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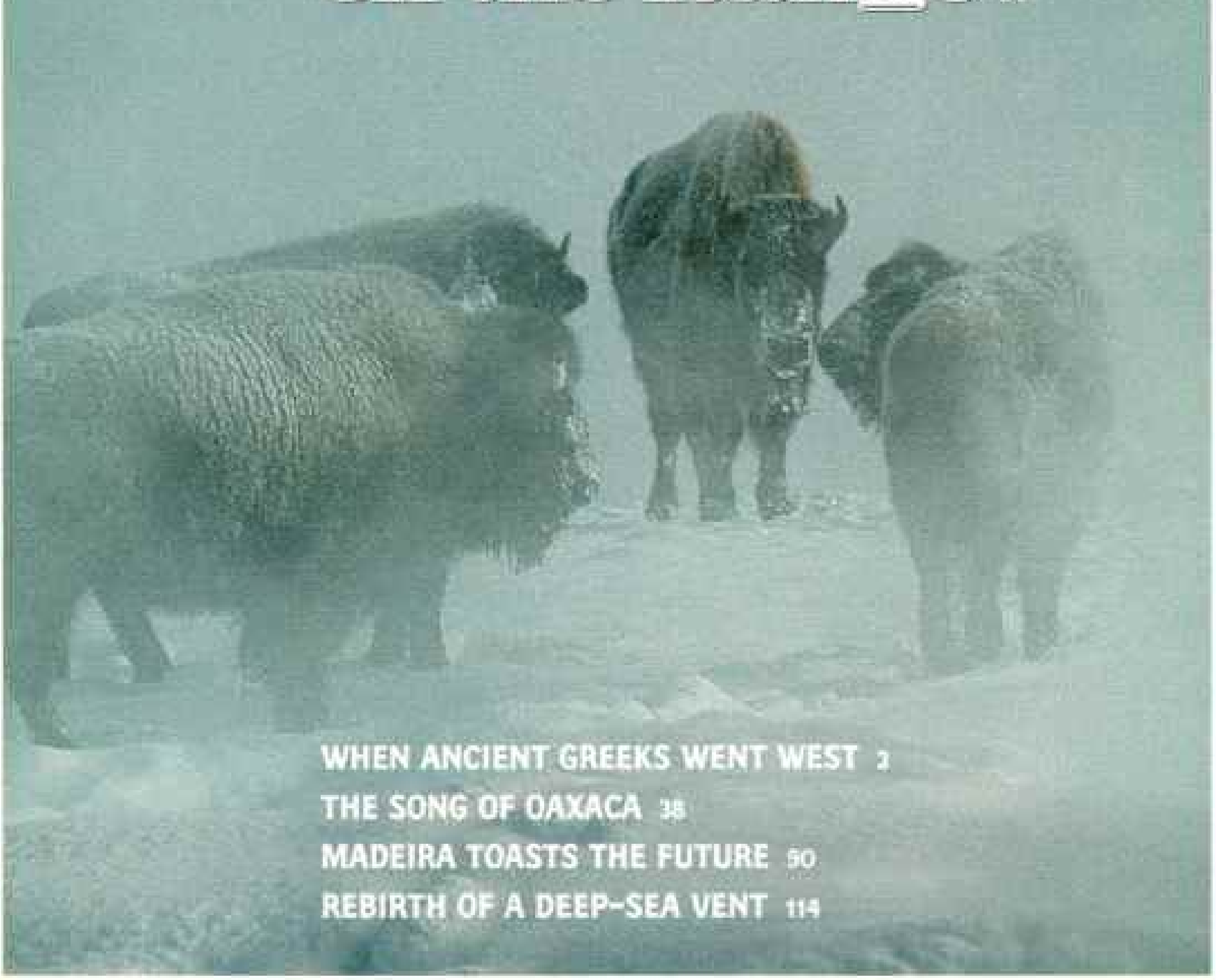
NATIONAL GEOGRAPHIC

Buffalo

Back Home on the Range ™



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COVER: Steamy warmth of thermal springs in Yellowstone National Park draws some of its 4,000 buffalo, ranging free here as they have for centuries. Photograph by Sarah Leen, Matrix.

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WHEN THE GREEKS WENT WEST

PHOTOGRAPHED AT REGIONAL ARCHAEOLOGICAL MUSEUM, SYRACUSE

FOR 500 YEARS, BETWEEN THE EIGHTH AND THIRD CENTURIES B.C., GREEK COLONIES IN SICILY AND SOUTHERN ITALY SCALED THE HEIGHTS OF POWER AND WEALTH. THE GLORY OF THE PIONEERING GREEKS STILL SPEAKS THROUGH AN ACTOR'S MASK AND ON SEGESTA'S ANCIENT STAGE.

By RICK GORE
SENIOR ASSISTANT EDITOR

Photographs by SISSE BRIMBERG

GREECE'S WESTWARD EXPANSION

In an age when the Mediterranean Sea was a daunting frontier, traversed in legend by Heracles and Odysseus, Greek settlers sailed west for a better life. Crossing the waters in oared ships, colonists made for southern Italy—a region that became known as Magna Graecia, or Great Greece—and for the island of Sicily.

The newcomers built cities, often on the sites of native towns. Eventually the colonies rivaled their parent cities, producing writers, athletes, and thinkers such as Archimedes and Pythagoras, as well as merchants wealthy from grain exports. In 413 B.C. Syracuse crushed an invasion from Athens to become the titan of the Greek world. Pressure from Carthaginians and Romans and feuds between cities weakened the western Greeks. By 200 B.C. Rome had toppled the westerners, though their language and customs would endure for centuries.

Modeled vase, 8 in. Gela, first half of the fifth century B.C. Regional Archaeological Museum, Syracuse

LATINS

VOLSCI

ITALY

DAUNI

SAMNITES

Adriatic Sea

Capua

KYME, ca 750 B.C. (Cumae) Chalcis and Eretria

Ischia

PITHEKOUSSAI, ca 770 B.C. Chalcis and Eretria

NEAPOLIS, ca 650 B.C. (Naples), Kyme

Vesuvius 4,203 ft

Bay of Naples

LUCANIANS

POSEIDONIA, ca 600 B.C. (Paestum), Sybaris

ELEA, ca 535 B.C. (Velia), Phokaia

Mirror, 12 in. Metapontion, mid-fifth century B.C. National Archaeological Museum, Metaponto, courtesy University of Texas Foundation. Photograph by Chris Williams

IAPYGIANS

TARAS, 706 B.C. (Taranto), Sparta

METAPONTION, ca 630 B.C. (Metaponto), ACHAEA

SIRIS, ca 650 B.C. Kolophon

MESSAPII

Gulf of Taranto

SYBARIS, ca 720 B.C. ACHAEA

THURII, 443 B.C. Athens

Tyrrhenian Sea

Aeolian Islands

Stromboli

Ionian Sea

Corfu

Cape Colonna

KROTON, 708 B.C. (Crotone), ACHAEA

BRUTTII

Bronze horse, 3 in. Syracuse, ca 310 B.C. Regional Archaeological Museum, Syracuse

Painted vase, 14 in. Gela, ca 480-470 B.C. Regional Archaeological Museum, Palermo

Pythagoras, 19.3 in. Rome, first or second century A.D., copy of fifth-century B.C. Greek work. Capitoline Museum, Rome. Bettmann Archive

LIPARA, ca 580-576 B.C. (Lipari), Knidos and RHODES

Vulcano

Rhegion

LOKROI, 673 B.C. (Locri), LOCRIS

Panormos (Palermo), PHOENICIA

ZANKLE-MESSENE, ca 730 B.C. (Messina), Kyme and Chalcis

RHEGION, ca 730 B.C. (Reggio di Calabria) Zankle-Messene and Chalcis

ZIZYMI, Motya, PHOENICIA

Segesta

HIMERA, ca 649 B.C. Zankle-Messene

SELINUS, 628 B.C. Megara Hyblaea

SICANI

Etna 10,902 ft

SICELS

Sicily

NAXOS, 735 B.C. Chalcis

Morgantina

KATANE, 729 B.C. (Catania), Chalcis

AKRAGAS, 580 B.C. (Agrigento), Gela

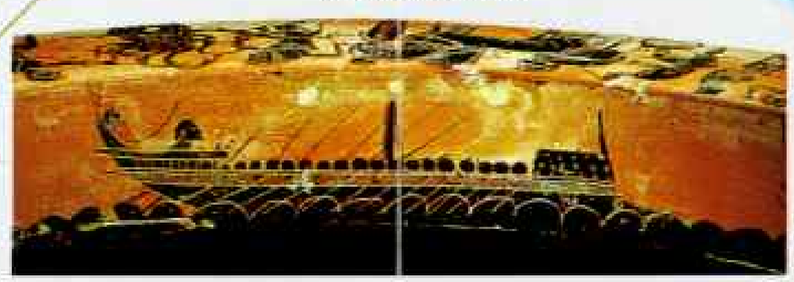
MEGARA HYBLAEA 728 B.C. Megara

SYRACUSE, 734 B.C. Corinth

GELA, ca 688 B.C. RHODES and CRETE

Palazzolo Acreide

Coin, 1.4 in. Syracuse, ca 405-390 B.C. Smithsonian Institution, Washington, D.C. Photograph by Douglas Mudd



Run of container, 8 in. Attica, ca 340-330 B.C. Regional Archaeological Museum, Lipari

Greek trade routes

TARAS — Greek colony or subcolony shown in red

706 B.C. — Founding date shown in red

(Taranto) — Modern name

Sparta — Mother city

ACHAEA — Mother region

BOEOTIA — Other Greek region

Capua — Non-Greek city

LATINS — Native people

Religious sanctuary

Ruin

0 30 MILES

MCG CARTOGRAPHIC DIVISION

DRAWING BY CHRISTOPHER A. KLEIN

MACEDONIA

Amphipolis

Thessaloniki

Thasos

Aegean Sea

GREECE

EPIRUS

Charioteer, 5 ft 11 in. Delphi, ca 475 B.C. Archaeological Museum of Delphi. Photograph by Nimatallah, Art Resource

Euboea

LOCRIS

AETOLIA

LOCRIS

Delphi

BOEOTIA

Chalcis

Eretria

Thebes

ATTICA

ACHAEA

Athens

Piraeus

Megara

Corinth

Cephalonia

ARCADIA

ELIS

Mycenae

Olympia

Argos

Zante

Zagora

Peloponnesos

MESSENIA

Sparta

LACONIA

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, TARANTO

WHETHER EXPRESSING THEMSELVES IN PLAYFUL SCULPTURES OF GYMNASTS OR IN A VASE SHOWING EROS, GOD OF LOVE, THE GREEKS IN ITALY INVIGORATED THE MOTHER CULTURE. FROM THE WEST CAME ADVANCES IN ART, ARCHITECTURE, AND SCIENCE, AS WELL AS STIRRINGS OF DEMOCRACY.

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, METAPONTO, COURTESY UNIVERSITY OF TEXAS EXCAVATIONS

Ancient mariners favored the Aeolian Islands, off Sicily,

FOR HERE LIVED AEOLUS, KEEPER OF WINDS, WHO SPED THEIR WAY.

