOSUMI



Exquisite gems that could fit on a finger ring, jewel anemones (left) stretch their tentacles to snare passing plankton. The perpetual twilight of the Poor Knights Islands caves and tunnels, coupled with constant ocean flushing, provides them with a rich feeding ground. The walls glow with shimmering diadems.

Illuminated by light pouring in a ceiling hole, a male Sandager's wrasse flashes its colors (far left). Named for a turn-of-the-century lighthouse keeper, this species uses large upper and lower teeth to dig up bottom crustaceans and also feeds on urchins. One spent an hour chewing intermittently on the top of my wet-suit hood.

Cloaked in kelp, the rare long-spined red urchin (left) looks black or slightly maroon in the underwater light spectrum. A flash restores its brilliant red and the lavender of its cloaca. Odd to think of red as camouflage. Underwater it seems darker than black—a shadow of night.

Lying about 15 miles off the North Island, the Poor Knights were named by James Cook in 1769. His log does not reveal his inspiration, but he may have been whimsically thinking of a dish known as Poor Knights, chunks of fried bread much like French toast. Small and mountainous, casting brooding shadows on the seascape below, the two main islands once supported Maori fishing villages, but no one lives there today. An underwater sanctuary was created around the Poor Knights in 1981.

BLACK CORAL, ANTIPATHES APICATA

Fiordland National Park

A CELESTIAL SPOTLIGHT split the late summer evening sky as Eric Gosse and I flew around Dusky Sound between the water and the cloud deck. Cook sighted and named this enchanting bay—the largest fjord in New Zealand—on a March evening in 1770 during his first voyage. Three years later he and his crew rested here after a harrowing Antarctic passage. They set up an observatory and also a brewery whose product "tasted rather like champagne."

A wildly corrugated expanse, Fiordland National Park covers more than three million acres. Glaciers sculpted these fjords to depths of as much as 1,350 feet. As the ice retreated some 15,000 years ago, the sea flooded in. Westerly winds blowing across the Tasman Sea carry moisture up Fiordland's mountains, making it one of the wettest places on earth. The deluge blankets the clear seawater with a layer of fresh water as deep as 25 feet. The rainwater is stained brown as it runs into the sea and like a great filter blocks much of the sunlight. This low light tricks normally deep-dwelling creatures, so it's possible to see small trees of black coral, usually found at 100 feet or more, living here at only 20 feet.

On an early winter day in May in Doubtful Sound, 45 miles north of Dusky Sound, Roger and Linda and I bundled in thick wet suits and dropped over the side of the ship through a thin coating of ice. A stiletto of freezing water stabbed my back. The water below my fins was more than 600 feet deep. I took a few deep breaths through my regulator and sank.

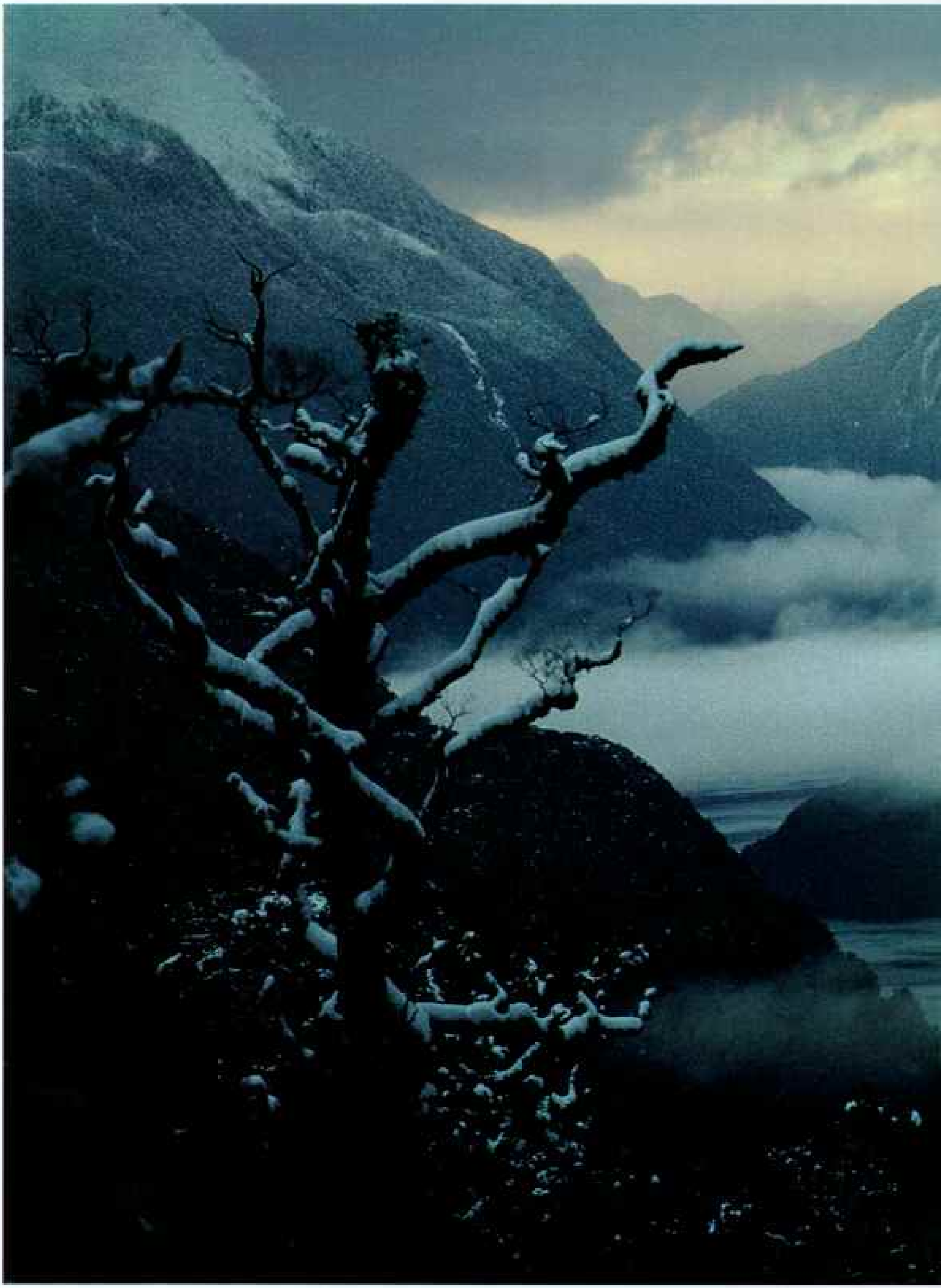
The freshwater layer, thinner in winter, was 33°F. Between it and the salt water there is a mixing zone where everything looks strangely fuzzy. The two waters mix together like crystal smoke. I passed through the fresh water into a world that was very still, dark, and green. The fjord's vertical walls plunged into blackness. At 75 feet a large black coral tree, its branches and polyps a ghostly gray-white, grew from the wall like an ancient cypress (right). I looked up as Linda descended. Her rising bubbles made holes in the freshwater layer, and she looked like a diver flying through green clouds.

GIANT STARGAZER; ANEMONE SPIDER (BELOW); RED CRAYFISH; JESSE EDWARDS (LEFT)

A SAMURAI'S ARMOR dresses the red crayfish, or rock lobster (far left). The crustaceans find sanctuary in the fjords, often clinging to the walls in large, gregarious groups. Tiny bristles cover the shell, and horn-like spines protect the eyestalks. Crayfishermen pursuing this succulent catch are the main year-round population in the remote fjords. Lobster pots are difficult to set in the deep waters and along the sheer walls, but worth the effort; fjord crayfish tails are exported around the world.

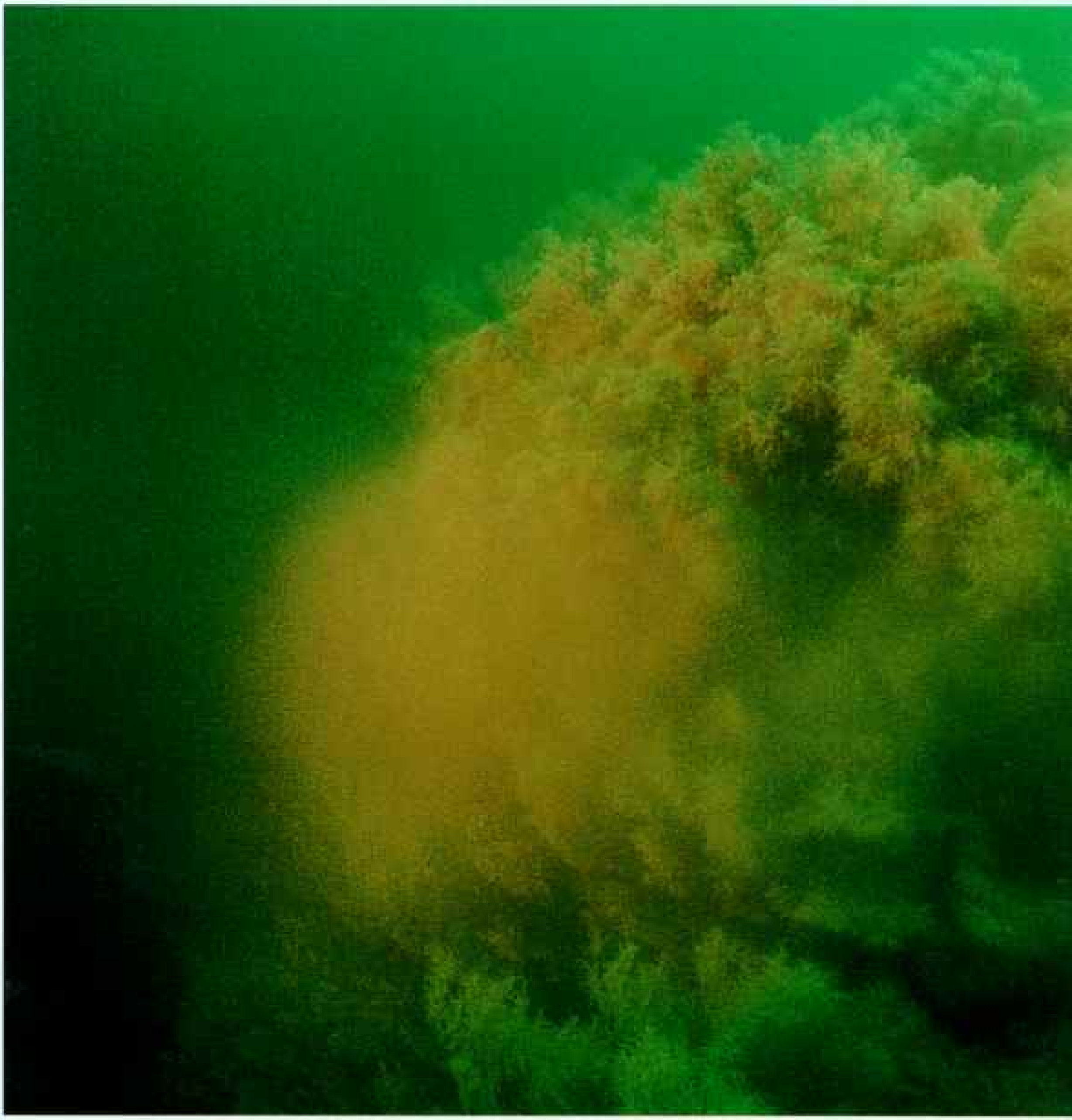
"Crowded knees" would be a loose translation of Pycnogonida, the classification given to sea spiders (left). At least 600 species are found worldwide. I watched this one crawl by shining a light behind a kelp leaf. Sea spiders eat anemones, using piercing mouthparts to drain their juices.

Looking like a loaf of moldy bread (lower), a giant stargazer rests 120 feet down in Doubtful Sound, uncharacteristically exposed. Usually buried in the sand, it waits implacably for passing prey—an immovable object after a movable feast. Spiky horns protect the fish's gill covers. This individual eventually became bored with my alien presence, stretched its cavernous jaws, and bumped off into the green fjord gloom.

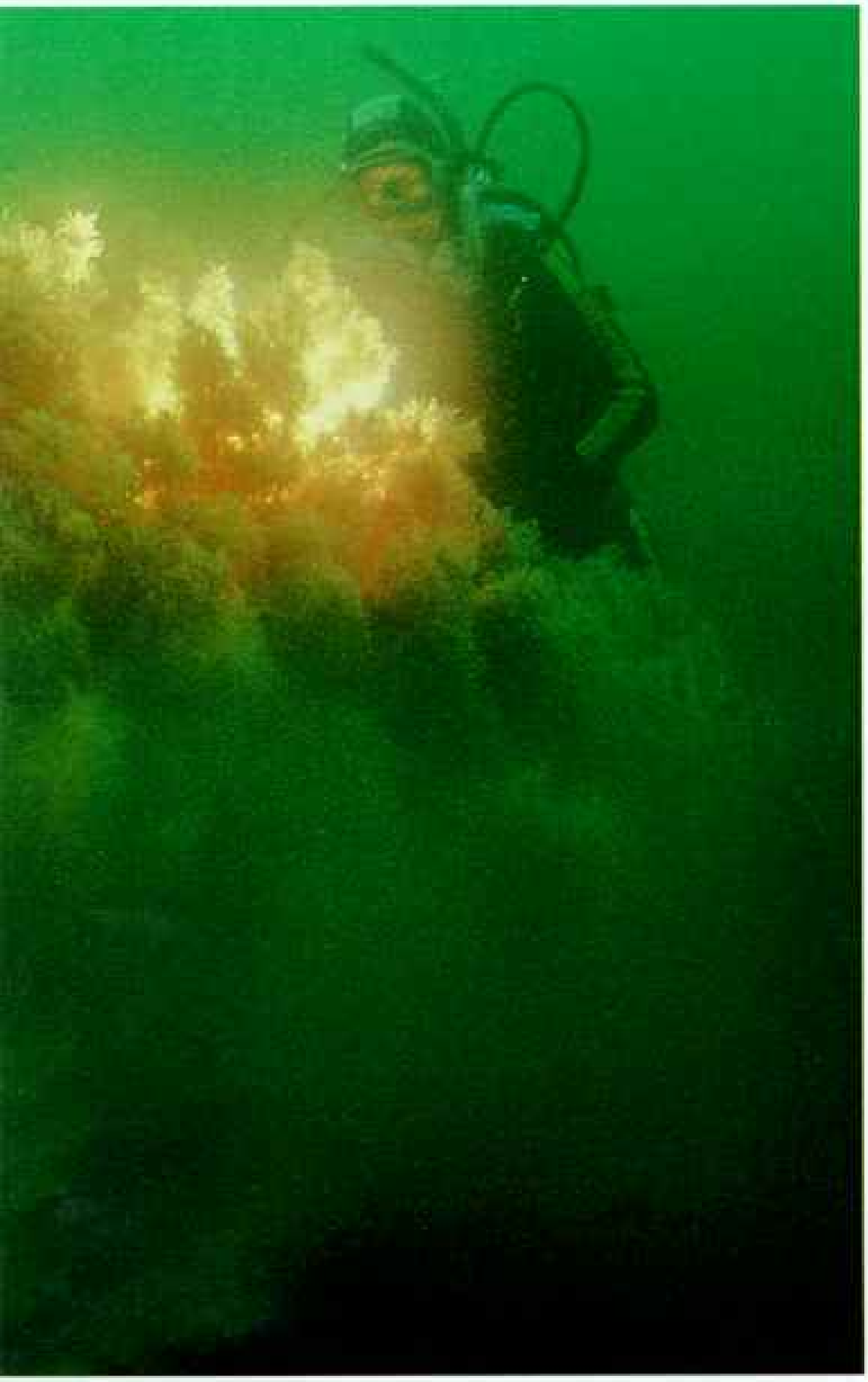


THE JOURNEY TO DEEP COVE—the head of Doubtful Sound—took us over 2,200-foot-high Wilmot Pass. Our snowplow surrendered a hundred yards from the top. It was a World War II British tank tow truck, reportedly used in the Battle of El

Alamein. Rommel's shells did not stop it, but a freak, thick May snow in Fiordland did. We plodded on, carrying dive gear, cameras, and food. As we rounded a bend, the setting sun broke over this hidden reach of the Tasman Sea.



NUDIBRANCH, *JASON MONARCUS* (ABOVE); BLACK CORAL, *ANTIPATHES APERTA*



A NIGHT AND A DAY OF RAIN revived a waterfall in Dusky Sound (far left). Captain of the *Renown* Lance Shaw cryptically announced: "The cauliflower is almost directly beneath us."

The "cauliflower" turned out to be his code name for a giant black coral tree. Lance, from New Zealand's Department of Conservation, guards its exact location to protect it from unscrupulous divers. We dove just before sunset; the roar of the waterfall was the last sound I heard. I swam over a ridge, and there was the coral—an untamed piece of submarine shrubbery 8 feet high and 12 feet around. It appeared to be smoking. An incredibly rare sight, the coral was spawning: its pink cloud was composed of thousands of microscopic eggs. Snake stars, like this tightly furled specimen (below), are common on black corals here.

Nearby I found a group of two-inch-long nudibranchs entwined in a slow, delicate ballet (top right). What a romantic corner of the ocean, I thought. What did that waterfall inspire?

SNAKE STAR, *ASTROBRACHION CONSTRICTUM*

Stewart Island

RAUCOUS BEASTS, the Hooker's sea lions at Stewart Island leave the beach in early morning and late evening and hit the water like a barrage of torpedoes for high-speed strafing runs and playful mock biting. Several showed special interest in my cameras, which drove others into jealous fits. Perhaps the rarest of sea lions, 5,000 to 7,000 animals breed on New Zealand's outer southern islands.

In the early 19th century a Scottish whaler named William Stewart established the first white settlement on this island, known to the Maori as Rakiura—"glowing sky." A fishing center, Stewart Island attracts a large population of mollymawks, small albatrosses with wingspans of nearly eight feet (right). Wondrous sky sailors, in calm air mollymawks do not take off gracefully. Wildly flapping their wings, they run on the water for some 50 yards before their wings begin to bite.

HAWKSBILL TURTLE (ABOVE) | SEA LION, PROSERPINE HOOKER

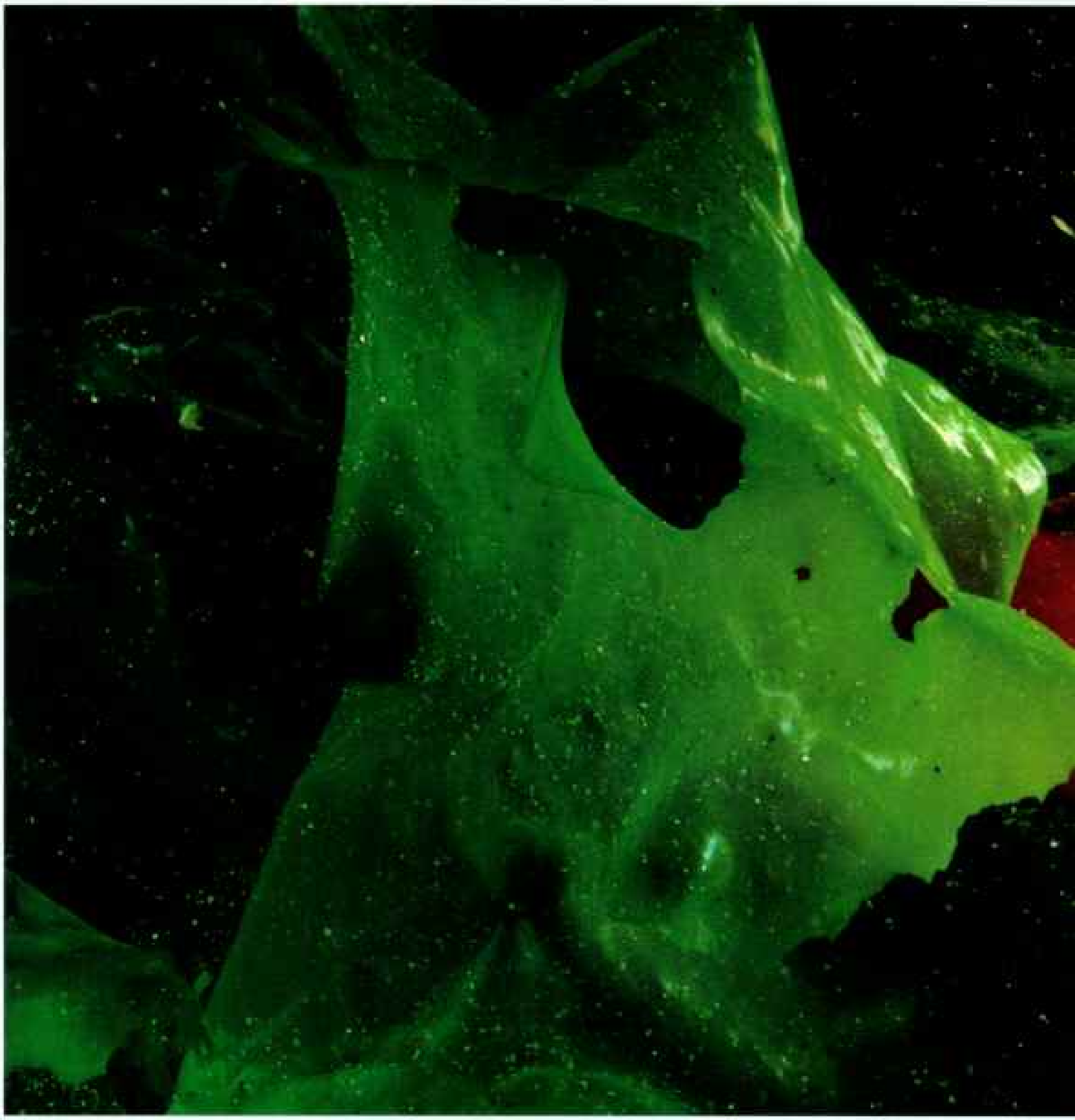
LOOKING REMARKABLY like a little wild boar, the southern pigfish (facing page) extends its snoutlike mouth to sweep crevices for crustaceans, worms, and other invertebrates. Off Stewart Island, Roger and I watched one foot-long pigfish rolling on the bottom with the tide. Then Roger did an amazing thing—he picked up the fish. In all my years of diving I had never seen anyone pick up a wide-awake fish. He handed it to me. It grunted softly.

A few years ago Roger was studying pigfish. He was holding one when he realized he needed two hands to work his underwater camera. He simply dug a hole in the soft sand bottom and carefully, gently "planted" his pigfish. The fish made no objection. Roger turned around, picked up his camera, and photographed it.

To test how these passive fish influence one another, Roger and Linda sowed a whole garden of pigfish (above), carefully keeping sand away from their gills. A few wriggled free and swam off. Others stayed put until Roger and Linda released them.

On an apt track, a sea horse races across a shallow bay in Port Pegasus on Stewart Island. Most likely a male, seven and a half inches long, its extended abdomen may hold eggs laid by a female. Undulating its fins, the fish levitates, then moves forward like a helicopter leaning into an undersea wind. Using his native Scottish word for conspicuous, biologist Sir J. Arthur Thomson called sea horses "the most 'kenspeckle' creatures in the sea. . . . Chameleons come a close second on land, and bats in the air. Surely Nature must have smiled to herself as she saw all three evolving."

