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Gray Reef Sharks 45

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COVER: Frenzied gray reef sharks home in on the low-frequency distress signals of a hooked fish near Bikini Atoll in the Marshall Islands. Photograph by Bill Curtsinger.

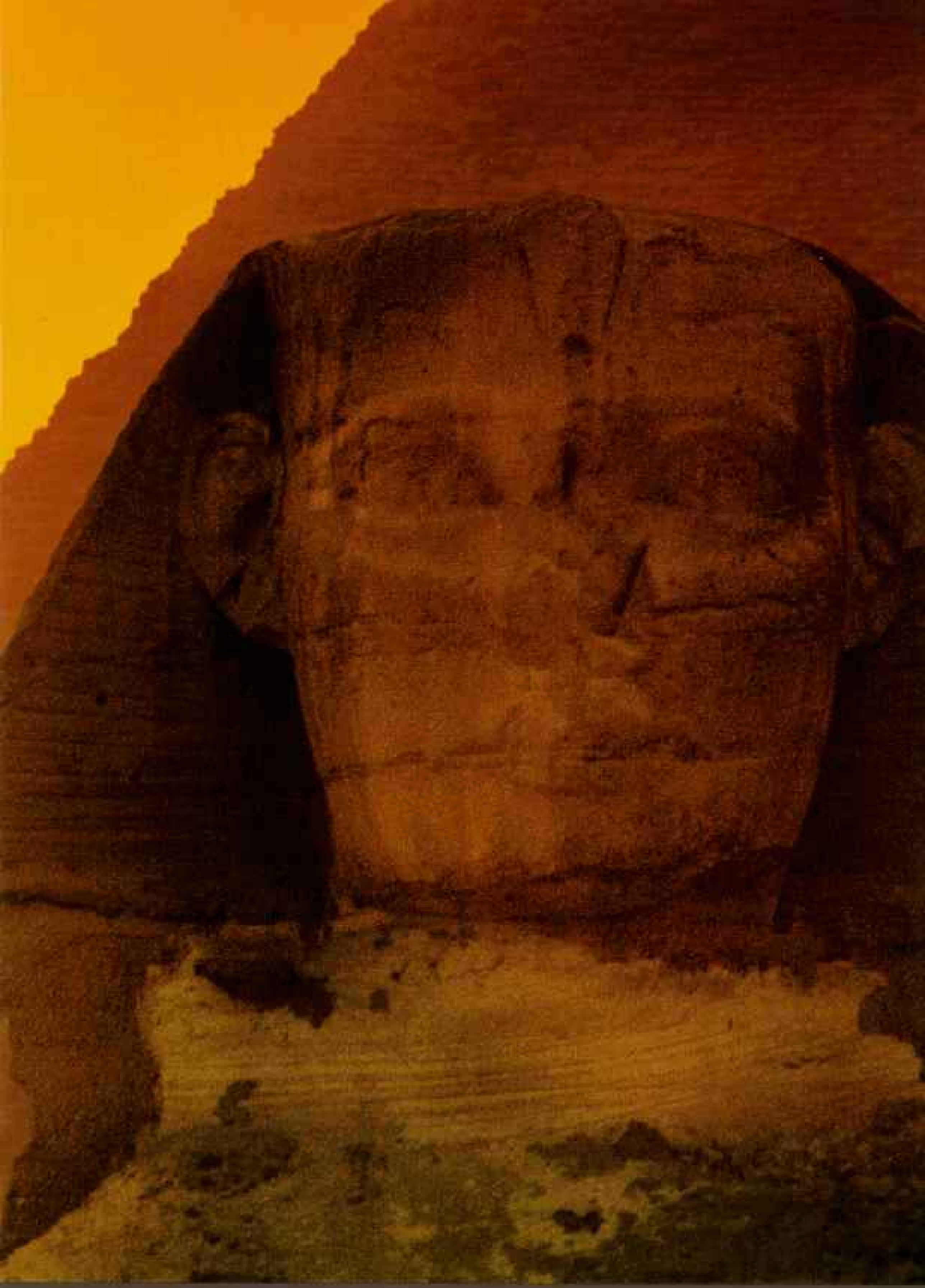
Cover printed on recycled-content paper.

Age of Pyramids

EGYPT'S OLD KINGDOM

Even the sun bows to Pharaoh Khafre, setting at the foot of his pyramid on the Giza plateau. Obsessed with the afterlife, Egypt's rulers of 4,500 years ago glorified themselves in stone—thereby laying the foundation of the first great nation-state.

By DAVID ROBERTS



Photographs by KENNETH GARRETT

Offerings from Egypt's far-flung provinces, carved in relief

DYNASTY V TOMB OF PTAHHOTEP AT SAQQARA

on an official's tomb, feed the departed for eternity.

"Of course the holes are not for you to look in but for the pharaoh to look out—perhaps at the stars in the northern sky called the Imperishables because they never set."

—EGYPTOLOGIST JEAN-PHILIPPE LAUER

Eternally beholding the stars, Pharaoh Djoser—who built Egypt's first pyramid at Saqqara about 2630 B.C.—is visible through one of two peepholes cut into the wall of a sealed chamber containing his likeness.

ON THE DUSTY SAQQARA PLATEAU, ten miles south of the Sphinx and the three Pyramids of Giza, the Step Pyramid of Pharaoh Djoser rises like a grand mirage, shimmering more than 200 feet above the stark Egyptian sands. The sight took my breath away. And that, of course, was its purpose.

When Djoser's subjects first looked upon this giant tomb more than 46 centuries ago, they probably trembled. This colossal monument, begun around 2630 B.C., was designed to awe the ancient Egyptians, to impress them with their ruler's godlike strength.

At the time, it was the biggest and finest monument any monarch had ever commanded; indeed, it was the world's largest building. Its bold shape—six great tiers of decreasing size—announced a divine truth that the humblest passerby in Djoser's time understood. The Step Pyramid was a ladder. Not the symbol of a ladder but an actual one, by which the soul of the dead ruler might climb to the sky, joining the gods in immortality.

Like the Step Pyramid, ancient Egypt seemed to rise out of nothing. Only a few generations before Djoser's reign, the civilization crowded along the Nile amounted to a mere patchwork of nomes—small regional

chiefdoms, each with its separate gods and government. Experts today only dimly grasp the forces that prompted those quarreling provinces to become, with Mesopotamia's Sumer, the most advanced civilization of its time—Egypt's Old Kingdom.

Many believe that the building of Djoser's pyramid complex, which was accomplished by hundreds of workers from across the land, served to join those provinces into the world's first nation-state. During the Old Kingdom, which began around 2700 B.C. and lasted some 550 years, each pharaoh after Djoser marshaled a vast portion of his country's manpower and wealth to build his own tomb and ensure his immortality.

To construct such monuments required a mastery of art, architecture, and social organization that few cultures would ever rival. The kingdom developed a funerary tradition so comprehensive and compelling that the religion, art, and thought of the people coalesced around the worship of their divine pharaohs, both living and dead. Every aspect of life was affected. The Egyptians dug a network of canals off the Nile to transport stone for the pyramids and food for the workers, and a simple, local agriculture became the force that knit together the kingdom's economy. The need to keep records of the harvest may have led to the invention of a written language.

Yet after five and a half centuries this flourishing civilization collapsed, plunging Egypt into disorder. Scholars today puzzle over the cryptic records that testify to this breakdown. Perhaps the seeds of the collapse were planted in the soil of a civilization that, for all its grandeur, seemed obsessed with the idea that its dead rulers must live forever.

The conventional view of this distant age as a period of prosperity and self-assurance, as a society governed by godlike pharaohs, has been influenced by two factors. First, because the stone pyramids and other funerary architecture were built for eternity (the ordinary villages of mud brick crumbled or were washed away), archaeologists have paid more attention to royalty than to the common people. Second, although hieroglyphic writing has recently been traced back to 3200 B.C., making ancient Egyptian one of the world's first written languages, during the Old Kingdom Egyptian script was used primarily for titles, epithets, and bureaucratic records. We have almost no records of history, myths, legends, or any other written glimpse into the human side of that epoch.

We know of no literature until around 2400 B.C., near the end of the Old Kingdom, and that literature is in the form of braggart autobiographies of officers, inscribed on their tombs, and poetic incantations to ensure the dead king's eternal rebirth with the gods.

DAVID ROBERTS has written for the magazine on Mali's Dogon people and on Geronimo, the subject of his 1993 book *Once They Moved Like the Wind*. Roberts and KENNETH GARRETT, who share a special interest in archaeology, collaborated once before, on "The Iceman" (June 1993).

Imitating bundled reeds and buttressed by solid walls, columns guard the only portal to Djoser's pyramid complex.

Thirteen false entrances are spaced along the outer walls, as seen in a reconstruction (below). Imhotep, Djoser's royal architect and brilliant innovator of the Old Kingdom, envisioned stone as a way to build for eternity.

ILLUSTRATION BY CHUCK CARTER, BASED ON INFORMATION FROM JEAN-PHILIPPE LAUER

In consequence the pharaohs, whom the ancients worshiped as gods, come down to us as one-dimensional ciphers.

MENTION ANCIENT EGYPT to the average person, and he usually thinks of the Sphinx and the three Great Pyramids at Giza, which today make up the most famous Old Kingdom site. That familiarity makes it easy to forget that basic questions about the Old Kingdom have remained unanswered. Only within the past two decades have Egyptologists begun to fill in the gaps, sifting the Egyptian sands and reexamining tales of the kingdom, which were often written as many as 2,000 years later, for clues to the texture of ancient life.

One of those researchers, Mark Lehner, an archaeologist from the University of Chicago, guided me around the Saqqara site.

"The real mystery is why the Old Kingdom happened," he said as we stood before Djoser's monument. "This pyramid was the start of it all. But we've focused too much on *how* the pyramids were built. I'm less interested in how the Egyptians built the pyramids than in how the pyramids built Egypt."

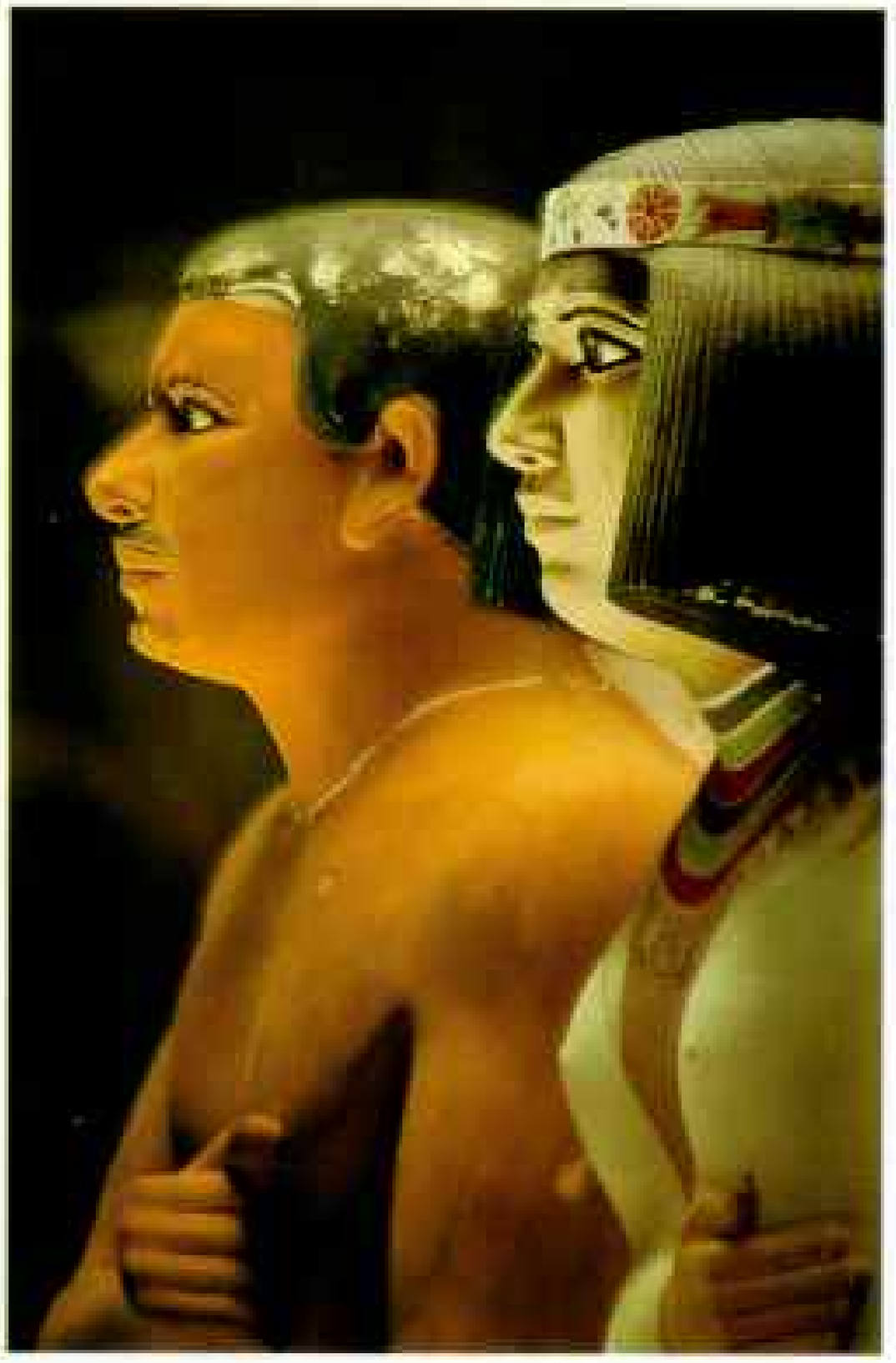
Lehner calls the Step Pyramid the world's first great construction project. (Pharaohs after Djoser invented the "true" pyramid, with smooth sides instead of steps.) For 15 years Lehner has studied the Giza site, which was built later than Saqqara, gradually uncovering evidence of how the workers lived.

"Imagine yourself as a 15-year-old kid in some rural village of about 200 people in the 27th century B.C.," said Lehner. "One day the pharaoh's men come. They say, 'You, and you, and you.' You get on a boat and sail down the Nile. You don't know where you're going, or why. Eventually you come around a bend and you see this huge geometric structure, like nothing you've ever known. There are hundreds of people working on it. They put you to work. And someone keeps track of you: your name, your hours, your rations. All this was a profoundly socializing experience. You might go back to your village, but you would never again be the same."

Lehner and I lingered on the plateau, within sight of Djoser's tomb. "You might expect such an unprecedented monument to have a tentative look," he said, gesturing toward the pyramid. "But look at it! The pyramid

Pharaoh's treasures were long gone when, in 1882, archaeologists found the pillaged chamber of Snefru's pyramid at Maidum (facing page). Shown the way by guides, today's visitors still see cedar logs in place since 2600 B.C.

Snefru's high priest Rahotep and his wife Nofret reigned in limestone (below) within their burial building, or mastaba, near the pyramid. Such realism was thought to help a spirit recognize a tomb as its afterlife home.



implies a supreme self-confidence on the part of the ancient Egyptians."

Perhaps most confident was Imhotep, the architect who probably conceived of building Djoser's tomb completely from stone. Known also as a sculptor, a priest, and a healer, Imhotep is considered the preeminent genius of the Old Kingdom. He assembled one workforce to quarry limestone at the cliff of Tura, across the Nile, another to ship the crude blocks by boat to Saqqara, and yet another to haul the stone to the site, where master carvers shaped each block and put it in place.

On a granite boulder above the Nile's First Cataract, the formidable rapids at Aswan, a sculptor who lived much later chiseled out in hieroglyphs the story of how Imhotep had

Abandoned during his reign, Snefru's pyramid rises from

desert that now, as then, abruptly ends at irrigated farmland.

Scene of the crime—looting of a mastaba at Snefru's pyramid—is probed by archaeologist Mark Lehner. Thieves wedged open the three-and-a-half-ton granite sarcophagus lid with a wooden mallet—still in position after 4,500 years—as they stripped the body of its treasures. "These robbers knew exactly how to get in here," says Lehner. "An inside job."

even saved his country from famine. The annual Nile flood, which inundated surrounding fields every autumn before farmers sowed their seed, failed seven years in a row. Djoser asked Imhotep where the source of the great river lay. The pharaoh intended to travel there to interrogate the river gods and to beg them to show mercy on his people.

But Imhotep replied that sacred books had given him the answer. Khnum, the god of the First Cataract, had caused the famine, out of pique at the neglect of his temple. Imhotep invoked Khnum, and the god relented: The floods returned, and the famine was over.

JEAN-PHILIPPE LAUER, a 92-year-old Frenchman who is the dean of Egyptologists, arrived at Saqqara in 1926 to find the Step Pyramid complex becalmed in a sea of sand. With only a few interruptions Lauer has returned to dig, study, and restore the site for 68 years—more than twice as long as it took Djoser to build his giant tomb.

As workmen gradually cleared away the sand surrounding the pyramid, the wreckage of an intricate complex of subsidiary buildings emerged: temples, crypts, courtyards, and a colonnade. Flouting the custom among early Egyptologists of simply crating up the finest relics and shipping them off to various European museums, Lauer is rebuilding the complex in place.

When I joined Lauer at Saqqara a few weeks after my first visit, I was struck by the strangeness of Djoser's complex. Everything about the place bespoke illusion. Towering limestone columns had been shaped to mimic the sway and droop of leafy plants. Immovable doors hung on great carved hinges. Facades called false doors, through which the pharaoh's *ka*, or vital force, was presumed to pass, lay recessed within walls. The interiors of dummy temples were packed with rubble.

No one knows why the Egyptians created this fantastic scene, but some archaeologists speculate that there was an Old Kingdom belief that a work of art, a building, even a chanted phrase had power and utility in the afterlife in direct proportion to its uselessness in the real world. In this view, each false door, each dummy temple "worked" in the afterlife precisely because it could not function in this one.

On the north side of the pyramid we paused before a small stone cubicle, canted

toward the north, with a pair of tiny holes in its facade. Lauer said, "Look inside." I peered through one of the holes and was startled to see two eyes returning my stare, the blank gaze of a life-size statue of Djoser sitting on a throne. He had the same imperious look I had seen in much Egyptian art. The eyes of the original statue, now in Cairo's Egyptian Museum, had probably once been inlaid with quartz crystal but had been gouged out by thieves, giving the pharaoh a chilling demeanor.

Lauer smiled. "Of course the holes are not for you to look in but for the pharaoh to look out—perhaps at the stars in the northern sky called the Imperishables because they never set." Here, once again, was the Old Kingdom obsession with immortality in the sky. A mere statue of the pharaoh staring at the stars aided his flight to the heavens.

TWO GENERATIONS after Djoser's reign, the center of the Old Kingdom moved north to the barren plateau of Giza. New pharaohs often moved to a new place, perhaps to outdo the splendor of their predecessors' monuments. The Great Pyramid of Pharaoh Khufu (or Cheops, as the Greeks called him) was built around 2550 B.C., and at 756 feet square by 481 feet tall it remains one of the largest buildings ever erected.

I would often walk up Pyramid Road, fending off camel hustlers and postcard vendors. I strolled the causeway past the Sphinx, or stopped to visit the royal boat of Khufu.* Just as I began to feel that I knew the place, Lehner gave me a whole new vantage.

One day he led me to the site from the southeast, where crowded tenements of the Cairo suburb of Nazlet el Simman creep across the sands. We strolled past stable owners leading tourists on afternoon horseback rides to the pyramids and came to an ancient stone wall half-buried in the dunes, half a mile southeast of the Sphinx. The wall opens into a massive gateway capped with a gigantic block of limestone.

Several years ago Lehner and Zahi Hawass, director general of the Giza Pyramids and Saqqara, began to excavate two sites just outside the wall in their search for signs of commoners—the ordinary people who built the pyramids. Within months they uncovered the remains of many mud-brick buildings. Lehner found a pair of back-to-back rooms—the oldest bakery yet discovered in Egypt (page 32).

Meanwhile, Hawass unearthed a cemetery of some 600 tombs nearby—the graves of workers. He discovered the evidence of their toil in their skeletons, their vertebrae compressed and damaged by years of carrying heavy loads. Some were missing fingers and even limbs. A few of the tombs were adorned with mini-pyramids several feet high, made of mud brick. Nothing like them had been found before.

In the past, scholars believed that the form of the pyramid was invented—perhaps by Imhotep—as the shape for a royal tomb. But Hawass argues the pyramid form may have arisen among the common people. He believes that the mini-pyramids evolved from sacred rectangular mounds found in tombs long before Imhotep's time. The pyramids built for the pharaohs may have been, as Hawass puts it, "just more enduring examples of traditional folk architecture."

In the work of these archaeologists and others may lie the origins of a whole new way of seeing the Old Kingdom: Not just as the brilliant civilization of a pharaonic elite trickling down to the masses but also as a culture built from the bottom up, standing on the daily toil of the workers and the very beliefs and values of ordinary men and women.

From recent excavations and from scenes carved on the walls of tombs, researchers have begun to fill in the details of daily life in the Old Kingdom. Much of the emerging picture is one of arduous and repetitive toil. On wooden sledges across the sands, workers hauled the giant stones—the largest granite blocks weighing as much as 70 tons—that built the pyramids. Egypt created a vast agricultural empire, yet all the irrigation was done by hand. Farmers filled two heavy jars from the canals, then hung them from a yoke over their shoulders.

Oxen dragging simple wooden plows tilled the fertile soil along the Nile, followed by lines of sowers who sang in cadence as they cast grains of emmer wheat from baskets.

The villages were crowded and dirty. Huts were made of thatch and mud brick. Men wore loincloths; women dressed in long sheaths with wide *(Continued on page 25)*

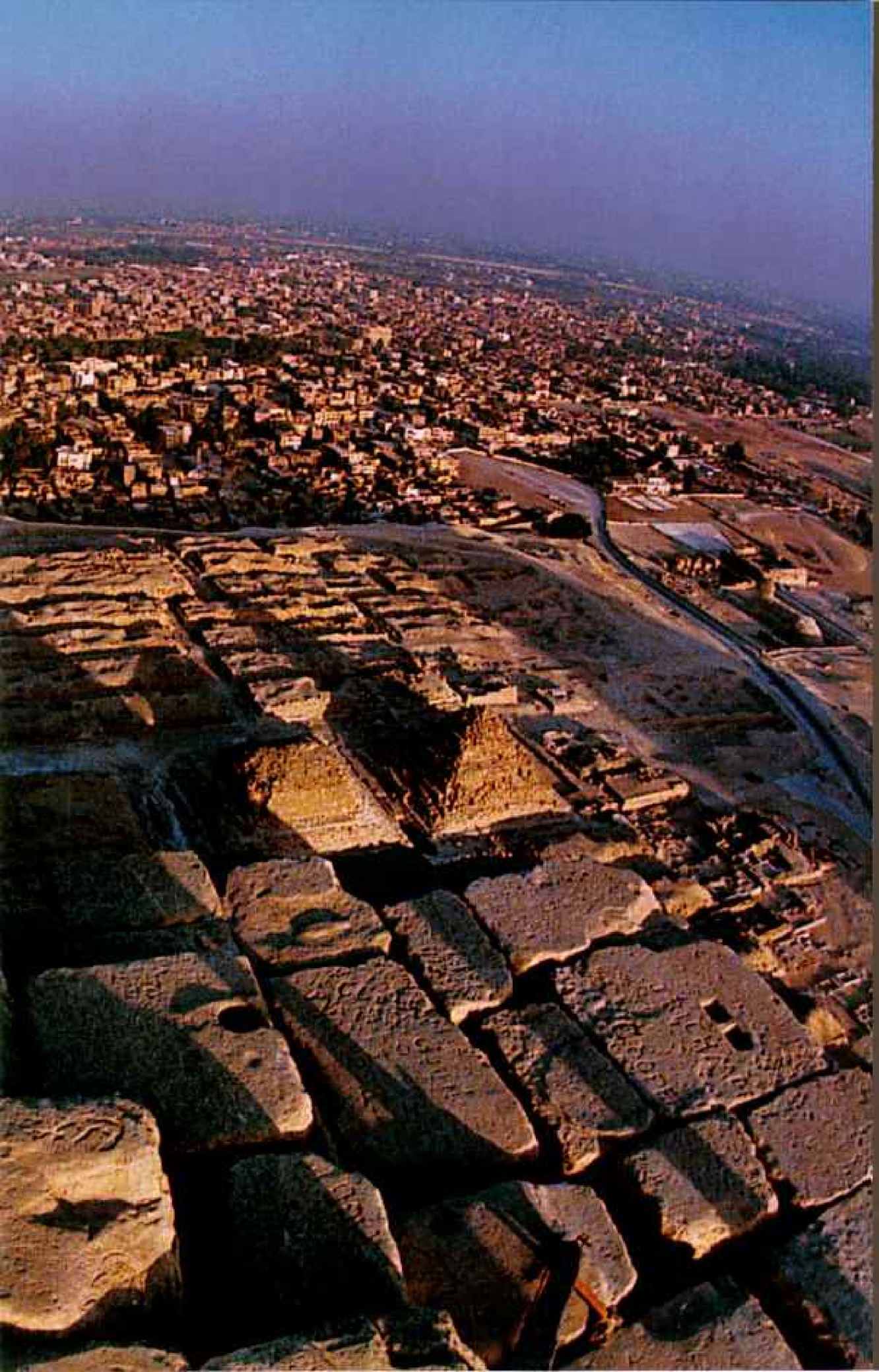
*See "Finding a Pharaoh's Funeral Bark," by Farouk El-Baz, NATIONAL GEOGRAPHIC, April 1988.

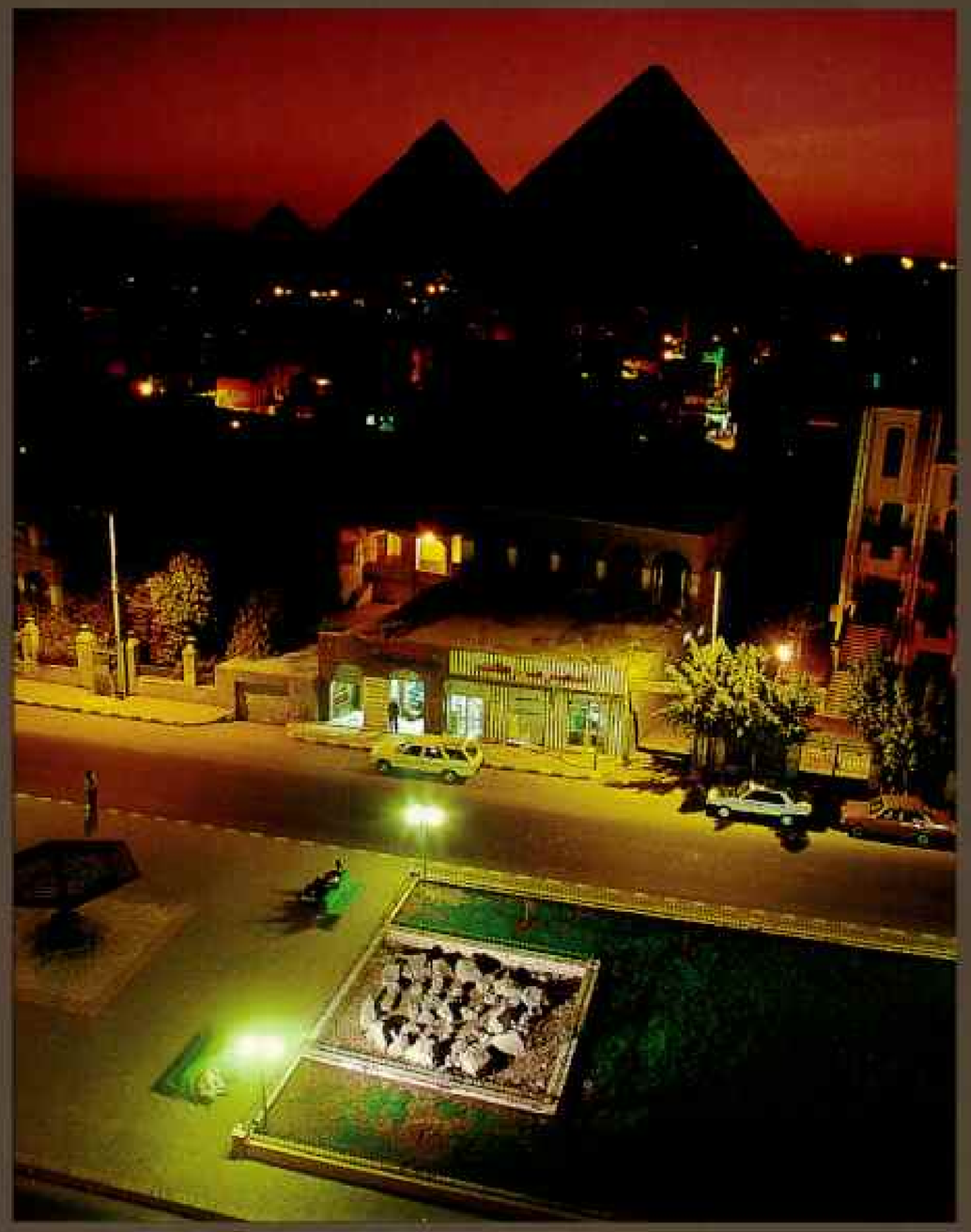
How the Pyramids Built Egypt

Giza's newest wonder nears completion about 2500 B.C. Limestone facing blocks, quarried across the Nile at Tura and floated to the work site, are dragged by teams to Pharaoh Khafre's pyramid. Ramps made of rubble were piled around it during construction. Some experts calculate the work took 10,000 men—far below earlier estimates of up to 100,000—and 25 years to lay five million tons of rock.

PAINTING BY C. F. PAYNE

Near the water, work is progressing on the Sphinx, which guards Khafre's valley temple and causeway. Half lion, half pharaoh, the Sphinx is carved from an outcropping left unexcavated in a U-shaped quarry. At the end of Khafre's reign, the Sphinx was left unfinished, like many of ancient Egypt's monuments. "New pharaoh, new project," explains archaeologist Lehner. "It's not much different from today."





Sunbeams in stone, the Pyramids of Giza mimicked rays descending from the sun god, Re. From atop the first and largest, built around 2550 B.C. by Pharaoh Khufu, twilight shadows pierce a Cairo suburb where so long ago sprawled a city of pyramid workers.
A half mile away are remains of Khufu's valley temple (above), terminus of a causeway to the pyramid.

PYRAMID POWER

THE FORCE BEHIND EGYPT'S ECONOMY

INSIDE THE GREAT PYRAMID
Despite hidden entrances, walled-off passages, and granite plugs to protect the dead king's treasures, Khufu's eternal security system soon fell to looters.

Khufu
ca 2550 B.C.
Great Pyramid
Giza
481 ft high
51°

Djoser
ca 2630 B.C.
Saqqara
204 ft high

Sneferu
ca 2600 B.C.
Maidum
306 ft high
51°

Sneferu
ca 2600 B.C.
Bent Pyramid
Dahshur
344 ft high
43°
54°

Sneferu
ca 2600 B.C.
Northern Stone Pyramid
Dahshur
341 ft high
43°

Khafre
ca 2520 B.C.
Giza
471 ft high
53°

Pepi II
ca 2250 B.C.
Saqqara
172 ft high
53°

To prevent collapse of the king's burial chamber, granite slabs beneath the pitched roof deflect the thrust of the stones above.

Narrow shafts, possibly corridors for the king's ka, branch out from both chambers.

Grand gallery

King's chamber

Ascending corridor

Erroneously called the queen's chamber, this room may never have been used; its function remains unknown.

Escape tunnel

A tomb robbers' tunnel has become the main visitors entrance.

Sealing the tomb from within by inserting granite plugs, workers exited through a tunnel to the subterranean shaft.

Descending corridor

A chamber carved out of bedrock may have been the original royal burial site.

Subsidiary pyramid
Enclosure wall
Mortuary temple
Boat pits
Causeway
Valley temple

CLASSIC COMPLEX
Old Kingdom pyramids gradually evolved into a standard form with flat faces and adjacent temple buildings and a causeway, as at Giza. The arrangement defined all subsequent pyramids.

Menkaure
Khafre
Khufu's Great Pyramid
Queens' pyramids
Royal family and nobility tombs
Khufu's valley temple
Menkaure's valley temple
Great wall
Bakery
Workers' village
Overseers' tombs
Khafre's valley temple
Sphinx and Sphinx temple

Giza plateau

COMPUTER-GENERATED IMAGE. VERTICAL SCALE EXAGGERATED TO SHOW ANCIENT NILE RIVER CHANNEL

Zawyet el Aryan
CAIRO
Giza
Former floodplain
Abusir
Saqqara
Dahshur
Probable location of Old Kingdom Memphis
Probable source of Nile in Old Kingdom
Tura
Mit Rahina (site of New Kingdom Memphis)
Modern Nile River channel

Mediterranean Sea

PHARAOH'S TOMB

The Kingdom's Economic Heart

Mystical gateway for a pharaoh's leap to immortality, a pyramid drew resources from throughout the king's domain and beyond. Farm workers were conscripted into national service. Provincial shipments of crops and domesticated animals fed workers and managers during construction. The food kept coming even after the pharaoh's death—daily offerings to nourish the king's vital force, or *ka*.

Recent discoveries near Old Kingdom pyramids—including villages, workshops, and workers' tombs—illuminate the daily life of ancient Egyptians.

SHIFTING NILE
Lifeline of the Old Kingdom, the Nile at flood stage pushed almost to the feet of the Pyramids of Giza, an area today choked by sprawling Cairo suburbs. Millennia of floods, drought, and silt deposits have shifted the river eastward. Memphis, west-bank seat of pharaohs, has literally followed the Nile in its wanderings.

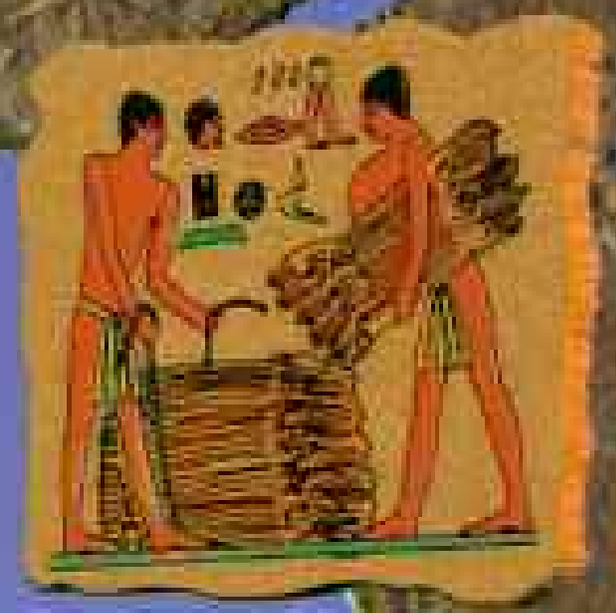
All Roads Lead to the Pyramids

As the world's first nation-state, Egypt became a magnet for trade. Venturing out by land and sea, Egyptians acquired resources from lands as distant as Byblos, now in Lebanon. Money was not yet invented, and it is thought that goods were collected at a central area and distributed by the government.