PAINTING BY JERRY PINKNEY

WHO OWNED SUCH A FINE DRINKING CUP? THE WINE BOWL, INSCRIBED WITH GREEK VERSE, WAS UNCOVERED IN A CHILD'S FUNERAL PYRE IN PITHEKOUSSAI, THE FIRST WESTERN SETTLEMENT. ARCHAEOLOGIST GIORGIO BUCHNER (RIGHT), WHO FOUND THE PIECE FROM ABOUT 720 B.C., BELIEVES A GRIEVING FATHER DASHED IT INTO THE FIRE.

ON AN ISLAND not far from the rocks where the mythical Sirens sang, grief overwhelmed the man. His son, a boy of about ten, had died. The year was 720 B.C., and funeral ceremonies had begun on this far-flung outpost of the Greek world.

Years earlier the man had left his home in Greece, fired by dreams of a fresh start in a rich land. He had sailed west in a cramped galley, disembarking on this island called Pithekoussai near the Bay of Naples. A rough-and-ready emporium, Pithekoussai teemed with not only Greeks but also Phoenician artisans and adventurers from across the Mediterranean. Laborers worked as smelters, processing ores from the iron-rich Etruscan lands to the north. Craftsmen shaped the metal into jewelry and other decorative goods to trade back to the Etruscans and nearby Italic peoples.

The man had married—perhaps the daughter of an Etruscan trading partner. He prospered. Then tragedy took his son.

He ordered a costly cremation, a rite normally reserved for adults. As flames roared around his son's body, the man bade him farewell. He picked up a favorite wine cup, drank deeply, then smashed the cup into the fire.

Twenty-seven centuries later I sit in a villa overlooking ancient Pithekoussai, now known as Ischia, talking of this long-ago anguish with Giorgio Buchner, an 80-year-old archaeologist. Buchner, who has excavated on the island since 1952, bases his tale of this ancient father on a grave in the valley below the villa.

"It is one of the richest graves we have," he says. "We found the boy's bones—and this." He opens a box. Inside is the very cup, pieced together again, that Buchner believes was flung by the grieving father. Three lines of poetry are inscribed across it. "Nestor had a fine drinking cup," Buchner translates, "but anyone who drinks from *this* cup will soon be struck with desire for fair-crowned Aphrodite."

Playful verses, they are reminiscent not of a funeral but of the parties called symposia that the father must have once enjoyed. They refer to King Nestor of Homer's *Iliad*.

"These words are among the earliest scraps of writing we know of in the Greek alphabet," says Buchner. "We don't know if the father himself wrote these verses, but they tell us that the people who lived here were cultivated. They knew the Homeric poems perhaps at the same time they were being written down."

I have come to Pithekoussai in search of such fragments. They represent the beginning of a great age of Greek emigration and exploration—a westward expansionary movement no less venturesome for ancient times than the settlement of the Americas would be two millennia later. I want to discover who these people were, what made them leave home, and what kind of new world they built.

Pithekoussai, founded around 770 B.C., was the first of those Greek settlements. A few decades later, colonies were established on Sicily. More sprouted all along the coast of southern Italy, a region called Magna Graecia, or Great Greece, by Latin historians.

The western lands were fertile, and their prosperous soils helped create great cities. On Sicily, Syracuse eventually reached a population that rivaled Athens's in size and power. Likewise, the city of Sybaris grew so rich that its name remains a synonym for voluptuous luxury.

Doric masterpiece of strength and symmetry, the Temple of Concord commands the site of

Akragas. The temples the colonists built here are among the best-preserved in the Greek world.

The western Greeks flaunted their success. They built huge temples that outshone most of those back home. Passionate about athletics, they dominated the Olympic Games for many years. They commissioned a number of the great artworks of antiquity. Even after they were overwhelmed by Roman armies around 210 B.C., the western Greeks lived on in Italy. When Mount Vesuvius erupted in A.D. 79, the citizens of Naples still spoke Greek.

This westward expansion invigorated the Greek spirit. Many of the great philosophers before Socrates emerged in the west. Pythagoras, called the father of science, flourished in Magna Graecia. Later, Archimedes, the most celebrated mathematician and inventor of ancient Greece, lived in Sicily. Perhaps the fires of democracy itself were fueled in the west before reaching Athens.

Modern archaeology is revolutionizing our portrait of the western Greeks. Until recently we had to rely on the often biased or hearsay writings of ancient historians, most of whom lived centuries after the events they reported. However, archaeologists are now documenting for the first time actual settlement patterns, farm sizes, and agricultural techniques. Excavations of cemeteries in and near the ancient city of Metapontion (today's Metaponto) in southern Italy have yielded hundreds of skeletons, providing scientists with some of their first hard facts about the physical health of the ancient Greek world.

WHY did the Greeks go west? "They were driven in part by curiosity. Real curiosity," explains Elizabeth French, director of the British School at Athens. "They wanted to know what lay on the other side of the sea."

Centuries earlier their ancestors, known as the Mycenaeans, had sailed western waters and had traded with the indigenous people. The Mycenaeans were the ones who, in legend, fought the Trojan War. Odysseus was a Mycenaean who got lost in the west on his way home from Troy.

Beginning around 1200 B.C. the Mycenaean civilization fell into turmoil, triggered perhaps by social unrest or a series of earthquakes. After 1100 B.C. a dark age descended over most of Greece, and writing disappeared. Contact with the west dwindled; nevertheless, it lived on in myth as a land of mystery, sorcery, and apprehension. The monsters Scylla and Charybdis lurked in the turbulent strait that separates Italy from Sicily. The Cyclops Polyphemus hurled boulders at Odysseus from the slopes of Mount Etna.

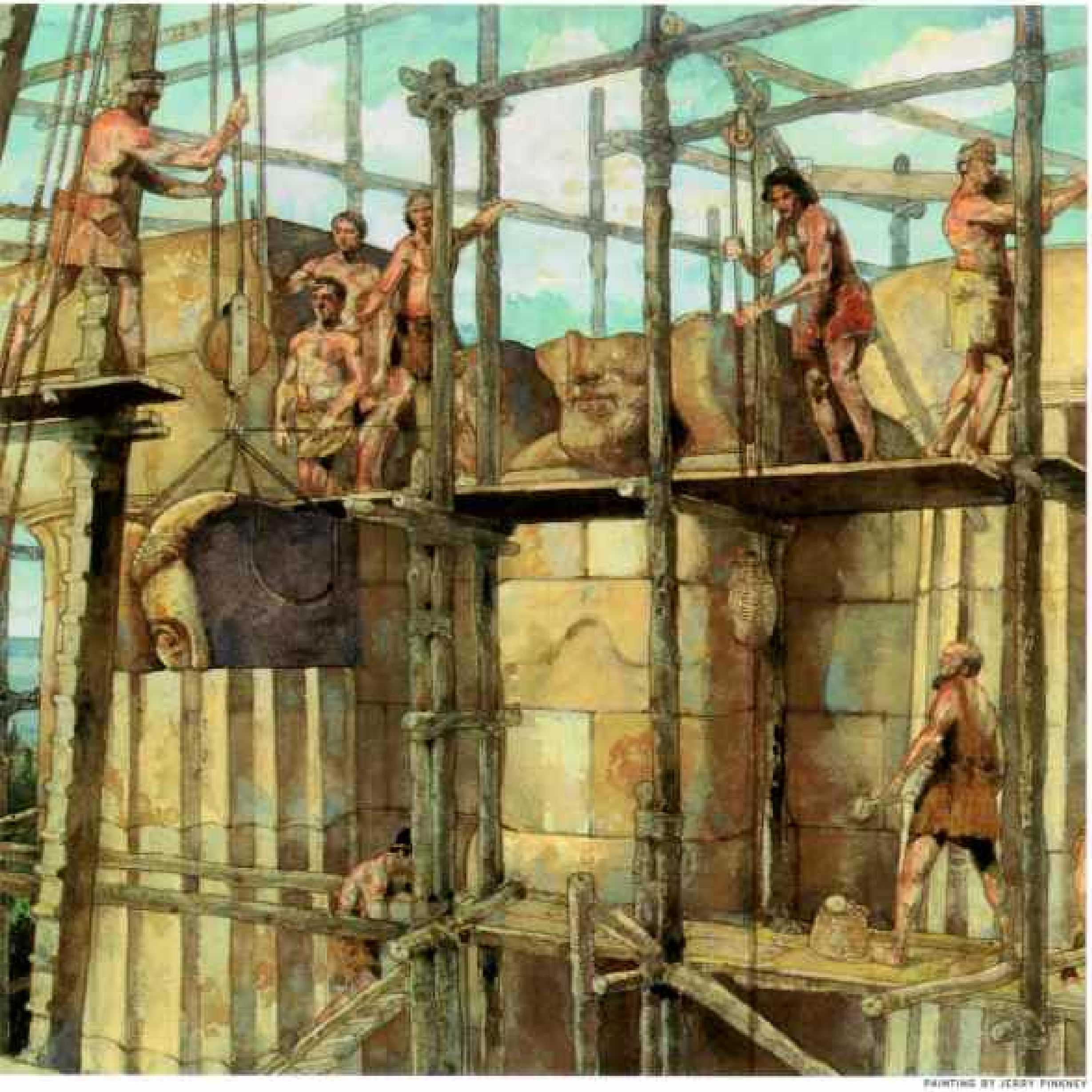
As the dark age ended, adventurous Greeks sailed west again. At first the lure may have been trade, but soon social forces at home began to dominate the colonization. "Villages coalesced into city-states, or poleis, such as Athens and Sparta," explains Anthony Snodgrass, an archaeologist at Cambridge University in England. "The population boomed. There was not enough land."

An emerging class of independent small farmers tilled rocky plots on infertile mountainsides. The ruling elite held the growing masses in contempt. In one polis aristocrats went through the streets clubbing people they disliked. Soon bands of people seeking a better life

Its dimensions worthy of the Greeks' highest god, the Temple of Zeus at Akragas takes shape as one of the most colossal sacred buildings in the classical world. In this interpretation of its construction about 500 B.C., laborers lift the upper face of a 25-foot-tall telamon, a giant used as a structural support.

The massive pillars, five stories high, were

Photographer SISSE BRIMBERG, a native of Copenhagen, came to Washington, D. C., in 1975 to pursue her craft. She has made the city her headquarters ever since. This is her 18th article for the GEOGRAPHIC.



PAINTING BY JERRY FINNEY

built in sections. Drums of rough limestone were lifted and fitted together, then fluted by a stonecutter. Though never finished because of war, the structure, now in ruins, would have been nearly twice as large as the Temple of Heracles, at left.

began striking out for the new world. Each band was led by a founder who first consulted with the famous oracle at Delphi. And so I, too, go to Delphi, where journeys west began.

The mystical aura of Delphi persists. Dark clouds brood above the Temple of Apollo, where the oracle sat, enshrouded by vapors and chanting in a language only the priests could interpret. The oracle was usually an older woman, but dressed as a girl. The Greeks believed she spoke the will of the god Apollo.