PIGFISH, CONGROPODUS LEUCOPAECILUS (TOP AND RIGHT); SEA HORSE, HIPPOCAMPUS ABDOMINALIS



THE STARTLING CRIMSON of a topknot fish brought a hoot from my diving partner Gary Bell, as we explored beneath the town pier at Oban on Stewart Island. Piers are wonderful marine habitats. They create places to hide, and the pilings, like great tree trunks, offer surfaces for encrusting creatures such as oysters, mussels, and sponges. Our underwater lights revealed the true contrast of the fish with its sea lettuce hideout, but to its night predators it is blackly invisible. Our movements awakened a lot of other fish. The topknot fish took advantage of this and struck, eating another fish so fast I could not identify it (right). I looked at Gary. He shook his head in amazement. In 30 years of diving I have only seen a fish eat another fish half a dozen times. Humans go into the sea as noisy, lumbering trespassers—the secret lives of its residents are usually beyond our visual reach. □

$29

PHOTOGRAPHY'S FIRST FIFTY YEARS

Seizing the Light

By ERLA ZWINGLE

FIRST KODAK CAMERA, 1888

"I HAVE SEIZED the light—I have arrested its flight!" cried Louis-Jacques-Mandé Daguerre upon producing the first daguerreotype, a small silver-coated copper plate on which he and his camera had captured and fixed a faithful image from life. Nobody knows what that image was, but the world would soon understand what it meant: After centuries of philosophical speculation, mechanical tinkering, optical refinement, and chemical experimentation, Daguerre had slipped the last piece of the puzzle into place and inaugurated the age of photography.

This year marks the 150th anniversary of that inauguration. But it was the first 50 years that saw the greatest evolution. During that period virtually every theme we still value in photography was embarked upon in a ferment of experimentation—landscapes, documentaries, portraits, polemics, fantasies. Form grappled with content, mind struggled to surmount matter.

Though most refinements of the early processes were discovered by amateurs (some experiments went nowhere, of course; the use of flower extracts as a light-sensitive agent, for example, never caught on), photography almost instantly became a business. "Into the practice of no other business or art was there ever such an absurd, blind, and pell-mell rush," said one of America's foremost daguerreotypists, Albert Sands Southworth.

Technical improvements were so rapid that histories of the period tend to focus on their domino-like progression. Exposure times shortened dramatically, image size grew and shrank, the advent of the

ERLA ZWINGLE has written extensively about photography and photographers. She is a frequent contributor to NATIONAL GEOGRAPHIC.

PHOTOGRAPHER UNKNOWN

Catching an instant in time, a Kodak snapshot illustrates the rapid evolution of photography. During its first 50 years, the young art grew from an aristocratic curiosity to a democratic memory maker.

UNTITLED, CA. 1899, INTERNATIONAL MUSEUM OF PHOTOGRAPHY AT GEORGE EASTMAN HOUSE, ROCHESTER, NEW YORK, GIFT OF GEORGE R. SNYDER

FULL-PLATE DAGUERREOTYPE CAMERA, 1840

collodion wet plate in 1851 resulted in a high-quality negative capable of producing numerous prints,* and the gelatin dry plate in 1871 (which led to shortened exposure times, allowing cameras to be hand held) ultimately made the snapshot possible, enabling everyone to be a photographer.

Yet fascinating as the mechanics and chemistry may be, we cannot enter into the spirit of the age if we regard photography's evolution primarily in these terms. Photography's advent was a triumph of imagination as much as of science, and the individuals who took part in it—regardless of which side of the lens they were on—were excited. Astonished. Overwhelmed.

"My dearest Miss Mitford," wrote Elizabeth Barrett Browning, "do you know anything about that wonderful invention of the day, called the Daguerrotype? . . . Think of a man sitting down in the sun and leaving his facsimile in all its full completion of outline and shadow, stedfast on a plate, at the end of a minute and a half! . . . the fact of the *very shadow of the person* lying there fixed for ever! . . . I would rather have such a memorial of one I dearly loved, than the noblest Artist's work ever produced."

But photography's exactitude could be risky. "Princess Caroline," wrote Danish novelist Isak Dinesen, ". . . had had her portrait painted many times in her life—but when she was given the first daguerreotype of herself, she looked at it silently for a long time and said, 'Well, I am very thankful my friends have stood by me.'"

THE CENTURIES OF THOUGHT that led to the invention of photography had been concerned as much with philosophy as with machinery: the essence of matter, the connection between thoughts and things, the reality of reality. Democritus of Abdera, for instance, had theorized that "the surfaces of all objects are continually throwing off 'images' . . . films or husks which float about in space and at last penetrate to the mind through the pores of the body" (hence "imagination"). By 1859, when the photograph had already captured a multitude of images, Oliver Wendell Holmes could write: "Every conceivable object of Nature and Art will soon scale off its surface for us."

At first the camera was perceived as a tool for the painter—a new way of recording reality before transforming it into art. Critics argued endlessly about what to criticize: photography was too accurate, not accurate enough, too much like painting, not at all like painting. Many feared that painter Paul Delaroche was prophetic in proclaiming, "From today, painting is dead."

The poet of decadence Charles Baudelaire, though frequently

*Use of the wet-plate process in the pioneer West was described in "The Life and Times of William Henry Jackson," by Rowe Findley, in the February 1989 issue.

HIPPOLYTE BAYARD

Ghostly images of Parisian windmills were captured in a direct positive print, a process invented by Hippolyte Bayard. His discovery went unrecognized in the excitement created by Talbot and Daguerre.

"MONTMARTRE, WINDMILLS," 1839; GILMAN PAPER COMPANY COLLECTION, NEW YORK CITY

LOUIS-JACQUES-MANDÉ DAGUERRE

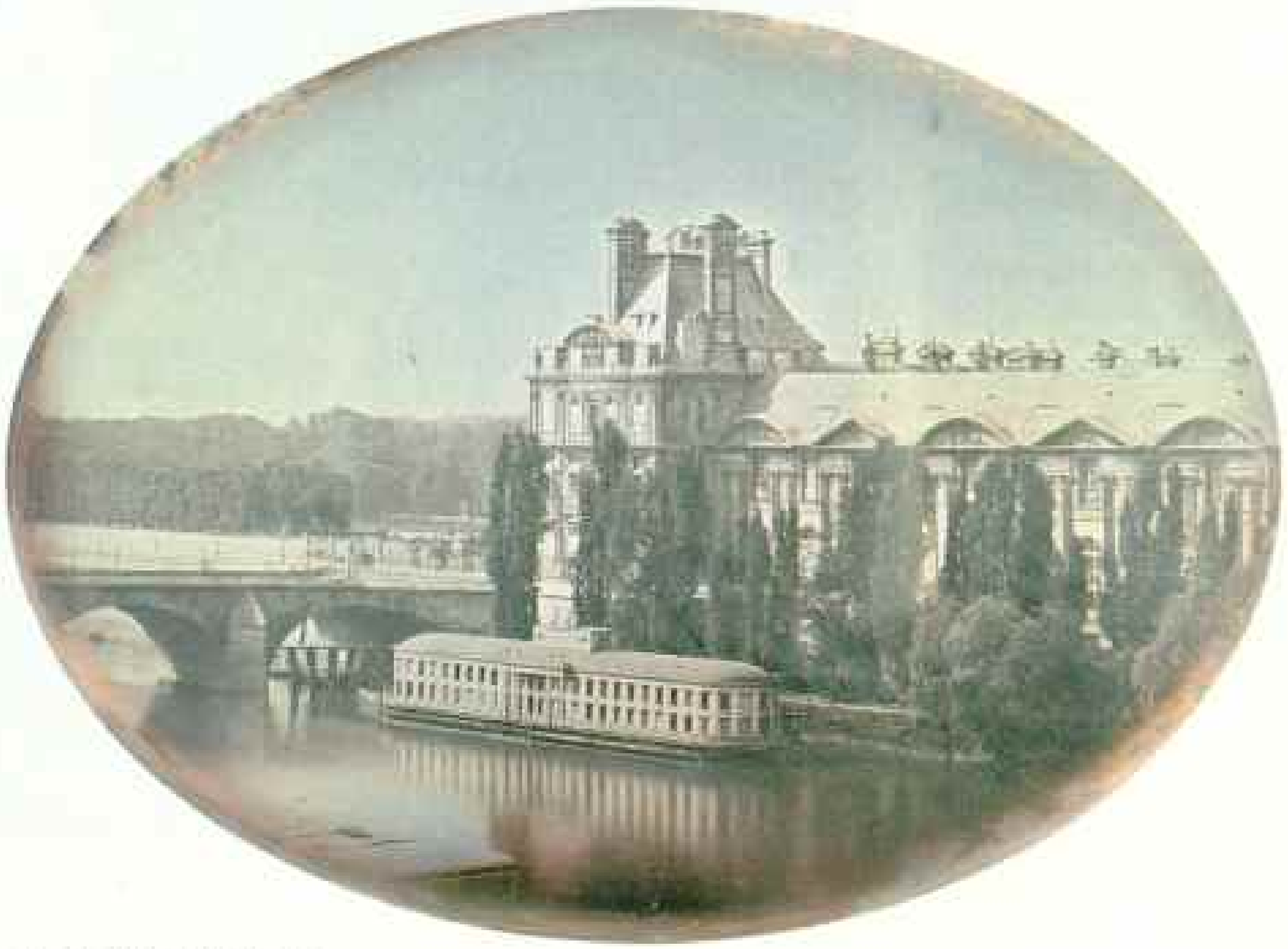
Evoking the splendor of the Tuileries (below right), Daguerre first demonstrated his new image-making process for the public at the Hotel d'Orsay. Legend holds that he stumbled upon the process after storing an experimental copper plate among several chemicals. The next day, mercury vapors had developed the image on the plate.

"PREMIÈRE ÉPREUVE FAITE PAR DAGUERRE DEVANT SES CONFRÈRES DE LA SOCIÉTÉ LIBRE DES BEAUX-ARTS," 1839; © MUSÉE NATIONAL DES TECHNIQUES, CNAM, PARIS

WILLIAM HENRY FOX TALBOT

Among the images fashioned by Talbot's invention of "photogenic drawing," a fragile swatch of lace (above) was captured on paper using silver chloride and sunlight.

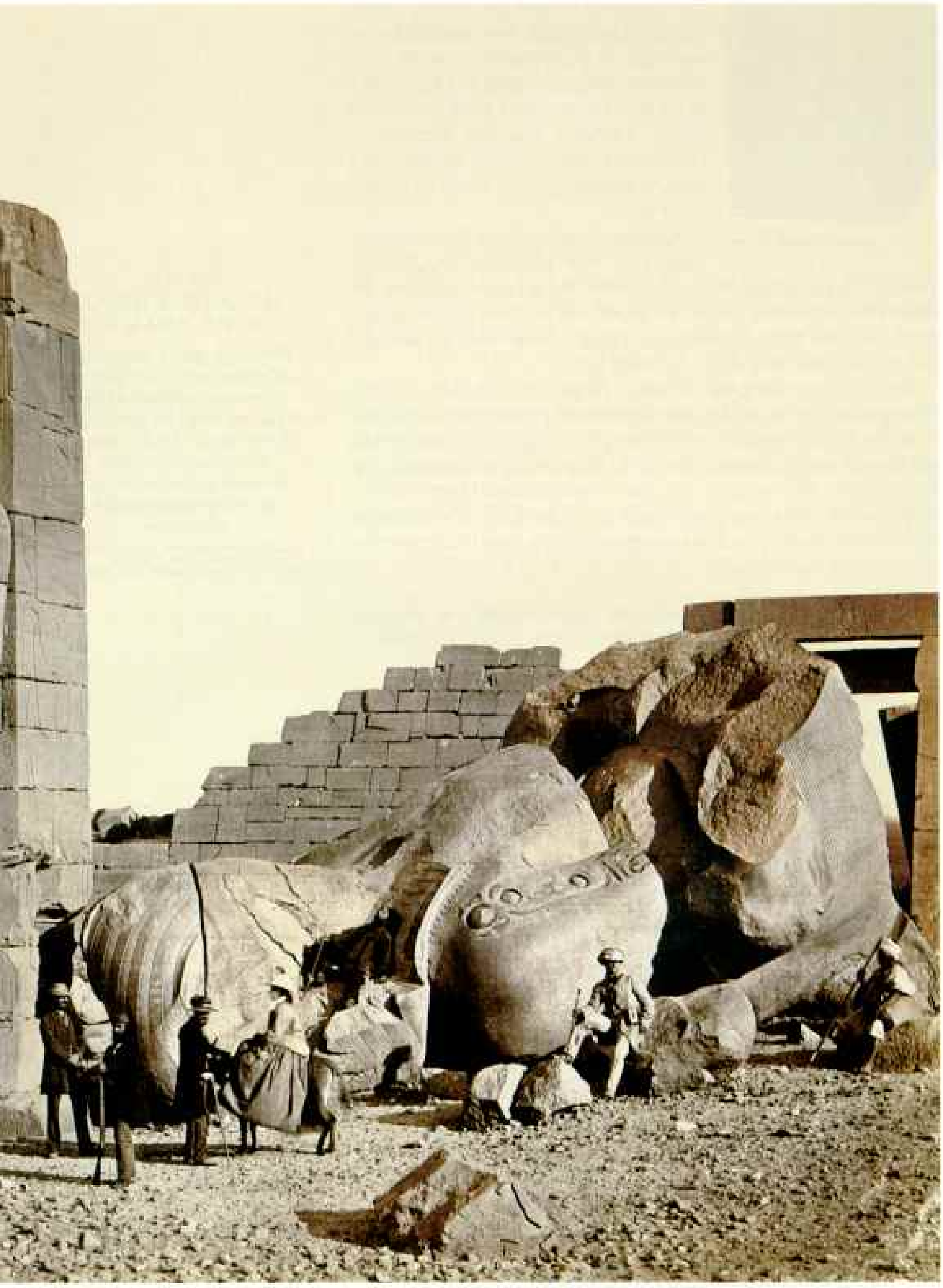
"LACE," C. 1844; NATIONAL MUSEUM OF SCIENCE AND INDUSTRY, LONDON, FOX TALBOT COLLECTION



FRANCIS FRITH

Cumbersome collodion wet plates, destined to be the standard process in photography over the next quarter century, were used by Francis Frith at mid-century to capture magnificent historical sites in Egypt and elsewhere in the Middle East. Selling individual albumen prints to travelers, archaeologists, and collectors—as well as supplying prints for two different editions of the Bible—Frith established himself as one of Britain's first great photographic publishers.

"FALLEN COLOSSUS,"
CA 1858; JANET LEHR, INC., NEW YORK



FOUR-LENS WET-PLATE CAMERA, CA 1860

photographed himself and having several photographer friends, was appalled by the onslaught of photography upon art: "The idolatrous mob demanded an ideal worthy of itself and appropriate to its nature," he wrote. "Daguerre was [its] Messiah. . . . Our squalid society rushed, Narcissus to a man, to gaze at its trivial image on a scrap of metal."

A generation later George Bernard Shaw, himself an avid photographer, gleefully asserted, "If you cannot see at a glance that the old game is up, that the camera has hopelessly beaten the pencil and paintbrush as an instrument of artistic representation, then you will never make a true critic: you are only, like most critics, a picture fancier."

Yet Delacroix, Gauguin, Cézanne, Degas, and Toulouse-Lautrec, among others, were quick to experiment with photography's new way of seeing. For the medium insisted on producing pictures that looked not like the world as seen by the eye or by painterly conventions. The hyperrealistic 20th-century American painter Edward Hopper admitted in despair: "I once got a little camera to use for details of architecture and so forth, but the photo was always so different from the perspective the eye gives, I gave it up."

WITHIN 20 years of its invention, the daguerreotype was obsolete. Because each image was unique and could not be used as a negative, it

DAVID OCTAVIUS HILL, ROBERT ADAMSON

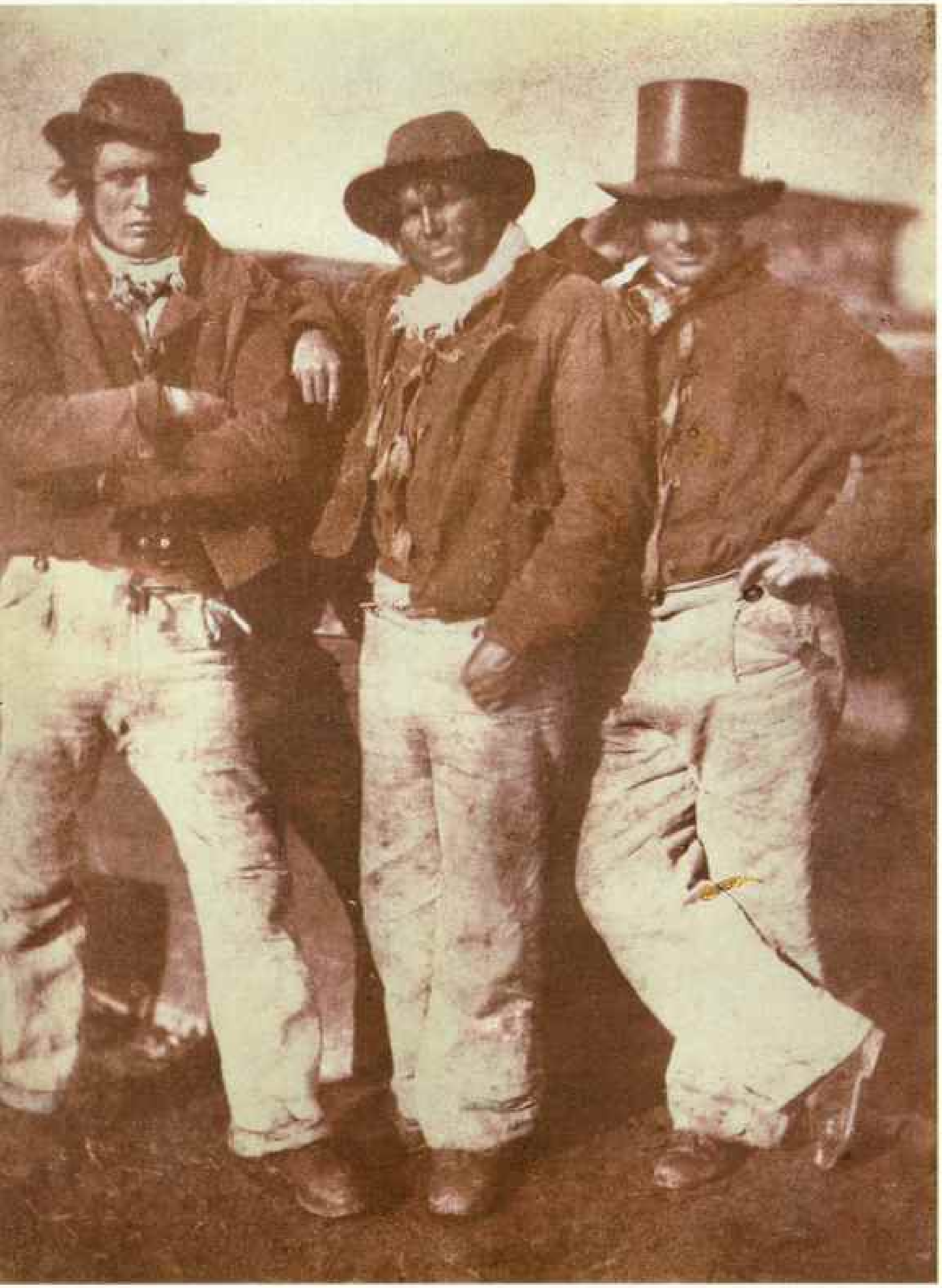
Projecting apathy, suspicion, and amusement, three Scottish fishermen (right) posed for a portrait in the fishing village of Newhaven. One in a series, this salted paper print followed a popular practice of romanticizing the life of the poor.

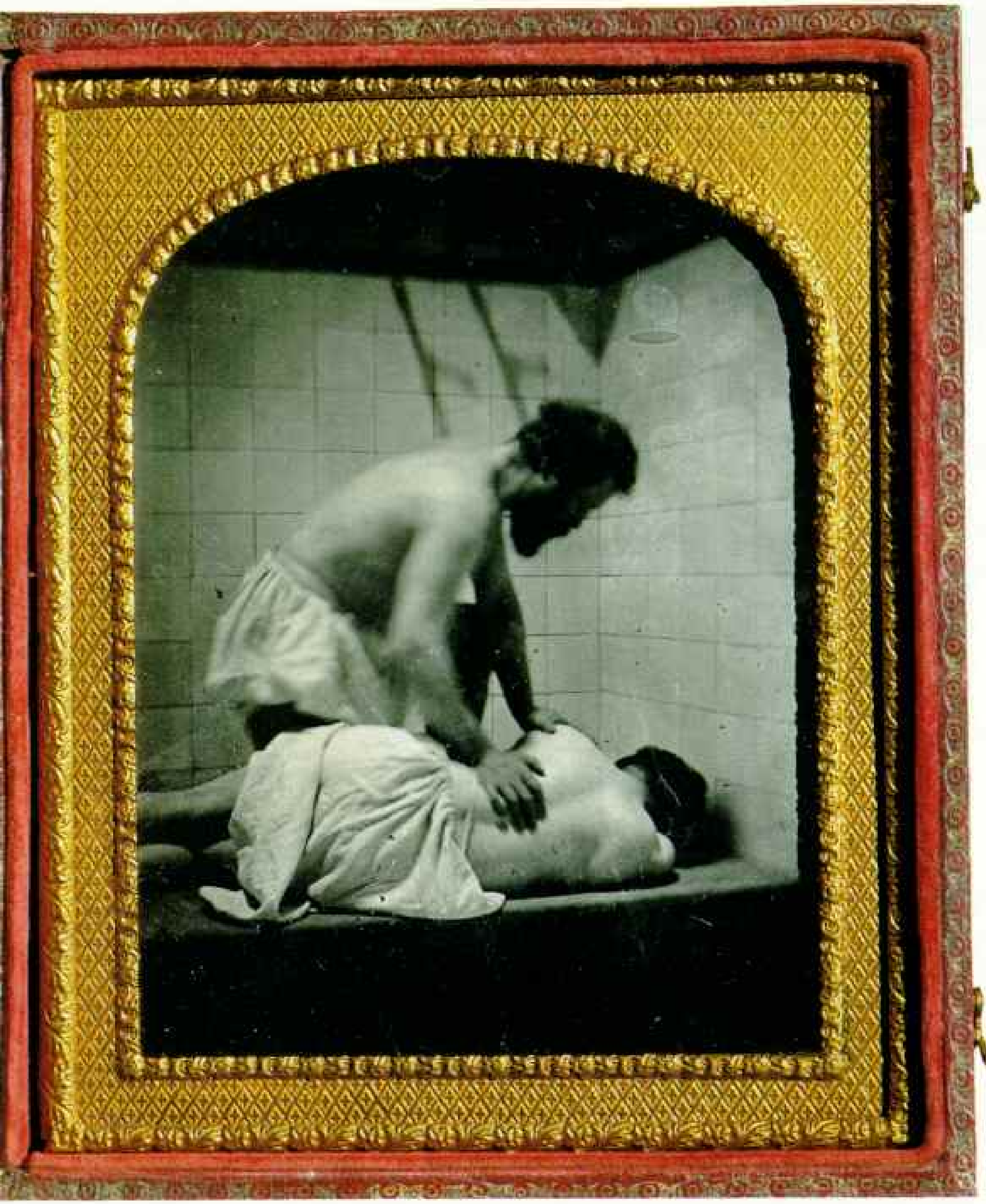
"ALEXANDER RUTHERFORD, WILLIAM RAMSAY, AND JOHN LISTON," CA 1845; ROYAL PHOTOGRAPHIC SOCIETY, BATH, ENGLAND

ALBERT SANDS SOUTHWORTH, JOSIAH JOHNSON HAWES

Setting themselves apart from their peers, Southworth and Hawes delved into the inner characters of their subjects. Bright skylights exaggerate Daniel Webster's imposing figure by darkening his eye sockets, dramatizing the overall daguerreotype image. A hidden neck brace held his head in place for the portrait, which required an exposure of 10 to 15 seconds.

