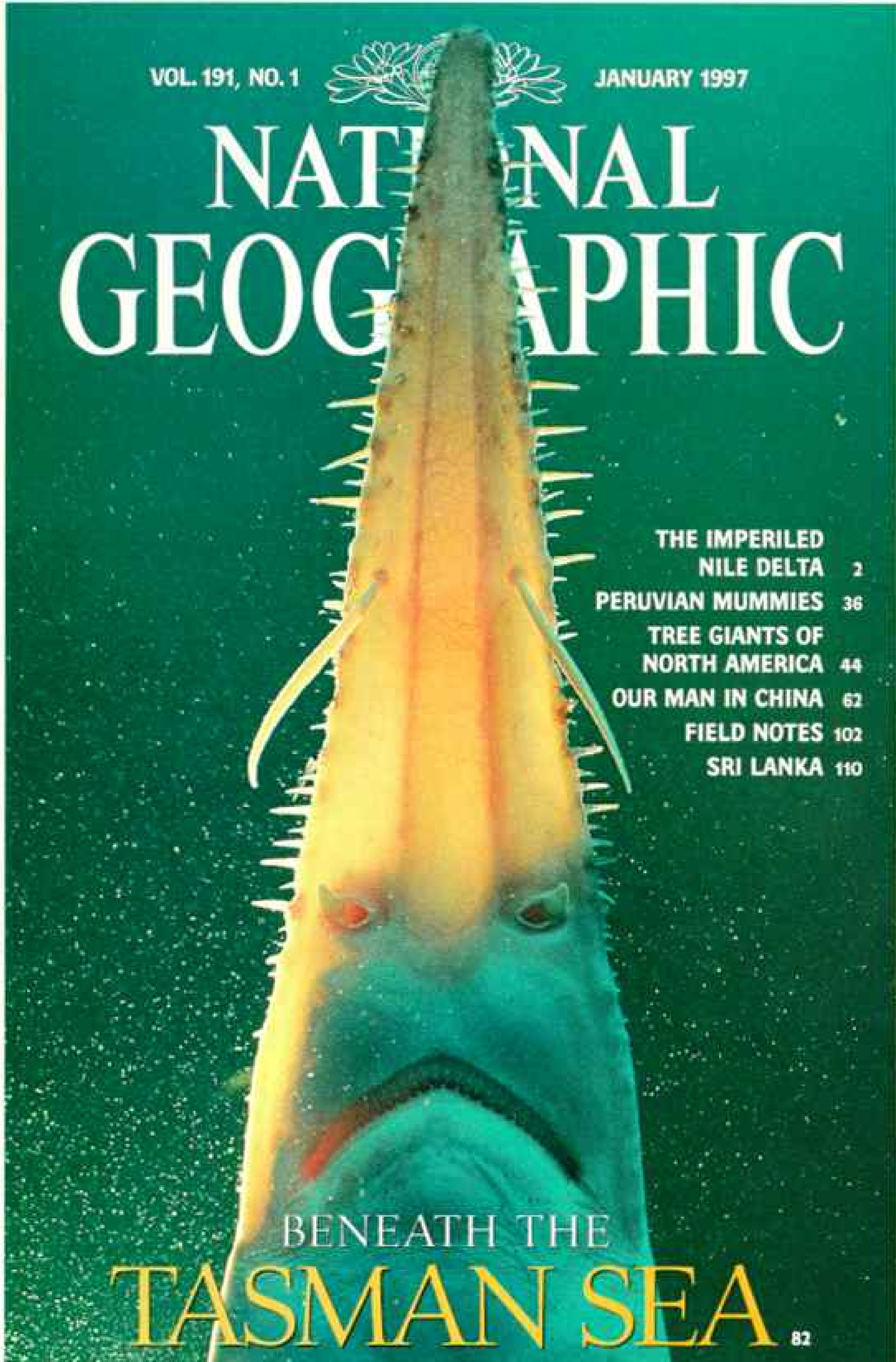

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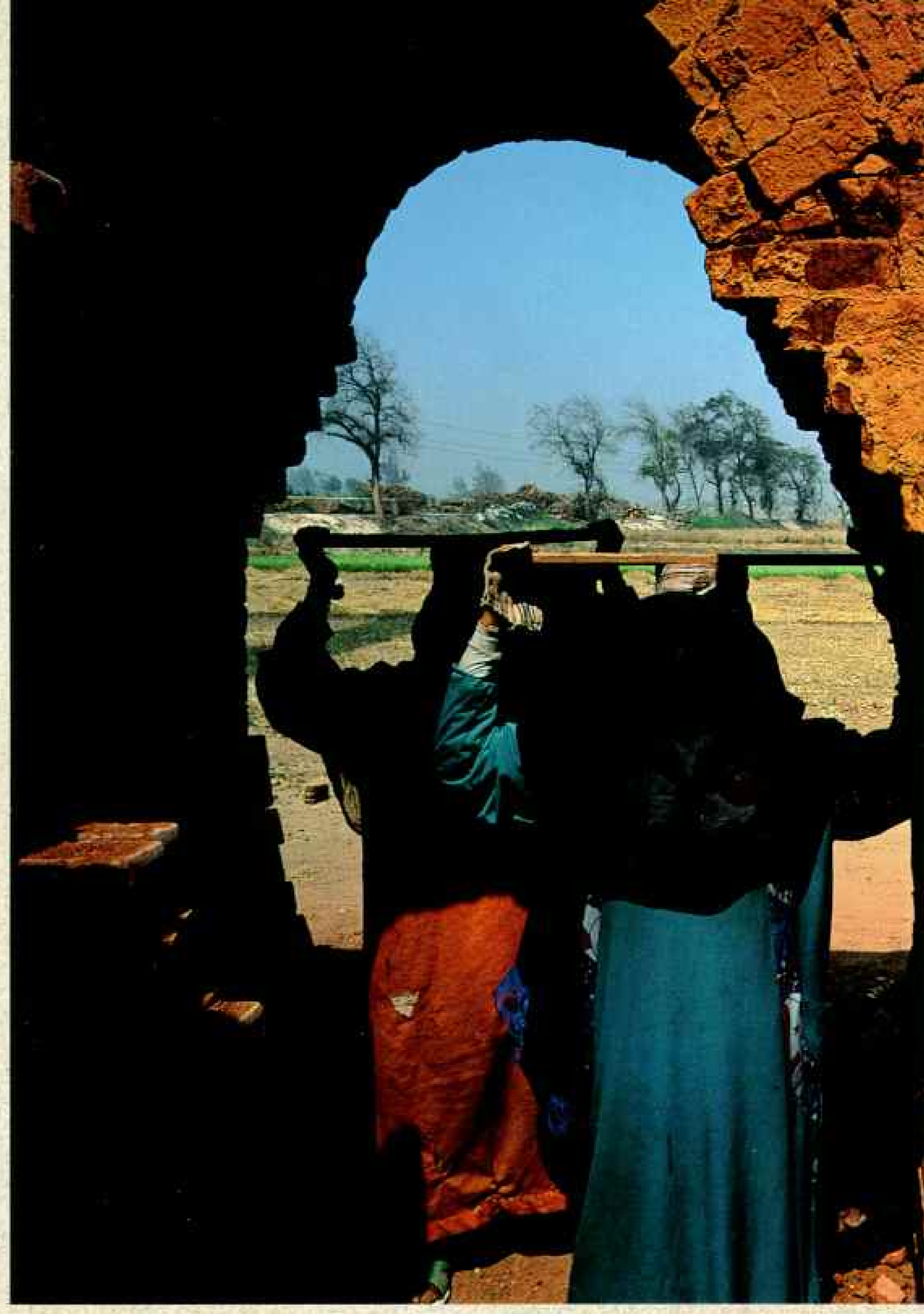
Annual flooding of the Nile River Delta once helped regulate the lives of ancient Egyptians. Today dams and diversions upstream have stifled the river's natural rhythms, opening more land for delta residents like these rice farmers—but at a price.

THE IMPERILED

By PETER THEROUX Photographs by REZA

NILE DELTA

Smoke signals the growth of industry along the shores of Lake Maryut, one of the delta's four coastal lagoons. Although such development has created jobs for those who no longer farm, the cost of the belching and dumping, piled atop poisons from agricultural runoff, has been high. Many of the 47 commercial fish species that once thrived in the Nile have disappeared.



Keeping their balance at a brick factory near Zifta, women shuttle stacks from kiln to trucks. A construction boom in the delta has boosted business for brick manufacturers, who once ruined hundreds of square miles of farmland by scraping up rich delta soil. Laws now require the factories to haul in their raw material from elsewhere.

MOHAMMED KASSAS, a professor of ecology at Cairo University, stepped out of his book-lined office to find a pot of tea. He is an expert on the Nile Delta, and I had come to his office to learn about this triangular swath of fertile land. But while he was down the hall, I saw the whole story for myself, from a satellite image hanging above his desk: An ocean of yellow sand covers Egypt, divided by the dark green vein of the Nile River. The river injects life into the bright green fan at its mouth, while the gray, man-made mass of Cairo eats away at the fan's delicate stem.

The black soil of the Nile Delta has made it the foundation stone of seven millennia of human history. By 5000 B.C. an increasingly arid climate had seared the grazing lands of Egypt, turning them into desert and forcing nomads to settle closer to the Nile. The resulting lifestyle in the Nile River Valley and the delta—growing crops, raising domesticated animals, and fishing—sustained settlements that evolved into the ancient world's first nation-state. Long before the pharaohs built the pyramids, Egypt's glory was the agricultural wealth of its delta.

At the intersection of Africa, Asia, and Europe, the land was also a strategic prize, and invaders seeking to control the rich delta brought riches of their own. Semitic Hyksos introduced the horse and chariot, which enabled Egypt to spread its empire; Greeks created Alexandria and brought their civilization, including the greatest library of antiquity.

"The delta was a battleground," said Kassas, his bright, unblinking eyes revealing his passion for Egypt, to which he has devoted his career.

Today Egypt's battle is to preserve the soil and water that have always given life to the delta. One hundred fifty years ago this nation had five million acres of farmland and five million citizens; now it has seven million acres of farmland and 60 million citizens. And every nine months there are nearly a million more Egyptians to feed. For nearly 30 years the Aswan High Dam, 600 miles south of Cairo, has kept the river from flooding and depositing renewing sediment at its mouth. The delta has instead been inundated with catastrophic superlatives: It is among the world's most intensely cultivated lands, with one of the world's highest uses of fertilizers and highest levels of soil salinity.

Cairo's commercial and residential sprawl has locked priceless soil beneath miles of concrete; the discharge of chemicals into delta lakes threatens the fishing industry and the supply of clean drinking water; and the Mediterranean coast is eroding. If global warming causes the sea level to rise, as some predict, the city of Alexandria and coastal province of El Beheira will be lost.

"The delta is subsiding," Kassas said with a helpless shrug. "It's tilting—the northeastern side is lower, and sinking a half centimeter a year; the northwestern side is sinking three millimeters a year. This will increase salinity

Her name is Sabah. She is 15 years old. Instead of attending school, she works—most recently hauling bricks.

Child labor persists in Egypt, where roughly 10 percent of the workforce is under 12 years of age. Although laws protecting children are on the books, they are not well enforced, partly because many poverty-stricken parents feel forced to send their children out to help support the family.

PETER THEROUX recently translated *Children of the Alley*, a book by Egypt's Nobel Prize-winning writer, Naguib Mahfouz. He and REZA, an Iranian photographer living in Paris, last joined forces on "Cairo—Clamorous Heart of Egypt" (April 1993).

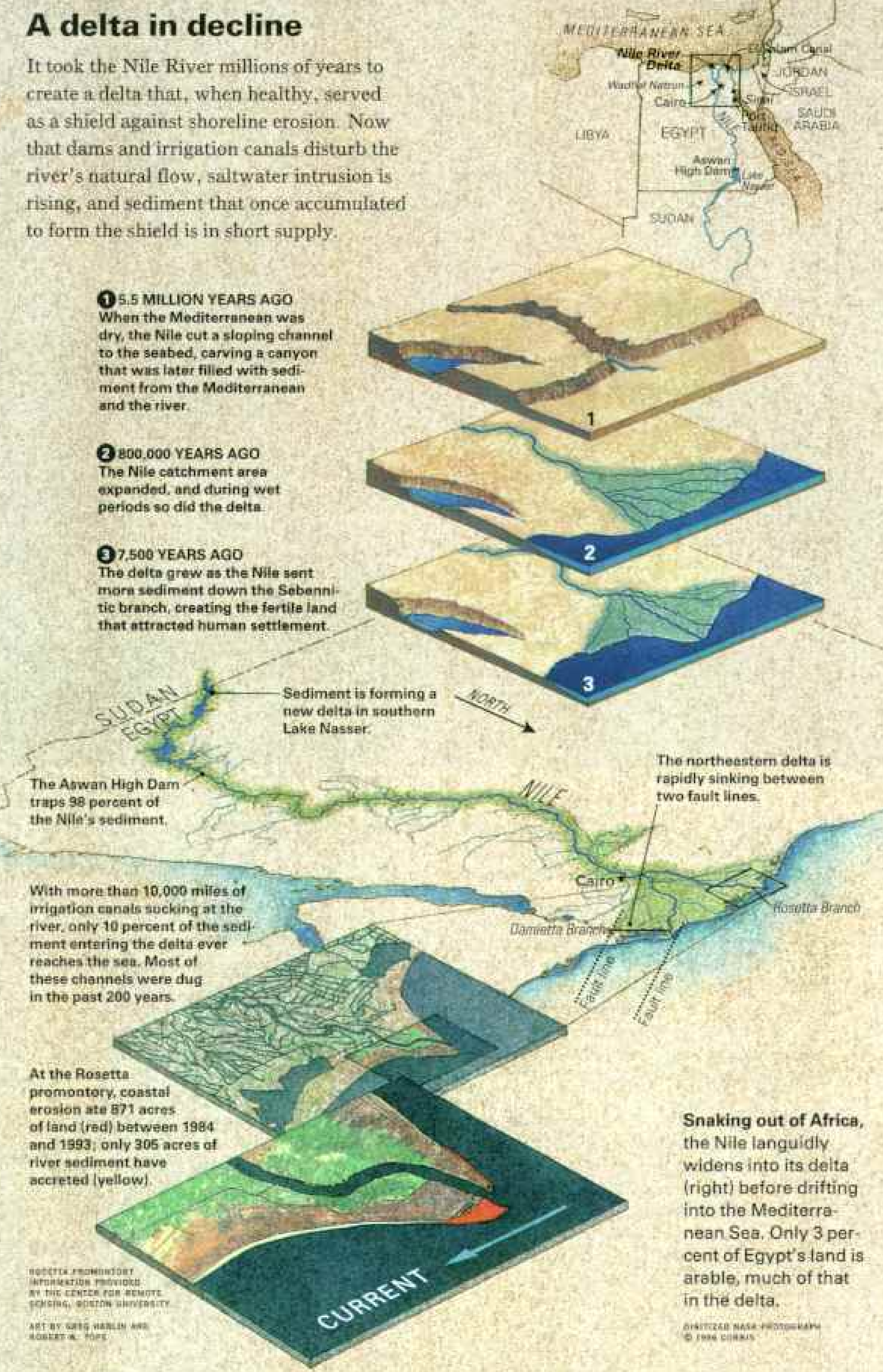
and affect the groundwater. Rice and cotton yields will be lower. Sediments now blocked by the Aswan Dam used to build up the delta but not anymore."

The Nile Delta, occupied by Greeks in 332 B.C., coveted by Romans as the granary of their empire, invaded by Libyans, Nubians, Persians, Arabs, Turks, French, and British, has survived many challenges from without. Now the challenges it must survive come from its own population, its own soil, and its very lifeline and creator: the Nile itself.

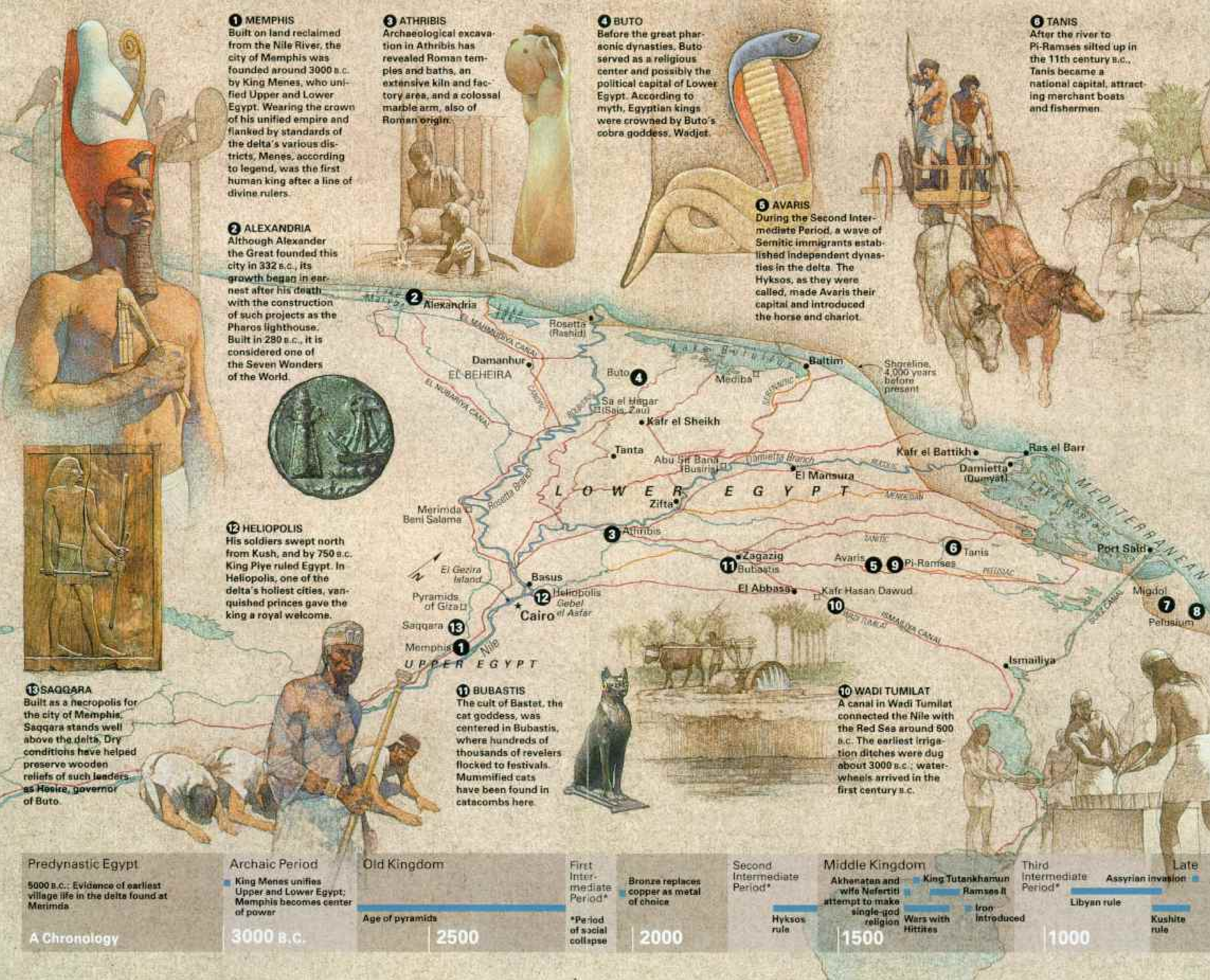
THE ANKH, the ancient Egyptian symbol of life, resembles a cross or a key, but it might also be seen as a map of inhabited Egypt. The upright is the Nile, the crosspiece is the east and west—the daily birth and death of the sun—and the loop is the delta. Seventy-five percent of Egypt's population lives in the loop of the ankh, on the alluvial land that gave populated Egypt its ancient name Kemet, the "black land," as distinct from Deshret, the bleak "red land" of the desert. The loop meets the crosspiece at Cairo, and it is here, where streets, parking lots, hotels, and apartment buildings have entombed hundreds of square miles of the fertile land, that you can view tons of delta soil in its mummified form: bricks.

"The use of baked mud bricks is worse than urban sprawl," my friend Ibrahim Sadek said, frowning out his downtown Cairo window at new buildings with gray frames and red brick walls. "Those bricks came from the richest soil of the delta. Do you know, peasants were selling off the top yard of their land for brickmaking? And as if that wasn't bad enough, if their neighbors didn't do the same, then all the chemicals leached from the higher land into that lower land, worsening the soil quality."

(Continued on page 16)



A delta in decline
It took the Nile River millions of years to create a delta that, when healthy, served as a shield against shoreline erosion. Now that dams and irrigation canals disturb the river's natural flow, saltwater intrusion is rising, and sediment that once accumulated to form the shield is in short supply.
MEDITERRANEAN SEA
Nile River Delta
Wadi el Natrun
Cairo
JORDAN
ISRAEL
Sinai
Port Taufiq
SAUDI ARABIA
LIBYA
EGYPT
NILE
Aswan High Dam
Lake Nasser
SUDAN
1 5.5 MILLION YEARS AGO
When the Mediterranean was dry, the Nile cut a sloping channel to the seabed, carving a canyon that was later filled with sediment from the Mediterranean and the river.
2 800,000 YEARS AGO
The Nile catchment area expanded, and during wet periods so did the delta.
3 7,500 YEARS AGO
The delta grew as the Nile sent more sediment down the Sebennitic branch, creating the fertile land that attracted human settlement.
1
2
3
SUDAN
EGYPT
Sediment is forming a new delta in southern Lake Nasser.
NORTH
The Aswan High Dam traps 98 percent of the Nile's sediment.
NILE
The northeastern delta is rapidly sinking between two fault lines.
Cairo
Rosetta Branch
Damietta Branch
Fault line
Fault line
With more than 10,000 miles of irrigation canals sucking at the river, only 10 percent of the sediment entering the delta ever reaches the sea. Most of these channels were dug in the past 200 years.
At the Rosetta promontory, coastal erosion ate 871 acres of land (red) between 1984 and 1993; only 305 acres of river sediment have accreted (yellow).
CURRENT
Snaking out of Africa, the Nile languidly widens into its delta (right) before drifting into the Mediterranean Sea. Only 3 percent of Egypt's land is arable, much of that in the delta.
ROSETTA PROMONTORY INFORMATION PROVIDED BY THE CENTER FOR REMOTE SENSING, BOSTON UNIVERSITY
ART BY GREG HARLIN AND ROBERT W. POPE



1 MEMPHIS
Built on land reclaimed from the Nile River, the city of Memphis was founded around 3000 B.C. by King Menes, who unified Upper and Lower Egypt. Wearing the crown of his unified empire and flanked by standards of the delta's various districts, Menes, according to legend, was the first human king after a line of divine rulers.
2 ALEXANDRIA
Although Alexander the Great founded this city in 332 B.C., its growth began in earnest after his death with the construction of such projects as the Pharos lighthouse. Built in 280 B.C., it is considered one of the Seven Wonders of the World.
3 ATHRIBIS
Archaeological excavation in Athribis has revealed Roman temples and baths, an extensive kiln and factory area, and a colossal marble arm, also of Roman origin.
4 BUTO
Before the great pharaonic dynasties, Buto served as a religious center and possibly the political capital of Lower Egypt. According to myth, Egyptian kings were crowned by Buto's cobra goddess, Wadjet.
5 AVARIS
During the Second Intermediate Period, a wave of Semitic immigrants established independent dynasties in the delta. The Hyksos, as they were called, made Avaris their capital and introduced the horse and chariot.
6 TANIS
After the river to Pi-Ramses silted up in the 11th century B.C., Tanis became a national capital, attracting merchant boats and fishermen.
12 HELIOPOLIS
His soldiers swept north from Kush, and by 750 B.C. King Piye ruled Egypt. In Heliopolis, one of the delta's holiest cities, vanquished princes gave the king a royal welcome.
13 SAQQARA
Built as a necropolis for the city of Memphis, Saqqara stands well above the delta. Dry conditions have helped preserve wooden reliefs of such leaders as Hesire, governor of Buto.
11 BUBASTIS
The cult of Bastet, the cat goddess, was centered in Bubastis, where hundreds of thousands of revelers flocked to festivals. Mummified cats have been found in catacombs here.
10 WADI TUMILAT
A canal in Wadi Tumilat connected the Nile with the Red Sea around 600 B.C. The earliest irrigation ditches were dug about 3000 B.C.; waterwheels arrived in the first century B.C.
Alexandria
Lake Maryut
Rosetta (Rashid)
Lake Burullus
Baltim
Shoreline, 4,000 years before present
Damanhur
EL BEHEIRA
El Mahmudiya Canal
El Nubariya Canal
Buto
Mediba
Sa el Hagar (Sais, Zau)
Kafr el Sheikh
Tanta
Abu Sir Bana (Busiris)
Damietta Branch
Rosetta Branch
Kafr el Battikh
Ras el Barr
Damietta (Dumyat)
El Mansura
Lake Manzala
MEDITERRANEAN
LOWER EGYPT
Zifta
Merimda Beni Salama
Athribis
Zagazig
Bubastis
Avaris
Pi-Ramses
Tanis
Port Said
El Gezira Island
Basus
Pyramids of Giza
Heliopolis
Gebel el Asfar
Cairo
El Abbasa
Kafr Hasan Dawud
Migdol
Pelusium
Saqqara
Memphis
Nile
UPPER EGYPT
Ismailiya Canal
Suez Canal
Ismailiya
N
A Chronology
Predynastic Egypt
5000 B.C.: Evidence of earliest village life in the delta found at Merimda
Archaic Period
King Menes unifies Upper and Lower Egypt; Memphis becomes center of power
3000 B.C.
Old Kingdom
Age of pyramids
2500
First Intermediate Period*
*Period of social collapse
Bronze replaces copper as metal of choice
2000
Second Intermediate Period*
Hyksos rule
Middle Kingdom
Akhenaten and wife Nefertiti attempt to make single-god religion
King Tutankhamun
Ramses II
Wars with Hittites
Iron introduced
1500
Third Intermediate Period*
Libyan rule
Assyrian invasion
Kushite rule
1000
Late

Hothouse of history

Seedbed of a great ancient civilization, the Nile River Valley and the delta gave its inhabitants two critical assets—fertile land and an enviable location. Situated at what seemed to be the center of the world, the delta was the seaside hub of Africa, Europe, and Asia. In peacetime Egyptians engaged their neighbors in trade, swapping surplus wheat and barley from their bountiful granary for commodities they lacked, including iron, copper, and spices. In war they fought to defend—and extend—the land and civilization they believed was governed and glorified by the gods.

But over the centuries Isis and Osiris and the rest of the Egyptian pantheon lost their sway to the machinations of men—with mixed results. In the early 1800s Napoleon noted: "Under a good administration the Nile gains on the desert; under a bad one the desert gains on the Nile."

(Continued from page 9) The Egyptian parliament passed a bill to stop the practice, but the new law has not been perfectly enforced. "Think how many people have been affected," Ibrahim said sadly. "Think how many seeds a single brick of earth could hold!"

As a student in Cairo nearly 20 years ago, my only knowledge of the delta came from fleeting views from the express trains I rode to Alexandria. I felt that there must be more to this land than the green fields and black buffalo that met my gaze.

Now I set out to see what lay beyond, heading first through the southeastern delta and then north along the Damietta, the longer of the two Nile River branches. I would hit the Mediterranean coast at the small town of Ras el Barr and then move west to the opposite corner of the triangle, anchored by Alexandria—all the while surveying the towns and antiquities of the delta and its coast.

"EGYPT IS A PLACE where you can go bird-watching in the past," said Mindy Baha El Din, as we drove into the southeastern delta. She was referring to art: the reliefs at Saqqara, south of Cairo, and wall paintings at other tombs and temples along the Nile Valley. Mindy and her husband Sherif, a conservationist, write wildlife books, lead tours, and lobby on environmental issues.

"The ancient Egyptians were superb natural historians," she said. "You can identify hundreds of species of fish and birds on the tomb wall paintings. Not only that—but you can also see that Egyptians still hunt the same way they used to, using clapnets."

Cairo tapered off behind us as we drove northeast on the perimeter of the delta, along what was once the Pelusiac branch of the Nile. The highway, dotted with military installations, hugs the line that divides the

Ever absorbing, the Cairo metropolitan area—including El Gezira Island—draws all of its water from the Nile, thereby decreasing drainage to the delta. To the south, African nations, especially Ethiopia and Sudan, also tap the river. To help defuse disputes over water rights before they turn violent, nations in the region are forming the International Nile Basin Association, scheduled to be operating by 1999.

sandy waste of Deshret from the dark soil of Kemet. Ancient Egyptians could never have avoided wildlife in their art because there was so much of it. "There were foxes, jackals, weasels, jungle cats, wildcats, fruit bats, frogs, and waterbirds—ducks, waders, herons, everything," Mindy said. "As late as 1980 Egypt had 25 percent of all the Mediterranean's wetlands."

Such riches shaped Egypt's history. While civilization started in the south, it was perhaps the lushness of the delta that tempted King Menes to conquer it around 3000 B.C. and unite Upper and Lower Egypt. Some scholars believe it was here, on this eastern land known as Goshen, that Joseph was sold to one of Pharaoh's officers, the Hebrews toiled on public works projects, and Moses grew up. The whole scope of Egyptian civilization—the pharaoh's authority, the magnificent cities, and the migrations of the workers who built them—was rooted in the land that made the nation prosper.

We turned off the main road and onto a track leading through low sand dunes. The golden mound of Gebel el Asfar, "yellow mountain," rose to our left, and a rancid smell pervaded the air as we passed a gate, a saluting peasant, and a farm. The smell of human waste came from the soil, irrigated with raw sewage from Cairo. We walked through the rows of tomatoes and lettuce to the cooing of palm doves, the cries of the crested lark, the whoops of the hoopoe, and the gurgle of the stinking black water running from chugging pumps into irrigation channels.

"There's a kind of paradox," Mindy said, squinting up for birds. "Land reclamation expands the delta—and the habitat for the painted snipe and the Egyptian mongoose, by the way—but with the new life and farming, urbanization reduces the habitat again."

The breadbasket of Egypt seemed more like a zoo as we drove by a reed bed whose gnarled trees sheltered a heron colony. "See the purple-gray birds in the trees? Those are night herons. These reed beds are being lost to land reclamation and pollution. But insects thrive on waste, so insect-eating birds like whiskered terns and little gulls are flourishing."

In the small town of El Abbasa, halfway up the slanting border of the eastern delta, Mindy's friend Gamal Zaara joined us. We walked through a fish farm fed by a canal, and farther in—Gamal pointed west—we saw rice fields. "Rice cultivation creates artificial wetlands with insects and toads for birds to eat," he said. "That's excellent for waterbirds like herons."

After the deafening modernity of Cairo, this excursion to a world of reeds, ponds, and birdsong was a leap to the Egypt of 5,000 years ago. Mindy agreed, adding, "Just imagine pharaonic Egypt, with the small population it had to support but with millions of birds and fish and the world's richest land! They must have thought they were living in paradise."

AGRICULTURALLY PRICELESS, this paradise attracted constant waves of migration and became the melting pot of Egypt. From 1650 to 1000 B.C., when national security was lax, Hyksos drifted in from the east and Libyans fought their way in from the west, forming powerful communities, governments, and eventually

Seeking posterity: Giza's great pyramids of Khufu and Khafre not only entombed Egypt's leaders for life hereafter, they were also national projects that occupied the people. Memories of Ramses the Great live on, thanks to the many megaliths he built of himself, including a few stockpiled in Tanis (below). Buried facing the dawn, skeletons in Kafr Hasan Dawud, a 5,000-year-old grave site (facing page), reflect the early Egyptians' obsession with the sun.

Remains of a Greco-Roman city at Kom el Dik in Alexandria include a statuette of Alexander the Great, the city's hero-founder. So strong was Greek influence here that the city was known as Alexandrea ad Aegytum, or "Alexandria beside Egypt," as if it were a separate nation. It still feels like a place apart on summer days when hordes of beachgoers arrive to get away from it all.

dynasties. In the 11th century B.C. the city of Tanis, on the eastern perimeter of the delta, grew up as a national capital and military stronghold. From here Egypt maintained a buffer zone against the rising powers of Assyria and Babylonia.

"It's the highest point in the delta," Philippe Brissaud, an archaeologist, said as he pointed to a gentle slope rising over a plain scattered with broken statues, a decapitated obelisk, and the deserted temples of once grand Tanis.

"Look at this half statue of Ramses II," my guide Yahya Emara said as we walked down an avenue strewn with diorite and granite remnants. "Have you ever seen more beautiful shins or kneecaps?" Aswan provided the granite for these dimpled royal knees, via a now extinct branch of the Nile. The statue itself was hauled here from the former delta capital of Pi-Ramses, which Hebrew laborers may have helped build in the 13th century B.C. Yahya showed me a well nine feet in diameter and the upper half of the Ramses II statue, which lay on its back amid sherds of clay pots.

"People from villages come here and walk all around the statue to get rid of their problems," he said, "and women who want to have children bring jugs of water, pour it over themselves, break the jugs, and then expect to conceive." He pointed to the imposing berms at the edge of the site: "The walls of Tanis were nearly 50 feet thick!"

Relatively few tourists make it to Tanis, but Egypt's Supreme Council on Antiquities is planning to invest heavily here, so that the obscure names of its mighty pharaohs—the Osorkons, Psusenneses, and others—become as well known as Ramses and Tutankhamun.

From Tanis, I headed west to the Damietta Branch of the Nile and a more recent period of Egyptian history. The Damietta bisects the

city of El Mansura, the unofficial capital of the delta. El Mansura is, for Egypt, a fairly new city, founded in A.D. 1220 as a military camp during the Crusades. It was the site of two crushing crusader defeats; the stone house where King Louis IX of France was imprisoned is now a museum.

It was in El Mansura that I discovered you can not only bird-watch in Egypt's past but also track the history of the area's modern diseases. Waterborne parasites thrive in the delta's canals and ditches, and poor plumbing worsens the problem, increasing the number and variety of infectious pests. The bilharzia parasite, which leads to schistosomiasis, damaging the liver and causing blood loss, is the most prevalent.

Schistosomiasis was first recorded in 2000 B.C. in the papyrus of Kahun, an Egyptian medical document that detailed the most common symptom, blood in the urine. The Ebers papyrus of 1550 B.C. describes both the disease and its cause—"worm in belly"—and notes that the parasites "are not killed by any remedy." Physicians of the time knew how the disease was spread and so proscribed contact with infected water. Portrayals of fishermen, farmers, and boatmen show them wearing penile sheaths, perhaps for protection.

Four thousand years later, schistosomiasis still plagues the delta. "Farmers who have skin contact with Nile water can get sick. So can people who drink it or children who swim in it," said Mohamed Ghoneim, director of the Urology and Nephrology Center in El Mansura. Dr. Ghoneim's friendly face was animated by piercing eyes that shuttled between me and the clock on the wall. He is a busy man, and it is rare to catch him sitting in his office.

Parasites, he said, are not the only cause of disease in the delta. Water is also sullied by pesticides and fertilizers that leach from the

Congregating for midnight Mass at the Anba Bishoy Monastery in Wadi el Natrun, Coptic Christians can trace their church's spiritual roots back almost 2,000 years and their ethnic roots to pharaonic times.

soil. The toxicity of such pollutants causes renal failure and liver disease, and thousands of people living in the delta suffer from such illness. I asked Dr. Ghoneim if the situation was getting better or worse.

"We educate people, but then those educated cannot implement what they have learned," he said. "There is clean water in almost every village, but farmers still use the canals for domestic use." Lacking indoor plumbing, most of the population cannot bathe, shower, or wash their clothes at home. Their only alternative is to use the polluted and infected water that surrounds them.

Behind the hospital a crowd of at least 150 peasants, the men wearing robes and skullcaps, the women kerchiefed and keeping their children in line, sat in long rows of chairs in an open-air reception area, looking worried. As Dr. Ghoneim's deputy, Salah Hammady, showed me around, a few of those waiting rushed over to seek his intervention. Dr. Hammady made a polite gesture of dismissal and quickened his pace. "We have a waiting list of 2,000 patients," he said. "Obviously there are priorities. Patients with tumors or renal failure we see the same week."

Dr. Hammady was taking the afternoon off to show me the eastern delta. "We are headed toward Baltim," he said as we left the concrete buildings of suburban El Mansura for a flat landscape checkered in green and black. I asked him about El Salam, or Peace, Canal, the four-billion-dollar project that would channel Nile water into the Sinai Peninsula. It would mean much less water flowing into the delta, but when the Israelis ended their occupation of the Sinai in 1982—in compliance with the peace treaty between Egypt and Israel—the Egyptians were impatient to make the liberated land bloom. Hammady grimaced.

"There is no schistosomiasis in Sinai—yet," he said. "They are bringing polluted water to an unpolluted place. It's not a good idea."

An empty, six-lane freeway greeted us east of the coastal village of Baltim. A lacy pattern

Pilgrims pray in Tanta at the tomb of Sayyid Ahmad al-Badawi, a Moroccan holy man who came to Egypt in the 13th century. His mystical Sufi Muslim order, the Badawiya, still thrives.

of sand drifted over the road, and breakers crashed only a few hundred feet away to the north. The stretch was part of the unfinished International Road that will someday link the delta to Libya and the rest of North Africa on the west and to Israel and the eastern Mediterranean on the east. We followed it toward a plain of beet fields with a mammoth industrial plant towering above them.

"This is new land," Dr. Hammady said. "Freshly reclaimed land is new land, and land reclaimed 30 to 40 years ago is called old new land. To the east is old black land," he said, referring to soil farmed from time immemorial. "Some of the new land is farmed by the El Salam Land Reclamation Society. New college graduates are given five acres of land to farm and $175 a year. It doesn't matter if their degrees are in literature or pharmacology. They farm the land and feed themselves and form new communities, like kibbutzim."

In Cairo an agricultural genetic engineer, Magdy Madkour, had given me some basic arithmetic of land reclamation. Of Egypt's 7.5 million acres of arable land, six million are in the delta. Two million acres of desert land reclaimed through irrigation had made up for the 1.5 million lost to urbanization, but the old land lost was more fertile than the new, irrigated desert land. Fertilizers are used, and overused, to increase the value of the reclaimed land, but the solution may lie elsewhere.