Like so many pilgrims in the past, I walk up Delphi's Sacred Way, passing the rubble of monuments erected by numerous city-states to commemorate great victories. The finest architecture, the most sublime sculptures once adorned this path. It would have glittered, awing suppliants. Some of the most conspicuous monuments were built by westerners after they became wealthy.

Delphi's first recorded involvement in establishing a colony dates

from around 730 B.C. The geographer Strabo writes that the city of Chalcis, suffering a severe drought, sent 10 percent of its young men as a human tithe to Delphi, thereby decreasing its overstressed population. Perhaps not knowing what to do with the men, the oracle in turn sent them to Italy to help establish the colony of Rhegion.

As the colonists arrived in their new world, a radical concept began to emerge—the equality of citizens. Colonists also began to build a new kind of settlement.

In Greece, towns had evolved helter-skelter. For instance, in the ruins of a Greek town called Zagora, which developed at the end of the dark age, I see houses built around a central hearth and arrayed in clusters. There was no regular pattern of streets. When I arrive in Sicily, however, I find an utterly different type of city. Called Megara Hyblaea, it was built in the eighth century B.C. by the first wave of colonists. Only the foundations of its buildings remain. Nevertheless, the houses were clearly laid out on a grid of streets, much like Manhattan today. Different sectors of the city served different functions. The plan was highly rational.

"Until the early 1970s we were taught that urban planning was invented at the city of Piraeus in mainland Greece in the 430s B.C.," says Malcolm Bell III, an archaeologist at the American Academy in Rome. "Megara Hyblaea shows us it happened in the colonies about three centuries earlier."

The grid reveals a major innovation. The city was divided into blocks and lots of roughly the same size. "Everyone was equal in the colonies in the beginning," explains Paola Pelagatti, an Italian archaeologist, "so that's how they laid out their cities."

THROUGHOUT the seventh and sixth centuries B.C. immigrants flooded into the new cities of the west. Because writing was still so limited, little is known of those cities until about 550 B.C. Around that date coins came into use, and each city produced its own distinctive design.

Among the earliest known coins in the west are those from Sybaris, which by then had become the most powerful city in Magna Graecia. The luxury-loving Sybarites reportedly banned roosters, lest the citizenry be awakened too early. They supposedly also had wine piped directly into the city from the vineyards.

Pipes still dominate the landscape at Sybaris, but now they belong to a massive pumping system designed to keep the excavated portions of Sybaris dry. The original Sybaris perished abruptly in 510 B.C. when its neighbors, led by the city of Kroton, attacked and razed it. Seventy years later Athens built a new city on the ruins. The Romans built yet another. Groundwater rose, and Sybaris eventually became a swamp.

"Without these pumps this would all be under water," says Isora Migliari, an archaeological assistant, as she takes me to see what's been exposed of the original Greek Sybaris during a quarter century of occasional digging. We enter the atrium of a Roman-era home. Migliari points into the remnants of a shallow well. I see a frog and a few building stones.

"That well belongs to Sybaris," she says.

"That's all that's left?"

"No. The whole city is buried here. Everything," she declares. "We know where the buildings are, and exactly where to dig.

"It is not a bad place at all . . . men could reap a full harvest," mused Odysseus upon spying the region of the Cyclops. Scholars suggest that the hero of Homer's epic, the Odyssey, *had come to Sicily, where the oat fields of antiquity are recalled today (above).*

Grain fed the colonies' wealth. Ships sailed to Greece with wheat, oats, and barley and returned with pottery and bronze figurines. Each colonial

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM OF CALABRIA, REGGIO DI CALABRIA

city-state included land where farmers worked plots richer, larger, and, at least at first, more equitably allotted than those in Greece. Cults formed around the grain goddess Persephone. A restored plaque from a sanctuary in Lokroi shows Persephone sharing the throne with Hades, god of the underworld, as they admire fruits of the land.

We have a great culture here but very little money to excavate."

I travel to Sybaris's rival and conqueror, the mighty city of Kroton. It too lies buried—beneath the bustling modern metropolis of Crotone. On a peninsula known as Capo Colonna on the outskirts of the city rises a lone column of a temple, a sanctuary for the goddess Hera. The original 42 columns were standing until around 1500, when looters began to cart them off to reuse the stone.

"The temple was like the Statue of Liberty, the first thing you saw as you approached," says Tommaso Tedesco, an architect and history enthusiast. "It was famous throughout the Mediterranean."

Crotone offers few other artifacts of the Greek town. However, its Piazza Pythagoras recalls ancient Kroton's most famous citizen.

PYTHAGORAS AND HIS DISCIPLES had enormous influence in the evolution of Western thought. They believed that all aspects of nature, from the notes of the musical scale to the sides of triangles, were governed by the relationships between numbers. Mathematics, science, architecture, and engineering revolve around that concept. The Pythagoreans probably influenced a school of philosophers in the city of Elea, thinkers such as Parmenides and Zeno, who also pioneered in asking questions about the nature of being. Although Greek philosophy had been born earlier—in Miletos, a Greek center in Asia Minor—these westerners refined the intellectual journey that Socrates, Plato, and Aristotle would later continue in Athens, a journey fundamental to Western civilization. It was the beginning of reason.

But who was Pythagoras? It's hard to separate the man from his legend. "We have no writings of his," says Leonardo Taran, a historian of philosophy at Columbia University. "Much of what is ascribed to him may, in fact, be that of his followers."

"Stupendo," says sculptor Bernardino Morsani of the ageless warrior he copies in Reggio di Calabria's archaeological museum. One of the most dynamic pieces of bronze sculpture executed by the Greeks, it and another male statue—both currently undergoing restoration with support from the Italian conglomerate Finmeccanica—were found by chance in 1972 in shallow water off Riace, Italy. Historians speculate that Carthaginians plundered the pair from a city and lost them at sea during a storm.

"Ssshhh," says a worshiper in the Syracuse Cathedral, built on the site of the Temple of Athena, many of whose columns remain in place after 2,500 years.

According to legend, Pythagoras fled a tyrant on the Aegean island of Samos as a youth and then traveled in Egypt and the Near East, where he was exposed to new ideas. He reached Kroton in 530 B.C. and established a school. He became deeply involved with the aristocracy of Kroton and during a political upheaval was forced to escape to the nearby town of Metapontion. Part of his difficulty was, ironically, a mystical side to his teachings. Pythagoreans became a religious sect. They apparently believed in reincarnation, emphasizing the purification of souls to erase some ancient wrong that all humans share.

In Pythagoras's day, however, his fellow Krotoniates were doubtless far more interested in the city's athletic prowess. Sports obsessed the city. At one Olympics, the first seven finishers in the stadium footrace were from Kroton, inspiring a saying that the last of the Krotoniates was the first among all other Greeks.

"Not only did Kroton have the best athletes, it had the most beautiful women," says Tedesco. "The great painter Zeuxis came here to find models for a painting of Helen of Troy."

Modern Crotone remains famed for beautiful faces. They surround me on a Sunday evening, when much of the town turns out for the *passeggiata*, or evening stroll. The piazza fills with young people chattering, kissing, and eating *gelato*, or ice cream. Older people walk dogs. Flirtation is rampant.

"This is a very old tradition," says Tedesco. "Until modern times women weren't supposed to be seen in public with men. The passeggiata was a chance to catch eyes. It was also a time to discuss business or have a chat. Perhaps such assemblies were also the way in the agora of the old Greek city."

Such outings may have been one of the few freedoms women had in ancient Greece.

"The Greek polis was something of a men's club," says classicist Erwin Cook of the University of Texas. "Women tended to stay at home and do the household chores. They went out chiefly for ceremonies, festivals, and such duties as drawing water. In myth, trysts often took place at wells. Going there was one way a woman got out of the house."

But nearby in Lokroi, one of the largest towns of Magna Graecia, women seem to have had more rights. Unlike Sybaris and Kroton, much of Lokroi has been excavated. I walk its walls with Elena Lattanzi, the superintendent of archaeology for the Calabria region, and Claudio Sabbione, director of the Locri museum.

"There was a strong tradition of matriarchy in Lokroi," explains Lattanzi. "The aristocrats, for instance, descended from the mother's side. Also, the cults of two goddesses, Persephone and Aphrodite, were powerful here."

Women across Magna Graecia identified especially with Persephone, the daughter of Zeus and the earth goddess Demeter. As a girl, Persephone was kidnapped by Hades, god of the underworld. Her mother demanded her return. But since she had eaten fruit in the underworld, she could only return for part of the year—when she blessed the earth with fertility.

Tablets that recount this myth were hung like stations of the cross in Lokroi's sanctuary. All over the west, women held festivals in Persephone's honor, often sacrificing piglets, symbols of fecundity, to gain her blessings. She became the Madonna of her day. Votive statues of her were mass-produced. They fill museum drawers all over southern Italy.

Persephone may have inspired a piety that lives on. Outside a church near Locri, I watch busloads of older women clutching rosaries and inexpensive statues of the Virgin Mary as they file into Mass on the Feast of the Madonna Nera. Most of the women's faces are creased, like seasoned olives, from years of work in the sun, and the majority wear black dresses, signifying they are in mourning. A few walk with husbands. The men look uninterested, but the women radiate their fervor as they move en masse toward the church. "I think of you night and day," they chant over and over to the Madonna, and somehow, across the ages, the women of Magna Graecia are still singing.

The ideal of beauty cherished by ancient Greeks today sends Sicilian women to a skin-toning mud pool on Vulcano, one of several hot spots in the Aeolian Islands.

The cool harmony of classical features shines from a paint-chipped miniature of a theater mask found on the islands. It is the face of the False Virgin, a character from third century B.C. Greek comedy. Both mime and vaudeville-style comedy emerged from the west.

PHOTOGRAPHED AT REGIONAL ARCHAEOLOGICAL MUSEUM, LIPARI (BELOW)

NOWHERE do the voices of Magna Graecia echo as poignantly as near Metaponto, a town that is little more than a train stop and minor resort. For centuries the site was abandoned, and most residents are oblivious of its past as the great Metapontion.

"This was a swamp. Metaponto didn't exist until Mussolini drained it," says Michele Marra, one of two local soccer players I meet at the ruins of the old agora. Dressed in stylish running clothes, he comes to this lonely spot to work out. As he stretches, Marra swats at a mosquito. The remains of an elaborate drainage system here in the center of the old city testify that even in its glory days, a high water table—and inevitably a healthy population of insects—plagued the residents.

Before jogging off, Marra says he finds little inspiration in the ruins—a few columns of a temple, the wall of a theater, and numerous stone foundations. Experts on Magna Graecia feel differently. In Metaponto's ancient cemeteries nearly 700 skeletons have been found—by far the largest sampling of bones from any site of classical antiquity. And in the local archaeological museum, I come face-to-face with a western Greek for the first time.

"We call him the Musician," says archaeologist Joseph Carter of the University of Texas. "That's because he was buried with a lyre." The lyre commonly was used by poets who sang Homeric tales. So perhaps it tells us the occupation of this man.