Buffered by sand and sea, Egypt had natural defenses against possible invaders. Border skirmishes did occur with Libyan desert dwellers and Nubian warriors from the south.

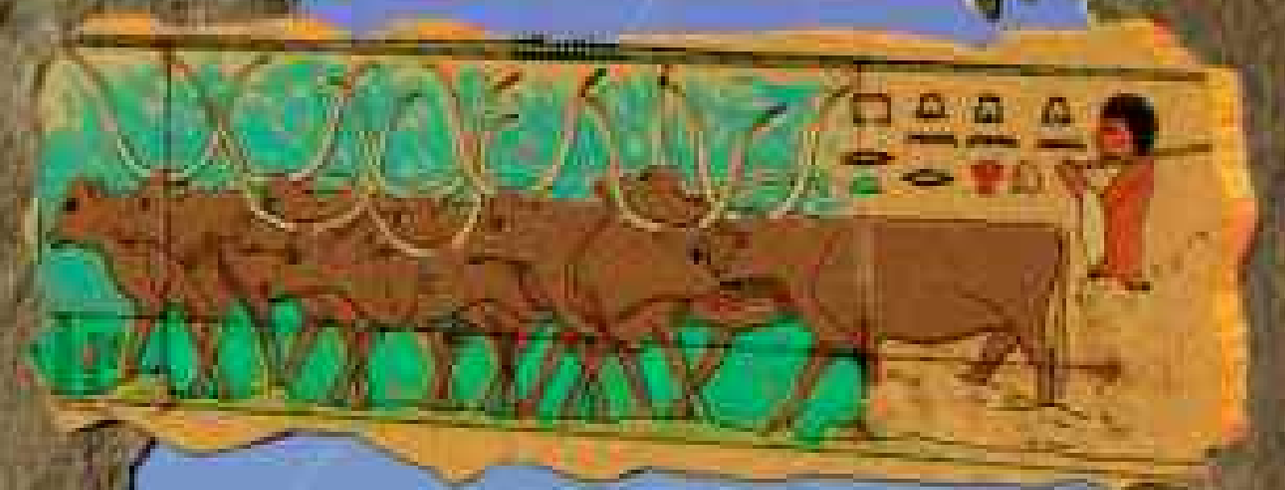
Libyan Desert
Siwa Oasis
Qattara Depression
Nile Delta
LOWER EGYPT
Kom el Farain (Buto)
Sais
Fayum Oasis
Abu Rawash
Tell Basta (Bubastis)
Heliopolis
Bahariya Oasis
ROCK CRYSTAL
Farafra Oasis
Maadum
FLINT
AREA ENLARGED ABOVE
EGYPT
Sinai
Dakhla Oasis
Western Desert
Wadi el Tumilat
Eastern Desert
TURQUOISE MALACHITE COPPER
Kharga Oasis
COPPER
Abydos
Wadi Qena
UPPER EGYPT
Dendera
Naqada
Qift (Coptos)
Luxor
Kom el Ahmar (Nekhen)
Edfu
El Kab (Nekheb)
Dunqul Oasis
Kurkur Oasis
JASPER AGATE
Red Sea
COPPER
AMETHYST
1st Cataract
Aswan
Arabian Peninsula
Wawat
2nd Cataract
N U B I A
FELDSPAR
Wadi Kharit
COPPER
Wadi Gabgaba
GOLD COPPER
Wadi el Allaqi

RAW MATERIALS
Sheaves of grain came from the Nile Valley, cedar from Byblos, gold from Nubia to the south.



SEA TRADE ROUTES
Boats from Byblos hugged the Mediterranean shore, then sailed up the Nile. Other traders probably sailed around the Arabian Peninsula and landed on Egypt's Red Sea coast.

CATTLE
Raised on estates primarily in the delta, herds provided meat for royalty.



Ancient site
City
Old Kingdom pyramid
GOLD Mine
Stone quarry
Trade route

Scale varies in this perspective.

ILLUSTRATION BY CHUCK CARTER; COMPUTER-GENERATED IMAGE BASED ON INFORMATION FROM SARAH JEFFREYS, INSTITUTE OF ARCHAEOLOGY, UNIVERSITY COLLEGE, LONDON; ORIENTAL INSTITUTE COMPUTER LABORATORY, UNIVERSITY OF CHICAGO; AND ARCHAEOLOGICAL GRAPHIC SERVICES.

In the ways of their ancestors, workers float stone to Cairo and heft it ashore for construction. The Pyramids of Giza used limestone blocks of up to 15 tons, but the earlier Step Pyramid was made of stones as small as these. At night workers may have filed through a gate in the now buried wall (below) that separated the necropolis from the workers' complex.

(Continued from page 15) shoulder straps usually attached just below the breasts; and children went naked into adolescence. In the alleys outside their huts, women traded spices, garlic, and onions for fish and other goods. Money would not be used in Egypt for another 2,000 years.

What tied the country together geographically was the Nile, with its network of hand-dug canals. Boats made of wood or papyrus and caravans of donkeys launched adventurers on expeditions into the Eastern Desert or south into Nubia, from which they brought back gold, ebony, ivory, rare stone for statues, incense, panther skins—and a menagerie of wild animals that the Egyptians tried to domesticate. They may have succeeded with the crane, the ibex, the gazelle, and even the baboon, but scholars doubt that Egyptians ever tamed hyenas, which are shown in vivid relief scenes lying on their backs with their legs tied, being force-fed lumps of meat.

The population of Old Kingdom Egypt was probably between a million and a million and a half. Less than one percent were literate. The Egyptians believed that writing had been invented by the god Thoth, usually pictured as a scribe with the head of an ibis; words, whether written or spoken, had a magical power. Thus the scribe played a special role in the kingdom, as he sat and recorded the daily quotas of workers' rations and the results of their sweaty toil on his papyrus roll. Each scribe was taught to write by his father, who gave him stones and potsherds on which to practice his hieroglyphs before he was allowed to set brush to papyrus. Noblemen and priests would hire the young men as apprentices.

"The Satire of the Trades," a poem written several hundred years after the fall of the Old Kingdom, tells how the scribes lorded themselves over barbers, potters, arrow makers, and other rival tradesmen. "It's the greatest of all callings, / There's none like it in the land," wrote the anonymous poet. "Set your heart on books! / . . . There's nothing better than books! / It's like a boat on water." "See, there's no profession without a boss, / Except for the scribe; he is the boss."

Many people think of the Old Kingdom as an austere, ascetic age. In reality its elite were devoted to excess and delight. Various sources depict royal banquets, where guests sat on the floor on beautifully woven mats as servant girls poured water over their hands before the food was brought in. Great piles of grapes, figs, and doom palm fruit weighed down the table, along with bread slathered with honey. Guests poured down bowl after bowl of red wine and ate gargantuan helpings of fish, beef, and fowl with their fingers.

Meanwhile, musicians appeared, playing flutes, harps, and bone clappers to accompany beautiful young dancers, naked but for

bejeweled collars and short skirts tied around their waists, who performed arabesques and mingled with the guests.

An old legend recorded in the fifth century B.C. by Herodotus, although probably apocryphal, captures the self-indulgence of the Old Kingdom. In the tale Pharaoh Menkaure—Khufu's grandson and the builder of the third Giza pyramid—receives an oracle that predicts he will live only six years longer. The pharaoh, says Herodotus, "had innumerable lamps made, by the light of which he set himself every evening to drink and be merry, and never ceased day or night from the pursuit of pleasure. . . . His object in this was by turning night into day to extend the six remaining years of his life to twelve, and so to convict the oracle of falsehood."

DESPITE SUCH HEDONISM, life for most ancient Egyptians was grim and tedious. Society was built around the oppressive preoccupation with the pharaohs' immortality. One day over lunch at Giza, I asked Rainer Stadelmann, director of the German Institute of Archaeology in Cairo, why the kingdom's citizens were willing to devote their lives to worshiping their leaders.

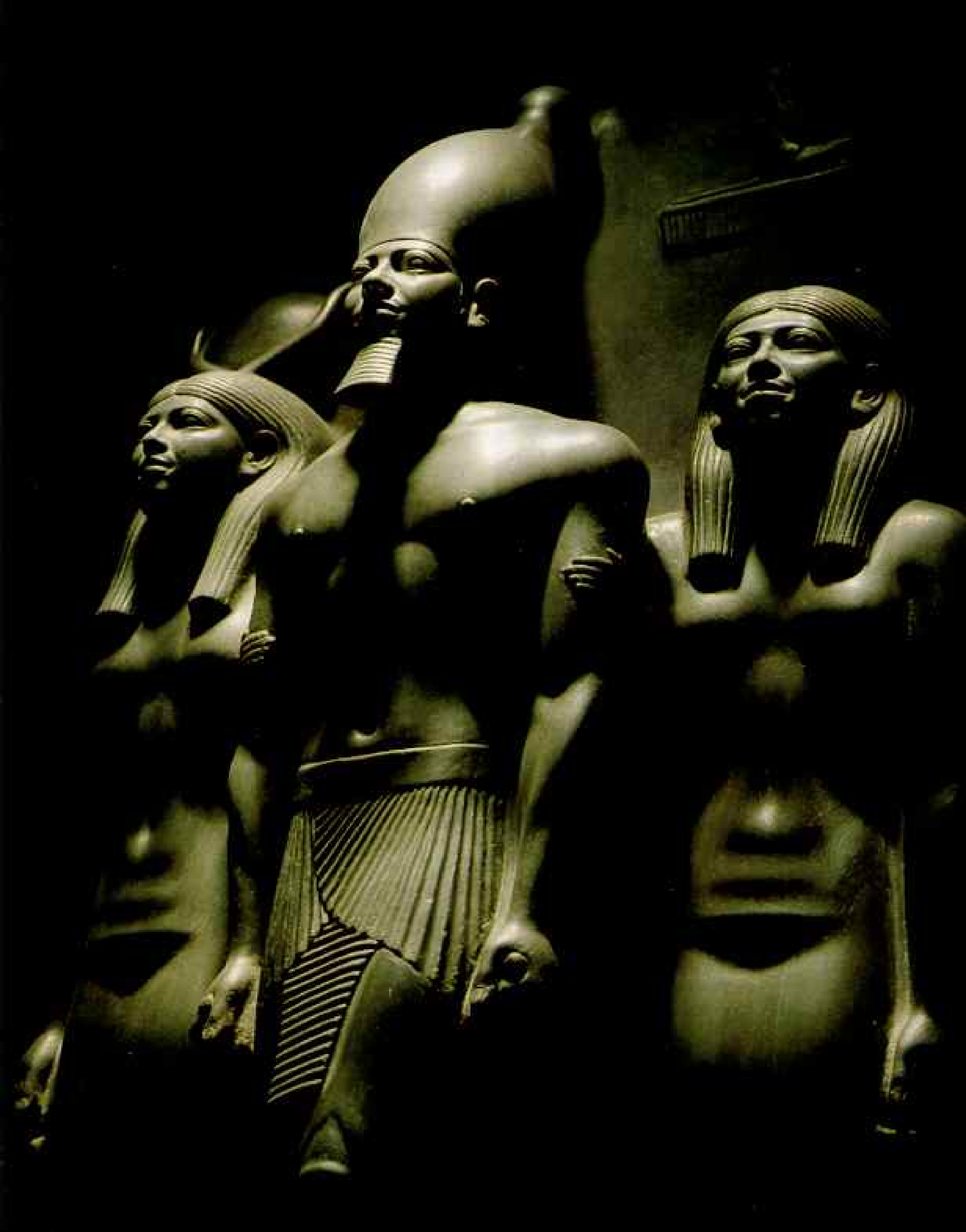
"What held the Old Kingdom together," he said, "was not so much a belief in the divine nature of the king as a belief that through the king was expressed the divine nature of society itself. Much later, after the fall of the Old Kingdom, Egypt would become something like a police state. But in the Old Kingdom, the people really believed in the importance of building a pyramid. It's like a small town that builds a huge cathedral in the Middle Ages. Faith is the spur."

To gauge the extent of that labor, Mark Lehner and a team built a 30-foot-high pyramid near Giza out of the same Tura limestone used by the ancient Egyptians. The men who built Khufu's pyramid, hauling and positioning an estimated 2.3 million limestone blocks, most weighing 2.5 tons, would have had to set a block in place every two and a half minutes. Using a helical ramp winding upward around their pyramid, Lehner's team found that just ten to twelve men could slide a block up the ramp, using desert clay and water as a lubricant, and lever it into place. Herodotus declared that 100,000 men were needed to build one of the Pyramids at Giza. Lehner

FACES OF THE GODS

Giza's Three Pyramid Builders

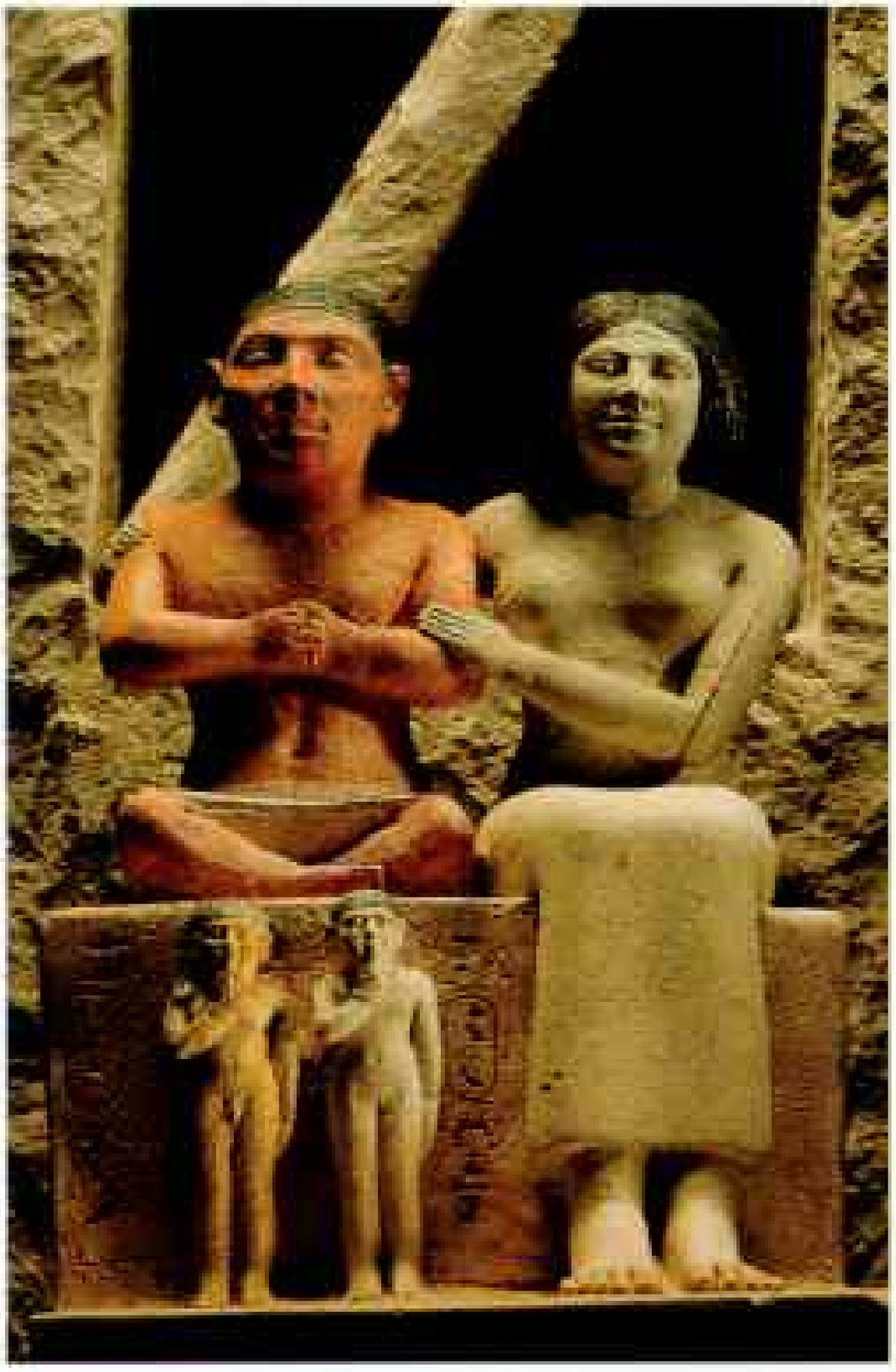
Keeping company with fellow gods (right), Pharaoh Menkaure is flanked by two female deities. His predecessor, Khafre, is embraced from behind by Horus, the falcon god of kings (above). Pharaoh Khufu's monument is Giza's first and most massive pyramid, yet his only known likeness is a three-inch ivory statuette (below).



calculates that as few as 10,000 could have pulled off the job.

As he puts it, "A pyramid turns out to be a very doable thing."

Lehner loves showing people the mysteries of the Old Kingdom. One he revealed to me at Maidum, an unfinished pyramid to honor the pharaoh Snefru, Khufu's father, that stands in isolation 35 miles south of Saqqara. Flashlights in hand, we crawled along the



cramped passage that leads to the burial chamber deep in the center of the pyramid. Cedars from Byblos, now in Lebanon, 4,500 years old, braced the walls. The chamber itself was surprisingly small, topped by a rudely built vault.

"Sort of small, for a king, don't you think?" Lehner commented. "Remember that no sarcophagus and no body were ever found here. Let's go look at Mastaba 17."

A mastaba is a flat-topped tomb built of mud brick. This one is near the pyramid on the northeast corner, a short walk from the vault. The mastaba here had long puzzled archaeologists, who for decades could find no entryway into it. The only passage known today is an ancient robbers' tunnel that leads to the crypt. Now I scuttled after Lehner down this narrow, crudely gouged passage. We popped through a narrow aperture. I stood up and gasped.

In the glow of my flashlight I beheld a T-shaped chamber several times larger than the cramped vault in the pyramid. Before us stood a massive sarcophagus hewn out of red granite that had been floated 500 miles down the Nile from Aswan.

"What do you think?" asked Lehner. "If you were a pharaoh, would you choose that crude chamber inside the pyramid or something like this?

"Now this is only speculation," Lehner paused. No idea about the pyramids is more sacrosanct than that they were always tombs for the pharaohs. "But I wonder if the Maidum pyramid is merely a cenotaph—an empty, symbolic tomb?"

Here, if Lehner's hunch proves correct, was the Old Kingdom principle of illusion as a higher truth at its most stunning. The pyramid itself—at least in the case of Maidum—might be a mere pseudo-tomb, made somehow more powerful in the afterlife of the pharaoh who only pretended to be buried there.

I peered inside the sarcophagus. The lid had been pried loose; a wooden mallet, which thieves had used to prop open the lid, still lay in place, distorted by the pressure of three and a half tons of granite bearing down for more than four millennia.

The robbers had pillaged whatever treasure the tomb once held but had left the body for W. M. Flinders Petrie to discover in 1910, the first archaeologist to enter Mastaba 17. The skeleton of the man had been taken apart, apparently by the officials in charge of the burial. Each bone was wrapped separately in linen; then the body was reassembled. The details of the wrapping showed exceptional care: linen wound in and out of individual vertebrae, inside the kneecaps, around each finger joint. The eye sockets had been filled with balls of paste pressed into linen. The penis was carefully modeled in linen.

Here, it seemed, was an elaborate early attempt to keep a corpse from decaying, several centuries before the Egyptians perfected mummification. Scientists today would give a great deal to reexamine Petrie's find. But the skeleton was shipped to England so roughly that the skull arrived shattered beyond repair. The remaining bones were deposited

in a box in the British Museum. Eight decades later, they have been lost: A recent search of that museum produced no trace of the corpse of Mastaba 17.

Around 2465 B.C.—halfway through the Old Kingdom—pyramids suddenly became less important. No one knows why, but many scholars have suggested that after Khufu's pyramid, which took roughly 23 years to build, the kingdom grew weary with each pharaoh's effort to outdo his predecessor. Several pharaohs died before their pyramids were completed, perhaps a cause of embarrassment or even horror among the populace.

Never again would a king build his pyramid on a truly colossal scale. Instead the religious focus shifted from the pyramid itself toward the mortuary temple that stood just east of it. Here, in columned courtyards, before alabaster altars, sculptors carved vivid semi-mythical scenes on the walls—of a pharaoh smiting his Libyan enemies or hunting bears in Syria. And here high priests carried on an elaborate cult to propitiate the dead king's ka. The funerary culture was growing more sophisticated, even as the pharaoh's omnipotence was beginning to erode.

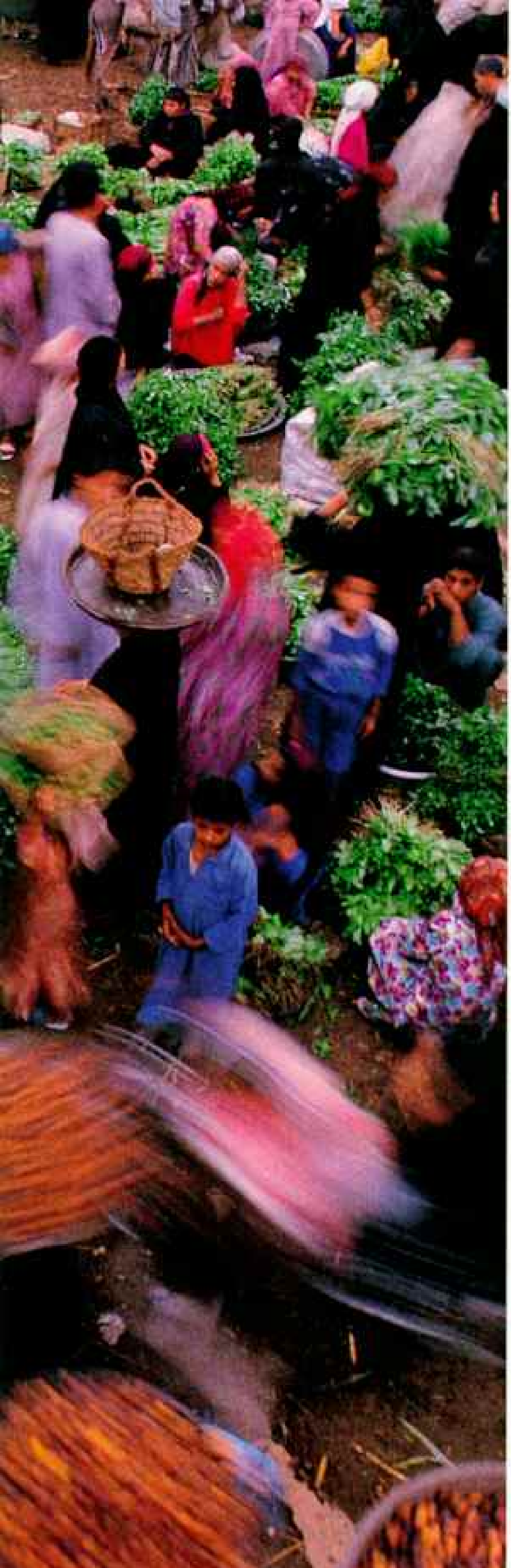
Some scholars think the pharaohs' decline began just before they moved south from Giza to Abusir. For the past 34 years an archaeological team, now under the direction of Miroslav Verner of the Czech Institute of Egyptology in Prague, has worked at Abusir. In 1982 they discovered the first of a cache of 2,000 pieces of papyrus in a mud-brick storeroom inside the mortuary temple of a pharaoh named Raneferef. These ranged from complete rolls to tattered fragments, all inscribed in the priestly writing of the day.

Together with similar caches unearthed in neighboring temples, the fragile pages make up the most detailed written documents ever salvaged from the Old Kingdom. Known collectively as the Abusir Papyri, the records delineate, with an exquisite fussiness, the rites conducted by funerary priests some 4,400 years ago.

Raneferef died before he was 25, having ruled for little more than two years. At the time only the base of his unpretentious pyramid had been constructed. The officials hastily plastered over the monument with clay, then capped it with a scattering of cobblestones. From the look of the pyramid, it

Confident bureaucrat, Khufu's court dwarf, who managed the royal wardrobe, sits for a family portrait. Scribes kept records like one found in a temple (above) by archaeologist Miroslav Verner. Translated by expert Paule Posener-Kriéger, it sheds light on rites for dead kings. Among the accoutrements (box above): a wooden hippopotamus.


CHEVROLET



Business is brisk at the market in Saqqara, near the Step Pyramid: Trays of dates streak by en route to sale in Cairo. Old Kingdom tomb reliefs show women carrying food on their heads, although cultivation of dates did not start until nearly a thousand years later. Ancient Egyptians would have traded grains, peas, onions, cucumbers, and figs.

would seem that the king had been little mourned and quickly forgotten.

Not so: Fifty or even 150 years later, the priests of Raneferef's cult still gathered daily to carry out the rituals his ka required. The priests led a daily procession, circling the pyramid three times. Others gathered before a statue of Raneferef: Pulling a covering from it, they sprinkled the statue with perfume, painted it with black eye shadow, waved an incense burner before its nose, and dressed it again in bright-colored cloths—all the while intoning mystical formulas.

Before the principal altar, a priest supervised a line of men bearing loaves of bread of many sizes and shapes—round, flat, conical, pointed. Bread, the most common food in Old Egypt, symbolized prosperity and abundance. As the bearers deposited their loads, the priest might read from a papyrus: "Ten loaves of *beset;* seven loaves of *paadj;* 11 loaves of *peseн;* 62 loaves of *hetjat;* one loaf of *toot;* one loaf of *khadj*. . . ." For perhaps an hour the loaves would sit in a heap on the altar; then they were removed. During that period, the Egyptians believed, Raneferef's ka received and was nourished by the bread.

Another building in Raneferef's temple complex was called the Sanctuary of the Knife. Here, one after another, several large bulls, their legs tied together, were bound to great limestone blocks in the floor. A butcher would seize a flint knife and cut the bull's throat, catching the spurting blood in an alabaster basin. Other men would cut off the left foreleg of the bull and carry it to the altar—another offering for the pharaoh's insatiable ka.

These ancient scrolls may also guide researchers in their future explorations of Egypt's past.

"From these papyri," says Verner, "we know the names of royal palaces and temples not yet discovered. We know they must be there, somewhere under the sand."

The greatest figure *(Continued on page 36)*

AFTER 4,500 YEARS

Rediscovering Egypt's Bread-Baking Technology

The pyramids built Egypt by drawing its provinces together in a unified effort—and bread built the pyramids. For thousands of workers, a loaf of emmer wheat bread—washed down with beer—was most likely the dietary staple.

How did the Egyptians bake their bread? To find out, a National Geographic team reconstructed the process in a replica of an Old Kingdom bakery near Saqqara.

Important clues came from bas-reliefs of the baking process, such as one found in an Old Kingdom tomb (above). Clay baking pots were clearly made with top and bottom halves. The tops were heated to such a degree that the nursing mother at far left shielded her face. Hot pots could be carried only with sticks, as demonstrated by the central figure. Dough, meanwhile, was poured into the bottom half of the pots to rise, as seen at far right.

Such mechanics aside, the essential details of Old Kingdom bread making seemed forever lost.

Then, in 1991, University of Chicago archaeologist Mark Lehner discovered an ancient bread-making facility on the Giza plateau.

The outdoor bakery was adjacent to a large building. Based on seal impressions at the site, archaeologists suggest it was a *per shena*, an ancient commissary, associated with Pharaoh Menkaure, who completed the third and smallest Giza pyramid about 2470 B.C.

At virtually all Old Kingdom archaeological sites, Lehner notes, experts find thick pieces of dull red bread-baking pottery poking from the sand.

To replicate Old Kingdom baking pots, the team turned to a local potter named Mohammed Taha. His shop, in Cairo's Batn el Baqara, "belly of the cow," is a Stygian place, with belching black smoke backlit by glowing flames. There, the frail but nimble-fingered tradesman pumped his foot-driven potter's wheel and in a week made 66 bread-mold tops and bottoms.

As the tops were heated in a wood fire in preparation for baking, an assistant shielded his face from the heat (right)—just as had that mother some 4,500 years earlier.

Duplicating Old Kingdom cookware was one thing; re-creating the bread made in it was quite another. For help, Lehner turned to Edward Wood, a retired pathologist living on a 640-acre Idaho ranch. He raises not cattle but exotic sourdough yeast cultures.

"Bread, especially ancient bread like the Egyptians made, has been an avocation of mine for 50 years," Wood says.

From Lehner's drawing of the Giza bakery (diagram, facing page, bottom), the team built a replica. Local workers used Nile clay to mortar Tura limestone into a low-walled working surface (far right).

Old Kingdom Egyptians made bread from emmer, a twin-kerneled form of wheat that is very difficult to husk.

"We had the worst time finding anyone who could supply emmer," recalls Wood. "Finally we found a California fellow who collects and grows ancient grains."

Another problem: The team wanted to avoid store-bought yeast. "The Old Kingdom Egyptians didn't know about yeast—they thought bread rose miraculously," says Wood.

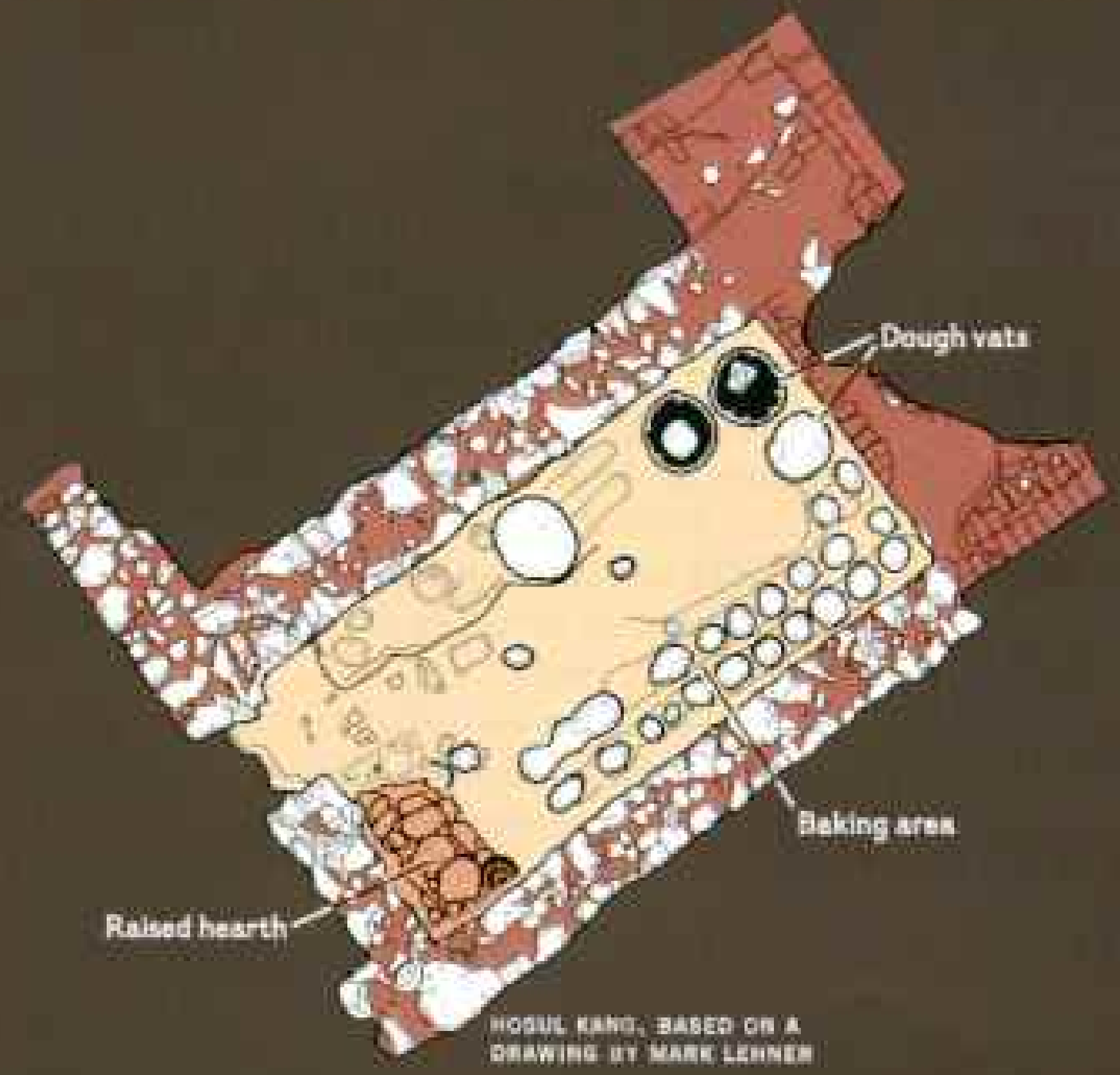
To collect free-floating native yeast spores and bacteria, Wood left an open container of wet flour on his Cairo hotel balcony. Within a week the pot was effervescing.

Finally it was baking day. Dough was placed into the pot bottoms, then allowed to rise while a hole for each pot was dug into hot coals (right). The pot tops were heated in an open fire, then lifted with sticks and placed atop the bottom halves nestled in the coals. If all went well, the combined heat from coals and lid would create an oven environment.

An hour and 40 minutes passed. Wood opened a pot and prodded the loaf. "It feels done," he reported. Wearing heavy gloves, Wood ran a knife along the edges and shook the pot upside down. For perhaps the first time in more than 4,000 years a perfect loaf of emmer bread popped from an Old Kingdom-style pot.

Slices were cut and passed around. Wood declared it "sourdough bread the way it's meant to taste." A worker compared it to *aish shamsi*, a staple Egyptians call bread of the sun.

Analysis at the National Food Processors Association in Washington, D. C., revealed that the loaves were nutritionally quite



HOSUL KANG, BASED ON A DRAWING BY MARK LEHNER

similar to store-bought breads.

"We showed that the bread of the Old Kingdom came in big loaves that could feed lots of people," concludes Lehner. "I was afraid we might get a ten-pound hockey puck."

Wood found it easiest to bear the weight of a loaf on his shoulder (upper left)—a pose assumed by bread bearers in Old Kingdom wall carvings. As for the big smile on his face, he says, "That's the culmination of a 50-year dream."

Adds Lehner, "From our bakery you could see the top of the Step Pyramid. And it looked just like an inverted loaf of Old Kingdom bread."

An eternal chorus line does high kicks for the spirit of Kagemni, an official of Pharaoh Teti whose tomb was built about 2300 B.C. Nobility enjoyed such gala scenes in life; stone re-creations ensured the show would go on in the afterlife. Egypt's love of dance endures: Belly dancing is a fixture at weddings, in nightclubs along Pyramid Road, and on Nile dinner cruises (facing page).

(Continued from page 31)

to emerge from the last years of the Old Kingdom was Pepi I, who ruled for some 34 years. An aggressive pharaoh, Pepi sent armies out to conquer the desert nomads that Egyptians called the Sand-dwellers, in the east, and the Nubians, to the south. A hollow statue of Pepi I, made of hammered copper and now in the Egyptian Museum, is one of only two life-size metal statues from the Old Kingdom ever found. He stands nearly six feet tall, his left hand stretched outward, his left foot forward, looking ready to march off to war.

Since 1966 the Mission Archéologique Française de Saqqara, under the direction of Jean Leclant, has been excavating Pepi's pyramid complex at Saqqara. One day last February I visited the dig, where a team of 60 was hard at work. Leaving the laborers to their sunny toil, project leaders Catherine Berger and Audran Labrousse led me into the dark passages inside Pepi's pyramid.