"After the land and the water," Madkour said, "you have to turn to the plant itself. We are tailoring plants to survive salinity, scarce water, and high temperatures. We need resistance to viruses, insects, and other environmental stresses."

Madkour and other scientists at Cairo's Agricultural Genetic Engineering Research Institute are working to clone genes that would make some of the delta's major crops—broad beans, potatoes, squashes, melons, and winter wheat—more resistant to these threats. The institute is also experimenting with organic farming techniques along the road from Cairo

to Alexandria, on the fringe of the desert. There researchers grow apple, peach, apricot, and olive trees and grapes, cantaloupes, and melons without the use of fertilizers or pesticides. This makes them more valuable in foreign markets that typically frown on the use of agricultural chemicals. If Madkour is successful in his development of healthier, chemical-free fruits and vegetables, the rewards for delta farmers could be great.

As I LEFT EL MANSURA after my day trip with Dr. Hammady, I saw a sign in the train station that read "Do not kill lives God has forbidden you to kill by riding on top of the trains" and stayed safely in my seat to watch an old Egyptian screwball comedy on a VCR. As we rolled through Kafr el Battikh, "village of watermelons," I admired the vista of "old black land."

"Wave to the river!" a weary-looking mother told her two toddlers, who scrambled across the aisle to spy at the riverbank parallel to the track. The children waved vigorously.

The Nile itself, rather than cities or the great alluvial plain, dominated my journey to the northeastern city of Damietta. The river widened and swirled under one long iron bridge and then another as the train approached the orderly concrete buildings of the city.

For some reason Egyptian folklore maligns Damiettans. There is an unkind saying that they are so miserly and dishonest that "they sell bread on one side of the train tracks and beg it from the other." This stereotype was belied by two perfect strangers who relieved me of my suitcase as soon as I arrived at the train station. The young men asked my destination, which was the mayor's office, and introduced themselves as Walid and Yasir as we trudged up the steps of the four-story city hall.

"We love hard work," I was told by Brig.

Songs and dances and eddies of emotion swirl through the streets of Tanta during Ragabiya, a local festival celebrating the memory of Sayyid Ahmad al-Badawi. Almost every place in the Muslim world honors its local saints with similar festivals, but because the Islamic calendar is lunar based, the celebrations do not occur in the same season every year. In Tanta, though, Ragabiya always begins when the Nile rises in late spring, and continues for three joyous days.

Gen. Gamal Amin, the mayor of Damietta. "And here we are known for our industry. We make furniture and ships. We have our own free zone. We would work 24 hours a day if we could! We are the Japan of Egypt!"

It is true that, in the largely agricultural delta, Damietta bristles with factories, and the area is promoting itself as the "Province of the Future" with its fishing industry, seaport, and medicinal "hot sand baths."

Amin is a veteran of the 1973 war between Egypt and Israel, and the wall behind his desk is adorned with photos of him holding an Israeli flag captured at Port Taufiq on the Suez Canal, with the late Egyptian president Anwar Sadat, and on a training course in the United States. He had seen me on almost no notice, even though I had shown up in his office with my luggage, carried by an unofficial welcoming committee.

"Typical Damiettans!" beamed Amin. He presented me with a history of the city (known to the pharaohs as Di-At, "city of the cedars," because it was the entry port for Lebanese cedar) and left me with Walid and Yasir, who found me a modest hotel and had dinner with me. They paid for the meal and would not accept anything in return for their assistance.

But neither they nor the mayor knew much about boatbuilding, so I had to find the boatyard on a beach south of the nearby town of Ras el Barr on my own. There the graceful boats of eucalyptus and mulberry, in various stages of completion, lay on the bank or, if nearly finished, on elaborate wooden chutes that are used to ease them into the river. A barefoot craftsman scaled a bowsprit and hammered spikes into the hull. This trade is family run, with skills passed from father to son. I struck up a conversation with a leathery man brushing sealant on the hull of a nearly finished boat, which was at least 60 feet long.

"This one costs 500,000 pounds [$147,000 U.S.]," he said, never interrupting his work. "It was made to order for a group of investors. Big boats are best because our fishermen have to go out farther and farther for fish." The catch is poor close to the river because of pollution and the decline in nutrients that floodwaters once delivered.

"Will it be painted blue?"

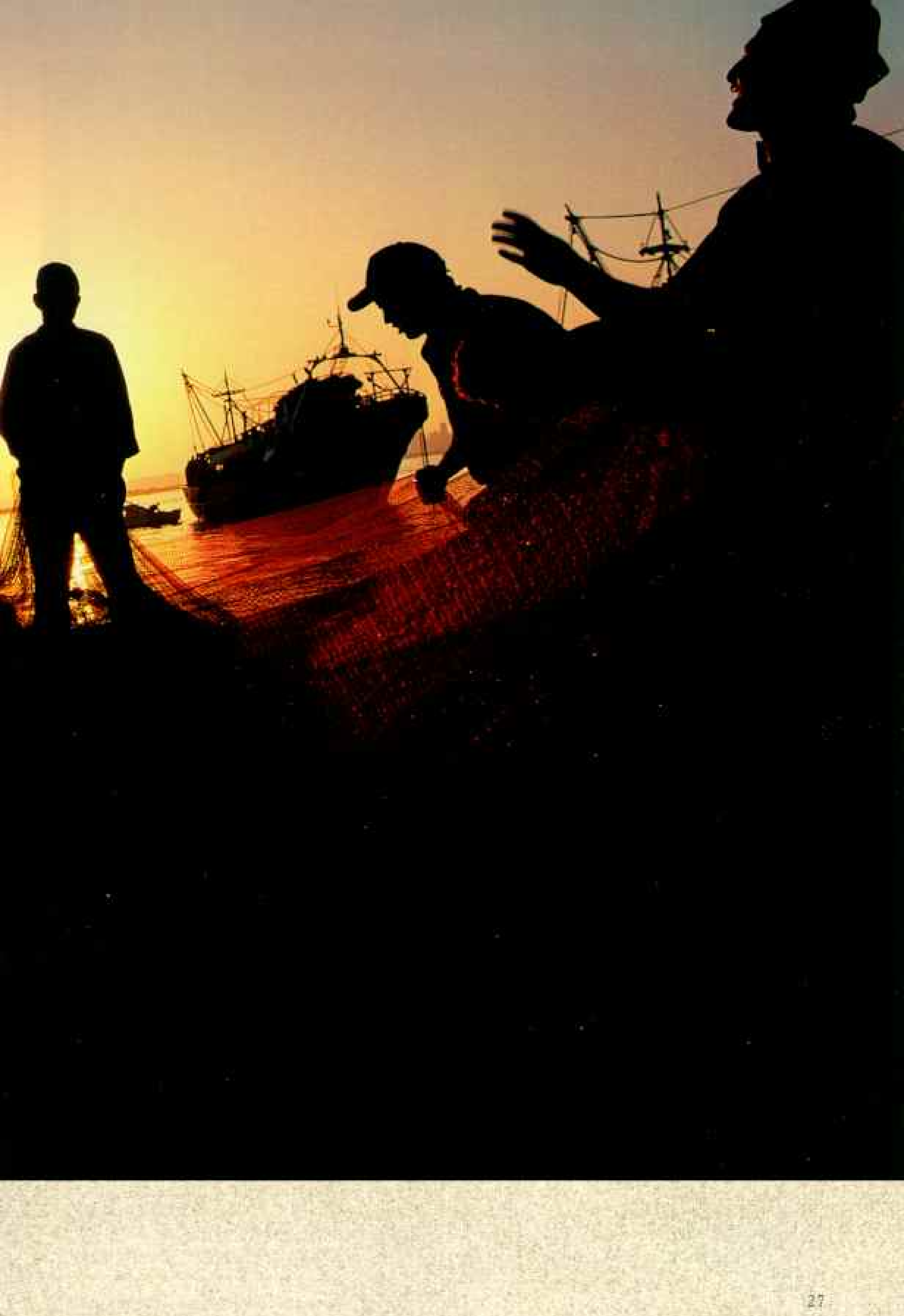
"All Ras el Barr boats are blue. Port Said boats are green. It's just a tradition, the way Cairo taxis are black and white while Alexandria taxis are black and orange."

Muhammad, as he introduced himself, dashed around the boat, forcing me to follow him but politely answering my questions. Yes, they build small boats too; he gestured to a graceful launch a few yards away. Yes, this is a skill passed on from father to son, but not in his case; he was a contract worker who finished, sealed, and painted boats. "And," he concluded brusquely, "I am very busy today."

That night, when I shot pool with Walid and Yasir at the Aladdin Coffeehouse on the beach, they confirmed what Muhammad had mentioned—local fish catches were down. "We used to export fish to Greece, Turkey, and other countries. Now we don't," Yasir said. "They just sell the fish here in Egypt, especially to the big hotels in Cairo."

Walid and Yasir were frustrated with their careers in this small town. Yasir wanted something better than his chauffeuring job, but the only moonlighting he could find was driving

After a long night of dragging their nets on the Mediterranean, fishermen take stock in Alexandria's Eastern Harbor. Years ago they enjoyed big hauls near the two main mouths of the Nile. Today, with the river delivering so few nutrients and so much pollution, the fish have gone farther out to sea. So too have the fishermen.



Fishing boats put out to sea near the mouth of the Damietta Branch, where salt water has seeped almost 20 miles inland. A freshwater aquifer beneath the northern delta remains relatively healthy.

a taxi. Walid was unemployed but wanted to be a professional swimmer. I told them about a fellow I had met in the southeastern delta. His hobby was catching poisonous snakes. He removes their fangs and muzzles them with thread, keeping them as pets. This was fine entertainment, he had said; even his cat wasn't afraid of his latest catch, and he had impressed his neighbors with it. Sometimes people even paid him for a peek.

"How do you like that, Yasir?" said Walid with a laugh. "Someone's more bored than we are."

THE RIVER finishes its 4,240-mile journey to the sea with the verve of a symphony in its last movement. After leaving Damietta, it rushes for the green flatlands it has created, and, bearing a few robin's-egg blue boats, then dozens of them, and then hundreds, it rushes past Ras el Barr and its two lighthouses for the Mediterranean. The river at this point is no longer the Nile but part and parcel of the enveloping sea.

Ras el Barr, with its relatively clean seacoast for swimming, has developed into a good-size town where Egyptians and visitors from other Middle East countries love to spend the summer. But it wasn't always that way.

"Ras el Barr was unknown," Khaled Abd al Moneim Abdou, a physician, told me at the Dolphin Inn, which he owns as an investment. "It was just sand dunes and collapsible straw-and-bamboo houses. At the end of the season, people took their houses apart and put them away until the next year."

The Dolphin Inn specializes in water sports and weddings. A boisterous reception was in progress near the outdoor table where we were sipping lemonade. A young video cameraman moved through the wedding guests, angling to capture the bride and groom as they sat enthroned on two raised and gilded armchairs. Before us, along the Nile, fishing boats and yachts drifted by or rode at anchor.

"This place started changing during World

Raw sewage once sloshed in open canals in the city of Damietta, but a new underground drainage system should help mitigate a national problem: Waterborne diseases kill tens of thousands of Egyptians a year.

War II, when people came here because Alexandria was considered too dangerous," said Abdou. "In the 1950s it became a more permanent town." I could imagine that the 1952 socialist revolution that dethroned the king opened this quiet retreat to the masses. "Then in the 1967 war between Egypt and Israel, Port Said on the eastern delta was shelled and badly damaged, and many of that city's people came here. The government asked the people of Ras el Barr to rent their summer homes to the refugees."

The eastern delta, from the ancient capital of Tanis to the new city of Port Said (1869) on the Suez Canal, has always been a crucial line of defense. The Military Museum in Port Said records not only Israeli shelling but also the British bombardment in 1956, which cost dozens of lives. Dioramas represent the same soil being defended by Ahmose I in the mid-16th century B.C. as he expelled the Hyksos, Thutmose III in the late 15th century B.C. as he attacked Megiddo, and two of Alexander's generals, Ptolemy and Perdiccas, as they fought a battle near Pelusium in 321 B.C.—just 20 miles from the museum itself.

THE AREA'S MODERN DEFENSES came into view as I left Ras el Barr for Alexandria on the western delta. Six concrete breakwaters lay a hundred yards out in the Mediterranean, protecting the shore from powerful waves. All of the delta's coast is prone to erosion, a problem made more serious by the dams blocking the flood-borne sediment that used to build up the shore. When the refugees from Port Said traveled the old coastal highway in 1967, the road was sometimes threatened by waves; now the highway is submerged.

Thousands of square yards of coastal land are lost every year. But this is not new: Even the earliest Egyptians knew that erosion was a threat, and only one major city was ever built on the 200 miles of delta coast. But that city was unique in more ways than this.

Alexandria is shaped like a crocodile, with its jaws biting the Mediterranean and its belly an inland shore along Lake Maryut. It was once the greatest cosmopolitan city of the Mediterranean, and hence the world, with Egyptian, Greek, Jewish, and Roman communities mingling amid its gleaming marble buildings. Now a far more homogeneous city, its colorful history is reflected even in the names of its tram stops: Chatby, Cleopatra, Moustafa Pasha, Camp Caesar, Glymenopolou, San Stefano, and, somehow, Miami.

Deinocrates, the urban planner hired by Alexander the Great in the fourth century B.C. to lay out the city, would not recognize it today. But the original street grid is discernible, though it is lined with shops, offices, and outdoor cafés. El Horreya ("freedom") Avenue follows the line of the Canopic Way, at either end of which stood the Gate of the Sun and Gate of the Moon in Ptolemaic times. An elevated point along Horreya was most likely Alexander's tomb, the Soma, which disappeared from history between A.D. 215, when Roman Emperor Caracalla paid his respects, and A.D. 390, when St. John Chrysostom is said to have gloated that no one remembered where the pagan monument had stood.

Many of Alexandria's monuments have been lost through the centuries. In the blazing heat of an Egyptian afternoon I examine a portion of one that has recently resurfaced from the bottom of Eastern Harbor. Two red-granite blocks—one 35 tons, one 40—once part of the seventh wonder of the world, the Lighthouse of Alexandria, rest just below the Qait Bey Fortress, built in the 1470s as a defense against the Ottoman Turks. Archaeologists have worked here for more than two years to locate and raise the remains of the 200-foot-tall tower, built in 280 B.C. and topped, legend has it, with history's first concave

Strewn like giant jacks, this concrete cluster will become part of a breakwater just off El Amal Beach near Baltim. Accelerated shoreline erosion – about 15 feet a year here – is yet another headache induced by changes in the region's water supply. Water quality suffers too: Repeated exposure to the toxic brew in Alexandria's Lake Maryut may have caused a fisherman's hand to become blotchy and swollen.

mirror. For years the lighthouse was the ancient world's greatest symbol of welcome, and one of the tallest buildings in the world. But centuries of abuse by earthquakes and tsunamis eventually claimed the tower, toppling it into the sea in the early 14th century.

Five colossal statues, more than 25 sphinxes, and nearly 2,000 architectural pieces are also being lifted from the seafloor. They may have been thrown into the harbor by 14th-century Egyptian rulers trying to keep invading crusaders from landing in the then crumbling city. On a grassy rise downtown, granite pharaohs, fragmented queens, and man-size sphinxes lie supine as I wander among them with Jean-Yves Empereur, the tanned and weathered director of the Center of Alexandrian Studies. "The inscriptions on the statues make it clear that they came from Heliopolis, near modern Cairo," he said with the sang-froid of a careful scientist. "The Ptolemies had a habit of transporting ancient monuments to decorate their city."

ALEXANDRIA IS, in many ways, in the delta but not of it. The Canopic branch of the Nile, linking the city to the rest of the region, dried up long ago. But even before this happened, Alexander's city was separate from the farmlands and peasant sweat that fed it.

"We have our own personality," said Adel AbouZahra, an Alexandria environmentalist. His apartment, on Omar Loutfy Street, an extension of Alexander the Great Street, posted the only No Smoking sign I have ever seen in Egypt. He sipped lemon tea and smiled. "We promote biodiversity, but most important is the biodiversity of our people! Look at our cemeteries—the Greek, the Coptic, the Muslim, the Jewish. Even a cemetery for free-thinkers! Try to imagine that in Cairo," he

Squeezing the last drop out of his land and labor, the owner of a rice farm near Tanis surveys his operation from beneath a parasol. Children are paid 80 cents for a 12-hour day to cultivate this crop, which requires huge amounts of water—two to three times more water per acre than wheat.

said, alluding to the more conservative, inward-looking capital. "We have been enriched by our proximity to Europe."

This is true. Alexandria's turn-of-the-century banks are more majestic than London's, and the stately, columned French and Italian consulates dominate the corniche. Throughout the city, Victorian mansions meet art deco apartment buildings in an architectural blend of European and Arab influences that suggests harmony rather than colonialism.

But it was hard to keep the energetic AbouZahra from his most passionate topic: Alexandria's environment, especially the polluted water that nearly surrounds it. He is aware, of course, that a rising sea could submerge the city, but this is not what worries him.

"Global warming doesn't scare me; our human activities scare me," he said. "We are one of the world's countries poorest in fresh water, and sewage and industrial runoff flow into the sea and Lake Maryut. You saw the beautiful Eastern Harbor? Two sewage pipes empty into it."

Alexandria has 37 percent of Egypt's industry, including paper manufacturers and silk dyers, which pollute the area's water with toxic acids. Oils and heavy metals empty from the city's manufacturing plants into the lake, which has been nearly filled in with solid waste from the city's sewers. The lake is so polluted that there are those who argue that the remainder should be filled in as well.

The city also produces 3,000 tons of garbage each day. I asked AbouZahra about recycling. "Recycling? It's the oldest idea in Egypt! There was no solid waste because people never threw anything away," he said as a tram clattered to a halt outside his living room window. "Now peasants buy frozen chickens in plastic and throw the plastic into the canals, which are choked with garbage. The delta is a crowded triangle that is going to explode with people, garbage, and sewage."

Drained of its power, the Nile slips placidly past a Muslim tomb in the village of Basus just before branching into the delta. The ancient Greek historian Herodotus foresaw disaster for the arid delta "if the Nile fails to flood." Deliberate taming of the river, though, has provided several extra harvests each year, a ready supply of hydroelectric power, and living space for Egypt's growing population. How these benefits will ultimately balance against their costs is a subject for historians to come.

"Do you smell it?" Essam Moustafa asked me. The slightly built Alexandria naturalist, made shorter by a natural stoop, was referring to Lake Maryut. I could smell burning trash, and I could see smoke as we drove out of the city. Before us lay a construction site behind ramshackle barriers. At the wheel, geochemist Mohamed Tamish turned right and drove west along the smoldering dump.

"This was part of the lake. That construction is for the Mubarak Sports City," he said, pointing to a fleet of earthmovers descending on the site. "East of here, 130 acres of fish farms were dried up to build the International Garden. This was once Lake Maryut. It has shrunk from 66,000 to 16,000 acres."

Maryut has always been sluggish, humid, and plagued with mosquitoes. Now, Moustafa and Tamish said, the thousands of families that fish here are facing the loss of their livelihood. Mercury is dumped into the lake, poisoning the fish. And there are waterborne diseases: hepatitis, typhoid fever, cholera, and, of course, schistosomiasis.

Driving south over one of the many divisions that separate the lake into small rectangles of water, we passed a petroleum plant.

"This is the dumping ground for the plant," said Tamish, pointing to a section of the lake made bright red by microorganisms that

thrive where oxygen levels are low. "And there are fish farms adjacent to this!" Men in skiffs paddled through shallow canals of clear water a few hundred feet on.

"Now we are going to show you something else," Tamish said as we turned north onto a road bisecting a shimmering green section of the lake.

"This is Maryut too," said Moustafa. "Isn't it spectacular? It's calm and clean and tourist worthy. If they put a tourist village here, it will forever block polluting industry from being built. Maryut can come back to life—we know it was done at Lake Tunis in Tunisia and Lake Okeechobee in Florida. We need water more than we need air!"

Less than a mile from the desert, we reentered the "black land" of Egypt. Such rich soil is the obvious reason that waves of people have continued to come here, but it is water that truly gives the delta life. It is little wonder, then, that the Nile, like the sun, was a deity to the ancient Egyptians. But unlike the predictable sun, the Nile god was and is highly changeable. The old river feeds and washes its rapidly multiplying subjects, and it responds to their abuse by striking back at them.

But the Nile alone does not determine the fate of Egypt's most precious parcel of land. The Mediterranean wears away the coast, as it always has. And even as the delta shrinks, the people keep coming in the millions, hungry for more crops and more land.

Returning to Alexandria from the south, we passed an industrial zone, then saw two fishermen hoisting a small boat toward the lake. Their children followed, carrying bundles of nets. I counted ten people before the sunlit scene was cut off by Maryut's high reeds. For nearly 7,000 years the delta has nourished its children. Now they must repay it for an entire history of favors. □

Sharp eyes of science probe the Mummies of Peru

Wrapped for travel, the Inca maiden featured in last June's issue (inset) glides into a Johns Hopkins Hospital CT scanner guided by author Johan Reinhard and a technician. Startling computer images would soon show how she died.

By JOHAN REINHARD

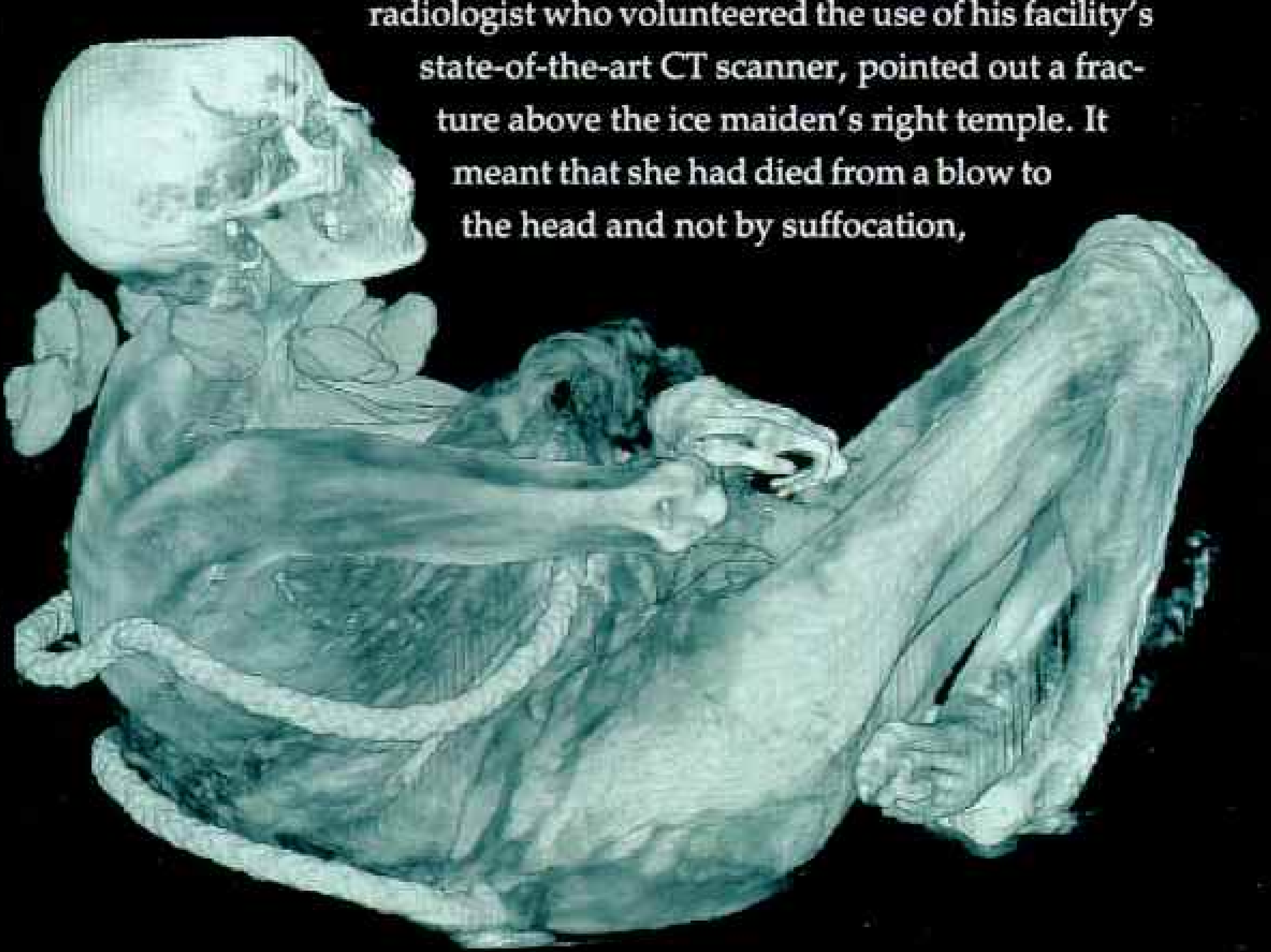
MARIA STENZEL

Since I last wrote about the Inca ice maiden, telling how my climbing partner and I found her frozen body high on a Peruvian peak and brought her down to the safety of a freezer at Catholic University in Arequipa, the girl who gave her life in sacrifice five centuries ago has made another unimagined journey. As a result she is, in a sense, being discovered all over again.

A RESEARCH PROJECT SUPPORTED IN PART BY YOUR SOCIETY

Last May, with permission from the government of Peru, we arranged for the mummy to travel to the United States in a special container donated by the Carrier Corporation. At Johns Hopkins Hospital in Baltimore, radiologists made computed tomography (CT) scans of her body—spectacular three-dimensional x-ray images published here for the first time—and pathologists took tissue samples (right) for analysis. Some findings were announced immediately; others are still coming in. We have also learned more about one of the two other sacrifices found on Nevado Ampato volcano (page 42).

I'll never forget the moment when Elliot Fishman, the Johns Hopkins radiologist who volunteered the use of his facility's state-of-the-art CT scanner, pointed out a fracture above the ice maiden's right temple. It meant that she had died from a blow to the head and not by suffocation,



as I had previously thought. This came as less of a surprise to José Antonio Chávez, the Peruvian co-director of the Ampato mummy project, who weeks earlier had noted something irregular about her right eye socket.

After the CT scans were made, Edward McCarthy and Patricia Charache, pathologists at Johns Hopkins, took a number of needle biopsies—small samples of tissue from different parts of her body, including the stomach and knees. Analysis of the samples allows us to fill in details about her diet and health. "She ate a meal of vegetables within six to eight hours before dying," says McCarthy, who has asked a forensic expert to identify what those vegetables were. Biopsies from her knees indicate that she had the bones of a normal, healthy teenager.

We had hoped the biopsies would also provide cell nuclei containing DNA, making it possible to trace the ice maiden's maternal and paternal lines

JOHNS HOPKINS HOSPITAL (FACING PAGE); MARIA STENZEL

of descent and perhaps even to locate her living relatives. But all the nuclei had dissolved, which suggests that her body did not freeze immediately after she died. Our hopes for establishing genetic links now rest with mitochondrial DNA isolated from her heart, skin, and muscle tissue by scientists at the Institute for Genomic Research in Rockville, Maryland. Mitochondrial DNA, found outside the nucleus, is passed down only on the female side.

We have barely begun to understand the children of Ampato, and when the time is right, I look forward to making additional reports of our findings.

Digital dissection shows results

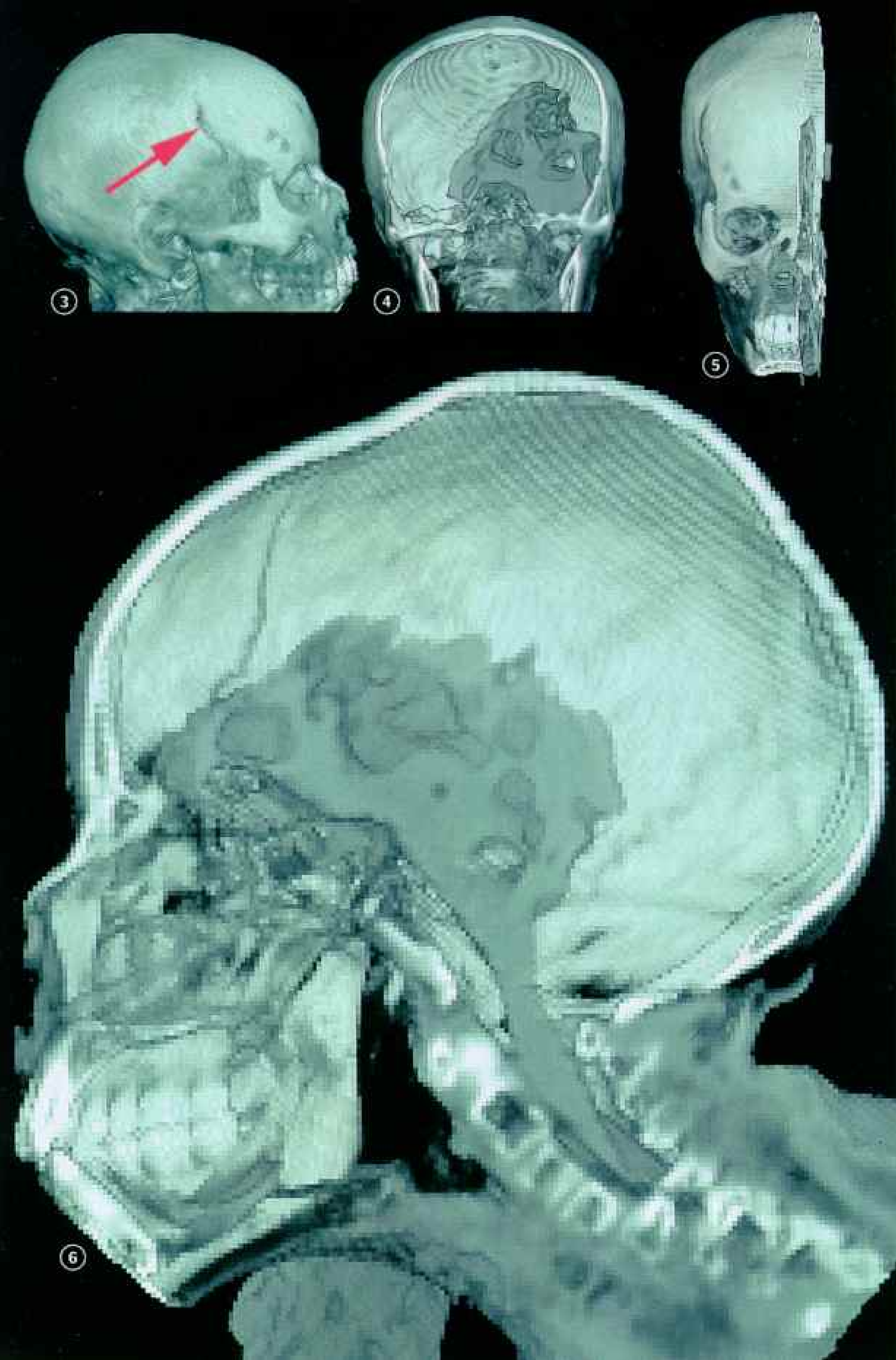
The diagnosis is swift: A blow to the right side of the head cracked the skull and caused a massive hemorrhage. "As soon as the image came up on the screen, we knew what had happened," says Elliot Fishman, director of diagnostic imaging, who pointed out details to the author (below, foreground) and his Peruvian colleagues José Antonio Chávez and Hilda Vidal. Computed tomography—creation of video images from x-rays—allows as close a study as an autopsy without destroying the mummy. These 3-D figures are a combination of 691 CT scans.

"In retrospect you can say, 'Aha! That eye is sunken and the orbit is deformed,' " notes Fishman of the ice maiden's face (1). "But it's like a diagnosis in a live person—after you have the answer, it's easy."

Front and side views (2 and 3) reveal a fracture about two inches long, marked by a red arrow. Inside the skull (4) sits the dark shape of the brain, pushed to the side by blood five centuries ago. Fishman sees similar cases today: "It's typical of someone who has been hit by a baseball bat."

A split view (5), rotated to display the spinal cord (6), reveals its surprisingly good condition—proof of fairly fast and sustained freezing. What the scans did not uncover is also important: Neither bones nor teeth show signs of disease or malnutrition. The Inca chose a perfectly healthy girl—about 14 years old and four feet ten inches tall—as a gift to their gods.

STEPHEN ALVAREZ (TOP LEFT); MARIA STENZEL (ABOVE); JOHNS HOPKINS HOSPITAL


3
4
5
6

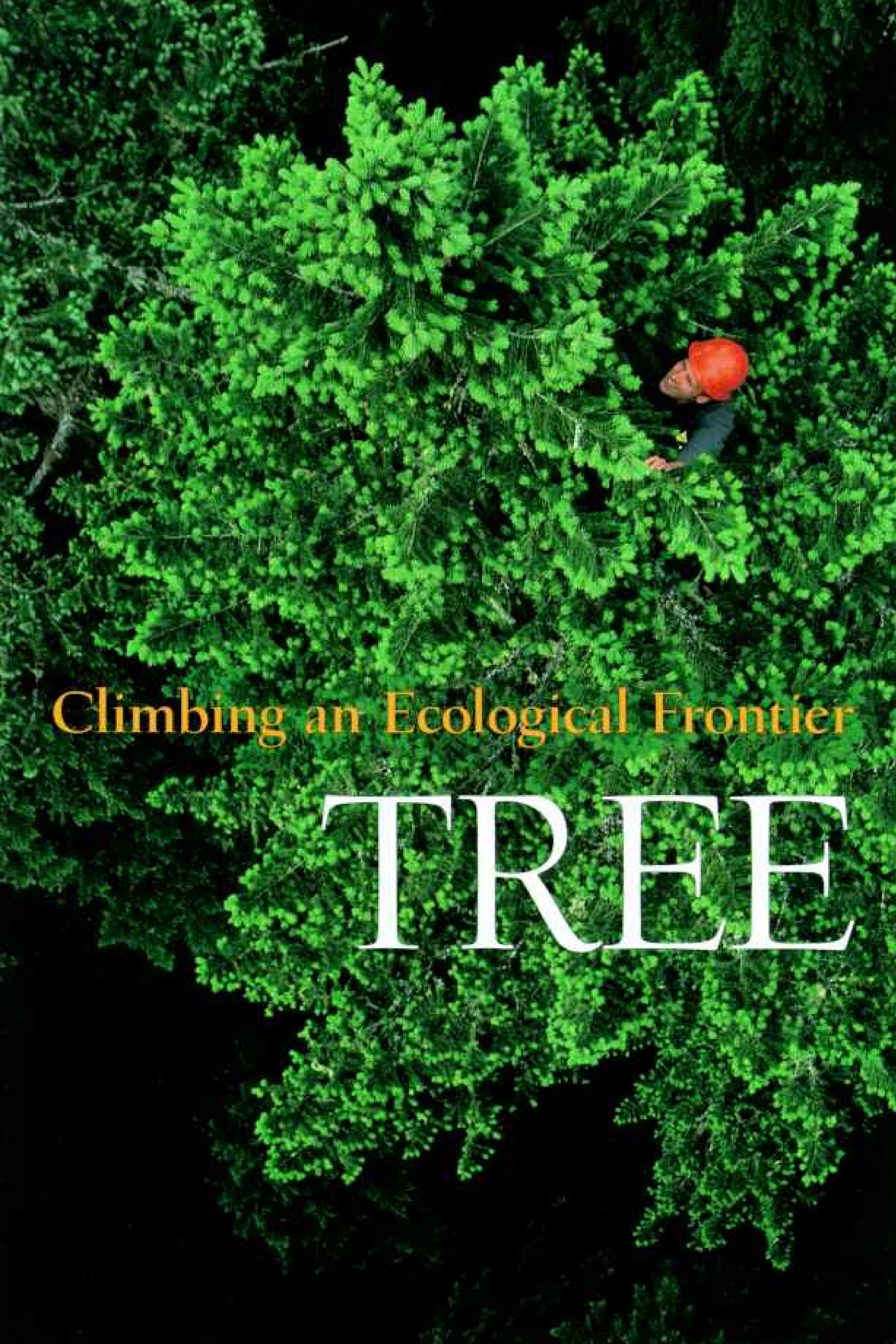
A burial struck by lightning

Bare bones protrude from one of the two graves uncovered on Nevado Ampato's high plateau in October 1995. There archaeologists found offerings around the remains of a child who was about ten years old when sacrificed and seated in the ice-cold earth for eternity.

Still partly locked in frozen earth (bottom right), the skeleton bears burns made by lightning. "To my knowledge, no one has ever seen lightning damage in 500-year-old bones," says John Verano, a physical anthropologist from Tulane University who examined the bones in Arequipa, where they remain. So far he has plotted damage to the skull, a rib, both legs, and both feet (right). "When we can reassemble the entire skeleton, we'll get a better idea of the specific path the lightning took."

The child was too young for the bones to reveal the sex, but other evidence indicates this was a boy. Around the head radiated reeds that once hung like fringe from strings—likely a headband worn only by Inca males. Also, the remnants of clothing show no signs of *tupus*, the pins that would hold together a female's dress and shawl. A silver male figurine about four inches tall (below), also blasted by lightning, rested near the mummy's thighs. Does this parallel the female figurines that accompanied the ice maiden on the summit? Continuing study, medical tests, and future excavations promise answers to this and other questions surrounding Ampato's mummies. □

CHRISTOPHER A. KLEIN, NATIONAL GEOGRAPHIC ARTIST (TOP); STEPHEN ALVAREZ


Climbing an Ecological Frontier
TREE

More than 200 feet above the ground, climber Joel Clement reaches the summit of a lofty Douglas fir. The trees around him are like layered skyscrapers packed with unusual species of animals, plants, fungi, and lichens normally hidden from human view. Understanding their ecology is the passion of Clement and a few other biologists who explore the canopies of some of the world's tallest forests: old-growth stands of the Pacific Northwest.

GIANTS

of North America

Article and photographs by MARK W. MOFFETT

A new world discovered

RIDING IN A GONDOLA 250 feet high in a forest of Douglas fir and western hemlock near Carson, Washington, any scientist who wishes can touch the crowns of 340 trees within the nearly six acres of the Wind River Canopy Crane's 280-foot horizontal reach (below). The crane was erected in April 1995 as a platform for tree canopy study. Despite all the controversy over the logging and preservation of old-growth forests of the Pacific Northwest, their canopies remained relatively unpublicized well into the 1990s, compared with much more remote tropical rain forests. (See the October 1990 and December 1991 issues of NATIONAL GEOGRAPHIC.)