The Musician's bones were found in nearly perfect condition, says Carter, who since 1974 has coordinated a multidisciplinary research program at Metaponto. The bones lie neatly arrayed in a box. The skull was in such good shape that scientists could create a lifelike plastic reconstruction of the Musician's head. Carter lifts the reconstructed skull and turns the face toward me. I see a robust man, one with a large nose and simple, rustic features.

He is haunting—a person history forgot but fortune saved.

"He died at about 40 and was exceptionally tall for his day—about five feet ten," says Carter. "Average height for a man then was about five feet five."

Why was he so tall? Maciej and Renata Henneberg, physical anthropologists at South Africa's University of the Witwatersrand,

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, METAPONTO

Even in death the Greeks comforted themselves with luxury. A woman's tomb from Taras held a bronze nutcracker shaped like hands. Another woman entered the underworld with a gold, boat-shaped earring, modeled on a stylishly coiffed sculpture.

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, TARANTO

think that the Musician may have had mild acromegaly—a condition caused by an overactive pituitary gland. Their evidence is enlargement of his hands and feet, a frequent symptom.

"If he had the disease, he was probably high-strung and nervous," says Carter.

The Musician had been a sickly child. Rings of thin enamel on his teeth suggest he had high fevers while his teeth were forming.

I meet the Hennebergs in Metaponto as they work on a new skeleton, examining such things as teeth and cranial sutures to determine age, sex, and health.

"Life expectancy of a newborn here was 21 years," says Maciej. "Half of all children died before age 15. If a female survived beyond that, she could expect to live to 38; a male to 41."

Survival meant living in pain, frequently in the mouth.

"There were no dentists to extract teeth," says Renata. "People were walking around with raging toothaches. We've seen many teeth completely decayed or lost."

Although dental care was lacking, Metapontion was praised by ancient writers for its medicine. Maciej shows me a fractured male thighbone that had been masterfully set and had healed.

"This was a remarkable surgical procedure," he says. "Someone used a lot of force to pull the lower part of the broken bone down, reset it, and keep it in place for weeks against the enormous pressures of contracting muscles."

Not everyone got such care, however. Maciej shows me a thighbone that belonged to a man buried in a rural cemetery. It looks twisted. No effort had been made to set it. It had healed with the bone fragments still separated.

"We can tell this man lived for at least five years after the break," says Maciej. "Someone cared for him for perhaps three months. After that he would have walked with a limp."

A garden of earthly delights embellishes a funeral wreath from a man's tomb in Metapontion. Hung with bronze leaves and terra-cotta berries and grapes, grasshoppers and cicadas, the crown evokes the bright summer world associated with youth.

THE HENNEBERGS' most surprising finding, however, suggests that syphilis, which most scientists believe spread to Europe from the Americas after Christopher Columbus returned, was already present in southern Italy in Greek times.

Renata holds up another skull. It is riddled with what look like wormholes.

"These lesions are indicative of the microorganism that causes syphilis—a spirochete called *Treponema*," she says.

"We see a lot of it," adds Maciej. "Forty-seven skeletons out of 272 show signs of treponemal infection."

The lesions could be related to another treponemal disease, called yaws, which children may have contracted from infected playmates. But other researchers have recently found evidence that syphilis probably occurred in medieval England before Columbus's time. The skeletons of Metapontion suggest that the disease may always have been present in Europe. In pre-Columbian times syphilis might well have been misdiagnosed as leprosy.

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, METAPONTO

At the time the man died, in the fourth century B.C., the worship of Orpheus, the mythical singer who traveled to the underworld, had spread to Magna Graecia. The crown's golden color, a symbol of immortality, and the presence of cicadas, valued for their singing, may refer to the secret Orphic rites.

The skeletons also lend credence to the idea that rituals of a mystic cult were practiced at Metapontion. Named Orphism for the mythical singer Orpheus, the cult apparently swept the Greek world in the sixth and fifth centuries B.C. Orphism taught that performing purification rituals guaranteed redemption and a better life after death.

"Orphic purifiers traveled the countryside," explains Walter Burkert, a German scholar. "Those wandering charismatics had books of poems supposedly written by Orpheus and gold leaves bearing instructions for getting through the underworld."

Orphic rituals varied. In some regions they might be frenzied revels with animal sacrifice and wine drinking.

"Wine, the gift of the god Dionysus, helped you reclaim the carefree existence of the golden age," explains scholar Erwin Cook. "You lost your inhibitions. You forgot your pain."

Elsewhere the rituals might be cleansings. The skin of an initiate was coated with plaster. It was coated again when the initiate died—so he would be recognized in the afterlife as among the saved.

Until the Metaponto excavations scholars had scant archaeological evidence for these rituals. However, several of the skeletons from one rural cemetery have plaster on their bones. The plaster would have settled onto the bone surface after the flesh decayed. The presence of that plaster indicates Orphic rites were indeed practiced in the countryside of Magna Graecia.

The archaeological survey team from Texas has also overturned the long-standing idea that the western Greeks were primarily city dwellers. "Half of Metapontion's citizens may have been farmers

Civilizations rise and fall, but love is eternal for a newlywed at a fifth-century B.C. temple

in Paestum. Here Greeks are thought to have honored Hera, goddess of marriage.

living outside the city," says Joseph Carter. Ancient seeds, pollen, and plant remains confirm that barley, wheat, olives, and grapes were the primary crops grown by the Metapontians.

"We've learned that agriculture was already happening here before the Greeks arrived," says Carter's Italian associate Lorenzo Costantini, an archaeobotanist. "But there weren't true farms. The indigenous people used the same plants as the Greeks. The Greeks brought a more efficient way of growing them. They were strong farmers, used to putting in effort. They knew that some sites were good for olives, others for vines or wheat. So they divided the land accordingly. They brought new tools and deeper plowing. They rotated crops. They used cattle dung to fertilize fields. They knew that if you prune a tree properly, you get a much better yield."

Carter's team found animal bones as well. "We see that large horses appeared with the Greeks," says Sándor Bökönyi, a Hungarian archaeologist and specialist in early domestic animals. They also introduced chickens and sheep that bore fine wool.

Bökönyi discovered that the Greeks often mistreated animals. "They were quite rude to them," he says. "I've found cattle with unhealed fractures. Their owners could have set the bones easily, but they didn't bother. Animals were often beaten. I've seen many fractures on the heads of dogs."

The Greeks were no strangers to the drama of dawn on Lipari Island. Then as now the Gran Cratere, an active volcano, exhaled clouds of steam on the nearby island of Vulcano. A Greek settlement hugged the sunstruck shore where the town of Lipari stands today. Like the early settlers, local men still make a business catching swordfish. For such serene weather, the Greeks praised Zeus (right), god of the sky.

DISCOVERIES by other teams at Metaponto may document a triumph of the human spirit—the emergence of democratic ideas—years before Athenian citizens introduced their revolutionary *demokratia*, or rule by the people, in 507 B.C.

Ancient historians wrote that the last tyrant of Metapontion was killed by a man named Antileon because the tyrant lusted after Antileon's young lover. After slaying the tyrant, Antileon fled with the youth. Unfortunately they ran into a flock of sheep tied together in the street. Slowed down, both men were caught and killed. Citizens celebrated the death of the tyrant by erecting bronze statues to the lovers—and by forbidding shepherds to tie their sheep together while driving them through the streets.

Later, in Athens, a similar assassination by two lovers preceded

PHOTOGRAPHED AT NATIONAL ARCHAEOLOGICAL MUSEUM, TARANTO (BELOW)

that city's democratic revolution. That tyrannicide was so glorified by the Athenians that scholars assumed the Metapontion slaying was just a fable based on the Athenian tale.

But in February 1993 the director of Metaponto's archaeological museum, Antonio De Siena, opened a series of newly discovered aristocratic tombs. Local farmers had found the tombs as they deep-plowed an old olive grove. In one monumental tomb the remains of a man and woman were laid out on couches. The man had a sword. The tomb dates back to around 550 B.C. The letters A N T were carved in several places on the walls of the tomb. De Siena believes those letters stand for Antileon.

"I think these are the relatives of Antileon, the tyrant slayer," De Siena says. "After the burial this part of the cemetery was never used again. I think the people of Metapontion made the family tomb a monument."

De Siena notes that sweeping social changes set in at Metapontion around that time. No more grand aristocratic tombs were built. The temple was reconstructed to align with a new grid plan in which land was divided into equal plots. Workers dug a massive drainage and sewer system, which served all the residents. Perhaps most significantly, a place for people to assemble, called an *ekklesiasterion*, was constructed. The earliest such structure known in the Greek world, it had seats for all the region's citizens.

A MORE DEMOCRATIC, independent spirit also appears in the spectacular temples of Magna Graecia and Sicily. "Western temples had especially large central rooms," says Dieter Mertens, an architectural scholar at the German Archaeological Institute in Rome. "They may have been used as much for political assemblies as for religious ceremonies."

Western temple builders freely experimented with design. They became the architectural leaders of the Greek world. For instance, the Temple of Athena in Poseidonia, a city south of Naples, fused the simple Doric with the more elaborate Ionic style. Architects in Greece would not dare blend those two rigidly observed styles for another 50 years. The same well-preserved temple also reflects the

famous Pythagorean dictum: "All is number." A two-to-one ratio runs through the building. Its width is half its length; its height, half its width. That ratio imbues the temple with harmony.

Nearby, the much larger Temple of Hera II, built half a century later, proclaims even more dramatically the western Greek mastery of proportion. Its massive yet elegant columns, its perfect unity, its muscular strength make it seem alive. It's an organism, a concept of the universe, an embodiment of the emerging force of reason.

The surge of temple building reached even more awesome dimensions in Sicily. In the fifth century B.C. Sicilians began to eclipse the Greeks of southern Italy. The indigenous people of the Italian peninsula had risen up against some cities, such as Poseidonia. Elsewhere local geophysical forces had caused the water table to rise, creating swamps and increasing the incidence of malaria. But Sicily prospered. Its vast wheat fields, vineyards, and olive groves brought fabled wealth, much of which went into temples. No city was more obsessed with temples than Selinus, the westernmost colony on the island.

"Here were constructed within one century the greatest number of temples in all the Greek world—Athens included," says Dieter Mertens at ancient Selinus. "Seven great temples. They were not only large, they also required highly skilled workmen." Selinus's so-called Temple G, for example, one of the largest Greek temples ever built, measured 362 feet long and 164 feet wide. To erect its 48 columns, workers had to hoist blocks weighing 50 tons as high as 60 feet. Slaves or captives may have provided much of the manpower.

"They used ropes, pulleys, and wooden cranes," says Mertens. "Imagine an ancient crane 80 feet tall!"

Yet Temple G was never quite finished. In 409 B.C. Carthage attacked and destroyed Selinus. Earthquakes later toppled the building, turning it into a jumble of huge blocks.

Perhaps the same earthquakes destroyed the even more daring Temple of Zeus in the nearby city of Akragas.