"DANIEL WEBSTER," 1851; THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, GIFT OF I. N. PHELPS STOKES, EDWARD S. HAWES, ALICE MARY HAWES, MARION AUGUSTA HAWES, 1937





ROBERT CRAWSHAY

Fearing that photographers would not easily accept the paper prints of the new collodion process after years of viewing daguerreotypes, Frederick Scott Archer conceived the ambrotype—a transitional process that made a unique positive image on glass. Robert Crawshay, a well-known amateur in England, used the process to create this positive, silvery white image backed with black paint.

"STUDY OF A TURKISH BATH," CA 1870;
COURTESY BOARD OF TRUSTEES OF THE VICTORIA AND ALBERT MUSEUM, LONDON

was superseded by other processes, some of which had been the object of inquiry by Daguerre's peers: Joseph-Nicéphore Niepce, for instance, who in 1824 had used a camera to produce the world's first photograph on a lithographic stone; Hippolyte Bayard, who in 1839 was the first to make a positive image on paper with a camera; and the Englishman William Henry Fox Talbot, whose positive-negative processes were the forerunners of the system we use today. In 1851 Frederick Scott Archer made a great technical leap with his collodion process, which produced on a glass plate a negative as sharp as a daguerreotype that was capable of yielding innumerable positive prints.

Nevertheless, the daguerreotypists left an extraordinary portrait gallery of a generation and a rich record of experiment that went far beyond the familiar studio portrait: photographs of the moon through a telescope, the hand of a Florida sea captain branded "SS" for slave stealer, candid shots grabbed in the street. The daguerreotypists' legacy abundantly demonstrates the basic artistic truth that the photograph is made by the photographer, not by the camera.

Photographers certainly behaved like artists from the start. "Max's days are entirely absorbed and consumed by photography," wrote Gustave Flaubert from Egypt to his mother concerning his companion Maxime Du Camp. "He is doing well, but grows desperate whenever he spoils a picture or finds that a plate has been badly washed. Really, if he doesn't take things easier he'll crack up."

Eadweard Muybridge, photographing the California wilderness, "waited several days in a neighborhood to get the proper conditions of atmosphere for some of his views . . . cut down trees by the score that interfered with the cameras . . . had himself lowered by ropes down

JULIA MARGARET CAMERON

The inspiration for Lewis Carroll's Alice's Adventures in Wonderland, *Alice Liddell appears as a Roman goddess in this portrait by Julia Margaret Cameron, among the more innovative photographers of the 19th century. Valuing aesthetic qualities over descriptive ones, she photographed personal friends such as Robert Browning, Charles Darwin, Henry Wadsworth Longfellow, and Alfred, Lord Tennyson. One of the first to believe that photography could be an art, Cameron frequently placed her subjects in classical settings.*

"PSYCHE," 1872; ROYAL PHOTOGRAPHIC SOCIETY

CLEMENTINA, VISCOUNTESS HAWARDEN

In contrast to Cameron's forthright portraits, Hawarden's photographs—here of her daughters in London—possess a subtle strength. A member of the aristocracy, she pursued her hobby at a time when it was socially unacceptable for a woman of her class to dabble in such activities. To produce her albumen prints, she was forced to handle chemicals that emitted foul odors. Silver nitrate, which burns the skin and turns it black, could only be removed by washing with harsh chemicals.

"A STUDY FROM LIFE," CA 1862; COURTESY BOARD OF TRUSTEES OF THE VICTORIA AND ALBERT MUSEUM

ANDREW JOSEPH RUSSELL

Their muskets at rest, dead Confederate soldiers fill endless trenches at Fredericksburg, Virginia. Andrew Joseph Russell, who photographed railroad construction during the Civil War, also made battlefield photographs for his commanding general. In composing this picture, he emphasized the converging lines of rock wall and fallen soldiers.

"STONE WALL, REAR OF FREDERICKSBURG, WITH REBEL DEAD," MAY 3, 1865
LIBRARY OF CONGRESS

CHARLES MARVILLE

Finding elegance in utility, Charles Marville transformed a urinal into a thing of beauty. Commissioned to document Paris streetlights and public urinals during municipal improvements, he pioneered the art of civic photography.

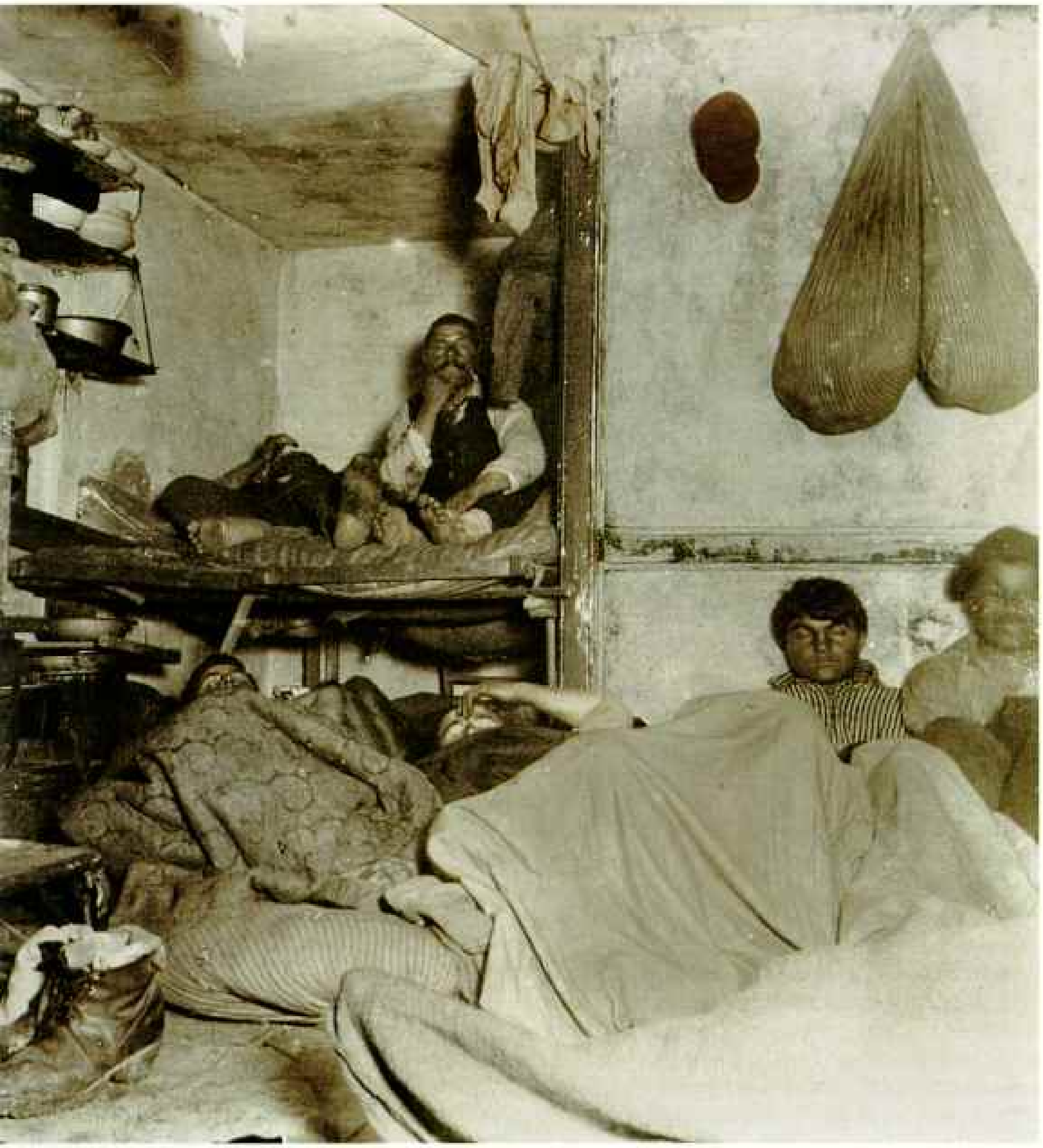
"NO. 2, URINOIR (SYSTÈME JOHNSON), PLATEAU DE L'AMBIGU," 1865–1870; PHOTOTHÈQUE DES MUSÉES DE LA VILLE DE PARIS, COLLECTION MUSÉE CARNAVALET

precipices . . . [went] to points where his packers refused to follow." Felice Beato, one of the first war photographers, shocked an army surgeon in one of China's Opium Wars who wrote, "Signor Beato was here in great excitement, characterising the group [of corpses] as 'beautiful,' and begging that it might not be interfered with until perpetuated by his photographic apparatus. . . ." Even domestic confusion was inevitable. The great portraitist Julia Margaret Cameron, who worked in her backyard, reminisced that her "habit of running into the dining room with my wet pictures has stained such an immense quantity of table linen with nitrate of silver, indelible stains, that I should have been banished from any less indulgent household."

IT WAS WHEN PHOTOGRAPHS could be easily reproduced (both by unskilled factory-system workers making copies and then in newspapers and books) that photography began to exert its remarkable force on our view of the world. Its potential as propaganda had been shown beginning with the Civil War. Abraham Lincoln, frequently photographed by Mathew B. Brady and acutely sensitive to the uses of publicity, uttered the famous remark, "Brady and the Cooper Institute [where Lincoln gave a crucial speech] made me President."

So far had photography entered our common experience by the last decade of the 19th century that Stephen Crane could write in *The Red Badge of Courage*: "His mind took a mechanical but firm impression, so that afterward everything was pictured and explained to him, save why he himself was there."

DRY-PLATE FIELD CAMERA, PERKEN AND SON LTD., LONDON, CA 1886



JACOB A. RIIS (?)

Moved to make a statement about the squalor of New York City slums, police reporter Jacob Riis added photographic documentation to the written word. Shocking in its visual impact, his series of prints helped lead to regulated housing—a step up from the Lower East Side slum dwellings.

"LODGERS IN A CROWDED BAYARD STREET TENEMENT. FIVE CENTS A SPOT," 1887. MUSEUM OF THE CITY OF NEW YORK, JACOB RIIS COLLECTION

CHARLES AUBRY

Probing with the camera's lens, Charles Aubry looks inquisitively at the intricate structure of a leaf. The sepia tone of this albumen print was achieved with a low concentration of gold chloride and a mild alkali mixture—a toning technique developed in 1855. The higher the concentration of gold, the bluer the print.

"A STUDY OF A LEAF (HERACLEUM LONGIFOLIUM)," CA 1856; FRAENKEL GALLERY, SAN FRANCISCO

The burgeoning souvenir trade found buyers for anything from individual prints to entire albums; in addition to historic ruins, the public wanted to see the world being transformed by the works of man, and increasing numbers of photographers were commissioned to document new feats of engineering. Andrew Joseph Russell and Alexander Gardner went from the battlefields of the Civil War to the railroads of the American West, documenting construction for the benefit of company engineers.

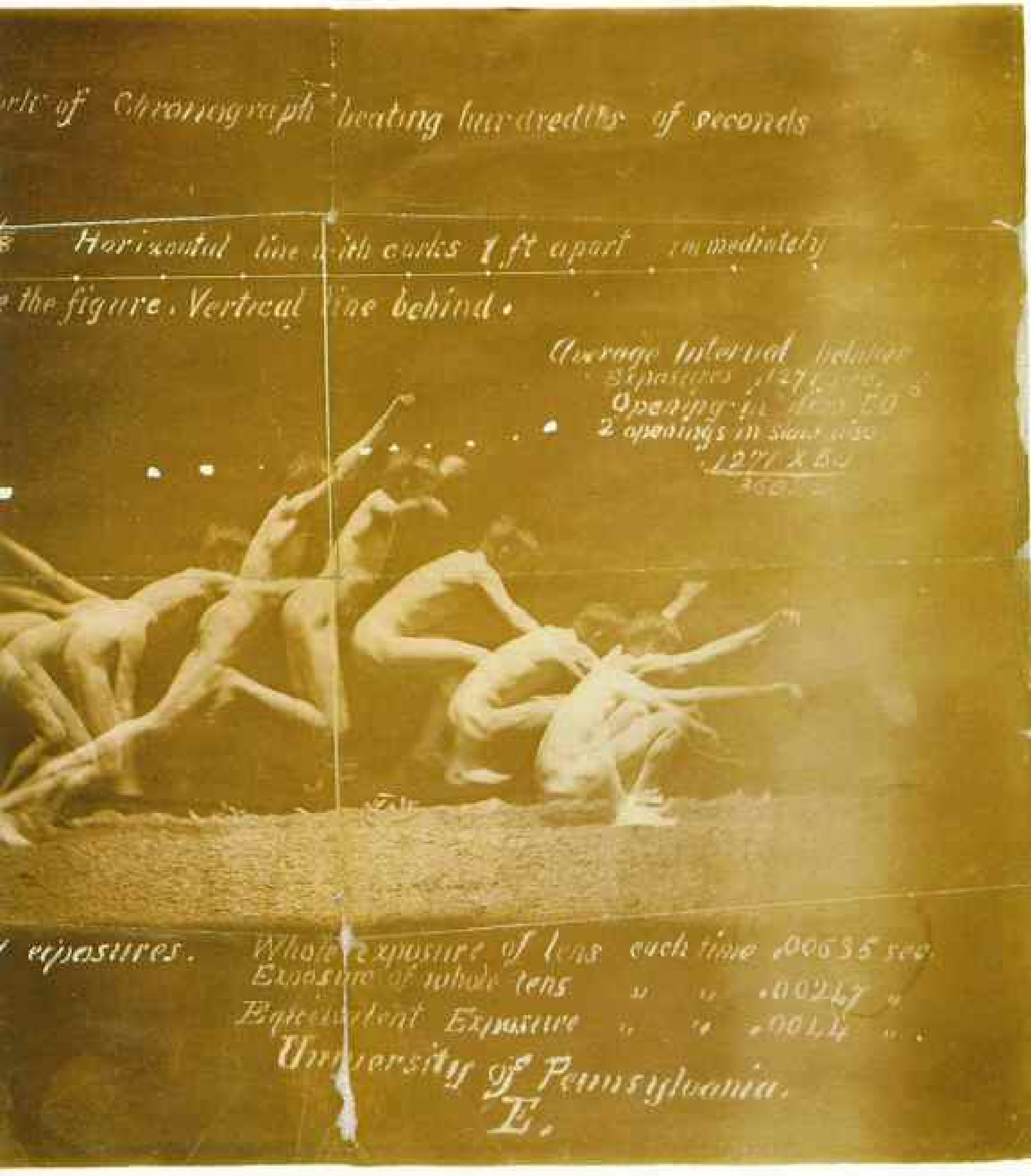
"The nineteenth century began by believing that what was reasonable was true," one critic observed, "and it wound up by believing that what it saw a photograph of was true." The camera continues to discover, as it did from its earliest days, meanings beyond mere description. Baudelaire castigated photography as "art's most mortal enemy," foreseeing that photography would give the real a firmer grip on our emotions than the ideal. Oscar Wilde apprehended the truer meaning of the craft, though ironically he was commenting on a painting when he wrote: "The true mystery of the world is the visible, not the invisible."

By 1889, when George Eastman was marketing his first Kodak for the amateur market with the irresistible slogan "You press the button, we do the rest," we had become seduced and then obsessed by the visual world. Far from plagiarizing nature, photography has seemed to transform it by revealing the "strangeness of the commonplace" to our still astonished eyes. □

THOMAS EAKINS

Fascinated with human anatomy, American painter Thomas Eakins captured the fluidity of motion through multiple exposures. The scientific accuracy afforded by this technique was yet another step in the advance of photography.

"NUDE BROAD JUMPING," 1884; THE LIBRARY COMPANY OF PHILADELPHIA

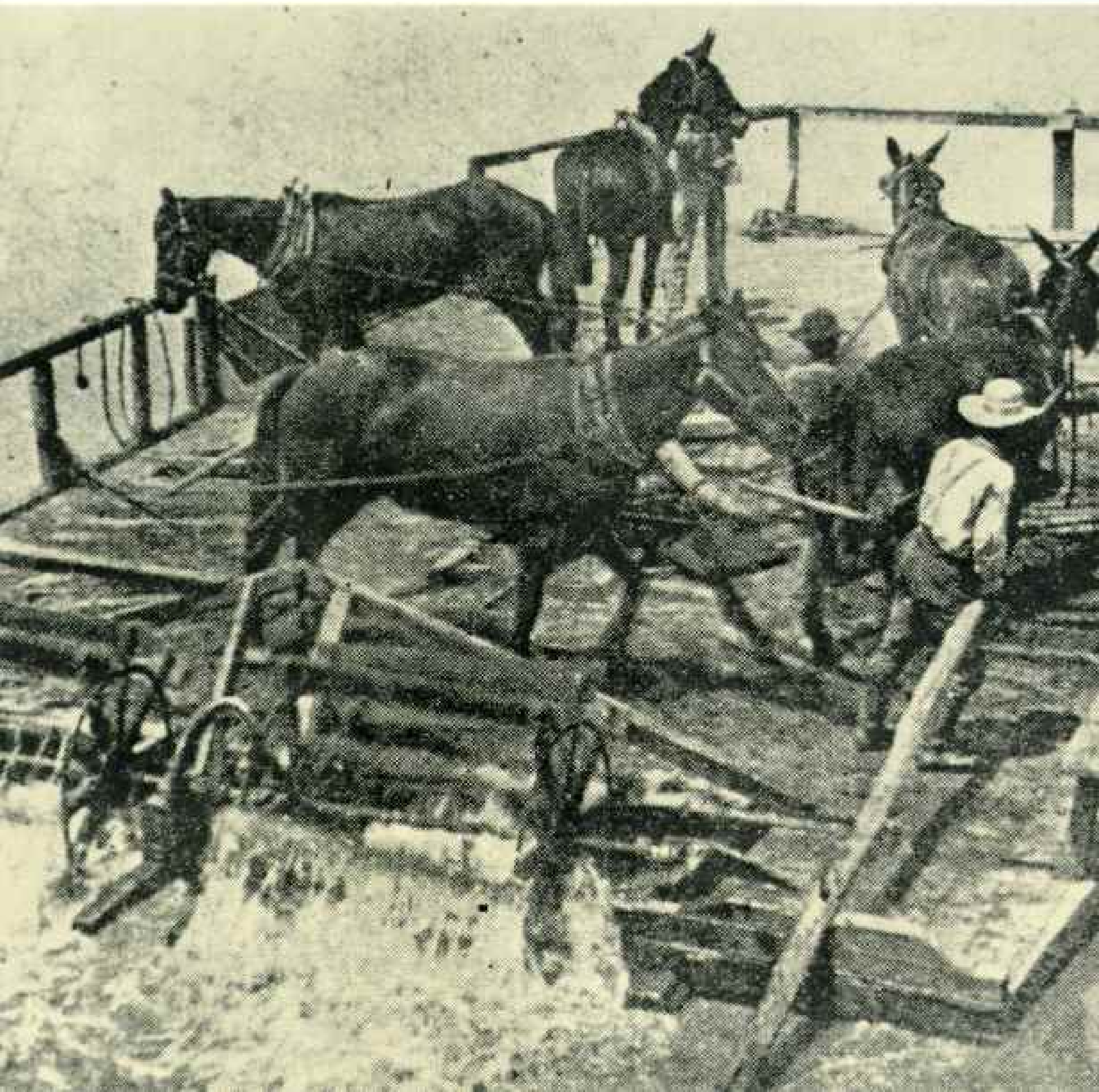


Photographs for this article were taken from a special exhibition, "On the Art of Fixing a Shadow: 150 Years of Photography," which was funded by the Eastman Kodak Company. The exhibition is at the Art Institute of Chicago September 16 to November 26, and will appear at the Los Angeles County Museum of Art December 21, 1989, to February 25, 1990. It opened in May at the National Gallery of Art in Washington, D. C.

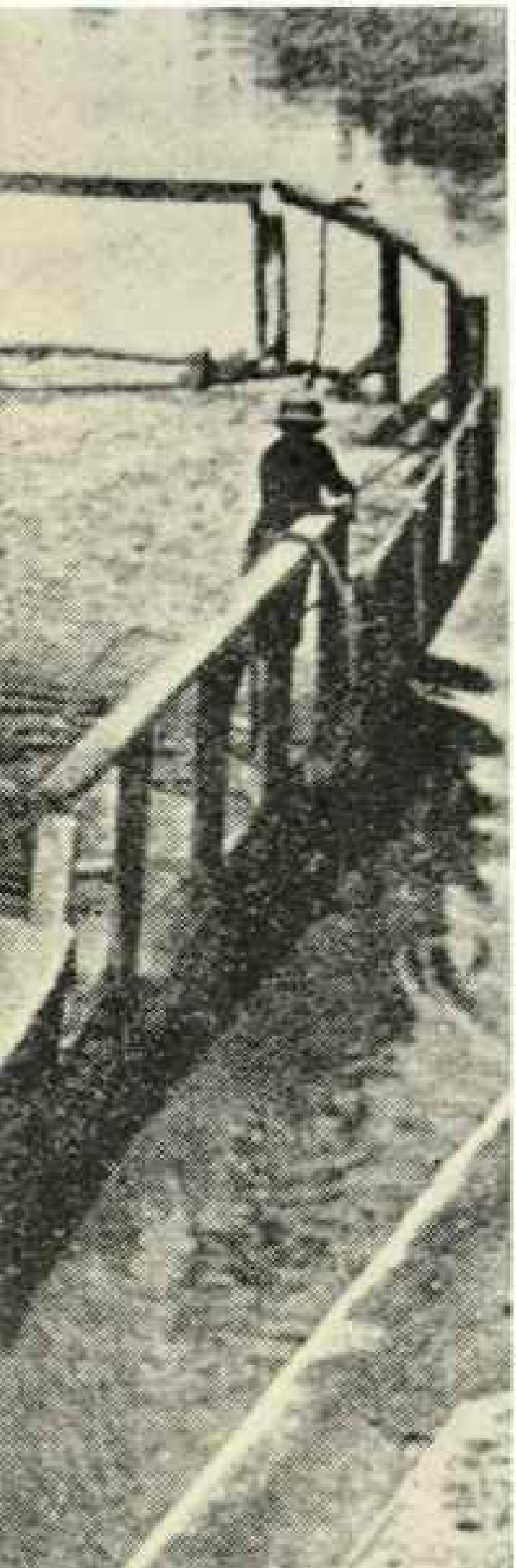
Heyday of the Horse Ferry

A long-forgotten animal-powered craft is discovered on the bottom of Lake Champlain.