Some studies of temperate rain forest canopies had been done in the 1970s by a handful of pioneering ecologists such as Oregon State University's Bill Denison—researchers with long climbing ropes and stomachs strong enough to operate at treetop heights equivalent to 35-story skyscrapers. When simply getting to the first branch of a giant tree can

require the combined skills of an archer, ship rigger, mountaineer, and gymnast, the pursuit of science is fueled by a significant boost of adrenaline. Compensations include tucking into a hammock at night high in the canopy and listening to the haunting call of a spotted owl.

Not all scientists can take that route, and the crane's reach brings old-growth studies into the mainstream. "But the crane covers only a very small area," says Steve Sillett of Humboldt State University in Arcata, California, who still traverses from tree to tree (right) and climbs straight up them. "There's always going to be the need for us lone guys and gals to be out there with our ropes."

A frequent contributor to the magazine, biologist MARK W. MOFFETT is the author of *The High Frontier: Exploring the Tropical Rainforest Canopy.*

Hard day's height

"A surreal candelabra jungle gym" is what Joel Clement, foreground, a Seattle-based canopy ecologist, calls a 2,000-year-old sequoia that he and I climbed with Steve Sillett for research. Their working day includes collecting some of the tree's lichen-laden reproductive cones, which grow on outer branches.

Partly because sequoias slough off their bark, lichens and canopy plants do not have a stable substrate to grow on. Dead limbs and cones are exceptions. For reasons not yet understood, sequoia cones remain on the tree for as long as two decades, allowing a community of lichens to develop.

Research with care

Checking a mist collector on a tower in Seattle's Cedar River watershed, John Rombold (left), a student of University of Washington forestry professor Tom Hinckley, holds on as rain begins to fall. Such collectors use hundreds of filament strands to rake moisture out of the air and deposit it in suspended cones. These and other measurements help Hinckley investigate hydrologic dynamics of the watershed.

Piloting the Wind River Canopy Crane, Mark "Sky King" Creighton (above) eases the gondola along the boom so that David Shaw, director of the crane facility, can observe bird behavior.

When making an ascent with arborist Donna Attewell in Mount Rainier National Park, I saw evidence that direct climbing can leave lasting wounds. Just by my foot (right) a dark ring shows scarring from a rope burn, and mosses and lichens had been scuffed from the branch. This hemlock was known to have been climbed only four times before — by a responsible professional. The rise in popularity of sport tree climbing now complicates canopy preservation. To protect forest health, Attewell and her colleagues are examining the methods and ethics of climbing.

Giant of giants

Discovered in 1963 by naturalist Paul A. Zahl, the National Geographic Society Tree (a coast redwood in Redwood National Park) has for several years topped the list of the world's tallest living trees. On March 24, 1995, Steve Sillett and I led an expedition to climb, map, and study the tree, and we established its exact height as 365 feet, 6 inches. Its status has recently been challenged by other coast redwoods in the region, although no official measurements have been announced.

Its striking features were drawn by artist R. Steve Foster in this silhouette view. Near its summit, massive, upturned branches produce mini-crowns of their own, some extending 60 feet above their junction with the trunk. Below, some branches sweep downward in great arcs, one approaching 50 feet. While large dead branches were a hazard during our ascent, even live branches can break free, plummet, and spear the earth. Some are thought to have sprouted new growth, exciting researchers with the possibility of an entirely new form of reproduction.

BRITISH COLUMBIA
Vancouver
CANADA
U.S.
CARMANAH PACIFIC PROVINCIAL PARK
Sitka spruce
Victoria
OLYMPIC NAT. PARK
Big-leaf maple
Seattle
WASHINGTON
Olympia
MT. RAINIER NAT. PARK
Douglas fir
Western hemlock
125°W
WIND RIVER CANOPY CRANE
Douglas fir
Western hemlock
Portland
45°
Salem
OREGON
H.J. ANDREWS EXPERIMENTAL FOREST
Douglas fir
Pacific
Ocean
REDWOOD NAT. PARK
Redwood
40°N
CALIFORNIA
NEVADA
Type of tree author climbed is shown in green
0 150
MILES
NGS CARTOGRAPHIC DIVISION
Sacramento
San Francisco
KINGS CANYON AND SEQUOIA NATIONAL PARKS
Giant sequoia
Los Angeles
Maximum height
Redwood 366.5 ft
Douglas fir 329 ft
Sitka spruce 315 ft
Giant sequoia 310 ft
Western hemlock 261 ft
Big-leaf maple 158 ft

Treetop world of rare surprises

MARK W. MOFFETT WITH S. KIM NELSON, OREGON STATE UNIVERSITY

A visit to the canopy puts familiar subjects in new perspectives and adds a few surprises. The top of one Douglas fir (above) has the look of a Ferris wheel ornamented with tinsel, in this case lichens, mosses, and liverworts. Such canopy plants, called epiphytes, form communities so dense in places that their mass equals a ton of plant material for every two acres of trees.

Prime examples are the big-leaf maples in Olympic National Park, where mosses reach a foot thick and contain more green leafy material than the trees themselves. Nalini Nadkarni (left) of Evergreen State College in Olympia, Washington, has been climbing big-leaf maples since she was a graduate student in the 1980s. Folding back the mosses like a luxuriant shag carpet, Nadkarni reveals a soil layer beneath. Treetop soil is created primarily from the decaying remains of leaves and epiphytes and, in the case of conifers, from needles shed by the tree.

Leached by heavy rains, soils in temperate rain forests tend to be so nutrient-poor that even the trees themselves cannot afford to ignore the epiphytes' contribution. Nadkarni's right hand holds a slender root of the maple itself, which is tapping canopy soil way up in its own crown.

Nadkarni's discovery of roots reaching into rain forest canopies around the world has helped turn our understanding of forest ecology on its head. Scientists now pay more and more attention to the role of canopy flora and fauna in the ecology of forest cycles.

An especially rare surprise is finding the nest of a marbled murrelet (above). Several times a day a parent flies as far as 50 miles from the nest to the Pacific Ocean and back to feed its mottled chick. The adult rests and then places a fish into the chick's mouth and speeds away.

Nervous and easily disturbed by humans, the murrelet, like the old-growth forests it requires for reproduction, has been in rapid decline. Despite efforts of survey teams up and down the Pacific coast, this was one of the few murrelet nests found in the region last year. As a consequence, plans for logging near the nesting site have been halted.

Snag sanctuaries

Skeletons of wood, dead standing trees, commonly called snags by foresters, were inaccessible as research subjects before the canopy crane. Once thought to be a sign of poor forest health, snags actually contribute greatly to biodiversity. Certain plants and fungi colonize the dead surface, while beetles and other insects inhabit the wood. Mammals and birds from woodpeckers to eagles build nests on limbs or in holes, where they have a clear view of approaching danger.

Canopy communities

Many old-growth trees are so tall that the epiphyte communities on them vary with height, much as forests themselves vary along a mountain slope. Transplanting lichens to branches, Steve Sillett (left) investigates habitat requirements in the H. J. Andrews Experimental Forest in Oregon.

Research suggests that rich communities develop only after a forest is several centuries old. Canopies of mature forests become, like rumpled terrain, more varied hosts than younger stands, thus promoting variety and richness in epiphyte species.

Sillett and others find that nitrogen-fixing lichens, which most heavily colonize the oldest forests, are especially important ecologically. When wet, such lichens leak excess nitrogen, which may be absorbed by other epiphytes or the tree itself. As old-growth forests of the Pacific Northwest are logged and replaced by young trees, nitrogen-fixing lichens are on the decline—and with them a critical source of forest nutrition.

Canopy insects have special niches. Tim Schowalter of Oregon State University in Corvallis focuses on a caterpillar of the silver-spotted tiger moth (above left), which increases light to the forest floor by eating needles. Arachnids, including the tiny crab spider (right), are numerous, with available insect prey flying up from the ground or wafting in on breezes. Future studies will measure the role of such "tourist" insect species.

Tree reproduction is likewise difficult to study from the ground. Consider a single branch of a noble fir (top). It has all the following on it at the same time: Large, green first-year female cones; large, gray second-year female cones; small terminal leaf buds; and the slender remnants of female cones.

Net results

Working from Sitka spruce treetops above the Carmanah Valley on British Columbia's Vancouver Island, entomologist Neville Winchester, in white hat, nets insects, aided by assistant Nancy Prockiw, in yellow hat, and others. His survey has found more than 300 new arthropod species and has begun to reveal the life cycles and ecological importance of many others. Temperate rain forests contain a tremendous number of undiscovered species, says Winchester, who teaches at the University of Victoria. "We have a virtually unexplored biological frontier in our own backyard."

Winchester's work finds strong evidence that microhabitats of ancient Sitka spruce canopies are unlikely to develop in second-growth forests. Or, simply put: Loss of habitat will cause extinctions.

Fear that canopy studies will bring rare new species to light and force more logging restrictions has put researchers at risk. Some have been threatened or had equipment or sites damaged or destroyed. I hope the logging community will come to realize that canopy research can help answer how best to manage forests, both to preserve beauty and species richness and to maximize long-term harvesting of North America's priceless trees. □

Turned out in Tibetan cold-weather garb, trailblazing explorer and journalist Joseph F. Rock struck a regal pose in the Jone Buddhist monastery in Gansu Province, China. His photojournalism opened Western eyes to such impressive sights as Jambeyang (facing page), in Sichuan Province. The discolored print shows the drawbacks of processing photographs in the field.

VOLUME XLI NUMBER THREE

[1922-1935]

OUR MAN IN CHINA

Joseph Rock

BY MIKE EDWARDS
ASSISTANT EDITOR

PHOTOGRAPHS BY MICHAEL S. YAMASHITA
ARCHIVAL PHOTOGRAPHS BY JOSEPH F. ROCK

Braving bandits and courting kings, Joseph Rock mounted elaborate expeditions to Asia's rough hinterlands. His adventures came to life in the ten articles he photographed and wrote for NATIONAL GEOGRAPHIC magazine from 1922 to 1935. This article, designed in the style of his time, celebrates the work of an imperious and determined explorer.

THE EDITOR

$3.50 A YEAR 50c. THE COPY

Menacing figures dressed as skeletons help usher in the god of the dead during a dance at a Tibetan monastery. This and other photographs made from black-and-white glass plates were hand-tinted by National Geographic artists using descriptions furnished by Rock.

He saw it, he survived it, he recorded it in words and pictures.

TO THE BANDITS who preyed on travelers in the backcountry of China in the 1920s, the caravan approaching on a mountain trail must have looked like an invading army.

There were 26 mules and 17 men, escorted by 190 soldiers with rifles. The leader had an imperious demeanor, and, in contrast to the ragged soldiers, he was well dressed in boots, riding breeches, and pith helmet. And he was *white*.

This was no invading troop, however. Joseph F. Rock, NATIONAL GEOGRAPHIC explorer, writer, and photographer, was on another marathon expedition through the unmapped mountains and kingdoms of premodern China. Rock had surrounded his caravan with soldiers to keep the bandits at bay.

EVER MINDFUL OF CREATURE COMFORTS, ROCK SET UP SHOP IN THE VILLAGE OF NGULUKO, CHINA, NOW YUHU, WHERE PHOTOGRAPHIC PLATES DRY ABOVE HIS BED.

Had those brigands been able to peer into the boxes lashed to his mules, they would have discovered things as strange as the sight of this stern-visaged foreigner who had penetrated their territory. Setting out for months at a time, Rock traveled like royalty. His baggage included tents, a folding bed, chairs, table, and, naturally, table linen and china. There was even a battery-powered phonograph. Sometimes he played opera for astonished nomads or monks at a Buddhist monastery; he duly noted that the nomads howled with laughter at the sad parts of *La Bohème* and *I Pagliacci*.

Freelance photographer MICHAEL S. YAMASHITA first traced Joseph Rock's footsteps while photographing "The Mekong, A Haunted River's Season of Peace" for the February 1993 issue.

Oh yes—he also took along a portable rubber bathtub, purchased from the famous New York outfitters, Abercrombie & Fitch.

Rock was a complicated man, a loner, stiff, proud, self-made, extraordinary, imperfect. Born in Vienna, the son of a nobleman's servant, he came to the United States in 1905 at the age of 21 and became an American citizen in 1913. Yet he never shed his autocratic, Old World ways.

He usually traveled on horseback, but when he called on a local ruler, Rock's expense accounts—among the most memorable at the GEOGRAPHIC—might contain such an entry as: *Chair coolies, 4 coolies at 80¢ per day.*

Since there were no roads where Rock operated, and hence no automobiles, the sedan chair, a compartment borne on two long poles, was his limousine. When the four porters put it down, the figure who alighted wore a white shirt, tie, and jacket. "You've got to make people believe you're someone of importance if you want to live in these wilds," he once said.

That was probably true. It was also true that Rock liked being important, and if he did not receive what he considered proper respect, his temper, always short-fused, would explode. Once, when a Chinese merchant entered his quarters and sat down without offering a greeting, Rock seized the man by the collar and tossed him out. "I will not put up with an impertinent Chinaman," he wrote in his diary, revealing the racism that was also among his imperfections.

The first record of Rock in the GEOGRAPHIC's archives is a memo written by Editor

HEIRS TO GENEROSITY, LI JINYUAN AND HIS WIFE CARRY A CHEST CONTAINING CARPENTRY AND DENTAL TOOLS GIVEN BY ROCK TO LI'S FATHER. HE BUILT FURNITURE FOR ROCK IN YUHU, WHERE LI NOW PERFORMS DENTISTRY. A SIMILAR CHEST (BELOW) IS BORNE ACROSS THE YANGTZE RIVER DURING ONE OF ROCK'S FORAYS.

Gilbert H. Grosvenor in 1921. It says: "Mr. Joseph F. Rock called here today regarding an article on 'HUNTING THE CHAULMOOGRA PLANT.'

"I offered him, for an article on the above subject, and a selection of 40 of his photographs, $400." In 1921 this was a goodly sum.

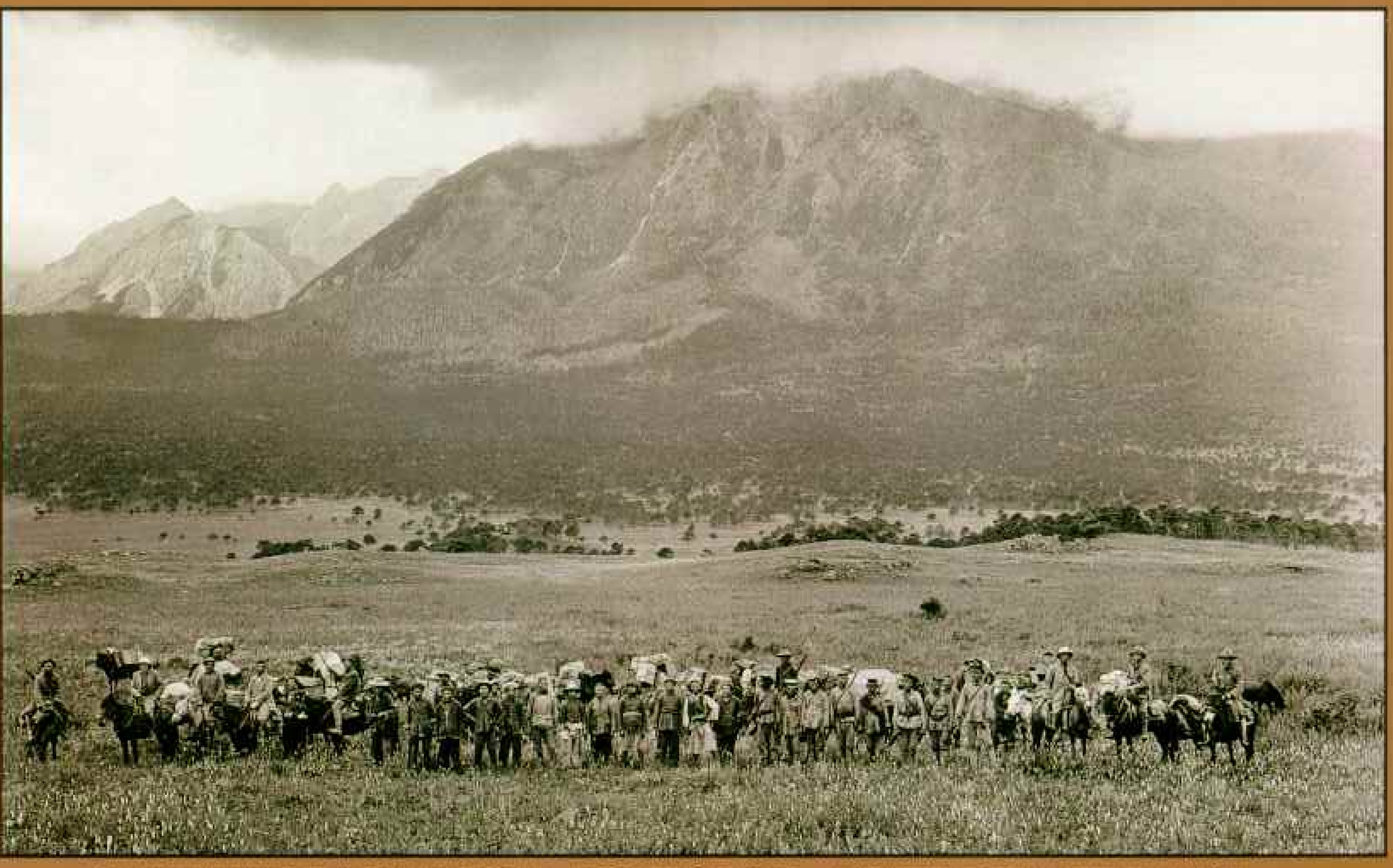
Rock had taken up botany in Hawaii, where he eventually settled after emigrating from Austria. Though he had no university education, he applied himself with determination—another personal characteristic—and became an expert, even teaching courses at what is now the University of Hawaii.

In 1920 the U.S. Department of Agriculture sent him to Siam, Burma, and India for a year to search for seeds of the chaulmoogra tree. An extract from chaulmoogra oil was believed to be useful in treating leprosy, and the department wanted to grow the tree in the U.S. Rock returned doubly successful; he not only brought a cache of seeds but also demonstrated that he could survive in the wilds of Asia. (Extract from chaulmoogra oil, unfortunately, proved to be of limited value against leprosy.)

His experience appealed to Grosvenor, who, seeking accounts of daring exploits for the magazine, eagerly supported explorers. Among the fruits of this policy were articles by Adm. Richard E. Byrd, describing his 1929 flight over the South Pole, and by William Beebe, writing of his record-breaking undersea dive in a bathysphere in 1930.

Rock would contribute accounts no less astonishing. Nine of his articles about China, accompanied by scores of photographs, were published from 1924 to 1935, bringing to

Sharing a chore, Naxi people sort chestnuts on the porch of Rock's home in 1923. In 1996 the Naxi Classical Music Orchestra practices music of the Tang and Song dynasties in front of the building, now a farmhouse. The musicians — who as children knew Rock — buried their traditional instruments to protect them from communist zealots during the Cultural Revolution of the 1960s and '70s.



A GRAND RETINUE PASSED BELOW THE YULONGXUE SHAN — JADE DRAGON SNOW RANGE — AS ROCK RETURNED FROM AN EXPEDITION IN 1928. ROCK ROUTINELY TRAVELED WITH RETAINERS TO ENSURE THAT HE CAMPED IN GRAND STYLE AND WITH SOLDIERS TO WARD OFF BANDITS.

readers' living rooms exotic kingdoms, faraway peoples, and snow-mantled peaks that were little known even to geographers.

He was the GEOGRAPHIC's man in China in 1923-24 with the imposing title, "Leader of the National Geographic Society's Yunnan Province Expedition," a title renewed in 1927 for three years. From mountainous Yunnan in the south, bordering Burma and Tibet, he worked his way almost a thousand miles north, close to the Gobi and Inner Mongolia. "No white man, since time began, ever stood here," he boasted as he overlooked the gorges of the Yellow River in Qinghai Province—a claim he repeated in most of his articles.

In "Through the Great River Trenches of Asia," August 1926, he wrote of sliding across

the frothing Mekong River on a rope of twisted bamboo strips. In "The Glories of the Minya Konka," October 1930, he described travel under blizzard conditions among some of China's highest peaks: "We packed our tents and bedding with numb hands. As we left our camping place the blizzard increased in fury." Rock often camped above 10,000 feet, sometimes exchanging exhausted mules for yaks, which were better suited to high altitude. He suffered bandit attacks on the trail, despite his large escorts, and dysentery attacks while staying in villages that stank from accumulated filth.

Writing of his difficulties, he began one article, "Much of a most unpleasant nature has happened to me in recent months." For him, that was an unusually simple sentence.

His editors straightened his contorted prose

INTRIGUED BY ASIA SINCE CHILDHOOD, ROCK INITIALLY TRAVELED THERE AS A BOTANIST IN 1913. ON HIS FIRST EXPEDITION (MAP) HE EXPLORED THE REGION IN SEARCH OF MEDICINAL TREE SEEDS, THE SUBJECT OF HIS FIRST GEOGRAPHIC ARTICLE. THOUGH OFTEN DISDAINFUL OF OTHERS, ROCK BECAME FAST FRIENDS WITH THE KING OF MULI, WHO POSED BETWEEN ROCK, AT LEFT, AND HIS ASSISTANT W. I. HAGEN.

Holiday crowds jam the market of Tengchong in 1923 the day before the Chinese New Year. Today pigs have the run of the street in a more subdued shopping district in Yongning, another Yunnan town. The ever fastidious Rock seldom failed to comment on conditions that did not meet his own standards of hygiene—often the case in his adopted homeland. Yet he always yearned to return.

and trimmed his manuscripts of interminable digressions. "Whole paragraphs of the history of Chinese revolutions, which occur in the first few pages, could be eliminated," an editor declared in a critique of one submission.

Such excising displeased the proud explorer, who once asked if an entire issue of the magazine could be devoted to his adventures. At least, "I hope you will find it possible to publish more than two articles of mine a year," he wrote, noting jealously that Assistant Editor Frederick Simpich, Sr., "has three articles in the magazine within six months."

Editors described Rock as "cantankerous." But offsetting his touchiness was one great, redeeming asset. Doggedly tenacious, he fulfilled the first rule of exploration and journalism: He *got there*.

A 1926 letter to Rock from Franklin L. Fisher, chief of GEOGRAPHIC illustrations, began: "We have finally been able to get together the material for your experiment in natural-color photography."

PUNISHMENT FOR A MURDERER SERVING FIVE YEARS IN A MULI DUNGEON INCLUDED A NECK BOARD THAT PREVENTED THE CONVICT FROM FEEDING OR GROOMING HIMSELF.

Besides ponderous manuscripts, Rock had been sending back photographs in black and white. Grosvenor believed color photos from Rock would "be worth thousands of dollars to our Magazine," but Fisher's word "experiment" suggested a more cautious outlook. At the time, color photography was a novelty; most of the "color" photos then published in magazines were black and whites that had been artificially tinted.

The odds against the success of this "experiment" were formidable. First, there was the shipping problem, for Rock would be working with five-by-seven-inch glass plates of the Autochrome color process. And indeed, many of the carefully packed plates broke en route to China.

The process was extremely slow. To make the colors, the plates bore a coating of potato-starch grains dyed orange, green, and violet. The image passed through this layer before it reached the emulsion. Even when photographing a landscape in bright sunlight, Rock had to expose the plates for a whole second. Of course, Rock's human subjects had to stand still at least that long while confronted by his big tripod-mounted camera—and few of them had ever even seen a camera.

None of these obstacles discouraged the indefatigable Rock. In fact, he usually processed the plates as he traveled, once, as he wrote, "tying our black developing tent to the branches" in a forest. He filtered water through cotton and lit dung fires to warm the chemical-developing baths to the required 65°F. A helper waved cardboard to shoo flies away from the sticky emulsion.

"I have one great difficulty in drying the plates," he complained in August 1929. "At this time of year the atmosphere is saturated with moisture . . . unless they dry quickly the film bursts in spots and leaves green spots all over the plate."

Sometimes defective coatings simply floated off the glass.

Inevitably, some of the developed plates that Rock shipped to magazine headquarters in Washington, D.C., also arrived in pieces. Still, nearly 600 reached us intact, and Rock's depiction of subjects both sublime and bizarre—glacier-topped peaks, temple rituals performed by dancers in frightening masks—began to be published with a chromatic breadth that approached the real thing, providing a glimpse of China that was both vivid and unique.

ROCK WAS DRAWN TO CHINA as a boy, learning to read a bit of Chinese by studying on his own in a Vienna museum. As an adventurer he was intrigued by the cultures of China's minority peoples and relished the prospect of plunging into its

forbidding mountains—of being "the first white man who. . . ."

Inevitably, however, on his months-long journeys he became disgusted with China's chaos and corruption and with its "miserable comfortless towns" and "opium sots," as he called the many addicts.

He vowed many times to leave China forever, and indeed he did depart several times. But he kept going back. Like a man without a country, he found that he was also repelled by "automobile-mad America" and the "so-called civilized world." He wrote in 1930: "I have lived on excitement for the last ten years and a humdrum existence is next to unbearable to me."

When visiting GEOGRAPHIC headquarters, he would wander down to the office of a sympathetic illustrations editor and pour out his homesickness for the mountains of Yunnan. He saw them last in 1949, when, with the communist takeover imminent, he departed for good, after 27 years.

Rock, who died in 1962, would be enormously pleased that he is still remembered in the village of Nguluko, in Yunnan Province in southwestern China, where he made his headquarters in 1922 and resided off and on until 1949.

When I went to the village last year, every oldster I talked to recalled Luo Boshi, as they still call him. "Luo" is the approximation of Rock, since the *ro* sound is difficult for some Asians to pronounce. "Boshi" means doctor—an honorific he liked and which even found its way into the GEOGRAPHIC, despite Rock's lack of formal education.

The villagers are Naxi, a Tibetan-related people with their own language, numbering about 275,000 in Yunnan today. They are slightly darker than the Chinese and are often tall. Some of the Naxi (also spelled Nashi, Nakhi, and Na-Khi) who were hired by Luo Boshi for his caravan journeys were taller than their employer, who stood five feet eight inches.

Rock won the loyalty of many by treating their illnesses. "When my great-grandmother was very sick, Luo Boshi gave her some medicine, and she recovered," declared Li Congguang, who lives in a house that Rock occupied. "That is the main reason all my family helped Luo Boshi in his work."

Another man, 75-year-old Li Shijun (most of the villagers that I met had the surname Li) said Rock enabled him to avoid being forced into Chiang Kai-shek's army in the 1940s. Rock looked contemptuously upon that corrupt regime, just as he abhorred the communists. When soldiers came to take away the young men from the village, Rock hid Li Shijun in his own house, probably as a favor to the young man's older brother, a Rock bodyguard.

Several villagers still cling to things that Luo Boshi brought to their families from the U.S. or left behind when he departed. A saw and chisels, for example, and even dental tools. Still used by a villager who practices rough-and-ready dentistry, the dental pliers have by now extracted hundreds of local teeth.

I hoped I might discover Rock's rubber bathtub. But when I asked about it, the villagers responded with blank stares.

NGULUKO'S plain houses of wood and stone cluster beneath the towering Yulongxue Shan—Jade Dragon Snow Range. The village has changed little since Rock's day, although it is now called Yuhu, Jade Lake, for a nearby body of water.

It was summer when I went there, and in the fields women, along with a few men, were bent at the waist, scything grain. Rock had noted that women did most of the daily labor; a

Canned ham, Chinese style: Two boys posed for Rock with a hog gutted, boned, salted, and sealed — preserving the pork for years. The carcasses, which sometimes double as mattresses, are still prepared today (above). Photographer Yamashita found the meat "sweet and quite tasty."

Naxi tradition that survives today.

Rock's first article as GEOGRAPHIC expedition leader was about the Naxi *dongbas*, shamanistic priests who conducted fantastic rituals—dancing, leaping into bonfires, dipping hands into burning oil—to drive evil spirits from a sick person.

Soon he began to translate ancient pictograph manuscripts that recounted the Naxi history and described their religious beliefs and rites, which are rooted in the ancient Bon traditions of Tibet. In this he relied heavily upon dongbas, for only those shamans had learned to read the pictographs.

Eventually, supported in part by Harvard University, he completed two copiously footnoted Naxi histories and a 1,094-page Naxi dictionary.

"What Rock did was very important," emphasized Yang Fuquan, a Naxi specialist in the Yunnan Academy of Social Sciences in Kunming, the provincial capital. "Today we can't get information like he got from those passed-away priests."

WITH STERN PIETY, TIBETAN MONKS GRASP STAFFS THAT SIGNIFY THEIR RANK. ROCK TURNED THEIR HATS SIDEWAYS FOR THIS PHOTOGRAPH.

The Naxi culture suffered greatly during the Cultural Revolution, 1966-1976, when Naxi religious practices were banned and shamans were outlawed.

But in the more relaxed China of today scholars want to explore that culture, and officials say the Naxi may return to their old beliefs if they wish. Rock's efforts to record Naxi lore are reckoned so important that Yunnan plans to erect a memorial to him.

WHEN HE SETTLED in Nguluko in 1922, at the age of 38, Rock called the village "charmingly situated, if not overclean."

The situation was important; besides exploring for the GEOGRAPHIC, Rock would collect plant specimens, and the mountains close by burgeoned with varieties of rhododendrons and other plants that might grow well in the U.S. And the conifers, ferns, and other flora, if not of practical value, were of interest to scholars.

Under the GEOGRAPHIC's sponsorship 60,000 plant specimens reached the U.S., pressed between paper. They were turned over to the Smithsonian Institution in Washington, D.C., to be shared with universities and botanical institutions. He sent seeds to the Department of Agriculture packed in powdered charcoal to prevent them from drying out. (Some of his rhododendrons grow today in gardens in San Francisco and Seattle and in Great Britain.) He also sent 1,600 specimens of birds for American ornithologists to examine. Rock collected thousands of additional tree and shrub specimens with the financial support of Harvard's Arnold Arboretum.

People in Nguluko recall that Rock trained a Naxi cook to prepare Western-style meals. He was the only villager who ate with a knife and fork. And he usually ate alone.

A lifelong bachelor, Rock had many friends in Europe and America, but when he recounted his China experiences, "he never spoke of a buddy, someone to have a couple of shots with," remembers Paul Weissich, retired director of the Honolulu Botanical Gardens.

Weissich knew Rock in his last years and was executor of Rock's modest estate. "He was so oriented toward scholarship that I think he had little time for friendship."

Sometimes he took a missionary or another Westerner on his journeys. Once he took Edgar Snow, the American journalist who chronicled the rise of the Chinese communists in the 1930s and '40s.

But, rigid and demanding, Rock inevitably found fault with his companions and parted company. He thought Snow naive and grumbled that one missionary was too full of "brotherly love and sweet words."

That the intrepid explorer yearned for

BRIGHT HEADPIECE, WORN CORRECTLY, CROWNS THE SENIOR MONK OF AN ORDER OF TIBETAN BUDDHISTS KNOWN AS THE YELLOW HATS. THEIR MONASTERY AT ZHONGDIAN WAS REBUILT AFTER BEING VIRTUALLY DESTROYED IN 1959 WHEN CHINA INVADED TIBET. PHOTOGRAPHED BY ROCK IN 1929 (BELOW), THIS MONASTERY AT YONGNING WAS ANOTHER STRONGHOLD OF THE YELLOW HATS, ALSO KNOWN AS THE ORDER OF VIRTUE.

BEFITTING HIS EXALTED STATUS, THE 81-YEAR-OLD HIGH LAMA OF DZANGAR'S MONASTERY IS AFFORDED THE LUXURY OF RIDING IN A LITTER. ROCK OFTEN HAD HIMSELF CARRIED INTO VILLAGES IN A LIKE MANNER TO CREATE AN AURA OF IMPORTANCE, THUS EARNING THE RESPECT AND COOPERATION OF LOCAL LEADERS.

companionship is sadly clear from his diary, in which deep melancholia is mixed with his observations of plants and wildlife and the compass bearings of his travels.

"Today I have been frightfully lonely," he wrote while putting up at a Buddhist monastery. And on New Year's Eve 1937: "I am unspeakably lonely." Such was the flip side of what he once called his "romantic" travels.

Invariably, Rock recovered. "Where I live," he wrote contentedly to an editor during the Great Depression, "we know nothing of depressions. . . .nobody works for a living—that is, in an industrial capacity—hence there are no hard times."

"ALL NGULUKO was out to see us off," he recorded as he began a journey to Yongning in 1928. His mules were laden with personal gear, canned food, animal feed, photographic equipment, and paper and charcoal for preserving plants and seeds.

With him, as usual, went a Naxi team, including his cook, muleteers, and men trained to collect and pack the specimens. Sometimes he complained that his helpers were lazy and careless, just as, at one time or another, he railed against almost every group he encountered in China: Buddhist monks who rarely bathed, Muslim soldiers, whom he called "absolute robbers," and overbearing Chinese officials. But on the whole he liked the Naxi, and once when he visited the U.S., he even brought along two of his assistants.

His caravan moved at the rate of 10 to 20 miles a day. Rock always stopped to visit local rulers and officials; to ward off robbers, he needed the armed escorts they could provide. In exchange he might offer the official a much prized Colt .45-caliber pistol. Rock himself carried two of them.

Sometimes he had an escort of as many as 200 men, but despite this protection his caravan was attacked at least twice. "We pushed on under fire as best we could," he wrote of one encounter. His soldiers fired back. "Thanks to the bad aim of the brigands we lost only one soldier killed."

That night he stayed in a Buddhist temple. At midnight soldiers came to warn that the

ENSCONCED ON A PLUSH PERCH, FOUR-YEAR-OLD LOBSANG YESHE—THE HIGH LAMA OF YONGNING—EXUDES A SOLEMNITY BEYOND HIS YEARS. NOW 66, LOBSANG IS PERMITTED BY THE COMMUNIST GOVERNMENT TO WEAR HIS OFFICIAL ROBES ONLY ONE WEEK A YEAR, DURING THE SPRING FESTIVAL CELEBRATING THE CHINESE NEW YEAR.

brigands were nearby "and that they could not protect me." Rock laid out his pistols and prepared to flee or fight. "I opened up my trunks and distributed [silver coins] among my men, wrapped up some extra warm underwear, a towel, condensed milk and some chocolate. . . . Every minute I expected the firing to commence." The bandits, however, never attacked.

On an arduous winter journey in 1924 Rock crossed 13,000-foot-high mountains into Sichuan Province to reach "one of the least-known spots in the world," the ancient Buddhist kingdom of Muli, the size of New Hampshire with but 22,000 citizens.

Inside the walled monastery, Rock "donned my best and sallied forth to meet the king." Chote Chaba was a huge monarch, six feet two and corpulent. He offered his guest buttered tea along with "ancient mottled yak cheese, interspersed with hair," and cakes "heavy as rocks."

Rock cautiously sipped his tea while taking in the scene. He noted golden plates and porcelain cups. The necks of the monarch and his attendants were greasy and black, which "showed that soap was not in demand."

Muli became the subject of one of Rock's most fascinating articles, in part because Chote Chaba, as unlearned as a babe, peppered him with questions. Could a man ride horseback from Muli to Washington? Was that near Germany? Did Rock have binoculars that could see through mountains?

More challenging targets for Rock were

Fearsome oracle, a man called the Sungma Balung Cho Je was said to become possessed by a demon when he donned his ceremonial robes. As monks chanted, this glowering agent spat, groaned, and shook as if in an epileptic fit, then shot off arrows to banish other demons.

KEEPER OF ARCANE LORE, HE ZOUYI, 82 (BELOW), TRANSLATES A STORY WRITTEN WITH NAXI PICTOGRAPHS (ABOVE). ROCK WAS ENCHANTED WITH THE SCRIPT AND THE CULTURE. BOTH BECAME A LIFELONG SCHOLARLY PURSUIT FOR THE ADVENTURER, WHO PRODUCED TWO HISTORIES AND A NAXI-ENGLISH DICTIONARY.

mountains even higher than those that enclosed Muli, especially the little-known ranges along the border of China and Tibet.

He spent more than a year trying to reach the Anyemaqen peaks in Qinghai Province, delayed by hostile nomadic tribes and a war between Buddhists and Muslims. Enduring fierce snowstorms, he finally penetrated deep into the Anyemaqen Shan, where "even the valley floors . . . reach a height of more than 15,000 feet." He made an extensive photographic record of the peaks and believed that the highest soared to 28,000 feet. According to modern surveys, he overestimated by more than a mile; the height is 20,610 feet.

That was not his only surveying error. Early in 1930 the GEOGRAPHIC received an astonishing cablegram. It said: MINYAKONKA HIGHEST PEAK ON GLOBE 30250 FEET ROCK.

Really? Had Rock discovered in unmapped western Sichuan a mountain that exceeded Everest's 29,028 feet? If so, it was exciting news. However, the GEOGRAPHIC delayed issuing a press release.

Rock had pushed resolutely toward Minya Konka (now called Gongga Shan) equipped with an aneroid barometer and other gear for measuring heights. But he was more than eight miles away when he estimated the altitude of this "white pyramid . . . which made me gasp."

When "The Glories of the Minya Konka" appeared in October 1930, Rock's editors had cautiously scaled his calculation down to 25,600 feet, based on other estimates. (Today it is reckoned at 24,790 feet.) Still, Rock had brought back the first Minya Konka photographs—in color.

Rock had an abundant knowledge of the terrain of western China as well as that of Siam and Burma, the main locus of his search for chaulmoogra seeds in 1920-21. At the height of World War II the U.S. Army wanted his help in drawing maps for pilots flying the "Hump," the lifeline for Allied forces fighting the Japanese in China. The cargo planes departed India and flew over Burma's mountainous border with China, landing at Kunming.

Rock was plucked from India, where he had gone to escape the war, and flown to Washington. He sent his belongings by ship. In those trunks was much of his Naxi research, including the dictionary that he had been working on

In elegant isolation, Rock bided his time on the island of Nyorophu in Lugu Lake, a favorite retreat. This view shows him marooned in 1929 after civil war broke out and ferryboats were destroyed.