Akragas, founded in 580 B.C., was built on a dramatic, steep-sloped limestone plateau that rises out of a fertile plain. The ancients presumably wanted to dazzle visitors approaching their citadel and so built a series of temples on its acropolis and along its walls. In late afternoon light the temples still glow as I near the modern town, now known as Agrigento. They affirm, as few places in Italy still do, that the city was born Greek.

Whole again but for its missing head, a statue of a woman nursing twins was jackhammered into more than 900 pieces at a construction site being cleared above a Greek necropolis at Megara Hyblaea. Called one of the most original pieces of Sicilian Greek art, the restored 30-inch-tall statue, carved in limestone, was likely a grave marker. The sculpture may represent the allegorical figure of Night feeding her children Sleep and Death.

PHOTOGRAPHED AT REGIONAL ARCHAEOLOGICAL MUSEUM, SYRACUSE

THE TEMPLE OF ZEUS, now rubble, was the grandest in Akragas's crown of temples. The city's tyrant, Theron, supposedly commissioned the monument to celebrate a crucial victory over the Carthaginians in 480 B.C. Theron enslaved his prisoners, forcing them to build this immense monument.

"This temple was unusual," says architectural historian Pietro Meli as we wander through its remnants. "It was not an open design. It had walls between the columns." Embedded in those walls were 36 painted stone giants 25 feet tall. These telamones resembled huge genies with their arms raised skyward.

Such extravagance characterized Akragas, which the poet Pindar called "the most beautiful of mortal cities."

"It was said they lived here as if they were going to die the next

day, but they built their buildings as if they were going to live in them forever," says Agrigento's archaeological superintendent, Graziella Fiorentini.

Sicily's most powerful city, however, was Syracuse. By 415 B.C. its growing influence had so alarmed Athens that it sent a great fleet to intervene in Sicilian affairs. In the celebrated Battle of Syracuse, the underdog Sicilians routed the Athenians after they sailed into the city's harbor.

Thousands of Athenian prisoners were held as slaves in stone quarries in Syracuse. A fortunate few were set free—reportedly those who could recite verses of the poet Euripides, who was much admired in Sicily. Most, however, died of disease or hunger working the quarries.

Earthquakes most likely destroyed most of those quarries, which were large chambers cut into a hillside. I enter one that survives, a dank, 200-foot-long grotto called Dionysius' Ear. Excellent acoustics inside the quarry, legend says, permitted the tyrant Dionysius I to sit unseen in an alcove high above prisoners and overhear their conversations.

I, too, can hear echoes across the quarry when I visit. Mostly they are the chatterings of tourists. But there's a deeper echo, sharpened by the countless chisel marks left on the grotto walls by the enslaved laborers of long ago. Much of the glory of Syracuse was built on the anguish of such slaves.

Despite bouts of egotism and cruelty, Dionysius I kept Sicily from falling into Carthaginian hands. Once he mobilized 60,000 people and 6,000 oxen to build in a matter of weeks a complex of 20-foot-thick walls that still stands on the northern edge of Syracuse. Warfare, in fact, obsessed Dionysius. "He assembled the best military minds of Italy and commissioned them to come up with new methods of attack and defense," says Dieter Mertens, who is studying the tyrant's great wall. "They developed the most important weapon of all antiquity—the catapult.

PHOTOGRAPHED AT REGIONAL ARCHAEOLOGICAL MUSEUM, SYRACUSE

"The catapult had an effective distance of up to 50 meters [164 feet]. It could hurl not only stones but also arrows. No longer did people have to fight person-to-person. Catapults were moved across

fields on top of towers ten meters high. That was tall enough to attack an enemy inside his own walls."

The power of Syracuse persisted. In 212 B.C., when the Roman armies of the general Marcus Claudius Marcellus besieged the city, Syracuse remained a citadel of military ingenuity. Audacious war machines invented by Archimedes thwarted Roman attacks for eight months or more.

His name writ in marble, the doctor Sambrotidas left behind this grave marker (left) befitting his profession's esteemed role. The western Greeks were famous for their medical arts, developed in conjunction with the strenuous training of Olympic athletes. A grave excavated in Metaponto by archaeologist Joseph Carter, of the University of Texas, reveals a masterful repair of a fractured thighbone (below, second from top). By comparison an unset bone healed grotesquely. Perhaps a doctor saved the life of one whose teeth (right) tell of high fevers suffered as a child.

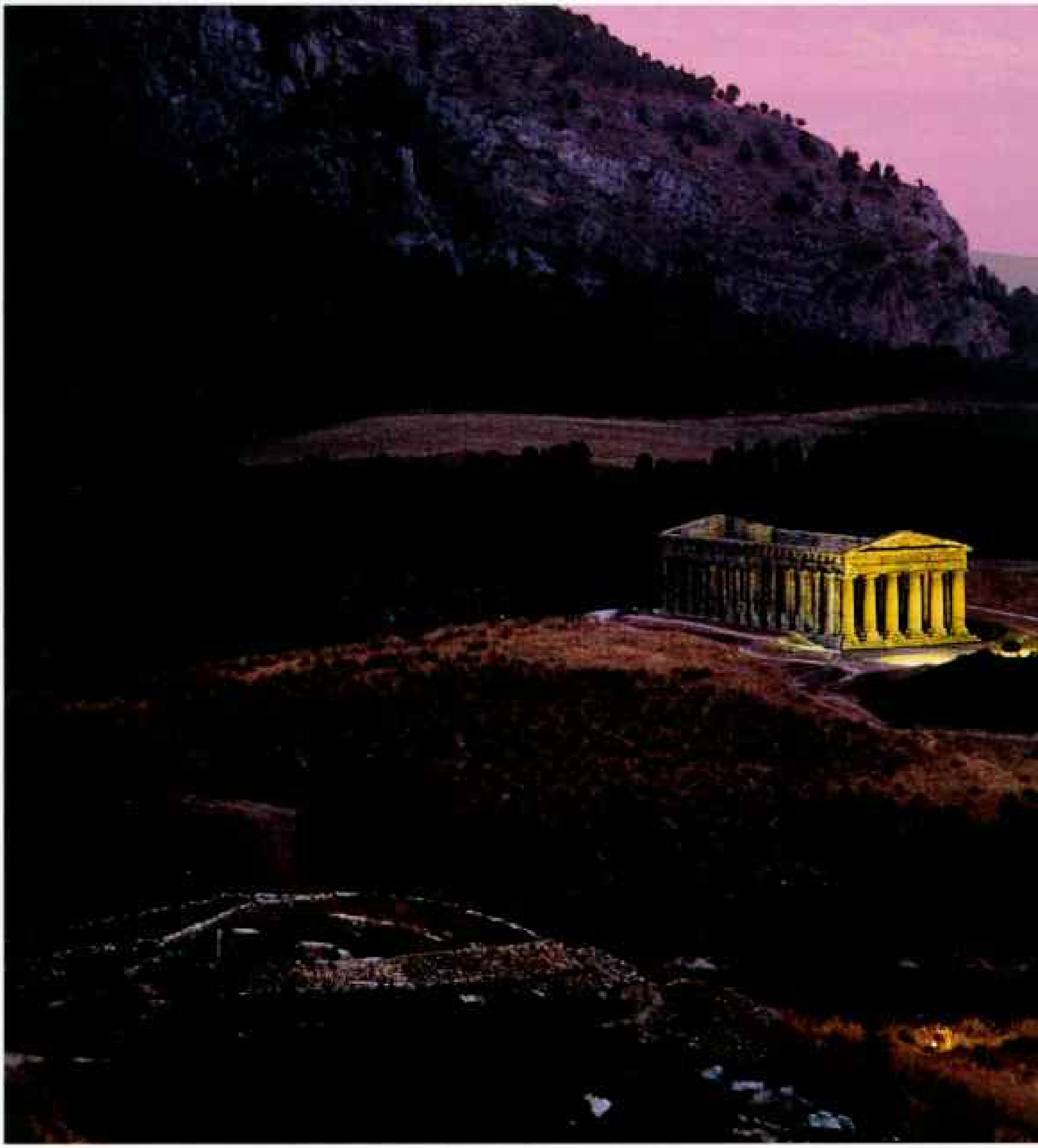
Archimedes found solving mathematical problems, such as determining the relationship between the surface and the volume of a sphere, far more engrossing than warfare. Nevertheless, to please the tyrant Hieron, he designed poles with huge iron claws that thrust out from the city walls overlooking the harbor. Those claws could pluck Roman warships out of the water as they approached the walls. Shaking sailors from the ships, Plutarch wrote, the claws lifted the vessels to great heights, then dashed them against the jagged rocks below. Archimedes also invented machines that hurled barrages of stone balls at advancing Roman infantrymen. Soon Roman troops regarded the name Archimedes with terror.

Finally Roman forces breached the walls after dark and sacked the city. In the aftermath a Roman soldier ran his sword through Archimedes. Some say the mathematician was too engrossed in solving a problem to notice that the city had fallen.

The death of Archimedes symbolizes the end of the western Greeks' long odyssey. Already Rome had vanquished the Greek

A passion for pageantry lives on in Sicily as citizens of the ancient hill town of

Palazzolo Acreide rain confetti on the statue of St. Paul on his feast day.



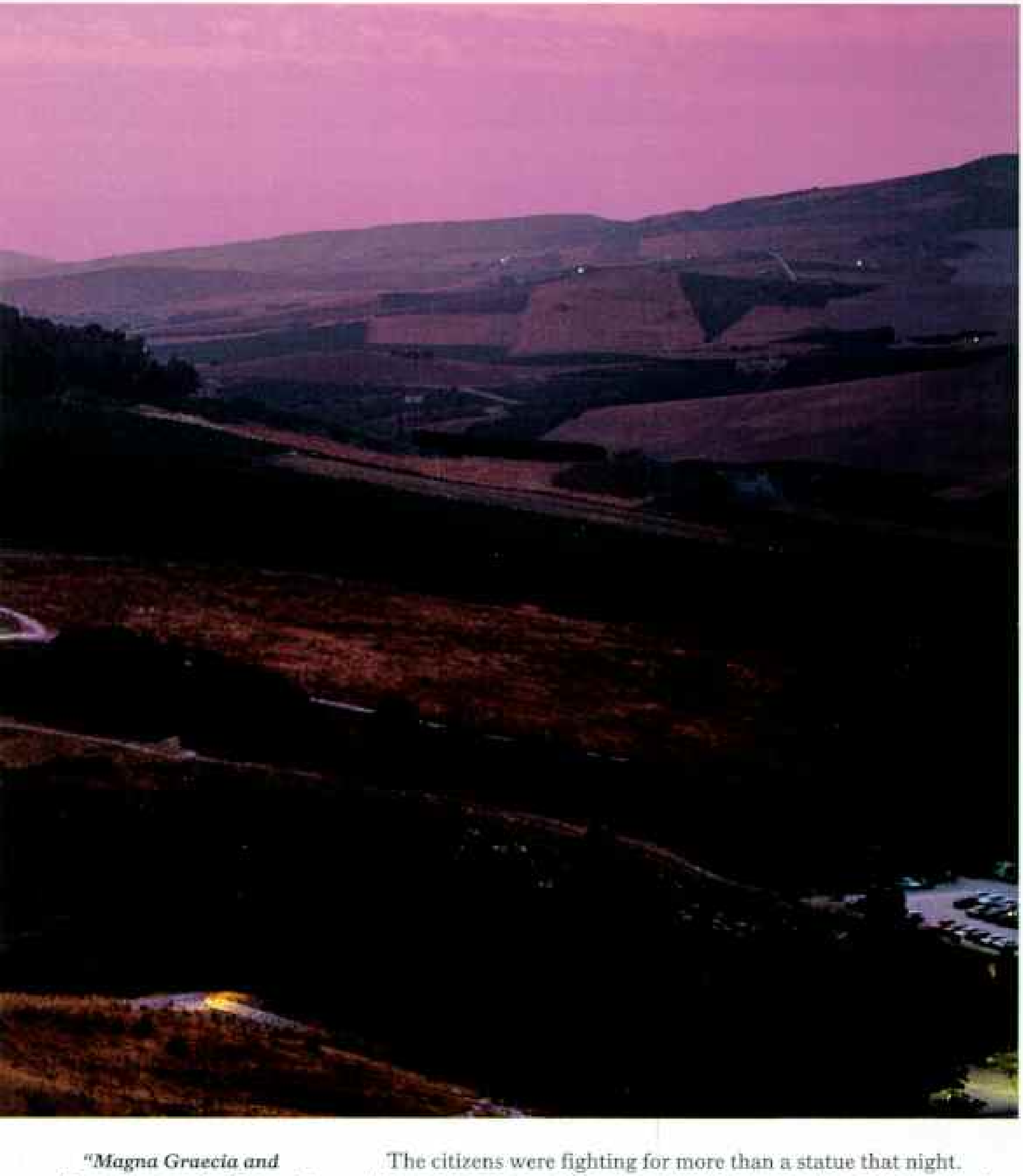
cities of the Italian peninsula. In Sicily only Akragas and the mountain town of Morgantina held out for another two years.