By DONALD G. SHOMETTE



BODLEIAN LIBRARY, OXFORD, ENGLAND (ABOVE); THE PUBLIC LIBRARY OF CINCINNATI AND HAMILTON COUNTY, OHIO



DRUMMING HOOFS and swirling paddle wheels drive a horse- and mule-powered cargo ferry across the Mississippi River at St. Marys, Missouri, around 1910 (left). Introduced into the United States in the late 1700s, these animal-powered vessels competed for a time with steamboats as successors to sail-powered ships. Known as teamboats, they employed as many as 22 horses or mules at a time, transporting up to 200 passengers and reaching speeds of five knots. The steamboat prevailed, but animal-powered craft continued to operate in the U. S. into the 20th century.

The concept of propulsion by animal power is an ancient one, as seen in a medieval copy of a fourth-century A. D. Roman illustration (above) depicting a battle ram propelled by oxen. They were harnessed to a series of capstans connected by gears to six paddle wheels. The vessel *Liburna*, named for a region along the Adriatic coast, was probably never built. But the idea of paddle-wheel ships powered by animals or humans intrigued later inventors such as Italian engineer Agostino Ramelli, German military designer Konrad Kyeser, and Leonardo da Vinci.

Men, not animals, powered the first known working version of such vessels—a 209-ton ship tested in the harbor of Barcelona, Spain, in 1543. Nearly a century and a half later Prince Rupert of the Rhine had an eight-horsepower paddle-wheel vessel built. In a race against the royal barge of England's King Charles II on the Thames River, Rupert's vessel won handily, though traditional marine designers ignored the innovation.

The first known animal-powered craft in the U. S. was a horse-driven boat built on the Delaware River in 1791 by John Fitch, a pioneer in steam-powered ships. By 1838 teamboats had spread westward to the Mississippi, where they were used primarily as ferries. In the vessel at left two horses and two mules are harnessed to a capstan connected by gears below deck to a pair of paddle wheels at the stern. Such boats inspired a newspaper to exclaim: "Thus in a few years we have witnessed the wonderful improvement from sails to steam, and from steam to animal power."

Marine archaeologist, historian, and author of several books, DONALD G. SHOMETTE is a staff member of the Library of Congress.

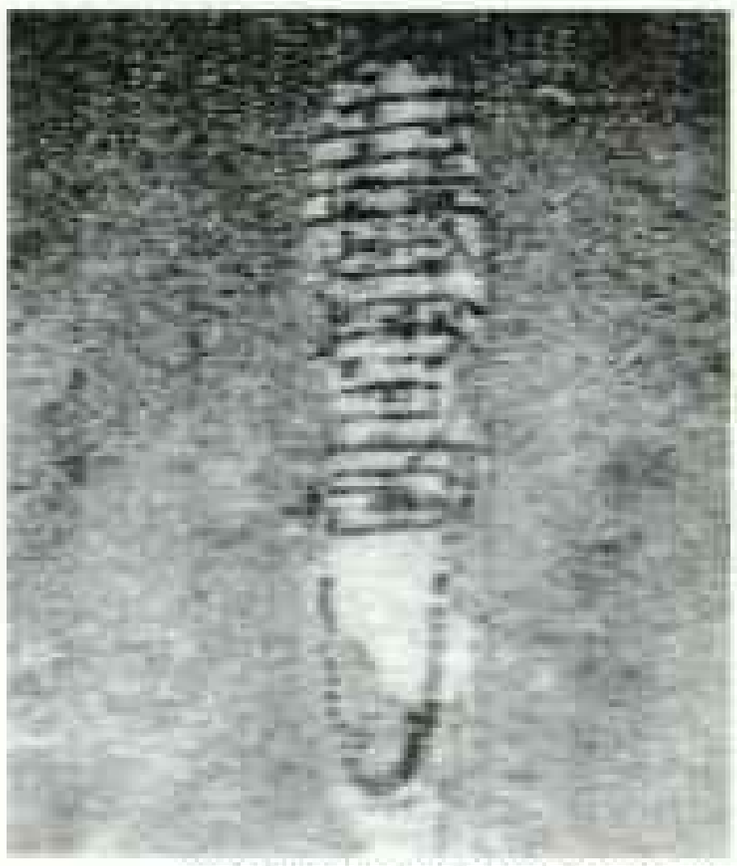
Lake Champlain yields a teamboat

Wedged between New York and Vermont, the sheltered waters of Lake Champlain (left) were ideally suited to teamboat commerce. In the first half of the 19th century animal-powered ferries, with names like *Eagle*, *Eclipse*, and *Gypsy*, made regularly scheduled runs across the lake. One possible teamboat route, between Burlington and Port Kent, is served today by a modern automobile ferry.

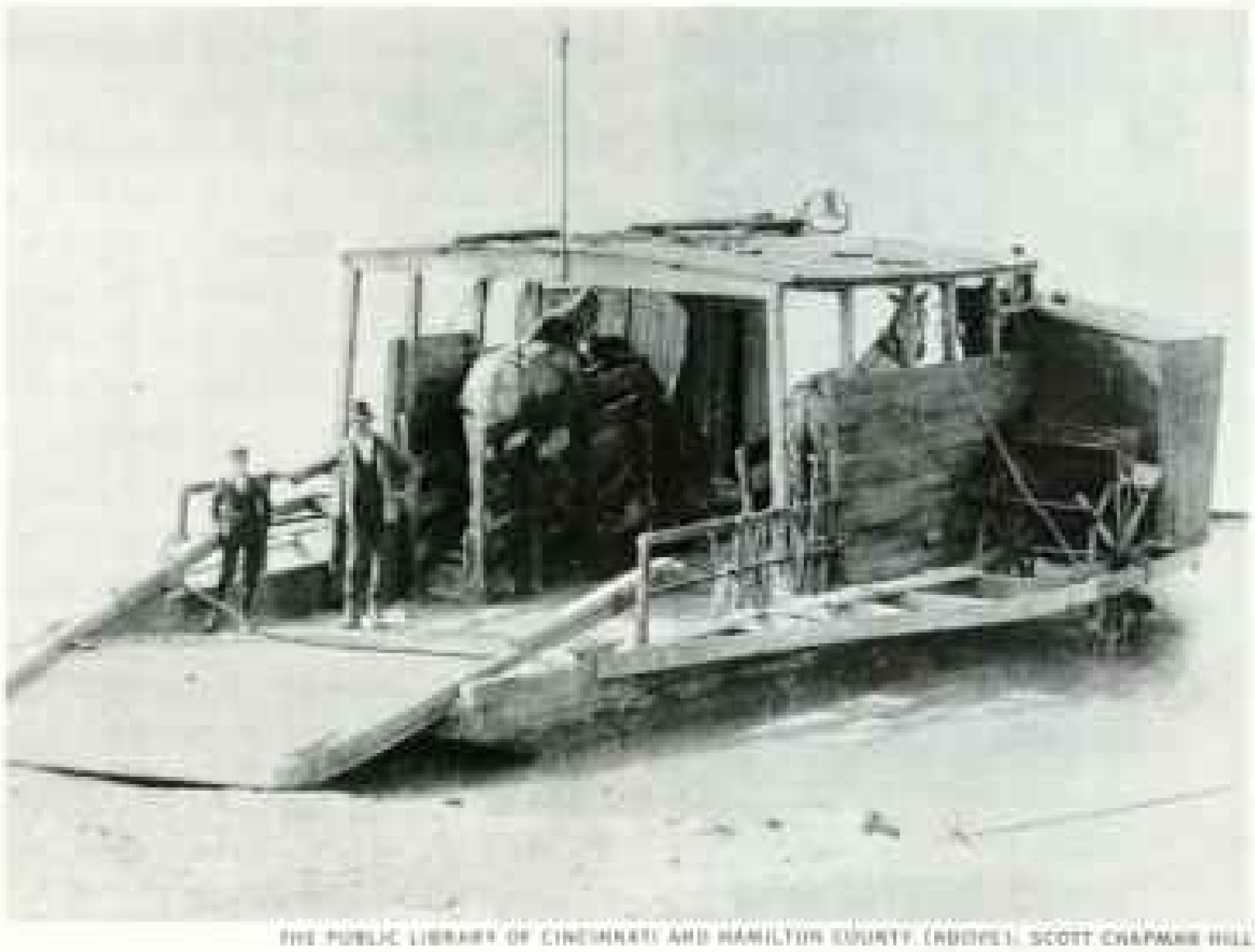
In 1983 researchers Scott Hill and James Kennard surveyed the lake bottom near Burlington by side-scan sonar and discovered the remains of a 19th-century teamboat near the Burlington-Port Kent ferry route. Their survey produced a remarkably detailed sonar image of the wreck (right), showing the outline of the hull and the massive cross timbers.

With a permit from Vermont and a small federal grant they began an archaeological survey of the 63-foot-long vessel. Careful inspection revealed that the craft was similar to a class of two-horse teamboat patented

EMORY KRISTOF



JAMES KENNARD AND SCOTT CHAPMAN HILL



THE PUBLIC LIBRARY OF CINCINNATI AND HAMILTON COUNTY (ABOVE); SCOTT CHAPMAN HILL

OPPOSITE PAGE FOLDS OUT >

in 1819 by Barnabas and Jonathan Langdon and operated at several points along the Hudson River. Another type of two-horse ferry (bottom left) ran on the Ohio River in the late 19th century.

In the winter of 1988 Scott Hill invited NATIONAL GEOGRAPHIC photographer Emory Kristof and me to conduct an additional survey of the Burlington teamboat through the lake's frozen surface, using sector-scan sonar and a remotely operated underwater vehicle, or ROV.

After cutting an opening through the eight-inch-thick ice, we lowered the ROV to the bottom (top left) and filmed the wreck extensively.

Later I dived on the wreck, whose fragile paddle-wheel spokes are examined by another diver (right). Although the wooden paddles between the spokes were missing, the wreck was well preserved in the lake's cold, fresh water.

My dive provided a possible answer to why the Burlington teamboat sank. Before the dive I had pored over hundreds of photographs and sonar and video recordings of the sunken vessel without finding the cause of the wreck. But once underwater I found a series of cracked frames along the ship's starboard side that had eluded the video lens. The cracks and other damage to the vessel's hull suggest that the ferry may have been trapped and crushed by ice, probably during a late-autumn run. The fact that deck planks had been removed suggests also that salvors had time to retrieve everything of value before the ferry went down.

Underwater mosaic of a historic craft

To produce a detailed portrait of the Burlington teamboat, Scott Hill enlisted the help of fellow divers and the support of Eric Gilbertson and Giovanna Peebles of Vermont's Division for Historic Preservation and of the Champlain Maritime Society. With a grant from the National Park Service administered by the state of Vermont, Hill and his colleagues built a movable plastic-and-aluminum frame three and a half feet above the lake-bottom wreck. Then they attached an underwater camera with strobe lights to the frame so that the camera could slide back and forth to any point above the site. Inching the camera along, Hill made a total of 550 overlapping photographs in the space of only two days.

"That was the *easy* part," Hill recalls. "Then we had to take those 550 shots back to the photo lab, develop them, and assemble them into an accurate rendition of the ship. It was like trying to put together a giant jigsaw puzzle without a picture of the completed scene to go by. It took us more than three months to do the job."

The result of their efforts is a unique portrait of one of the only known teamboat wrecks in the United States.

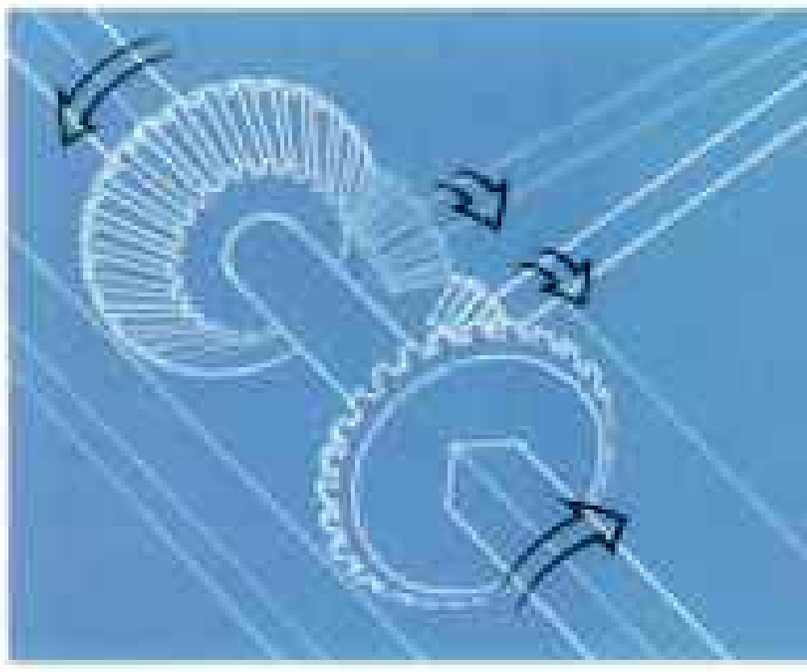
Like many modern-day ferries the teamboat was double-ended and could navigate in either direction. The remains of the paddle wheels are amidships at the vessel's sides, still joined by the 20-foot-long main axle and connected by a pair of gear wheels to the drive shaft. Remnants of the huge turntable on which the horses walked appear beneath the deck timbers. For scale, Hill posed divemaster Don Mayland in the vessel's empty section. Douglas Entz (below right) inspects the ferry's twin gear wheels amid a pile of timbers.

PHOTO MOSAIC BY SCOTT CHAPMAN HILL WITH DENNIS R. FLOSS AND MILT SHARES; SCOTT CHAPMAN HILL (INSET)

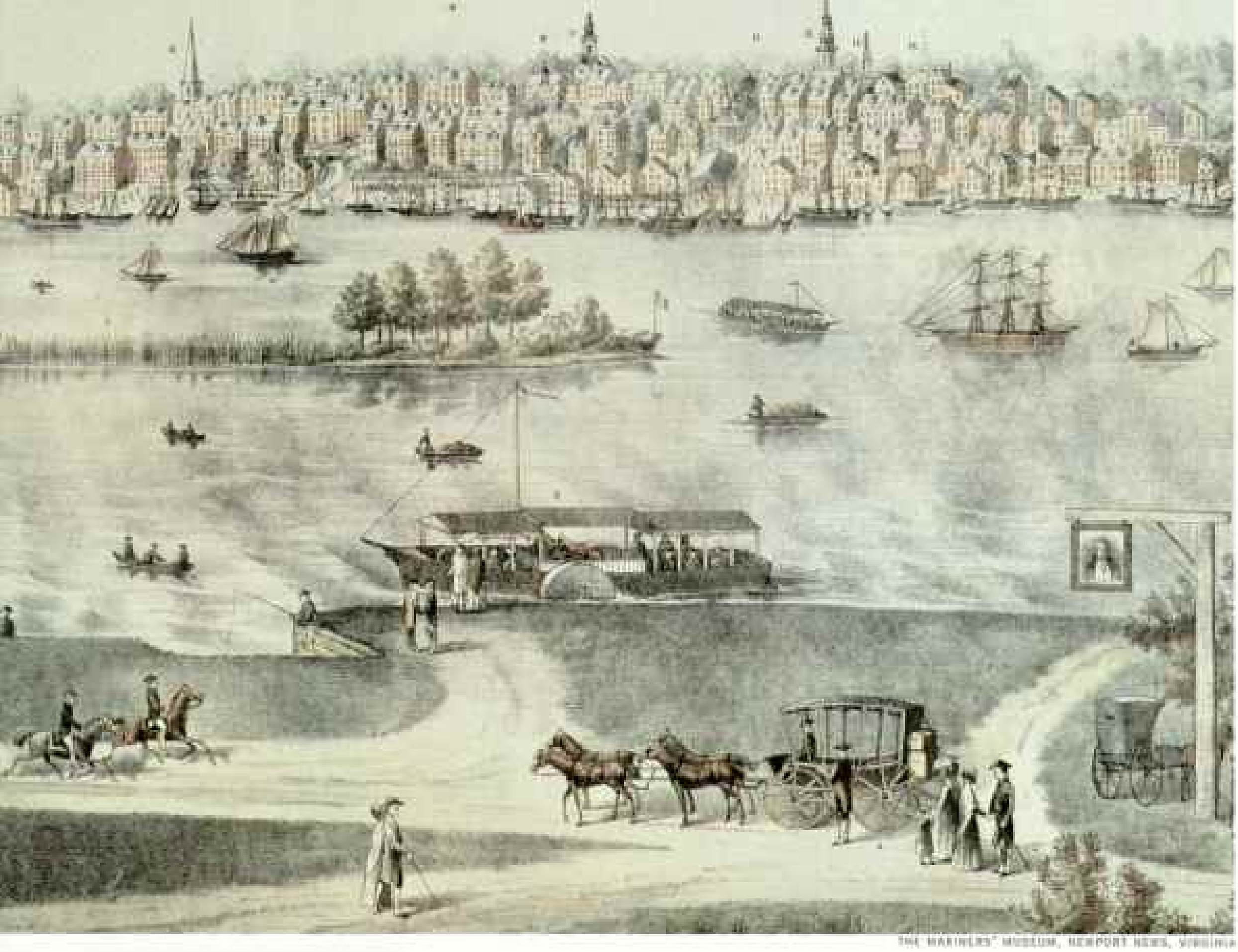
Inner workings of a teamboat

At least 16 designs for teamboats were filed with the U. S. Patent Office, but the Burlington ferry was typical. Two mules or horses walked a large turntable mounted beneath the deck. The turntable drove the paddle wheels via a system of gears, drive shaft, and main axle.

To reverse direction, the pilot pulled a lever shifting the drive shaft from one axle gear wheel to the other (right), reversing the paddle wheels. A scale model of the wreck, carved by Lt. Comdr. Robert Gwalchmai of the Canadian Navy, will be presented to the people of Vermont by the National Geographic Society.



PAINTINGS BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BOND



THE MARINERS' MUSEUM, NEWPORT NEWS, VIRGINIA

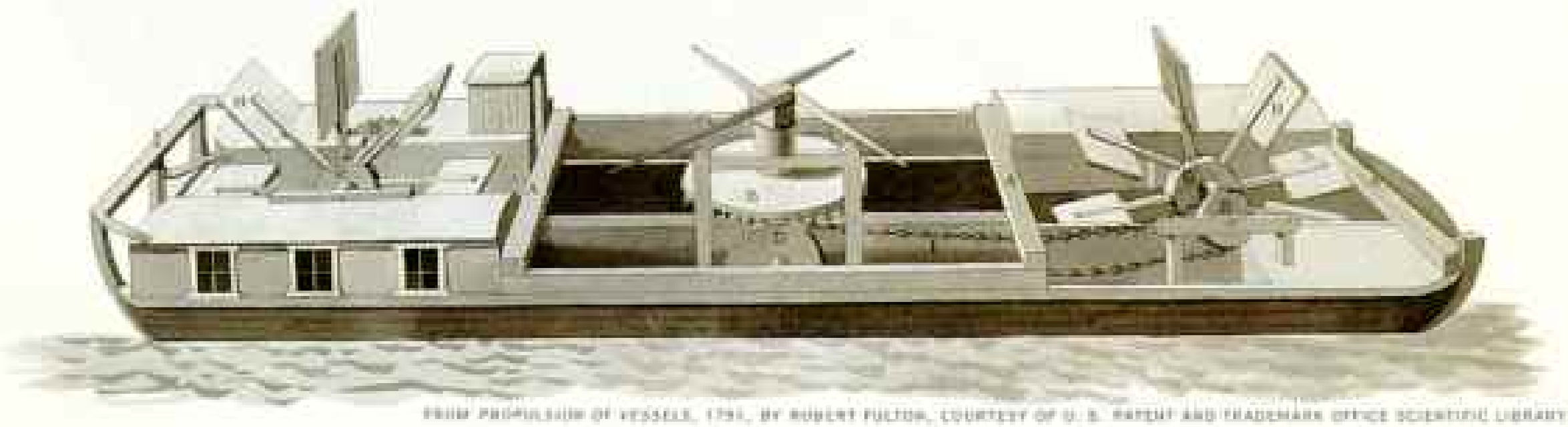
The passing of the horse ferry

The height of the teamboat era in the U. S. lasted from 1814 to the middle of the century, by which time steam-powered vessels had literally pulled ahead. By 1840 horse-powered ferries had seen service at Albany, Hartford, New York City, Washington, D. C., and Philadelphia. An 1820 print of Philadelphia shows a 40-foot ferry docked at Cooper Point as a second rounds a spur of land in the Delaware River.

First introduced in America's eastern cities, teamboats moved westward with the settlers to the Ohio country and the Mississippi and Missouri Rivers. By the time of the Civil War the number of animal-powered craft had begun to decline. Few ever appeared in the Far West.

Among the many versions of teamboats was a man-powered catamaran-hulled craft (below) patented by inventor William P. Sprague in 1795 and tested on the Delaware River. Four men amidships turned the capstan, which was connected by a chain to paddle wheels fore and aft. Like John Fitch's teamboat, Sprague's invention was a mechanical success but a commercial failure.

The last American teamboat—a modest craft powered by a single blind horse—was retired in 1929. It had served only briefly, but it is perhaps fitting that the home port of this humble descendant of the ancient *Liburna* was Rome—Tennessee, that is. □



FROM PROPULSION OF VESSELS, 1796, BY ROBERT FULTON, COURTESY OF U. S. PATENT AND TRADEMARK OFFICE SCIENTIFIC LIBRARY

FROM SEA TO SHIN
SUCCEED IS PART OF

...G SEA, THE WILL TO ...HE AMERICAN SPIRIT.

The instant you become an American, whether by birth or by choice, you are guaranteed a particular freedom that is nowhere mentioned in the Constitution, but in fact flows from it.

You are guaranteed the freedom to succeed.

You are free to dream your own dream of success, to study, to work, to create and discover and build, for yourself and your children, the success you want.

Our deep belief in that idea is one reason that our company—Citicorp and Citibank—has grown to become by far the nation's largest financial services organization.

For over 175 years, our freedom to innovate, to create new financial ideas and services, has led to an unbroken line of initiatives allowing us to help countless millions of individuals.

Today, more Americans are pursuing college education and graduate degrees with help from us than from any other private lender.