OLD WAYS SURVIVE ON LUGU LAKE, WHERE THE MOSUO PEOPLE WEAR THE SAME TRADITIONAL DRESS AS THEY DID DURING ROCK'S DAY. ROCK KEPT HIS OWN TRADITIONS, TAKING HIS MEALS ON FINE DINNERWARE WHEREVER HE CAMPED. THE GRAND EXPLORER WAS ABSORBED IN, BUT NEVER BY, THE CULTURES HE FOUND SO COMPELLING.

for more than a dozen years. The trunks went to the seafloor when the vessel was torpedoed.

Rock was apoplectic. But he seems never to have considered *not* returning to Yunnan to start over. With Harvard's support he was back in 1946, hiring dongbas to help him translate Naxi manuscripts anew.

He had to hurry. "The political situation is not too good," Rock wrote early in 1949 to his friend Kip Ross at the GEOGRAPHIC. "The southern and eastern parts of this province are in the hands of bandits"—that is, communists.

Dayan (Lijiang), a small city near Nguluko, fell in July 1949, and "red soldiers with guns and bayonets searched my belongings." A month later Rock packed and departed.

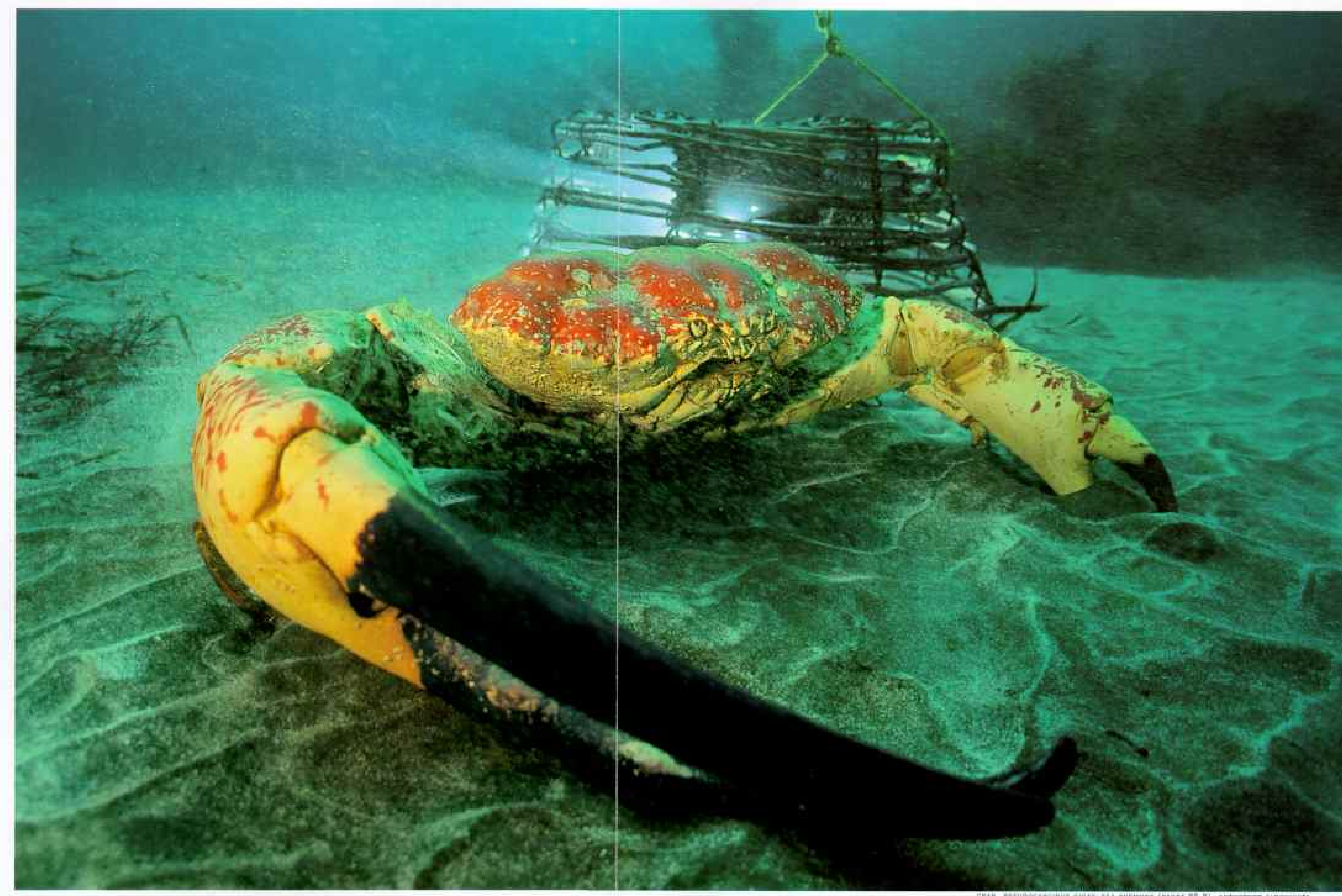
He spent his last years in Hawaii, collecting plants and continuing to work on Naxi lore and language. His two-volume Naxi history had been published by Harvard. He wrote Kip Ross that he looked forward to the appearance of the dictionary by his 79th birthday on January 13, 1963. But on December 5 he died of a heart attack at home, surrounded by Naxi pictograph manuscripts. The first volume of the Naxi dictionary was printed soon after his death. The second was published in 1972.

Our man in China was, of course, not just ours; as a botanist he was Hawaii's and Harvard's, and Harvard also claimed him as a historian and lexicographer. But most of all, he belonged to China. He saw it, he survived it, he recorded it in words and pictures. He *got there.* □

BENEATH THE TASMAN SEA

Evening light coats the stark thousand-foot cliffs of Tasman Island, a deserted shard of the island state of Tasmania, which lies between the Tasman Sea and what Australians call the Southern Ocean. Clear, cold, deep, and remote, these waters invite fanciful creatures such as this foot-long weedy seadragon—distant cousin of the seahorse—which paddles like a tin-plate toy through emerald jungles of giant kelp.

PHYLLOPTERYX TAENIOLATUS



CRAB, PSEUDOCARCINUS GIGAS; SEA ANEMONE (PAGES 88-9), ANTHOTHOE ALBOCINCTA

LYING LOW Australia's version of the king crab is truly regal. Weighing as much as 35 pounds—perhaps more—the world's heaviest crabs live only off the coasts of southern Australia and Tasmania, some at depths of a thousand feet. Hauled to the shallows by fishermen, this male weighed 23 pounds and dwarfed a crab trap measuring three feet across. Slow and stately, he moved like a sleepy sumo wrestler, digging in with his long black claw. Females are smaller and can dance more gracefully across the sand.

ARTICLE AND PHOTOGRAPHS BY
DAVID DOUBILET

Dawn in the Tasman Sea always seems to be a struggle. The sun rises against powerful, dark weather rolling in from the west. Clouds form, then break, and for a moment the huge cliffs of southeastern Tasmania glow with yellow warmth.

"This must be the most accessible wilderness in the world!" shouts local diver Gary Myors as he drives his 20-foot powerboat through the swells. We're heading south toward Fortescue Bay near Tasman Island. Hobart, Tasmania's capital, is only 35 miles away. Yet the cliffs here are bleak. Tasman Island is uninhabited, its lighthouse an automated beacon.

I imagine our roaring yellow boat is a time machine traveling along an unchanged seascape, a land that Dutch explorer Abel Tasman first saw in 1642 and that English navigator Matthew Flinders circumnavigated in 1798. Those explorers, traveling at the edge of their known world, had no idea of the stranger, wilder world beneath their creaking hulls.

Just a few miles off Tasmania's eastern shore the continental shelf ends, and the ocean floor plunges to more than 3,000 feet. Cold water rolls up the slope, while pockets of warm water drift south from the Australian mainland. In coastal bays these waters blend—clear, cold, and rich in plankton, a lure to creatures normally found 600 to 1,000 feet deep off the mainland.

We anchor in the calm of Fortescue Bay. The water is 51°F. As we struggle into dry suits, I feel like an aged knight preparing for a joust. Once overboard we fly into the sunlit branches of a kelp forest rooted 75 feet below. It's rare to see kelp teem with such strange actors. Silvery fish called real bastard trumpeters weave past red velvet fish. Brilliant white-lined sea anemones (following pages) nestle in beds of yellow sponge. Weedy seadragons feed on clouds of mysid shrimp that roll through the kelp like fog.

After an hour and a half we surface. Our dry suits have leaked, and we shiver like badly tuned diesel engines. But we'll soon go again. Diving here is like peering into a secret window to the deep.

DAVID DOUBILET covered saltwater crocodiles for the June 1996 magazine.

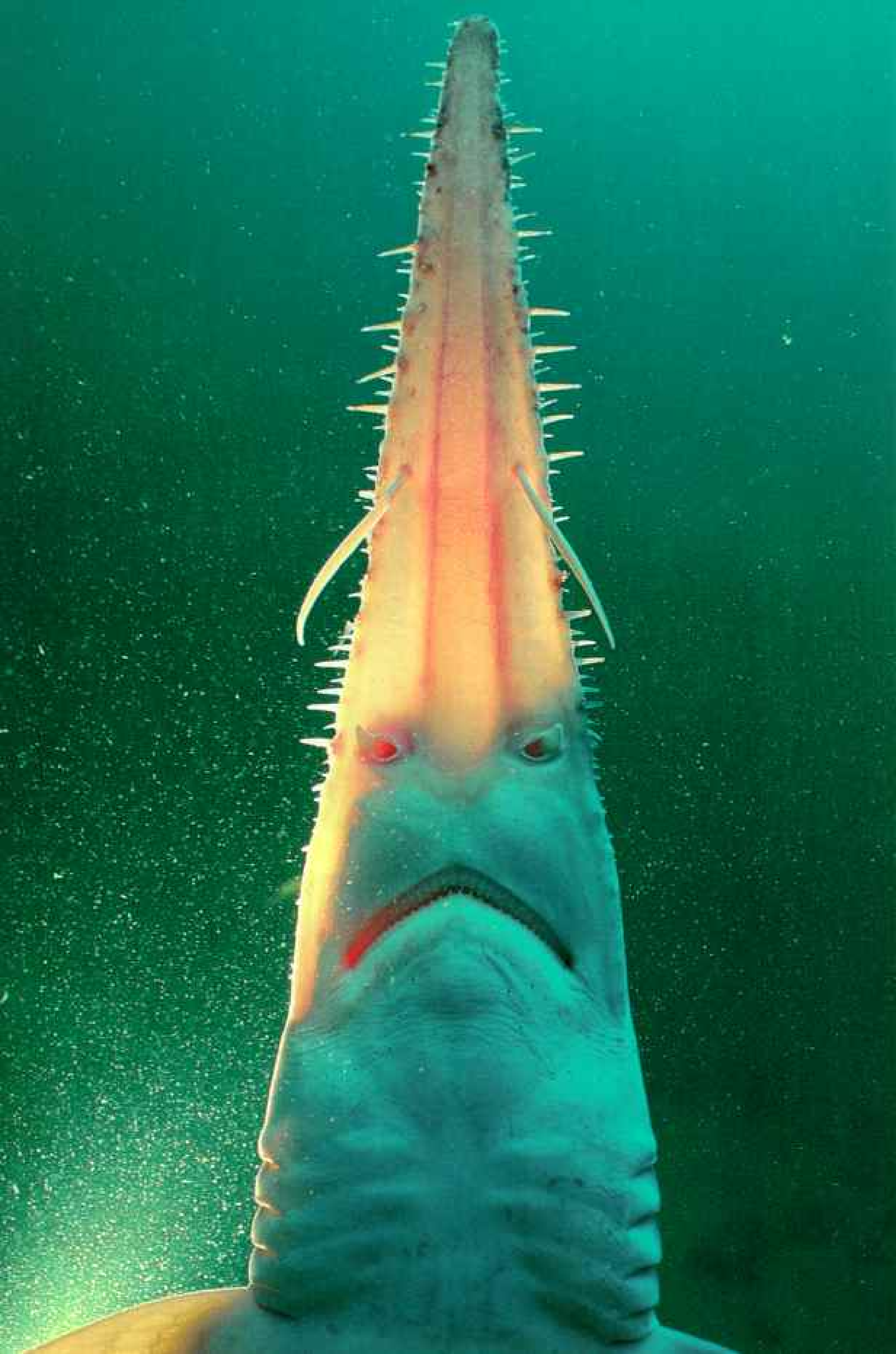
ELEPHANTFISH, *CALLORHYNCHUS MILII*; RED VELVET FISH, *GNATHANACANTHUS GOETZEEI*; SAW SHARK, *PRISTIOPHORUS NUDIPINNIS*

PORTRAITS OF THE DEEP

The skin of the elephantfish (above) feels to the touch as if woven of silk and aluminum foil. A possible link between sharks and bony fishes, this member of the Callorhynchidae family has inherited a plowlike proboscis, which it apparently uses to dig for shellfish. In springtime it abandons deeper waters to mate and feed in Tasmania's sandy bays.

Nose architecture reaches its pinnacle in the southern saw shark (facing page). Long tentacles above eyelike nostrils sense prey, and saw teeth slash it. The shark feeds with a snuffling, sweeping motion of its snout through the mud.

I couldn't resist touching the face of a red velvet fish (right). Soft as a plush toy, it is far from cuddly: The spines of its pompadour are highly venomous.



DELIGHTS OF THE DARK

For Australian marine biologist Karen Gowlett-Holmes (right), diving in Cathedral Cave is a religious experience. And a dangerous one. Part of the largest sea-cave system in Australia, this Tasmanian maze can safely be explored only during calm seas. "A heavy swell can trap you in the back of the cave or shoot you up 20 feet in a heartbeat," Karen says.

It's worth the risk. The cave's walls are upholstered with vivid sponges, soft corals, and other invertebrates fed by the rich broth borne in on strong currents. Ample food and dim light allow some creatures normally found below 300 feet to thrive in these shallower depths.

In the winding darkness we spot a rare Ziebell's handfish crouching in a copse of orange sponge (below right). Near the cave's mouth, red handfish grip the sand (below). Found only in southeastern Tasmania, these fish rarely swim, instead using handlike pectoral fins to walk, grasp the substrate, and brace against the surge—much like the panicky dance of human hands in a lurching subway car.

RED HANDFISH, *BRACHIONICHTHYS POLITUS*; ZIEBELL'S HANDFISH, *BRACHIONICHTHYS* SP.

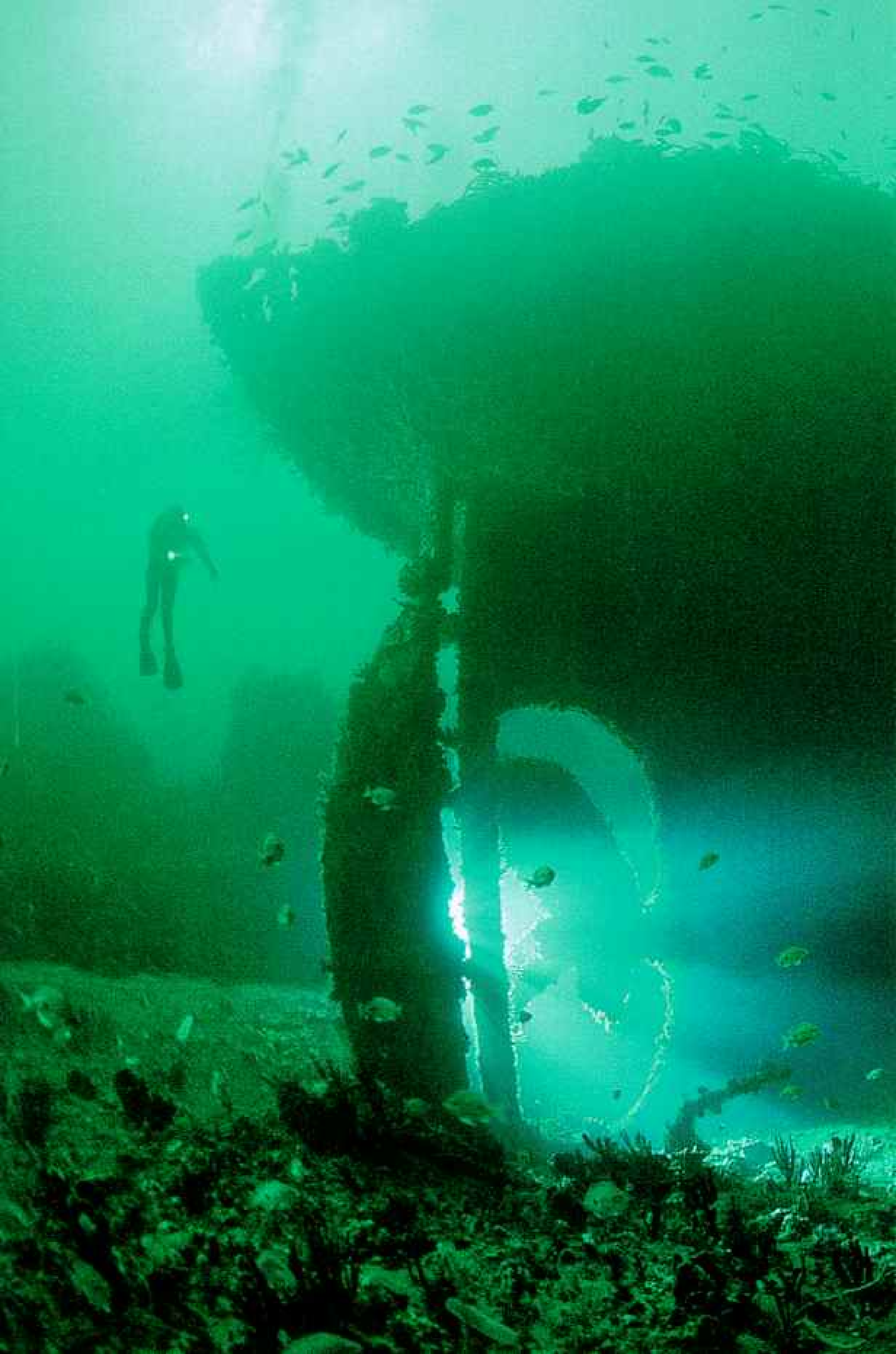
WEEDFISH, *HETEROCLINUS TRISTIS*; ANEMONES, *CORYNACTIS* SP.; SEAHORSE (PREVIOUS PAGES), *HIPPOCAMPUS ABDOMINALIS*

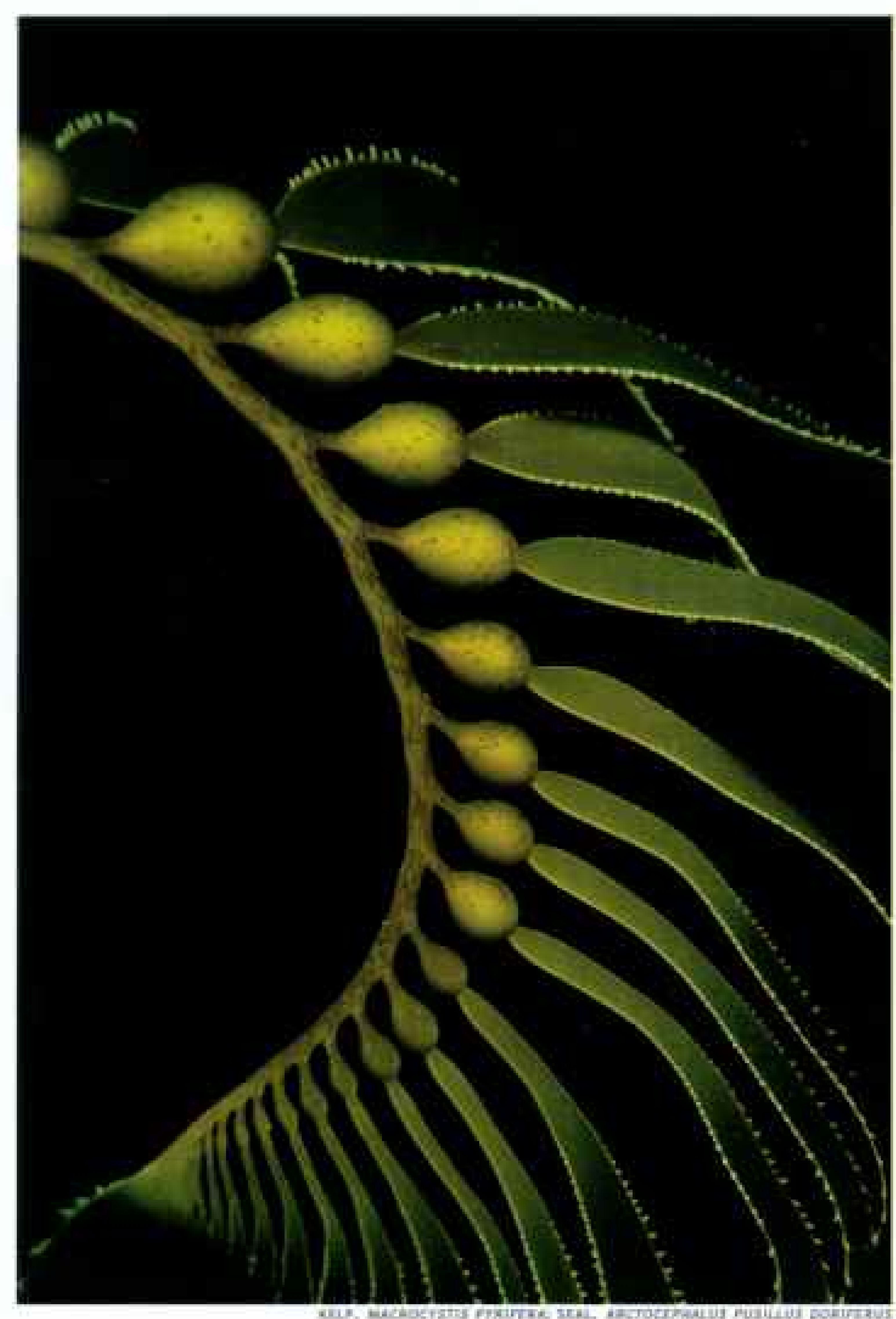
UNEARTHLY GARDENS

North of the Tasman Peninsula the great cliffs end. At Bicheno the land rolls softly to the sea, where endless meadows of kelp unfold. Here I spot a ten-inch male big-bellied seahorse (previous pages). Only the males brood their young, and this pregnant fellow will soon give birth. Far less conspicuous, a longnose weedfish (facing page, top) hides in the kelp, its perforated fins an effective camouflage. When backlit, this shy fish emerges like a lace silhouette.

Farther offshore we drop to 130 feet, where diver Tony Douglas hovers above a lush Persian carpet of sponges and corals (above). Sea whip gorgonians rise and wave like thick hairs. On some dead sea whips, pink jewel anemones cluster (facing page, bottom), each individual a perfect clone.

Lighting such scenes can be treacherous. Once, assistant Joe Stancampiano became under-ballasted while lugging our heavy lights. Air filled his dry suit, shooting him up 100 feet. By exhaling all the way he avoided serious injury—a gift of experience.



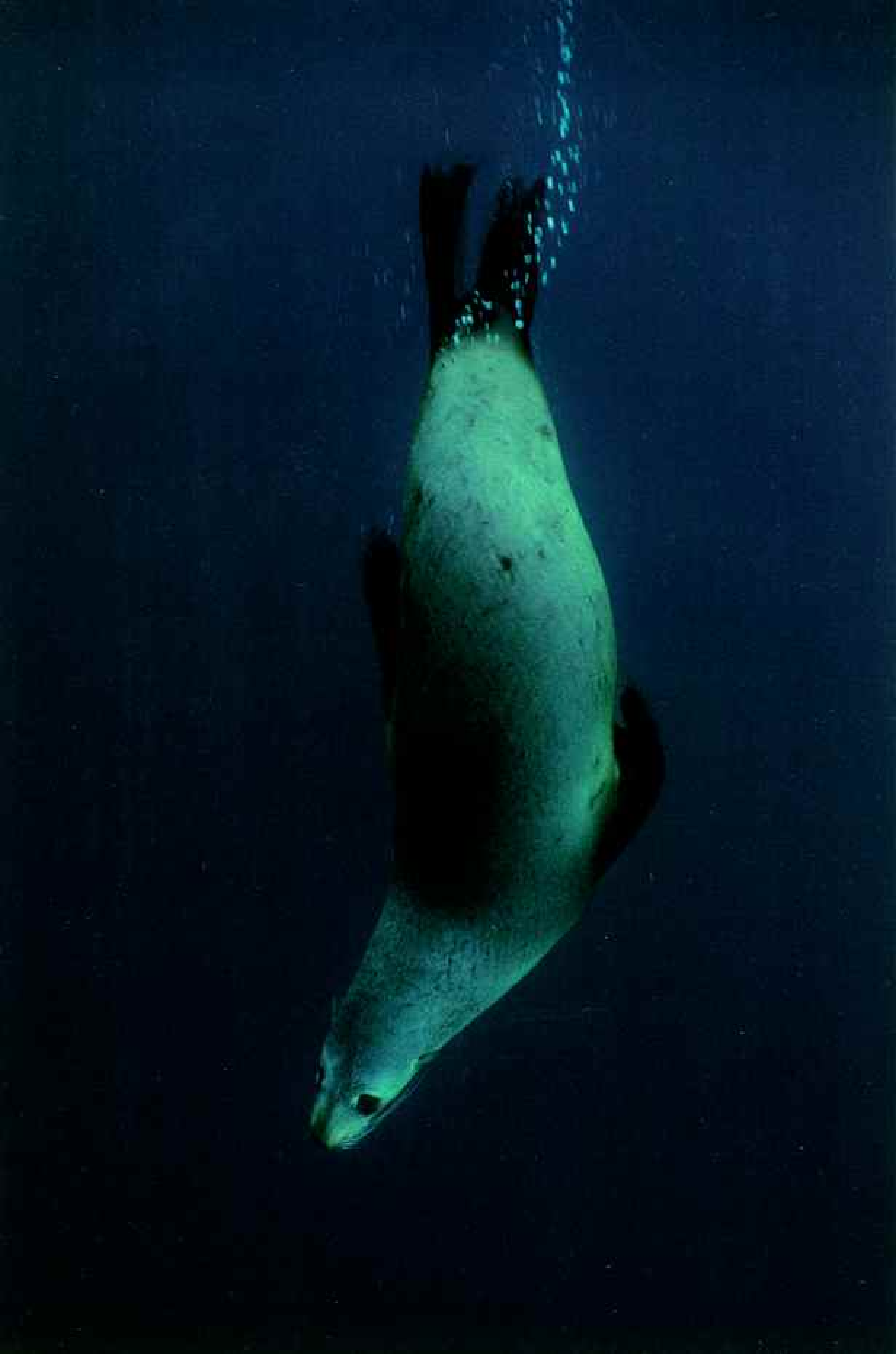


KELP, MACROCYSTIS PYRIFERA; SEAL, ARCTOCEPHALUS PUSILLUS DORIFERUS

A SEA OF SHADOWS

Off the tip of Cape Pillar a vague shadow becomes a living memory when light splays between propeller and rudder of the wreck of the S.S. *Nord,* a 269-foot iron ghost from the age of steam (previous pages). Its hull pierced by a hidden rock, the British cargo ship sank in 1915, settling upright 130 feet down.

The deep dive to the *Nord* requires decompression stops before surfacing. Hanging helpless in mid-water, I try not to think of the great white sharks known to cruise nearby. In the gloom I spot a shape. A shark? No. It's an Australian fur seal (right) that stares with huge eyes, then disappears. This ocean, this edge of Tasmania, offers the softness of a seal's eye and the delicate curve of a kelp frond (above)—bits of warmth in the cold sea. ☐



Field Notes

ANACONDA MAMA-TO-BE — all 17 feet and 214 pounds — gets a lift from biologists funded by the Society's Committee for Research and Exploration. Says John Thorbjarnarson, "Her girth indicates she'll reproduce soon." Transmitters implanted in 12 anacondas in Venezuela's wetlands revealed a range of up to 472 acres.

JOHN THORBJARNARSON, WILDLIFE CONSERVATION SOCIETY; LEFT TO RIGHT: SUSAN ELBIN, MARIA MUÑOZ, JOHN THORBJARNARSON, TIBISAY ESCALONA, FRANK INDIVIGLIO

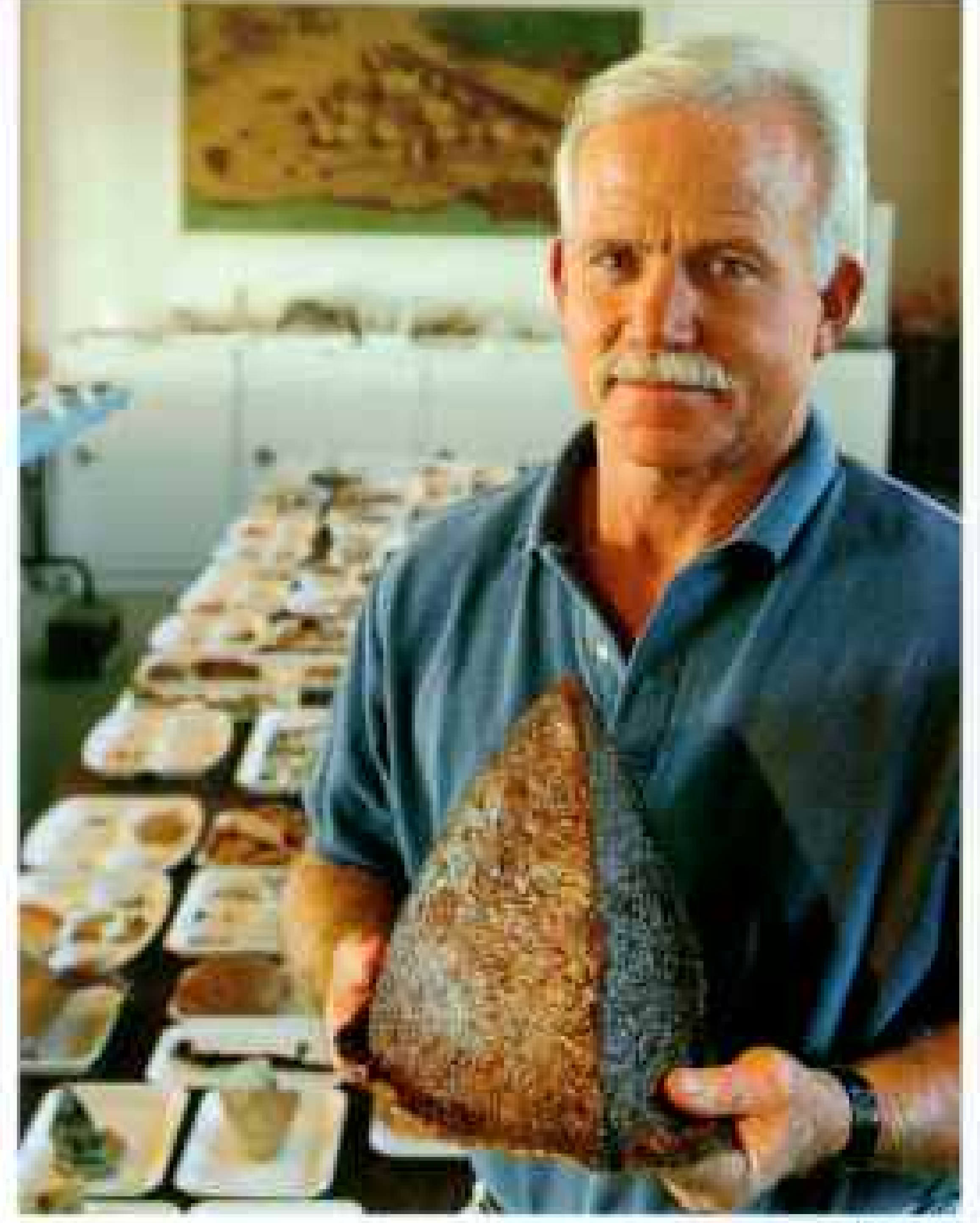
Two years ago National Geographic Society grantee Mary Miller of Yale University reported on the first stage of her work in using infrared photography and computer enhancement to reconstruct the 1,200-year-old Maya murals of Bonampak, Mexico.

Now, with new grants from the Society's Committee for Research and Exploration and two foundations, Miller is completing her task of making what was so long hidden once again visible, not only to members of the Society but to all the world as well.

In a sense the task of revealing the unseen is a common thread among the dedicated scientists supported during the past year by the Committee for Research and Exploration. Awarding nearly 3.5 million dollars in grants to 200 field projects, the committee mobilized a small army of scientists whose discoveries often amazed and delighted.

Of the many researchers funded by the Society during the past year, only a handful can be named in this summary. All, however, are proving themselves invaluable to our understanding of the world around us.

As the millennium approaches, the Committee for Research and Exploration plans exciting initiatives aimed at investigating our planet and the impact of humans, both past and present, on its delicately balanced environment.



IRA BLOCK

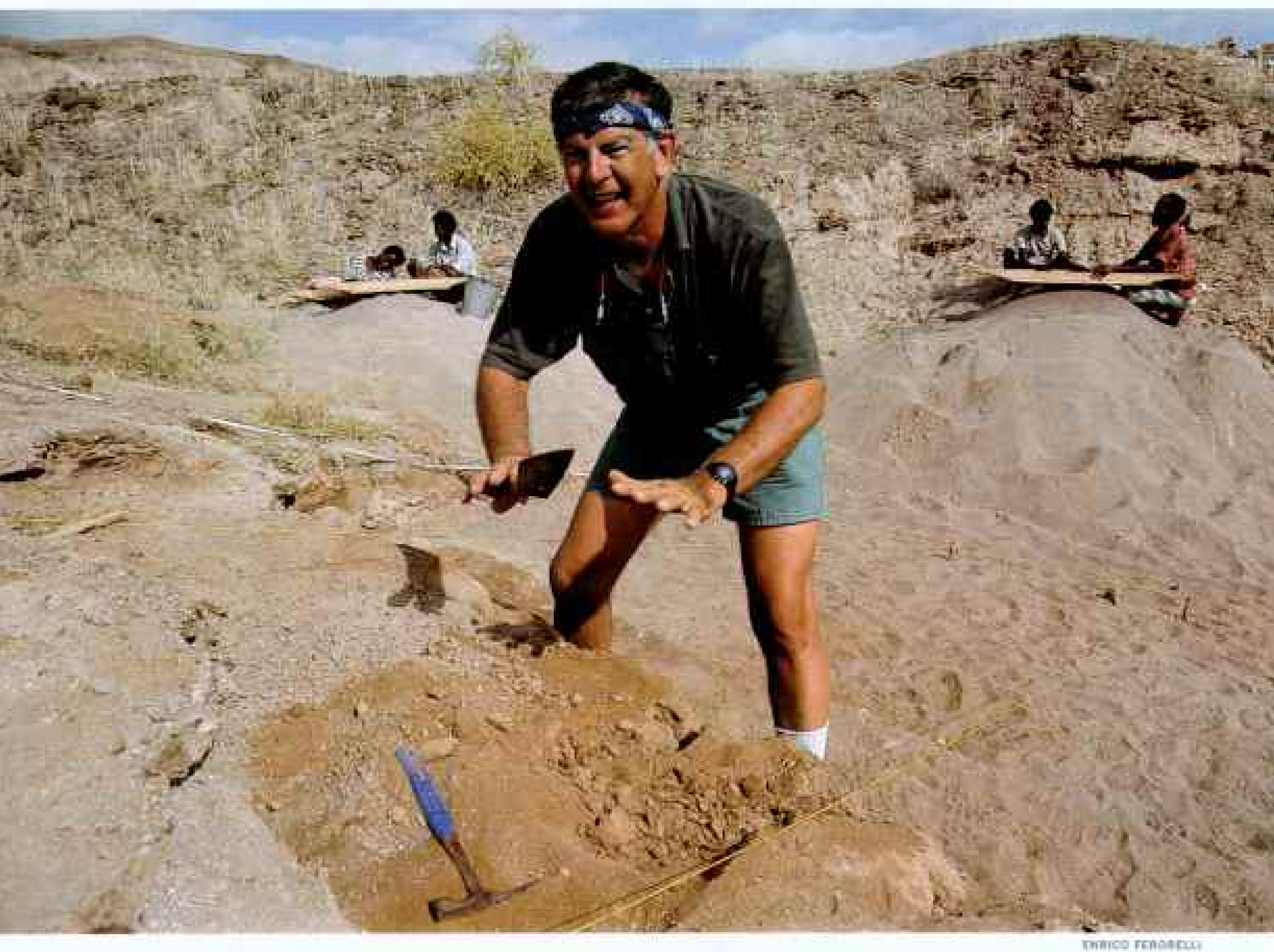
DAVID W. WOODDELL, NGS

ROBERT I. M. CAMPBELL

SHELLEY WACHSMANN, INSTITUTE OF NAUTICAL ARCHAEOLOGY

"IT'S THE HOLY GRAIL of British influence in America," says William Kelso (top left), whose team found ruins of the 1607 fort at Jamestown, the first permanent English settlement in the New World. This soldier's helmet was dug up 20 feet from the James River. Many had assumed the river had long since washed away traces of the fort.

"THE SISTINE CHAPEL of ancient America," is how committee chairman George Stuart describes the murals of Bonampak, Mexico, which reveal details of Maya life 1,200 years ago, thanks to the work of Yale University art history chairman Mary Miller. At top right, she explains a carving that tells of an eighth-century king and includes the sculptors' signatures.



ENRICO FERORELLI

PLASTERING THE PAST, paleontologist Meave Leakey encases a fragile fossilized elephant skull at Kanapoi, near Lake Turkana in northern Kenya (opposite, lower left). Since 1960 the Society has been a major supporter of the Leakey family's work, notably their historic search for humankind's ancestors.

"SHIPWRECKS R US" is how grantee Shelley Wachsmann describes Israel's Tantura Lagoon (opposite, lower right)—and the basketball-court-size area where his team has found six ships wrecked between the second and eighteenth centuries. They've also found two cannon dumped overboard during Napoleon's 1799 Mideast expedition.

HE LOVES LUCY: In 1974 Donald Johanson discovered the fossilized bones of a 3.18-million-year-old female hominid, which he named after the Beatles song "Lucy in the Sky With Diamonds." Says Johanson, "I see her, in a sense, as the mother of all mankind." Returning to Ethiopia's Hadar wilderness in 1992, his team found a skull of the same species.