In spirit, however, the Greeks fought on. The orator Cicero tells how in the first century B.C. the people of Akragas rushed to a temple to keep Romans from stealing a treasured statue of Heracles.

"I do not know that I have ever seen a lovelier work of art," Cicero wrote of the statue. Its mouth and chin were rubbed, he said, as if the people had not only prayed to it but kissed it.

"There was not a man in Akragas that night," he continued, "so old or infirm that he did not get out of his bed . . . and lay hold of the first weapon that came to hand."

Unbowed by earthquakes and war, a temple at Segesta, in Sicily, glows at dusk like a heavenly portal. Though not a Greek town, Segesta, like the Roman settlements that followed, paid homage to the high achievements of engineering and culture that the Greeks instilled.



"Magna Graecia and Sicily became the Texas of the Greek world," says architectural historian William L. MacDonald. "Everything was bigger, bolder. It was a grand experiment."

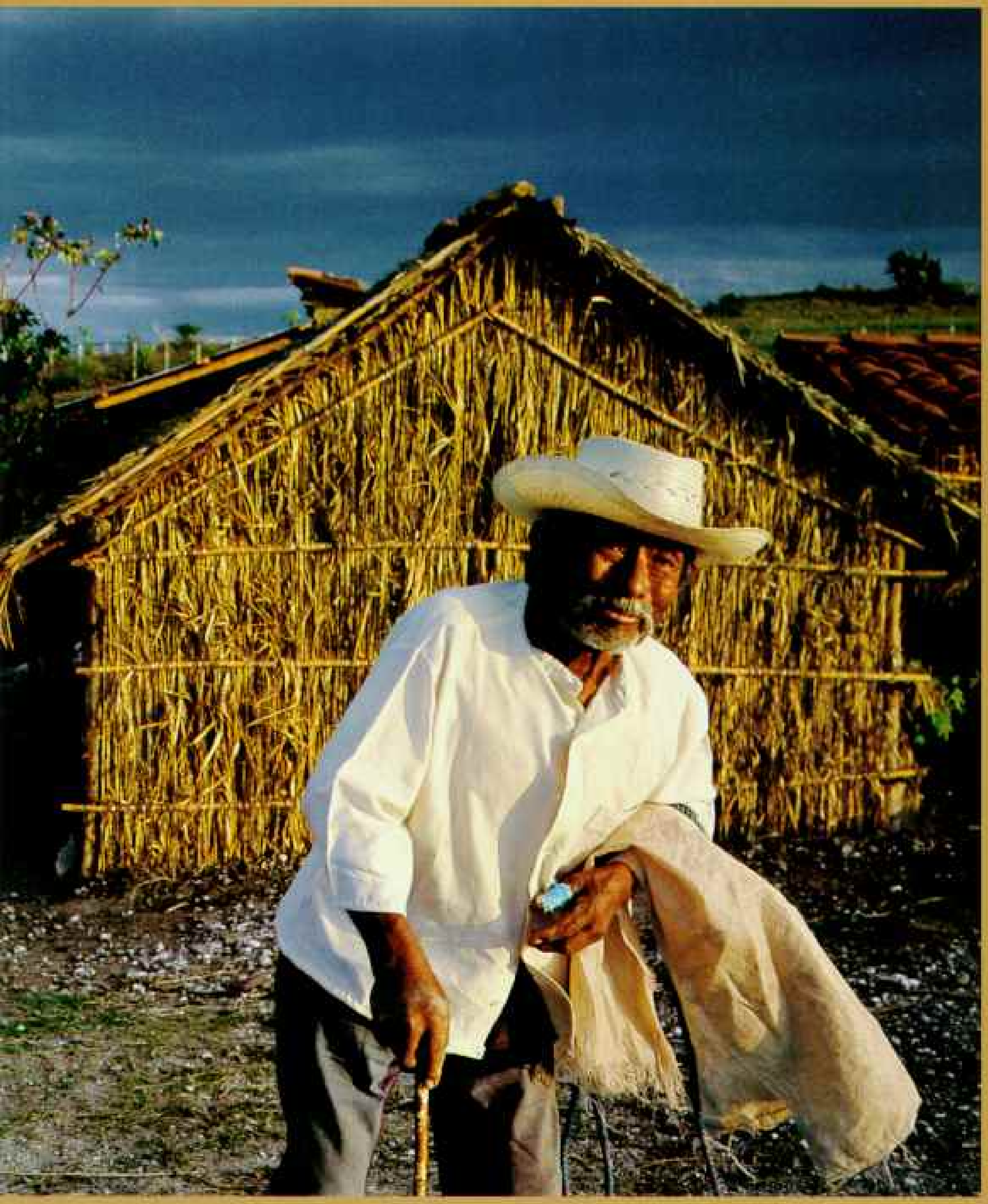
The citizens were fighting for more than a statue that night. "Many Greeks saw Heracles as their ancestor," says Erwin Cook. "He was their superman. In his 12 labors he descended into the underworld and triumphed over the forces of death. He held the sky on his shoulders. He destroyed monsters to make the land safe for habitation and agriculture. He represented the civilizing forces of the Greeks. Take away Heracles and you take away their identity."

Like Heracles, the western Greeks had traveled to the ends of the known earth. In a sense, they themselves had briefly held up the sky. And through their many labors, they, too, have become immortal. □

The Song of

By SANDRA DIBBLE

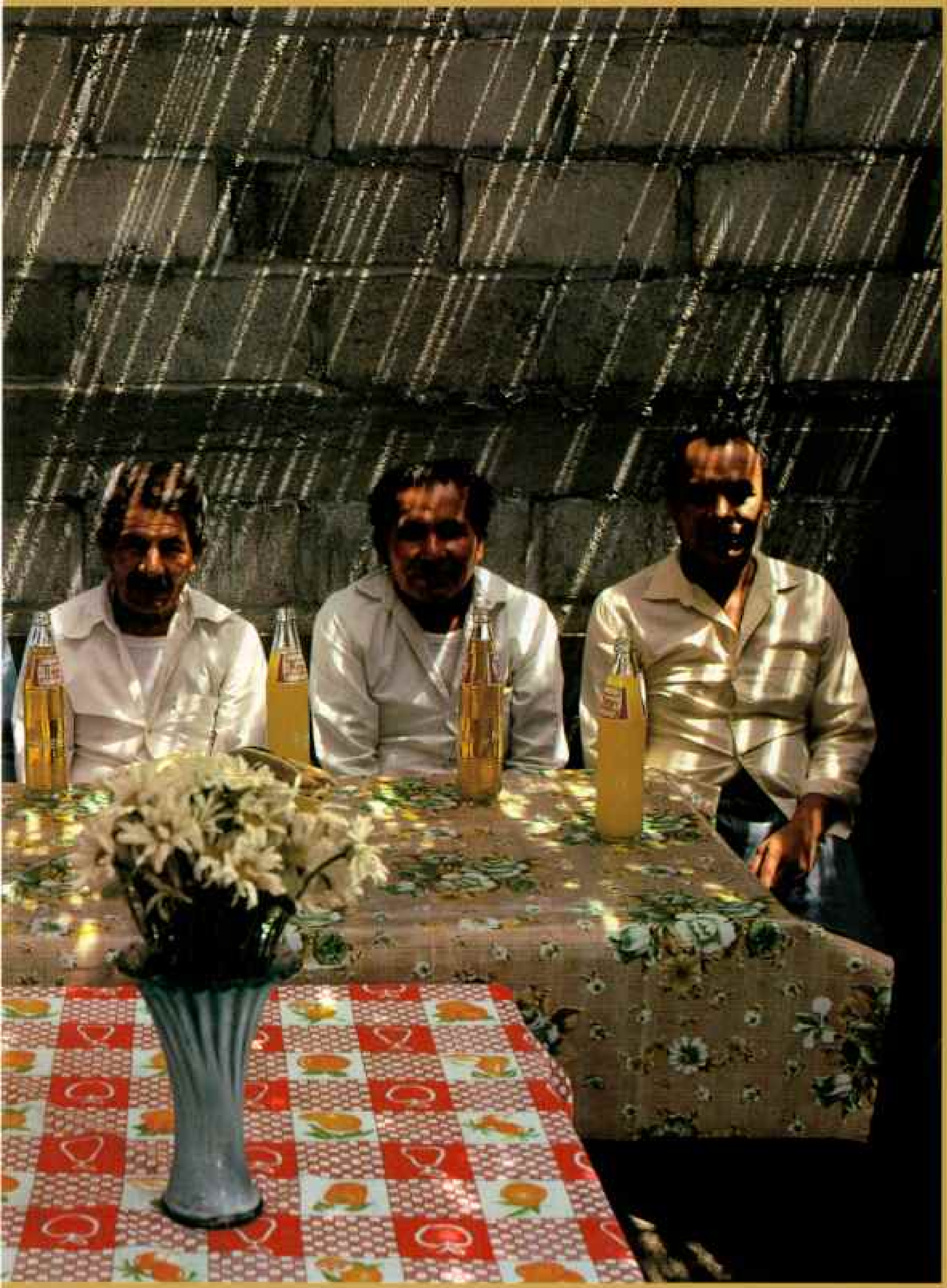
Photographs by DAVID ALAN HARVEY



Oaxaca

is sung in at least 14 Indian languages and 90 dialects across the mountains, valleys, and farms of this southern Mexican state. It drifts over isolated villages and falls like warm sunlight on the hard lives of farmers like Rogelio Martínez, home from the fields with his burro.