The walls of every pharaoh's burial chamber discovered prior to 1880 had been bare, with neither reliefs nor inscriptions carved into the stone. But that year Gaston Maspero found in Pepi's crypt column after column of hieroglyphs, each about two inches high, carved with masterly grace.

Berger shone her flashlight on a column directly above the low portal to the burial chamber. Pyramid Texts, as they are called, have been found inside the pyramids of the last five rulers of the Old Kingdom. But Pepi's texts are the most extensive of all.

Berger began to read the glyphs. "Hail to you, Ladder of the God! . . . Stand up, Ladder of Horus, which was made for Osiris that he might ascend on it to the sky. . . . Now let the ladder of the God be given to me. . . ."

The Pyramid Texts amount to a vast corpus of poetic spells, all aimed at ensuring the passage of the dead king to the heavens. These are no mere accounting recipes, like the formulas of the Abusir Papyri: They are charged, sacred incantations, originally recited by a priest standing inside the crypt. The performance of these spells was crucial to the ascension of the pharaoh's soul.

We moved on into the burial chamber. "If the god lives, this king will live," Berger continued. "If he does not die, this king will not die. If he is not destroyed, this king will not be destroyed."

"All this, the texts and the pyramid itself," Labrousse explained to me, "is an enormous machine that helps the king go through the wall of the dead, achieve resurrection, and live forever in the happiness of the gods. But there's a kind of anxiety in the repetitious litany. The priests are confident of success, but they are worried at the same time that it will not work."

I could not take my eyes off the hieroglyphs, each so precisely carved, each painted green. "Why green?" I asked.

"Green," answered Berger, "is the color of youth, of rebirth, of spring, of the swamp, of vegetation, of resurrection."

She then pointed out some hieroglyphs that were only partly depicted; humans and

certain animals were never represented whole but only by a disembodied arm or head. "It is a way of ensuring that the creature cannot act," she said.

To carve the hieroglyph of a lion raised the threat that the beast itself might sabotage the magic—by eating up, for instance, the offerings left for the pharaoh's ka.

By 2200 B.C., after five centuries of relative prosperity and political stability, the Old Kingdom was in trouble. Its last known pharaoh, Pepi II, gained the throne as a boy and ruled for more than 90 years, as the state crumbled around him. An inscription from the tomb of one of Pepi's expedition leaders reveals the impulsiveness of an eight-year-old ruler. From Nubia the expedition brought back 300 donkey loads of spoils, ranging from elephant tusks to incense.

What Pepi cared most about, however, was a Pygmy the adventurers had captured. "Come north to the residence at once!" he urged the expedition leader in writing. "Hurry and bring with you this Pygmy whom you brought from the land of the horizon-dwellers. . . . When he goes down with you into the ship, get worthy men to be around him on deck, lest he fall into the water! When he lies down at night, get worthy men to lie around him in his tent. Inspect ten times at night!"

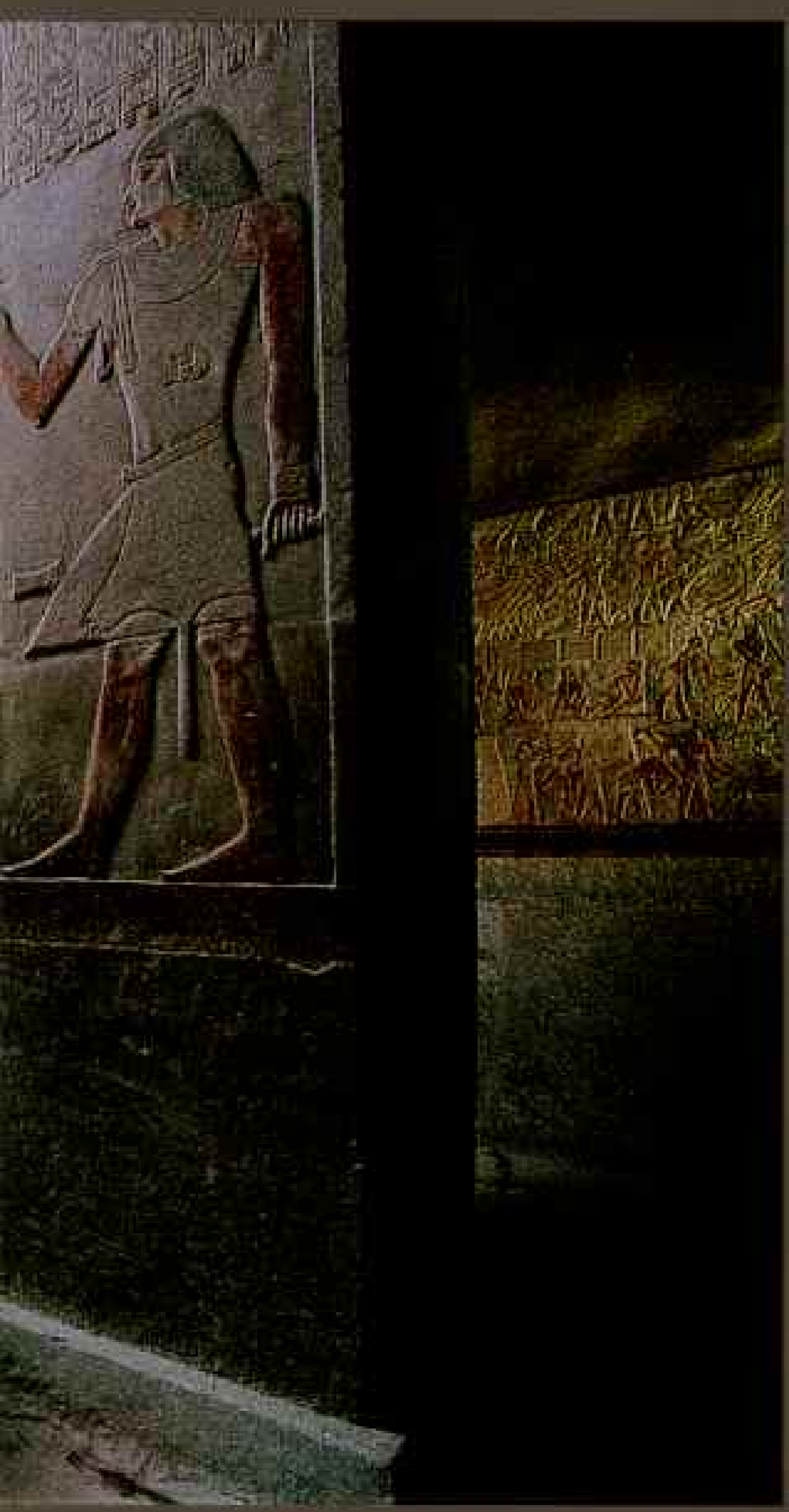
The causes of the Old Kingdom's collapse are much debated by scholars. For centuries the authority of the pharaoh had been weakening, as the priestly caste and the governors of the nomes gained power and autonomy.

Around 2200 B.C., moreover, a climatic crisis may have stunned Egypt, as the life-giving floods of the Nile grew undependable and drought seized the land.

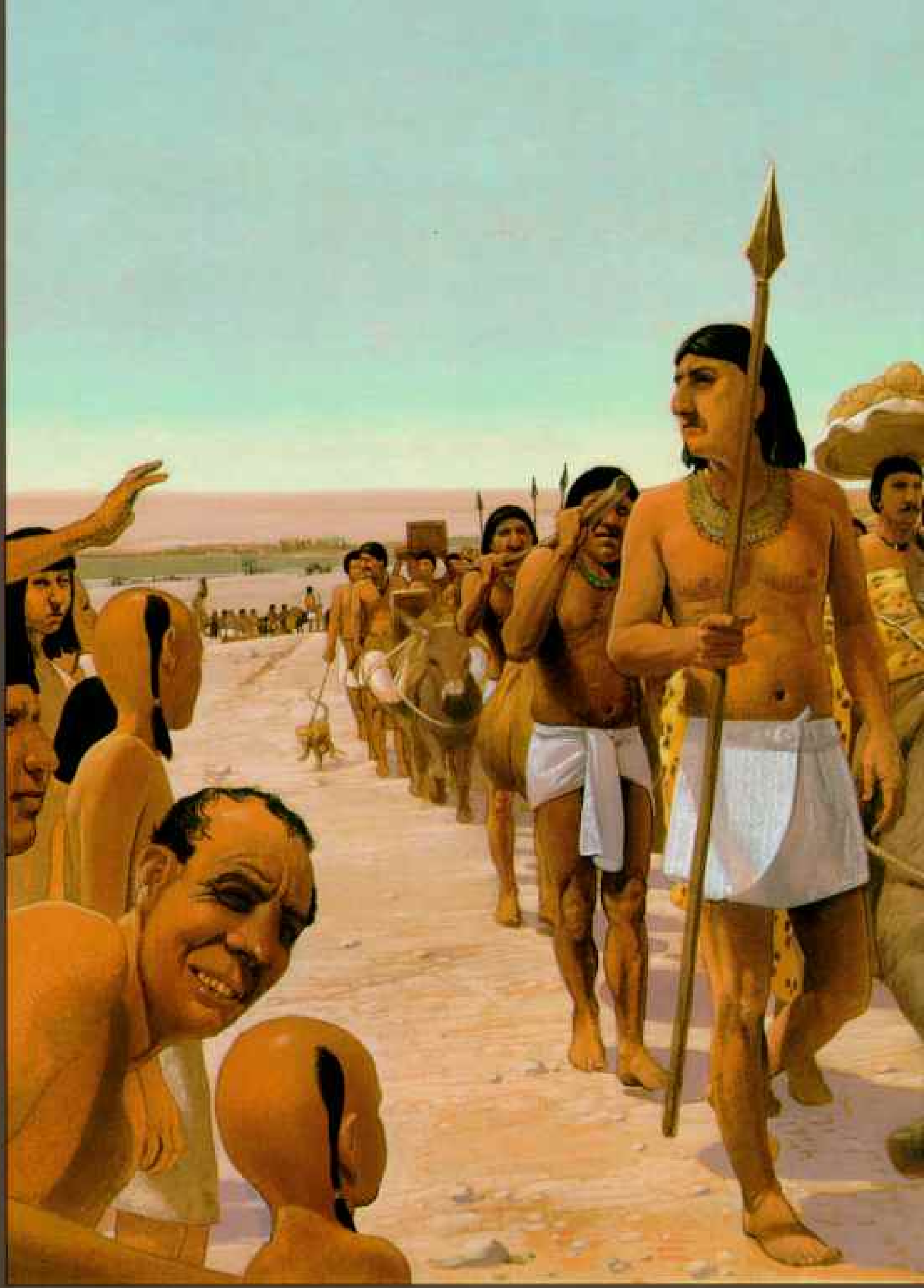
Pepi's very longevity may have drawn the state into stagnation. As Rainer Stadelmann, the archaeologist whom I had lunched with at Giza, told me, "Exceptionally long reigns are disastrous for civilizations. Louis XIV in France—it's he who should have been guillotined, not Louis XVI.

"During Pepi II's *(Continued on page 42)*

With a grand entrance from a false door, Pharaoh Teti's chief executive, Mereruka, surveys his own offering room. His wife, knee-high in the wall relief to his left (detail above, far right) sniffs a lotus blossom. Using early mummification methods, Old Kingdom Egyptians put plaster features on defleshed bodies (right).



"Take your head, collect your bones, gather your limbs, shake the earth from your flesh! . . . The gatekeeper comes out to you, he grasps your hand, takes you into Heaven." —OLD KINGDOM PYRAMID TEXT



Spectacle Amid Collapse

Carried in splendor toward the royal court at Memphis, provincial governor Harkhuf escorts a caravan of booty from beyond Egypt's borders.

Returning from the southern region of Yam about 2240 B.C., Harkhuf brought 300 donkeys bearing elephant tusks, panther skins, ebony, and incense. But it was a captured Pygmy that most pleased Pharaoh Pepi II, who was just eight years old. Most likely the true power of the

PAINTING BY C. F. PAYNE

young king's reign was wielded by his mother and her brother.

During some 90 years of weak rule under Pepi II, the royal coffers dwindled. Other regional governors paid lip service to the pharaoh, even as they busied themselves amassing as much wealth and influence as they could. Northern trade routes were disrupted by civil unrest. Famine, possibly caused by drought, revoked the gods' blessings.

The Old Kingdom decayed after the reign of Pepi I, whose copper statue still flashes limestone-and-obsidian eyes. When Pepi II's reign ended in 2150 B.C., the pharaoh's power was undermined by regional strongmen. His pyramid, now rubble, echoes an ancient sage: "The land spins round like a potter's wheel. . . . The state has gone to rack and ruin."

reign, I am sure a courtier came out every day and announced, 'He still lives.' Pepi finished his pyramid in his 30th year—then followed six more decades of corruption. The governors of the nomes discovered they could act without instructions from the palace."

Soon after the death of Pepi II, around 2150 B.C., the Old Kingdom came to an end. The ensuing age, which scholars call the First Intermediate Period, remains an enigma.

"The First Intermediate Period was a terrible rupture," Labrousse said, "a complete collapse of the kingdom. All the pyramids were looted, not secretly at night but by organized bands of thieves in broad daylight."

We were standing atop the pyramid of Pepi I at Saqqara. Labrousse gestured at our feet, where what looked like a bomb crater in the top of the pyramid still bore witness to the looters of that time.

"The temples were burned. There was widespread violence. And a desperate famine took hold of the land."

Some of the tomb inscriptions from officials of this period testify eloquently to the famine. "I gave bread to those who were hungry," claimed one survivor, "and clothes to those who were naked. . . . All of Upper Egypt was dying of hunger, to the point where people ate their own children. . . ."

EGYPT WOULD RISE TO GLORY twice more, in the Middle Kingdom after 2040 B.C. and again in the New Kingdom of Akhenaten, Tutankhamun, and Ramses II. As the Old Kingdom receded into the past, it came to seem to latter-day Egyptians a kind of golden age.

In about 1200 B.C., fully 1,400 years after his death, Imhotep, the genius architect of Djoser's reign, was deified by the Egyptians, who built cult temples to honor him. Centuries later workmen dug a shaft through the Step Pyramid down to Djoser's burial chamber—not to pillage the grave but to try to decipher the secrets of the tomb.

I said good-bye to Jean-Philippe Lauer in the colonnade of the Step Pyramid complex, where he was directing laborers as they set a stone high in the south wall. To guide their efforts, he clasped the stone and gentled it into place. In the 69th year of his own homage to Djoser, Lauer knew that his life's work would never be finished; no less reason, his hands seemed to say, to get on with it. □

Close Encounters With the Gray Reef Shark

Text and photographs by
BILL CURTSINGER

Lords of the shallows, gray reef sharks investigate an underwater remote-control camera in their home range—the waters of Bikini Atoll, former nuclear test site in the Pacific Ocean.

Sharks with an attitude patrol Bikini Atoll

On a still, sun-dazed morning our speeding boat was the only sign of life on the glassy 25-mile-wide lagoon. Below, it was different. In the clear depths fish darted from clumps of coral. On the reef edge, schools of jacks and snappers drifted among coral cliffs. Lovely, yes, but I had eyes only for sharks.

Gray reef sharks seemed to materialize wherever I looked. Here was an ace of predators, cruising with slow flicks of its black-edged tail (right). I had been to Bikini Lagoon in the early 1990s to photograph sunken warships. They were the unmanned targets of

atomic bomb tests conducted here by the United States shortly after the end of World War II.

Prepared for a wasteland, I had found reefs swirling with life. The marine systems, once bombarded by radiation, had been flushed by time and tides. And with fishermen absent for 50 years, Bikini's waters had returned to a rare, undisturbed condition.

I now came back to photograph the gray reef shark, the most populous shark in these waters. It belongs to the large family of requiem sharks—the Carcharhinidae—sleek, swift creatures found throughout the tropical seas. The range of the gray reef shark, *Carcharhinus amblyrhynchos,* extends from the Indian Ocean eastward to Hawaii and the islands of French Polynesia. Not a ceaseless wanderer like many sharks, the gray reef shark establishes its home along a coral reef. It is a medium-size shark, growing to six feet or more. It is also one of the most aggressive.

What truly sets the gray reef shark apart is the incredible body language it speaks. Whenever it feels its space is being threatened, it drops its pectoral fins straight down, raises its snout, arches its back, and starts swimming with an exaggerated weaving and rolling motion. This startling display serves as a warning for an attack.

I know all about this defensive behavior. Twenty-two years ago I was charged and bitten by a gray reef shark while snorkeling in the Caroline Islands—like Bikini, part of Micronesia. It was with some anxiety that I again confronted these powerful animals. Yet when I was done, my cameras had come as close to the gray reef shark as you are to this page.

BILL CURTSINGER, a contract photographer with NATIONAL GEOGRAPHIC since 1973, recently followed sea turtles (February 1994) and Hawaiian monk seals (January 1992).

Storming the waters of Bikini Lagoon, gray reef sharks go berserk when dead fish are thrown from a boat. Feeding frenzies have been likened to mob behavior in humans, with the overload of stimulation erasing inhibition.

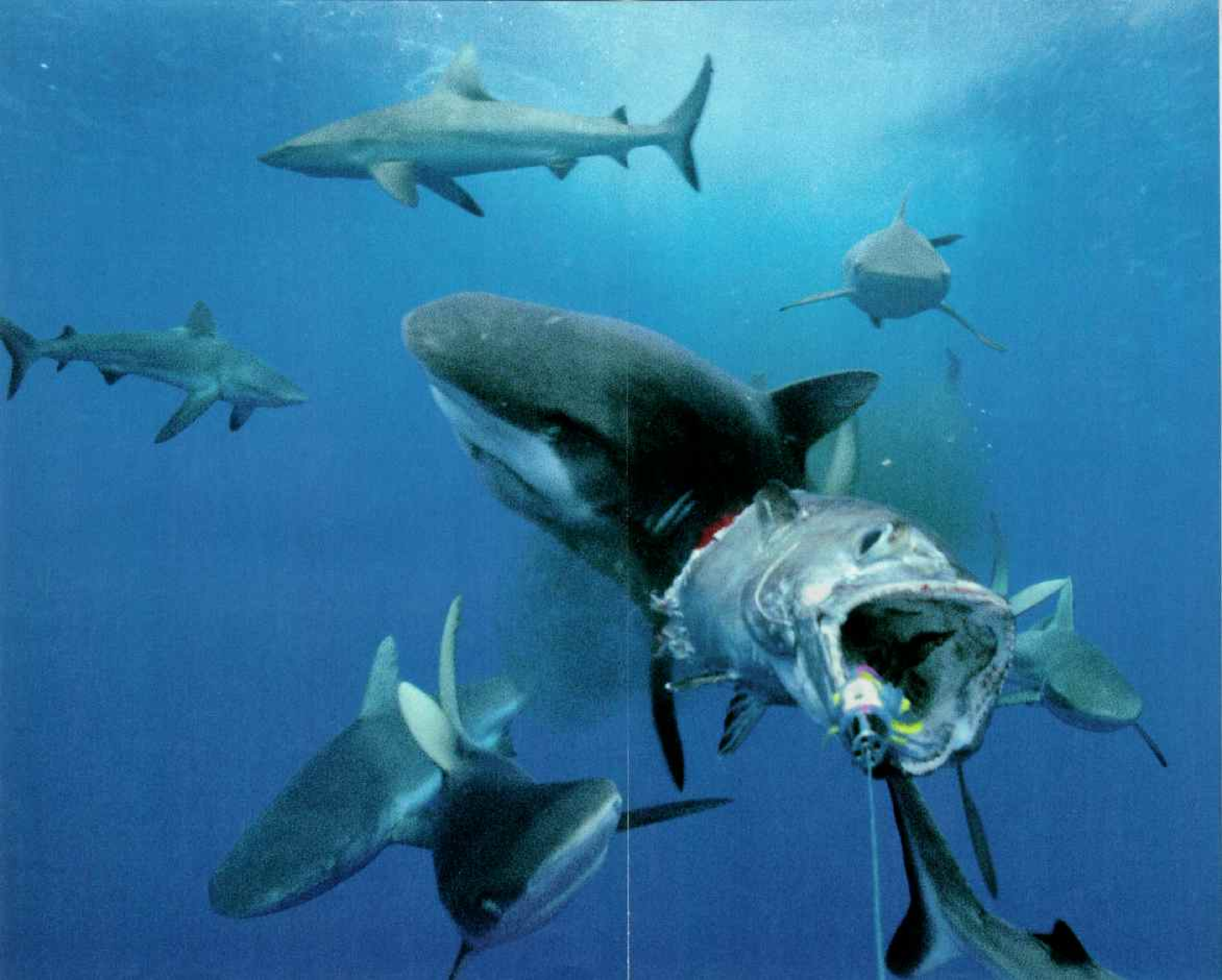
Homing in on the bait

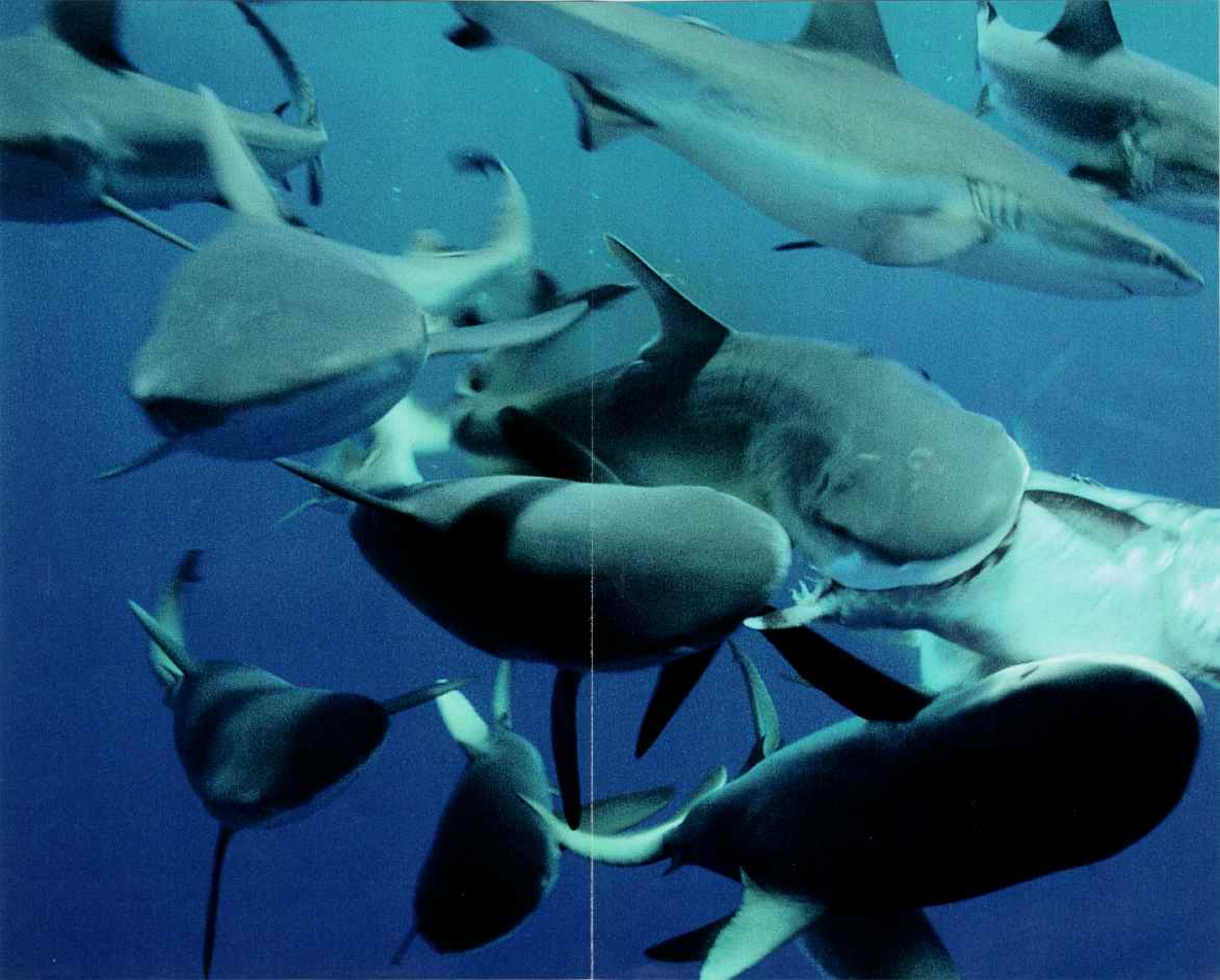
To a hungry shark a fish in distress is a dinner bell going off. As soon as our fishing line, attached to the camera system, hooked a jack (right), we watched the inevitable shark lift off the reef and torpedo toward its hapless prey.

Sharks operate like high-powered antennas. They hear over long distances—possibly as much as a mile—the low-frequency vibrations emitted by struggling fish. At the same time their sensitive noses pick up the faint scent of blood spread on ocean currents. Through visible pores on their heads that lead to special receptors, they detect at close range electrical fields given off by animals, including humans.

Although gray reef sharks will hunt alone, they often attack and feed in large groups (right). When a shark crunched onto a hooked fish (below), I was amazed at the ferocity of the assault and at how in the midst of the churning frenzy the sharks appeared to show no aggression toward one another.

"The feeding scramble is like a football fumble," says shark researcher Donald Nelson of California State University at Long Beach. "Everyone goes for the ball, not each other."





To the swiftest goes the meal as sharks swarm toward a hooked yellowfin tuna. Another attack left tooth marks on the plastic dome around the camera. Because of the electrical field created by the equipment, the sharks probably thought my camera was alive.

Survivor's tale of a shark attack

It is probably the most basic human fear: getting attacked by a wild animal. When a gray reef shark tore open my left hand, I remember feeling as if I had been hit by a sledgehammer. Such was the shock, I don't recall the actual bite.

The incident took place in 1973 in a remote Micronesian lagoon in the Caroline Islands. I was swimming alone, ascending in a slow spiral after a dive, when I noticed the shark. It was 20 feet away and closing. I saw it sweeping its head back and forth; its back was arched like a cat's. The shark was speaking to me, but at the time I didn't know the words.

The shark came at me like a rocket. I had time only to lift my hand, the shark ripping it with its teeth. As I swam frantically toward the boat, I saw that each dip of my hand left a cloud of blood in the water. The shark struck again, raking my right shoulder. At that moment a friend in a dinghy rescued me.

The next day I posed with my bandaged wounds (left). Later I had minor surgery on

ERIC HINER

my hand and shoulder. I was lucky, yes, but this defensive animal, I realized later, was not trying to eat me; it was in fact driving me away, quite possibly seeing me as a potential predator.

Since then I have learned defensive behavior myself. When photographing in Bikini, I sometimes donned a stainless-steel mesh suit and slipped into a plastic "shark scooter" (above). The eerie thing is that I didn't know that a gray reef shark had sneaked up below me until I saw this picture.

Eye in the storm

How could I photograph a feeding frenzy without putting myself in a place where no diver in his right mind would go? The answer was to go remote. With the help of the National Geographic Society's custom equipment shop, my assistants and I designed and built a one-of-a-kind remote camera system. The stable, lightweight sled (above), made of plastic pipe and stainless steel, could be towed underwater. On it I mounted a video camera and a still camera, both equipped with wide-angle lenses, and enclosed them within a clear plastic dome.

The cameras were wired to the boat, allowing me to operate them from above. Behind the tow camera we ran a fishing line with a lure. To incite a shark attack, we ran the line (A) out some one hundred feet. As soon as we felt a tug, we'd reel the hooked fish toward the cameras (B). A wave of sharks was never far behind. Using the video camera as my "eye" underwater, I could follow the action live on a TV monitor aboard the boat. When the sharks rushed in, sometimes as many as 20, I snapped the still camera and captured the maelstrom.

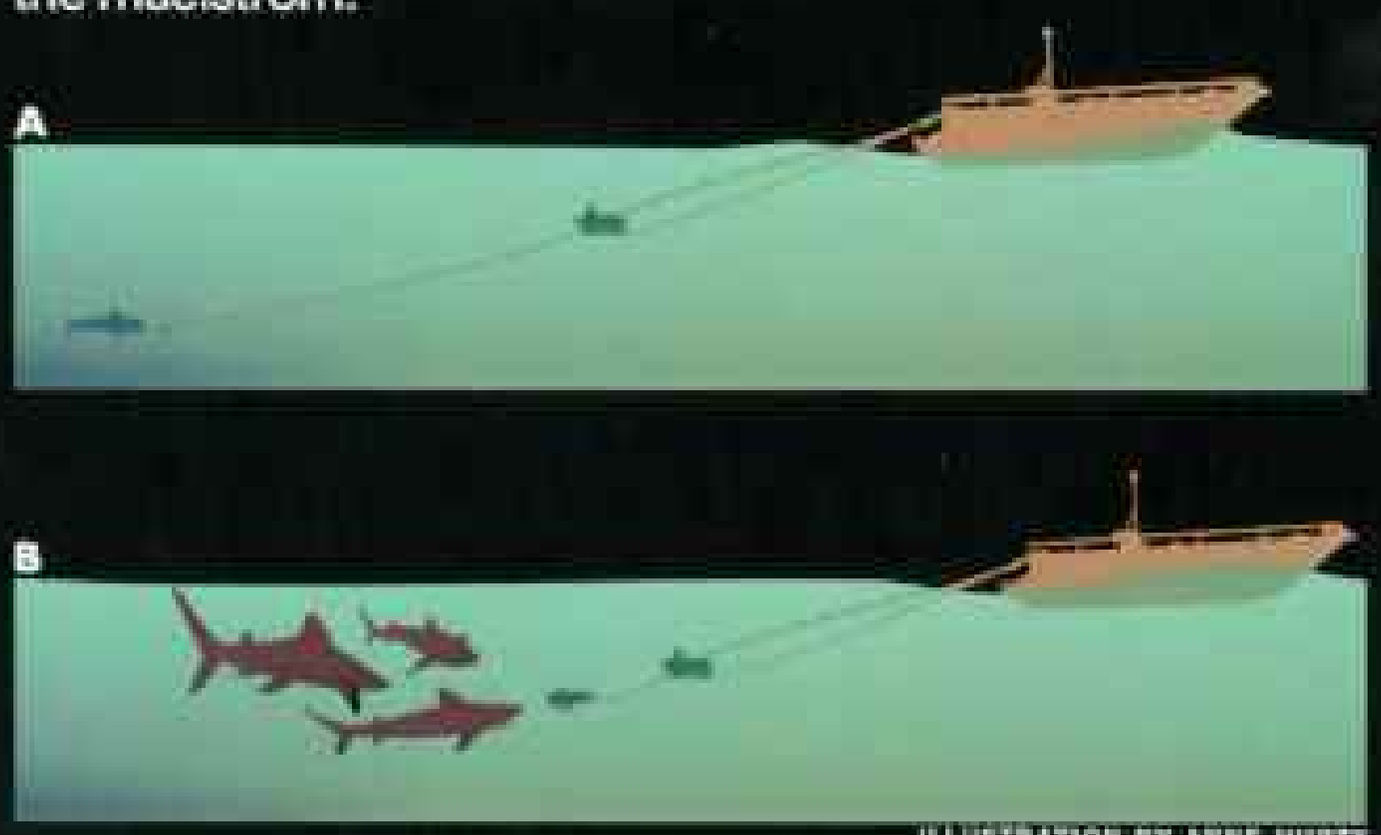


ILLUSTRATION BY ANNE HURFF

It's a shark-eat-shark world

One moment a six-foot-long gray reef shark is lying on the bottom of the lagoon; then in a flash half of it is gone, devoured in a single chomp by a 13-foot-long tiger shark (left).

For five nights I stood watch at a video monitor, squinting at an image of the sea-floor where I had placed a dead gray reef shark as bait. Jack Randall, an ichthyologist at the Bishop Museum in Honolulu, had told me that the tiger shark, known for eating anything from sea turtles and dolphins to birds and humans, would also feed on other sharks, even other requiem sharks, like the gray reef. With my remote camera I wanted to document this rarely seen behavior.

Experience told me that tigers spend most of the day in deep waters beyond the reef. At night they come into the lagoon to feed. We attached our dead shark to the camera system and waited—and waited. Finally on the sixth night, near dawn, I saw the flank of a very large shark pass through the beam of light from the camera. Minutes later it swam into full, mesmerizing view. It was a tiger all right, recognizable by the broad head, blunt snout, and pronounced nostrils. I had to work fast. After the second bite, all that remained was a head and the pectoral fins (above).

There is no light at the end of this tunnel—the gaping maw of a hungry tiger shark. After swallowing most of a gray reef shark, the tiger investigates the camera dome with its mouth, exposing gill slits and rows of saw-edged teeth.

At nuclear ground zero

At first glance the beach at Bikini (above) looks like a tropical paradise. But in truth the land and water share a poisoned history, from the era when 23 atomic tests were conducted at Bikini Atoll.

In 1946 some 42,000 people, from bombardiers to oceanographers, and more than 90 target vessels invaded the lagoon for the U. S. government's Operation Crossroads, the first peacetime testing of nuclear weapons. All 167 native Bikinians were relocated.

Although testing continued until November 1958, the most damaging explosion came on March 1, 1954, when a 15-megaton hydrogen bomb, code-named Bravo, was detonated on the atoll (map). The most powerful bomb ever set off by the U. S., it had a thousand times more explosive force than the bomb dropped on Hiroshima. Not only did it open a mile-wide crater on the lagoon floor and vaporize one small island and part of another, but it also sent a plume of deadly radioactive debris drifting across the atoll.

To this day the soil on Bikini contains too much radioactive cesium to permit the Bikinians, now numbering 2,025, to return from their exile.

My diving buddy Eric Hiner, who works at the Bikini field research station, explored the edge of the crater (left). Filled with pulverized coral and sand, the crater is empty of most marine life. The bottom material is so fine that clams and other invertebrates are unable to take hold. Fortunately this bleak underwater landscape does not tell the full story of Bikini.

The comeback of a reef community

Soon after the first atomic clouds mushroomed into the sky above Bikini Lagoon, scientists went out to test the water. What they found was alarming. Fish and coral showed high doses of radiation. The surviving target vessels were too "hot" for decontamination. Most were towed away and sunk elsewhere in the Pacific.

Given these sinister findings, I wasn't prepared for the wealth of life that greeted me underwater four decades later. A flurry of yellow-finned goatfish (above) flew at me above a reef patch. I wondered if they had seen a diver before. Fish that normally shy away swam right up to me. And Eric found himself shadowed by a snapper that liked swallowing the bubbles he blew, apparently drawn to them because they resembled silvery fish (right).

The lagoon healed itself, says William L. Robison of the Lawrence Livermore National Laboratory in Livermore, California. Director of cleanup research at Bikini, funded by the U. S. Department of Energy, Robison concludes that the daily exchange of lagoon waters with the open ocean has significantly diluted the contamination. "Cesium 137, the main radioactive substance in the fallout, is pretty soluble in water," he said. "Most has gone away. If you go down four to six inches in the sediment, you still find a little cesium, but in the water column there is no radioactive material harmful to fish or divers."