FOWL WEATHER gear includes a ladder for Manuel Marin of Louisiana State University (above), who stops at nothing to peer into the nest of a white-chinned swift. The rare birds nest behind waterfalls in Latin America. In that soaking environment they plant pieces of moss, which then grow and reinforce their nests. Says Marin, "No other bird we know gardens like that."

ALISON M. JACKSON

BUTTERFLIES ARE FREE, but Gary Ross still has to go tramping all over Mount Magazine in Arkansas to collect, mark, and then follow them as they go about their daily rounds. "The Diana butterfly is one of the most beautiful in North America," says Ross. Yet his is the first in-depth study of the insect's life history.

GARY N. ROSS

BIG BILL, BIG CITY: Researcher Melody Serena is studying platypuses that live in and around Melbourne, Australia. "This is the first major study of the platypus in an urban environment," says Serena. As a Society grantee the researcher perfected a technique for fitting radio-tagging devices on the shy, mostly nocturnal aquatic animals.

AUSTRALIAN PLATYPUS CONSERVANCY

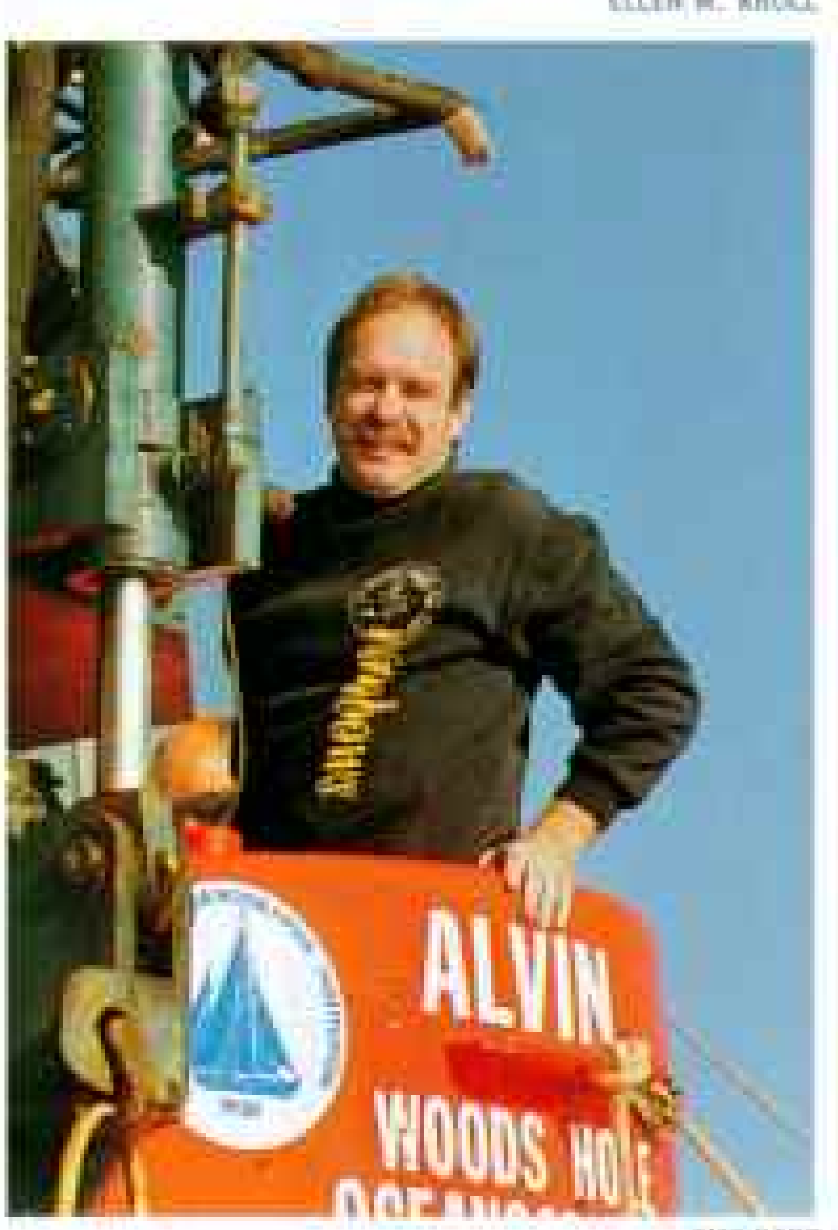
TO CATCH A MOLE, zoologist Roger Seymour of the University of Adelaide, Australia, follows the Namib Desert golden mole's tracks to the spot where it burrowed into the loose sand to rest. Then he surrounds it with metal barriers and three "pitfall cups" to learn how the insect-eating mole survives in southwest Africa, one of the world's driest areas.

PHILIP C. WITHERS

ERIC W. SALVA

ELLEN M. KROLL

TIM LAMAN



AMY NACO

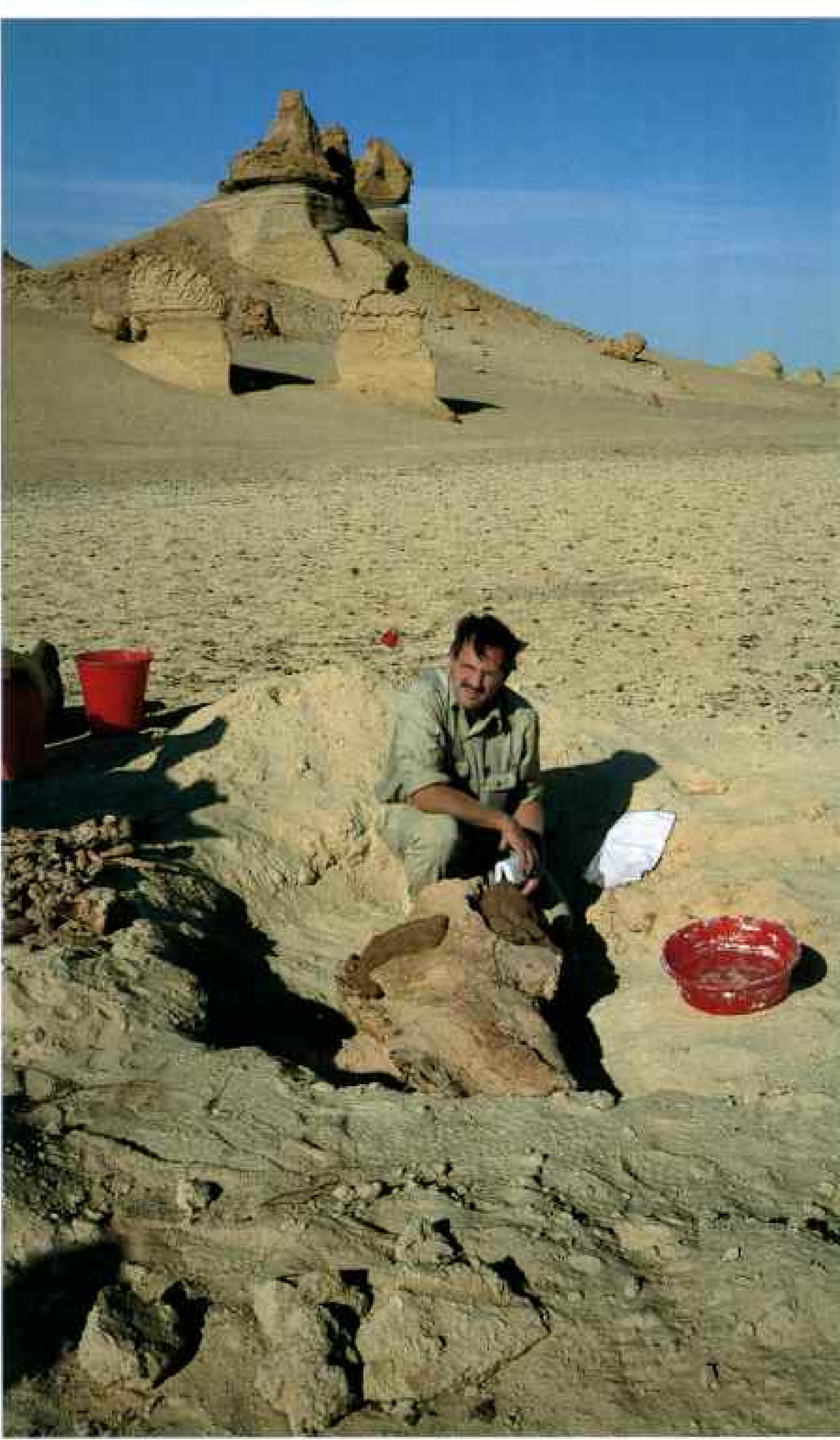
TODAY'S CRAB SPECIAL is a 15-million-year-old fossil *Tumidocarcinus giganteus,* remarkable not only for its state of preservation but also for the ancient secrets it disclosed to Kent State University geologist Rodney Feldmann (top left). This and other fossilized crabs from New Zealand, he says, show "clear evidence of a parasite that has never before been documented in the fossil record."

ARROW POINTERS are given to Henry Bunn by a Hadza hunter in Tanzania (top right). Bunn and fellow University of Wisconsin anthropologist Margaret Schoeninger have spent years studying the Hadza, one of the world's last societies of hunter-gatherers. Says Schoeninger, "The Society's support has enabled us to take a graduate student along to study specific topics, such as the Hadza's use of plants and honey."

SANDY SKULLS of ancient whales excite University of Michigan paleontologist Philip Gingerich (right)—but his most significant finds in Egypt are 40-million-year-old whales with feet and toes, vestiges of ancestors that lived on land. Next it's off to Pakistan to dig up even older specimens. "Those whales actually walked," he says.

DEEP INTEREST in dead whales puts Craig Smith in the submersible *Alvin* (opposite, lower right) to observe marine life on a leviathan skeleton 4,000 feet down. "We've collected 43 species on it," says the University of Hawaii oceanographer. Using a time-lapse camera, he's now photographing a dead whale off California.

LOOKING UP to her subject (opposite, lower left), Harvard anthropologist Cheryl Knott is investigating how availability of wild fruits affects the reproductive patterns of Borneo's orangutans. "It's amazing we know so little about creatures that are so much like us," says Knott. "It takes intensive fieldwork, and Society funding makes it possible." □



B. HOLLY SMITH

SRI LANKA

By **Priit J. Vesilind**
NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by **Steve McCurry**

Like outlandish herons, a flock of men clad in traditional *saram* fish the south coast from wooden perches. Not long ago their island nation was poised to join Asia's economic dragons, but 13 years of strife have cramped development and kept many Sri Lankans working the land and sea like their ancestors.

A continuing ethnic war tarnishes the pearl of the Indian Ocean.

An entire Tamil village finds refuge in a warehouse in Batticaloa. Their houses were burned and neighbors killed in the conflict between minority Hindu Tamils and majority Buddhist Sinhalese. After more than four

years here they have now moved to a temporary settlement, too afraid to return to their homes in the combat zone some 15 miles from the city. Almost a million people from both sides have been similarly displaced.

BIRDSONGS DART THROUGH THE HUMIDITY. Leeches fatten on my ankles on a morning that seems liquid with heat. With my guide, Kamal Samarasinghe, I hike through the scrub jungle of central Sri Lanka, carrying a package of betel leaves, nuts, and tobacco—gifts for Tissahamy, the aged chief of a clan of Veddas.

The Veddas say they are aborigines, descendants of hunter-gatherers who first inhabited this island in the Indian Ocean some 12,000 years ago. Some anthropologists have their doubts. Many other Veddas have assimilated into rural Sri Lankan life, but Tissahamy and his clan, about a hundred families, have struggled with the government to remain here, on a small tract at the edge of a wilderness reserve.

Some of them still try to live off the forest, selling dried meat and wasp honey in a nearby village market. But a group of magnificently bearded hunters sits by the road to have their pictures taken by the occasional tourist, and if you pay them well, they will dance for you.

Nothing suspicious turns up as Colombo police run a security check on a car and its owner. Fighting for a separate Tamil state, guerrillas as young as this AK-47-toting trainee (opposite) try to slip bombs into the capital for suicide attacks. "Unless we all cooperate at the checkpoints, they will strike again in no time," says one city resident.

Later that day we sit on a baked-mud veranda with Tissahamy and his oldest son, Uruwaruge Wanniya, a tall, unsmiling man whose eyes seem fixed somewhere in the distance. He speaks for the chief, who is disgusted by the selling of his culture. But, he tells me, "This land is not big enough for us. And if we go into the reserve to hunt, they arrest us. We feel like cattle being herded."

Despite the pressure, few Veddas want to leave this community. They are, however, proud of the one who went to university in Colombo. Dambane Gunawardena, a man of 30 with long black hair and fluid grace, returned here as a schoolteacher and plans to remain. "Our life is very simple. We don't think of a tomorrow. We don't save or collect things. But here we can do what we want. Freedom is the most precious thing."

But what of his students who show promise? "My ambition," he says, "is to take at least ten children to the university."

"What good will education do if they come back here?" I ask.

"They will learn this," he answers, "that it is good to live here. The outside world will not capture them, because they will know what the outside world is like."

The outside world that encircles the Vedda people is a tropically seductive island that punctuates the grand statement of India like a comma (map, page 117). No speck of land lies between Sri Lanka's southern tip and Antarctic ice, and both summer and winter monsoons feed the swollen rivers that gush from Sri Lanka's hub of mountains. Medieval Arab merchants who bumped into the island called it Serendib, inspiring the

Photographer STEVE MCCURRY's lens often focuses on places of civil unrest. His most recent GEOGRAPHIC coverage was Burma (July 1995).

Velvet swags of tea drape the hills of this emerald island, which Arab traders once called Serendib. In the cool eternal spring, vast estates produce the leaves that make Sri Lanka the world's largest tea exporter. Stands of cinnamon, lush rubber plantations, and coastal groves of coconuts also yield crops sold abroad.

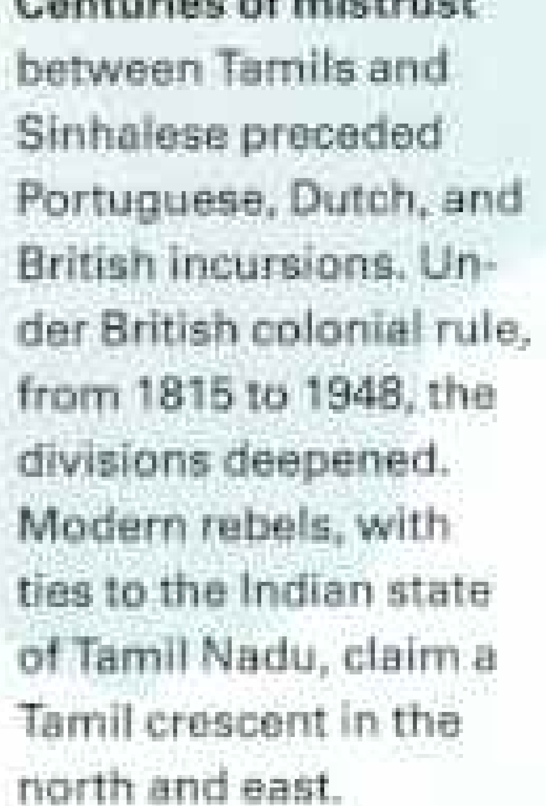
word "serendipity," the spirit of unexpected and happy discoveries.

Today Sri Lanka is a world of modern comforts and complexities, a nation of 18 million people gathered from waves of conquest, trade, and colonization, a nation still struggling to find unity. For the past 13 years it has been wracked with ethnic violence and social insurrection in which some 100,000 islanders have died or simply disappeared.

Veddas and other tribes were already here when the Indo-Aryan Sinhalese arrived from northern India around 500 B.C. The Sinhalese, who now number 13.5 million on the island, eventually embraced Theravada Buddhism and constructed city-kingdoms that thrived in the dry, north central plain, using sophisticated irrigation canals and reservoirs. Tamils, a Dravidian people, later came from southern India and in the 13th century established a Hindu kingdom in the north. Three million Tamils now make up Sri Lanka's largest minority group.

European invaders exploited Ceylon, as it was known until 1972, for its deep ports, spices, and gems: The Portuguese came in the early 16th century, the Dutch in the 17th, and the British in the late 18th.

Sri Lanka means "blessed island" in Sinhala, and at its best it has been an enlightened, multiethnic democracy, an India without the crushing



Centuries of mistrust between Tamils and Sinhalese preceded Portuguese, Dutch, and British incursions. Under British colonial rule, from 1815 to 1948, the divisions deepened. Modern rebels, with ties to the Indian state of Tamil Nadu, claim a Tamil crescent in the north and east.

AREA: 25,332 sq mi. **POPULATION:** 18 million. **ETHNIC GROUPS:** Sinhalese 74%, Tamils 18%, Muslims 7%, others 1%. **LANGUAGES:** Sinhala, Tamil, English. **LITERACY:** 90%.

social problems. Its 90 percent literacy rate is among the highest in southern Asia; its population growth rate of 1.3 percent is very low. Caste discrimination is minimal, and women seem fully engaged in the life of the nation.

But when I arrive in the fall of 1995, Sri Lanka is mired in a civil war. The government, dominated by Sinhalese, is battling the Liberation Tigers of Tamil Eelam (LTTE or, simply, Tigers), guerrillas who demand a separate state for Tamils. The army has launched a major offensive against Jaffna, the Tiger stronghold on the island's northern tip. Social and economic progress is on hold, and conversations about the future soon veer back to the war that has polarized the nation and blackened many hearts.

After decades of tension between the two ethnic groups, hostilities broke out in 1983 when the Tigers attacked a Sri Lankan Army patrol, killing 13 soldiers. Mobs of Sinhalese went on a rampage in retaliation—burning, looting, and executing Tamils throughout the country, unleashing a cycle of violence.

"But Tamils were not so easy to distinguish from Sinhalese," says Neelan Tiruchelvam, a Tamil intellectual who is director of Sri Lanka's Law and Society Trust. "The rioters would literally have to stop a man and ask his ethnicity. If they doubted he was Sinhalese, they would make him recite a Buddhist text."

Four years later, in 1987, the Sri Lankan government asked India to send troops to help enforce a cease-fire, but the move awakened an old

Sinhalese fear of invasion from the north and provoked a campaign of terror by a Sinhalese Marxist group, the People's Liberation Front (JVP), to overthrow the government. The Indians pulled out after two years, but the counterattack by the Sri Lankan Army and police against the JVP lurched out of control. Tens of thousands of insurgents and suspects were liquidated, often without trial.

Sri Lanka's president, Chandrika Bandaranaike Kumaratunga, gained office in 1994 by campaigning against such human rights abuses and advocating peace with the Tigers. She represents the political establishment; her late father had been prime minister, and she has named her mother to be the current prime minister. But for many Kumaratunga symbolized a new generation of hope that is now stymied by the relentless hostilities.

"It is a twist of fate when the peace candidate is waging war," says Radhika Coomaraswamy, a Tamil woman who is a director of the International Centre for Ethnic Studies in Colombo. "Among the human rights groups there is an eerie silence. They are flabbergasted. But they still believe she is the only one who will deliver a political solution."

President Kumaratunga admits that Tamils have "legitimate grievances," but, as she reminded local newspapers last year, "The war was not waged against the Tamil people but against the LTTE, which . . . must understand that force cannot be the means to settle grievances."

Sri Lankans are known as a gentle people, reared in peaceful religions. They have a cultural gesture, a slight waggling of the head and a deferential smile, that means, "I acknowledge you and respect what you have said." It is disquieting that they seem habitually willing to cut each other's throats. I ask many Sri Lankans about this contradiction during my four-week stay. They waggle their heads, smile beguilingly, and tell me they can't figure it out either.

A shining string of jewelry stores lights Colombo's Sea Street. Mostly 22-karat gold, purchases here are considered investments. "On the dollar market, prices are always coming down, going up. But jewelry is always up," reasons a successful shop owner. Such jewelry dresses up increasingly popular Western clothing as well as customary silk saris. Purnima Abeyratne, fitting an evening dress on a model in her workshop, designs for the city's fashion conscious.

COLOMBO, SRI LANKA'S CAPITAL, is a boisterous and cheerful city where cool ocean breezes collide with a hot breath of exhaust fumes, woodsmoke, spices, sweat, and coconut-oil pomade. Its center honks with three-wheel taxicabs and chatters with sidewalk vendors offering paper cones of juicy mango chips and coconuts with sweet water inside.

I walk along the Galle Face Green, a seashore promenade where young men play cricket, lovers snuggle for privacy beneath wide umbrellas, and a snake charmer scurries after me and lifts the lid of his basket to reveal a drowsy cobra. Later the daily storm crackles in from the west, its thunder scattering the crows that roost in the plumeria trees below my hotel window, its torrents sweeping the sidewalks clean.

Colombo yearns to cultivate an energetic peace but lives under a constant threat of violence. Black smoke still hurls from the oil storage facility in the industrial district, bombed by the Tigers two days before my arrival. Soldiers with AK-47s scowl from behind sandbags, and schools are closed. Travel is difficult and dangerous. The army monitors highways with roadblocks and has grounded all domestic airline flights.

Ethnic fears are raw. Young Tamil men who fit a certain profile are routinely pulled off buses for questioning and detention.

"We do it," admits Brig. Sarath Munasinghe, the military spokesman, when I ask him about the detentions. "What *else* can we do? If the Tigers want to disrupt our economy, they will hit tourist targets next. They're extremely desperate now."

To make sense of the present, Sri Lankans tell me, I must revisit the colonial past. Great Britain ruled Ceylon for 133 years, granting independence in 1948 and leaving behind a passion for cricket and a ruling class of pipe-smoking, English-educated politicians—both Sinhalese and

Tamil—who proved fatally out of touch with their own culture. The modern tragedy of Sri Lanka begins there.

"Back in 1948 independence meant nothing to the majority of Sri Lankans," says Kalyananda Godage, a Sinhalese and the foreign ministry's political-affairs chief, "because the government continued to be run in English, but only about 10 percent of the people spoke English."

An enthusiastic host, Godage offers me ginger beer and does not notice when a horde of tiny ants attacks my glass.

The British, he says, often pitted ethnic groups against one another to control their colonies. In Sri Lanka they elevated Tamils, who had been quick to learn English from American missionaries, to dilute Sinhalese power. An educated class of Tamils arose, and by 1947 the minority Tamils held 60 percent of the most lucrative government jobs.

After independence Sinhalese resentment provided fuel for a populist candidate for prime minister, Solomon W.R.D. Bandaranaike, who in 1956 campaigned to bring power to middle- and lower-class Sinhalese and to institute Sinhala as the state language.

"Bandaranaike romped to victory," Godage says, "and the 'Western gentlemen' were dethroned. The elitist prime minister at the time was disgusted. He said he refused to sit in parliament 'with the monkeys.' "

Bandaranaike's "Sinhala only" policy effectively cut off the Tamil professional class, which was forced to learn Sinhala or lose jobs and status. Although Tamil was later deemed a national language, resentment had already poisoned the air.

In the 1970s and '80s radical Tamils renewed calls for a separate state, to be called Eelam. The Tigers were one of several antigovernment groups, but their leader, Velupillai Prabhakaran, consolidated power with a string of political assassinations, including, it is alleged, the killing of former Indian Prime Minister Rajiv Gandhi.

THE WAR has come to a critical juncture. Prabhakaran, hidden somewhere in the jungles of the north, controls an insurgent army of 10,000, including a potent naval unit. He and the Tigers responded to the Jaffna offensive by attacking five villages of Sinhalese peasants on the border of Tiger territory, killing more than 120 innocent people.

The press has been kept from the war, and the government openly censors local newspapers. The spokesman for the Foreign Ministry in Colombo, Ravinatha Aryasinha, politely denies my request to visit Jaffna, but assures me, "This is a clean process, a clean war. There is no

one going berserk. There will be some civilian casualties, of course."

Peace might have come in March 1995, after President Kumaratunga presented a proposal to divide Sri Lanka into several regions, granting Tamils virtual autonomy in the north. Moderate Tamils expressed interest, but the Tigers balked, charging that the government was merely trying to drive a wedge between them and other Tamils. When the Tigers shattered a 14-week cease-fire in response, the government launched its campaign against Jaffna, which the Tigers had operated as a virtual ministate since 1987, with their own police, banks, and civil servants.

Jaffna fell to the army in December 1995, but the Tigers kept up their campaign of terror through the summer. In July perhaps 4,000 Tigers massed for an attack on Mullaittivu army camp on the east coast, in one of the biggest battles of the war. More than 700 soldiers and rebels died.

Tamils have migrated all over the world to avoid the conflict, and the LTTE maintains fund-raising offices in Western capitals like Paris and London, but not all Sri Lankan Tamils support the Tigers. Educated Tamils, many of whom remain in top government and commercial positions, struggle to balance ethnic loyalty with reason.

Fresh off the boat, billfish go straight to market in Trincomalee, blessed with one of Asia's best harbors. Catching some 220,000 tons of fish a year, Sri Lankans favor seafood. "When I was small, fishmongers traveled every street. No meat vendor would do that – there wouldn't be enough customers," remembers a man who grew up by the sea.

Deliciously tiered and trimmed, a century-old home outside Colombo serves up ambience for a family tea. "My great-grandfather built this on 40 acres of cinnamon and coconut," says Manik de Silva, at right, who

inherited the estate. "We've kept the appearance but fitted it with all the modern things—lights, air conditioners, a microwave." Better able to afford the expensive upkeep, businesses now own many such mansions.

"I think the people of Jaffna are fed up with the Tigers," says Radhika Coomaraswamy, the Tamil woman I had met in Colombo. "They have destroyed all their opponents, so they emerge as the only expression of the Tamils. Tamils have no alternatives, and they're frustrated."

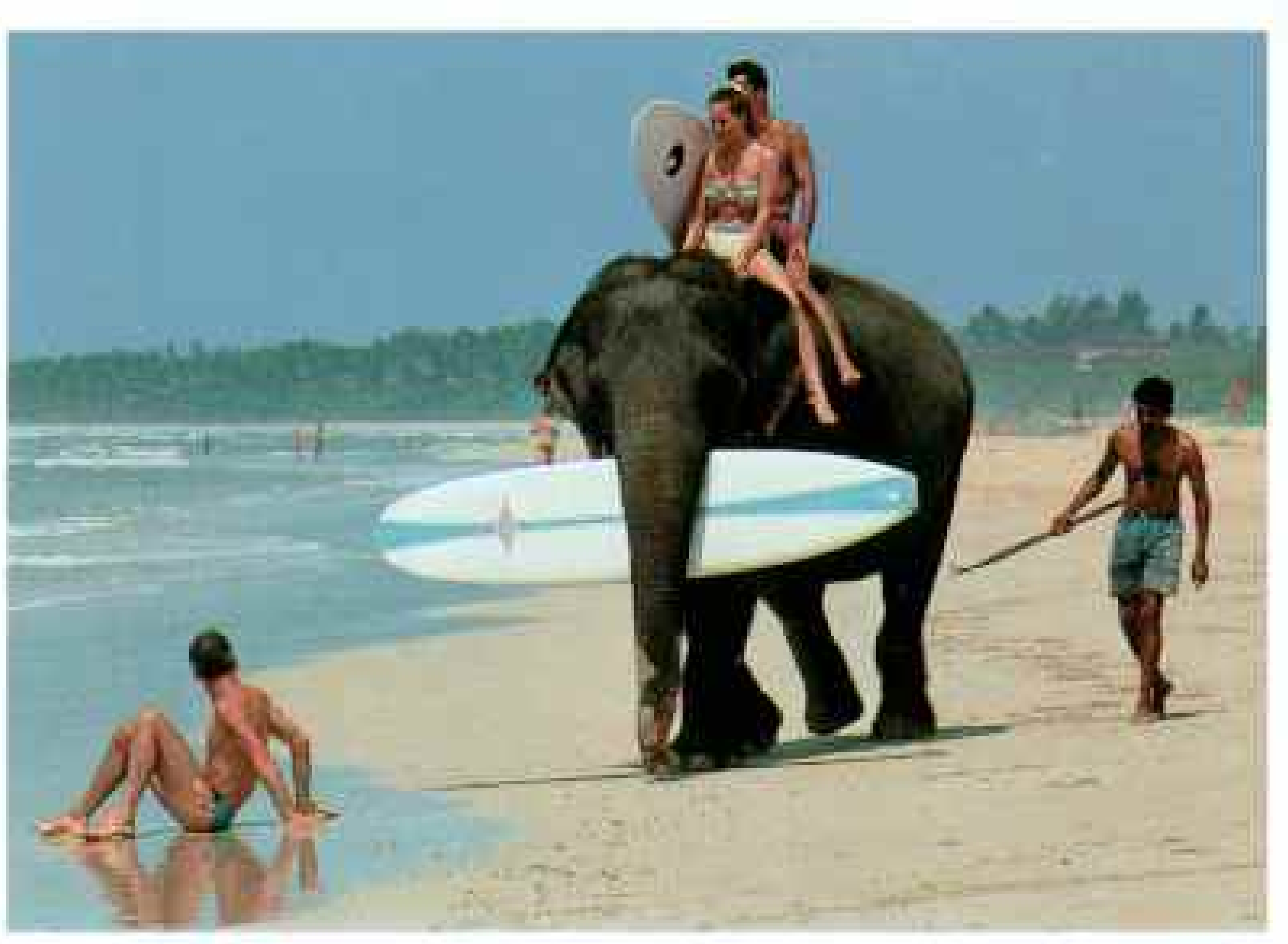
Ironically both ethnic groups feel like beleaguered minorities. Though Tamils are outnumbered by Sinhalese on the island, an additional 50 million Tamils crowd into the Indian state of Tamil Nadu, just 20 miles across the Palk Strait from Jaffna. Many Sinhalese, who see themselves as the protectors of Theravada Buddhism in southern Asia, fear a conspiracy among Hindu Tamils to create a greater Tamil state.

An officer in the Sri Lankan Navy tells me, "There is a strong chauvinist Buddhist feeling that they should not give in, or the Tamils will conquer them. The Sinhalese are scared that Eelam will be the whole country and that they will end up on the southern shore waiting for a passing ship to pick them up."

I learn later that the officer was among the missing when a helicopter carrying 39 men was downed by Tamil gunners southeast of Jaffna.

TEN YEARS AGO Sri Lanka was ripe for an economic renaissance. More than 40 foreign garment firms had invested in assembly plants in the free-trade zone north of Colombo, and a clutch of office towers arose on the city skyline in anticipation of new waves of managers and high-tech middlemen. Now the nation that aspired to be the financial center of southern Asia has fallen behind such high achievers as Singapore and Malaysia.

Ken Balendra, a Tamil with a restless mind, is the first Sri Lankan to be chairman of John Keells Holdings, a former British concern that runs hotels and tea estates as well as import-export companies. "Sri Lanka has an ideal location and a highly skilled workforce," he says. "And the quality of life in Colombo is so high that no one wants to leave. What we need is salesmanship to attract the big boys, the *Fortune* 500 companies, and others will wonder why *they're* not here."



A raucous energy drives the disheveled Pettah district, where I wander that evening. No beggars tug at my sleeve, as they might in India, and few of yesterday's plodding bullock carts remain. On one street are the textile shops of white-capped Muslims, on another a glittering gallery of jewelry shops. Signs in Sinhala script flow above the storefronts, looking, in the choice phrase of British writer Michael Watkins, like "small plump circles . . . all trying to enunciate the word 'Coco.' "

"Hello, my Lord," says an old-timer, grinning at me, remembering the British vanities.

Surfing safari: Foreign travelers take native transport at Bentota. "It's not a comfortable ride, but some like it for the adventure," says the manager of a hotel that provides elephants for its guests. Tourism helps keep the economy afloat, as do manufactured exports such as Mickey Mouse dolls getting a last brush at a factory in a free-trade zone near Colombo.

In this urban mix the war can seem distant. Largely fought by the children of the poor, it barely touches the professional class that gathers for cocktails at the Orient Club, a watering hole left from colonial times. At the bar I ask Denzil Gunaratne, a Sinhalese lawyer, about the crisis in Jaffna.

"What crisis?" he says. "The monsoons will come and this thing will just sort of settle down."

But any pretense of business as usual was stripped from Colombo in January 1996, when an immense bomb ripped into the fancy buildings of the commercial district, killing 86 people and wounding 1,200 more.

The war has divided Sri Lanka into zones. At the time of my visit the government controls the south-central core, the Tigers the northern and eastern coasts, where Tamils, Malays, and Muslim descendants of Arab cinnamon traders have traditionally lived. The government maintains only a tenuous grip on Trincomalee and Batticaloa, the main towns on the east coast, which have been reduced to army-held bastions surrounded by a hostile Tamil population.

I hitch a ride to Batticaloa with a Tamil who works with a nongovernmental development agency. We drive as if parting the waters, scattering goats, bicycles, coconut-water vendors, cattle, and monks carrying black umbrellas against the wilting sun. The land turns dry and scrubby and blazes with rampant bougainvillea as we pass through coastal villages, some Tamil, some Muslim. Gaunt men balancing piles of firewood on the backs of their bicycles teeter beside us.

"Rotary Club—Batticaloa—Drive Carefully" a sign says, and we cross a bridge into the quiet Tamil town once famous for its legendary singing fish. They say if you dip your head in the water by Kalladi Bridge, you can hear them, a sort of harmonious noise in a disquieting place.

Few of the government troops who occupy Batticaloa speak Tamil, and their fear is palpable. Spencer Morawilla, a professor at the university here, tells me, "We understand the soldiers. They think that all Tamils have tails. No one trusts anyone."

There is no official way to reach the Tigers. We simply negotiate past the final army checkpoint into one of the most destitute areas of Sri Lanka and on to the village of Vakarai, 35 miles north of Batticaloa. Here, from a side road surrounded by thick vegetation, three Black Tigers emerge, wearing flip-flops and strolling with cautious bravado. They are suicide cadres, sworn to take their own lives if captured. Around their necks are vials of cyanide.

An exacting art, tea tasting at a Colombo export company starts with three grams of leaves steeped for three minutes in water at 100°C. Tasters assess infusions from the more than one hundred varieties produced by estates first planted by the British. Tea pluckers fill their baskets with the buds and tenderest leaves from each bush.

"Why do you fight?" I challenge them. "The army is much stronger than you."

"When we fight, they run," says 22-year-old Ramesh Kanth, not quite smiling. "Mentally they are not very strong."

His own toughness comes down to the matter of the cyanide, and my heart churns as Kanth pulls the two-inch-long plastic vial from beneath his shirt. He puts it between his teeth, to demonstrate: "You have to keep it in your mouth and bite down."

A waiting list exists to join the suicide squads. On the wall of a deserted hospital a recruiting poster depicts three Black Tigers, two boys and one girl, about 15. In 1995 they blew up a Sri Lankan naval vessel, and themselves, in Trincomalee harbor. The photographs show them just before the mission, with the explosives strapped to their backs, looking scared and fiercely angelic.

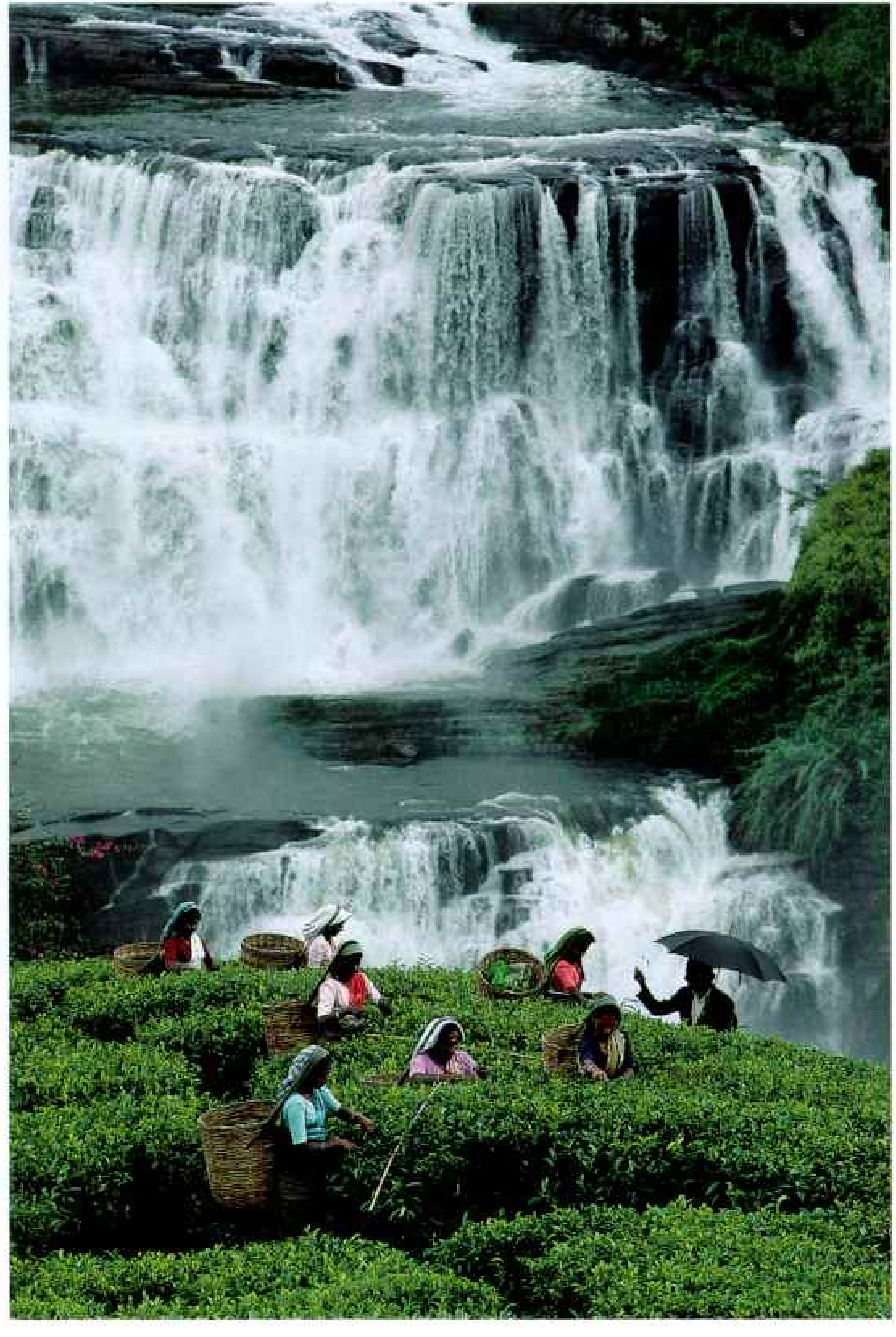
On the following morning we track down the elusive Sivagnanam Karikalan, the Tigers' political officer, at a camp west of Batticaloa. I ask him why the Tigers will not consider the president's proposal to form autonomous districts.