SOLEMN *autoridades*, or respected leaders, of the Huave village of San Mateo del Mar meet to discuss such community problems as fishing disputes and poor medical care.



Thousands of small and fiercely independent communities cover Oaxaca—a vestige of pre-Hispanic times, when the area was filled with sovereign city-states.

They called themselves the Cloud People. They lived on the forested slopes and in the highland valleys of Mexico's Sierra Madre del Sur, where rushing walls of evening fog shut out the setting sun. They worked corn seed into their communal fields and prayed to the gods of rain and sun for abundance. They spoke in tonal languages that rose and fell like music.

Thousands of years later they still do. The Cloud People never left these mountains in the state of Oaxaca, at Mexico's narrow ankle. Once warriors, builders, and artists, they are today primarily peasant farmers, quiet Indian people with formal manners and callused hands.

The Cloud People are not Aztec or Maya, though their ancestors created civilizations rivaling those of the larger, more celebrated groups. They are known as the Zapotec and Mixtec. Along with the Chatino, Trique, Mixe, and several other groups they make Oaxaca (pronounced wah-HAH-kah) the most ethnically complex of Mexico's 31 states.

Modern Mexico is a mestizo nation, forged from the blending of Indian and European cultures. Oaxaca, by contrast, is a mosaic: Nearly half its three million people speak an Indian tongue. At least 14 indigenous languages and 90 dialects are spoken in this land the size of Indiana.

Oaxaca's cultural diversity rises directly from its fractured landscape. Spreading out from a mile-high central valley, the ranges of the Sierra Madre break the state into thousands of isolated enclaves. Every village is a world in this rugged countryside; every town is a universe. Over the next ridge, around the next bend, across a few dry rocky hills—that's someone else's universe.

Oaxacans are typically more loyal to their hometown than to their state or country or even to their ethnic group. People find their identity in the way they glaze a pot, embroider a blouse, or play a piece of music.

I hoped to learn how the state's Indian cultures had survived and how

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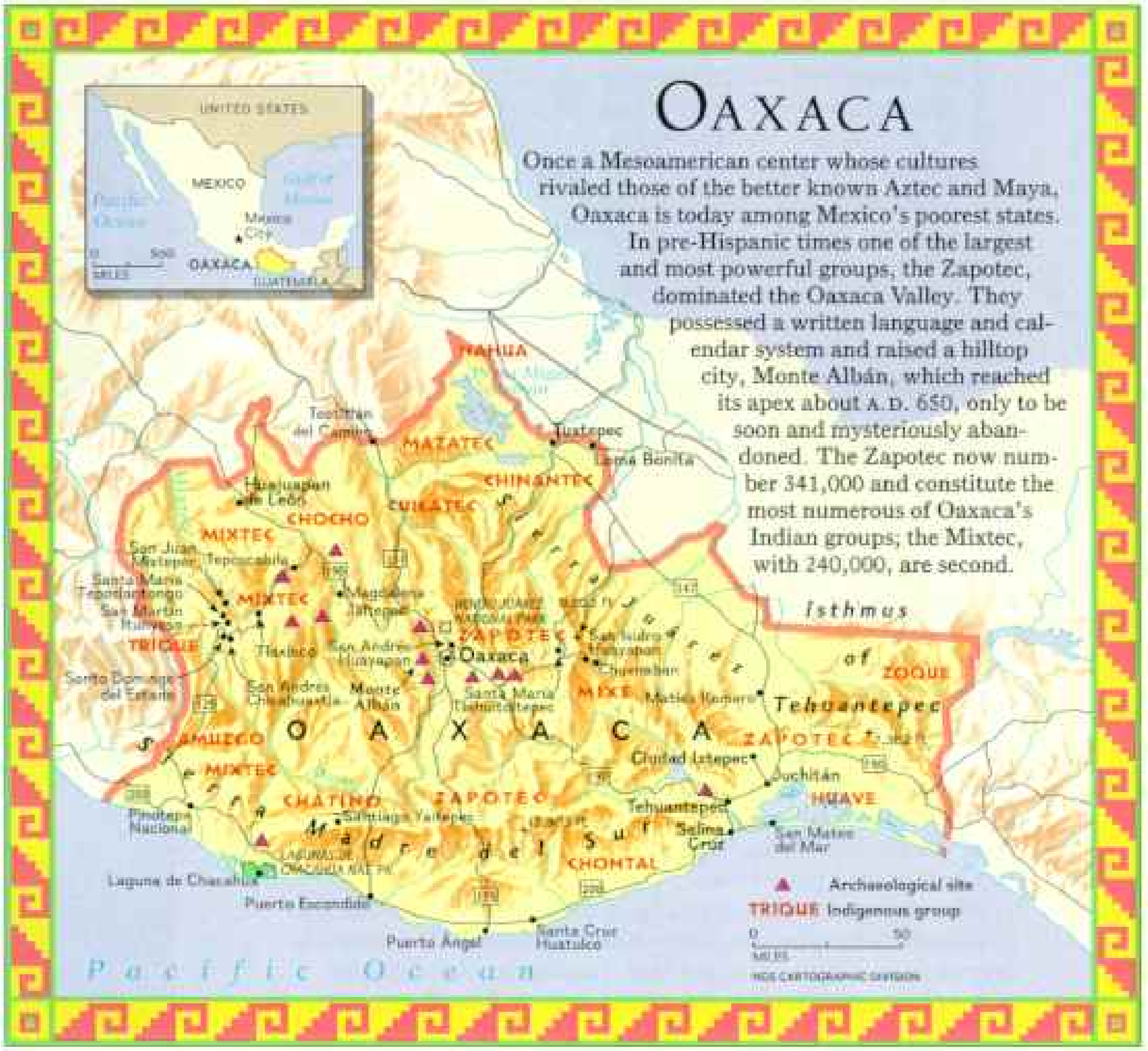
SANDRA DIBBLE, a former member of the GEOGRAPHIC's editorial staff, is now a reporter for the *San Diego Union-Tribune*, based in Tijuana. Photographer DAVID ALAN HARVEY has frequently covered Latin America for the magazine.



they were faring against 20th-century foes: alcoholism, poverty, the intrusion of outside culture. Usually I traveled the way most Oaxacans do, by bus, *segunda clase*—second class, without reserved seats—in aisles spilling over with passengers and piles of produce, stopping in towns where crowds of children push forward to sell soft drinks and tamales.

Sometimes night would catch us on a mountain road. As the driver's tape player sang out a succession of fast-paced *cumbias* and the bus rounded curve after curve after curve, I would look out the window and, seeing only blackness, try to imagine the world we would come to next.

San Juan Mixtepec

THE LONG ROAD HOME

José Castañeda Sánchez, the cheerful young clerk of San Juan Mixtepec's one-room telegraph office, shouted at the women in gray serapes who pressed against the counter: "María Reyes, María Rojas, Agustina López." Behind him a telegraph machine rapped out a steady list of remittances: From Quincy, Florida, $700; from Hermiston, Oregon, $1,000; from Clinton, North Carolina, $1,500.

Every weekday an average of $18,000 comes pouring into this town in the heart of the Mixteca, the homeland of the Mixtec and among the poorest regions in one of Mexico's poorest states. Though the population of San Juan Mixtepec is about 11,000, at any one time "we can say half the population is gone," said the town's *presidente*, Germán López Cruz. Gone looking for work.

Centuries of overfarming have eroded the soil; now too many people share the scarce arable land. The Mixtec have little choice but to leave their arid mountains in western Oaxaca for the toughest, lowest paying jobs in the fields and orchards of northern Mexico and the United States.

"We know the road very well," said Rosendo Ramírez Chávez, 64, between swigs from a Superior beer bottle at a dusty store counter. He has been to the U. S. 11 times, "four times under contract, seven times as a wetback."

Luis Hernández Santiago, 41, keeps Maine plates on his 1977 Ford pickup. He works on an egg farm near Augusta, earning four dollars an hour and free lodging for his wife and four children. He has immigration documents and could stay in the U. S. But he is always pulled back.

When he's gone, Hernández says, he misses his *ranchito*, the plot above town where he grows beans and corn. He misses his *aguardiente*, a liquor distilled from sugarcane. He misses his church's statue of San Juanito, nickname for John the Baptist, the town's patron saint.

When summoned by town elders in 1991 to serve San Juanito as *segundo mayordomo*, a church lay leader, Hernández returned like a dutiful son. For a year he paid to keep fresh flowers under the saint's statue. Forsaking earnings from the egg farm, he remained in Mixtepec and spent $5,000 to help underwrite the town's three-day celebration of its patron saint.

"You have to fulfill your obligations, because it's your town," said Hernández. "If you don't, then people scold you."

Mother María Rosa Ramos believes there are deeper motives. People come back to Mixtepec to "live again," said the nun. "Here they are someone; they find their world, their cosmos. They seek it out like a fish looks for water."

The migrants are changing their town as they return with the trappings of outside culture. Teenagers strolling the muddy streets look dressed for a suburban mall: shag haircuts, blue jeans, T-shirts, and sneakers. Small concrete-block houses sport powerful television antennas, pulling in nightly episodes of a steamy *telenovela*, or soap opera, from Mexico City—a 300-mile, ten-hour drive away.

But Mixtepec remains a conservative town, where residents respect neighbors.

ON THE ROAD AGAIN, travelers await a ride in the Mixteca, where poverty and homesickness send many on endless loops between home and low-paying U. S. jobs.

"People are very refined," Germán López Cruz told me. "Nobody kisses in the street."

The old ways surface especially at feast days, weddings, and funerals. One sunny morning I came across a swarm of women and children and a handful of men gathered on a porch, sipping soft drinks and beer. In a cauldron set on a wood fire, chicken simmered in a spicy sauce.

"What's the celebration?" I asked, when they invited me to join. Not a celebration, a woman said, but a farewell for Angela Gómez, who had died following a sudden illness.

She had been buried in a coffin built by male relatives. For eight days and nights friends and family streamed through the house she shared with a sister, praying for her soul. On the ninth day came the final good-bye, this feast put on by family members. But the dead woman's two closest relatives could not be there. Her son was in northern Mexico, her daughter in Arizona. Both were looking for jobs, and neither had enough money to make the long trip home.

A SIERRA HOMECOMING is sweet for a Triqui girl sashaying in frills and pearls through the village of Santo Domingo del Estado. Though her family moved away to find work, they

returned to celebrate her 15th birthday. They came as well to renew ties with relatives and friends – and to find reassurance that they still belong.

Chuxnaban

A New Day, A New Song

"A town without a band is a town without life," say the Mixe. At fiestas, rallies—virtually any occasion—15, 20, even 40 players march in with their clarinets, flutes, trumpets, trombones, tubas, and saxophones to strike up boisterous marches and lilting waltzes—unhurried tunes with names like "Voice of the Sierra," "Flowers of the Soul," and "Beneath the Mixe Sky."