Ever since my first trip to Bikini, part of the recently independent Republic of the Marshall Islands, people have loved to tease me: "Do you glow in the dark, Bill?" I tell them that I glow inside, remembering as I do the exquisite times spent diving in the lagoon. My favorite moment came when the largest school of jacks I have ever seen surrounded me, thousands of silver bodies eclipsing the sun. Eric said all he could see of me was my stream of bubbles rising from a swirling carousel of fish. Nature has won, I remember thinking. The lagoon has survived.

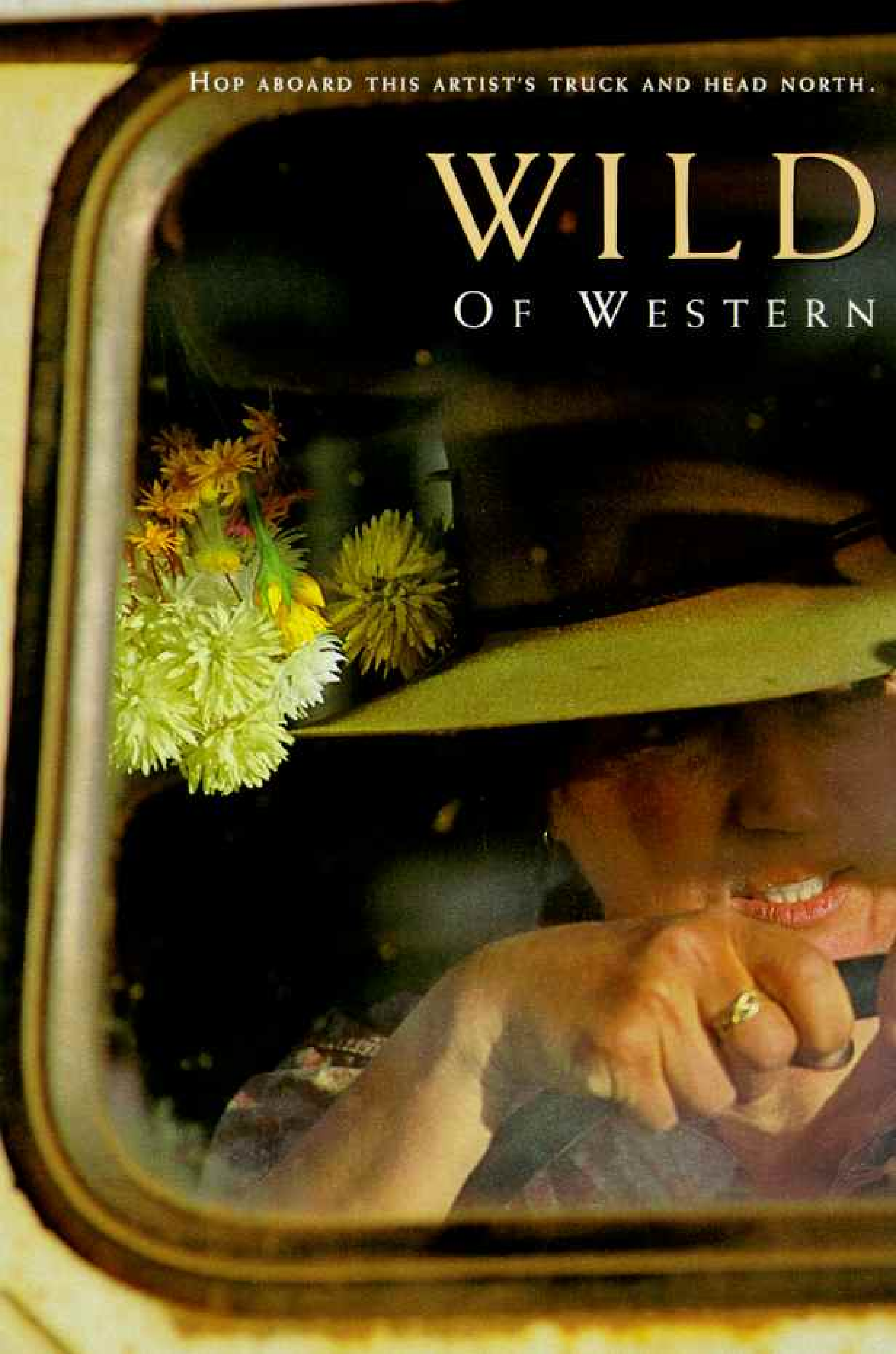
Now I worry about the rogue fishing boats that sneak into far parts of the atoll. Fishing is forbidden without permission from the far-removed Bikinians. Unfortunately, lack of resources makes enforcement—by the Marshallese government—nearly impossible. How ironic that without much effort a fishing fleet could destroy what years of nuclear weapons testing could not.

Creature of terrible beauty, a gray reef shark glides through its domain, carrying a remora for what promises to be an eventful ride. By their abundance these sharks tell me that I have come to a healthy wilderness. Rightfully they rule the reefs. □

HOP ABOARD THIS ARTIST'S TRUCK AND HEAD NORTH.

WILD

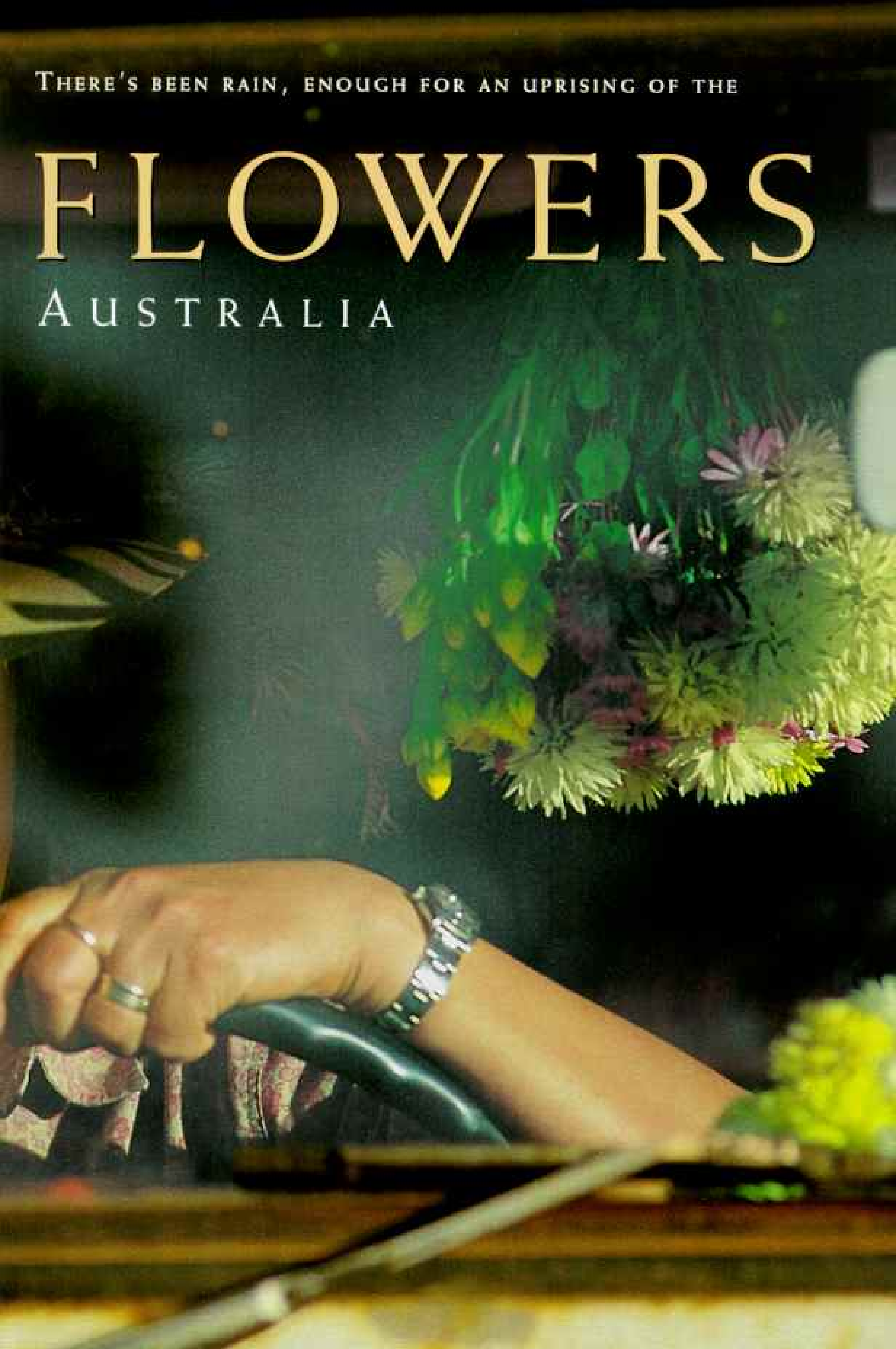
OF WESTERN



THERE'S BEEN RAIN, ENOUGH FOR AN UPRISING OF THE

FLOWERS

AUSTRALIA



TEXT AND PHOTOGRAPHS BY CARY WOLINSKY

"Beaut!" Philippa Nikulinsky breaks a long silence and grinds her battered truck to a halt, allowing a tornado of yellow dust to catch up and engulf us. Philippa, a botanical artist, is making her annual pilgrimage to visit "old friends." A dozen of them, perfect wreath flowers (below), are strewn along the road as if they had bounced from the back of a florist's van. Farther on, a startling pink pigface (right) nestles in a stony pinnacle. It is August—late winter—and one of the planet's most extravagant wildflower shows has begun. Over the next three months most of Western Australia's 12,000 species of wildflowers will burst into bloom.

LECHENAULTIA MACRANTHA, 8 TO 16 IN ACROSS (ABOVE);
CARPOBROTUS VIRESCENS, 8 IN ACROSS

When Australia and Antarctica separated 50 million years ago, rain forests covered the land. As Australia drifted north and the climate grew more arid, leaching and erosion left patchy soils. Isolation and adaptation to new conditions produced new varieties of plants, such as the more than 95 species of *Dryandra* (top). To lure pollinators, grass trees send flower spikes skyward (left). For green algae (below, under a non-native grass) adaptation means going dormant until rains revive them.

ANTHOCERINOPSIDA SP., 3 TO 5 FT. (1 TO 1.5 M) TALL; *DRYANDRA SESSILIS*, 1 IN. (2 CM); GRASS, *LAMARCKIA AUREA*, FLOWER SPIKE 2 IN.

"No good!" Kalgoorlie artist Mary Mclean scowls as she tastes a blossom, hoping to find one sweet with nectar. Aborigines long made a sweet drink by soaking nectar-laden flowers in water. When explorer Ludwig Leichhardt crossed Australia in the mid-19th century, he relied on food from Aborigine camps. He found bark bowls "full of honey water, from one of which I took a hearty draught, and left a brass button."

Feasting with her eyes, a member of a Tokyo flower club (below) stalks wildflowers in their natural habitat. Wool growers, hurt by low prices, solicit tourists to pick flowers on their land. Dormant in summer heat that bakes the ground to 140°F, the *Borya*, or resurrection plant (following pages), blossoms for a few weeks if Warrdagga, the huge granite outcrop to which it clings, has been blessed by winter rain.

CARY WOLINSKY, a frequent contributor who lives in rural Massachusetts, got hooked on Australian wildflowers when photographing Perth for the May 1982 issue.

HAKEA ROCCELENTA (LEFT); WHITE PLUME GREVILLEA, CONOSPERMUM INCURVUM; YELLOW CLAW FEATHER FLOWER, VERTICORDIA WOODII; AND PINK FEATHER FLOWER, *V. CHRYSTELLA* (ABOVE); *BORYA SPHAEROCEPHALA* PLANTS, EACH 6 TO 12 IN ACROSS (FOLLOWING PAGES)

Named for Sir Joseph Banks, who collected the first specimens at Botany Bay in 1770 while on the Cook expedition, the genus *Banksia* includes plants ranging from low shrubs to 90-foot trees. Ensconced like candles on coastal cliffs, *Banksia praemorsa* (left) thrives on icy, wet winds that blast the south shore, yet it readily succumbs to *Phytophthora*, a fungus that has become epidemic.

FLOWER SPIKES 8 TO 10 IN. HIGH (LEFT) AND 5 IN. HIGH (ABOVE); FOLLICLES SLIM TO 1 IN. ACROSS

Several species are now threatened with extinction by the blight. *Banksia menziesii* (left) sheds its mane of blossoms to reveal a cone of velvety bracts. Swelling seed follicles later push the bracts apart. As with most of Western Australia's 61 species of *Banksia*, the follicles of *B. incana* (above) may endure for years before fire splits them at the seams and they drop their seeds.

Fire—essential to many Australian wildflowers—reduces competition, opens seedpods, triggers germination, and provides nutrient-rich ash. A blaze set deliberately to provide a firebreak (right) leaves a charred landscape (below). Across it ambles a lizard called a mountain devil, looking like a cross between a hand grenade and a seedpod. Behind this six-inch-long, ant-eating monster, cones of *Banksia*, cracked open by heat, have released their seeds.

Rustling in the breeze, papery everlastings (following pages) adorn the picnic that bush guide Allan Woodward and Philippa, at right, enjoy with visiting friends. In flower arrangements, everlastings live up to their name. A favorite of grazing kangaroos, the fresh blossoms last only a month in the wild. As Philippa says, "When they go, they're completely gone, and the ground will be just parched until next year."

LIZARD, ROSLYN ROBINSON EVERLASTINGS, CERATOPTERIDIUM DRUMMONDII (FOLLOWING PAGES)

"Nobody knows how many there are," eminent botanist Alex George parries when pressed to number the species represented in the wildflower population. "In Western Australia's nearly million square miles, new ones are being discovered all the time. Four new species of feather flowers (right) were recognized last season, bringing their total to a neat hundred."

BRACHYCOME SP., 0.5 IN ACROSS (LEFT); VERTICORDIA EXALATA, 0.2 IN ACROSS (TOP); CALYTRIX ENEABBENSIS, 0.6 IN ACROSS

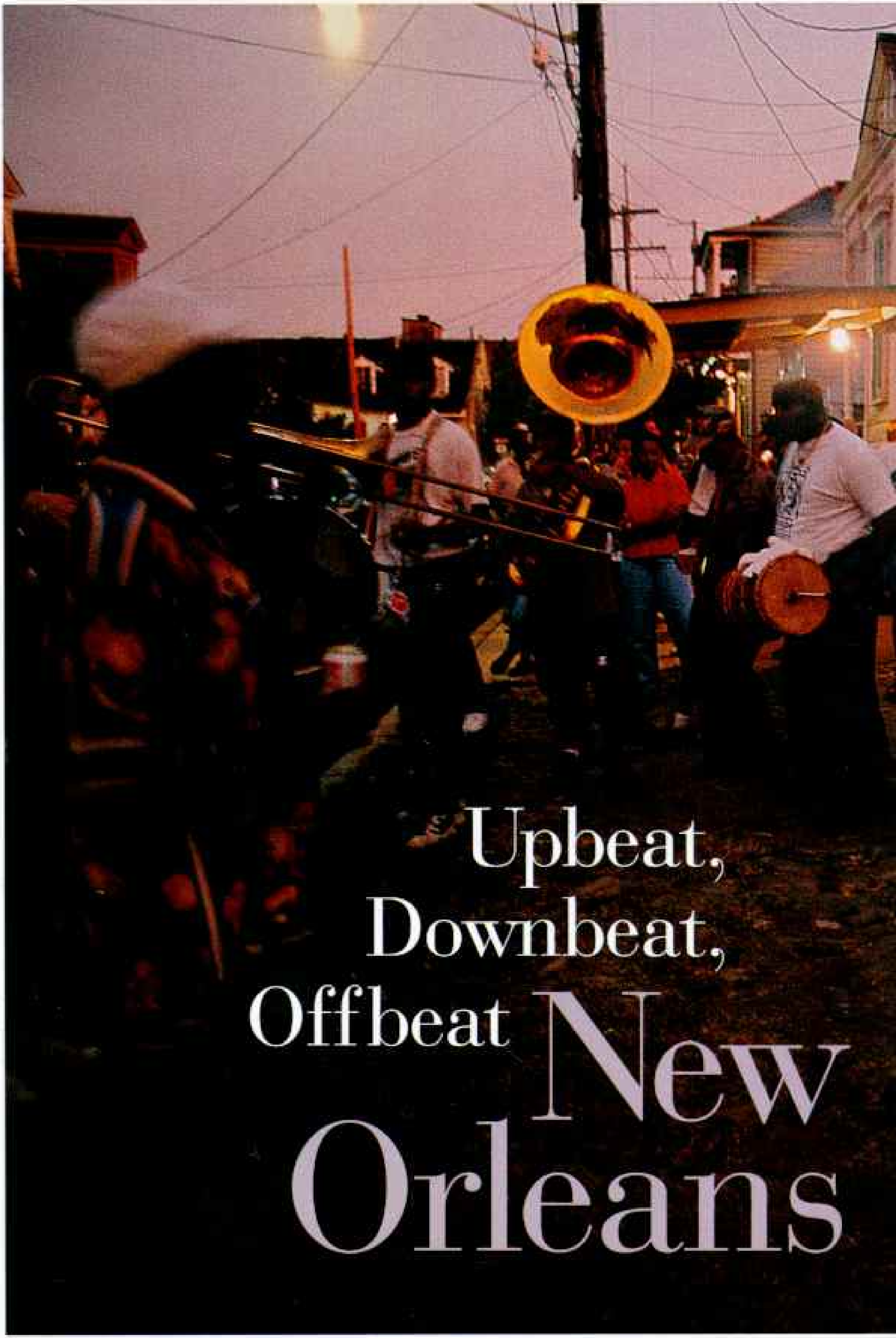
Native daisies (opposite) belong to a large, cosmopolitan family and look familiar. Yet many of the 800 known Australian species grow nowhere else in the world.

Some wildflowers grow only in one small area of Western Australia. Exclusive to 25 square miles around the town of Eneabba, *Calytrix eneabbensis* (left) glistens like an ice palace in the cool morning dew.

With feet like a dinosaur's, a flightless emu tramples a purple velvet fanflower (right). Wildflowers have long since adapted to drought, fire, and the abuse of kangaroos and emus. Since the early 1800s, however, land clearing for agriculture has stripped extensive bush areas. Even today many farmers consider wildflowers a fire hazard and rarely spare even a patch of native grass trees, unlike a grower who left some in his rapeseed crop (below).

Attitudes are changing. Researchers anticipate finding wildflowers of enormous pharmacological value. Picking—permitted only with a state license—is coming under close scrutiny, and cultivated hybrids are helping meet the growing export demand. Philippa Nikulinsky and other artists and botanists have shown what a treasure Western Australia's wildflowers are. So now Philippa's old friends have a mob of new ones. □

KINGIA AUSTRALIS, 6 TO 12 FT (ABOVE); PURPLE FANFLOWER, SCAEVOLA PHLEBOPETALA, PLANT 1 TO 3 IN ACRES, AND CONOSTYLIS CANDICANS, FLOWER CLUSTER 1 TO 6 ACRES

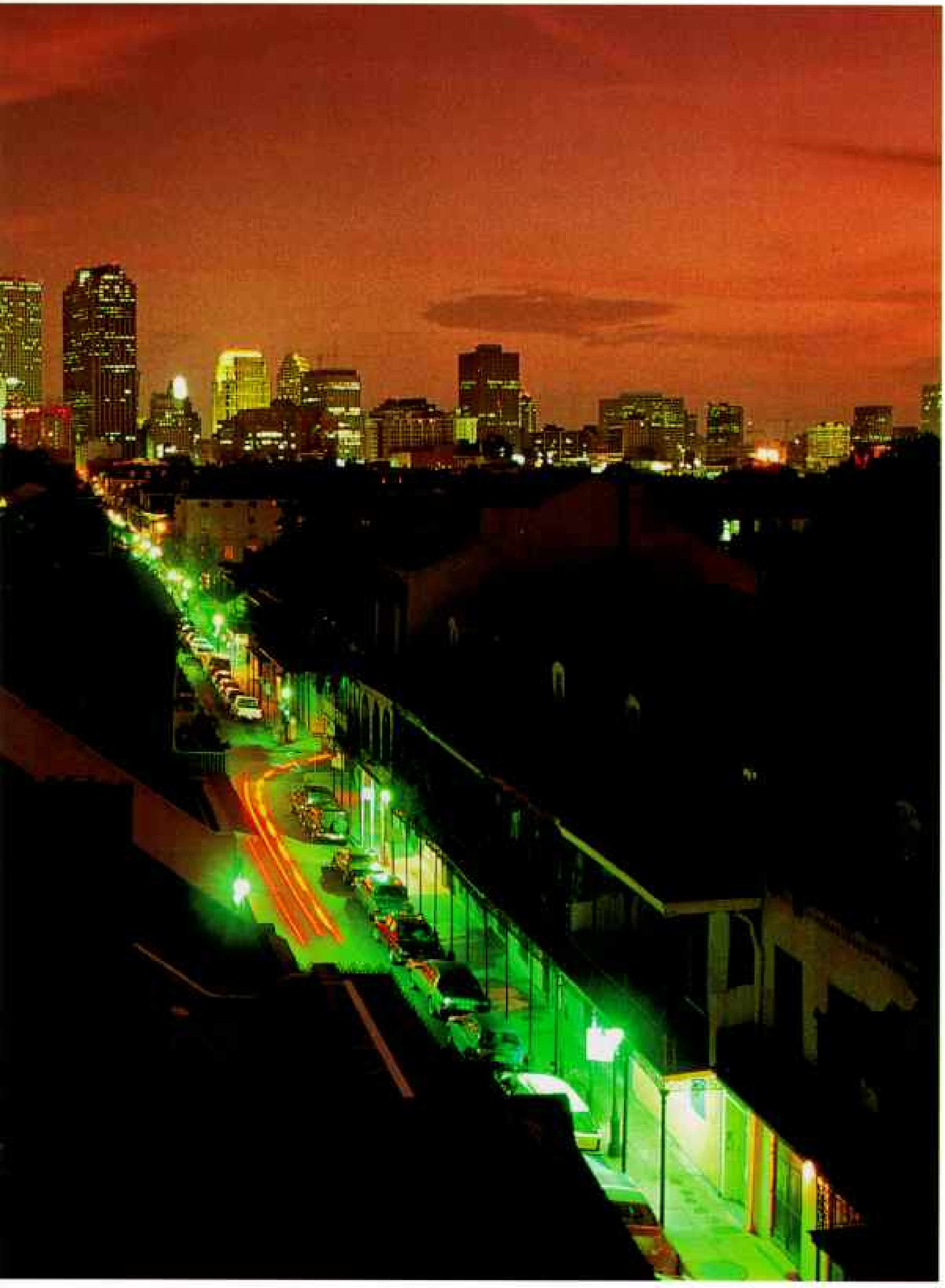

Upbeat,
Downbeat,
Offbeat New
Orleans

In the backstreets where it was born, the exuberant sounds of New Orleans jazz are kept fresh by neighborhood brass bands. Sustained by their music, residents of the Big Easy beat back the blues, even through hard times.

By PRIIT VESILIND NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by BOB SACHA

RAMPARTS OF GLASS AND STEEL beyond Canal Street turn square shoulders to dusky courtyards and gaudy lanes of the historic French Quarter. The skyline bulked up during an oil-and-gas boom that crashed ten years



ago. The Quarter trades in goods it has refined for centuries: music, celebration, intimacy, and excess. Those commodities coax visitors to part with inhibitions—and currency—to the benefit of a needy New Orleans.

"IT'S MORE FUN FOR US than for the customers," says Jamie Shannon of the sought-after "chef's table," where he and his cooks serve up an haute Creole cuisine prepared under the delighted eyes of special patrons. Shannon inherited his kitchen at Commander's Palace from such famous cooks as Paul Prudhomme.

NEW ORLEANS reclaimed a soul when artist Jerry Walters came here ten years ago.

"On the first day, I was standing by the river, and I heard a clarinet playing," he tells me. "I took a deep breath, started to cry, and said, 'I'm home.' "

I don't live in New Orleans, but I have also heard the clarinet.

The city does that to you. It lulls you with the sweet sense of belonging, confronts you with the fact that life is played but once—why waste it somewhere else? It offers tolerance and, in the end, absolution.

The Big Easy, they call it—a city of tribal rites, music, and myth, a city "obsessed with facade maintenance," as Matt Anderson, a local photographer, likes to say. A city whose citizens line up to praise its virtues as guilelessly as witnesses at a tent revival.

"In the North the cities look so . . . put upon," says Mary Lou Ochsner, who married into a prominent New Orleans family. "They haven't laughed in a while. In New Orleans, everybody has a joke, or someplace to go."

Yet the past ten years have been anything but easy for New Orleanians. Crime has gutted their neighborhoods. Politics has soured their beloved Mardi Gras. And now, after years of economic hardship, gambling casinos and their operators have arrived, welcomed by City Hall as saviors, shunned by traditionalists as aliens from backward planets.

I came here to see if New Orleans had held on to its soul.

By the mouth of the Mississippi River, New Orleans grew on the edge of the American mainstream. Even the hard rock of the continent ends well upriver; southern Louisiana is merely the runoff, a residue of silt from 31 states and parts of two Canadian provinces, perched on the Gulf of Mexico like a webbed foot (map, page 97).

Much of the city lies below sea level, shielded by thick levees, swept by heavy rains, and flushed out by pumps and canals. Within city limits the 23,000-acre Bayou Sauvage National Wildlife Refuge shelters tens of thousands of migratory waterfowl.

On this warm November day the bayou is filled with coots—awkward, gooselike birds that eat the floating duckweed that has flourished in the summer heat and now covers the

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BOB SACHA, a freelance photographer who grew up in Buffalo, New York, and now lives in Manhattan, admits his addiction to New Orleans. "The music keeps drawing me back. It's a dangerously seductive city."

water like an oil slick, green as bell peppers.

"*Les prairie poulets,*" Joe Madere calls the coots. "Prairie chickens. They are stupid birds." Joe's a 68-year-old refuge guide with a crew cut and a backyard where the duckweed crawls right up into the grass. We are out in his canoe, on the bayou.

"Sometimes they eat so much they can't take off," he says, paddling hard toward the feeding coots. They scatter, churning their lobed feet in the tea-colored water, a sound like warm applause. Thank you, thank you.

Along a narrow channel of the bayou the air is silky above the murk where alligators lounge, and water striders scat across the duckweed as if it were solid ground, part of the New Orleans illusion of permanence.

REALITY IS THE RIVER, redolent of creosote and catfish, muddy with midwestern topsoil and silt from the dredges that clear docksides for merchant shipping: coffee coming from Brazil, steel from Japan, aluminum from Russia; Illinois corn heading for Somalia.

But cargo of a different stripe leaves from Poydras Street Wharf on the sultry, windy morning of February 10, 1994, as city fathers christen New Orleans's first floating casino on the Mississippi. The Reverend James C.

POLING HIS bateau through a carpet of duckweed, a guide crosses the new Bayou Sauvage National Wildlife Refuge—haven for migrant birds, alligators, and wild hogs. Largest of its kind in any U. S. city, the 23,000-acre wetland offers a glimpse of what confronted New Orleans's first settlers. Today pumps, canals, and levees keep the largely below-sea-level city dry.

Carter offers prayer, thanking God for "the ability to play: a virtue with which you have blessed the city."

A steam whistle bellows, and Hilton Hotels' *Queen of New Orleans* pushes off. Cocktail ice tinkles. Slot machines honk and wail like demented pipe organs. I pull the lever of the 25-cent slot: two double bars and one single. Good-bye, quarter, but *laissez les bons temps rouler*—let the good times roll.

Twenty years ago New Orleans boomed with oil-and-gas exploration, but that bubble burst in the mid-1980s. Hoping to revive the economy, the state legislature approved 15 riverboat casinos in 1991 and one land-based casino in 1992.

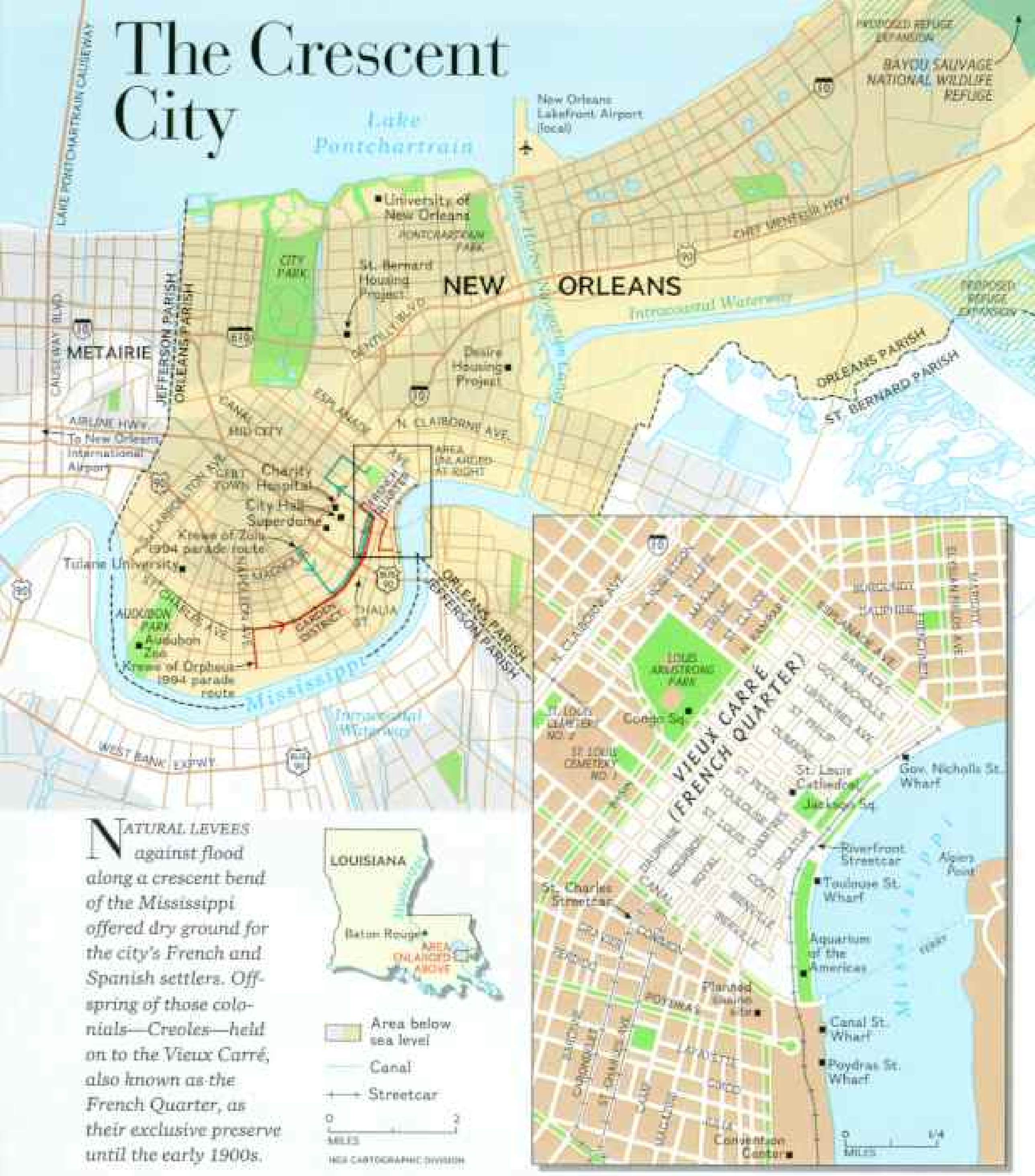
The right to build the land-based casino—the world's largest—went to a consortium: Christopher Hemmeter, an outside developer; Harrah's Casinos; and a group of local investors. In its pact with the gambling devil, the city and state hope to create 20,000 jobs and harvest at least 130 million dollars a year in revenues when the casino opens in 1996.

But cultural guardians complain that gambling on the edge of the historic district—the French Quarter, also called Vieux Carré—will erode the character of the city. And they wince at the gastric mix of quick money and officials with their palms extended.

Peggy Wilson, then the only Republican on the city council, is just plain insulted. "Christopher Hemmeter comes in from Hawaii and talks about how we need a 'signature piece' for the city. He said, 'You all don't have anything here, and I'm going to bring you something.' The nerve! The nerve! Christopher Hemmeter was the quintessential Music Man who came to town to bring River City a brass band."

But well-paying gambling jobs lured New Orleanians from banks, retail jobs, hospitals, police forces. Optimism spread, and moral objections were few; a Roman Catholic church group booked the *Queen*'s first charter trip.

Duncan McKenzie, president of Hilton Riverboats, came here from Nevada, and he too has heard the clarinet. "I grew up in Detroit," he tells me. "When the auto industry folded there, we left. But when gas and oil left New Orleans, most everybody stayed. They've

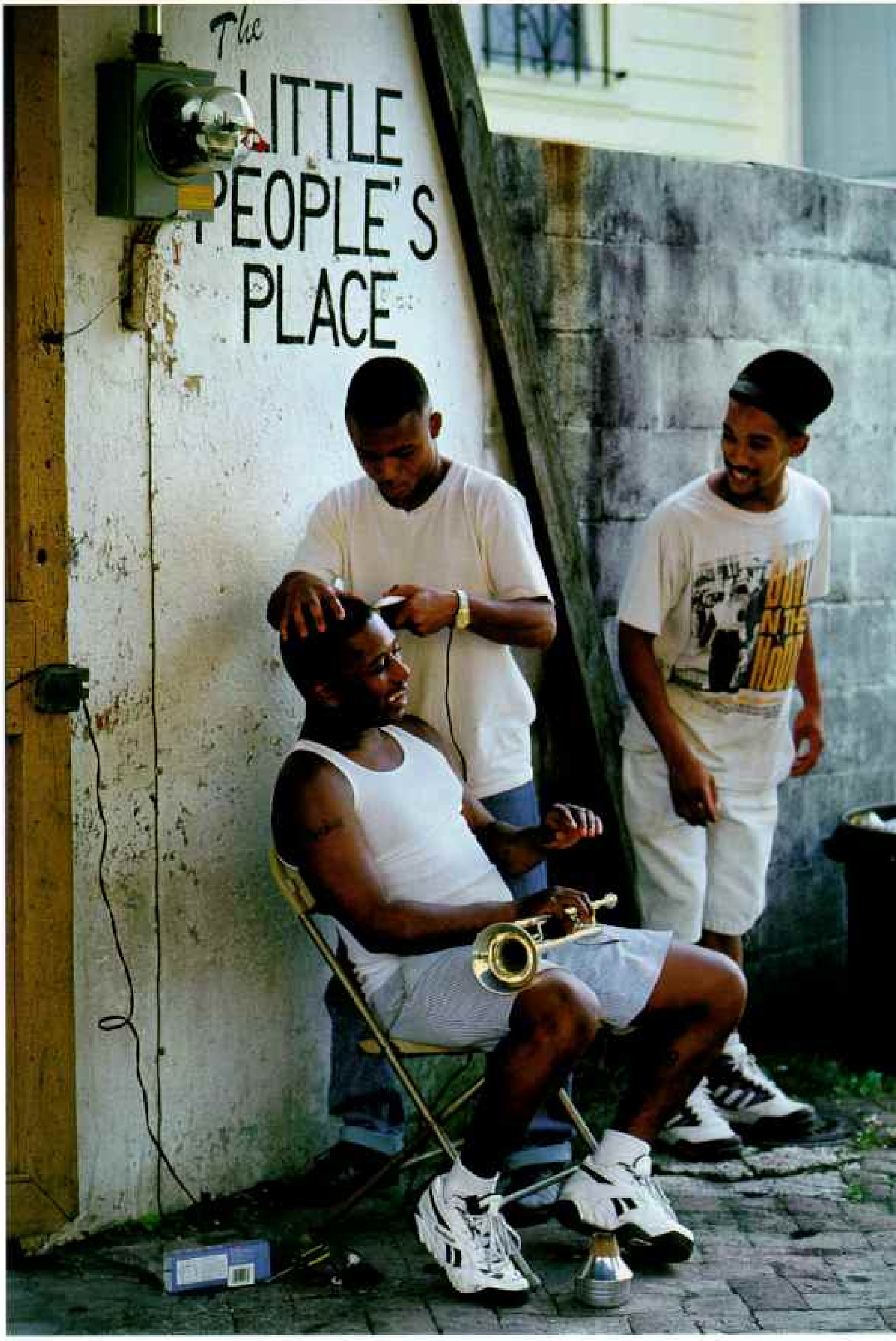


NATURAL LEVEES against flood along a crescent bend of the Mississippi offered dry ground for the city's French and Spanish settlers. Offspring of those colonials—Creoles—held on to the Vieux Carré, also known as the French Quarter, as their exclusive preserve until the early 1900s.

got tradition here. People just don't leave."