"We have entered into this war to achieve a separate state," he says, "Nothing much will happen through negotiations with the Sri Lankan government." But Karikalan denies that Tigers are responsible for the massacre of Sinhalese villagers: "If we wanted to kill innocent people, it would be easy for us; we could do it all the time. But we are not terrorists. We are a liberating force."

And the recruitment of children?

"When a young person makes a decision to become a Black Tiger—to destroy himself—he goes through several training courses. It is his final act, his only act, and here is where the dedication of our young people is built. There is no liberation without sacrifice."

I am the father of teenagers, and that evening I can do no more than sit on the hotel roof and absorb the healing beauty of the sunset over Batticaloa lagoon.



Mortifying the flesh fulfills vows to the Hindu god Skanda at the Kandy Perahera, a centuries-old Buddhist pageant held each summer. As in everyday life, the two religions intertwine during ten days of parades that

include elephants, traditional drummers and dancers, and flame-juggling acrobats. The procession bears a golden casket – a copy of a reliquary that holds a tooth venerated as being from the Buddha himself.

Water swirled in wicker baskets washes mud from gravel—and leaves perhaps a sapphire or garnet—near Ratnapura, "gem city" in Sinhala. Legendary source of a ruby that King Solomon gave the Queen of Sheba, the island now earns 35 million dollars a year from its coveted stones.

BACK IN COLOMBO I make plans to see Sri Lanka without the war. My guide, the resilient Kamal Samarasinghe, takes me to the city of Kandy, in the foothills of the central mountains.

Kandy was the final redoubt of Sri Lankan royalty, where the kings thumbed their noses at European colonizers for more than 200 years. It was not until 1815, when the British consolidated rule, that the flamboyant monarchs were dislodged from power.

The road to Kandy is a climb from clinging heat to crisp mountain air. Traffic is madcap and harrowing as ever, but there are remarkably few accidents, and never a rude gesture between drivers.

"The middle way of the Buddhist says that he must hold his temper at all times," Kamal explains. During my four-week trip I see only one angry driver, and he, Kamal points out, looks Korean. Perhaps, I speculate, such self-restraint builds a backlog of anger that may suddenly collapse.

I read daily in Colombo newspapers about suicides over seemingly trivial things like a bad grade or an insult. "Sri Lanka has one of the highest suicide rates in the world," a U.S. official in Colombo told me. "Why should we be surprised that a Tiger would commit suicide for his nation, when a wife will do it because her husband didn't like dinner?"

Kandy has become the cultural center of Sri Lanka, a city of scholars, and home to the sacred tooth of the Buddha, Sri Lanka's holiest object. The relic rests in a gilded temple by a tree-lined lake, where thousands of pilgrims a day peer through a small window at the golden casket that holds the tooth.

When I pay respects to the high priest of Malwatta, an infirm man who is a custodian of the sacred tooth, I ask him about Sri Lanka's continuing violence. "It is the European influence," he says, putting his own spin on history. "For 300 years there was no problem. Before the Portuguese came, this was a peaceful country. We are a peaceful people."

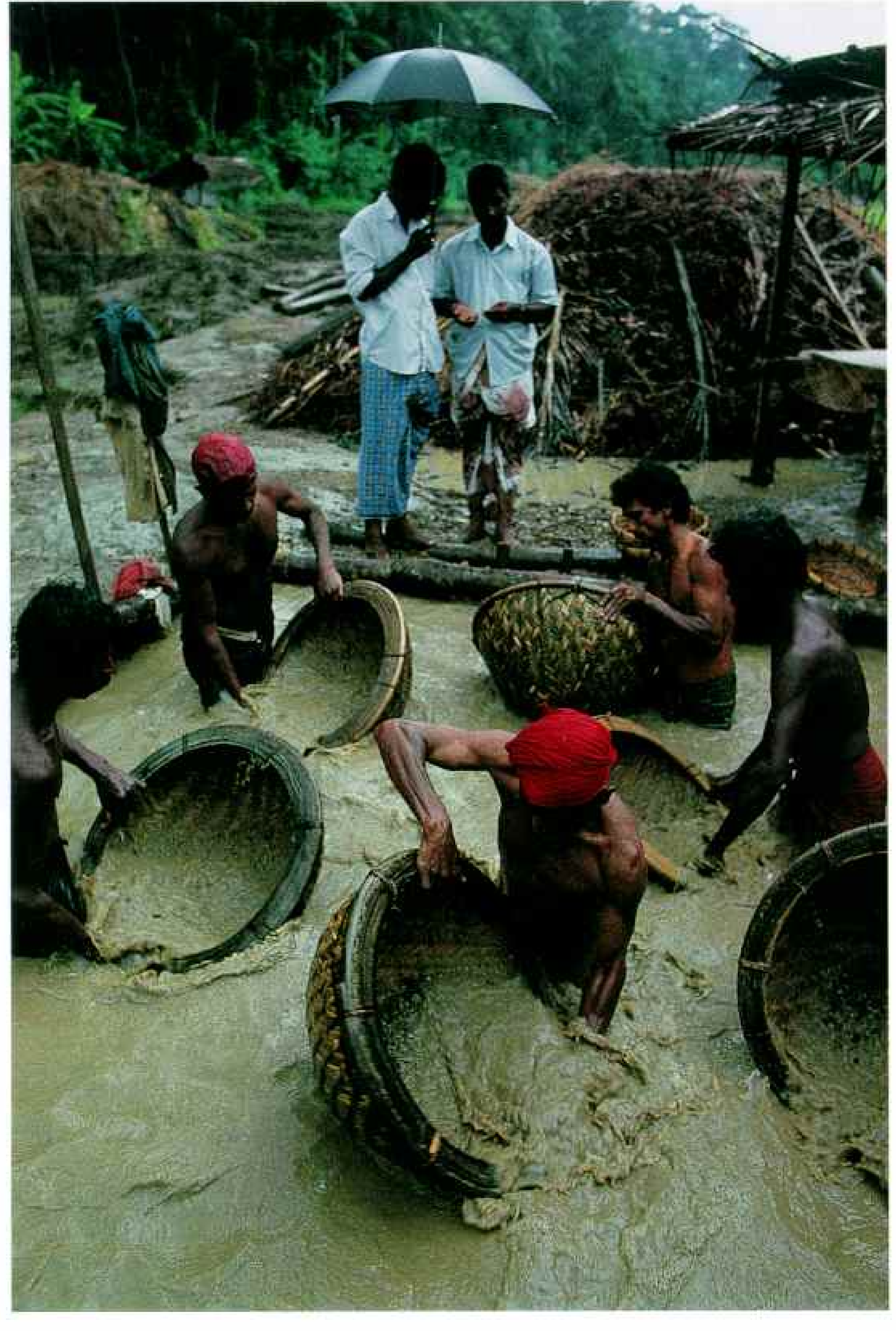
The hill country to the south of Kandy remains the most European part of Sri Lanka, due to the dominance of tea. Arriving there is like landing in Oz, a Technicolor fantasy of mountain tops, sweeping hedges, and waterfalls—all as sharp and clear-lined as a cartoon drawing.

In the town of Nuwara Eliya, in the cap of tea country, homesick colonialists imported European vegetables like beets and cabbages, built Tudor homes, Victorian cottages, and social clubs—creating a cozy replica of England. The Grand Hotel here is as musty as any in the Pennines, and the Hill Club is a proper gentlemen's retreat, with billiard room, stuffed leopard heads, and a bar closed to women.

The club's golf course is one of only four in Sri Lanka. At my 8 a.m. tee time my partner is a young Malaysian personnel manager with a ten handicap, who is in Sri Lanka to recruit cheap labor. "Being in Nuwara Eliya," he tells me, "is like walking back 30 years in Malaysia, when British influence was still strong. They have waiters here in starched sarongs! You can hear them swish when they walk."

The British first planted coffee in the central highlands and imported seasonal workers from India because few Sinhalese would work as indentured laborers. Leaf disease destroyed the coffee crop in the 1860s, and tea was planted as a substitute. Tea, unlike coffee, requires year-round labor, so between 1870 and 1930 roughly 200,000 Tamils from India migrated to Sri Lanka.

Women pick the tea, dressed in shimmering saris, wrists jangling with gold and silver, as if on their way to some fantastic celebration. They earn less than $45 a month, and that must pay for basic foodstuffs such as



dried fish and flour from the company store. Housing is free, but many workers are still stuffed into British-era "line houses," long buildings rude as cattle stalls.

The next day we leave for the southern coast, hairpinning down through mountain vegetation virtually leaping from the soil. In good years thousands of vacationing snowbirds alight here from Switzerland, Germany, and Finland. Most settle in for sun and snorkeling at a necklace of hotels and cottages that extends from Matara to Colombo. The economy depends heavily on tourists, but hotel occupancy is disastrously low because of the war.

Sumedha Alexander, a guide with a busload of Belgians in the town of Hikkaduwa, tells me his guests are a bit frightened. But he remembers worse times, like in 1989 when the island was sick with carnage from the Marxist JVP insurgency. "I had a tour group of elderly Belgians," Alexander says, "and one morning we saw 27 severed heads stuck on fence posts—young men who had been executed. I didn't know what to do. I told my clients that the villagers had a pageant the night before and had made these rubber masks.

" 'Oh, they're not real, then,' they said.

Reflecting the glory of the last Sri Lankan kings, who built their capital here, Kandy confirms Sri Lanka's potential. "When peace comes, this country really can do wonders," says one woman. "It's in the people. Look at all the amazing things they've already done."

" 'Oh no,' I said. 'Just a drama.' I couldn't tell them the truth. It would have been too much. They would have collapsed."

We stop in the Sinhalese village of Kottagoda, home of the late Rohana Wijeweera, who led the JVP rebellion. Young men idling by a small grocery say that fanaticism is still cultivated here, that lives are still in limbo. "People are violent mostly because of poverty," one says. "That's why young people get involved in these groups. They see no future, have no hope. Look at us: four educated men, no jobs."

Traditional work goes on. Fishermen perch on stiltlike poles planted in the seabed. Agile toddy tappers scale coconut trees to gather the sweet, milky nectar. But most workers abandoned such livelihoods for tourist jobs 10 to 20 years ago; now those jobs have shriveled up.

The children of wealthy Sri Lankans can escape; increasingly they are educated at universities abroad. Less well-off Sinhalese youth are taught in state universities in Sinhala, which practically condemns them to bottom-rung jobs that require no English. Unemployment among college graduates is nearly 30 percent, and they are prime recruits for virulent political movements.

And Tamils? "We've had an extraordinary brain drain," Neelan Tiruchelvam had told me in Colombo. "At least half a million have emigrated since 1983. There are hundreds of Tamils graduating from engineering schools in Canada alone, but in the whole of the northern province of Sri Lanka there is only one Tamil surgeon."

IN THE DRY ZONES of north central Sri Lanka, slash-and-burn *chena* cultivation is a traditional but fading livelihood. It forces the farmer to push deeper into the jungle to find good soil and then to guard his fields against elephants, wild boars, and scavengers. He and his crew will sit all night in tree houses, shouting, firing shotguns, and singing to kill time and stay awake.

Their songs are called *pel kavi,* which means "songs of the huts"—lilting, homey melodies that reflect loneliness and wonder. "*Ranwan eranwan, gangaboda kokune,*" one song begins: "Golden and golden, egrets on the riverbanks."

I spend my last night in Sri Lanka with a young farmer named Jagath, in a tree house near Habarane, helping guard his pepper fields. We climb 30 feet to a platform where a small candle glows, revealing two other farmers, both grinning at the foolishness this night has brought them.

We have no common language but share tea and lemon cookies and laughter. Later we simply sit in the darkness. The log fire of another chena farmer glows in the distance, and fireflies glitter. My feet dangle over emptiness. Bright stars emerge. By ten o'clock my eyes are heavy.

"Yo-ha-ha!" Jagath yells into the jungle every half hour, to scare the unknown. The shouts of other farmers echo from the bush, and one voice sings, boldly. Jagath is too shy to sing or too young to know the old songs; he borrows my tape recorder and earphones, and listens to a Verdi opera with a toothy smile.

The moon at three o'clock hangs like a golden cradle. Jagath ventures a few more *Yo-ha-has,* but he drifts off to sleep before Orion stalks overhead. The farmers in the next shelter toss a log on their fire with a small eruption of sparks, and fog moves into the clearing with a moist sigh.

In the morning the shapes of large trees emerge from the night thickness, the ground seems to lift, until we hang, suspended, under the immensity of the firmament.

A moment of peace. □

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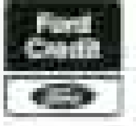

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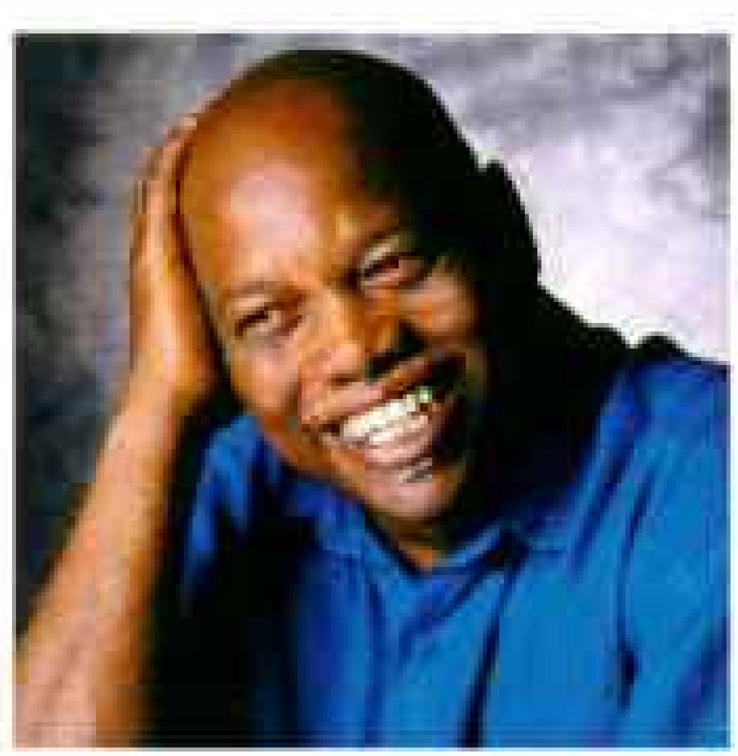

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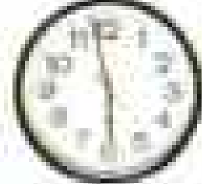

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NATIONAL GEOGRAPHIC

JANUARY 1997

2 **The Imperiled Nile Delta** *As the Mediterranean Sea encroaches and the Egyptian population grows, what's to become of the fertile lands at the mouth of the ancient river?*
BY PETER THEROUX PHOTOGRAPHS BY REZA

36 **Peruvian Mummies Revisited** *An Inca maiden, sacrificed on an Andean peak five centuries ago, reveals more secrets.*
BY JOHAN REINHARD

44 **Tree Giants of North America** *Suspended hundreds of feet above the ground, scientists investigate the temperate rain forest canopies of the Pacific Northwest.*
ARTICLE AND PHOTOGRAPHS BY MARK W. MOFFETT

62 **Our Man in China** *Explorer and journalist Joseph Rock brought China to life for* GEOGRAPHIC *readers in the 1920s and '30s.*
BY MIKE EDWARDS PHOTOGRAPHS BY MICHAEL S. YAMASHITA

82 **Beneath the Tasman Sea** *The plankton-rich waters off Australia's island state host rare and splendid creatures.*
ARTICLE AND PHOTOGRAPHS BY DAVID DOUBILET

102 **Field Notes** *The Society's Committee for Research and Exploration helped fund 200 field projects last year.*

110 **Sri Lanka** *A nation of azure skies and emerald forests in the Indian Ocean is turning crimson from bloody civil conflict.*
BY PRIIT J. VESILIND PHOTOGRAPHS BY STEVE McCURRY

Departments

Behind the Scenes
Forum
Geographica

Flashback
On Television
Earth Almanac
On Assignment

The Cover

Long tendrils above eyelike nostrils help a Tasmanian saw shark sense prey as it sweeps its toothed snout through the mud. Photograph by David Doubilet.

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We cater to your individual needs ... by offering a seat that does, too. Note, for instance, the adjustable lumbar support.

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Up to 30% more seat travel puts comfort within easy reach. For added comfort and convenience, the seat belt moves with the seat.

We code many of the new Dakota's plastic parts for the day they can be recycled. Because, like you, we think the world of the environment.

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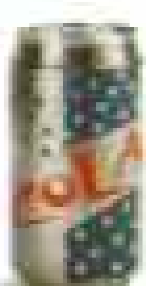
You can opt for a premium Infinity® stereo system with cassette and CD player in the new Dodge Dakota. Eight speakers in six locations kick out some real concert-quality sound.

There are up to five cupholders in all. Hey, you never know when some thirsty friends are going to need a ride.



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The New Dodge Dakota
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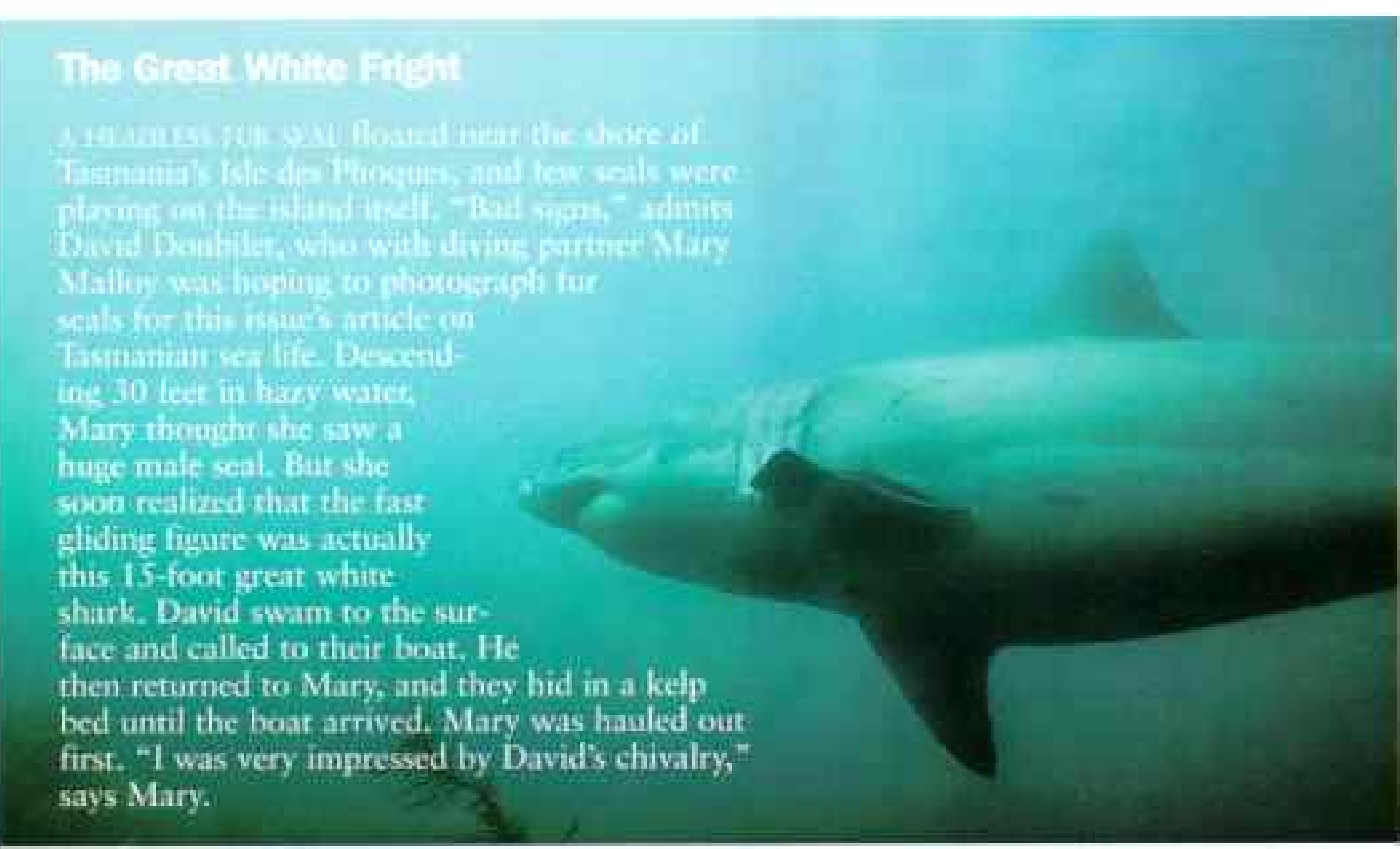
Behind the Scenes



The Great White Fright

A HEADLESS FUR SEAL floated near the shore of Tasmania's Isle des Phoques, and few seals were playing on the island itself. "Bad signs," admits David Doubilet, who with diving partner Mary Malloy was hoping to photograph fur seals for this issue's article on Tasmanian sea life. Descending 30 feet in hazy water, Mary thought she saw a huge male seal. But she soon realized that the fast gliding figure was actually this 15-foot great white shark. David swam to the surface and called to their boat. He then returned to Mary, and they hid in a kelp bed until the boat arrived. Mary was hauled out first. "I was very impressed by David's chivalry," says Mary.

JASON FOUNDATION FOR EDUCATION (BELOW); MARY MALLOY

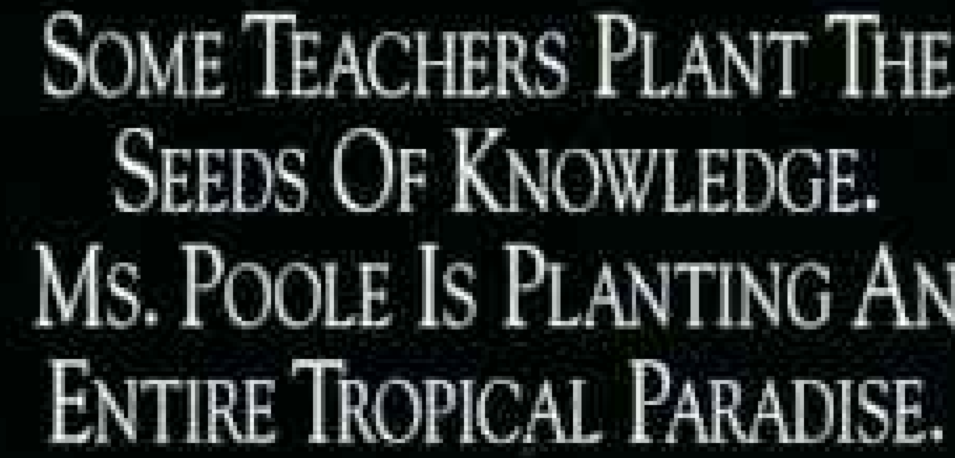
Flying off the Shelves

THE THURSDAY NIGHT craft group of the Philadelphia Protestant Home needed a new project. In March members began making these stick-on ornaments from old issues of the GEOGRAPHIC. Some 2,000 butterflies later, they're still going strong.

"The paper is just the right weight, and the colors are glorious," says butterflier Dorothy Yates. Proceeds from the ornaments, sold in their gift shop, go to the home's benevolent fund.

Ballard Wins the Hubbard

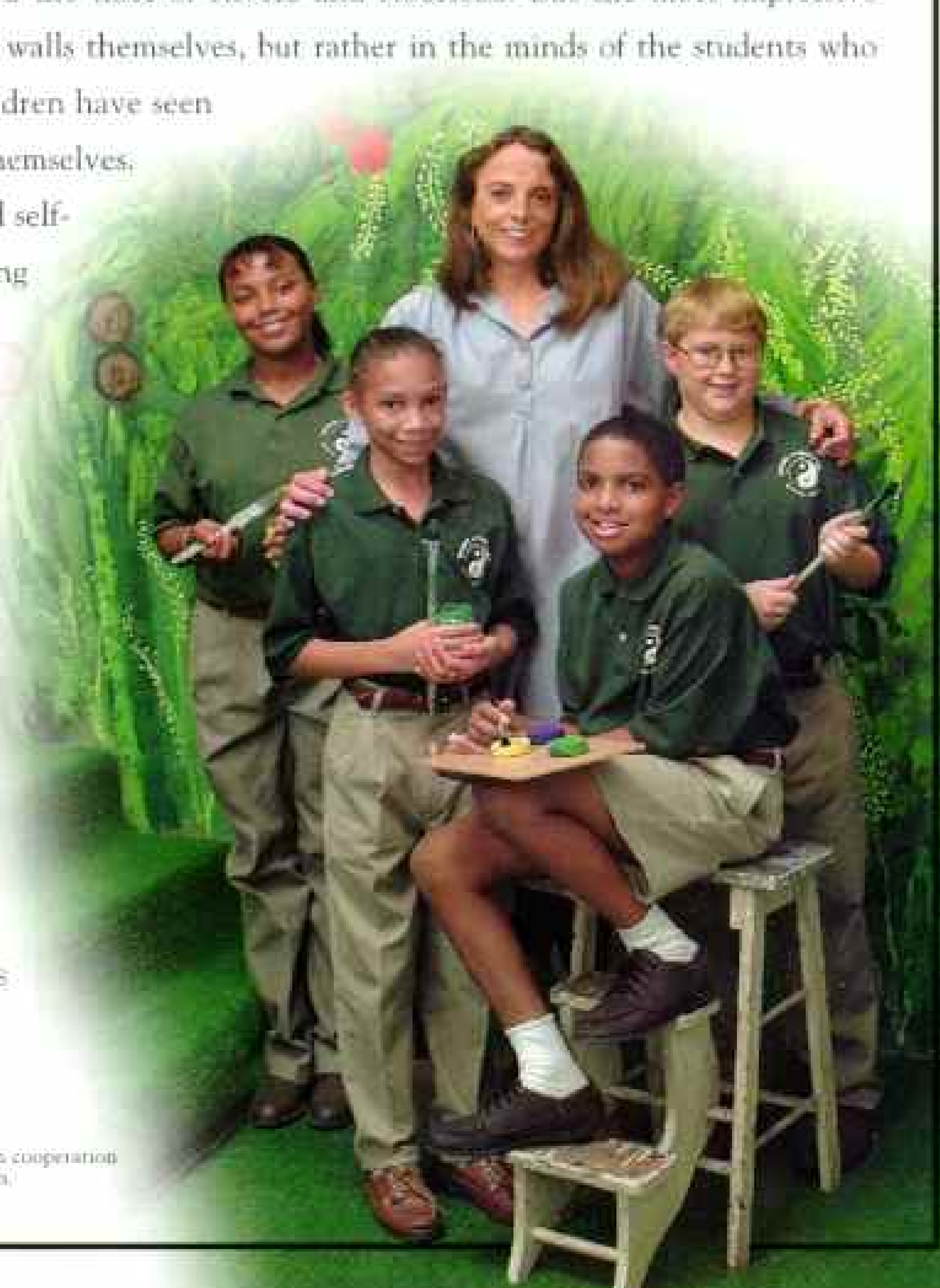
HE GREW UP fascinated by the sea, collecting shells and studying tide pools near his boyhood home in California. He is still finding things underwater, including the long-lost *Titanic*. Bob Ballard was recently honored with the Society's highest award, the Hubbard Medal, "as much for your work bringing science to life for schoolchildren as for your scientific discoveries," Gilbert M. Grosvenor told him. Deluged by mail after finding *Titanic*, Bob wanted to make science more accessible to young people. In 1989 he founded the JASON Project, using the latest technology to connect more than 100,000 students worldwide to his yearly explorations. "It's a scientific Super Bowl," he explains—where everyone wins.



When it came time for Laurie Poole to teach her 6th grade art students about the works of Paul Gauguin, Henri Rousseau and Diego Rivera she took them not to the halls of a museum, but to the walls of their own courtyard cafeteria. And there she handed them paint and brushes and gave a whole new meaning to the phrase, *Learn by doing*.

Today the walls of Selma, Alabama's School of Discovery are abloom with the same tropical themes that inspired the likes of Rivera and Rousseau. But the most impressive change occurred not on the walls themselves, but rather in the minds of the students who painted them. For these children have seen the beauty that lies within themselves. And experienced the joy and self-esteem that come from sharing it with others.

For her achievements, State Farm is proud to present Laurie Poole with our Good Neighbor Award, and to donate $5,000 to the School of Discovery.



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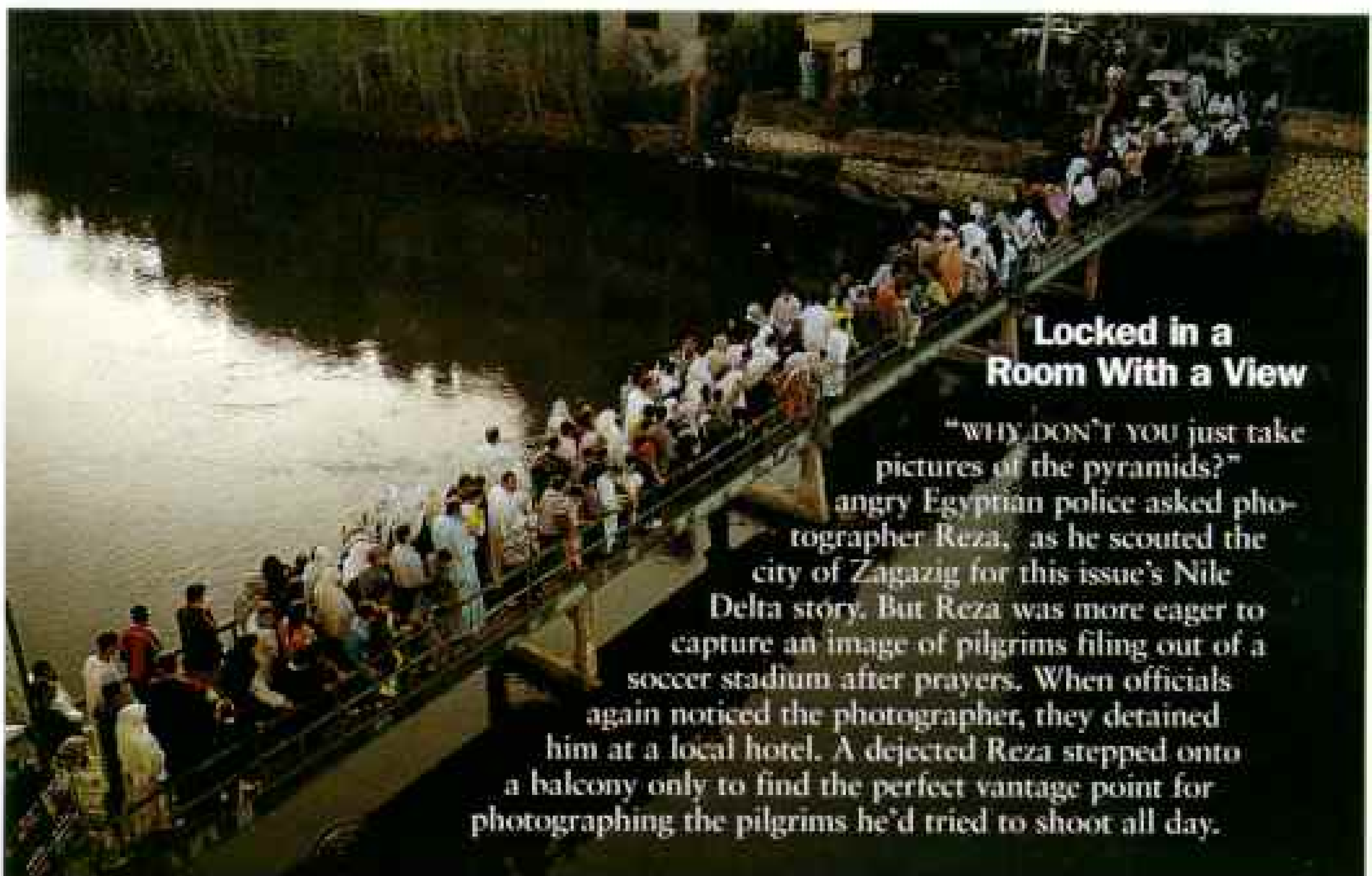
The Good Neighbor Award was developed in cooperation with the National Art Education Association.



Locked in a Room With a View

"WHY DON'T YOU just take pictures of the pyramids?" angry Egyptian police asked photographer Reza, as he scouted the city of Zagazig for this issue's Nile Delta story. But Reza was more eager to capture an image of pilgrims filing out of a soccer stadium after prayers. When officials again noticed the photographer, they detained him at a local hotel. A dejected Reza stepped onto a balcony only to find the perfect vantage point for photographing the pilgrims he'd tried to shoot all day.

REZA

Mummy Money

MORE THAN 80,000 PEOPLE visited our Explorers Hall in Washington, D.C., last spring to see the Ice Maiden; many bought our June issue featuring the mummy. The proceeds—$5,530—went to Catholic University in Arequipa to fund further research.

PETER KROGH

Anatomically Correct

IT'S NOT THAT Chris Klein had a skeleton in his closet; he just wanted to be sure everything was in the right place. The staff artist boned up on anatomy with this plastic model of a female skeleton—known nevertheless as Mr. Art Locker around the art department—before making the illustration of a lightning-struck skeleton on page 42 of this month's "Mummies of Peru" article.

The artist's appraisal of his model? "Very cooperative," Chris says. "And very quiet."

We've Got the Answer

WE LOVE to hear from members—and we often do. Our Research Correspondence Division answers letters and calls. In 1995 its staff replied to 44,339 questions and acknowledged 7,652 comments.

One of the most frequently asked questions: "How can I help the environment?" The hardest? From a six-year-old girl: "You're always writing about the North Pole. Why haven't your explorers seen Santa Claus?"

—MAGGIE ZACKOWITZ

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Forum

Among the many comments we received on our September 1996 article on Scotland was this concern from a South African reader of Scots-Irish descent: "The thought that Great Britain might splinter into quarreling little nationalist fiefdoms is an appalling prospect." A firefighter recognized ideas examined in our article on fire as a "sermon we have been preaching for over 20 years."

Scotland

Nooo doubt y've already hearrrd from 10,000 or more Scots round the worrld that y're otherwise faen piece was sadly flawed by y're title "Plaid to the Bone." As the reporrt itself makes purrfectly clear, it's no plaid man—it's the tartan. Nooo self-respecting Scot would be caught dead in the plaid!

BRUCE E. MACDONALD
Ottawa, Ontario

Our mountain landscapes and our wildlife habitats are threatened by overdevelopment and the lack of effective statutory protection. Scotland is among the few countries lacking national parks. The World Conservation Union has been calling on our government for years to introduce national parks and make our small contribution to the protection of the planet's wild places. To our shame Scotland—birthplace of John Muir—is still denied parks legislation. Can somebody out there please help us?

MALCOLM PAYNE
Scottish Council for National Parks
Perth, Scotland

Scotch is the most successful spirit in the world. The value of these alcoholic exports in 1993 was more than two billion pounds [three billion dollars U.S.]. In France, for example, more Scotch is now consumed in a month than cognac in a year. Why not include a couple of lines about this important factor in the Scottish economy?

HANS VAN DER MEER
Schwalbach, Germany

I take exception to the characterization that Sun Microsystems' glass-and-steel facility in Linlithgow appears airlifted directly from Silicon Valley. As facility manager for Sun during start-up, I can assure you that we worked with a Scottish architectural firm and the local government to ensure that the setting and exterior blended with the 600-year-old Royal Burgh of Linlithgow. The materials used were chosen specifically to echo the stone walls, slate roofs, and green window trim used in the surrounding conservation district.

BILL COLDWELL
Excelsior, Minnesota

Especially impressive to me as a pastor was the detail devoted to worship services. Such vivid renderings of the religious expression of some Scots added an important dimension to your usual thoroughness in introducing people of various nations. Issues of faith are easy to overlook, and it might be tempting to comment on externals like religious buildings or customs while neglecting the overarching personal impact of a peoples' inner faith.

REV. JOHN G. SCHETTENHELM
Orange, Connecticut

Gaza

The War of Independence of 1948 did not begin as a spontaneous "explosion" of tension between Arabs and Jews but was an organized invasion of the newly formed state of Israel by the armies of Egypt, Transjordan, Syria, Lebanon, and Iraq.

JOSEPH WEBER
Atlanta, Georgia

Searching for the Scythians

The farmlands of my mother's family in the Cherkasy region of Ukraine were dominated by a large kurgan [burial mound] near which our house stood for centuries. My great-grandmother told of a long-standing belief that kurgans were raised by mourners, who individually placed a handful of earth or a piece of sod on the grave. The more important or loved the deceased, the greater the number of mourners and the greater the size of the mound. My grandfather participated in archaeological digs at the turn of the century and was struck by the respect that had been accorded to female burials. Many Scythian customs have been assimilated into Ukrainian folklore, such as taboos forbidding the extinguishing of fires on St. John's, Christmas, and New Year's Eves.

EVA PIP
Winnipeg, Manitoba

For thousands of years gold dust has been extracted from the rivers draining the Caucasus area by placing sheepskins on the stream bottom to trap the particles. Hence the presumed origin of the legend of the golden fleece pursued by Jason. The two warriors depicted on the gold pectoral (page 64) appear to be disputing the ownership of such a fleece.

THOMAS F. HIGBY
Fowlerville, Michigan

High Over Four Corners

Your timeless pictures and eloquent article took me on a journey home. I grew up on the Navajo Nation, between the sacred mountains, and each time I return I am amazed by the magical tranquility of its colors. For a time, each day I drove between Crystal, New Mexico, and Window Rock, Arizona. Each sunrise and sunset cast the towering sandstone formations with a different hue of the seasons. Like many sons and daughters on the Navajo, my walk in beauty remains because I have experienced this land. It is the home of my people; it is very special.