More are getting what they want with the help of MasterCard® and Visa cards from Citibank than from any other company.

And more Americans who once dreamed of "some day" owning their own homes now own them, or are buying them, with help from Citicorp and Citibank.

Meanwhile, here at home and in 90 other countries, Citicorp and Citibank serve over 25,000,000 customers, companies and governments, in every major world marketplace.

We can help you, or your company, achieve success, here and abroad.

Whether you get to know us as Citicorp or Citibank, we'd like you to get to know us better.

CITICORP

BECAUSE AMERICANS WANT TO SUCCEED, NOT JUST SURVIVE.™

What good is more legroom than the biggest Cadillac if you don't have Ultradrive transmission?

Introducing Chrysler Fifth Avenue.

Study the interior of the 1990 Chrysler Fifth Avenue, and luxury impacts every sense. Legroom unavailable in many larger, far more expensive cars. Available Mark Cross leathers and an eight-way power memory seat for the driver. Climate-controlled air conditioning. Infinity II stereo sound through four speakers. And more standard features than any car in its class.

But Chrysler believes true luxury must also include the

*See this limited warranty at dealer. Restrictions apply. Excludes normal maintenance, adjustments and wear items. Comparison to 1989 competitive warranties.

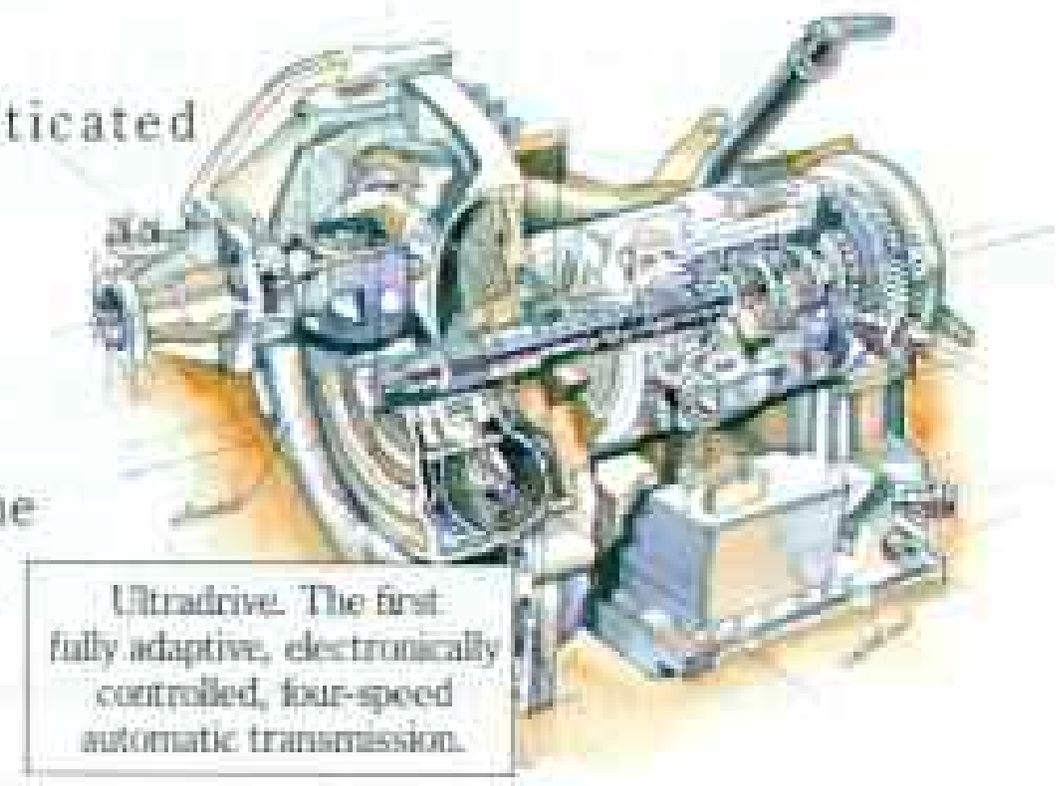
precisely the right moment. The result is a remarkably smooth ride, enhanced engine performance, and impressive fuel efficiency. And because the adaptive controls in Ultradrive also compensate for fluid changes, engine changes and internal wear...its performance remains dependable after years of ownership.

luxury of sophisticated engineering.

World's most advanced transmission.

Ultradrive is the world's first fully adaptive, electronically controlled, four-speed automatic transmission.

It "fine-tunes" itself, constantly sensing and adapting to changes in speed and driving situations. Electronically and automatically, Ultradrive shifts Fifth Avenue into precisely the right gear at



Ultradrive. The first fully adaptive, electronically controlled, four-speed automatic transmission.

A high-tech, high-performance engine.

Ultradrive is linked to a new 3.3-liter multi-point, fuel-injected V-6 with direct ignition. It delivers 90 percent of its full torque at only 1,600 rpm. Translation: It gets Fifth Avenue off the mark fast, and stays nicely quiet at cruising speeds.

Chrysler's Crystal Key Program

	BASIC CAR WARRANTY Covers entire car except normal upkeep	MAJOR COMPONENTS PROTECTION	DEDUCTIBLE YOU PAY FOR REPAIR of major components	POWERTRAIN/ ENGINE PROTECTION	OUTER BODY RUST-THROUGH PROTECTION
1990 CHRYSLER NEW YORKER FIFTH AVENUE	5 YEARS/ 50,000 MILES	5 YEARS/ 50,000 MILES	NONE	7 YEARS/ 70,000 MILES	7 YEARS/ 100,000 MILES
1989 ROLLS ROYCE CORNICHE	3 YEARS/ UNLIMITED	3 YEARS/ UNLIMITED	NONE	3 YEARS/ UNLIMITED	3 YEARS/ UNLIMITED
1989 MERCEDES BENZ 560 SEL	4 YEARS/ 50,000 MILES	4 YEARS/ 50,000 MILES	NONE	4 YEARS/ 50,000 MILES	4 YEARS/ 50,000 MILES
1989 CADILLAC SEDAN DEVILLE	4 YEARS/ 50,000 MILES	4 YEARS/ 50,000 MILES	$100 AFTER 1 YR./12,000 MILES	4 YEARS/ 50,000 MILES	6 YEARS/ 100,000 MILES
1989 LINCOLN CONTINENTAL	1 YEAR/ 12,000 MILES	6 YEARS/ 60,000 MILES	$100 AFTER 1 YR./12,000 MILES	6 YEARS/ 60,000 MILES	6 YEARS/ 100,000 MILES

The most comprehensive protection.

Fifth Avenue's new engine and Ultradrive form a powertrain with quality and performance Chrysler has the confidence to back for 7 years or 70,000 miles.* And Crystal Key Owner Care covers Fifth Avenue from bumper to bumper, including electronic components, for 5 years or 50,000 miles.* That's a warranty you can't get from Rolls Royce or Mercedes Benz.

Automotive luxury today is not simply the name, but the engineering behind the name. Chrysler New Yorker Fifth Avenue.

For information, please call 1-800-4A-CHRYSLER

7/70

There Is No Luxury Without Engineering.

"BY 1945, AMERICA'S FORESTS WILL BE HISTORY."

In 1920, authorities predicted that we'd run out of forest land in 25 years. But today we have nearly *730 million acres* of lush forest land in the U.S. — and more trees than we had 70 years ago.

Thanks, in part, to private landowners and America's forest products companies, who plant over 6,000,000 trees a day, reseed entire forests, and use other forest management techniques to promote natural regrowth.

We're determined to keep up with the growing demand for wood and paper products. And to make sure our forests will continue to make history.

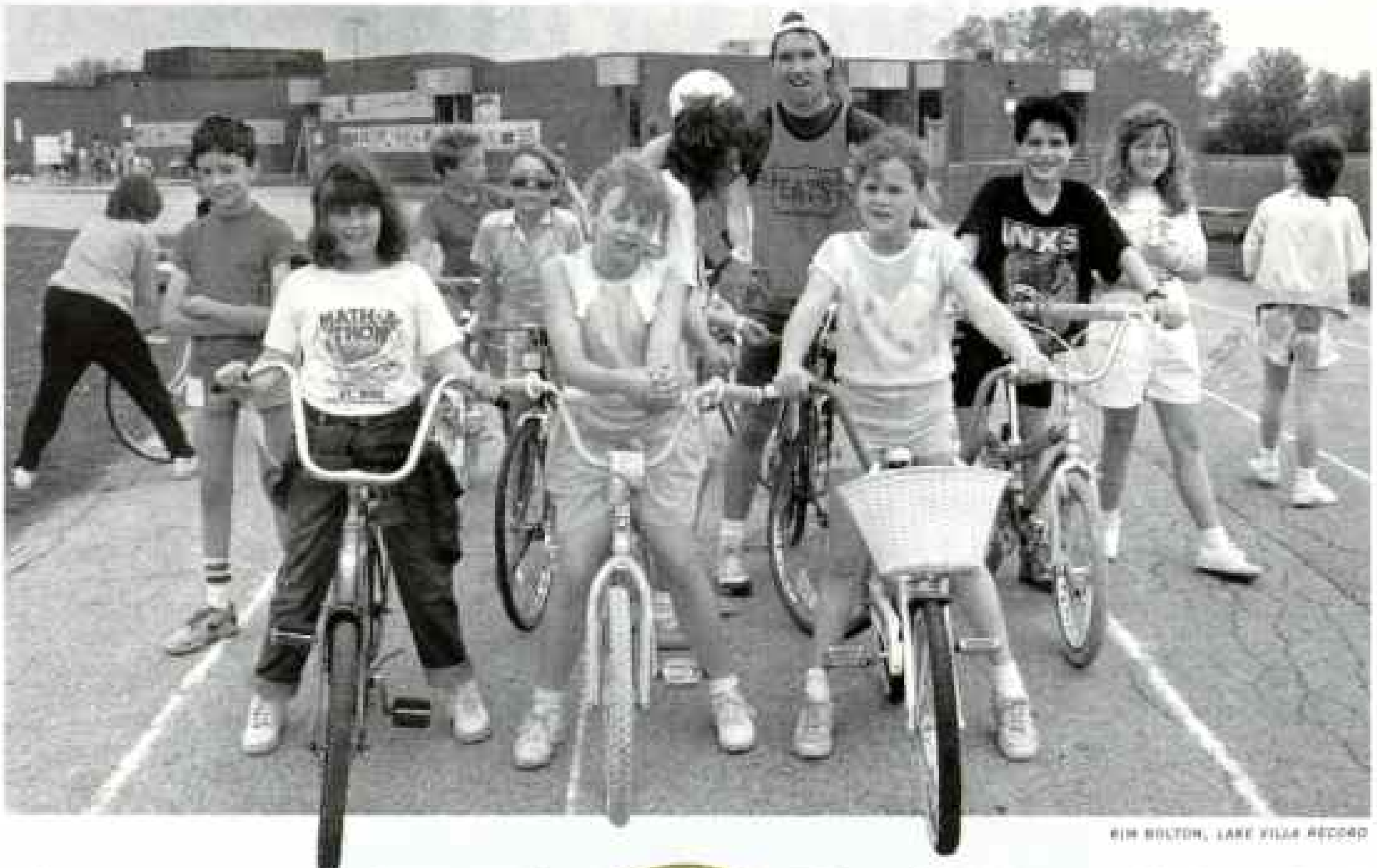
To learn more about the future of America's forests, write: American Forest Council, 1250 Connecticut Avenue, N.W., Washington, DC 20036. Or call **1-800-648-6699.**

AMERICAN FOREST COUNCIL
MANAGING THE FUTURE OF AMERICA'S FORESTS

Boise Cascade · Bowater, Inc. · Champion International · Consolidated Paper, Inc. · Gaylord Container Corp. · Georgia-Pacific · International Paper · ITT Rayonier · Mead Corp. · Packaging Corp. Of America · Simpson Timber · Temple-Inland · Union Camp Corp. · Weyerhaeuser · Willamette Industries

A ride for wildlife

THE NATIONAL GEOGRAPHIC SOCIETY



KIM BOLTON, LAKE VILLA RECORD

AROUND AND AROUND they went. For five hours one Saturday in May, 115 students pedaled their bicycles through a two-mile course in Lake Villa, Illinois, in a bike-a-thon to raise money for the mountain gorilla and the California condor, two species on the brink of extinction.

The event was organized by Judith Bock's eighth-grade class at Lake Villa Intermediate School. Ms. Bock, a 1988 graduate of the Society's Summer Geography Institute—and an instructor at this year's session—had inspired her class of gifted and talented students through a series of lessons on African geography and wildlife. By the end of the bike-a-thon, they had logged 2,000 miles and raised nearly $2,800 for the World Wildlife Fund.

"That was a lot of money for us," said eighth grader Alisa Yingling. "We hope it encourages other people to see that even a small group can do something good for a cause."

These kids were demonstrating exactly the kind of spirit for which the National Geographic Society itself was recently honored. At a ceremony in Paris in June, we were awarded a medal (above) by the renowned Institut de France for our work in encouraging geographic awareness.

"The earth is our common inheritance," said Pierre George, a member of the institute's Academy of Ethical and Political Sciences. And geography, he reminded us, teaches humanity to recognize earth's "limits and fragility."

It was a proud moment for the Society—doubly so, perhaps, because our special July issue on France had just been published and was receiving great praise. It was as thrilling a moment as that last June, when we received the Special Medal of the Royal Geographical Society in London for a century of achievement.

And yet, in a way, I derive as great a sense of satisfaction from hearing about students like those in Lake Villa who have been inspired by graduates of our summer institute. This year 98 teachers from 27 states came to Washington to learn the latest methods of teaching geography. By creating a network of teachers like Judith Bock, we are helping to ensure that the next generation will be prepared for the world they will inherit.

Gilbert M. Grosvenor

IBM TOOLS FOR EDUCATION

Volcano Erupts In South Carolina Classroom.

You won't find this eruption on the six o'clock news.

You will, however, find it in classrooms everywhere a teacher is teaching with IBM's Earth Sciences Series Courseware.

It's an exciting series for high school students that explains how natural forces are at work on our planet and how they affect our daily lives.

IBM courseware developed with teachers for teachers

And it's just one of the many high-quality classroom courseware programs that run on the IBM PS/2 Model 25 desktop computer.

The Model 25 features the power, speed and color graphics of the IBM Personal System/2 family in a single compact unit made specifically for the classroom. Combined with our courseware, it puts a complete library of flexible teaching tools at your fingertips.

Thousands of schools are teaching English, math, physics, chemistry, foreign languages and much

more on IBM PS/2's with IBM Educational Courseware.

That's hardly surprising when you consider that our courseware has been developed with the help of more than 200 active teachers nationwide.

In fact, IBM has courseware programs for kindergarten through high school—courseware designed to complement curriculums and current textbooks.

But courseware

isn't the only way IBM is bringing subjects to life. IBM LinkWay, for example, is a new, fun-to-use interactive multimedia tool that actually combines full-motion video, text, sound and color graphics.

With it, teachers can create their own special multimedia shows that work with their own curricula.

And there's so much more we're working on to help you teach. Together we can help students learn to read and write, watch atoms collide—or just see a volcano show its true colors.

For further information about IBM Educational Systems, write:

IBM Corporation
P.O. Box 3900
Peoria, Il 61614

Members Forum

Extinctions

I continue to be impressed with the depth of your investigation. Between cosmic and terrestrial causes [for the extinction of species, June 1989], I was pleasantly surprised to see humankind included as a potential source of natural mass extinction. Too often we see ourselves as outside the natural world.

CHRISTOPHER J. LIGHT
Los Alamos, New Mexico

The article suggests that the diversity of life on earth diminishes rapidly as man dominates every corner of the planet. Ironically, as humanity burgeons, its cultural diversity is slowly becoming extinct. Small unique communities that add so much to our species disappear or become absorbed into a mainstream society.

PETER BOSCO
Brookfield Center, Connecticut

The article covers the subject well, and the excellent graphics show the significance of the various lines of research. However, the caption on page 685 inadvertently implies that Glen Izett discovered shocked quartz in the K-T boundary layer. This is not the case, as Glen will agree. I discovered it in 1982 at Brownie Butte, Montana, and with co-workers published the details in *Science* in May 1984. As you stated, Izett initially was skeptical about the impact theory and our evidence supporting it, but we soon convinced him of its validity. Since then he has made several contributions to the field, but the initial discovery of shocked quartz is not one of them.

BRUCE F. BOHOR
U. S. Geological Survey
Denver, Colorado

We regret that we gave an incomplete account.

The asteroid impact theory is just that, a theory. You only allude to dissenting opinions of "other scientists." The iridium layer that is inferred to mark a cataclysm occurs only in a few isolated stratigraphic sections globally and is *assumed* to be coincident with the end of the Cretaceous. The criteria used in defining the Cretaceous-Tertiary boundary differ from scientist to scientist: Palynologists recognize changes in pollen; marine invertebrate paleontologists use foraminifera; vertebrate paleontologists have used the highest stratigraphic occurrence of the last "dinosaur."

Perhaps the greatest weakness of the asteroid impact and other catastrophic theories is their inability to explain the apparent selectivity for wiping out the dinosaurs when most other terrestrial vertebrates pass through the K-T transition unaffected. By my assessment there are only about 12 species of dinosaurs known from the late Maastrichtian [Cretaceous]. The elimination of 12 species within an unknown time interval, perhaps on the order of one million years, does not constitute a mass extinction.

ROBERT M. SULLIVAN
Natural History Museum
San Diego, California

I have never read any explanation of why the alligators and crocodiles survived past the end of the dinosaurs. Modern crocodilians had evolved by the Cretaceous. Like dinosaurs, they are large vulnerable reptiles that could not escape a catastrophe by burrowing underground. That they are still with us makes the catastrophe theory to explain the extinction of the dinosaurs not true, in my opinion.

ROBERT A. MCGEACHIE
Willowdale, Ontario

Fossils known as conodonts used in determining ages of rocks are not "small eel-like animals." Rather, they were interior parts of the animals, probably of the digestive system. Conodont-bearing creatures had soft bodies and are rarely preserved as fossils. Still the abundance of conodonts in the Paleozoic makes them good index fossils, whether we know what they are or not.

STEVE MALONEY
Rockville, Maryland

Since their discovery in 1856, these fossils have been variously interpreted. Recent studies of fossils found in Scotland that preserve soft body parts reveal conodonts to have been "eel-like."

Compared with the natural-cataclysm route to species obliteration, the human depredations that outrage environmentalists look feeble.

WILLIAM F. SHEELEY
Phoenix, Arizona

The supplement was tremendous. John Gurche gave the essence of what I've always imagined the dinosaurs to be. I can smell the dusty air, feel the ground vibrate, and see the predators move between the adults' legs.

WENDY ROBSON
Powell River, British Columbia

Consider the possibility that the last set of dinosaur extinctions was caused by small mammals eating dinosaur eggs.

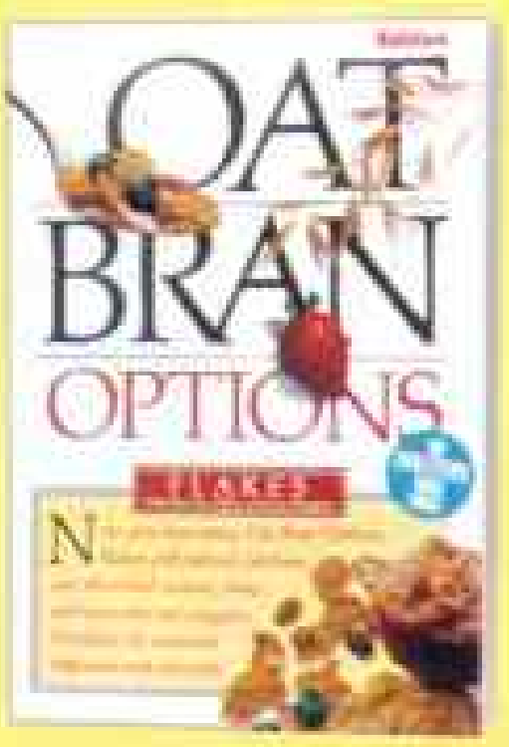
LEE RATZAN
East Brunswick, New Jersey

If this is how you feel about oat bran...

you need a tastier option.

The last thing you need at breakfast is another boring bowl of oat bran. This one is designed to dazzle! Oat Bran Options™ takes luscious raisins, chewy dates, and surrounds them with oven-toasted flakes and crunchy oat nuggets for a combination that talks straight to your tastebuds and to your health.

Oat Bran Options™ cereal from Ralston. Because you need a tastier option.



Malta

How horrifying to read of the senseless slaughter of hundreds of thousands of birds for sport on Malta (June 1989). We in the Salt Lake area watch with keen interest the nesting pair of peregrine falcons atop Hotel Utah as they fight for the survival of their species. Can not the world ask for the cessation of the macabre ritual that Malta uses in welcoming spring?

PRISCILLA A. TODD
Centerville, Utah

I found William S. Ellis's article on the Maltese people fascinating—like learning more about the fiercely independent Basques. However, to call the goddess figure in the temple of Hagar Qim "a fat lady" and "fertility figure" promotes old assumptions about pre-Judeo-Christian faiths. For several years there has been much research and discussion of older religions that honored the Creator as goddess for more than 50,000 years from northeastern Russia throughout Europe, the Middle East, and northern Africa.

MEGAN EOYANG
Oakland, California

You ignore the Italian character of Malta's people and their bitterness at being deprived of the use of the Italian language in their schools and public institutions. Historically, Malta has been culturally and politically a part of Sicily. The

forced use of English, while it may have economic advantages, is looked upon as a means of anglicizing and proselytizing into Protestantism its people, and is bitterly opposed by the Maltese people and their clergy.

A. J. Pansini
Waco, Texas

Computer Graphics

I enjoyed your article on computer graphics, but as a graduate student in geography, I was surprised to find no mention of geographic information systems (GIS). Although not as flashy as other applications featured, GIS promises to occupy a far more central role in the understanding of human and natural systems. It has proved a useful tool in management of scarce resources and in monitoring of endangered species and habitats.

Paul Adams
Lakewood, Colorado

Computer graphics retain a cold artificial flavor, even though they may be superficially exciting in a gee-whiz sort of way. The CAD/CAM and art images in your June issue show this clearly. In the same issue you commissioned a painting of the causes of mass extinctions, even though the subject, a diagram, was well suited for computer treatment. I agree with your illustrations department that when you need a warm human image,

you still have to use the most sophisticated of all computers—a real artist with a paintbrush.

ERIK WAHLSTRÖM
Helsinki, Finland

This new technology has brought also the significant danger of becoming addicted to computer games. They can broaden human imagination; however, under certain circumstances they can function as a drug, keeping the affected person before the screen for endless hours. This may lead to injuries to mental and physical health. Computer graphics should serve people and/or make them more creative. Your article was written in this spirit. Thanks to author Ward.