Cautions Timothy Ryan, an economist at the University of New Orleans, "Gaming is not going to solve all our economic ills. People will lose interest in four, five years." Tourism, says Ryan, is a major industry, and that still relies on the hurly-burly of New Orleans's unsanitized, authentic neighborhoods: "The French Quarter—you know it's real. It can't be replaced. If you lose it, you lose it."

I SIT IN A SHABBY VINYL CHAIR in the Café du Monde. Powdered sugar from a beignet, a yeasty cousin to the doughnut, dusts my morning *Times-Picayune* newspaper. Rain falls, softly. I sip café au lait, as travel guides suggest. Banana trees, sloppy and insouciant, glisten green against the iron fence across the street on Jackson Square, the center of the hundred-block French Quarter, the original New Orleans.


The
LITTLE
PEOPLE'S
PLACE

"I'M PROUD TO SAY I'm one of the best cooks in New Orleans," boasts jazz trumpeter Kermit Ruffins, who gets a haircut in the neighborhood where Louis Armstrong was born. Though he's performed around the world, Ruffins prefers his hometown, where he often plays and cooks at the same gig. Uptown in her Garden District home, whose restoration has been a lifelong project, Mrs. Frank Strachan, standing, entertains friends. Jefferson Davis, President of the Confederacy, died here in 1889.

Here, in 1718, Jean-Baptiste Le Moyne de Bienville roughed out a clearing to honor the Duke of Orléans, Regent of France, the nation that claimed the Mississippi Valley. With the Louisiana Purchase in 1803, New Orleans arrived into the United States as an eccentric Catholic island of voodoo and Spanish moss, dangling from an Anglo-Saxon Protestant South.

On the sidewalk a cornetist spins out "Basin Street Blues" as casually as he might pick his teeth. Across the square, Ernest Nixon, a shoeshine man, labors by St. Louis Cathedral, a New Orleans signature piece built in 1794. "I do two kinds of shines," Ernest says, "tourist and local." Local's better.

The French Quarter today is a living neighborhood whose residents lean toward smug and whose historical integrity is guarded by the powerful Vieux Carré Commission. The Quarter is Downtown, as distinct from Uptown, the English-speaking New Orleans on the other side of Canal Street. Downtown is better.

With James Farr, an architect who specializes in preservation, I walk under wrought-iron balconies dripping ferns. "People from all over have bought homes here," he says. "It revives their senses. You really smell things—real things being cooked."

Jim takes me to visit Eugenie Schwartz, whose family has lived in the Quarter for three generations. "People take property very, very personally," she says. "That little piece of turf is your blood, sweat, tears, and money."

But businesses have been crowding out homes, and unlicensed bed-and-breakfasts have mushroomed.

"The sharks are circling," says Mrs. Schwartz. "It's the same with every developer. If I hear the word 'viable' again, I'll gag. It's not viable to keep it residential?"

Behind the coolness of her flagstone patio, where hibiscuses bloom, Mrs. Schwartz

shows me where Formosan termites, chewing their way through the French Quarter, have attacked her carriage house.

"This climate is terrible," Mrs. Schwartz says, "fit for nothing! It floods when sycamore trees start seeding and the roof drains clog up with their fuzz." But then she smiles, thinking fondly of the sycamores: "I love the weather. Your gills dry out if you go inland."

STRIP SHOWS, mud wrestling, female impersonators, tourists chugging alcoholic concoctions sold like Slurpees; raw oysters, crawfish pie, and filé gumbo; Dixieland, Cajun, country, zydeco, and rock music palpitating through open windows. Bourbon Street, the French Quarter's entertainment strip, is a soft-core adult Disneyland of forbidden fantasies.

On the corner of St. Peter Street a man stands propping up an eight-foot-tall wooden cross, hustling souls. An electric message runs across its beam: "No fornicators, swindlers . . . [blink] Jesus loves you . . . [blink] but HE HATES your Sin. [blink] Sin . . . [blink] Sin . . . [blink] Sin."

"You got to be *called* to do this," says Dick White, evangelist. "This is a rough business. Four nights a week—right in the middle of hell. But sometimes, people fall to their knees and receive the Lord right here."

Others look for help at the Historic Voodoo Museum and its shop on Dumaine Street, where I ask how I can assure good luck on the new casino boats. "Dried raccoon penis is very popular," I'm told. "You just carry it in your pocket. But, sorry, our stock has run out just now. You can try the brown candles."

Voodoo as a religion was practiced openly in New Orleans by African slaves and their descendants until the 1920s, and some of its rituals survive in local "spiritual" churches. In St. Louis Cemetery No. 1, worshipers still leave chicken bones and other charms on the grave of Marie Laveau, a powerful voodoo priestess. She lies next to Ernest "Dutch" Morial, the city's first black mayor, whose son, Marc, was elected to that post in 1994.

In the corner of the museum shop is an altar where Momma Margaret, a serene woman with a polished pecan-colored face, gives personal gris-gris ceremonies against the malady of your choice. By the counter stands a nervous Cajun man who has just finished.

"What gris-gris did you get?" I whisper.

"Me and my girlfriend have to get together," he answers, and turns back to Momma.

"Will it keep me from anger?" he asks. "Will it keep me from . . . hitting her?"

"Trust me," Momma says.

For my gris-gris Momma takes a pinch of spearmint (for love and healing), bay leaf (for instant memory), chamomile (for calming), and a potion from a jar marked "gambling success." She adds lavender and "love oil" and pours it all into a bright-red velvet bag.

"Before you go to sleep, play with the bag, and concentrate on your inner self," she says. "Don't get upset when you lose. You'll get it back. Trust me."

I carry the gris-gris bag to ward off evil smells along Esplanade Avenue, where I've been living in former slave quarters. Esplanade always smells of dog droppings. People here tend to be gay or too old to have small children. But there are many dogs.

Few tourists wander here. Waiters and musicians stroll to work in tuxedos in the evening when the velvet air is spiced with garlic cooking, and gaslight glows against the overspreading branches of live oaks.

At the corner of Esplanade Avenue and Decatur Street, Ross Hennessey, a fireman, sits outside his station, Creole No. 9, reading. On his biceps is a tattoo of a fireman as a death's head, holding two axes, rising from a torch of flames.

Ross likes working in the Quarter. "You'll never know from the outside of a building what you'll find on the inside," he says. "We got to one house, there's this huge, naked voodoo queen in a chair, surrounded by about 400 candles burned down to the floor. She's passed out, and the floor is smoking. 'You pull her out,' I said to my buddy.

" 'No! *You* pull her out!'

" 'Flip you for it.'

"Took two of us to get her out of there."

Hennessey says he'd never leave New Orleans. "You can't eat anyplace else," he reasons. "Florida's got beautiful seafood, but they have no idea what to do with it. You can't even eat red beans and rice outside the city."

"Why?"

"We're below sea level. You can only cook it in low altitudes. It doesn't have that creaminess at higher elevations."

Here successful chefs—Paul Prudhomme, Emeril Lagasse, Susan Spicer, Jamie Shannon—are household names, admired like

ON THE OLDEST WORKING TROLLEY LINE in the world, streetcars with reversible wooden seats still trundle through corridors of great oaks on St. Charles Avenue, home to Tulane University. Long discontinued are the streetcars named Desire, so called for a street with tenements made legendary by playwright Tennessee Williams. Desire today is a drug-infested, crime-ridden housing project.

symphony conductors. The best of them have used both Creole, the city food based on sauces, and Cajun, the hearty country food of étouffées and jambalaya.

On a Sunday afternoon at Marda Burton's apartment on Royal Street, writers, antique dealers, and whatever visiting celebrity the divine Marda has snagged, gather for a literary salon. We drink champagne on the balcony, as a piano and a washtub bass play ragtime.

Just down the block from where William Faulkner wrote his first novel, *Soldier's Pay*, minutes from where Tennessee Williams wrote *A Streetcar Named Desire*, a distinguished man named Bill Gershuny reads from his new book—a cookbook. Amanda Newberry, an actress, helps him dramatize the recipe for peach Melba. "One angel food cake. No-o-o-o-o-o fat!" she croons. "One can of peach halves—we-e-e-ll drained!"

A line of diners stretches halfway down the block for Friday lunch at Galatoire's on Bourbon Street, even though it's raining. Reservations are not accepted, but I have come with Mrs. Sue Hyams, a widow whose family tree grew in the right New Orleans forest. Despite my misgivings, the doorman hustles us over to a table.

Inside is a brightly lit, astonishingly noisy single room, already warm with wine and intimacy, filled with New Orleans's elegantly rowdy white upper class—lawyers and account executives, artists and heiresses, a fraternity of young stockbrokers from Merrill Lynch and their spiffy wives.

We eat nut-sweet, succulent trout meunière and deep-fried eggplant sticks covered with powdered sugar. Beside us a young man with a cellular phone lights a too conspicuous cigar. Behind the entrance door, the next in line peer in wistfully from the sidewalk.

After lunch a woman confronts us in the parking garage: "You're the party that just came through the front door and got a table," she says. She stares.

"I go there twice a week, dear," answers Mrs. Hyams, *(Continued on page 108)*

The Many Faces of Mardi Gras

***FAT TUESDAY** in English, Mardi Gras in French, the last day of Carnival in New Orleans ends a season of revelry with celebrations as diverse as the city's people. Most traditional, dating from the 1740s, are the great bal masqués inspired by classical themes. Dressing as a muse from the Divine Comedy, Eva Maier gets help from sister muse Marcella Baxter.*

Earthlier fun fills the French Quarter, where rowdy out-of-towners all seem to end up on Bourbon Street. Uniting in a libidinous sea of flesh, they wring the last drop of abandon from their drinkfest—until midnight, when police move in to empty the street.


ONE
WAY

PREPARING for a day of ritual aggression, Mardi Gras "Indians" rehearse in a bar. Claiming spiritual kinship with the Native Americans who gave refuge to runaway slaves, several such "tribes" stalk and confront one another on Mardi Gras day with displays of dancing, chanting, and "masking," or parading in costume. Veteran masker Howard Miller sews his costume year-round. "I've been through every color twice," he says. "It was time again for pink."

Inside the Convention Center, terminus for a stream of paraders, revelers chase the floats, begging for beads and other favors tossed in profusion. One celebrator catches a stuffed frog. Much of the city's black middle class shows up here for the Zulu ball, where the year's crop of debutantes make spectacular entrances.

(Continued from page 101) gently. "I have kept them alive in the bad years."

"No, no, that's OK," protests the woman. She clutches Mrs. Hyams's arm. "I've lived here all my life, and I can't get a table like you did. I've heard Richard Nixon was here, and Galatoire's wouldn't let *him* right in."

Sue Hyams lives on the tattered edge of the Garden District, a virtual catalog of historic homes. She serves drinks in silver cups. The family history is framed in the hallway: weddings, balls, banquets.

"I'm here by myself now," she tells me. "My black people have all left. I came home one day, and my one remaining girl was sitting on the steps, crying."

The house had been robbed.

Her friends talked her into putting iron bars on her windows. "When I got them, I couldn't sleep at all," she says. "I couldn't breathe. Well, of *course* I could breathe, but I hated it."

Many old-line families have made the jump to suburban Metairie or to the other side of Lake Pontchartrain, but most have stayed in town—in the Garden District, in the magnificent homes around Tulane University and Audubon Park, and on St. Charles Avenue. Until the oil-and-gas boom brought in another hierarchy, New Orleans society was a closed and cozy corporation. It was built around the proper parochial school, a preferred college such as Tulane, and men's private luncheon clubs like Boston and Pickwick.

"Living here has been like living in a tribal myth," says C. L. Pierson, a young artist who now lives in the suburbs in her great-grandfather's old house, where, she says, a rogue white cockatoo keeps attacking the shutters, trying to nest behind them.

"So many of our myths are being shattered," she adds, "but it's not death we fear, it's loss of memory—our traditions. There's a threat to them now like never before."

THE CITY'S POPULATION had shifted to a black majority by 1980, and City Hall is indifferent to the social presumptions and hostile to the prejudices of the old ruling class. Private clubs are under fire for discrimination.

In the early 1800s, slaves marched each Sunday to a public plaza known as Congo Square, where their West African drumming and dancing grew so intense that it both thrilled and frightened whites. Fugitive slaves, called Maroons, lived for generations among the Choctaw Indians in the swamps.

Today a network of some 20 flamboyant black "Indian gangs," with names like Wild Tchoupitoulas, Yellow Pocahontas, and Creole Wild West, preserves these ties. Each gang chief "masks" in an elaborate quasi-Indian costume of beads, rhinestones, and ostrich feathers that he has spent the entire year sewing. On Mardi Gras morning the gangs roam neighborhood streets and confront one another in ritual displays of pride and power. They meet like coveys of strutting peacocks, drumming and chanting, the chiefs displaying plumage and posturing—each gang declaring its leader "prettier."

"The Indians showed us how to survive in this land," says Howard Miller, chief of the Creole Wild West. "They had medicine men, chiefs, even spears like we had in West Africa. That allowed us to portray them and to be ourselves at the same time. The neighborhoods are our tribes now; we're still in the culture."

On Sunday nights before Mardi Gras, Creole Wild West practices its chants at a neighborhood bar known as Pop's Place. Amid the hypnotic energy of drums and tambourines—a raw rhythm that seems pre-soul, pre-jazz—the leader shouts a verse, and the gang responds with, "Hold 'em, Joe!" or "Shoo, fly, don't bother me!" Ritual dancers thrash, arms flailing. Boys dressed in suits, brought here by their fathers, watch with shining eyes.

"Somebody's gotta sew, sew, sew!" they sing. "Somebody's gotta sew, sew, sew!"

More Uptown gangs arrive for formal visits. I hear their drumming at the door, as if from a distant forest. But when a gang from the other side of town shows up, its young chief misses a crucial signal from Howard. The crowd tenses, the drums stop. Bodies hurl across the dark room. Fists fly. I leap onto a chair, feeling foolish. The skirmish lurches toward the door, then dissipates into the night.

The visiting chief should have silenced his drummers when Howard shouted "countefay" and hit hard on his tambourine. He did not, and Creole lieutenants took it as an insult.

"My gang looks up to me," Howard tells me later. "These are *my* people. Not everybody's gonna be an Indian, but the community rallies around the one they think *can* do it. They think, 'Through him, I'll live!' "

Jazz was born on the streets of New Orleans and played first by blacks and immigrants,

IN THE BLOODIED STREETS of a town so gun-happy that military medics come here for special trauma training, a shooting victim receives aid from paramedic Jacob Oberman, at left, and Jeffrey St. Clair, M.D., of Charity Hospital. Police suspect the assault was narcotics related. Caught in the cross fire of a relentless drug war, the hospital absorbs much of the price of the city's rising street violence.

notably Sicilian. They picked up military instruments left at pawnshops after the Civil War and turned European brass-band music into something hipper, adding the rhythms of Congo Square.

Such legendary trumpeters as Buddy Bolden popularized jazz funerals and street processions, and King Oliver and Louis Armstrong took the New Orleans sound to Chicago and beyond. Piano wizards like Jelly Roll Morton banged out ragtime in the city's famed Storyville bordello district around the turn of the century, and Fats Domino turned 1950s pop upside down with rhythm and blues. Today crooner Harry Connick, Jr., son of Harry, Sr., who is the district attorney of New Orleans, attracts an international audience.

Connick, Sr., also has a nightclub act—at Maxwell's Toulouse Cabaret. "Some people play golf or go scuba diving for relaxation," the D.A. tells me. "I sing. I don't see it as a problem. I would hate to see Janet Reno get off work and go down to a local nightclub for a few hours of torch singing, but. . . ."

Music and celebration seem nonstop. Spring brings the New Orleans Jazz and Heritage Festival, where such locals as the Neville Brothers are joined by 4,000 of the finest jazz, blues, and gospel music makers in the world for a ten-day celebration of food and sound.

Summer is a steamy, hide-your-head thing, but in fall the second-line parade season begins, the annual celebrations of the Social Aid and Pleasure Clubs of working-class black neighborhoods. Members strut in front (the first line). A brass band follows, blowing Dixieland, and a happy mob (the second line) dances with them, down miles of city streets.

On this Sunday morning members of the Avenue Steppers Marching Club wear olive green shirts and beige hats. Their queen and court are propped up in convertibles, all glitter and perfume. The sousaphone starts the music with a syncopated rhythm that lures in other instruments. And so they move down Thalia Street, followed by a half-stoned, half-drunk, comically lewd second line, moving fast and fierce, and dangerous as bubbling lava.

GUNS APPEAR in a defiant salute for a slain comrade in his Gert Town neighborhood during a venerated New Orleans tradition, the jazz funeral. Third poorest city in the nation, after Detroit and Laredo, New

Orleans endures more than a murder a day, many of them in "the projects." Said one longtime resident of kids in these neighborhoods: "They don't even go to high school. They go straight to dope."

I lurch along, gettin' down, singing, "Your mamma don't dance, and your daddy don't rock 'n' roll!"

"Hey, white boy," I hear behind me. "If you're gonna dance, do it right, shake your booty, not your hands!" A skinny, short-haired woman moves behind me, patting me with every step: "Shake your booty, not your hands!" Others pick it up, yelling, "White! White! Shake your booty, not your hands!"

My booty takes on new life as we boogie past the shacks and boarded storefronts to Magnolia Street. And at the end of the line the brass band reaches for transcendence, toward a raucous, sweaty, and delicious crescendo.

"That's the release! The release!" says a voice beside me, an older man in a discreet fedora. "That's the . . . oomph!"

"THE BLACK IS ALWAYS TUGGING at the white," says Sally Reeves, the state archivist for New Orleans. "They're saying, 'Come here and see!' Black street life is the siren call to the fun life. Culture draws us together. We haven't had a race riot in this community since 1900."

Much of New Orleans was built around plantations, and the slave compounds of many mansions eventually coalesced into black communities. The city is still laid out in a black-and-white checkerboard. While there still is peaceful coexistence, drugs are now making war zones of black neighborhoods, and the structure is coming unglued.

"I was mugged the year I was King of Carnival, 1990," says Dr. John Ochsner, a heart surgeon. "I was in a tuxedo, walking the dog, and two guys came up. I wasn't scared—I was angry, and disappointed."

I drive through the public-housing project named Desire in Sgt. John Bryson's squad car, through what seems like a small city of brick buildings, as plain as Monopoly hotels, many boarded. A group of toughs in front of us suddenly dissolves, five dudes studiously uninvolved with one another.

"There's a drug deal gone down," says Bryson. "But I'm not going to endanger your life by getting out." He heads a special team of police assigned to the projects, built as "garden apartments" in the 1950s but now stripped as if a fearsome hurricane had blasted through. "Desire's a monster, and now this monster has new teeth: crack cocaine."

At another project, St. Bernard, the sergeant shows me where tall iron fences have been installed to cut off foot traffic and escape routes for dealers. "We've taken this territory back," he says, sounding like an occupying general. "Now back here," and we walk to the other side of the project, "it's wide open."

Three middle-aged men hail us from the sidewalk, ready to complain. Says one, Roley Arnaud, "This place is full of dope-dealing rockheads, all day and all night—and they don't even live here. My mother didn't believe what was going on until she saw it on the news. And then I had to say to my Momma, 'Open the door, this is it, Momma, see what it is.' "

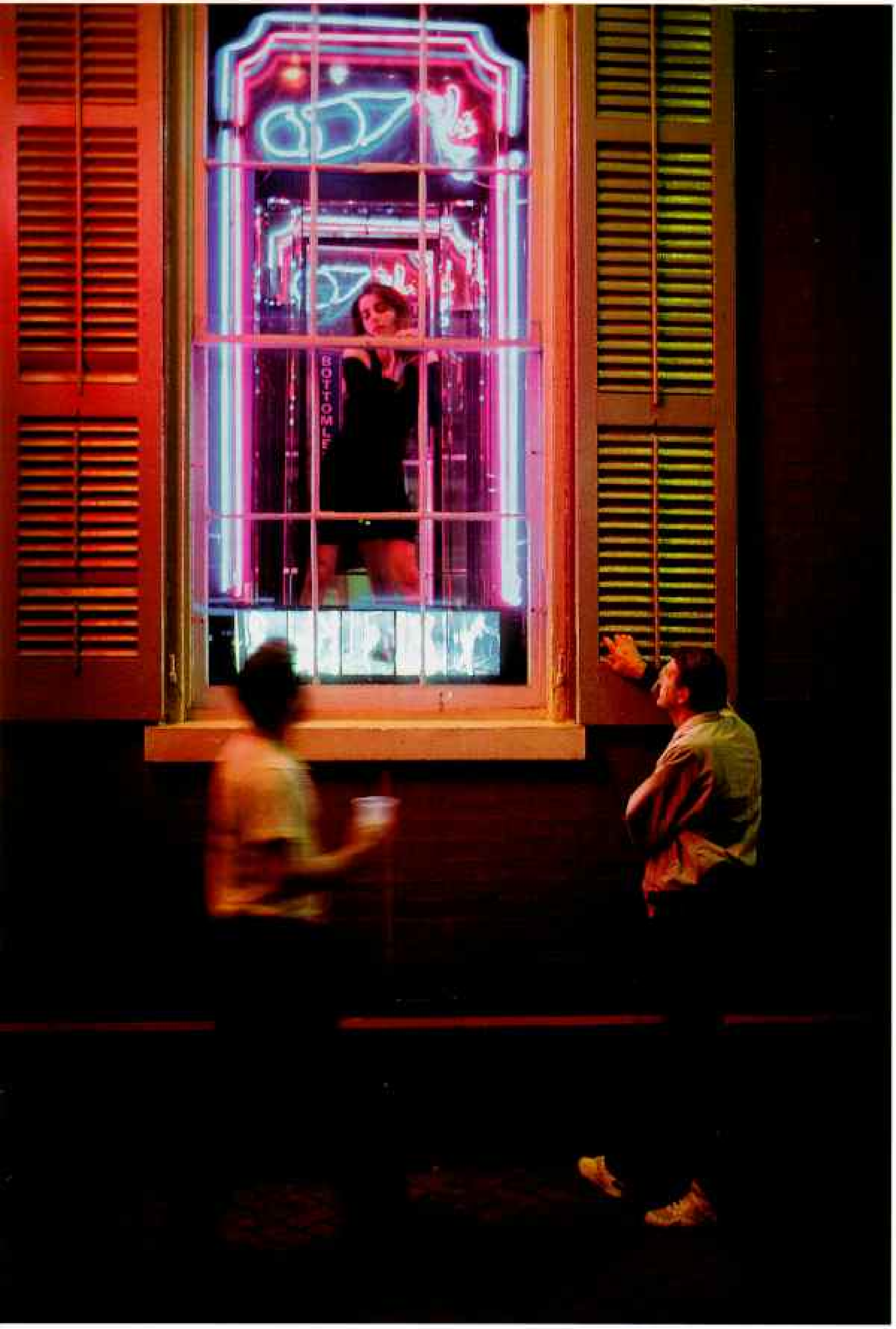
Drug violence has escalated flight to the suburbs; more than 37,000 dwellings sit empty in the city. But in some ways New Orleans remains unchanged. There are few "edge cities" to draw off the population, and no high-rise apartment buildings. Mom-and-pop grocery stores thrive, and neighborhoods are filled with middle-class houses—"Creole cottages" and one-story shotgun houses, so named because you could shoot straight through them and hit every room. Life remains on a manageable, human scale.

The Preservation Resource Center hopes to save neighborhoods by showing people how to purchase and renovate blighted but historically distinguished homes. Patty Gay, the center's director, feels she's fighting a misguided but entrenched federal policy.

"All the programs coming out of HUD really don't help cities at all," she tells me. "They help the *poor* in cities, because they're afraid of gentrification and displacement. The situation horrifies me, because you don't have a city without a middle class.

"But we're sitting on a gold mine in terms of urban heritage and quality of life," she adds. "People still come here despite the economy and the crime. They love our neighborhoods."

ON AN ALL-NIGHT CAROUSE, gawkers on Bourbon Street check out a stripper named Danielle, who advertises for her employers' club. A mixture of jazz and licentiousness, the Big Easy's exuberant heart inspired the words of novelist and hedonist Henry Miller: "At last on this bleak continent the sensual pleasures assume the importance which they deserve."



Some old working-class white neighborhoods are home to the "Yats." Through some linguistic quirk, the Yats talk as if they lived in Brooklyn, perhaps because of the similar combination of immigrants—Irish, Italian, German, Caribbean. "Where y'at?" (Where are you at?) means "How are you?"

Several years ago, in the Mid City neighborhood, a proper young Yat named John Blancher couldn't figure out what to do with his life. He had a strong faith, so he made a pilgrimage to Medjugorje, Bosnia-Herzegovina, where the Virgin Mary is said to appear. "I didn't see an apparition," Blancher tells me, "but I wrote a petition saying, 'Give me something I can do with my whole family.' Three weeks later, someone asked me if I wanted to buy a bowling alley."

Blancher took it as a sign. He bought the Mid City Lanes from the Knights of Columbus, hung up a portrait of Mary, and painted the alley Blessed Mother blue.

Blancher soon turned the lanes into a New Orleans institution—Rock 'n Bowl—a combination bowling alley and nightclub, featuring blues and zydeco bands and 18 lanes of equal-opportunity bowling. Monday night is gay league, Tuesday is yuppies, Wednesday is a cadre of deputy sheriffs, and on Thursday a league of mentally disabled people.

I arrive on Thursday night for zydeco, the rollicking black counterpart to Cajun music, played with an accordion and a *frottoir*, or washboard, worn on the chest and scraped with a spoon. By eight o'clock the disabled bowlers are gone, and a busload of rosy Tulane sorority girls rolls in. By nine, Rockin' Dopsie's zydeco band has set up, bringing in a mixed-race crowd. A brave woman, Evelyn Estes, drags me to the floor for a rousing two-step.

"I had four monks here from Nepal—in their saffron robes," Blancher says. "Wanted to know if they could bowl barefoot. I said, sure! I wanted to put out an ad: 'When people are in search of the truth, go where the Buddhist monks go—to the Rock 'n Bowl.' "

Catholicism is blamed and credited for much of what goes on in New Orleans. A bogus pope, Lionel Alphonso of Chalmette, dresses as the pontiff to incite the crowd at Saints football games at the Superdome. "It started when the pope came to New Orleans," Alphonso tells me. "And now, if I don't wear the costume, the fans get mad."

But Catholicism's greater claim would be Mardi Gras, literally "Fat Tuesday," the holiday before Ash Wednesday, born of the pagan rituals of spring and celebrated in New Orleans with much relish and deep tradition.

MORE THAN PLAYERS are gambling on a New Orleans floating casino, the Queen of New Orleans, whose slot machines buzzed away on its inaugural run last February. Hoping to capitalize further on the city's tourist hordes, the state legislature authorized 15 such vessels, along with an onshore casino, being billed as the world's largest. There should be no shortage of high rollers. Of eight million visitors last year, 1.5 million were conventioneers like these meeting in the Aquarium of the Americas.

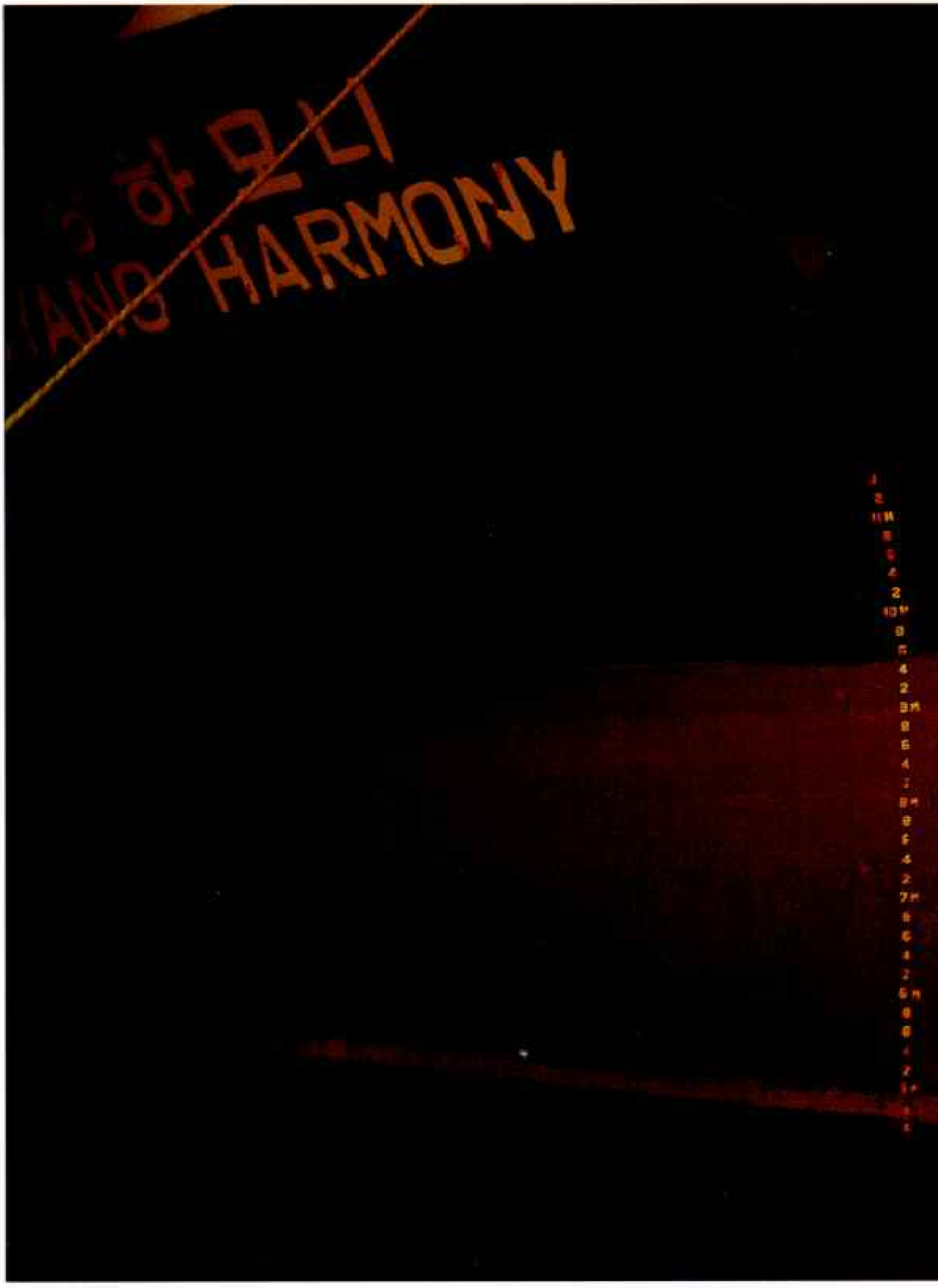
Carnival season, culminating on Mardi Gras, starts on Twelfth Night, January 6, and dominates New Orleans for weeks. It draws 300,000 visitors and offers more than 60 elaborate parades with floats and marching bands, each financed by dues-paying private krewes, or clubs. Crowds line parade routes, shouting, "Throw me something, mister!" Masked krewe members toss strings of beads, aluminum doubloons, plastic cups, and other favors from the floats. Families prop children up on special ladders and eat Popeye's fried chicken. And for the city, Carnival now generates more than half a billion dollars in spending and nearly 11 million dollars in revenues.

A dozen older krewes stage *bal masqués* with debutantes and mythical themes, and the *Times-Picayune* is thick with photographs of kings, queens, courts, and breathless descriptions of their tableau rituals. But their old-line traditions of secrecy and privacy have been challenged by the city, which ruled in 1992 that private clubs must open membership to minorities or they may not use city services, like streets. In protest, the oldest, most establishment white krewes—Comus, Momus, and Proteus—have canceled their parades.