JOHN ROANHORSE
Phoenix, Arizona

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I would add a footnote to the article: It is a common but erroneous belief that windblown sand is a major shaper of desert landforms. Wind normally does not have the power to lift particles as large as sand grains to significant heights. The pitting of cliff faces, sometimes attributed to wind action, is often formed by solution of the calcium carbonate cementing agent in the sandstone as groundwater moves through the porous rock. The major agent of weathering and erosion in deserts is water.

PAUL R. LARSON
Assistant Professor, Geography
Southern Utah University
Cedar City, Utah

I found it ironic that this article came only a month after a piece in Earth Almanac called "Noisy Skies Over the Wilderness," which gave a different interpretation of the value of aircraft over our national parks and monuments. The September article represents all that air tourism stands for—the ability of people to witness the miracles of this earth from a perspective not possible by any other means, all without leaving a single trace of their visit. Over two million air-tour passengers each year have similar experiences over our scenic wonders.

DANIEL W. ANDERSON
President, U.S. Air Tour Association
Alexandria, Virginia

I just returned from an automobile trip to the Four Corners area, and, unfortunately, my impression of the profound natural beauty was shattered by the prevalence of roadside litter, trailer homes at the base of nearby buttes, and the selling of trinkets, soft drinks, and food at the monument itself.

HELMUT SOIKA
New York, New York

Tarantulas

Fascinated by things I fear most, I read this article first. Midway through Richard Conniff's intriguing account of his tarantula expedition, I felt I was being watched. Slowly I lowered the magazine only to come eyeball to eyeball with a good-size, furry, tan-and-brown spider sitting on my knee. My first instinct was to crush it between the covers of the magazine. However, having just read the section on the spider called Queen Mary, I overcame my violent urge. I scooped up the critter in my blanket, carried it to my deck, and shook it into the grass. And this from a woman who once gunned down a poor house spider with hair spray and toothpaste.

MARGARET LIPPENS
Maybee, Michigan

My son, an archaeologist, found a tarantula in a Nevada desert and brought him to my fourth grade classroom. "Fang" was hairy, docile, and had lost one leg. For three years he captured the attention of all the children. They kept him well fed with crickets, which filled our classroom with chirping.

JEANNETTE STEARNS
Madera, California

The problem I had with this very interesting article was the emphasis on tarantula "pet" owners. What was particularly repulsive was the description of how Nilo collected these creatures and where they end up—as dead souvenirs in glass boxes.

CHRISTINE J. WALFORD
Calgary, Alberta

Fire

As a structural firefighter with an interest in wildland fires, I now understand the meaning of "fighting fire with fire." I also realize that there is a lot more to wildland firefighting than just trying to contain and extinguish. It seems strange to deliberately start a prescribed burn, but it is necessary for the ecobalance of the forest.

CAROL M. ROSE
Lexington, Massachusetts

The problem with the "let it burn" theory is that it does not take into account the increased presence of man in our great outdoors and his penchant for starting far more fires than natural forces ever did. Even as I write, there are eight fires burning west of Denver. The air is filled with smoke haze. I don't see a need to create more fire from where I am sitting.

THOMAS M. SLATTERY
Wheat Ridge, Colorado

The article leaves the impression that before fire control began all wildfire was benign. Yet many of the largest, most damaging fires in U.S. history burned before fire control began, such as the fires in the Great Lakes states between 1870 and 1910 and those in California, Oregon, and Washington. The Idaho-Montana fires of 1910 burned three million acres of old-growth forest and killed many people. Something should be said for the long-term benefits of fire control.

ROBERT W. CERMAK
Oroville, California

In 30-plus years with the Forest Service, I have never seen a major wildfire put down by men and machines alone. Big wildfires need the proper climate situation to allow for control. All heroics notwithstanding, they quit burning when the wind and weather say so. Also, there are certain places in our too fragile landscape where fancy houses just don't fit. And for sure the owners shouldn't expect and receive my tax dollars for rescue efforts.

BILL WERTZ
Tyrone, Pennsylvania

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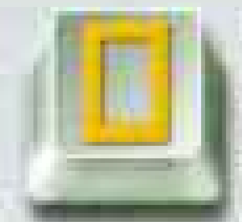

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Yellow Cardinal *(Gubernatrix cristata)* **Size:** Length, 20 cm **Weight:** Approx. 38 g **Habitat:** Open woodland, scrub and shrubby savanna in Brazil, Uruguay and Argentina **Surviving number:** Unknown

Photographed by Luiz Claudio Marigo

SOUTH AMERICA
Pacific Ocean
Atlantic Ocean

WILDLIFE AS CANON SEES IT

The characteristic crests of two yellow cardinals are silhouetted against bright summer skies on the Brazilian pampas. These elegant cardinals are highly valued as cagebirds because of their melodious song and colorful plumage. For over a century, constant trapping to fill the market demand reduced cardinal populations drastically, to where they have become very rare throughout much of their range. Yellow cardinals can still be seen in pairs or small flocks in a few southern localities, but the future of these songbirds in the wild remains threatened without protection. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

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Good Weather Helps Satellite Track a Towering Ash Plume

SKIES OVER NEW ZEALAND'S North Island were clear on June 17, 1996, when Mount Ruapehu rumbled to life, as it had the previous September and October. As the 9,170-foot-high volcano belched ash, a NOAA polar-orbiting weather satellite passed over in the midafternoon. Using a sensor that records visible and infrared light, it provided data for this remarkable false-color image of the northeast-drifting ash plume, which had earlier climbed 18 miles high.

"North Island is typically very cloudy," says Stephen McNeill of Landcare Research New Zealand in Wellington, which processed the data. "To find it cloud free is like finding gold. To find an eruption at the same time is even more unusual."

One scientist calls the 1995-96 eruptions Ruapehu's most significant in 50 years. Though eruption virtually ceased in August, the volcano trembles still.

LANDCARE RESEARCH NEW ZEALAND/NOAA

Female Fish Go for Algae-mat Mate

IN THE SHALLOW WATERS where garibaldi damselfish seek mates, a male swims loops and grunts loudly to attract a passing female. But he's wasting his time unless he cultivates a thick mat of maroon algae on a rock to win her favor.

Males who clean off rocks so that only maroon algae thrive easily mate. Paul Sikkel of the University of the Virgin Islands has studied garibaldis off Santa Catalina island in California for a decade, partly with Society funding. He wondered if it's the male or his algae mat that lures the female. His analogy: "If I'm driving a sports car and attract a date, is she picking me or the car?" Female garibaldis, Sikkel found, go for the car: When he scrubbed algae off a rock in a male's territory, females sought another suitor with an algae-coated rock.

Among Sikkel's theories for this behavior: Males tend the fertilized eggs until they hatch, and cultivating algae mats demonstrates a similar skill.

With fish populations dropping at his study sites, Sikkel joined with Catalina's diving community to have the foot-long garibaldi—named for the Italian patriot—designated California's official marine fish. No collecting is allowed.

NORBERT WU, PETER ARNOLD

CD-ROMs give you a rich multimedia experience you can't get anywhere else.

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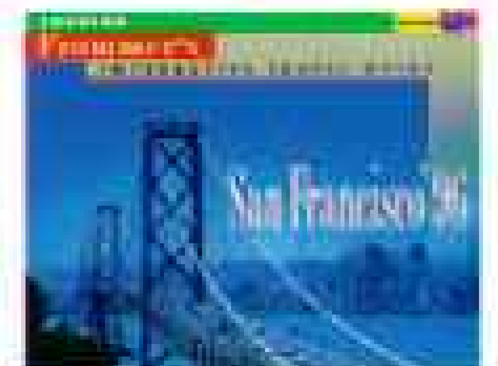
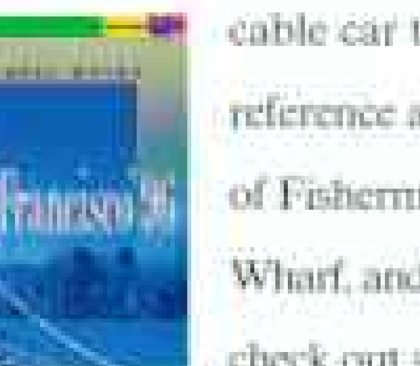
For example, say you were using Frommer's Interactive Travel Guides San Francisco '96® CD-ROM to plan a vacation. It would let you take a cable car tour, reference a map of Fisherman's Wharf, and even check out some of the nearby hotels. The Internet link could then connect you to those hotels with a Web site so you can book your actual room reservation.

The connected CD-ROM is just one more example of how advanced technologies combined with powerful Intel microprocessors are adding new dimensions to your PC experience. But this is only a taste of what it's all about. To learn more about connected CD-ROMs, check out the Intel Web site. ► www.intel.com

"To an underwater photographer, time is even more precious than light."

David Doubilet

For nearly two decades, David Doubilet has been recognized as one of the world's most artistically ambitious underwater photographers. As elegantly composed as they are painstakingly lit, David's photographs possess the intimacy and detail of great portraiture.

He says, "I look underwater for the same basic elements that a surface photographer does – light, color, motion, and gesture – and no place on earth offers a more subtle variety of those elements than does the sea."

To achieve his singular effects, he and his assistants submerge themselves for hours at a stretch, taking with them as many as ten complete camera systems, spare SCUBA tanks, and computers to carefully monitor their dives.

Yet, of all his equipment, David has come to trust the reliability of his Rolex Submariner most of all. "Underwater," Doubilet says, "your health depends on proper timing. I would never dive without my Rolex."

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NUBAR ALEXANIAN

Cape Cod Lighthouse Goes for a Ride

"THE CAPE is wasting here on both sides," Henry David Thoreau wrote in 1855 of the surf-pounded cliff under the Highland Light, a Cape Cod landmark. "Erelong, the lighthouse must be moved."

"Erelong" is now. Last July workers jacked onto rails this 400-ton, 66-foot-high brick lighthouse, which in 1857 had replaced the one Thoreau saw. It took 20 days to roll it 453 feet back from the cliff. Now it's a new hazard on a golf course.

The original wood lighthouse began warning ships of shoals off the Truro bluffs in 1797. "Then there was 510 feet of cliff in front of the light," says Robert Firminger of the Truro Historical Society, which persuaded the state of Massachusetts, the Coast Guard, and the National Park Service to save the landmark. "By last summer we were down to the last 100 feet." The Highland Light now is back in operation.

A Medieval Bath Fit for a Hotheaded King

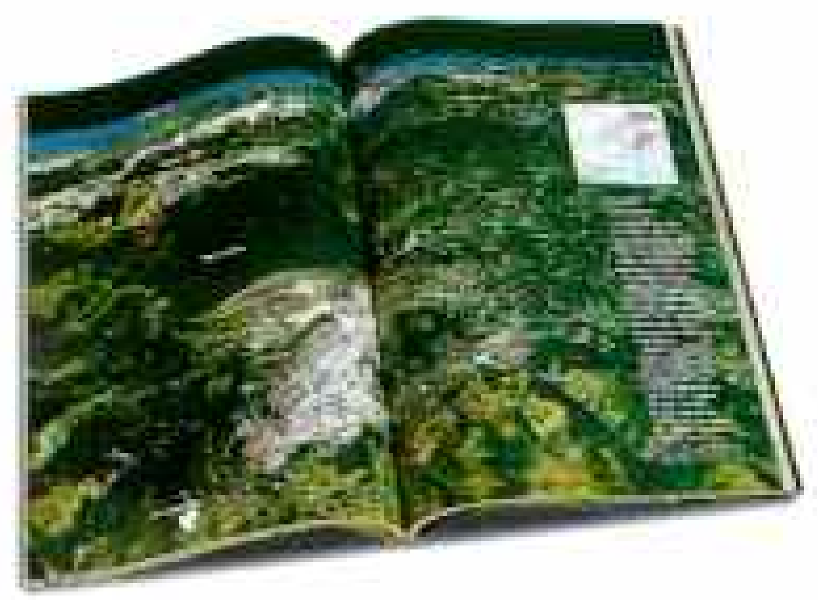
AND YOU THOUGHT King Henry VIII was just an overweight dirty old man who beheaded two of his six wives. In truth Whitehall, a favorite palace of the 16th-century Tudor monarch, was furnished with England's earliest Turkish bath.

Excavation of the palace's "privy gallery" in 1939 had exposed a sunken tub and glazed tiles, many bearing royal heraldry. Recently David Gaimster of the British Museum noted that the excavated chamber lacked windows that would have allowed hot air to escape and that the tiles probably came from a tall stove blasting out heat to keep the tub's water temperature high—classic elements of a Turkish steam bath. "I put two and two together," says Gaimster. "What's unusual was finding these bath features together in the king's private apartment. Their presence destroys the myth of the Tudors being of questionable personal habits."

RICHARD THOMPSON

Image of Sarajevo Stars at War Crimes Tribunal

SOON AFTER our June article on the Bosnian conflict appeared, its computer-generated mosaic



depicting the topography around Sarajevo made a second appearance—at the UN war crimes tribunal at The Hague in the Netherlands. Created for the magazine by Autometric, Inc., from satellite data provided by the U.S. Air Force, the image became Exhibit 71 in a hearing that ended with the issuance of arrest warrants for Bosnian Serb leaders Radovan Karadžić and Gen. Ratko Mladić. Both were charged with genocide and crimes against humanity, including the shelling of civilians in the Bosnian capital and a continuous sniping campaign from the surrounding hills. The mosaic received international TV coverage during last summer's tribunal hearings.

—BORIS WEINTRAUB

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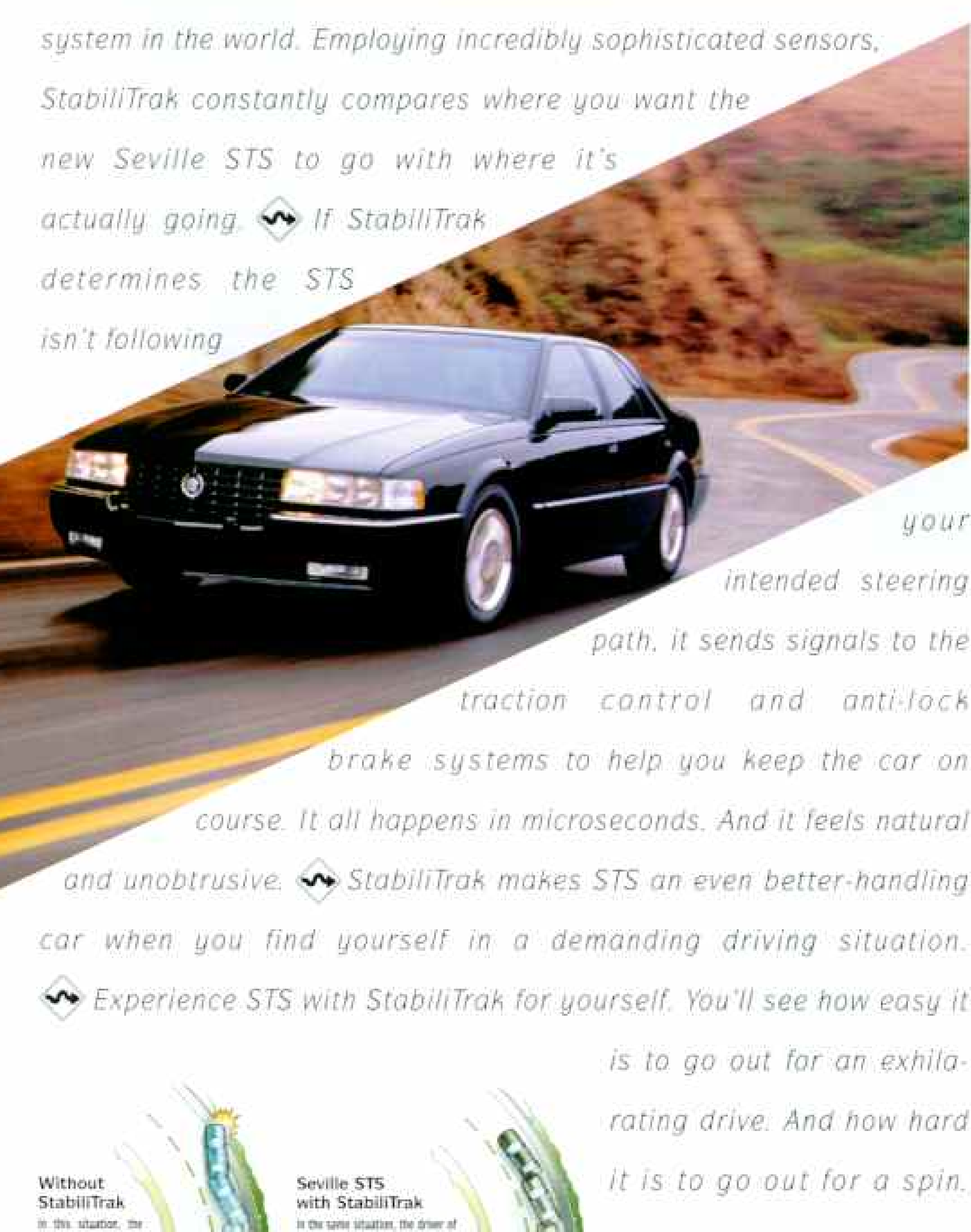
system in the world. Employing incredibly sophisticated sensors, StabiliTrak constantly compares where you want the new Seville STS to go with where it's actually going.
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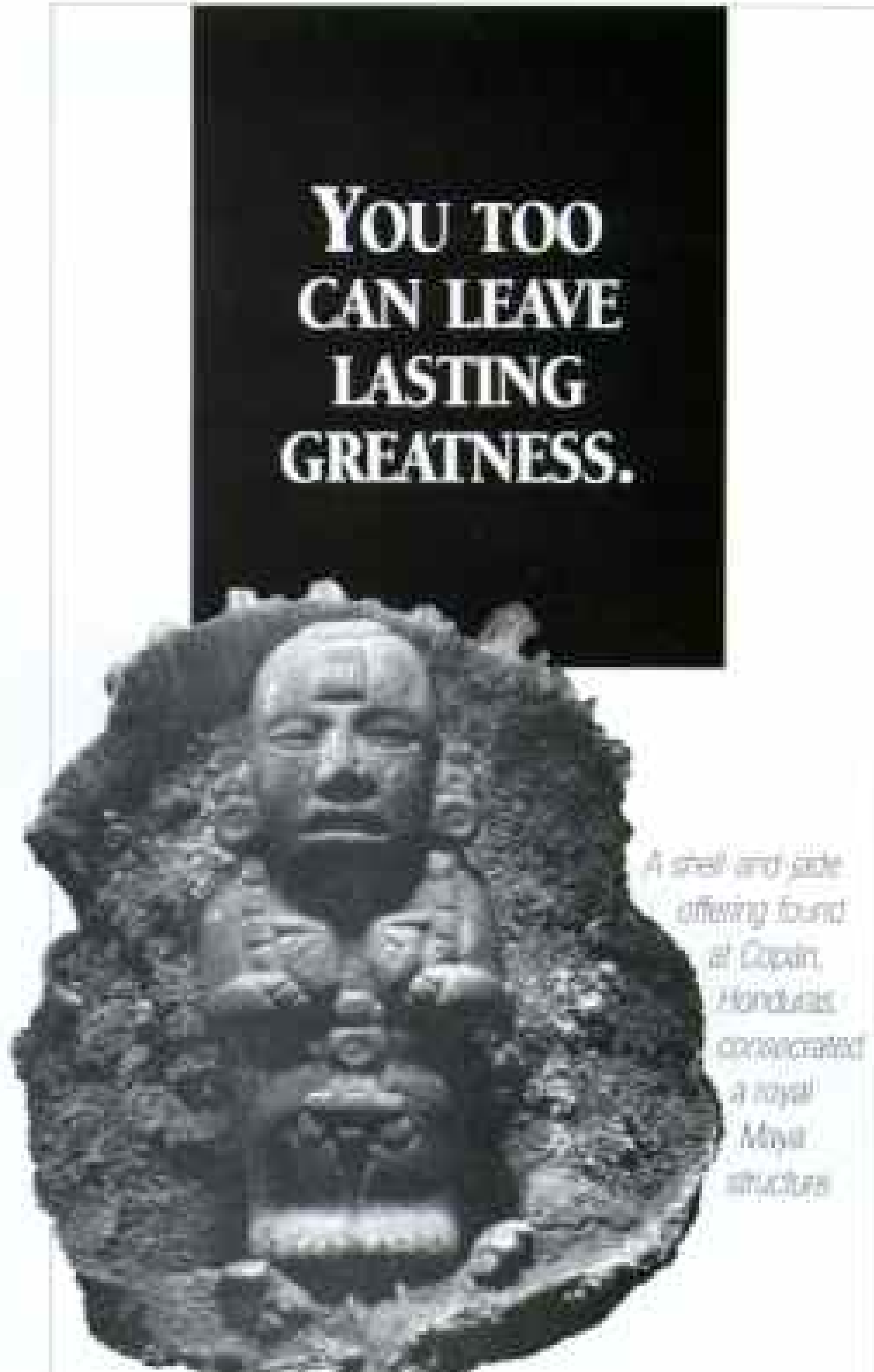

A shell-and-jade offering found at Copán, Honduras, consecrated a royal Maya structure.

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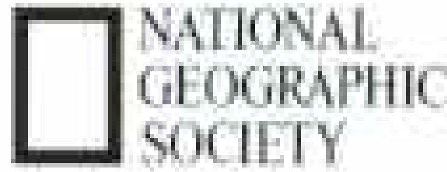

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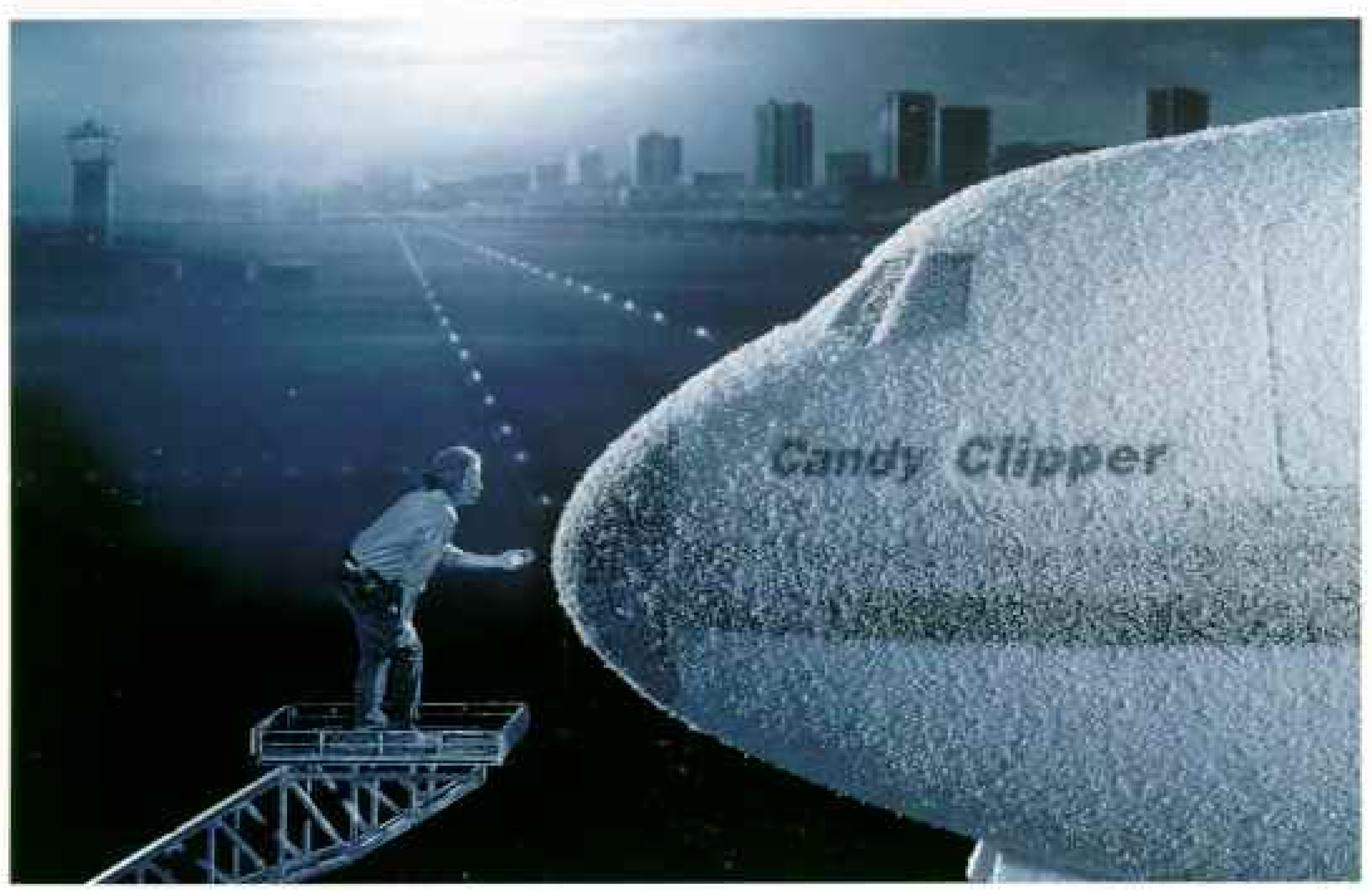
Through Taiwan Innovalue℠ Tom Anthony finally faced his fear of foreign travel.



Composer Tom Anthony hates making trips. He is a diabetic. On planes, in restaurants or hotels he never knows how much sugar his food may contain.

Recently in Taiwan he found the perfect safeguard, the Sensorex Blood Glucose Monitor. Using ampermetric measurements, Sensorex from Metertech can analyze a pin-prick of Tom's blood in 30 seconds, storing data up to 180 times.

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The Sensorex Blood Glucose Monitor will soon be upgraded to measure cholesterol and uric acid.

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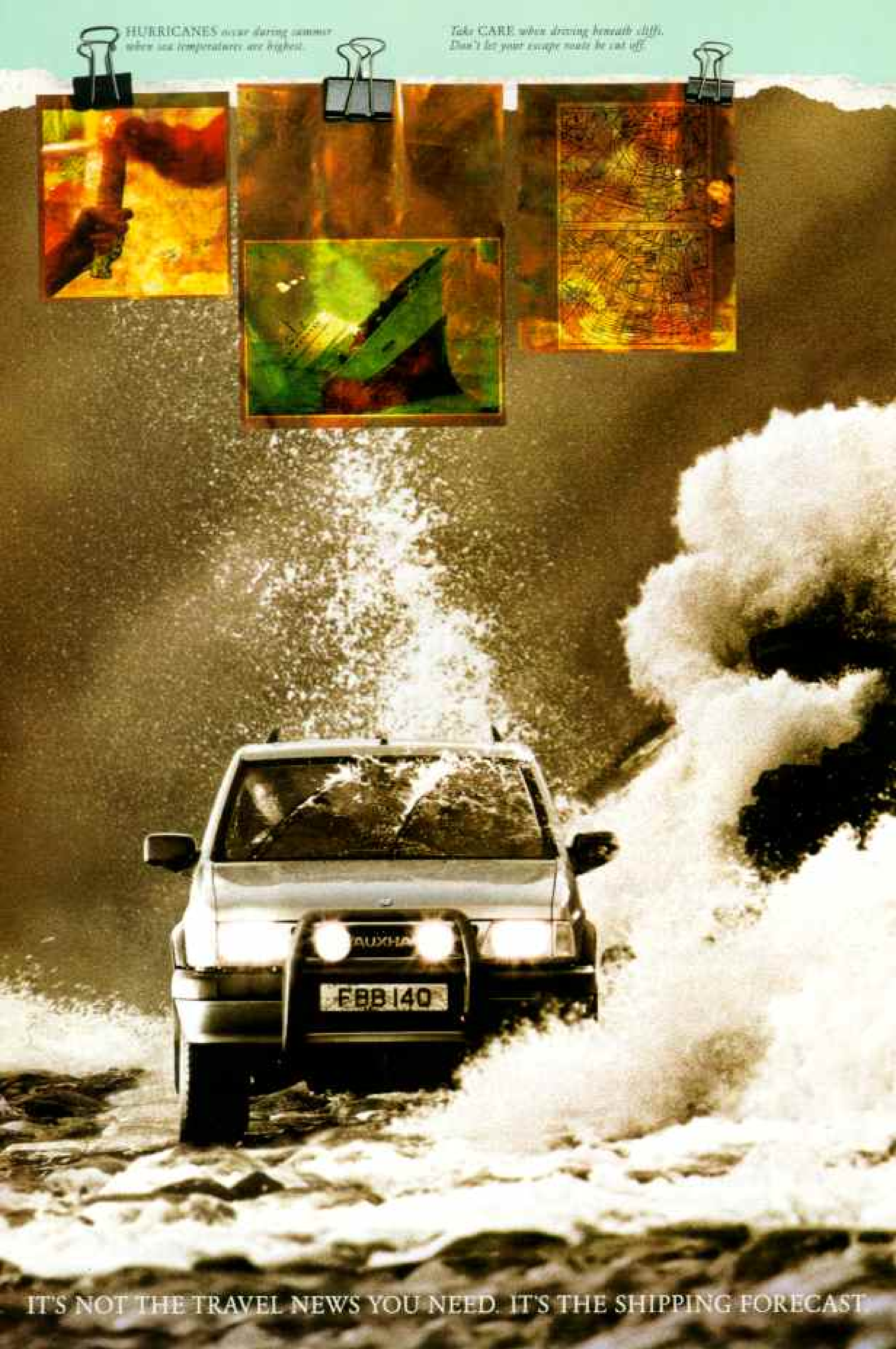
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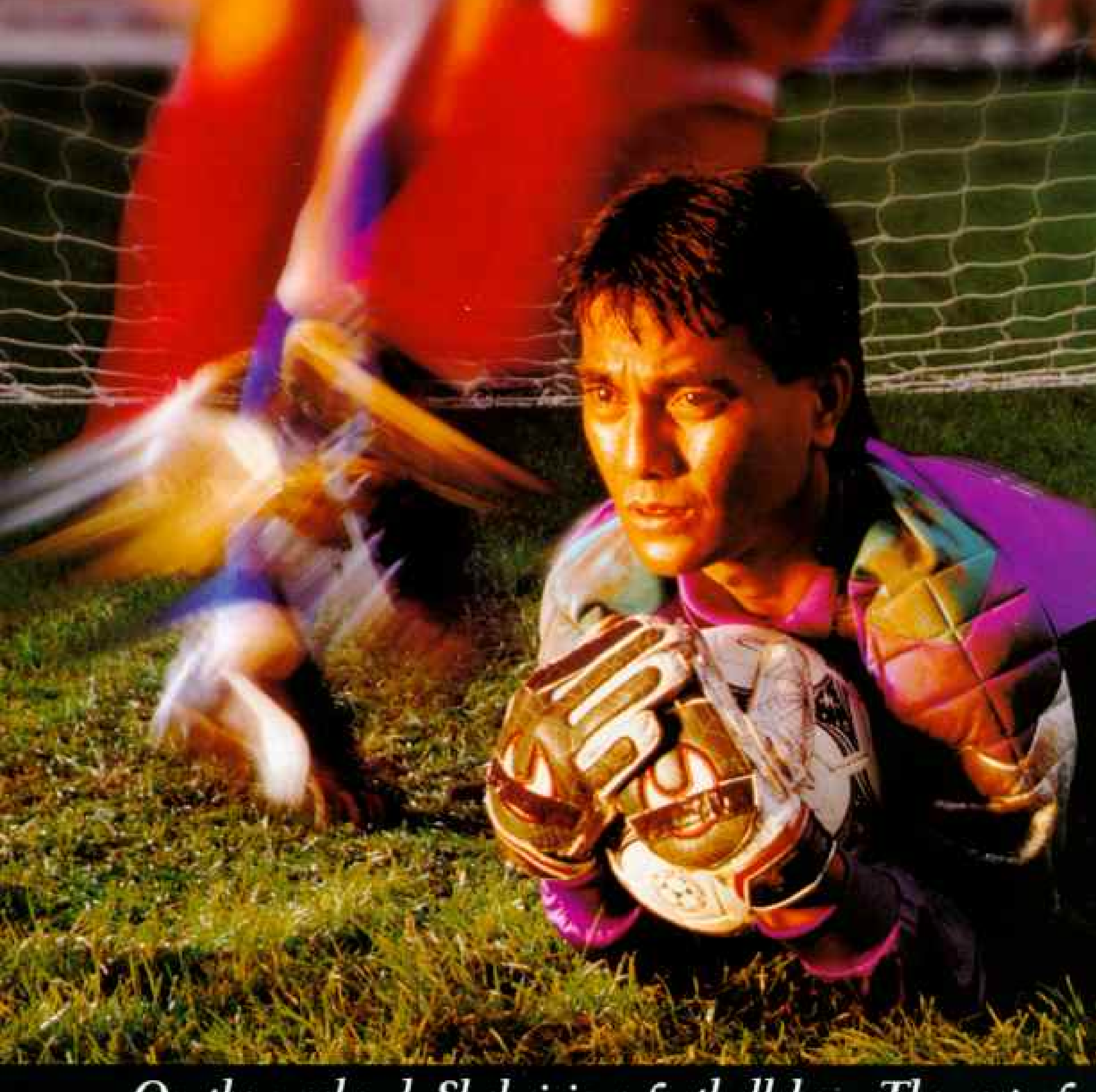


On the weekend, Shabri is a football hero. The rest of

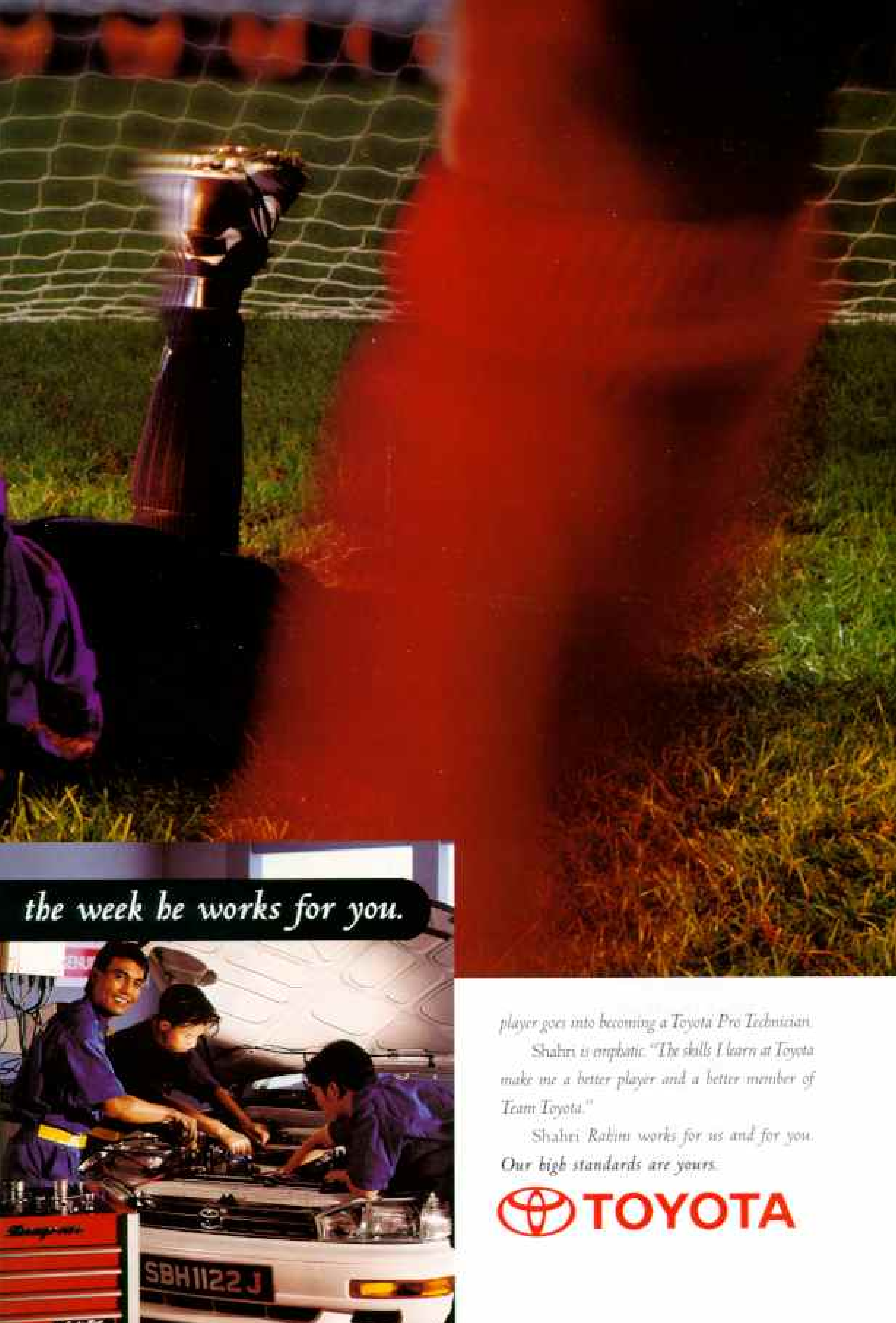
Shahri *Bin Abdul Rahim works for Toyota in Singapore. He's a Pro Technician, trusted to lead a team of skilled mechanics who repair and maintain a range of Toyota vehicles.*

During *the week, Shahri is like thousands of Toyota people around the world, working hard to ensure that satisfied Toyota owners continue to receive the best possible service.*

But *on weekends, he satisfies fans as the goal keeper for Geylang United, a top team in Singapore's football league.*

Shahri *has been selected three times to play for Singapore's national team and he also travels the region as an ambassador for football.*