MICHAL STAVAR
Gottwaldov, Czechoslovakia

Tibetan Nomads

For some 50 to 60 years I have enjoyed the GEOGRAPHIC, especially the excellent pictures. I have made a habit of carefully examining their background. In my way I've been able to get an even closer understanding of many people and many places. On page 767 in the picture of a woman kneeling with her prayer wheel, a sweet white cat seems to be kneeling in worship with her. This cat evidently is a part of the nomad family, showing it is the human association it seeks, not a house. It would be interesting to know whether the cat adopted the human race or the human race domesticated the cat.

LAURA M. ROGERS
Dallas, Texas

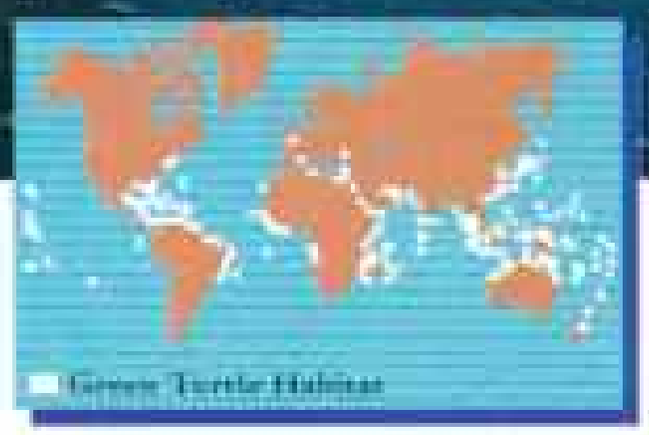
Geographica

I was pleased to see the chronometer watch in the piece about Robert E. Peary's dash to the Pole. My paternal grandfather, Henry N. Allen, worked for the E. Howard Watch and Clock Company and was chief regulator when Peary came to get an accurate timepiece that would not slow down in extreme cold. A small refrigerator was set up in my grandfather's Boston office, and a 25-pound block of ice was delivered each day. The watch was kept on ice, and many tests were made before the proper mainspring was selected. Peary kept the watch on ice in a box so that its accuracy could be preserved. This watch was used for the final dash. I feel this further vindicates Peary's insistence on accuracy.

ELINOR ALLEN BRAYTON
Stowe, Vermont

Letters should be addressed to ***Members Forum****, National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.*

Green Turtle **Genus:** *Chelonia* **Species:** *mydas*
Adult size: Length, approx. 1m **Adult weight:** 90-230kg **Habitat:** Temperate and tropical seas worldwide **Surviving number:** Estimated at less than 500,000
Photographed by John L. Behler



Wildlife as Canon sees it

The sea greets a returning green turtle on the beaches of Tortuguero, Costa Rica. Every two to four years, female green turtles instinctively navigate hundreds of miles across the open ocean and come ashore to nest on their native beaches. With powerful flippers, the green turtle excavates a pit where she lays her eggs, safely covers them with sand, then heads back out to the sea. Within a couple of months, at nightfall, the little hatchlings will emerge from beneath the sand and scramble to the water to begin their own journey to the open sea. Though the green turtles' range is worldwide, commercial exploitation, habitat destruction and pollution have reduced their numbers from tens of millions to scattered thousands.

To save endangered species, it is vital to protect their habitats. Understanding the fragile balance of our world's ecosystem holds the promise for the future. Photography, both as a scientific research tool and as a means of recording the world around us, can help promote a greater awareness and understanding of the green turtle and how it lives within its natural environment.

And understanding is perhaps the single most important factor in saving the green turtle and all of wildlife.

Let's dig a little deeper into the notion that much of our garbage is made up of plastics.

America's growing waste problem is monumental. We generate 160 million tons of garbage a year.

Our nation's landfills are being filled up. In five years 2,000 of our remaining 6,000 landfills will be closed.

A lot of well-intentioned solutions are being offered. One is that foam plastics, plastic bottles and plastic packaging should be banned.

The fact is that plastics make up less than 8%, by weight, of our nation's waste. Paper and paperboard make up about 36%, glass and metal about 9% each, all by weight. Plastics are naturally lighter, but still, when compressed, account for only about 20% by volume.

If plastics were banned, the need for packaging wouldn't go away. The idea is to substitute other materials which are assumed to be biodegradable, so a landfill would take longer to become full. Studies show, however, that paper and other materials decompose so slowly in today's landfills that the lives of the landfills are not extended.

Recycling must play a part.

In addition to environmentally secure landfills, and more state-of-the-art waste-to-energy incinerators, we believe that a significant answer to America's waste problem lies in recycling. Everything recyclable should be recycled. Yard waste. Paper. Metal cans. Glass bottles. And plastics.

Although plastics recycling is in its infancy, plastics are potentially more recyclable than alternative packaging materials.

In South Carolina, one company recycles 100 million pounds of 2-liter plastic soft drink bottles a year into everything from fiberfill for ski parkas to scouring pads to automobile distributor caps.

In Chicago, another company processes 2 million plastic milk jugs a year into "plastic lumber" for boat docks, park benches and fences.

What Amoco Chemical is doing.

Amoco Chemical is sponsoring a recycling program in New York State demonstrating that polystyrene foam food service containers from schools and restaurants can be recycled into insulation board for commercial construction, cafeteria trays and home and office products.

We're participating in a consortium with other major plastics manufacturers which will support construction of regional polystyrene recycling plants.

In Portland, Oregon, we renovated a 10-acre environmental learning center with a new wetlands walkway, signs, kiosks and benches made from recycled plastics.

We're encouraging the start-up of new plastic recycling efforts, helping to find new ways to collect and sort recyclables, and supporting efforts to create markets for recycled plastic products.

At Amoco Chemical, we believe we're only beginning to see the benefits of recycling. In the not-too-distant future, it can turn our solid waste from a national problem into a national resource.

For a free copy of "Recycling. Do It Today For Tomorrow," write Amoco Chemical, 200 East Randolph Drive, Chicago, IL 60601.

Recycling. Do It Today For Tomorrow.

AMOCO

Amoco Chemical

Good news travels faster.

Introducing the New V6 Hyundai Sonata.

Since the day it was introduced, the midsize Sonata from Hyundai has been generating the kind of press most cars simply dream about.

And now, it is giving the editors of respected automotive publications even more to write about.

Introducing an engine so impressive, it's sure to make headlines. This optional 3.0-liter overhead-cam V6 is Hyundai's most advanced power plant to date. Along with boasting 142 horsepower, it offers multi-point electronic fuel injection for smooth, responsive performance and greater fuel efficiency.

The powerful Sonata has what it takes to go head to head with Camry. And the matchup against Accord is no contest; it doesn't even offer a V6.

We're also glad to report that the Sonata GLS comes equipped with a well-appointed interior that includes power windows and door locks, a tilt steering wheel, cruise control, power steering, and a 6-speaker AM/FM stereo cassette system. Plus, plenty of passenger room to enjoy it.

Like any good story, we saved the best news for last. Starting at just $9695*, the Sonata is several thousand dollars** less than an Accord or Camry. So now that you've read all about it, call 1-800-826-CARS for the location of your nearest Hyundai dealer.

Because a story like this is worth following up on.

The Sonata from
HYUNDAI
Cars that make sense.

*BASE MODEL MSRP EXCLUDES FREIGHT, TAXES, TITLE & OPTIONS. DEALER'S PRICE MAY VARY. **COMPARISON BASED ON MSRP OF COMPARABLY EQUIPPED MODELS. SEAT BELTS MAKE SENSE. DRINKING AND DRIVING DOESN'T. © 1991 HYUNDAI MOTOR AMERICA.

Dots and dashes: a September day 2,000 years ago

To Mesoamerican scholars, the date is as clear as today's calendar: September 2, 32 B.C. That's what the carved dots (for ones) and dashes (for fives) spell out on this 1.5-meter (five-foot)

fragmented section of a stela found near Tres Zapotes, a small village in the Mexican state of Vera Cruz.

No one knows for certain who carved the date, one of the two oldest known in the Western Hemisphere. The other, found in nearby Chiapas state, is four years older. Nor is it known why the monument, Stela C, was created. Perhaps it marked a conquest or the inauguration of a ruler.

The bottom portion was found by Dr. Matthew W. Stirling on a 1939 National Geographic Society-Smithsonian Institution expedition; the top part turned up nearby in 1972. Both fragments are now in Mexico City's National Museum of Anthropology.

Who were the people who carved it? "We don't know for sure," says Dr. George E. Stuart, National Geographic staff archaeologist. "The date falls late in the Preclassic period, an exciting time when great civilizations, such as the Maya, were forming. The area was earlier inhabited by the Olmec. Stela C reflects a complicated calendar and writing; it may be a bridge between the Olmec and the Maya, but little is known about this region archaeologically."

Scholars have been working on Mesoamerican writing and calendar systems for more than a hundred years. By 1900 Ernst Förstemann, head librarian of the Royal Public Library at Dresden, had—in 14 years of spare-time effort—figured out the Maya calendar. Virtually all dates, he realized, were counted from a single starting point, equatable to our own August 12, 3114 B.C.

Expeditions sponsored by the Society and reported in NATIONAL GEOGRAPHIC have been instrumental in helping dispel the mystery that once shrouded the Maya and their precursors.

Actual height of snow globe approximately 6".

NE

The First Limited Edition Disney Crystal Snow Globe

MICKEY MOUSE

Edition Limit: 9500 Collections

Stars for a Star! Oscar winning Mickey in his famous role as the Sorcerer's Apprentice a dazzling star-filled globe of genuine crystal.

Created by
Reed & Barton Silversmiths

- **Delightful, hand-painted ceramic figurine. Completely authentic. Full Disney color!**
- **Genuine crystal globe. Hardwood base included. Serially numbered Certificate of Registration.**
- **Just $19.50!**

Disney's First Limited Edition Crystal Snow Globe is wonderfully nostalgic. A marvelous, enchanting art object from a bygone era. A thoughtful gift. An authentic heirloom to save and treasure.

Mickey is hand-painted to delightful Disney perfection. Rich colors. Authentic detail. Endlessly showered by a shimmering snowfall of twinkling stars! And the perfect globe is pure crystal. Just dazzling!

Hardwood base and serially numbered Certificate of Registration included free. Don't miss this exclusive Limited Edition, the first issue in a collection subscribers will be offered later under no obligation. Your satisfaction is guaranteed. Order now!

The New England Collectors Society is a division of Reed & Barton Silversmiths, makers of fine products since 1824.

NE The New England Collectors Society
237 Saw Mill Road, P.O. Box 816
West Haven, CT 06516

GD0163

Please enter my order for The First Limited Edition Disney Crystal Snow Globe, "Mickey Mouse."

_____ Snow Globe(s) @ $19.50 each ..... $_____

Shipping & Handling @ $2.95 per Snow Globe ..... $_____

Total Amount Enclosed* ..... $_____

Or charge my credit card as follows: ☐ MasterCard ☐ VISA

Card # _____ Exp. _____

Signature _____
All applications are subject to acceptance

Name _____

Address _____

City _____ State _____ Zip _____

*CT and CA residents include applicable state and local taxes. Please allow 8-10 weeks for shipment.

You can save a piece of the Maya rain forest.

Jaguar, photograph by David Allan Harvey

And all that lives in it.

Every $30 you give will help save an acre of Maya rain forest—a small price to protect jaguars, toucans, and the migrating songbirds that brighten your backyard.

100% of your gift will go directly to save Maya rain forest areas like the Rio Bravo.

In the time it takes to read this ad, 50 acres of rain forest will have been destroyed. You can't bring back what's gone, but you can help protect what's left.

The Nature Conservancy

The Nature Conservancy works with the Programme for Belize and other local conservation partners to protect tropical rain forests.

1815 North Lynn Street, Arlington, Va. 22209

Only one camera can predict the future.

Maxxum® 7000*i*'s Predictive Autofocus knows where your subject will be before it gets there.

It's a sure thing. The best way to capture a race, or any other fast-moving action, is with the new Maxxum® 7000*i*. With three major advances in autofocusing technology it's way ahead of the field.

First, Predictive Autofocus calculates the speed and direction of your subject until the instant you release the shutter. Second, the widest focusing area—as much as 12 times wider than other SLR's—means your main subject can be off-center and still be in perfect focus. And third, Maxxum 7000*i* is the fastest autofocus camera in the world.

This Maxxum's your best bet for other reasons, too. "Intelligent" auto-exposure, optional Creative Expansion Cards and five new ultra-compact zoom lenses, to name a few.

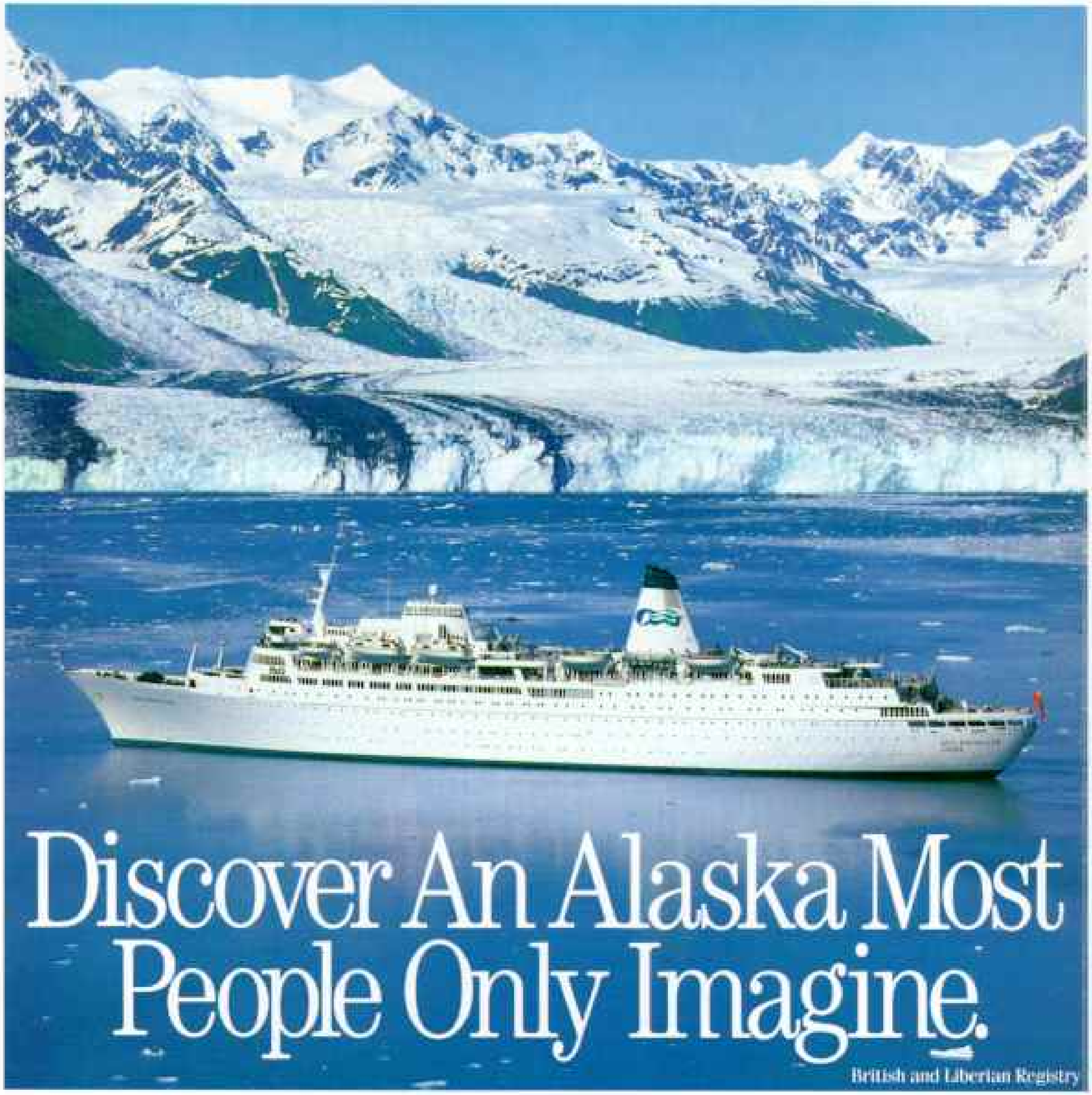
Which is why it's also safe to predict that there's a Maxxum 7000*i* in your future.

MAXXUM 7000*i*

ONLY FROM THE MIND OF MINOLTA

MINOLTA

PRINCESS TOURS®



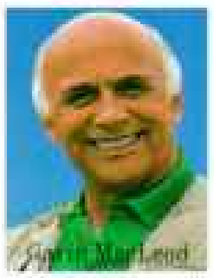
Discover An Alaska Most People Only Imagine.

British and Liberian Registry

Discover a land where nature is still king. The sun shines through the night. And the stillness of the morning is broken by the thunder of caribou. This is Alaska, the land of Princess.

Our "Voyage of the Glaciers" across the Gulf of Alaska includes the entire Inside Passage and Glacier Bay or Yakutat Bay. Plus the 16 glaciers of College Fjord, Columbia Glacier and Anchorage, gateway to Alaska's interior.

Discover more of Alaska with our 37 cruisetour packages. Enjoy our elegant railcars, the Midnight Sun Express™ Ultra Domes.® Stay at Princess' own Harper Lodge and take in the wonders of Denali Park and Mt. McKinley. Travel across the Arctic Circle to Prudhoe Bay. Or visit our new resort, the Kenai Princess Lodge, on the Kenai Peninsula.



"Nobody can show you Alaska like Princess."

Choose from 6 luxurious Love Boats. Sail 7 days between Vancouver and Anchorage. 7 days round-trip from Vancouver or 10 days round-trip from San Francisco.

Book by January 31, 1990 and save $300 to $400 per couple* with our Early Booking Discounts. You can discover Alaska for as little as $849 per person.* Contact your travel agent for details or mail the postage-paid card for your free 1990 Princess brochure.

*Based on double occupancy

PRINCESS CRUISES®

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 70289 SEATTLE WA
POSTAGE WILL BE PAID BY ADDRESSEE

PRINCESS TOURS®
2815 2nd Ave Suite 400
Seattle WA 98121-9981

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

Please fold here and tape together

Free! Choose The Alaska You Want To See From Our 108-Page Full-Color Brochure.

Please send me a free 1990 Princess Alaska brochure.

Please tell us about yourself:

1. When are you likely to visit Alaska?
   ☐ 1. 1990 ☐ 2. 1991 ☐ 3. 1992 ☐ 4. Later
2. Have you vacationed more than 2,000 miles from your home in the past 5 years? ☐ 1. Yes ☐ 2. No
3. Have you cruised in the past 12 months?
   ☐ 1. Yes ☐ 2. No
   Ship_____ Destination_____
4. Have you taken a package tour in the past 3 years?
   ☐ 1. Yes ☐ 2. No
5. Are you interested in taking an:
   ☐ 1. Alaska land tour including a cruise (cruisetour)
   ☐ 2. Alaska cruise only
6. Your age group is:
   ☐ 1. Under 25 ☐ 3. 35-44 ☐ 5. 55-64
   ☐ 2. 25-34 ☐ 4. 45-54 ☐ 6. 65+
7. Your educational background is:
   ☐ 1. High school ☐ 3. Graduated college
   ☐ 2. Attended college ☐ 4. Post-graduate

Name_____ (Please Print)

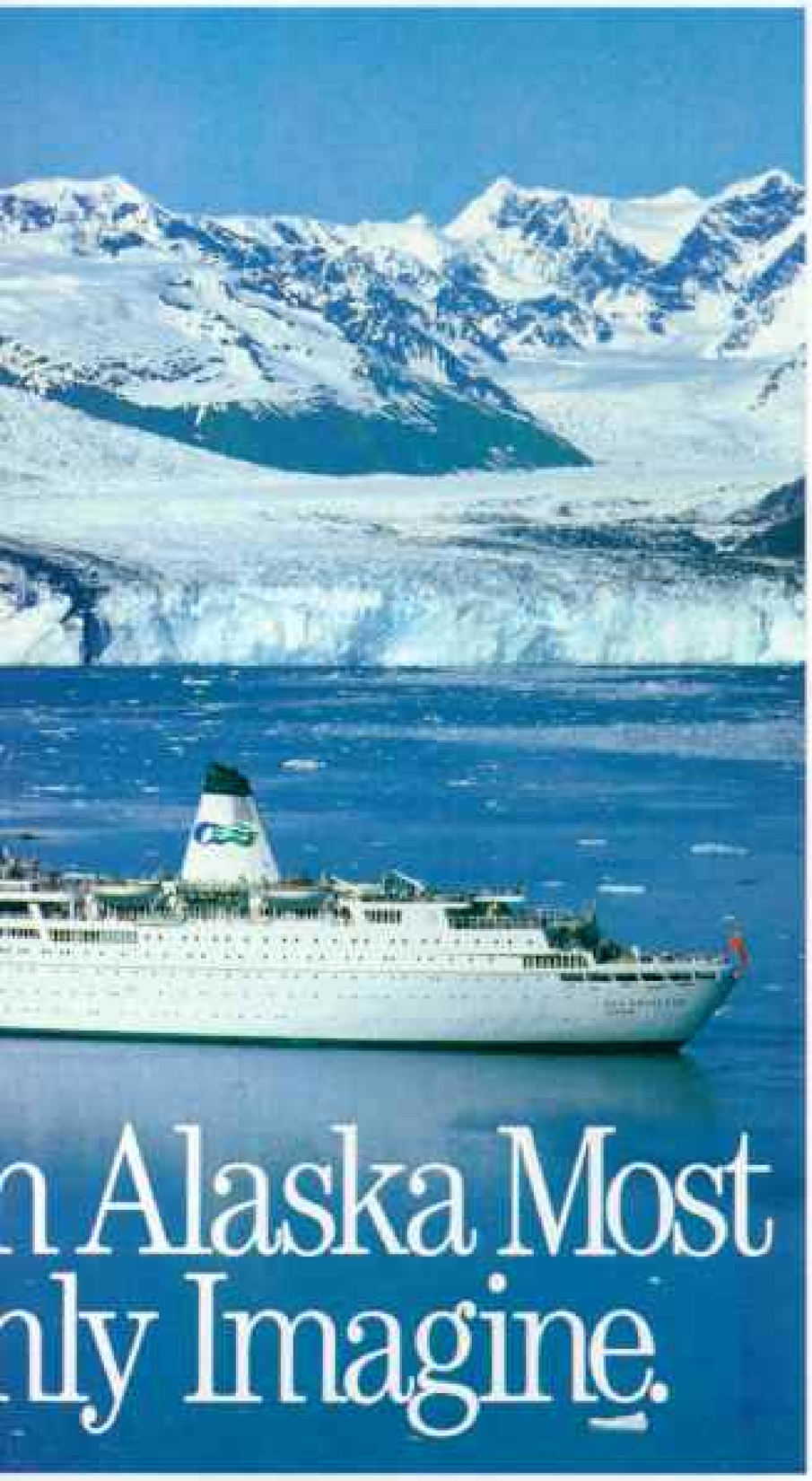
Address_____

City_____ State_____ Zip_____

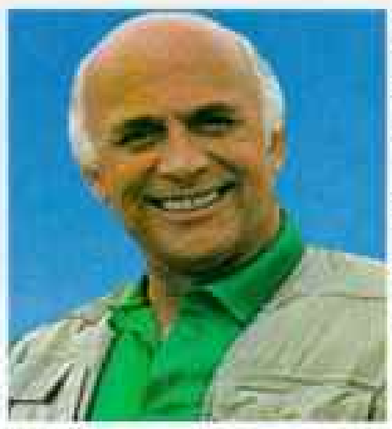
My Phone Number is (____) _____

Travel Agent_____ NG10089

S TOURS®



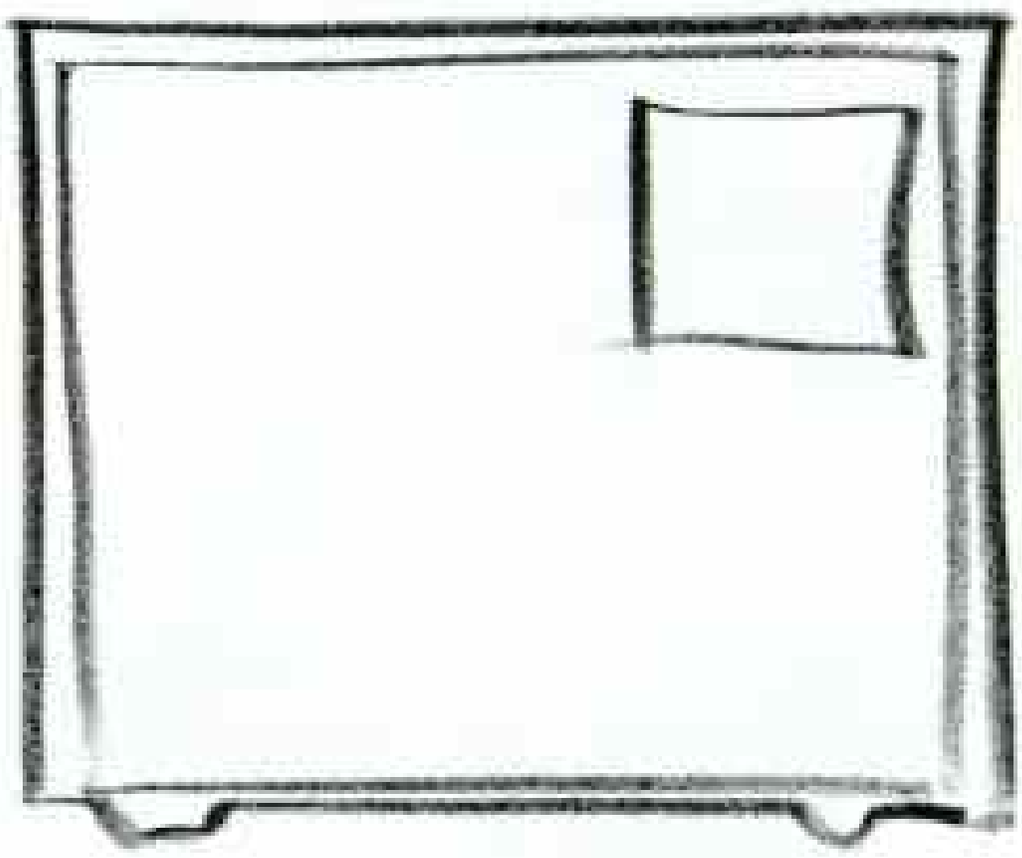
n Alaska Most nly Imagine.