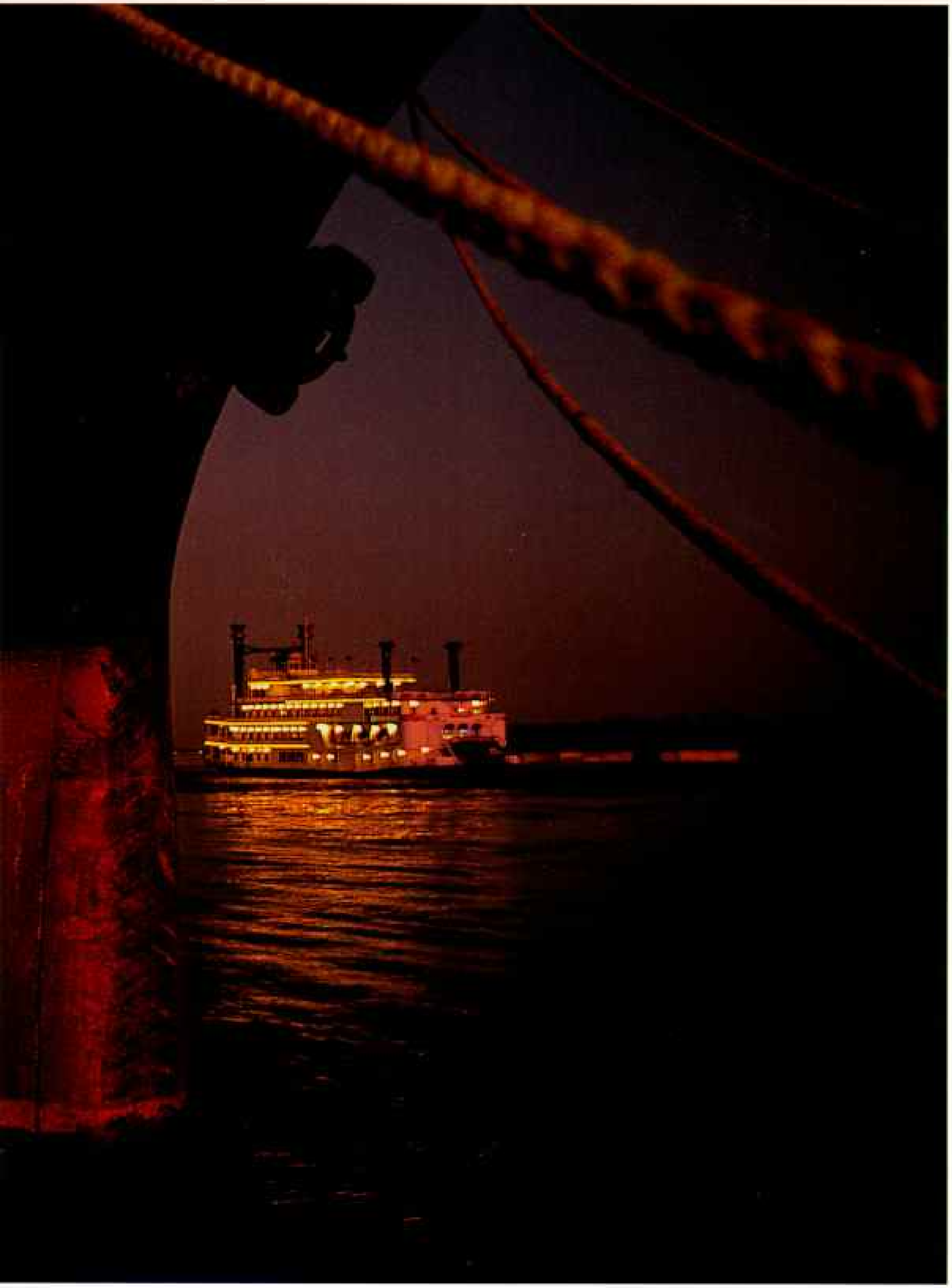
Outraged purists see a meddlesome public hand destroying what it does not understand.

George Schmidt, artist, self-styled elitist, and a founder of the retro-1920s New Leviathan Oriental Foxtrot Orchestra, sees no less than the end of Catholic civilization. "The big sneaky thing about New Orleans is that it's being taken over by southern Protestants," he laments. "They have taken the linchpin out of the city's spirit—taken it and destroyed it. Thrown it away! Puritans! The city has lost its identity."

Beau Bassich, director of New Orleans City Park and member of several old-line krewes, doubts they will ever parade again: "Some krewes have waiting lists of 80 to 90 proposals for membership. Many are sons and sons-in-law and friends. There's a handwritten book in one organization that has people's



WORK AND PLAY compete for the waterways of the Port of New Orleans, where huge freighters from around the world still crowd the docks and channel. Once a workboat hauling millions of bales of cotton down



the mighty Mississippi, the paddle-wheel riverboat has been resurrected by the gaming industry. Concerned for passenger safety in the busy waterway, authorities may keep the new gambling boats dockside.

FIDDLES fly and accordions pump at the Swamp Fest in Audubon Zoo, where area Cajuns gather to celebrate their music and food. Of French-Canadian heritage, they—like the Creoles—are a key ingredient in the cultural gumbo that is New Orleans.

daughters listed through 2009, who are looking forward to being in the ball. Now what's going to happen?"

Roy Glapion, Jr., a member of the city council and an officer of Zulu, a black krewe that parades in blackface and grass skirts, says their traditions are just as deep: "There are whites in our organization, but we have a private club, and we reserve the right to exclude people we don't want.

"I have no real sympathy for the Beau Bassiches of the city. Things have changed—and for the better. How many blacks in this town would belong to Comus, even if it were free?"

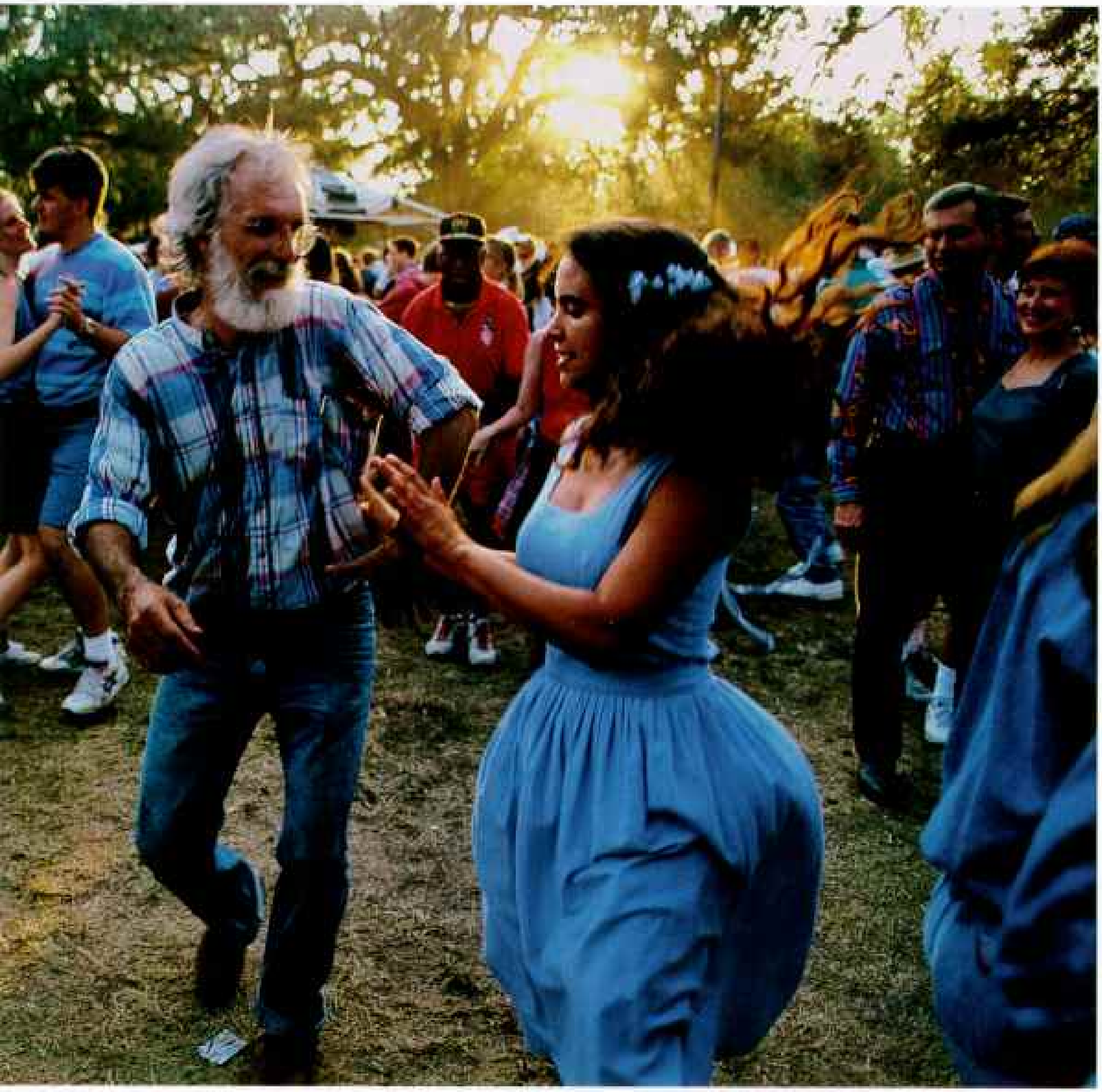
IT IS AN HONOR for me to be taken as a member of the star-studded Krewe of Orpheus, a group of 854 parading for the first time. Orpheus—open to anybody with the $750 price of admission—will parade on Monday, taking Proteus's usual slot, thus symbolizing the new era. I'm on the African music float. We wear purple costumes with skulls on our chests. Headhunters? Voodoo? No one seems to know or care.

We roll at four, for the six o'clock parade. A pair of ophthalmologists from New York, a couple from San Antonio, and a woman from Brazil named Jackie join me on the float, one of 28 tractor-pulled wagons. Each of us has about 6,000 strings of beads (some have spent $1,000 for favors), and we are stocked to the gunwales with soda, beer, and sandwiches.

We are safety-belted to the side like galley slaves. My post is in front of a four-foot-tall speaker blaring rock-and-roll oldies. We inch toward Napoleon Avenue, where the parade begins, and where unreality hits: a sea of outstretched arms and shouting faces, begging for our beads. The float lights flash green and yellow; the loudspeaker blasts out "Louie, Louie." Young women sitting on their boyfriends' shoulders bare their breasts, as custom dictates, bargaining for better, longer, beads. Jackie eats potato chips beside me, applying new lipstick after every bite.

I aim the beads at sympathetic faces, but the faces fade like apparitions. The sandwiches get soggy, "Louie, Louie" grinds into my head. Finally, the grasping hands grow tiresome; the sense of power turns to numbness. I should go to the ball tonight, starting at 11:30. Harry Connick, Jr., founder of Orpheus, will sing, but I am humbled by my first Mardi Gras parade and crawl to bed.

FAT TUESDAY NIGHT brings a soft rain down on Bourbon Street, a kind of solvent for the knots of revelers gathered for the final hoopla. The storm drains clog with plastic beads, paper cups, beer cans, and grayish mud. Exotic maskers, drag



queens, randy college kids, all are packed like earthworms in a bait bucket, taking photographs they would not show their ministers.

"Excuse me, ma'am," I ask a silver-haired woman in a pantsuit, "but what exactly is that rubber hat on your head?"

"It's a condom."

At midnight sharp, sirens wail by Woolworth's at the end of Bourbon Street, and a phalanx of police cruisers, flashing red and blue, creeps toward the crowd. A loudspeaker blares: "Please clear the streets! Mardi Gras 1994 is officially over!"

They are followed by seven mounted police and a rank of task-force cops with batons, looking out of tune with the good times. Lines of medics follow, their arms linked. Then come trucks spraying water on the street and machines with brushes sweeping up the bead soup. The crowd cheers.

In the misty drizzle the pizza parlor pulls its bars shut. Lucky Dog vendors, their carts shaped like giant buns and wieners, do brisk business. Doormen yawn. The last laughs float down the storm drains, into the 170 miles of subsurface canals that cross New Orleans, a city already below sea level and sinking.

And New Orleans is flushed, cleansed once more by the heavens, absolved of sins. It must be so, for God loves those who love life. □

Perilous

Three years across the Arctic

Answering an urgent call to adventure, author Ramón Larramendi set off to cross the Arctic from the southern tip of Greenland to the southern coast of Alaska by kayaking, dogsledding, and slogging through trials and dangers he could not have imagined. Larramendi, and three Spanish colleagues

Journey

ARTICLE AND PHOTOGRAPHS BY
RAMÓN HERNANDO DE LARRAMENDI

who joined him intermittently on his trek, spent four months training in Greenland. There they learned how to hunt, fish, and handle sled dogs. A native hunter, who helped prepare them, cracks a whip over his dogs on a training run. "*Assut!* Faster!" he bellows, as Rafael Peche and his team follow behind him.

"At any second the ice could have cracked my kayak like a nut," says team member Manuel Olivera, who eases through grinding chunks on the way to the island of Narsalik. En route the men spent five days maneuvering through fog and around icebergs, all to cover only 56 miles.

The gusting winds catch us by surprise. Swells of frigid black water rise menacingly above our heads as we paddle our kayaks along the west coast of Greenland. Spray from whitecaps stings our faces. Suddenly a six-foot curler breaks over Manuel, and my friend is in the water, fighting for his life.

The sea is fearfully cold on this August morning. Manuel has to make a decision fast. His kayak is swamped and useless, but the shore is at least 500 yards away. He pushes away from his boat and starts swimming in my direction.

Mistake. The waves keep crashing over his head. We can't reach each other, though I'm only 20 yards away. Manuel is losing his fight against the surf. In desperation he turns and heads toward land.

My heart sinks as another wave thunders down on him. He disappears. Terrified that he can't survive in the icy water, I shoot a signal flare into the air in hopes that someone will see it. Then I paddle furiously toward the island town of Qeqertarsuaq, a few miles away.

"What happened?" shouts a policeman as my kayak skids onto the beach.

"My friend is in the water!" I yell, pointing toward where Manuel capsized—now 20 minutes ago. Four men jump into an outboard skiff and roar off toward the spot.

"We go in the ambulance," says the policeman, rushing me to a vehicle filled with people talking all at once in Greenlandic—an explosion of *q*'s, *k*'s, and *r*'s. We race along the coast, swerving across the tundra until we see Manuel stumbling in the distance. When the driver hits the brakes, I jump out and run toward him. He is alive!

Shivering violently and suffering from hypothermia, he has no strength to speak. By the time the ambulance rushes him to the small hospital, his temperature

MANUEL OLIVERA

has plunged to 90°F—dangerously low.

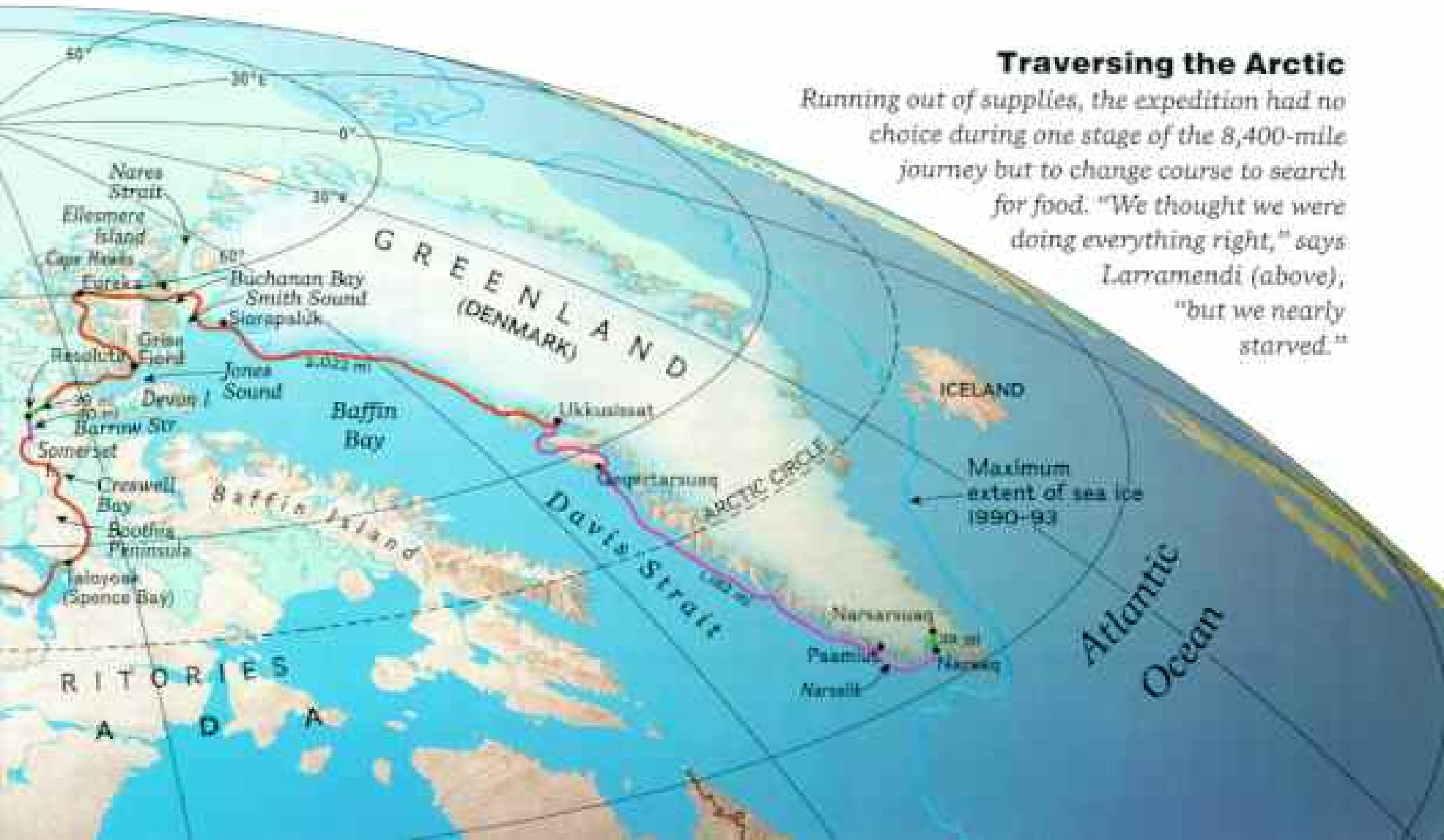
"Bring him here," calls a nurse, who submerges Manuel in a tub of warm water to thaw him out. Then she buries him in blankets. Within an hour he begins to recover. The immediate crisis is past.

The accident shakes Manuel's confidence, however. He does not want to return to the water right away. It's a blow to my confidence as well. We have only begun our long journey. For a few tense days in Qeqertarsuaq I wonder if our dream is over.

TEN WEEKS BEFORE, on June 16, 1990, after four months of training, we'd set out from the town of Narsarsuaq, 750 miles away, near the southern tip of Greenland. Along with two other teammates—Antonio Martínez and Rafael Peche—Manuel and I planned to make a three-year, 8,400-mile trip from Greenland through Alaska (map, below). We weren't trying to set any records, only to gain a better understanding of northern ways.

Our plan was for me to make the whole journey, while Manuel, or Manolo as he is called, would accompany me for most of the first year and again briefly at the end of the third. Antonio, a mountaineer and caver who had impulsively left a promising business to be part of the group, would join me for the last two years. Rafael, a streetwise photography student, would drop in from time to time to film the trip.

Among us city slickers—all from Madrid and all in our 20s—I had the most Arctic experience, having taken part in expeditions across Iceland and Greenland. But even I didn't know much



Traversing the Arctic

Running out of supplies, the expedition had no choice during one stage of the 8,400-mile journey but to change course to search for food. "We thought we were doing everything right," says Larramendi (above), "but we nearly starved."

Center of attention, Larramendi unloads his kayaks in Paamiut, Greenland. Living with a local family for a few days, he took away a wealth of advice—and left villagers with a taste for Spanish cooking.

Sunset seems to warm a frigid evening as the team heads north from Ukkusissat. Says the author: "For our sanity, we never thought farther than the next village."

BOTH BY MANUEL OLIVERA

of what we needed to survive, especially since we were determined to use only traditional forms of transportation—kayaks in summer, dogsleds in winter, and, of course, our own feet—as did Greenlandic explorer Knud Rasmussen in 1921-24 and Japanese adventurer Naomi Uemura in 1974-76 on similar treks from Greenland through Alaska.

If bad weather kept us from traveling, as we expected it might for months at a time, we would stay in villages, learning from hunters about training our dogs and making traditional gear. We had a lot to learn.

Spring 1991

Harsh Days on Nares Strait

■ It has been about eight months now since Manolo's near-fatal accident in the kayak. The bad memories have faded. The two of us are in Siorapaluk, the northernmost town in Greenland, eager to begin our 150-mile trip by dogsled across the frozen water to Canada. During our 2,100-mile journey here from Narsarsuaq, we were delayed for more than four months by the condition of the ice. After kayaking halfway up the coast by late September, we had to wait until February for the sea to freeze over before we could continue by dogsled.

To help us make the difficult crossing to Canada, Manolo and I hire two brothers, Paulus and Adolf Simigaq from Siorapaluk. They will guide us across the ice and hunt walruses and seals for food. The polynya, an area of open water in sea ice, in Smith Sound extends far north. From Siorapaluk we must sled northwest nearly a hundred miles to find good ice.

"Taama! Taama!" I shout to my dogs. "Let's go!" Off we gallop up the coast.

The dogs are extremely fresh today, I write in my journal on April 18. *They are running like crazy. Wind whirls the snow around like a storm, though the sky above is bright blue.*

We head north of Smith Sound, then west across the Nares Strait. Our progress slows to a crawl. Jumbled blocks of sea ice more than ten feet tall trap our four sleds in a labyrinth. The journey excites the dogs, which nip at one another as they jump over the ice. Despite the minus 13°F cold, sweat streams down my face.

To avoid the rough ice, we follow the edge of the polynya, racing over smooth, new ice as rapidly as possible. Water bubbles up here and there as our sleds, weighing 400 pounds each, skim over ice only two inches thick. Our nerves are jangling.

Standing on the back bar of his sled, Paulus searches the horizon for game. He had warned us that we might have trouble finding animals because of the severe cold this spring. But even he is surprised by the lack of game. During our eight-day crossing the brothers shoot only one seal, which we share with our dogs. They devour the meat in seconds. By the time we reach Cape Hawks on Canada's Ellesmere Island, we have no food for the dogs.

Our plan is to keep going to Buchanan Bay, a place known for game, where the brothers could hunt. But on our third night in Canada, still 30 miles from the bay, Paulus gives me the bad news.

"We have to go back," he says of his brother and himself.

"We took you to Canada as we promised. But there is no food to go farther."

"But how are we supposed to go by ourselves?" I reply. "We have no experience hunting. We will be helpless."

"You will learn to hunt," he says. "If we leave now, our dogs

may be strong enough to make it back. But if we wait a few days and don't find any seals, they will never make it."

I am disappointed but understand. The next morning, as Manolo and I watch the brothers pack, we try not to show how afraid we are. We have never felt so alone in our lives with so little idea of what may lie ahead.

"*Ingerialluarisi*," says Paulus. "Have a safe trip." He waves and rides off.

After the brothers leave, Manolo and I argue about what to do. He wants to continue to Buchanan Bay to hunt seals, then keep going to Grise Fiord, a hamlet on the southern coast. I tell him we can't make it.

"Look, it's 300 miles to Grise Fiord," I say. "What if we don't find seals at Buchanan Bay? The brothers didn't think we would, or they wouldn't have left."

Our only option, we realize, is to try for the weather station about 180 miles northwest at Eureka. Our maps show that it is no farther away than Siorapaluk if we take the shortest route across the island. What we don't know is how dangerous this route will be.

Carrying the Dogs

■ Ten days have passed since we left Siorapaluk. Our meager supplies are dwindling. My anxiety turns to excitement, however, when Manolo spots a seal. Concealing himself behind a *taalutaq*, a square screen of white canvas about a yard across, he cautiously advances toward the animal, the first we have tried to shoot. Watching through my binoculars, I hold my breath as he lies on the ground and pulls the trigger. A hit. But the wounded seal plunges back into its hole. My hope sinks with the seal.

We push harder now to reach Eureka. With our rations down to ten ounces of oatmeal and rice a day to sustain us for 12 hours on the sleds, I feel my strength ebbing. Immense glaciers with dangerous crevasses cover the interior of Ellesmere Island. At times, stopped by frozen waterfalls, we are forced to lower our sleds down icy cascades with ropes. At other times we race down rivers of ice through canyons of snow, never knowing whether we're being lured into a dead end.

The worst part is what is happening to our dogs. When Manolo and I started, we had 24. By the time we reach the west coast, two have starved to death. Sondre, my lead dog, has been killed in a fight with another dog, and five more are suffering so badly we have to shoot them. Among them is Tontainas, my favorite. I cry as I feed his flesh to his ravenous sled mates.

We have abandoned one sled. The dogs are too weak to pull it. After combining our teams,

Jagged ice in the Nares Strait between Greenland and Canada slows guide Adolf Simigaq, who works a rod to free sled traces jammed between frozen blocks. After four days of such conditions, exacerbated by breakdowns and agitated dogs, the party chose to continue across hazardously thin but smooth ice that ensured swift travel—if it held their weight.

MANUEL OLIVERA

Stuck between walls of rock and snow (opposite), Olivera must jolt his sled clear of a tight passage on Ellesmere Island. To make camp, the men pitched their tents atop two sleds for insulation. After rough ice wore out his dog Canela's booties, Antonio Martínez improvises a new pair from duct tape and canvas.

we are down to 16 dogs. Then another dog is killed by an arctic wolf that slips into our camp at night. Waking to the sound of frenetic barking, we race out to find the white-coated wolf standing over the carcass. Before Manolo can fetch his rifle, the wolf sprints across the tundra.

I'm so nervous now I can't sleep at night, Manolo writes in his diary on May 6. *All I want to do is finish this hellish trip.*

When we finally stumble into Eureka, 13 days after parting with the Simigaq brothers, only five of our dogs have the strength to pull. Five others are walking beside us, and the remaining five are riding on the sled, with Manolo pushing from behind. We have lost the desire to carry on. The memory of our dead dogs torments us.

Summer 1991

On Thin Ice

■ We stay ten days at the weather station in Eureka, which is no more than a few barracks, warehouses, and a radio dome. The eight Canadians stationed here give us plenty to eat, and we gradually regain our confidence. Our dogs bounce back too, once their stomachs are full of seal meat flown in from a nearby supply base. We lose one more dog, however, to another wolf boldly scavenging for food on the outskirts of the station.

The journey to Grise Fiord takes 11 days. Antonio and Rafael, or Rafa as we call him, are waiting there for us. As planned, Manolo returns to Spain.

"Try to behave yourselves," he tells us.

While at Grise Fiord I hear news of the Simigaq brothers. Although not all their dogs survived, they have made it home safely.

On June 7, as the weather grows almost balmy, we three decide to test our luck by setting off across Jones Sound toward the hamlet of Resolute on Cornwallis Island, 250 miles to the southwest. We don't know if the ice will hold our sled and 14 dogs. The ice cracks and grinds beneath us.

"Wake up!" shouts Rafa early one morning at our camp. "The sea is here!"

I jump out of the tent. The water's edge has crept within 600 yards during the night. The ice beneath us could break up at any moment. We decide to backtrack and try a safer route.

Rafa walks ahead, hunting for seals, whose fat and dark red

flesh has become our only food. During the long polar days of summer we lose track of time, sometimes going for more than 20 hours before sleeping. Our compasses don't work, because we are too close to earth's north magnetic pole. We guide ourselves by observing the location of snowbanks—a technique we learned from hunters in Greenland. Since the winds in this region almost always blow from the east, snow piles up on the western side of boulders. In three weeks we arrive at Resolute.

I sense right away that this community of 170 is different. The few residents we see don't come up to say hello. In fact, they ignore us. A couple of strangers in town is nothing new here. The Canadian government operates a weather station, airport, and supply depot five miles away. For decades it has also served as a jumping-off point for tourists and explorers bound for the North Pole and other remote destinations.

The feeling of being unwelcome lasts for the three months we are pinned down here by the weather—too warm to take the sled on the sea, too cold to kayak in the ice-choked water. Rarely are we invited into homes, asked to go hunting or to help with chores, as we had been in Greenland villages. There are problems here, as elsewhere in the Arctic, with liquor and violence.

"I don't go out at night without a baseball bat," one neighbor tells me. "I don't want any unpleasant surprises."

Because of our late arrival we cannot cross Barrow Strait by dogsled. So in early August Rafa takes our dogs ahead by plane to an Inuit camp 200 miles to the southeast on neighboring Somerset Island. Antonio, meanwhile, tears a muscle in his shoulder, making it impossible for him to kayak with me. When the broken-up ice clears enough in

early September to put a boat into the water, I rashly decide to cross the strait alone.

On the third day of my trip a jagged piece of ice pierces my kayak's fiberglass skin off the coast of Somerset Island. Water leaks in. The Inuit camp is still a week away. It has taken all my strength to get this far. Although I do not want to admit defeat, nevertheless, I radio for help. An airplane bound for Cornwallis Island makes an emergency stop on Somerset, bouncing its wheels on the snow, to pick up my broken kayak and me. I return gloomily to Resolute.

Fall 1991

Slipping and Sliding in the Dark

■ Frustrated by our confinement in Resolute, Antonio and I decide to fly to Somerset Island on September 25 to join Rafa, who is living at the Creswell Bay camp of Timothy Idlout, an Inuit elder. We use our time with Timothy's family to make traditional-style equipment—harnesses for the dogs and seal-hide whips—and to sew warm leggings and parkas from caribou and polar bear skins. A few weeks later, Rafa flies ahead to prepare for the next leg of our trip at the hamlet of Taloyoak—also known as Spence Bay—250 miles to the south on Boothia Peninsula.

In the meantime, there is

ANTONIO MARTINEZ

unfinished business. Antonio and I must return to the spot on the northwest coast where the plane rescued me earlier. We do not want to leave any part of the trip undone. Because of the short days and cloudy weather, however, we are forced to travel in murky darkness most of the time, which makes everything more difficult. With very little snow to run on, our dogs slip and fall on the ice. The wind pushes our sled around on the frozen water like a rudderless sailboat. Then we discover our radio is broken. Our nerves are shot.

By the time we get back to the Idlout camp, the family has left. The place is empty. Exhausted and discouraged, we finally decide to postpone the next leg of our journey until the sun returns in a few months.

The Gift

■ We leave Creswell Bay on February 8, sledding three weeks to Taloyoak. There we are greeted by Rafa and Steve Aqqaq, an Inuit hunter whose weather-beaten face reflects a long and difficult life.

Following Aqqaq into his house, I find his wife, Emily, sitting on a chair, sewing *kamiks*, or boots, from sealskin. From the ceiling hangs an enormous polar bear hide stretched out to dry. On the floor is a large piece of raw caribou meat and an *ulu*, or woman's knife. The scene might

Wasting nothing, Inuit hunters from Resolute fleme narwhals at Creswell Bay. The animals' tusks buy small luxuries; their muktuk, or skin, is a favorite food. Meat will feed sled dogs in winter.

Caribou skins protect Inuit George Konana from head to toe (facing page, at left), while bound seal hide makes a sturdy whip to rouse Martínez's dogs.

RAFAEL PEQUÉ

have been taken from one of the igloos in which they were raised.

A few yards away two grandchildren are playing. The older child has a can of Coca-Cola in one hand and a bag of potato chips in the other. They are arguing in English about which television program to watch.

During Aqqaq's lifetime he has seen his family move from oil lamps to electricity, from nomadic camps to prefabricated houses. When I ask him if he prefers life then or now, he looks at me thoughtfully.

"Before, things were simpler," he says at last. "I had only myself to rely on. I had *control* over my life. Now everything is so complicated."

Aqqaq treats us like family, worrying about every detail of our plans. When it comes time to leave, he asks to see my handmade caribou parka. I proudly show it to him. Grasping my coat in his strong hands, he carefully inspects the seams, hide, and shape. Then he makes a disgusted face and flings the garment on the ground.

"*Namangituq!*" he says. "Not good enough!"

Taken by surprise, I don't know how to react. I don't dare pick up the coat, which I leave lying on the snow.

Aqqaq goes into the enclosed porch of his house and comes back with a parka of much better quality than the one I have. This he presents to me, saying, "*Namaktuq!*—Much better!"

The old hunter's generosity moves me. It is a good note on which to resume our journey.

Summer 1992

Dancing With Caribou

■ After leaving Taloyoak on March 4 we sled more than 1,400 miles west along the edge of the Northwest Passage toward Inuvik. We have been trekking, often at long intervals, almost two years now. Unlike our earlier ordeals, the going here is easy. A bulldozer pulling a train of sleds carrying fuel tanks has forged an 80-mile path between Jenny Lind Island and the hamlet of Cambridge Bay on its way to resupply nearby radar stations. Our dogs run like the devil on the hard-packed snow.

During our stay at Inuvik, a modern community on the Mackenzie River Delta, Manolo rejoins us, bringing our kayaks with him, and Rafa returns to Spain. We had planned to continue dogsledding from here to Alaska's west coast, but since summer is coming we decide to switch to kayaks. Knowing we can no longer keep our dogs, we are forced, to our distress, to sell or give them all away.

Paddling north, then west from Inuvik, we discover how shallow the Beaufort Sea can be. Sometimes we have to climb out of our kayaks and walk them into deeper water. At night we camp on the beach, setting up a fishnet in the sea. By morning it holds arctic char, which we roast over a driftwood fire.

One July dawn, after having crossed into Alaska, we awaken to the sound of rumbling hoofs. Sticking my head out of the tent, I am amazed to see hundreds of caribou passing not 40 yards away. They are coming from the hinterland to escape the clouds of mosquitoes that torment them. We pack up our gear and follow the magnificent animals along the coast in our kayaks.

A mass of caribou are jammed together on a point of land opposite a small island, as if working up the courage to make the 50-yard crossing. Grunting and shoving, they push together until one or two animals lunge into the water and begin swimming for the island. Soon they are all around us in the water, eyes wide with fear and determination. For a moment I am caught

up in their excitement, feeling in my blood what it must have been like for Inuit hunters of the past to give chase.

Once the peaks of the Brooks Range disappear, we grow bored by Alaska's monotonous coast. The tundra extends endlessly in every direction. For a change of pace we paddle onto the beach of an oil field operated by the Atlantic Richfield Company (ARCO) at Prudhoe Bay. A security vehicle screeches to a stop as we change into dry clothes.

"Hey, how are ya doing?" asks an ARCO guard in a blue uniform. "Where ya going?"

"We're traveling along the coast from Canada," I say. "We'd like to buy supplies."

The guard talks into a radio. Within minutes a green company bus rumbles down the road. We ask the driver to take us to a supermarket in Deadhorse, the nearest town to the oil fields. He drives us to a bright new store.

Inside we find aisle after aisle of tortilla chips, chocolate bars, sunglasses, and baseball caps, but no flour, rice, sugar, or butter, which is what we really want. Antonio asks the clerk, a man as large as a sumo wrestler, where to find such staples.

"Not in this store," he says.

"But I thought this was a supermarket."

"Nobody buys any of that stuff up here. Everybody eats at the oil company cafeterias or hotels. Talk to a cook."

We find a sympathetic one at the North Star Inn, who fills our order. Then it's back onto the bus, past mile after mile of oil wells, to our campsite on the beach. It astounds me that there can be so many roads and so much sophisticated equipment in so isolated a place.

Winter 1992-3

Time Travelers

■ The weather turns colder after a ten-day stay to the west of Prudhoe Bay in Barrow, the northernmost community in the United States. By the time we reach the town of Kotzebue, after traveling 600 miles to the southwest, on September 16, our hands are numb from the icy water and freezing winds. We have come 1,250 miles since Inuvik. We can go no farther by kayak for now.

Manolo leaves us during this leg of the trek. "Our journey across the Arctic has turned into a trip through time," says Manolo. "When a hunter in northern Greenland gets hungry, he takes his dogs out to find seals. When someone in this part of Alaska wants a bite to eat, he can pick up the phone and place an order for burgers and fries from the restaurant down the street."

In Kotzebue, Antonio and I follow the dictum, "When in Rome, do as the Romans do." We replace our kamiks with molded plastic boots, our fur parkas with single-layered, foam-insulated pants and parkas, and our homemade sleds with a sleek new one made of laminated oak and aluminum to continue our journey to Anchorage by land.

Even our dogs are high tech. Sonny Russell, a former Rookie of the Year in the Iditarod Trail Sled Dog Race, lends us a team for the winter. The Iditarod, held every March from Anchorage to Nome, has become a big media event since it began in 1973. The dogs that take part in

it, bred for speed and stamina, are raised on a scientifically formulated diet.