The *same dedication to teamwork and training which goes into becoming a football*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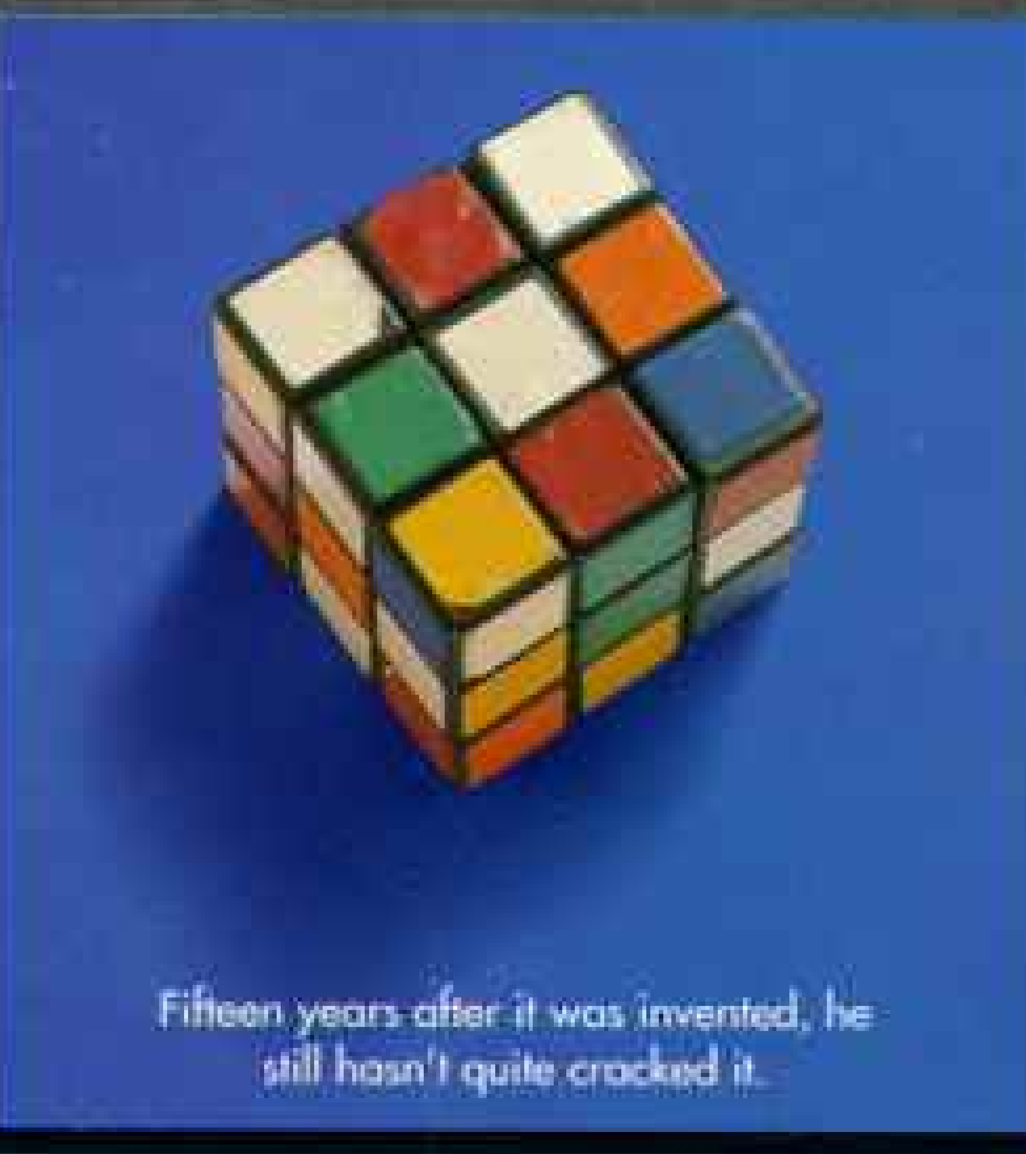
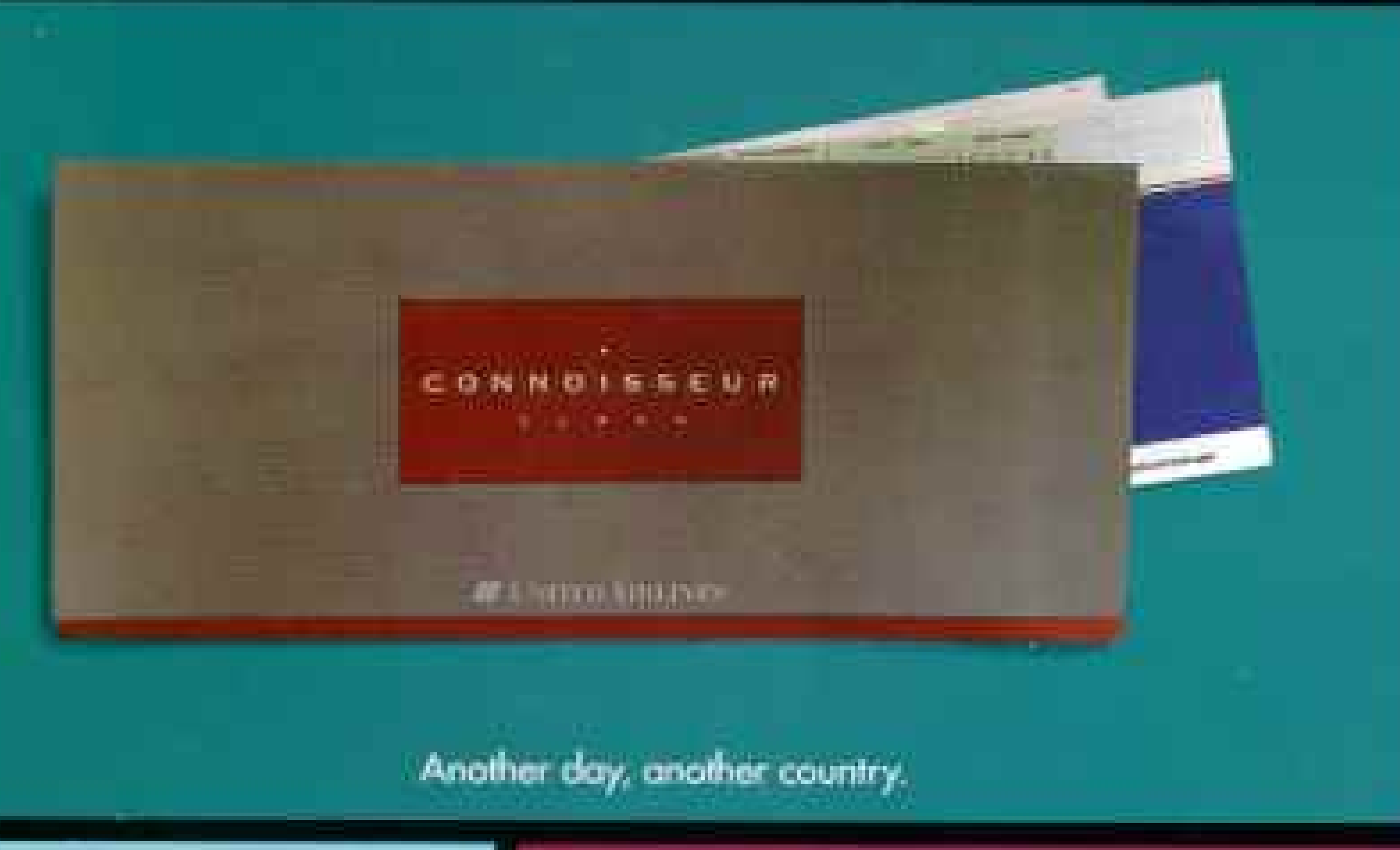


Fifteen years after it was invented, he still hasn't quite cracked it.

On long-haul flights, he likes to watch the hours slip away.



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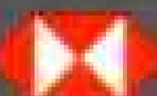
HongkongBank 

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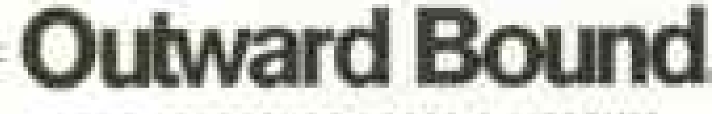

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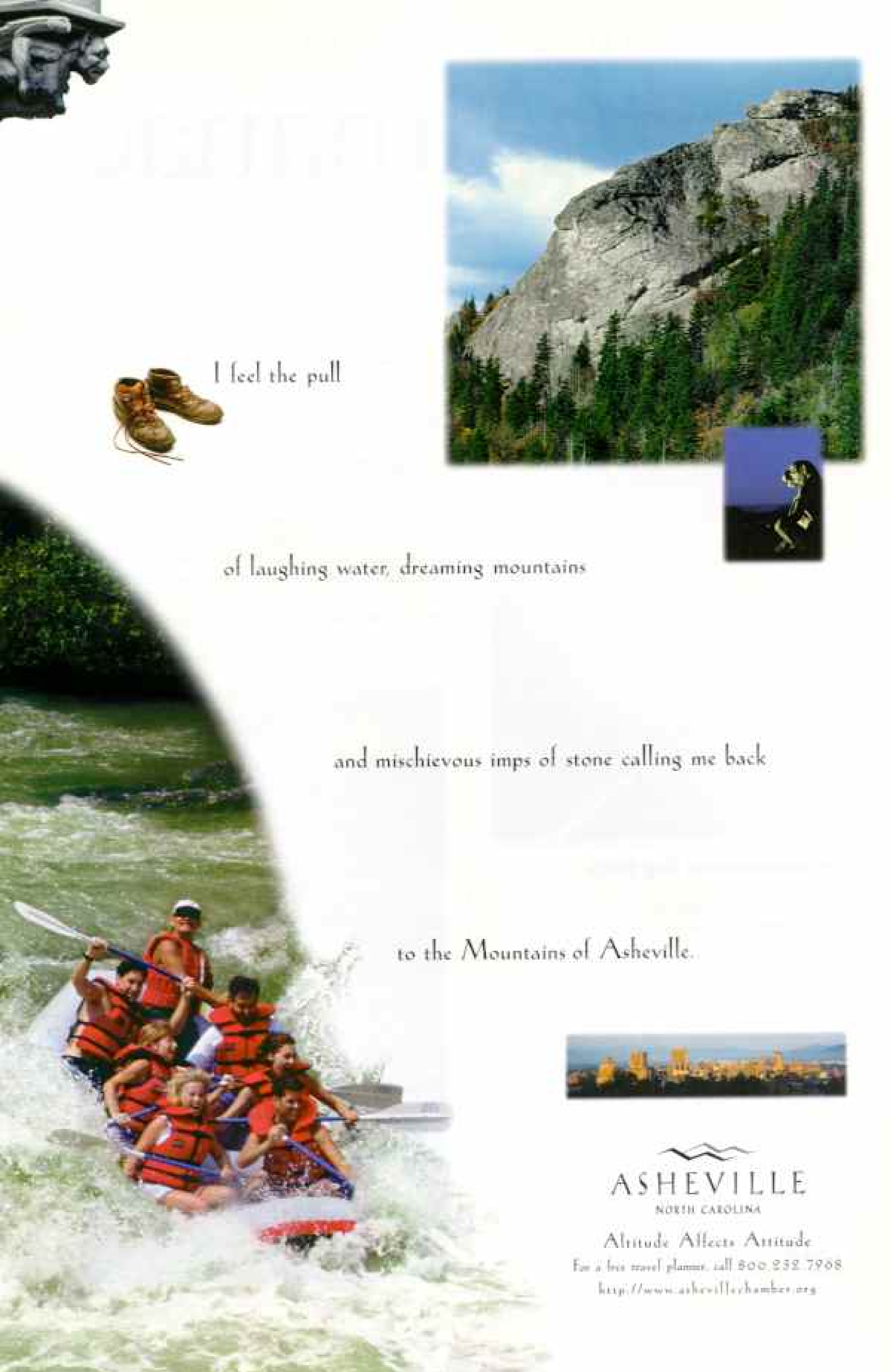
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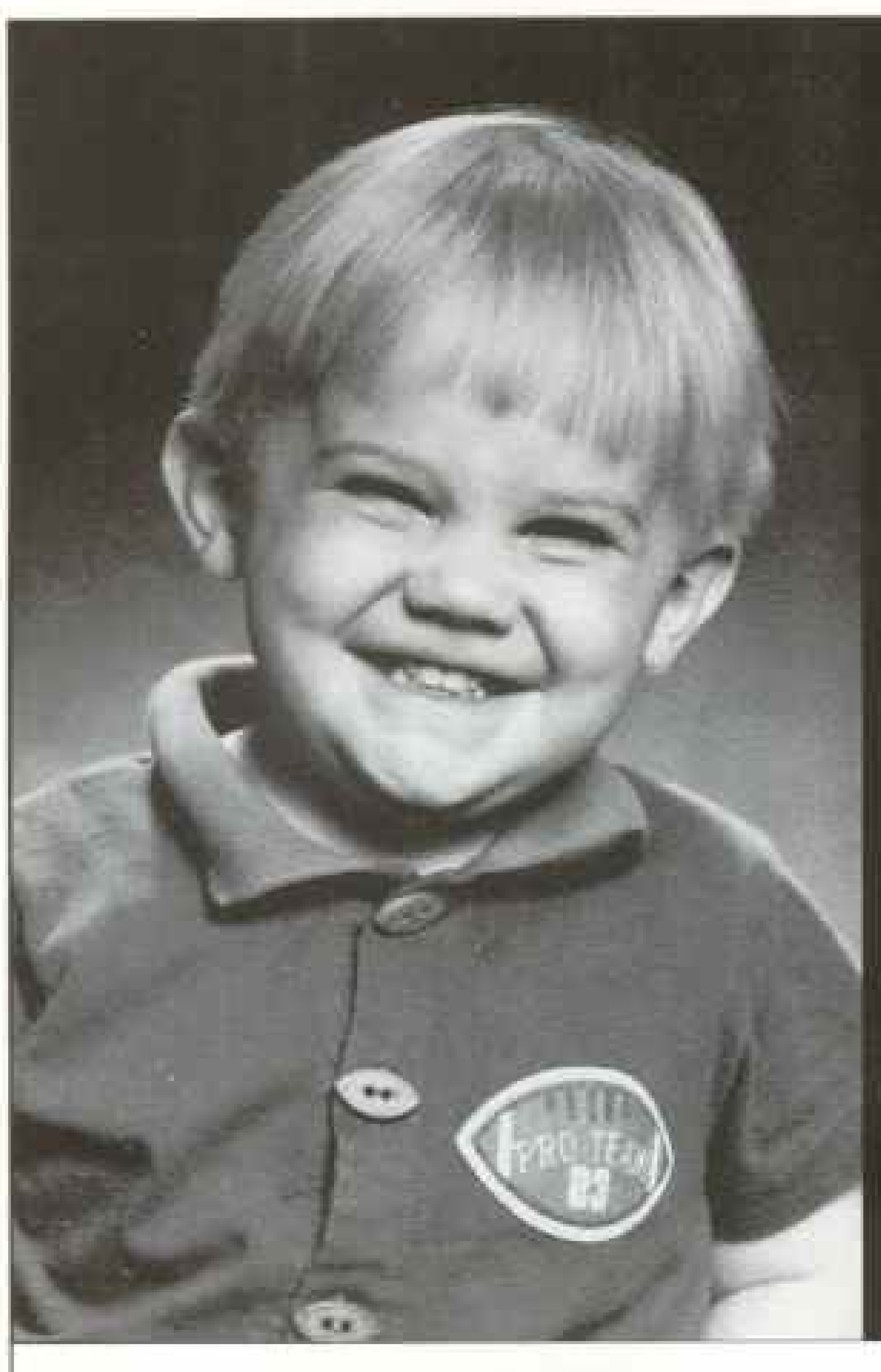

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■ FROM THE GEOGRAPHIC ARCHIVES

That Piercing Look

"A slim boy doubles himself into a basket, ducks his head, and the lid is made fast with ropes. The elders thrust swords through the basket. The lid is lifted and the boy emerges smiling." The magazine's associate editor Eliza R. Scidmore described the street magician's trick in her February 1912 article on Ceylon, today's Sri Lanka. The article, titled "Adam's Second Eden," was one of 17 she wrote for the GEOGRAPHIC. A geographer and photographer and the first woman on our Board of Managers, Scidmore once wrote to our Editor from Japan: "I shall try to get you some pictures of the women divers at Ago next week, if the typhoon now loafing around Formosa does not hit these shores and spoil the arrangement I am making with the full moon."

Making The World A Safer Place. One New Camry At A Time.

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On Television

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■ EXPLORER, JAN. 5, 7 P.M. ET

Males Compete but Females Decide Winners

MALE BIGHORN SHEEP butt heads to determine breeding rights (above). In many other species, however, it is the females that shape evolution through their subtle exercise of choice.

EXPLORER's "Animal Attraction" examines the nature of sex appeal. Charles Darwin speculated that females have an "aesthetic taste" and choose males that best fit their ideal. Female finches go for males wearing red leggings, Nancy Burley found. With fruit flies, those that dance best mate most. Female beetles require complex courtship rituals.

"Beauty is a certification of health," says Randy Thornhill, who found that scorpion flies equate symmetry with beauty—as do humans. "It's all a matter of biology."

GARY MOORE

■ EXPLORER, JAN. 12, 7 P.M. ET

When the Wild and the Settled Meet

DEFINITELY NOT overgrown Bambis, elk in the town of Banff, Canada—inside a national park—share the streets with humans. Hundreds of elk live in Banff, which sits on their traditional winter range. Encounters between the species, especially during the rut, are not always harmonious (left).

EXPLORER's "Deadly Encounters" tells of the wild animals that occupy our suburban spaces, sometimes with dangerous results. Whether it's elk in a park, a snake in the hot tub, or a black widow spider in a shoe, creatures can surprise us with their venom—or just plain wildness.

■ PROGRAM GUIDE

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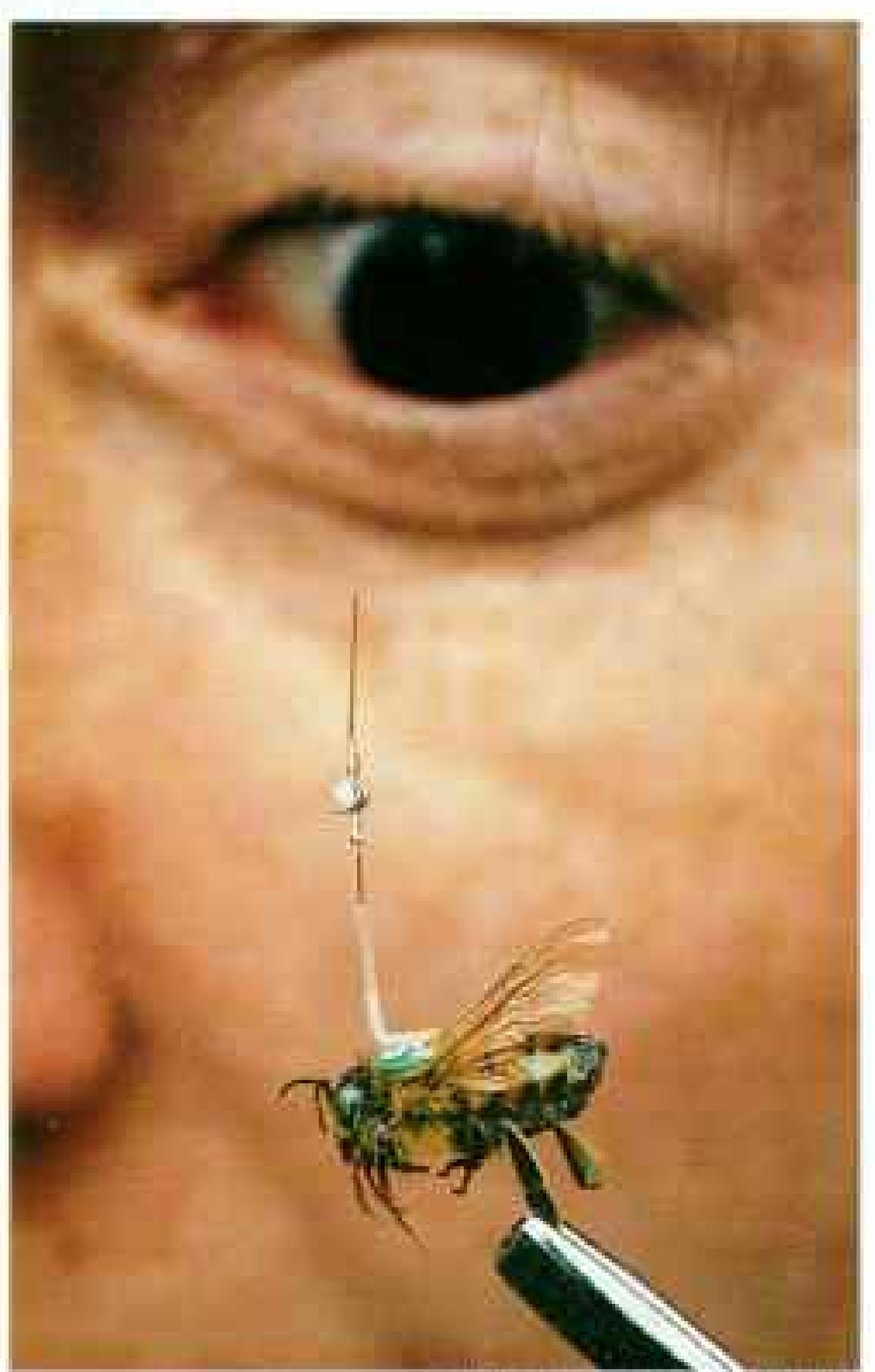

DAN CHUNG, NEWS TEAM INTERNATIONAL

Mini-transmitters Bug Bugs

EYEING THE WORLD'S SMALLEST tracking device, Joe Riley sizes up a radar transponder he has glued to a honeybee to monitor its flight patterns. Weighing only three milligrams, the device was developed by Riley and colleagues at Britain's Natural Resources Institute. Tracking low-flying insects is difficult, because signals from earth and vegetation interfere with the target's. This transponder returns signals at a different frequency, so researchers can home in.

The miniaturization secret: The transponder carries no battery. It is powered by an external transmitter, a dish that sends a signal to the antenna, activating it; another dish receives the antenna's signal and locates the bee. The group's true target: tsetse flies, which will need tags weighing less than a milligram. "We expect to achieve that," says Riley. His partners, scientists in Zimbabwe, want to study the flies' behavior in order to control them more effectively.

Red-knobbed Hornbills—"Flying Dogs" of Indonesia—Lose Ground

WITH A WHOOSH created by gaps in their wing feathers and raucous barking that inspired their nickname, red-knobbed hornbills can be easily heard on Indonesia's Sulawesi Island, their sole home. Aided by a Society research grant, Margaret Kinnaird and Timothy O'Brien have found that the birds' habitat is shrinking.

"Sulawesi has lost 90 percent of its richest lowland forests to agriculture and logging," says Kinnaird. In their study area, Tangkoko-DuaSudara Nature Reserve, abundant figs draw as many as 200 hornbills a square mile. The birds repay the fig trees by dispersing the seeds. Nesting females use their droppings to seal themselves in tree cavities, a behavior that may have protected them from predators on Borneo, likely their original home. On Sulawesi they face few threats—except the activities of man.

RHYTICEROS CASSIDIX MALE; TUI DE ROY, THE ROVING TORTOISE

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Travel Wizard Times

Volume 3, Number 2 — December–February

It's Powder Time!

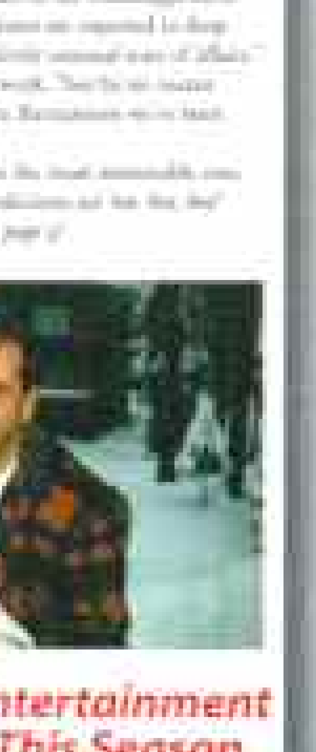
(continued on page 3)

Bargain Airfares to All Major Western Ski Resorts

(continued on page 2)

Expect Lively Entertainment on the Slopes This Season

(continued on page 4)



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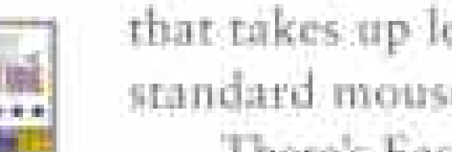

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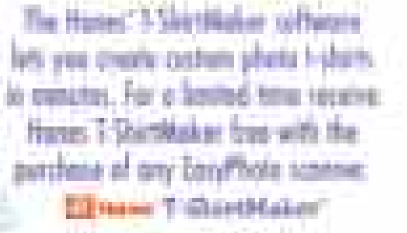

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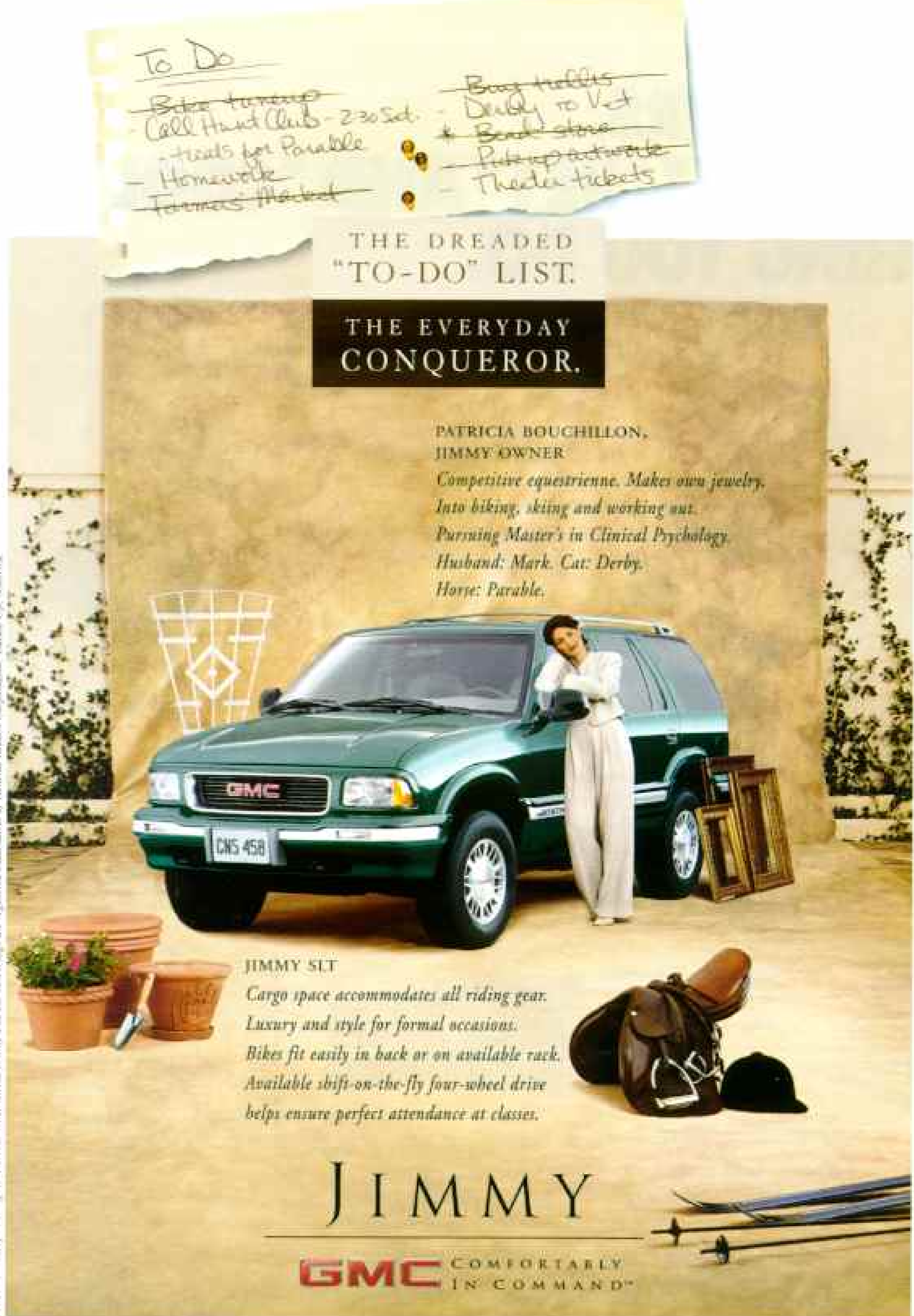

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PTEROPUS RODRICENSIS; ART BY JOHN D. DAWSON

Bat Midwife Aids Mother-to-be

"I WAS TOTALLY AMAZED," Boston University biologist Thomas Kunz recalls, when he witnessed a drama among Rodrigues fruit bats—a female struggling with a difficult birth, assisted for three hours by a female helper, at left.

Kunz made the discovery by chance at the Lubee Foundation lab in Gainesville, Florida, one of about a dozen captive breeding facilities for these bats. In the wild they are known only on Rodrigues Island in the Indian Ocean, where perhaps 350 have survived deforestation. Although bats usually give birth in a head-up, feet-down position, this female was laboring to do so head down. Another female approached her and repeatedly assumed the correct position, imitating contractions and straining. Finally the mother caught on, and a wing and a foot emerged in a breech birth—a successful one.

Undersea Graffiti at Coral's Expense

UNDERWATER PLAYGROUND, the Philippines draws thousands of divers from Japan, China, and Taiwan. One visitor left a calling card in the Twin Rocks area of Anilao Batangas sanctuary. Carved into a large brain coral—which may consequently die—are Chinese characters reading Lee Ming-Run. "Few divers are aware that when they brush even lightly against coral, the live animals, the polyps, often die," notes California diver Robert Yin, who recorded this damage. To publicize reef conservation and research, the Coral Reef Alliance and more than 40 other organizations have designated 1997 the International Year of the Reef.

ROBERT YIN

Keeping Whales' Hopes Afloat

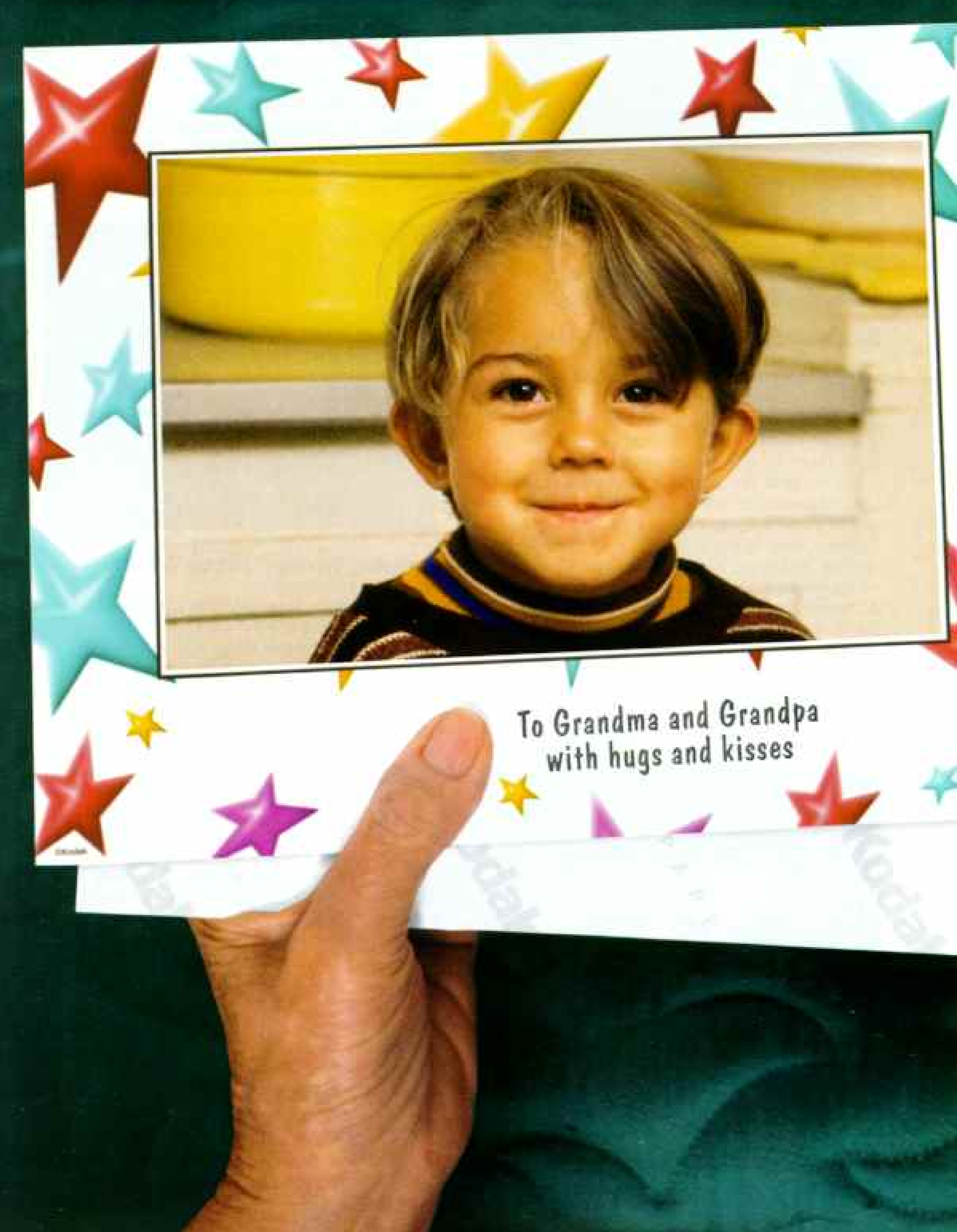
WHY DO MARINE MAMMALS run aground? Biologists still ponder, but volunteers who flock to such crises know one thing: Although many stranded animals perish, some can be saved. And techniques are getting better all the time.

Since 1985 a New Zealand group called Project Jonah has employed a reusable inflatable pontoon system to successfully refloat and rescue more than 2,000 stranding victims. They have ranged in size from dolphins to 45-foot Bryde's whales.

INGRID VISSER, PROJECT JONAH

The goal: to get the animals off the beach before they fatally overheat. "The pontoons allow us to float a huge animal in less than a foot of water," says Project Jonah's Ingrid Visser, who helped assist this pilot whale, one of 89 beached in New Zealand in a single year. First the whale is rolled so a mat can be slipped under it. As the tide rises, twin pontoons attached to the mat are inflated so workers can ease the animal into the water. The pontoons are now in use in the U.S., Canada, and the United Kingdom. —JOHN L. ELIOT

Now you can send perfect pictures



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NATIONAL GEOGRAPHIC

*On*Assignment

SUSAN WELCHMAN, NGS STAFF

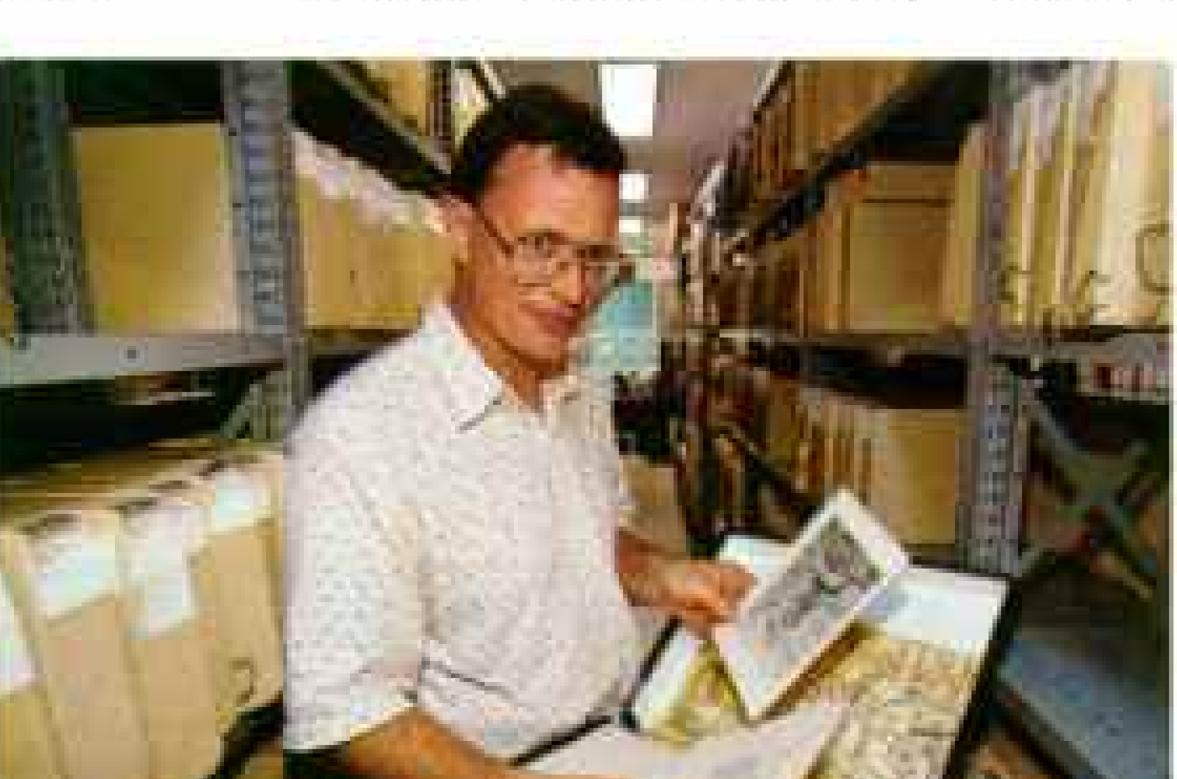
■ JOSEPH ROCK

Rock Collectors

A GEOGRAPHIC ARTICLE can start anywhere—all it takes is an idea. When he began work in our Image Collection ten years ago, picture editor Joergen Birman (below) took special interest in organizing materials from an early contributor, Asia specialist and explorer Joseph Rock. Back home in Denmark, Joergen had studied Chinese history. He also lived in China to learn to speak the language.

Putting order to Rock's collection was a gargantuan task. Holdings include 3,000 black-and-white prints, 100 sepia prints, and 600 Autochromes, as well as movies, artifacts, journals, letters, and books. When he was through, Joergen thought we had more than a collection—we had the story of a fascinating life. He proposed an article, and the piece was soon under way with photographer Mike Yamashita (above).

"I already knew Joseph Rock through his writings on the Mekong," says Mike, who shot that river for the February 1993 issue. "I had an interest in this story, since I'd traced his footsteps there." Following him in Yunnan, Mike photographed these Mosuo women, who live—and look—much as their grandmothers did when Rock came through.



PETER KROGH

"Unless I can work in the wilderness and the unexplored regions," Joseph Rock once wrote, "I would have no incentive to living." Not much lies uncharted in southwestern China anymore—thanks in part to Rock himself. But he might be glad to know that much is wilderness still.

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