"Send For Your Free Princess Brochure On Alaska."

Gavin MacLeod

SS CRUISES®



This Simple Idea Will Change The Way You Look At TV.


Simulated pictures
MAGNAVOX

The Smart Window™ By Magnavox.

If you flip out every time someone switches channels on you, we've got the answer.

The Magnavox Smart Window TV. So smart, it will end home TV wars forever.

It's like having two TVs in one. A full-size screen to watch your favorite program. Plus a special built-in Smart Window so others can see what else is on, anytime they want, any channel they want*.

The Smart Window by Magnavox. An idea so smart, you'll wonder how you ever lived without it.

MAGNAVOX

Smart. Very smart.™

*When used with a VCR.

The Duchess of Alba
by Francisco de Goya.
Courtesy of
The Hispanic Society
of America, New York.

For once, view the works of the Spanish masters without flipping pages.

Goya. El Greco. Velázquez. Miró. Picasso.

From the pages of art books, their paintings have fascinated and inspired you.

Yet the printed page does not really allow you to see them. For what makes each a masterpiece is what it demands of the viewer: a personal relationship in which the work reveals itself layer by layer. Until finally, standing before it, you come to experience the full emotional and spiritual power the artist intended you to feel.

At the Prado in Madrid – and in many other museums throughout Spain – you will find hundreds upon hundreds of the world's greatest works of art. And you will recognize many from reproductions you have seen.

But as you fix your gaze on them you will recognize something else.

That you are looking at them for the first time.

The Prado. An extraordinary destination along your journey of discovery.

Spain

Everything Under The Sun.

ESPAÑA

For everyone who wishes they could just push a button and become a better photographer.

To take a picture like this, you have to push beyond the ordinary. But here the only thing the photographer pushed was the shutter release. The N4004s' Decision Master System did everything else.

Obviously, this is no ordinary SLR.

It accepts all Nikon autofocus lenses and has a built-in speedlight with fill-flash capabilities. And unlike cameras that are merely automatic, the N4004s has a selection of exposure controls, from fully automatic to fully manual. So you can take great pictures with one finger or all ten.

Nikon

We take the world's greatest pictures.®

There are still a few things in this world that can only be done...by hand.

It's hard work. Painstakingly complex work. Long, difficult and, at times, daring work.

The kind of work only a human can do.

You'll never trust anyone in your life the way you trust your surgeon.

That's why surgeons must undergo nearly a decade of rigorous training under the masters of the profession.

It's why surgeons, throughout their careers, continue to build upon their knowledge, broaden their expertise, and bring about continuing advancements in surgical care.

When you place your confidence in the hands of a qualified surgeon, you can be sure you'll receive the best care available today . . . and tomorrow.

American College of Surgeons
55 East Erie Street
Chicago, Illinois 60611

Get the facts about surgical care.

You can learn more about basic surgical procedures, whether or not you should get additional consultation or a second opinion, and other concerns, through a series of free brochures prepared by the American College of Surgeons. Just fill in your name and address below, then mail this information request to: American College of Surgeons, Dept. NG-9, 55 East Erie Street, Chicago, Illinois 60611

Name_____

Address_____

City/State/Zip_____

Please allow 8-10 weeks for delivery.

CRIME FIGHTER, AGE SIX.

In cities, suburbs and rural communities all across the country, persons involved in crime are younger than ever. And so are the victims.

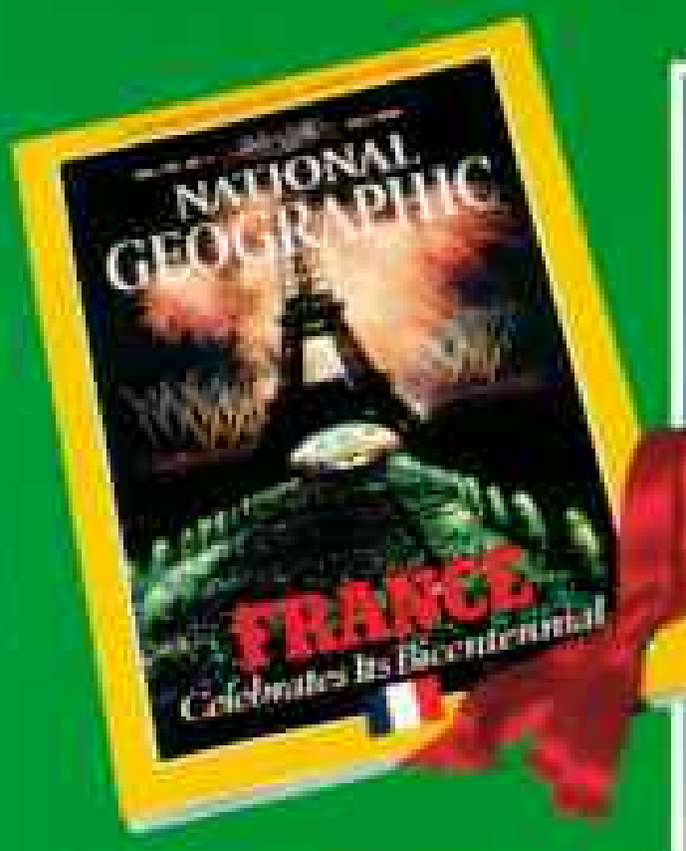
Camp Fire responds to this alarming statistic with "I'm Safe and Sure," a program that combines personal safety and good citizenship, specifically structured for kindergarten and first grade children. It's just one of many Camp Fire "learning for life" programs that teach kids vital lessons in living — for today and for their future.

As kids' needs have changed, so has Camp Fire. Today, you'll find Camp Fire involved in national issues which affect boys and girls of all ages.

Support Camp Fire in your community. For more information on today's Camp Fire, write Camp Fire, Dept. E, 4601 Madison, Kansas City, MO 64112.

Camp Fire

This Christmas give the spirit of the season!



Share the world and all its wonders with a gift that expresses your best wishes each month of the year.

Give National Geographic membership to one person in a family, and you give a magazine the whole family will enjoy—***for only $21.****** (In an independent study the GEOGRAPHIC was chosen as the magazine people want most as a gift!)

And it's easy to give. Simply complete the attached form, enclose dues in the envelope, and mail. Or write to:

NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C. 20036 U.S.A.

*See form for rates outside U. S.

CAMERON
DANIEL

GLORIA
LACEY

IN

RENDEZVOUS

... A DREAM COME TRUE

A STEVEN CAPP PRODUCTION

There's a company that produces happy endings. And it's not in Hollywood.

In the movies, happy endings look easy.

But in the real world, happy endings don't just happen. They take solid planning. Hard work. And a little imagination.

That's why so many people turn to the companies of The Prudential to help make their biggest dreams come true.

Peace of mind

Consider Prudential insurance. For over 110 years, Prudential insurance has been helping families just like yours. Today, millions of Americans depend on The Rock® for the peace of mind that comes from solid protection.

Financial security

Prudential-Bache Securities is known for its rock solid resources and market wise investment advice. Advice that's helping investors all over America reach their financial goals. And, feel a little more secure and confident along the way.

The home of your dreams

Now you can also turn to The Rock when you're buying or selling a home. Because some of the best names in residential real estate have joined The Prudential.

Backed by the strength of The Rock, The Prudential Real Estate Affiliates can help make the home of your dreams become a reality.

So if your plans call for insurance protection, investment advice, or even buying or selling a home, look to the companies of The Prudential to help you with your most important financial needs.

Because, no matter how your script reads now, with the strength of The Rock it could have a much happier ending.

Build your future on The Rock.℠

ThePrudential

Barcelona, 1987
from A Day in the Life of Spain

From the first time I picked up

THE

a camera, I knew I wanted to

POWER

make powerful pictures of

OF

people. The inherent power of

BLACK

the black and white medium

AND

gives my photographs an

WHITE

impact otherwise impossible.

Black and white strips away the

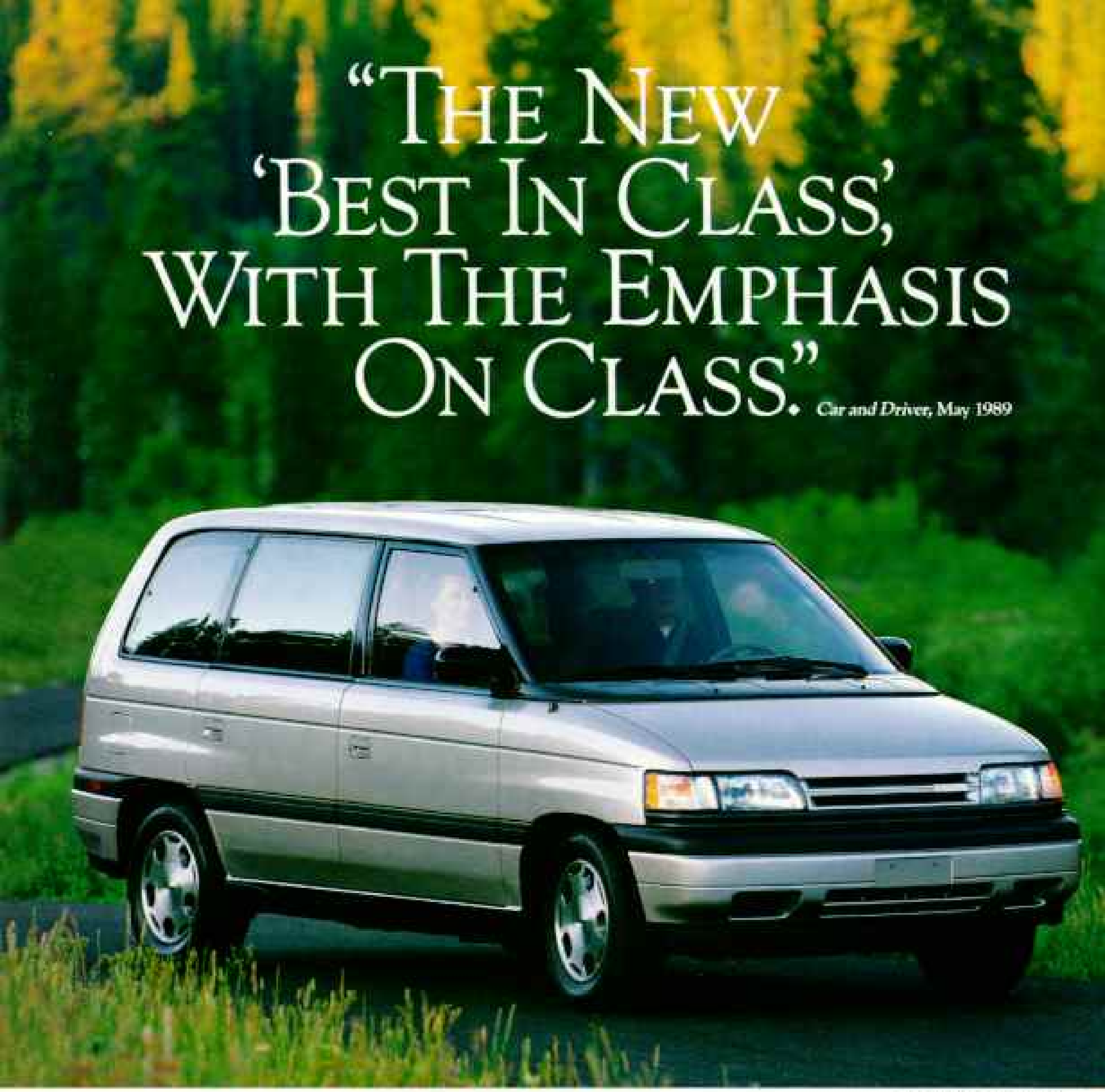
seductiveness of other pictorial

elements and gets to the point.

MARY ELLEN MARK
User of Kodak black-and-white materials for 15 years.

The Language of Black and White.

"The New 'Best In Class,' With The Emphasis On Class." *Car and Driver*, May 1989



Car and Driver Magazine Puts Mazda MPV At The Top Of The Category For 1989.

The verdict was overwhelming. *Car and Driver* editors rated Mazda MPV and its competitors in ten separate categories—and MPV claimed victory by winning nearly every one, including handling, ride, styling, comfort and value. This remarkable coup is attributed to something we call "Kansei Engineering"—engineering based on human feelings.

In selecting the Mazda MPV, *Car and Driver* stated: "Winner, winner, winner . . . phenomenally good road dynamics . . . a *most* carlike feel . . . great layout . . . delivers more fun per mile than we thought possible from a utility-minded vehicle."

And now Mazda will offer a new choice in four-wheel-drive versatility with the MPV 4WD.

The reviews are in and the consensus is definitely clear: Mazda MPV is the "'Best In Class' with the emphasis on class." For more information on the Mazda MPV, call this toll-free number today: 800-424-0202.

mazda

It Just Feels Right.™

NATIONAL GEOGRAPHIC MAGAZINE

PROTECTING TROPICAL RAIN FORESTS is vital to the survival of millions of species that live there. Surprisingly, it may be just as vital to saving humans who never go near one. As massive filters that absorb carbon dioxide from the atmosphere and emit clean oxygen, they offer one antidote to the global warming that threatens life on earth as we know it.

Unfortunately, rain forests are falling at an alarming rate, because their timber provides quick cash, and cleared forests become coveted farms for the growing masses of poor people who live near most tropical forests. Even if they wanted to, governments cannot fence the forests and order citizens to stay out.

Only imaginative plans and quick action that provide alternative income can save them. As we explain in the article on La Ruta Maya leading this issue, "eco-tourism" offers one hope. But roads to serve tourists could open remote areas to even faster destruction. Making some forests into living theme parks with cable-car or monorail systems, as shown above, offers one exciting solution. Sustainable harvesting of many forest products is possible but requires that local people learn a new approach to agriculture. Land reform that puts idle land to work would make a big difference. Buying or leasing some lands as preserves will be required.

Imaginative ideas have and will continue to come forth, but whatever is done will be expensive, and all of us will have to contribute. Doing nothing will be far more costly.

Wilbur E. Garrett

EDITOR

Lux One-Fam, 138 Cu Ft, W/W Carpet, Magnif Liv Spce, 4-Drs, Hi Ceil, Easy Commute City/Shppg/Wilderness. New.

It's good to find something that rewards your investment as handsomely as the new Montero.

Consider it just as a 4x4: automatic-locking hubs, 4-wheel drive, and a 3.0-liter, 143 hp, V-6 powerplant are all standard. They let Montero take you out where the *Grt Vus* are.

In comfort. "Off-road, the Montero handled the rough with grace," reported *Motor Trend*, "courtesy of its independent suspension with unequal-length A-arms, torsion bars, and anti-roll bar in front and solid axle with coil springs in back."

But there's no sense in achieving such comfort and control off-road, only to feel sorely out of place on the highway. So the Montero's sophisticated suspension system is designed to be smooth-riding on the paved roads.

Add the fact that the 4-door Montero provides nearly a third more interior cargo space than Jeep Cherokee or Isuzu Trooper II, and you'll see why *Motor Trend* ultimately chose it Top Buy in the Sport/Utility Class for 1989.

All this, and so *Vry Rsnably Prcd* at only $17,099.*

Call 1-800-447-4700 for your nearest Mitsubishi Motors dealer.

*MSRP suggested retail price. Actual price set by dlr. Tax, lic, freight, dlr options, and charges extra. Montero shown with optional alloy wheels—MSRP $464.

MITSUBISHI MONTERO

SUDDENLY, THE OBVIOUS CHOICE.™

IT ONLY LOOKS LIKE A FAMILY CAR WHEN THERE'S A FAMILY IN IT.

The problem with most cars that seat six is, they look like cars that seat six. Not Mercury Sable. Its shape makes promises. And its fuel-injected V-6 and four-wheel independent suspension are designed to keep them. Sable. Sure, it loves a crowd. It just loves a driver even more. For more information, visit your Lincoln-Mercury dealer or call **1-800-446-8888.**

LINCOLN-MERCURY DIVISION Buckle up—together we can save lives.

MERCURY LINCOLN

Quality is Job 1.

MERCURY SABLE

SOLAR ENERGY.

Have a little pick me up before you get back to work. Iberia's Business Class always welcomes you with a glass of sherry. A taste of Spanish sunshine to whet your appetite for the delicious meal ahead. And afterwards relax and take advantage of our unique, multi-lingual, on-board library.

Efficient and professional but warm and hospitable. That's how we think business should be.

Call your travel agent or 1-800-SPAIN-IB.

IBERIA
AIRLINES OF SPAIN

WARM TO THE EXPERIENCE.

SUNGLASSES/Arnel

AFRICAN ELEPHANT ALERT

You know about the slaughter. You have seen the images of baby elephants gunned down by poachers for their little tusks. You've looked in horror at the piles of dead elephants, killed for their ivory. Everyone knows that unless we take action now the African elephant will disappear from the face of the earth. Wildlife Conservation International urges you to back up your concern with your support.

Everyone's talking about it. But what can be done about it? President Bush's ban on ivory is only the beginning. In order to stop the increase in illegal ivory trade, we must support the new action plan to stop the poachers from attacking the elephants with renewed greed and savagery.

Wildlife Conservation International is leading the effort to save the African elephant through strong defensive measures, scientific study, economic strategies and education for local populations. We are working with African leaders to conserve their rich heritage of wildlife, establishing parks and reserves, putting up physical and legal barriers between the poachers and the elephants, working to stop illegal traffic in ivory.

But we need your help now or our efforts can never match the strength of the forces working to annihilate the African elephant. Please give what you can to assist us. If we cannot save this gentle giant—the largest land animal on earth—then wildlife everywhere is in danger of extinction. Help us stop the poachers.

1 800 221·3333

WILDLIFE CONSERVATION INTERNATIONAL
c/o New York Zoological Society, Bronx Zoo/Bronx, New York 10460

OUR TALES OF ROMANCE ARE MUCH EMBROIDERED.

FLY MEXICANA

DISCOVER MEXICANA'S MEXICO

LONG AGO, A BEAUTIFUL MAYAN PRINCESS WAS COURTED WITH BOUQUETS OF FLOWERS WHICH SHE WOULD FASTEN ABOUT HER DRESS. BUT WHEN A FIERCE BATTLE TOOK HER BELOVED'S LIFE, THE PRINCESS MOURNED HIM BY PLUCKING BLOSSOMS HERSELF, UNTIL AT LAST SHE GREW TOO OLD TO GATHER THEM. UNDAUNTED, SHE EMBROIDERED A DRESS WITH A PROFUSION OF COLORFUL BLOOMS. THIS DRESS, CALLED A "HUIPIL," IS STILL WORN IN ENCHANTING VILLAGES WHERE ROMANCE BLOOMS NATURALLY. NO ONE CAN TAKE YOU TO MORE OF THOSE SPECIAL DESTINATIONS THAN MEXICANA. CALL MEXICANA OR YOUR TRAVEL AGENT, AND DISCOVER THE ROMANCE OF MEXICANA'S MEXICO. BRING HOME SOME OF YOUR OWN TALES TO TELL.

MANUFACTURERS HANOVER

Responsive

"Jim, I've got two weeks to exercise my stock options, but I won't have the money until I get my bonus. Can you lend me $300,000?"

"I'm sure we can help, George. Fax me the details and I'll call you this afternoon."

You want a banker who sees the possibilities, not the problems. A banker who helps you make the most of opportunities that call for quick turnaround. A seasoned banker who knows you and what you need.

In short, you want everything a major worldwide bank can offer a senior executive. Which is precisely what the private bankers at Manufacturers Hanover have to offer.

To learn more, call Dolores H. Brown, V.P., Manufacturers Hanover Trust Company, (212) 286-6226.

Offices in New York, Chicago, Los Angeles, Miami, Boca Raton, London, Guernsey, Geneva, Zurich, Hong Kong, Singapore.