When Antonio and I leave Kotzebue by dogsled on January 1 to cross the Seward Peninsula, speed is the last thing on our minds. We have waited until midwinter to be sure that the many rivers and creeks we must cross are frozen solid. But now the snow has become so deep that one of us must walk ahead in snowshoes to lead the team, while the dogs struggle along behind with our single sled. The forests, moreover, make us uncomfortable. After traveling so far across open tundra and sea ice, we are not used to moving among the crowded trees, which sound like an angry mob when they shake in the wind.

On the morning of January 12, as I ride on top of our sled to rest, Jake, one of our lead dogs, is guiding us through the mist. Suddenly the dogs at the front of the team begin to disappear. One by one, they drop away, sliding over the edge of a steep slope. "Stop! Stop!" I shout behind me to Antonio, who tries with all his might to brake. Now the sled is vertical, and I have no time to think. I am flying through the air. I close my eyes and hold my breath. *Thud!* When I lift my head out of the powdery snow, I see a jumble of sled, dogs, and harnesses.

We have fallen about 25 feet, yet amazingly neither of us nor any of the dogs is injured. The

Broiled over a driftwood fire, arctic char from the ocean make a welcome change from seal meat. Warm summer temperatures breed mosquitoes that drive desperate caribou to water.

Hitched and loaded like a sled dog, Olivera drags his kayak through marshy tundra that locks each step in gripping muck.

One stroke closer to home, Larramendi meets his family at Valdez in Alaska's Prince William Sound before returning to Madrid. "I went home a different person from the one who started out three years ago," he says. "I can no longer take life for granted, something easy to do in a big city like Madrid. In the Arctic we had to rely on each other. Our lives depended on it."

MANUEL OLIVEIRA

snow has cushioned our fall. After spending the better part of an hour unraveling the traces, we are off again.

We join the Iditarod Trail at the village of Koyuk, 150 miles south of Kotzebue on Norton Bay. A recent snowmobile race has left deep ruts in the trail, which makes it feel more like an interstate highway than the unmarked tracks we took in northern Canada.

Spring 1993

End of the Road

Something strange happens to me during our journey from Kotzebue to Anchorage. I sink into a deep depression, becoming convinced that I am on the verge of death, even though there's nothing wrong with me. I dread the thought of getting out of my sleeping bag to face each day. The smallest chore seems too difficult. I'm overwhelmed by feelings of regret for things that have happened during our long expedition.

"What's wrong?" Antonio asks.

"I can't explain it," I say, crying.

"Let me take you to a hospital."

"No, there's nothing they can do."

"Look, when I was feeling so low back in Canada, you helped me through," Antonio says. "Now I'll do the same for you. But if you die on me, I will never forgive you."

With words of encouragement and by his own example, he keeps me going. He tells me jokes. He cuts my shaggy hair. He shouts at me when I need it. Inch by inch, he helps me back out of the darkness.

By the time we get to Knik, a village north of Anchorage, I feel strong enough to continue by myself on foot, while Antonio arranges the return of the dogs to Kotzebue. The long and grueling trek has been tougher on me than I realized.

On March 6, as I walk through downtown Anchorage with my backpack, I stop to gaze at my reflection in a shop window. Who is that man with the scruffy beard and wild eyes?

I don't feel comfortable being back in a city. The traffic is too noisy, the sidewalks crowded with people. The faces of so many strangers make me feel like a foreigner, something I never experienced in the wilderness. I realize that I can't stay here tonight. I keep on walking past the last factories and suburban houses, right out of town, and spend the night in my sleeping bag in the trees at the side of the road.

Antonio brings our kayaks to Whittier, a small town on the shores of Prince William Sound. Manolo also joins us there, and from Whittier we paddle together the final 95 miles to Valdez. We talk about all the people we have met during our journey and what we have learned about the north. Manolo says that for him the most important lesson was not to fight against nature but to respect it. For Antonio it was learning to cooperate with others under adversity. As for me, I rediscovered the power of friendship, which gave me the strength to continue day after day.

As we paddle into Valdez on March 25, a cheer goes up from my parents and 18 other members of my family who have come from Spain to meet us. After three years, I can scarcely believe that our journey is finished and that my dream has come true. I am a different person from the one who set out from Greenland. But as my mother takes me in her arms, I am reminded that—Arctic adventurer or not—I am still her little boy.

"Oh, *mi niño*," she says, giving me a hug. □

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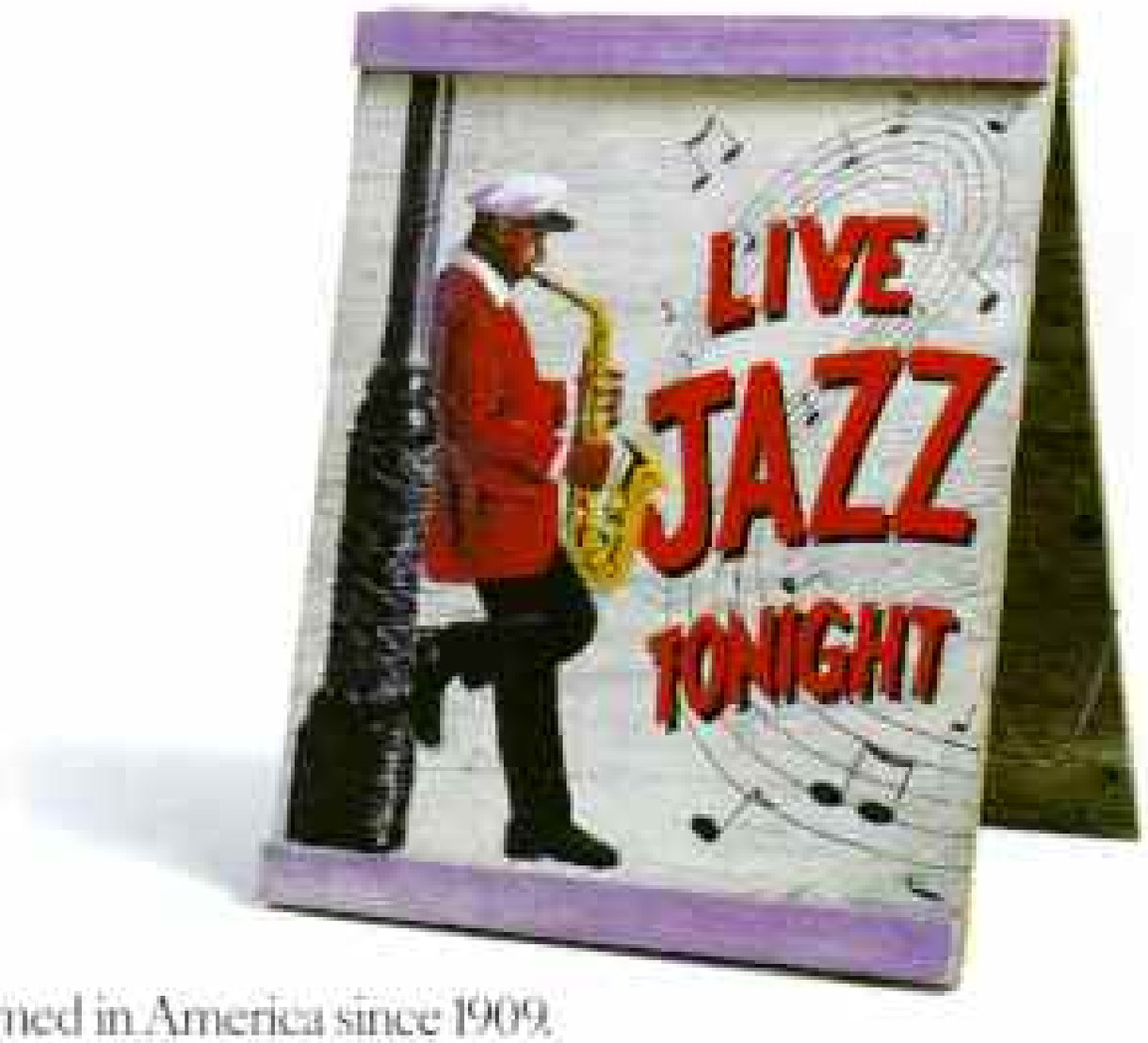

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Report from the President

KENT J. KOBERSTEEN, NGS

In Perfect Step, The Guard Changes

It was quintessential Bill Graves. No sooner had explorer Will Steger's expedition reached the North Pole on May 1, 1986, than Bill and a NATIONAL GEOGRAPHIC team roared in on three ski-planes to congratulate him.

Bounding across the ice, slapping Steger on the back (above), Bill effused such enthusiasm you'd have thought *he* had just mushed a dog team to the Pole.

Then again, in a way he had. At the time, Bill was NATIONAL GEOGRAPHIC's expeditions editor. During his 14-year tenure he coordinated this and dozens of other adventures for magazine articles.

But without question Bill's greatest contribution to the magazine, and to the Society, began in 1990, when I asked him to channel his energy in an entirely new direction: as Editor of NATIONAL GEOGRAPHIC. At a time when most people are winding down their careers, Bill started a new one—with characteristic exuberance.

I knew up front that Bill had great story sense. Author of more than 20 GEOGRAPHIC articles, he knew how to work closely with that rare breed of photographer and writer that inhabits our halls. So when the magazine won three top American Society of Magazine Editors awards—and produced a splendid special 1993 edition on water along with our 12 regular issues—I can't say I was surprised.

What did amaze me no end was Bill's blossoming skill at managing the magazine's finances. For example, Bill saved the Society millions of dollars at our printing plant, simply by ensuring that text and photographs arrived on time consistently. Such economies are essential to the survival of any periodical in a world where the printed page must compete for a share of the information marketplace.

Another profound contribution of Bill's, quietly achieved, will be felt here for decades. On the first day he strode into the Editor's office at headquarters, he began preparing his successor, Bill Allen, and his team. This month, with Bill Graves's well-deserved retirement, that mission is accomplished.

Bill Allen (below, showing Bill Graves possible covers for this issue—his first as Editor) came to the Society as a summer intern in 1969. In 1975 he was named managing editor of WORLD, our children's magazine. In 1985 he joined NATIONAL GEOGRAPHIC as an illustrations editor, and in January 1992 he was named associate editor.

Like his predecessor, Bill Allen is fascinated with the world. Clearly of a younger generation than Bill Graves and I, who have worked together here for nearly 40 years, he will connect with readers of all ages.

Bill Allen is taking the helm of a ship trimmed well for the times, thanks largely to the stewardship of Bill Graves.

In the end, beyond any testimonial I can give Bill Graves is the one he leaves himself: The greatest magazine in the world, enhanced in content and solidified in economic health by his contributions. Old friend, you'll be missed.

Gilbert M. Grosvenor

TERRI BROWNING

National Geographic, January 1993

Grévy's Zebra *(Equus grevyi)* **Size:** Height, 150 cm **Weight:** Males, up to 450 kg; females, 10% less **Habitat:** Semi-arid scrub/grassland in Kenya and Ethiopia **Surviving number:** Less than 5,000
Photographed by Mary Rowen

WILDLIFE AS CANON SEES IT

A Grévy's zebra and her curious offspring graze in the dry thornbush of northern Kenya. Largest of the wild equids, this zebra is most distinguished for its fine, intricate line pattern. Grévy's zebra skins were highly sought after until the 1970s, but trade was effectively halted when the species was listed as endangered. Today Grévy's zebra populations continue to decline from loss of habitat. To save endangered species, it is vital to protect their habitats and understand the role of each species within the earth's ecosystems. As a global corporation committed to social and environmental concerns, we hope to foster a greater awareness of our common obligation to ensure that the earth's life-sustaining ecology survives intact for future generations.

Solar Cells
Aiming to offer a clean and safe energy source, Canon is working to optimize the overall performance of amorphous-silicon solar cell panels based on its experience in copier technology.

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Forum

Ireland

Your cover article in the September 1994 issue was insightful and balanced. It was interesting that the discussion of Ireland's modernization began with a picture of U2, as the band admits to a fascination with technology. Wouldn't it be grand to have the last country in Western Europe to modernize do it best? This small nation has the ability to plan the pace, direction, and extent of its modernization.

NANCY RILEY KRIZ
Newport Beach, California

Congratulations to Richard Conniff on his excellent article. He seemed to end on a rather despondent tone. He may take some consolation—despite the fact that "real Ireland is an urban nation now"—in a small but significant migration to Ireland's west coast taking place under the Rural Resettlement Scheme. Started by Jim Connolly, a sculptor from County Clare, it has resettled 138 families since 1990, with 2,300 more on a waiting list. Classes in Dublin for prospective migrants teach such skills as turf cutting and leatherwork. Such schemes are to be applauded, and it is good to know that the pioneering spirit is not dead.

CHRIS CARVER
Fareham, Hampshire, England

The article ignored the positive impact that Catholicism had and is having on the people and the country. What about the authors, statesmen, and scientists that Catholic Ireland has given the world, including America?

KENNETH F. ULATOWSKI
Jacksonville, Florida

The author put this land in which I live in a new and almost terrifying light. He has shown a true vision of Ireland and of a people surging onward with little concern for culture and environment.

RACHEL CASSIDY
Inver, County Donegal
Ireland

You mention with gloom the small farmers being paid not to grow food. This has been happening for a long time in the U. S. Of course small units are not economical. There are, however, large, efficient farms in Ireland. If you order top-choice beef in Germany, guess where it comes from? Also the finest lamb in France.

TOMÁS MAC CATHMHAOIL
Portmarnock, County Dublin
Ireland

The section on Northern Ireland has been overtaken by fast-developing events of the current peace process and the IRA cease-fire. Already there is a palpable mood of optimism throughout the island of Ireland, and it is the fervent hope of all decent people that Northern Ireland will indeed find peace and that the troubled times are nearly over.

JOSEPH M. TYRRELL
Clonsilla, County Dublin
Ireland

Sonoran Desert

My wife and I have always admired the U. S. desert landscape, the adobe, and the beautiful cactuses. With succinct text and vivid photographs, your article has certainly created a stir in our hearts to make us want to visit this lovely country.

BENNY LIM
Singapore

In the first-class article by Priit J. Vesilind a key element not mentioned is the efficient plant-watering process used now in many desert areas to conserve water. A small line with a measured drip head is placed at the base of each plant to provide a computer-controlled amount of water over a specific period. Most modern homes in Scottsdale, for example, use this system.

FRANCIS M. RAST
Scottsdale, Arizona

As an explosive-ordnance-disposal technician, I would point out that the munitions being carried (pages 46-7) should be considered armed, since they are outside their dispensers. Their fusing can be extremely sensitive. Not stressing that the photograph shows professionals performing a hazardous job could cause someone to believe it is safe to handle any ordnance they find. It is not. There have been numerous cases where an individual has been killed or injured when a device he picked up detonated.

BRYAN R. GODDARD
Master Sergeant, U. S. Army
Fayetteville, North Carolina

The "inexplicably named" town of Why is not a mystery to us old-time desert rats. There is a fork in the road here with one road to Ajo and the other to Puerto Peñasco. The fork is referred to as a Y.

BILL KAIN
Tucson, Arizona

Page 56 says "tourists sally south, fearing *banditos* and the drinking water." The word is *bandidos*. Some Americans think that because its meaning is bandit they can just add the "os."

OLGA A. FRANKLIN
Henderson, Nevada

As a cattleman who recently visited San Carlos, Mexico, outside Guaymas, I believe your reference to Mexican cattlemen imperiling ecosystems

is missing the point. The Mexican government has targeted Guaymas/San Carlos as a future tourist mecca. The areas the government is clearing for highways, resorts, and housing are far more vast than acreage cleared for grazing. And the droves of people soon to follow will do far more damage than native cattle and cattlemen.

JOHN JOSSERAND
Hereford, Texas

Regarding the brief discussion of the prehistoric inhabitants of the Sonoran Desert, current data indicate that the Hohokam occupied the Salt River Valley earlier than stated, as early as A.D. 1. A Hohokam house recently uncovered in downtown Phoenix was dated A.D. 40 to 140.

Floods cannot solely account for the abandonment of the Salt River Valley. A very large flood, which the Hohokam survived, is recorded for A.D. 899. Data suggest that the 1358 (not 1353) flood was followed by drier than normal years, so a series of floods and dry periods may have added to other environmental problems. I suggest that their 1,500-year occupation of the Sonoran Desert is a remarkable accomplishment that ended, in part, from a combination of forces beyond their control.

TODD BOSTWICK
City Archaeologist
Phoenix, Arizona

I was born in Monterrey, Mexico, and proudly say that I'm a *norteño*. To write that we mestizos are still unsettled in our own identity is unfair. How can we be unsettled in our own homeland?

MARIO CAVAZOS
Venice, California

Mexico Map

In 1848 the United States annexed almost half of Mexico's territory, and many Americans, including Ulysses S. Grant, considered the act infamous and unrighteous. This epoch is very important in the history of Mexico.

RAÚL CASTRO DE LA CRUZ
Ciudad Obregón, Sonora
Mexico

As a sixth-grade teacher in northern California with 60 percent of my kids of Mexican origin, I was excited to find the supplement on Mexico. Such a map is so important in my classroom. My last one bit the dust when a substitute took over for me.

VIVIAN HANSTEN
Riverbank, California

Freight railroads provide important transportation links within Mexico and between Mexico and the U. S. It would seem desirable to show the major rail lines to help readers understand the total transportation facilities available.

SIDNEY E. HAWKINS
Greenville, South Carolina

Inner Japan

There's a word in Japanese, *natsukashii*, meaning a thinking back to pleasant past events coupled with a longing to go back to that special place. Patrick Smith's portrayal of Japan made me feel just that. In 1990-91 I spent one fabulous year in Takaoka as a Rotary exchange student. Moving among five host families and attending a Japanese high school, I had experiences ranging from being taught to windsurf by a Buddhist priest, to being wrapped in a hand-painted silk kimono, to eating fresh eel, squid, and octopus by the ocean.

LISA DEROCHE
Winchester, Virginia

I speak for many if not all haiku poets in the U. S. in saying how excited I am to see the master's work in the September issue. October 12 was the 300th anniversary of Matsuo Basho's death, and haiku celebrations were held worldwide.

WILMA M. ERWIN
Western World Haiku Society
Portland, Oregon

Geographica

A report in the September column regarding the ancient forests in Umbria states that no sequoias live in Italy. I'm proud to announce that I have successfully started a Pacific redwood grove in the hills near Reggio Emilia with seeds from California. Ten sequoias are now about 1.5 meters high.

MICHAEL ZACCONE
Milan, Italy

It is with deep sorrow that I learned of the passing of Barry Bishop, whose accomplishments were featured in the October Geographica. I met Barry when he was 21, a member of the Colorado Mountain Club and leader of a climb in Colorado's San Juan Mountains. I occasionally visited him at Society headquarters. He was a great scientist. I will miss his companionship and his articles.

G. C. KEHMEIER
Denver, Colorado

On September 24 Barry Bishop, 62, died in an automobile accident near Pocatello, Idaho. His wife, Lila, suffered minor injuries. They were en route to San Francisco, where he was to deliver a lecture.

Dr. Bishop was a member of the Geographic staff from 1959 to his retirement in 1994, serving the past ten years as vice chairman, then chairman, of the Committee for Research and Exploration. In addition to his 1963 climb of Mount Everest, he participated in many expeditions and acted as liaison to the scientific and academic communities. In November the Society honored him posthumously with its Distinguished Geography Educator award.

Letters for FORUM *should be sent to National Geographic Magazine, Box 37448, Washington, D. C. 20013-7448, or by fax to 202-828-5460, or via the America Online computer network to: ngsforum@aol.com. Include full name, address, and daytime telephone. Letters selected may be edited for clarity and space.*

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Geographica

Rare Dwarf Mammoth Unearthed

The old bull mammoth lay down in the sand on his left side and died a quiet death. Within months a dune buried the body, keeping wind and water from washing away the remains.

There it stayed for tens of thousands of years until Tom Rockwell, a San Diego State University geologist, came to Santa Rosa Island, California, to map marine terraces. Last June he spotted the mammoth's remains exposed in the now eroding dune—the most complete dwarf mammoth ever found intact.

"I could see the whole spinal column, from the back of the skull to the pelvis," recalls Rockwell (below, second from left). "I'd seen parts of other mammoths excavated here, and I knew right away what it was."

Mammoth specialist Larry Agenbroad of Northern Arizona University, third from left, calls the new find "a spectacular specimen"—a virtually complete skeleton of the species *Mammuthus exilis*.

Only the Channel Islands—a national park—and Wrangel Island off the Siberian coast have yielded dwarf mammoth remains, and only partial remains at that (Geographica, October 1993). This dwarf bull's left tusk (right), its breastbone, bones that held its tongue in place, even delicate foot bones "smaller than a thimble" have survived—"things you never find in mammoth skeletons," says Agenbroad. Missing remains, including the right tusk, must have washed away.

The bull stood five to six feet tall at the shoulder; mainland mammoths reached a height of 14 feet. Full-size mammoths probably swam to the Channel Islands in the Ice Age, when the sea level was lower and the islands formed a single landmass. As the ice melted and the sea level rose dividing the islands, the mammoths were left with fewer food resources, giving smaller animals an evolutionary edge.

BOTH BY LAUREN GREENFIELD

Will a Dimpled Bat Hit a Grand Slam?

Boston Red Sox players eyed Jeffrey DiTullio warily as he walked onto the hallowed grass of Fenway Park with some very odd bats. They were covered with little dimples that, he claimed, would enable batters to hit a baseball farther and faster.

Funny, the things a Massachusetts Institute of Technology aeronautics instructor can think up while stuck in traffic. Dimples on jet aircraft and golf balls allow air to flow over them more efficiently by reducing surface drag. DiTullio reasoned that a swinging bat is simply a cylinder trying to push its way through the air. Wouldn't a dimpled bat also move more efficiently, and thus strike the ball with more energy?

BRUCE DALE

DiTullio tested his invention against a regulation bat in the MIT wind tunnel (left) and found that drag dropped by 60 percent. Batters increased swing speed by 3 percent, making it easier to send the ball over Fenway's 40-foot-tall left-field wall, the infamous Green Monster—"if the hitter made contact," DiTullio notes. He is manufacturing experimental bats while ensuring that they stay within the rules: No cork allowed.

Geographica

Lenin's Caretakers Nurse a Siberian Mummy

JERRY ALEXANDER

The Pazyryk lady will soon be in good shape—as good as possible, that is, given that she's been dead for 2,400 years.

Lifted from an icy grave in Siberia, the mummified woman (GEOGRAPHIC, October 1994) began to deteriorate in the air. Her soft skin darkened and hardened, and the tattoos on her shoulder and wrist faded. Last April she was brought to Moscow for expert treatment.

Sergei Debov (right, second from right) is director of the Scientific and Research Center for Biological Structures, which cares for the publicly displayed body of Vladimir Ilyich Lenin. He and his staff plunged the Pazyryk mummy into a tank of chemicals—formaldehyde, alcohol, and some that are secret—to kill microbes. Then months of soaking in embalming fluid restored her skin and tattoos. After bits of bone and flesh that had been removed for testing are restored, she will return to Novosibirsk for display at the Russian Institute of Archaeology and Ethnography.

Canada Commemorates Immigrants' Struggle

Belying its name, Grosse Ile is small: a mile and a half long, half a mile wide. But the suffering and death that occurred there were great.

The island lies in the St. Lawrence River 30 miles northeast of Quebec City, the major port of entry for European immigrants to Canada. From 1832 to 1937 those who arrived with infectious diseases were quarantined on Grosse Ile. Its first year saw an epidemic that gave the name Cholera Bay (now Black Bay) to the place where the sick came ashore. An 1847 typhus siege killed 5,424. "Deaths occurred daily on ships waiting to land their sick passengers," says Marianna O'Gallagher of Quebec, author of a history of Grosse Ile.

Canada has named Grosse Ile a national historic site devoted to immigration. Irish Canadians, recalling that their forebears accounted for more than half Canada's yearly average of 30,000 immigrants between 1830 and 1860, succeeded in gaining an Irish focus for its development and interpretation.

VINCENT J. MUSI

Last August, Ireland's President Mary Robinson (left) joined 400 Irish Canadians on a memorial visit to the island. She laid a wreath at a Celtic cross erected in 1909 to honor the Irish dead on Grosse Ile.

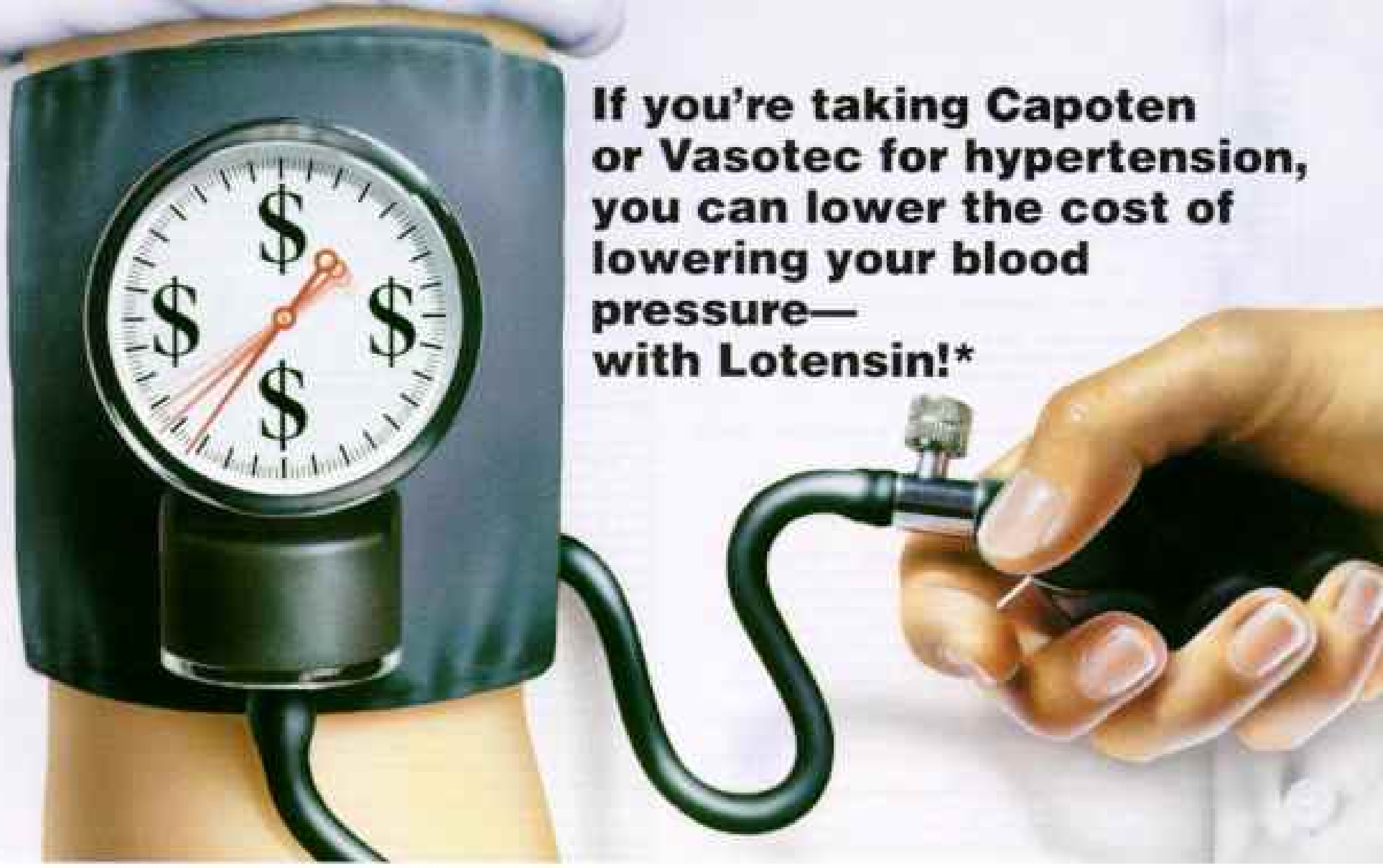
First Look at a New Asian Mammal

She lived barely four months after farmers captured her last year in central Vietnam's Vu Quang Nature Reserve, but this female *sao la* was a revelation—the first live example of her species seen by scientists. She was nearly eight months old when she died of respiratory and digestive problems in a botanical garden in Hanoi.

PRZEWORTS NGHIATINHNEWSIR, DAVID HOLBE, WORLD WIDE FUND FOR NATURE

The sao la came to the world's attention when John MacKinnon, a World Wildlife Fund biologist, and Vietnamese researchers saw three partial skulls during a survey of the Vu Quang (Geographica, January 1993). DNA analysis confirmed that it was a previously unknown species—one of only a handful of large mammals discovered this century. A second sao la, a young male, brought to Hanoi last September, died a week before the female.

—BORIS WEINTRAUB



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Like Capoten and Vasotec, Lotensin should be discontinued as soon as pregnancy is detected because of concerns about its effects on the unborn child.
As with other ACE inhibitors, Lotensin has also caused headache, dizziness, and cough, and in rare cases, a potentially dangerous swelling of the mouth and throat. Talk to your doctor about the potential risks and benefits of these medications.

Remember, only your doctor can decide if Lotensin is right for you. If it is, fill your Lotensin prescription and give us a call—toll-free—for more information about the Lotensin Lifetime Price Guarantee. The number is:

1-800-955-9100, ext. 950.

- Price comparisons are not intended to imply similar levels of effectiveness of these products.
- The cost of these products may vary depending on where you live, your pharmacy's pricing policy, and the prescribed dosage strength and dosing regimen.
- When switching brands of drugs, additional costs may be incurred for office visits or monitoring. In addition, dosing regimens may need to be adjusted in order to control blood pressure effectively.

*Cost data based on average retail prices as compiled by *Walsh America*, August 1994. Pricecomparisons are based on Capoten 25 mg or 50 mg twice daily; Vasotec 5 mg, 10 mg, or 20 mg once daily; and Lotensin 10 mg, 20 mg, or 40 mg once daily (other dosage strengths and dosing regimens are available).

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BRIEF SUMMARY (FOR COMPLETE PRESCRIBING INFORMATION, SEE PACKAGE INSERT)

Use in Pregnancy
When used in pregnancy during the second and third trimesters, ACE inhibitors can cause injury and even death to the developing fetus. When pregnancy is detected, Lotensin should be discontinued as soon as possible. See WARNINGS, Fetal/Neonatal Morbidity and Mortality

INDICATIONS AND USAGE
Lotensin is indicated for the treatment of hypertension. It may be used alone or in combination with thiazide diuretics.
In using Lotensin, consideration should be given to the fact that another angiotensin-converting enzyme inhibitor, captopril, has caused agranulocytosis, particularly in patients with renal impairment or collagen-vascular disease. Available data are insufficient to show that Lotensin does not have a similar risk (see WARNINGS).

CONTRAINDICATIONS
Lotensin is contraindicated in patients who are hypersensitive to this product or to any other ACE inhibitor.

WARNINGS
Anaphylactoid and Possibly Related Reactions: Presumably because angiotensin-converting enzyme inhibitors affect the metabolism of eicosanoids and polypeptides, including endogenous bradykinin, patients receiving ACE inhibitors (including Lotensin) may be subject to a variety of adverse reactions, some of them serious.
Angioedema: Angioedema of the face, extremities, lips, tongue, glottis, and larynx has been reported in patients treated with angiotensin-converting enzyme inhibitors. In U.S. clinical trials, symptoms consistent with angioedema were seen in none of the subjects who received placebo and in about 0.5% of the subjects who received Lotensin. Angioedema associated with laryngeal edema can be fatal. If laryngeal stridor or angioedema of the face, tongue, or glottis occurs, treatment with Lotensin should be discontinued and appropriate therapy instituted immediately. **Where there is involvement of the tongue, glottis, or larynx, likely to cause airway obstruction, appropriate therapy, e.g., subcutaneous epinephrine injection 1:1000 (0.3 mL to 0.5 mL) should be promptly administered (see ADVERSE REACTIONS).**
Anaphylactoid Reactions During Desensitization: Two patients undergoing desensitizing treatment with hymenoptera venom while receiving ACE inhibitors sustained life-threatening anaphylactoid reactions. In the same patients, these reactions were avoided when ACE inhibitors were temporarily withheld, but they reappeared upon inadvertent rechallenge.
Anaphylactoid Reactions During Membrane Exposure: Anaphylactoid reactions have been reported in patients dialyzed with high-flux membranes and treated concomitantly with an ACE inhibitor. Anaphylactoid reactions have also been reported in patients undergoing low-density lipoprotein apheresis with dextran sulfate absorption. (a procedure dependent upon devices not approved in the United States).
Hypotension: Lotensin can cause symptomatic hypotension. Like other ACE inhibitors, benazepril has been only rarely associated with hypotension in uncomplicated hypertensive patients. Symptomatic hypotension is most likely to occur in patients who have been volume- and/or salt-depleted as a result of prolonged diuretic therapy, dietary salt restriction, dialysis, diarrhea, or vomiting. Volume- and/or salt-depletion should be corrected before initiating therapy with Lotensin.
In patients with congestive heart failure, with or without associated renal insufficiency, ACE inhibitor therapy may cause excessive hypotension, which may be associated with oliguria or azotemia and, rarely, with acute renal failure and death. In such patients, Lotensin therapy should be started under close medical supervision; they should be followed closely for the first 2 weeks of treatment and whenever the dose of benazepril or diuretic is increased.
If hypotension occurs, the patient should be placed in a supine position, and, if necessary, treated with intravenous infusion of physiological saline. Lotensin treatment usually can be continued following restoration of blood pressure and volume.
Neutropenia/Agranulocytosis: Another angiotensin-converting enzyme inhibitor, captopril, has been shown to cause agranulocytosis and bone marrow depression, rarely in uncomplicated patients, but more frequently in patients with renal impairment, especially if they also have a collagen-vascular disease such as systemic lupus erythematosus or scleroderma. Available data from clinical trials of benazepril are insufficient to show that benazepril does not cause agranulocytosis at similar rates. Monitoring of white blood cell counts should be considered in patients with collagen-vascular disease, especially if the disease is associated with impaired renal function.
Fetal/Neonatal Morbidity and Mortality: ACE inhibitors can cause fetal and neonatal morbidity and death when administered to pregnant women. Several dozen cases have been reported in the world literature. When pregnancy is detected, ACE inhibitors should be discontinued as soon as possible.
The use of ACE inhibitors during the second and third trimesters of pregnancy has been associated with fetal and neonatal injury, including hypotension, neonatal skull hypoplasia, anuria, reversible or irreversible renal failure, and death. Oligohydramnios has also been reported, presumably resulting from decreased fetal renal function; oligohydramnios in this setting has been associated with fetal limb contractures, craniofacial deformation, and hypoplastic lung development. Prematurity, intrauterine growth retardation, and patent ductus arteriosus have also been reported, although it is not clear whether these occurrences were due to the ACE inhibitor exposure.
These adverse effects do not appear to have resulted from intrauterine ACE inhibitor exposure that has been limited to the first trimester. Mothers whose embryos and fetuses are exposed to ACE inhibitors only during the first trimester should be so informed. Nonetheless, when patients become pregnant, physicians should make every effort to discontinue the use of benazepril as soon as possible.
Rarely (probably less often than once in every thousand pregnancies), no alternative to ACE inhibitors will be found. In these rare cases, the mothers should be apprised of the potential hazards to their fetuses, and serial ultrasound examinations should be performed to assess the intraamniotic environment.
If oligohydramnios is observed, benazepril should be discontinued unless it is considered life-saving for the mother. Contraction stress testing (CST), a nonstress test (NST), or biophysical profiling (BPP) may be appropriate, depending upon the week of pregnancy. Patients and physicians should be aware, however, that oligohydramnios may not appear until after the fetus has sustained irreversible injury.
Infants with histories of in utero exposure to ACE inhibitors should be closely observed for hypotension, oliguria, and hyperkalemia. If oliguria occurs, attention should be directed toward support of blood pressure and renal perfusion. Exchange transfusion or dialysis may be required as means of reversing hypotension and/or substituting for disordered renal function. Benazepril, which crosses the placenta, can theoretically be removed from the neonatal circulation by these means; there are occasional reports of benefit from these maneuvers with another ACE inhibitor, but experience is limited.
No teratogenic effects of Lotensin were seen in studies of pregnant rats, mice, and rabbits. On a mg/m² basis, the doses used in these studies were 80 times (in rats), 9 times (in mice), and more than 0.8 times (in rabbits) the maximum recommended human dose (assuming a 50 kg woman). On a mg/kg basis these multiples are 300 times (in rats), 85 times (in mice) and more than 3 times (in rabbits) the maximum recommended human dose.
Hepatic Failure: Rarely, ACE inhibitors have been associated with a syndrome that starts with cholestatic jaundice and progresses to fulminant hepatic necrosis and (sometimes) death. The mechanism of this syndrome is not understood. Patients receiving ACE inhibitors who develop jaundice or marked elevations of hepatic enzymes should discontinue the ACE inhibitor and receive appropriate medical follow-up.