The Private Banking and Investment Group

OCTOBER 1989

GEOGRAPHICA

NATIONAL GEOGRAPHIC MAGAZINE

Herculaneum's Dead Still Tell Tales

Archaeologists continue to uncover the remains of victims buried in the seaside chambers of Herculaneum (NATIONAL GEOGRAPHIC, May 1984), destroyed in the same eruption of Mount Vesuvius that buried its sister city of Pompeii in A.D. 79. The excavations are yielding buried treasure as well.

Since 1986 crews digging in the chambers that once stood at the edge of the Bay of Naples have found more than 80 skeletons (right), many huddled together in mute testimony to the suddenness of the eruption and the havoc it wrought. They included a mother sheltering her child and, in a chamber nearby, a youth with a dog.

One room also held one of the richest finds yet uncovered from the chambers. Amid the rubble were a gold brooch with the image of Helios, the sun god (below), gold earrings, rings,

© LOUIS MAZZATENTA, NGS STAFF

two snake-head bracelets, silver vases, the imprint of a wicker basket, and the bronze and silver coins it once held. There was also a glass bottle containing the residue of a dozen aromatic substances that may have been used as an ointment.

Meanwhile a study of 139 skeletons uncovered earlier produced a surprise: Sara Bisel—a physical anthropologist sent by the National Geographic Society at the request of Italian authorities to preserve the remains—says the skeletons reveal that the average age of the people in the chambers was older

© LOUIS MAZZATENTA, NGS STAFF

than expected. This suggests that many children and young people may have been able to escape the destruction. But Dr. Bisel cautions that the "missing" youths may be found in chambers not yet excavated.

Tidying the "World's Highest Trash Pit"

Liz Nichol and Bob McConnell went to Mount Everest in 1987 as part of an expedition that came within a thousand feet of the summit via a North Face route. They will return next summer—not to climb up, but to clean up.

Filled with shame that mountaineers have created the "world's highest trash pit," Nichol and McConnell will lead a month-long expedition to the advance base camp, at 18,500 feet, on the Tibetan side of Everest. They will gather trash that has been left by climbers, burn what can be burned on the world's highest mountain, and separate the rest to be carried out and buried or recycled.

The Everest Environmental Expedition, based in Colorado Springs, Colorado, hopes to enlist the cooperation of Tibetans in properly disposing of trash and preserving the area's beauty. It also will work to remind climbers worldwide to carry out their trash and waste. The effort has the support of the American Alpine Club, the Explorers Club, and the American Mountain Foundation.

It's a Twig, a Catkin . . . No! It's a Caterpillar!

Imitation is the sincerest form of flattery, even for a caterpillar.

Nemoria arizonaria, a kind of inchworm found on oak trees in the southwestern United States and Mexico, produces two broods a year. When the first brood hatches in the spring, the oaks are covered with fuzzy, spiky flowers called catkins. The caterpillars eat these flowers and end up looking like the catkins (below). A few months later a second brood hatches. By this time the catkins are gone, and the new brood of caterpillars eat leaves. Instead of resembling catkins, the summer brood ends up looking like oak twigs.

Erick Greene of the University of California, Davis, who discovered this "developmental novelty," has found that the form the caterpillar takes is determined by what it eats. "I can take eggs from either brood and turn them into the catkin or the twig form after they hatch, depending on what I feed them," he says. Catkins are more nutritious, but they are available as a food bonanza only for a month or so.

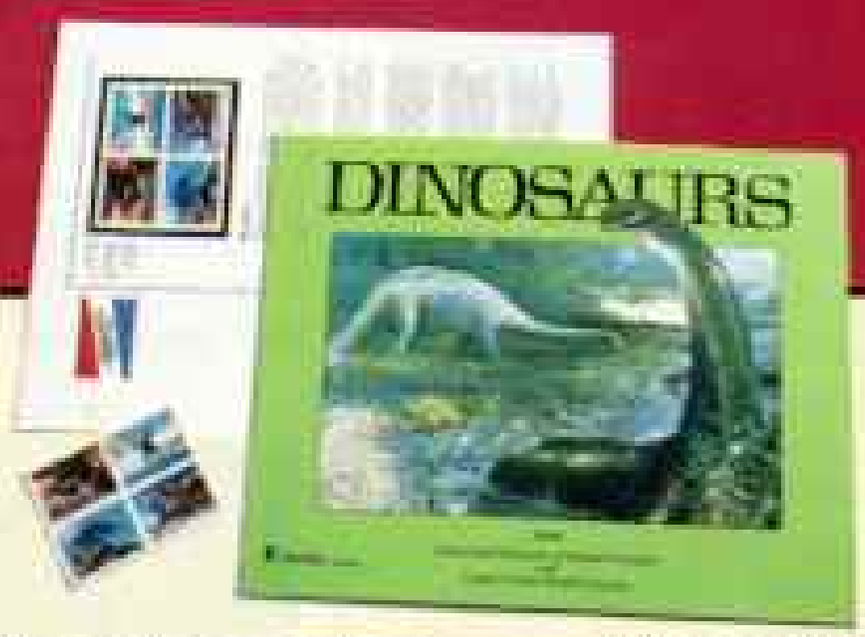
ERICK GREENE

The mimicry probably provides caterpillars with visual cover from birds flying around in search of food, Greene says. That may explain why if you put a catkin mimic on a catkin, it remains still; but if you put it on a leaf, it heads for the nearest catkin.

The new dinosaurs are here!

The new Prehistoric Animals are available at your local post office nationwide October 2.

Get them with this 1990 Dinosaurs calendar before they disappear.



Wall Calendar opens to 8" x 28"

A $9.95 value for only $3.95

Send for the new Prehistoric Animals commemoratives from the U.S. Postal Service and get the American Museum of Natural History's full-color 1990 Dinosaurs wall calendar, too! (You cannot get the 1990 issue of this popular calendar anywhere else.)

This exclusive offer—a $9.95 retail value—is yours for just $3.95 and is available only by mail. It even includes an official Album Page and protective mount. So better hurry before it disappears!

Look for our Dinosaur T-shirt offer inside **The Land Before Time*** videocassette available at a store near you.

UNITED STATES POSTAL SERVICE
We Deliver

☐ YES, please send me _____ Dinosaur Offer/s (limit 2 sets) at $3.95 each. Total amount enclosed $_____. (Do not send cash or postage stamps as payment.) Allow 8-10 weeks for delivery.

DINCOV

Name _____

Address _____ Apt./Box No. _____

City _____

State _____ ZIP Code* _____

Make checks or money orders payable to: **U.S. Postal Service**
MAIL TO: DINOSAURS SPECIAL OFFER
BOX 9980
WASHINGTON DC 20265-9980

(Offer expires December 31, 1989, and is valid only while supplies last.)

Information which you provide will be protected and only disclosed in accordance with the Privacy Act of 1974.

PAINTING BY JAMES H. GURNEY

Did Neandertals Speak? New Bone of Contention

Could Neandertal man, the last hominid to appear before modern humans, speak? Scientists have wondered about that for a long time but have been hampered by the absence of definitive fossil evidence. Now an international research team

HUGH RAE-AR, ARGYLL

has found what it believes is the Neandertal version of a bone that is a key to modern human speech. It suggests that, whether or not Neandertals did speak, they could have.

Baruch Arensburg of Tel Aviv University and his team unearthed the hyoid bone while digging in Israel's Kebara cave (GEOGRAPHIC, October 1988). It was part of a nearly complete skeleton that dates from about 60,000 years BP, a time when Neandertals were in the late stages of their existence and modern humans had appeared.

The hyoid is a U-shaped bone that supports the tongue and its muscles. The Kebara hyoid is the oldest such bone found in a prehistoric site.

"This bone was very modern in shape, in size, and in position," Arensburg says. "It is a bone so similar to modern bones that it may be an indication of anatomical capabilities." Arensburg notes that because the population in the Middle East 60,000 years ago was different from that in Europe, "we can't be 100 percent sure that this *is* a Neandertal." But if it is, it's a missing piece of an old puzzle.

A Welcome Increase in Condor Hatchings

The population of California condors, which are hovering on the verge of extinction (GEOGRAPHIC, June 1989), took a welcome turn this year with the hatching of four chicks in the San Diego Wild Animal Park. Their arrival increases the number of condors to 32, all in captivity.

The four chicks hatched from among seven eggs laid by condors in the Wild Animal Park and the Los Angeles Zoo. Two eggs were infertile, and the seventh, which also may have been infertile, was destroyed by an adult condor. All the chicks are doing well with the aid of a condor puppet (below) to socialize them to their own species. They will help provide a healthy genetic base for a viable population.

If captive condors in Los Angeles and San Diego continue to produce offspring, biologists will soon begin to release condors into the wild, says William Toone, curator of ornithology at the San Diego Wild Animal Park.

RON GARRISON, ZOOLOGICAL SOCIETY OF SAN DIEGO

The new chicks are Mandan, the name of an Indian tribe; Towasinah, or "friend" in the Karok Indian language; Kaduku, "strong in spirit" in Komkow Indian; and Shasta, named for Indians in northern California.

Scientists Identify a New Lemur Species

Lemurs are under siege in their homeland of Madagascar, as its forests are slashed and burned to provide desperately needed cropland, pasture, and firewood. Yet new species of lemurs continue to be identified.

Scientists first sighted the golden bamboo lemur in 1986 (GEOGRAPHIC, August 1988). Now Elwyn Simons,

DAVID HERING

director of the Duke University Primate Center in Durham, North Carolina, has identified another species, called the golden-crowned sifaka, from the noise it makes that sounds like "shi-fakh." Simons formally christened the lemur *Propithecus tattersalli*, after British primatologist Ian Tattersall, who photographed the animal in 1974 but was unable to determine if it was a distinct species. It is about 18 inches tall with a tail the same length and has prominent ears, mostly white fur, and a shock of golden orange on the crown of its head.

Scientists at the Duke Primate Center, which has received National Geographic Society support for work in Madagascar, believe there are only a few hundred golden-crowned sifakas, making them one of the most endangered lemurs. Andrea Katz, who manages the center's lemur colony, says researchers think more lemur species will be identified as scientists penetrate new areas of forest.

Ticket to Ride.

"Dad talks in smokescreens. Can't ever say what he really feels. Like this morning, getting ready to go. All he could talk about was the truck. Did I have the oil checked? How were the brakes? So I told him, I had the Goodwrench guys at the GM dealership look it over.
I did, too.
See, this truck is my ticket to the real world. My freedom to go where I want to go. You better believe I'm gonna take care of it.
Dad just nodded.
But I knew what he was saying."

Your truck is an important part of everything you do, whether it's hauling bales of hay or striking out on your own. That's why it's important to take it to Mr. Goodwrench.
No one else has the GM factory training, the experience, the genuine GM parts that Mr. Goodwrench has. That goes for GM cars as well as trucks.
So whether you drive a Chevrolet, Pontiac, Oldsmobile, Buick, Cadillac or GMC Truck, bring it to Mr. Goodwrench.
You'll find him at over 7200 General Motors dealerships coast to coast.

Goodwrench

Mr. Goodwrench

GM Parts

It's not just a truck . . . it's your freedom.

PETER SIBBALD

Bird Control Uses . . . What Else . . . Birds!

Toronto's Lester B. Pearson International Airport is using falcons to drive other birds off its runways, where they are a serious hazard.

Dominic Di Carlo, a master falconer, roams the runways with his trained falcons, routing out gulls, pigeons, Canada geese, snow buntings, and other avian hazards. Di Carlo is in radio contact with the airport control tower and can be on the spot of a bird invasion in less than ten minutes. His falcons rarely kill but are sufficiently terrifying to frighten away other birds for hours. In fact, he says, the hundreds of gulls that hang around the airport "are so wary of the falcons that now they fly away when they see my van."

The falcons can't fly in heavy rain or severe wind, so falconers, including those at the Canadian Forces base at Trenton, Ontario, also use traditional bird-control methods such as firing harmless explosive devices near bird-infested runways or playing tape recordings of bird distress cries. But Di Carlo says that birds stay away longer when his falcons are used.

No major airport in the United States routinely uses falcons, says Mike Harrison, wildlife biologist for the Federal Aviation Administration. Strict regulations—in the interest of preventing cruelty to animals—limit U. S. airports to traditional measures.

Tiny Step up Mountain, Big Step for Navigation

The researchers used navigational satellites circling the earth. They used computers crunching vast chunks of numbers. They climbed Washington's Mount Rainier to plant radio receivers on the summit. And when they finished, they had a new figure for the elevation of the mountain: Instead of rising 14,410 feet, it is actually 14,411.1 feet above sea level.

It may not seem like much, but to those who demonstrated the global-positioning system that measured the elevation of Mount Rainier, the fact that the new measurement is so close to the old one indicates that the new system works.

According to Stephen DeLoach, a civil engineer for the U. S. Army Engineer Topographic Laboratories and a project consultant, the system uses a series of Defense Department satellites "to determine exactly where you are." It will work for anyone with the necessary receiver, says DeLoach: "a soldier, a tank, a ship, an aircraft," or, fairly soon, the driver of a car.

For a Male Rattlesnake, Life Is Full of Troubles

Pity the male prairie rattlesnake as he slithers his way along the Continental Divide in Wyoming. His home territory is dry and cold—only about 95 frost-free days a year—and his favorite prey, the deer mouse, is widely dispersed and exists only in small populations. In midsummer, when he wants to mate, fewer than half the females in the vicinity may be receptive.

David Duvall of the University of Wyoming, who has been studying these snakes with support from the National Geographic Society, believes that because of the lengthy cold seasons females may require two or even three years to produce offspring, making many of them unavailable for mating each year.

NGS PHOTOGRAPHER JAMES L. AMOS

Duvall and a colleague, Michael B. King, find that both sexes spend mid-May to mid-July searching for food. But after both shed their skins, males spend the remaining warm days searching for a mate, while females continue to hunt.

"Females are so widely dispersed that males compete in searching for a mate," Duvall says. "Instead of fighting, they try to outrace each other to a receptive female. Only half find even one female each year."

Those who fail to mate don't take it badly. They just go back to their dens and start over the next year.

Vial of Anointing Oil Found in Israeli Cave

And Zadok the priest took an horn of oil out of the tabernacle, and anointed Solomon. 1 KINGS 1:39

The Bible contains many such references to the installation of kings of ancient Israel by anointing them with oil. An archaeological team excavating a cave at Khirbat Qumran, near the Dead Sea, recently

SUSAN MACKENZIE, BIBLICAL ARCHAEOLOGY SOCIETY

found a small earthen vessel filled with an oil that may have been destined for such a purpose.

A copper scroll discovered in 1952 is believed to be a list of items from the Temple in Jerusalem that fearful Jews had hidden in this cave and others nearby as the Romans approached the city. In A.D. 70 the Romans destroyed the Temple.

Vendyl Jones, a Texas archaeologist who joined the team from the Hebrew University of Jerusalem, said that the vial was wrapped in a nest of palm fibers. Team members first thought the flask was filled with dirt, but when they took it outside, a dark substance began to seep out. Chemical tests revealed most of the components used in making the oil, though one plant has not been identified.

Jones says the Jews may have hidden the oil because the Romans valued it as a perfume.

Ask one of the 3 million Americans who've survived cancer, if the money spent on research is worth it.

We are winning.

Please support the
AMERICAN CANCER SOCIETY®

This space contributed as a public service.

DON'T EVEN THINK OF BUYING A TREADMILL... CONSIDER THE OVERWHELMING ADVANTAGES OF NORDICTRACK

Better exercise.

NordicTrack simulates the world's best exercise, cross-country skiing. This smooth, total-body motion exercises all major body muscles including arm and shoulder muscles that are neglected in walking or running.

Non-jarring.

NordicTrack's smooth, efficient skiing motion has none of the jarring motions which can damage joints and ligaments.

Safer.

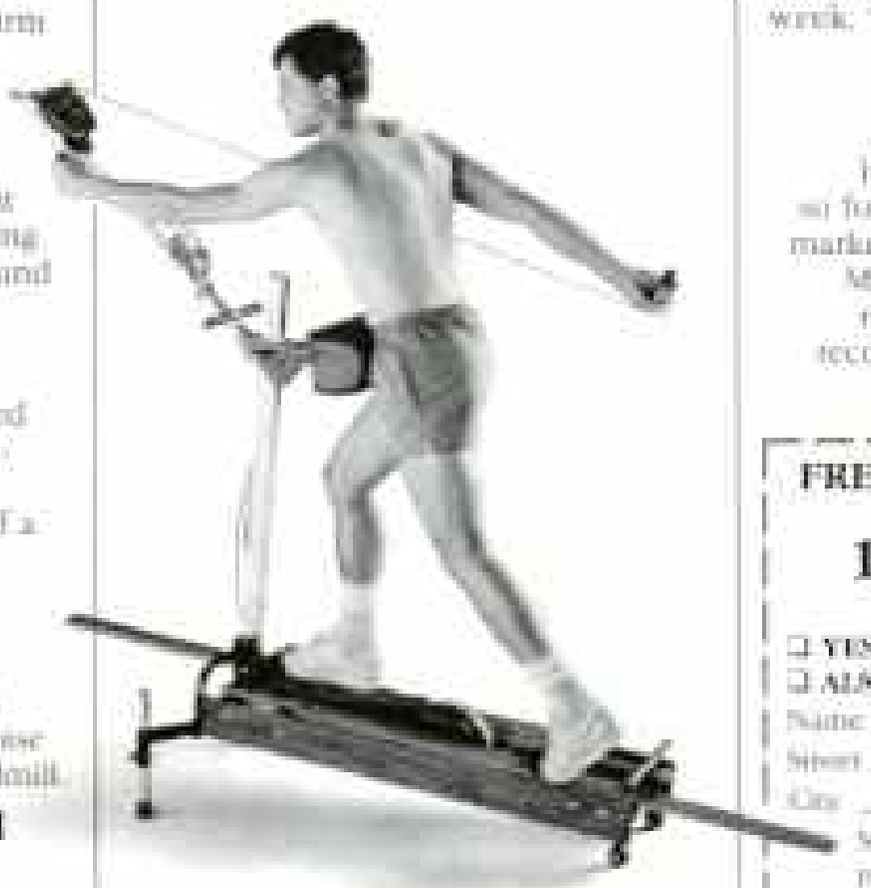
NordicTrack is human powered and has no electric motors or high-speed belts that require constant concentration or that can throw off a user or child.

Quieter.

NordicTrack's smooth, skiing motion is inherently quiet and has none of the pounding foot step noise associated with running on a treadmill.

Costs far less for equal quality.

NordicTrack's efficient and human-powered design needs no expensive electric motors and speed controls. And, because NordicTrack is simple and uncomplicated, little upkeep is required.



NordicTrack
A CML Company

Non-boring.

People love their NordicTracks. In fact, 7 out of 10 owners are still using their machines more than 5 times a week, 5 years after purchasing one.

The machine you'll recommend.

In fact, NordicTrack owners are so fond of their machines, that in a market research study conducted by Maritz Research in 1988, 97% responded that they would recommend NordicTrack to their family and friends.

FREE BROCHURE & VIDEO
Call Toll Free:
1-800-328-5888
In Canada 1-800-433-9562
☐ **YES,** please send me a free brochure
☐ **ALSO** a free video tape ☐VHS ☐BETA
Name: _____
Street: _____
City: _____
State: _____ Zip: _____
Phone # ( ) _____
NordicTrack • 141 Jonathan Blvd. N. Chaska, MN 55318
3689

On Assignment

TURNS ABOUT is fair play, as Editor BILL GARRETT tries to focus on a Guatemalan subject that became interested in him. Born in the wild, this orphaned jaguar—one of a threatened species in the Maya region—is being raised for release in a forest reserve. Once a symbol of royalty to the Maya, the jaguar is a living link between the pomp and power of cities long abandoned and the modern Maya that Garrett has met during years of travel to the countries that now embrace their ancient homeland.

La Ruta Maya sent photographer KEN GARRETT off in his father's footsteps, "racing around trying to cover mountains, forests, beaches, reefs, animals, and people. One minute I was a news photographer at a festival, the next I was doing scenics. It was fun, but it took a lot of planning."

A degree in anthropology and experience photographing Mexico City's spectacular Templo Mayor, excavated a decade ago, provided good background for Ken (right, with a spider monkey at Copán).

"While the Maya Route covered diverse aspects of a wide region, my work at Copán was literally in depth. During the opening of the royal tomb we were down at the end of a long tunnel, hot, humid, and miserable. I had to bring my cameras in an hour ahead because they'd fog up."

While scientists reconstruct the lives of the ancient Maya from buried clues, the exposed art and architecture take a beating in the tropical air. Thirty years ago staff archaeologist GEORGE STUART heard of a collection of Copán photographs taken in 1946-47. It didn't mean much at the time, but recent concern about the deterioration of the monuments there jogged his memory. When he contacted the photographer, Mexican archaeologist Raúl Pavón Abreu, "he still had the negatives in their original boxes."

Last June the National Geographic Society donated a set of the photographs to the Honduran Institute of Anthropology and History for use at Copán's research center. Stuart (above, at right) and Victor Cruz Reyes, director of the institute, look over the more than 1,300 images. "It's just amazing what's in there," says Stuart. "Not only photographs of all the hieroglyphs in good light but beautiful pictures of the site and splendid panoramas too. It's a real treasure."

PHOTOGRAPHS BY DAVID ALAN HARVEY (TOP), JACK KOTZ (LEFT), KENNETH GARRETT

NATIONAL GEOGRAPHIC (ISSN 0027-9358) IS PUBLISHED MONTHLY BY THE NATIONAL GEOGRAPHIC SOCIETY, 17TH AND M STS. N.W., WASHINGTON, D. C. 20036. $21.00 A YEAR, $2.65 A COPY. SECOND-CLASS POSTAGE PAID AT WASHINGTON, D. C., AND ELSEWHERE. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, P. O. BOX 2174, WASHINGTON, D. C. 20013

INTRODUCING PROEDIT. THE WORLD'S SMALLEST VIDEO PRODUCTION STUDIO.

The new, highly advanced RCA ProEdit™ camcorder is equipped with features many would consider remarkable in a studio, let alone a camera.

Quite simply, it places in your hands the most comprehensive array of recording and editing capabilities ever assembled in one camcorder.

These range from sophisticated dubbing features that allow for such professional touches as narration and background music, to a time-lapse mechanism that lets you create your own animated videos.

Of course, there's another reason you end up with such professionally produced video with the new RCA ProEdit camcorder. It gives you a better picture to begin with.

Thanks, in part, to a flying erase head that eliminates the video distortion typical of scene changes in conventional camcorders.

Also included among the RCA camcorder's convenient operating features is a built-in mini-speaker that allows you to monitor your tapes during playback without the need for cords or earphones.

All of which strongly argues for a visit to your RCA dealer. Where you'll discover the pleasures of creating truly exceptional amateur video.

As opposed to video that's merely amateurish.

RCA
NUMBER ONE WITH THE TOUGHEST CRITICS IN THE WORLD™