PRECAUTIONS
General
Impaired Renal Function: As a consequence of inhibiting the renin-angiotensin-aldosterone system, changes in renal function may be anticipated in susceptible individuals. In patients with severe congestive heart failure whose renal function may depend on the activity of the renin-angiotensin-aldosterone system, treatment with angiotensin-converting enzyme inhibitors, including Lotensin, may be associated with oliguria and/or progressive azotemia and (rarely) with acute renal failure and/or death. In a small study of hypertensive patients with renal artery stenosis in a solitary kidney or bilateral renal artery stenosis, treatment with Lotensin was associated with increases in blood urea nitrogen and serum creatinine; these increases were reversible upon discontinuation of Lotensin or diuretic therapy, or both. When such patients are treated with ACE inhibitors, renal function should be monitored during the first few weeks of therapy. Some hypertensive patients with no apparent preexisting renal vascular disease have developed increases in blood urea nitrogen and serum creatinine, usually minor and transient, especially when Lotensin has been given concomitantly with a diuretic. This is more likely to occur in patients with preexisting renal impairment. Dosage reduction of Lotensin and/or discontinuation of the diuretic may be required. **Evaluation of the hypertensive patient should always include assessment of renal function (see DOSAGE AND ADMINISTRATION).**
Hyperkalemia: In clinical trials, hyperkalemia (serum potassium at least 0.5 mEq/L greater than the upper limit of normal) occurred in approximately 1% of hypertensive patients receiving Lotensin. In most cases, these were isolated values which resolved despite continued therapy. Risk factors for the development of hyperkalemia include renal insufficiency, diabetes mellitus, and the concomitant use of potassium-sparing diuretics, potassium supplements, and/or potassium-containing salt substitutes, which should be used cautiously, if at all, with Lotensin (see Drug Interactions).
Cough: Presumably due to the inhibition of the degradation of endogenous bradykinin, persistent nonproductive cough has been reported with all ACE inhibitors, always resolving after discontinuation of therapy. ACE inhibitor-induced cough should be considered in the differential diagnosis of cough.
Impaired Liver Function: In patients with hepatic dysfunction due to cirrhosis, levels of benazeprilat are substantially unaltered (see WARNINGS, Hepatic Failure).
Surgery/Anesthesia: In patients undergoing surgery or during anesthesia with agents that produce hypotension, benazepril will block the angiotensin II formation that could otherwise occur secondary to compensatory renin release. Hypotension that occurs as a result of this mechanism can be corrected by volume expansion.
Information for Patients
Pregnancy: Female patients of childbearing age should be told about the consequences of second- and third-trimester exposure to ACE inhibitors, and they should also be told that these consequences do not appear to have resulted from intrauterine ACE inhibitor exposure that has been limited to the first trimester. These patients should be asked to report pregnancies to their physicians as soon as possible.
Angioedema: Angioedema, including laryngeal edema, can occur with treatment with ACE inhibitors, especially following the first dose. Patients should be so advised and told to report immediately any signs or symptoms suggesting angioedema (swelling of face, eyes, lips, or tongue, or difficulty in breathing) and to take no more drug until they have consulted with the prescribing physician.
Symptomatic Hypotension: Patients should be cautioned that lightheadedness can occur, especially during the first days of therapy, and it should be reported to the prescribing physician. Patients should be told that if syncope occurs, Lotensin should be discontinued until the prescribing physician has been consulted.
All patients should be cautioned that inadequate fluid intake or excessive perspiration, diarrhea, or vomiting can lead to an excessive fall in blood pressure, with the same consequences of lightheadedness and possible syncope.
Hyperkalemia: Patients should be told not to use potassium supplements or salt substitutes containing potassium without consulting the prescribing physician.
Neutropenia: Patients should be told to promptly report any indication of infection (e.g., sore throat, fever), which could be a sign of neutropenia.
Drug Interactions
Diuretics: Patients on diuretics, especially those in whom diuretic therapy was recently instituted, may occasionally experience an excessive reduction of blood pressure after initiation of therapy with Lotensin. The possibility of hypotensive effects with Lotensin can be minimized by either discontinuing the diuretic or increasing the salt intake prior to initiation of treatment with Lotensin. If this is not possible, the starting dose should be reduced (see DOSAGE AND ADMINISTRATION).
Potassium Supplements and Potassium-Sparing Diuretics: Lotensin can attenuate potassium loss caused by thiazide diuretics. Potassium-sparing diuretics (spironolactone, amiloride, triamterene, and others) or potassium supplements can increase the risk of hyperkalemia. Therefore, if concomitant use of such agents is indicated, they should be given with caution, and the patient's serum potassium should be monitored frequently.
Oral Anticoagulants: Interaction studies with warfarin and acenocoumarol failed to identify any clinically important effects on the serum concentrations or clinical effects of these anticoagulants.
Lithium: Increased serum lithium levels and symptoms of lithium toxicity have been reported in patients receiving ACE inhibitors during therapy with lithium. These drugs should be coadministered with caution, and frequent monitoring of serum lithium levels is recommended. If a diuretic is also used, the risk of lithium toxicity may be increased.
Other: No clinically important pharmacokinetic interactions occurred when Lotensin was administered concomitantly with hydrochlorothiazide, chlorthalidone, furosemide, digoxin, propranolol, atenolol, naproxen, or cimetidine.
Lotensin has been used concomitantly with beta-adrenergic-blocking agents, calcium-channel-blocking agents, diuretics, digoxin, and hydralazine, without evidence of clinically important adverse interactions. Benazepril, like other ACE inhibitors, has had less than additive effects with beta-adrenergic blockers, presumably because both drugs lower blood pressure by inhibiting parts of the renin-angiotensin system.
Carcinogenesis, Mutagenesis, Impairment of Fertility: No evidence of carcinogenicity was found when benazepril was administered to rats and mice for up to two years at doses of up to 750 mg/kg/day. When compared on the basis of body weights, this dose is 11fl times the maximum recommended human dose. When compared on the basis of body surface areas, this dose is 14 and 9 times (rats and mice, respectively) the maximum recommended human dose (calculations assume a patient weight of 50 kg). No mutagenic activity was detected in the Ames test in bacteria (with or without metabolic activation), in an in vitro test for forward mutations in cultured mammalian cells, or in a nucleus anomaly test. In doses of 50-500 mg/kg/day (6-60 times the maximum recommended human dose based on mg/m² comparison and 37-375 times the maximum recommended human dose based on a mg/kg comparison), Lotensin had no adverse effect on the reproductive performance of male and female rats.
Pregnancy Categories C (first trimester) and D (second and third trimesters)
See WARNINGS: Fetal/Neonatal Morbidity and Mortality.
Nursing Mothers: Minimal amounts of unchanged benazepril and of benazeprilat are excreted into the breast milk of lactating women treated with benazepril. A newborn child ingesting entirely breast milk would receive less than 0.1% of the mg/kg maternal dose of benazepril and benazeprilat.
Geriatric Use: Of the total number of patients who received benazepril in U.S. clinical studies of Lotensin, 18% were 65 or older while 3% were 75 or older. No overall differences in effectiveness or safety were observed between these patients and younger patients, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.
Pediatric Use: Safety and effectiveness in children have not been established.

ADVERSE REACTIONS
Lotensin has been evaluated for safety in over 6000 patients with hypertension, over 700 of these patients were treated for at least one year. The overall incidence of reported adverse events was comparable in Lotensin and placebo patients.

The reported side effects were generally mild and transient, and there was no relation between side effects and age, duration of therapy, or total dosage within the range of 2 to 80 mg. Discontinuation of therapy because of a side effect was required in approximately 5% of U.S. patients treated with Lotensin and in 3% of patients treated with placebo.
The most common reasons for discontinuation were headache (0.6%) and cough (0.5%) (see PRECAUTIONS, Cough).
The side effects considered possibly or probably related to study drug that occurred in U.S. placebo-controlled trials in more than 1% of patients treated with Lotensin are shown below:

PATIENTS IN U.S. PLACEBO-CONTROLLED STUDIES:

	LOTENSIN (N=964)		PLACEBO (N=496)	
	N	%	N	%
Headache	60	6.2	21	4.2
Dizziness	35	3.6	12	2.4
Fatigue	23	2.4	11	2.2
Somnolence	15	1.6	2	0.4
Postural Dizziness	14	1.5	1	0.2
Nausea	13	1.3	5	1.0
Cough	12	1.2	8	1.6

Other adverse experiences reported in controlled clinical trials (in less than 1% of benazepril patients), and rarer events seen in postmarketing experience, include the following (in some, a causal relationship to drug use is uncertain):
Cardiovascular: Symptomatic hypotension was seen in 0.2% of patients; postural hypotension in 0.4%, and syncope in 0.1%. These reactions led to discontinuation of therapy in 4 patients who had received benazepril monotherapy and in 9 patients who had received benazepril with hydrochlorothiazide (see PRECAUTIONS and WARNINGS). Other reports included angina pectoris, palpitations, and peripheral edema.
Renal: Of hypertensive patients with no apparent preexisting renal disease, about 2% have sustained increases in serum creatinine to at least 150% of their baseline values while receiving Lotensin, but most of these increases have disappeared despite continuing treatment. A much smaller fraction of these patients (less than 0.1%) developed simultaneous (usually transient) increases in blood urea nitrogen and serum creatinine.
Fetal/Neonatal Morbidity and Mortality: See WARNINGS, Fetal/Neonatal Morbidity and Mortality.
Angioedema: Angioedema has been reported in patients receiving ACE inhibitors. During clinical trials in hypertensive patients with benazepril, 0.5% of patients experienced edema of the lips or face without other manifestations of angioedema. Angioedema associated with laryngeal edema and/or shock may be fatal. If angioedema of the face, extremities, lips, tongue, or glottis and/or larynx occurs, treatment with Lotensin should be discontinued and appropriate therapy instituted immediately (see WARNINGS).
Gastrointestinal: Constipation, gastritis, vomiting, and melena.
Dermatologic: Apparent hypersensitivity reactions (manifested by dermatitis, pruritus, or rash), photosensitivity, and flushing.
Neurologic and Psychiatric: Anxiety, decreased libido, hypertonia, insomnia, nervousness, and paresthesia.
Other: Arthralgia, arthritis, asthenia, asthma, bronchitis, dyspnea, impotence, infection, myalgia, sinusitis, sweating, and urinary tract infection.

Clinical Laboratory Test Findings

Creatinine and Blood Urea Nitrogen: Of hypertensive patients with no apparent preexisting renal disease, about 2% have sustained increases in serum creatinine to at least 130% of their baseline values while receiving Lotensin, but most of these increases have disappeared despite continuing treatment. A much smaller fraction of these patients (less than 0.1%) developed simultaneous (usually transient) increases in blood urea nitrogen and serum creatinine. None of these increases required discontinuation of treatment. Increases in these laboratory values are more likely to occur in patients with renal insufficiency or those pretreated with a diuretic and based on experience with other ACE inhibitors, would be expected to be especially likely in patients with renal artery stenosis (see PRECAUTIONS, General).
Potassium: Since benazepril decreases aldosterone secretion, elevation of serum potassium can occur. Potassium supplements and potassium-sparing diuretics should be given with caution, and the patient's serum potassium should be monitored frequently (see PRECAUTIONS).
Hemoglobin: Decreases in hemoglobin (a low value and a decrease of 3 g/dL) were rare, occurring in only 1 of 2,014 patients receiving Lotensin alone and in 1 of 1357 patients receiving Lotensin plus a diuretic. No U.S. patients discontinued treatment because of decreases in hemoglobin.
Other (causal relationships unknown): Clinically important changes in standard laboratory tests were rarely associated with Lotensin administration. Elevations of uric acid, blood glucose, serum bilirubin, and liver enzymes (see WARNINGS) have been reported, as have scattered incidents of hyponatremia, electrocardiographic changes, leukopenia, eosinophilia, and proteinuria. In U.S. trials, less than 0.9% of patients discontinued treatment because of laboratory abnormalities.

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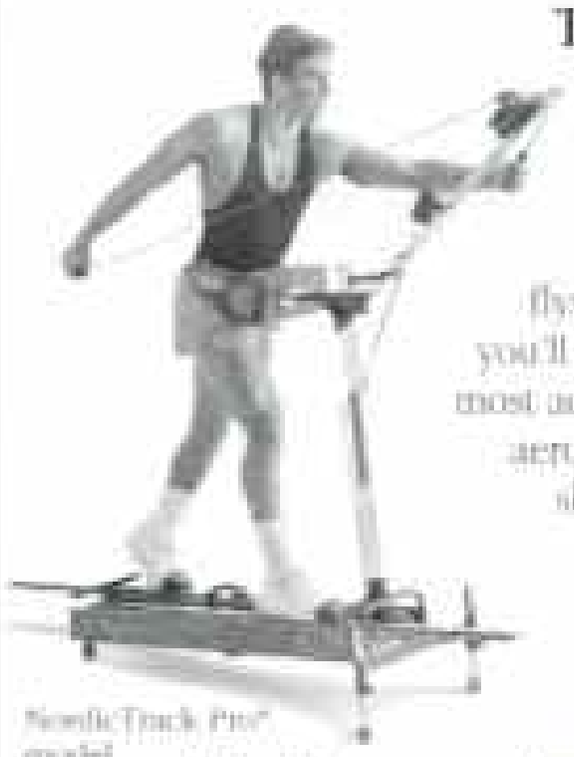

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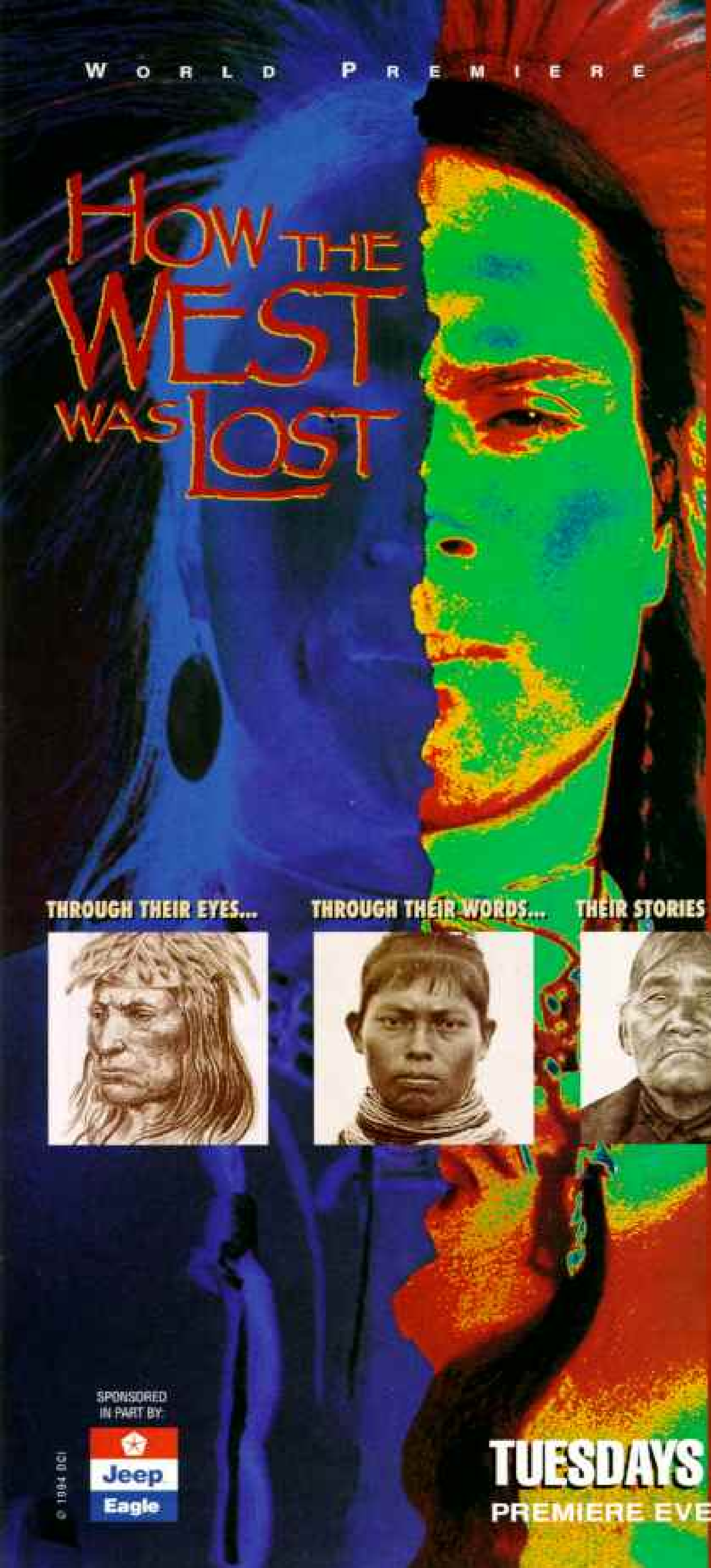

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On Television

30 YEARS ON THE AIR

Like a family album, National Geographic Specials have captured moments that became memories. Some images profoundly changed our ways of thinking. In 1965—the Society's first year on television—a young scientist named Jane Goodall showed that chimps, like humans, use tools. Other scenes had a visceral impact, such as a great white shark slamming its crushing jaws against a diver's cage.

Now the National Geographic's 30th-Anniversary Special, the 114th of these prime-time programs, celebrates the highlights in humankind's quest for new knowledge of "the world and all that is in it."

Producers Gail Willumsen and Barry Nye pared down 120 hours of film to a two-hour retrospective of outstanding sequences. The result—"30 Years of National Geographic Specials"—features footage from some 70 programs.

"This film applauds the spirit of exploration," says Executive Producer Nicolas Noxon, who produced some of the first Society Specials. "It begins with the origins of the planet, surveys wildlife behavior and human cultures, then weighs our impact on the environment."

From the Special "Born of Fire," a glowing lava fountain suggests the primordial planet. After the earth cooled, life appeared, and so too the rhythms of the natural world—mating, birth, maturation, and, most strikingly, predation. In one contest for survival from "The Living Sands of Namib," a black wasp attempts to dig out a trap-door spider. Suddenly the spider curls up and cartwheels down a dune, executing a great escape.

Attacks often end in failure for the predator—which would have been a comforting thought for the photographer in India who found herself 15 feet away from a snarling 300-pound cat during the filming of "Land of the Tiger."

National Geographic Specials also explore the kaleidoscope of human cultures. In the rain forest of Cameroon, a boy of the Baka people—known to outsiders as Pygmies—inspects a modern artifact.

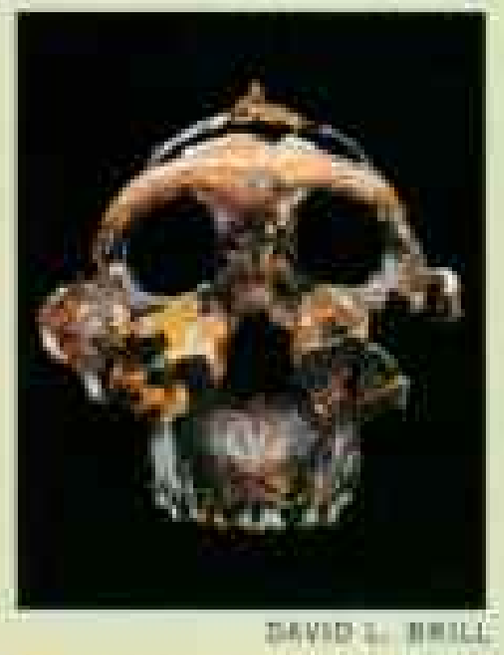
For all our diversity, we humans spring from a common source. The film revisits the work of Louis S. B. Leakey and his wife, Mary, who unearthed the skull of *Zinjanthropus*, now called *Australopithecus boisei*, in Tanzania's Olduvai Gorge. In so doing they found commanding evidence of our relatives from two million years ago. Their discoveries changed the course of anthropology.

This look at past journeys—sojourning with elephants, finding new life-forms in the deep sea, venturing into uncharted caves—is also a preview. As the Specials begin their fourth decade, they move to the NBC network. Society President Gilbert M. Grosvenor promises that "we'll continue to produce quality programming on a range of subjects by giving top filmmakers the resources to capture compelling images and tell the accurate story."

"30 Years of National Geographic Specials" airs January 25 on NBC at 8 p.m. ET.

HUGO VAN LAWICK

DAVID DOUBILET



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ANNE HILMORN (BOTH)

Scores of Serengeti's Lions Perish From a Virus

Racked by neurological seizures, a male lion collapses (above). It died the next day. Famed among big cats, Tanzania's Serengeti lions are under siege. Since December 1993 about a hundred have been killed by a common virus better known in dogs, wolves, and foxes—canine distemper.

"This is unprecedented mortality over such a short time," says Craig Packer, a University of Minnesota biologist who has studied East Africa's lions (GEOGRAPHIC, April 1992) since 1978. The disease has wiped out about a third of the 250 lions in Packer's 775-square-mile study area. But 3,000 lions range across 10,000 square miles in and around the Serengeti park, and many other victims may never be discovered.

Observers have been watching for distemper symptoms in lions in the nearby Masai Mara and the Ngorongoro Crater. The disease has been detected in a few hyenas and is suspected in bat-eared foxes. Researchers fear it could also spread to leopards, jackals, and wild dogs.

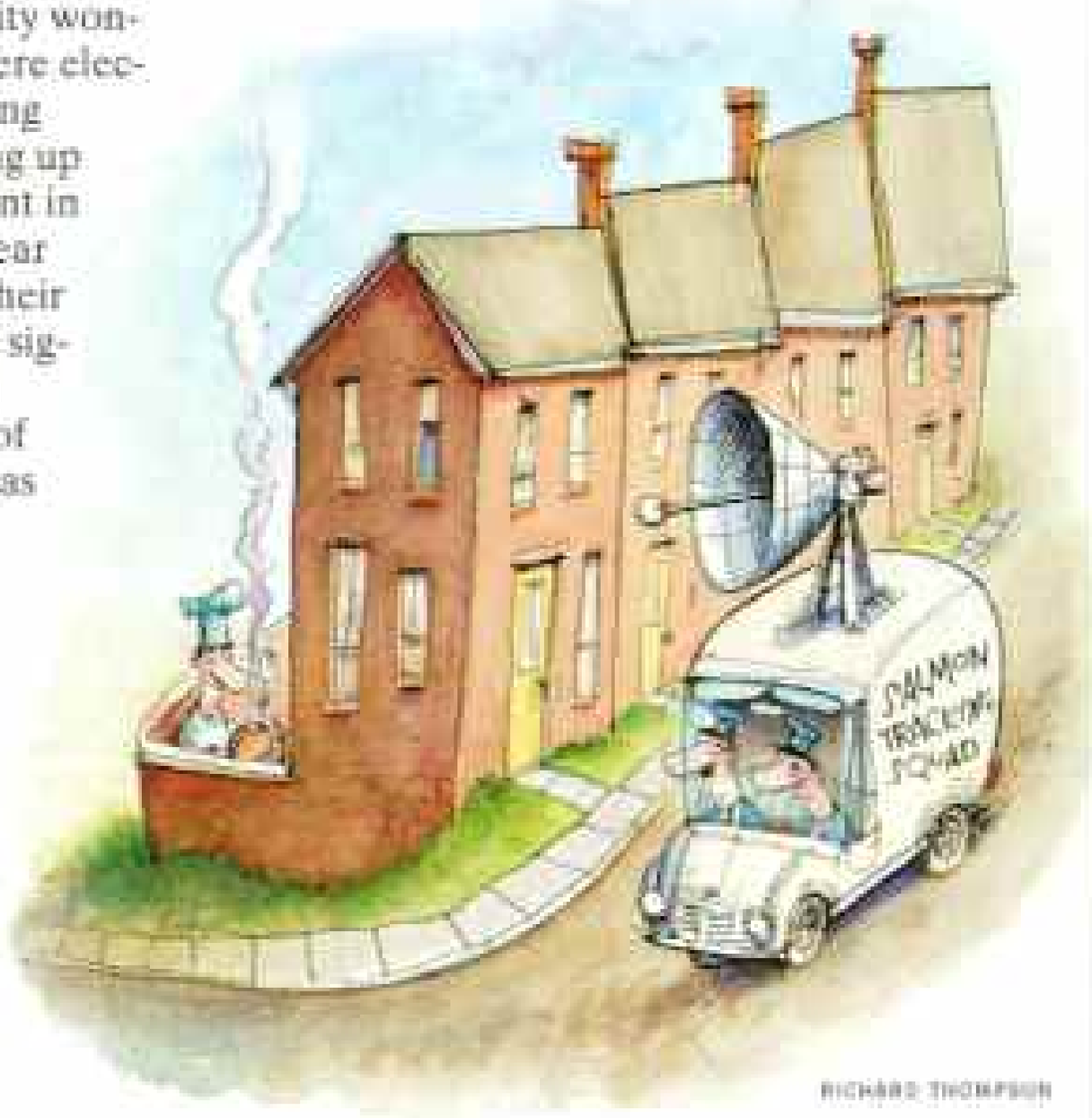
Packer and Melody Roelke-Parker, chief veterinarian for Tanzania National Parks, suspect that the distemper was transmitted to the wildlife by domestic dogs. "There are 30,000 dogs kept by people living around the park," adds Packer, who urges vaccinations for the pets.

Poacher Hooks Something Fishy—Bugged Salmon

Was it a flying fish? Officials of Britain's National Rivers Authority wondered as they were electronically tracking salmon migrating up the River Hirnant in north Wales a year ago. Suddenly their mobile detector signaled that a fish had leaped out of the water and was sailing across dry land.

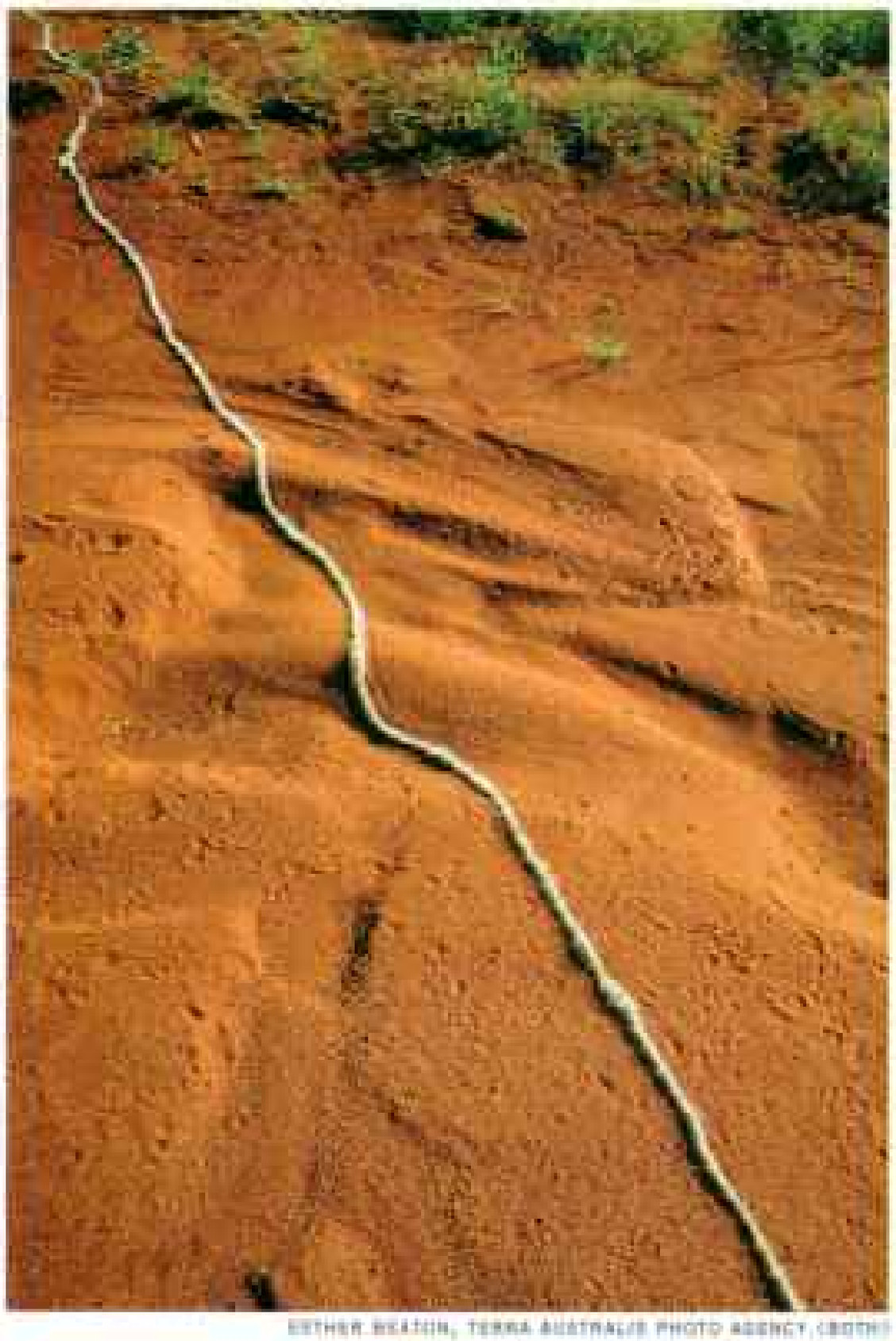
Since the fishing season was closed, the officials followed. They could do so because the levitating fish had a tiny radio transmitter inserted in its stomach, one of about 450 salmon so equipped during a three-year period. Each fish broadcast on a different frequency and could be monitored by researchers.

The authorities tracked the airborne salmon to the home of a young fisherman, who was first outraged, then confessed to poaching the tagged fish—and three other salmon on his kitchen table.



RICHARD THOMPSON

National Geographic, January 1995



ESTHER BEATON, TERRA AUSTRALIS PHOTO AGENCY (BOTH)

A Silken Road Across the Outback

An 18-foot-long snake seems to undulate across the desert of Australia's Northern Territory. Or could it be a huge worm? No, it's a trail of more than a hundred two-inch-long caterpillars lined up head to tail, marching relentlessly over the sand. That's why they're called processionary caterpillars.

These larvae of the bag-shelter moth live in acacia trees and feed on their leaves. The caterpillars spin a large nest of silk and suspend it between two branches. When the leaf supply runs low, the caterpillars strike out in single file in late afternoon to find a new acacia. Completely exposed when traveling, they seem easy pickings for birds or other predators—which get a nasty surprise from chemical irritants in the caterpillars' long barbed hairs (above).

OCHROGASTER LUNIFER

Traveling mostly at night, the caterpillars spin continuous threads, literally creating a silk road that helps keep the queue together. After locating a promising tree, the larvae build a new nest. As individuals make forays to acacia leaves in their newfound arboreal larder, they continue to spin strands of silk, which guide them back to the nest.

Pet Trade Puts American Box Turtle in a Bind

Miniature tanks lumbering across the backyard, box turtles give many a child its first brush with nature. Though not officially endangered, these native North American reptiles are suffering abuse and are in need of protection.

Demand for box turtles as pets in Europe has soared; others go to Asia, like these awaiting shipment in Los Angeles. Total U. S. exports exceed 25,000 a year. Crammed rudely together, turtles are often deprived of food and water for weeks. The result of such inhumane treatment: Half the turtles shipped to Europe die within a month.

"The British have always been turtle crazy," says Michael W. Klemens, a herpetologist with the Wildlife Conservation Society. Until the mid-1980s most European turtle fanciers bought Mediterranean tortoises from North Africa and southern Europe as pets. When trade in those tortoises was banned in 1984, dealers turned to the American box turtle. U. S. retailers often pay children a small bounty per turtle to scour the woods and deliver the goods.

Box turtles range from the East Coast to the Rocky Mountains. Although many live to a ripe old age—50 to 75 years—their reproductive rate is extremely low, and few eggs or hatchlings survive.

Klemens says such mass exploitation poses a serious threat. He and other conservationists have been working to see that export permits are required and that the number and condition of exported turtles are monitored by the U. S. Fish and Wildlife Service.

—JOHN L. ELIOT

WIL LUIJF, TRAFFIC EUROPE

National Geographic, January 1995

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On Assignment

BOB SACHA

Dressed for excess in New Orleans, senior writer PRIIT VESILIND (above, at left) and freelance photographer BOB SACHA joined revelers aboard a Mardi Gras parade float while reporting on the city for this issue. The team flung souvenir necklaces to celebrators along St. Charles Avenue. "You feel like King for a Day," says Priit. "Everybody is screaming for beads; everybody wants what you've got." What did Priit get for his efforts? "Tired," he admits. "I also ended up with a sore pitching arm."

Bob Sacha found the Big Easy lived up to its name: "New Orleans is the one other place in America I'd want to live," says the Manhattan-based jazz enthusiast. "The streets are filled with music there. You just can't help moving your feet."

"That mallet probably weighs five pounds," says freelance writer DAVID ROBERTS, who tested replicas of pyramid-building tools near a Saqqara archaeological site in Egypt. His observer, CHRISTOPHER SLOAN, an art director for NATIONAL GEOGRAPHIC, was duly impressed: "Ancient Egyptians must have had very strong arms."

Researching Egypt's Old Kingdom, David and Chris secured government permission to climb the Great Pyramid of Khufu at Giza. Says Colorado-born David, a former mountaineering instructor, "We made it to the top in 17 minutes. We knew that officials had posted a guard below to assist us, but we weren't really at risk—although I understand people have fallen off the pyramids before."

David sees a common thread in the subjects he has covered for the GEOGRAPHIC: Geronimo, the Alpine Iceman discovery, and Mali's Dogon people. "I like a combination of remote places and archaeology," he says, "and adventure."

KENNETH GARRETT

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