Oaxaca's 89,000 Mixe (pronounced MEE-hey) live in the state's northeast, where steamy overgrown lowlands rise to the oak and pine forests of the Sierra Juárez.

The Mixe like to point out that they are the only indigenous group in Oaxaca that never submitted to 16th-century Spanish soldiers. Their conquest was a spiritual one, carried out by the Dominican friars who soon followed, using music to help woo converts to Christianity.

Today's bands are a kind of glue that binds indigenous communities across Oaxaca, a force that gives them identity and pride. When feuding communities decide to mend fences, they send their musicians to serenade each other.

"By exchanging music, the pueblos share their joys, their sadness, their emotions, their experiences," said Donato Vargas Pacheco, director of the Mixe music conservatory in the highland town of Santa María Tlahuitoltepec. With state support the conservatory aims to strengthen indigenous musical traditions. Graduates of its program are expected to return to play in their hometowns or to travel to villages that need a musical boost.

The Mixe village of Chuxnaban had sent a delegation to report that it was in dire straits. The community of 700 had not had a band since 1979, and even the eight members of its informal *orquesta* had grown old, leaving their trumpets and trombones in a tangled heap in a room at the village hall.

Musical missionaries were dispatched: a 15-year-old trombonist named Donato Vargas Jiménez and French horn player Javier Gómez Santillana, 16. For two weeks the pair would teach in Chuxnaban, hoping to inspire a new generation of musicians to start a band.

The sky threatened rain as Donato, Javier, and I entered town. Women in patched dresses watched wordlessly from their sooty kitchens. A village hall loudspeaker blared mournful *ranchera* songs from a scratchy record. A yellow light bathed a dozen men who lingered on a wooden bench staring out at the silent basketball court.

Someone stopped the record to broadcast our arrival; strangers don't come here often.

"We're a little bit sad now," said Pedro Romero, a thin man in his late 20s. Though Chuxnaban's fertile lands grew abundant corn, chilies, mangoes, oranges, lemons, and avocados, a slump in world coffee prices had meant the loss of their only cash crop. "We have no other way to make money," Romero said.

But the village was starting to pull out of its isolation, said Pascual Sánchez Vásquez, Chuxnaban's schoolteacher and one of its few Spanish speakers. Since a road opened in 1989 to San Isidro Huayapan, three miles away, trucks have delivered supplies once

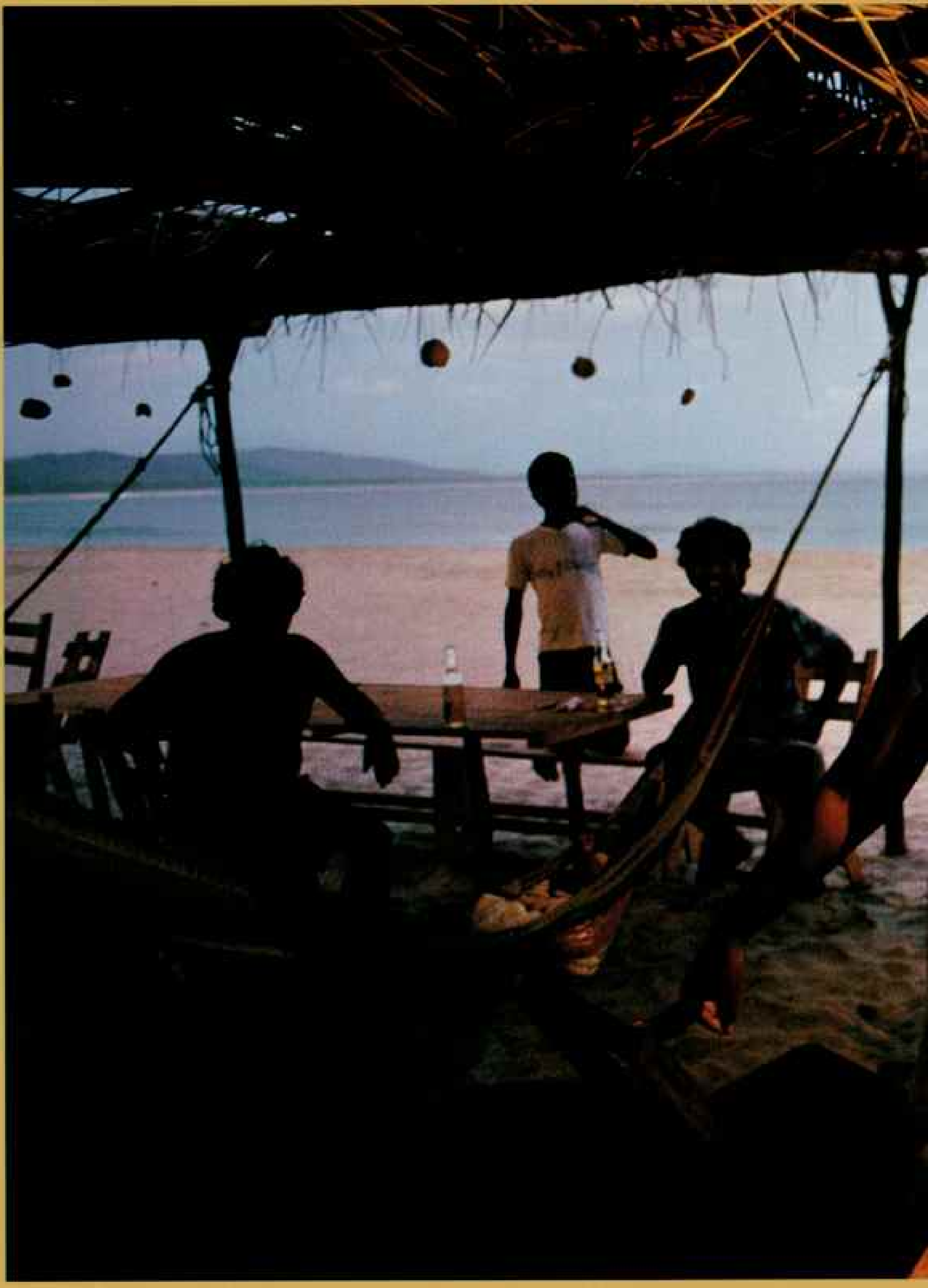
BLASTS OF BRASS lead a Lenten procession through the town of Teposcolula. Somber or joyful, almost any occasion calls for music from the local band.

brought in by donkey. Politicians from Mexico's ruling Institutional Revolutionary Party have started dropping by since Chuxnaban received its first ballot boxes.

Still, Sánchez Vásquez said, "People feel lowly; if outsiders pay attention to them, they feel honored, they're surprised."

When I woke up the next morning, the sun was shining. Men began shooting baskets on the court. In the river's rushing waters, women stripped to the waist splashed and soaped their hair. Peering through the classroom window, giggling girls watched Javier and Donato lead three dozen boys, ages six to late teens, in beating four-four time with their right hands. *"So-la-so-la-si-re-si,"* they sang for their teachers. The village leaders nodded with approval.

Buoyed by the promise of music, Chuxnaban's sadness had lifted like the previous night's clouds. Now, if they could raise the money to buy new instruments, if the price of coffee climbed just a bit, maybe they would have a new band.

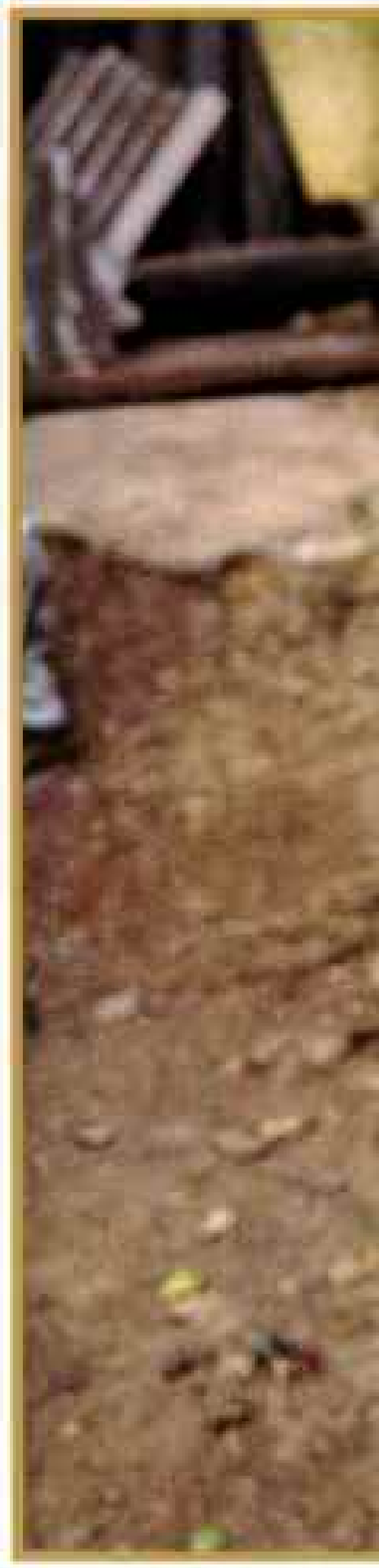


A WARM SMILE and a round of beers greet fishermen ending the day in the Pacific coast community of Laguna de Chacahua. Mixtec once occupied the region but fled when the

Spanish arrived. Escaped African slaves soon took the Mixtec's place; their descendants still occupy the remote shore where fate cast them.

Itunyoso versus Teposlantongo

WHOSE LAND? WHOSE TRUTH?



Knee-deep in a sea of grasses and purple wildflowers, I followed a round-bellied farmer named Hilario Cruz López over a windswept hilltop above the village of San Martín Itunyoso. Far behind us we could see people moving slowly through plots of corn and along the dirt paths curling between small wooden houses. We could hear nothing but the songs of mountain birds.

Cruz pointed to a small heap of stones 20 yards away: "If we walk over there," he warned, "they'll kill us."

"They" were the villagers of Santa María Teposlantongo, whose metal roofs shimmered hundreds of feet below us in the high noon sun.

As recently as 1985 these two villages in the western Oaxacan highlands had been friendly. It didn't matter that the residents of Itunyoso are Trique, one of the smaller indigenous groups, and that the people of Teposlantongo are Mixtec, second in number only to the Zapotec. They attended each other's religious festivals, competed in basketball, and served as godparents to one another's children—a relationship that bonds families as tightly as blood.

By the time of my visit dozens had died in a bitter battle over a few hundred acres of land.

No one agrees on exactly what set off this boundary fight, only that it goes back generations and flares up every few years. The drug trade has added a new strain. Mexican national police agents, *federales*, have arrested villagers from both Itunyoso and Teposlantongo for growing marijuana and opium poppies and have found spent shells from high-caliber weapons normally beyond the means of these farmers.

But the roots of the dispute may well reach back to when Spanish colonial rulers issued land titles to Oaxaca's Indians. The mountainous terrain was hard to measure, so neighboring villages often ended up with overlapping titles. Today land battles rage throughout the state, though most are being fought with court papers, not guns.

For indigenous communities, "The land has great meaning," said Roberto Olivares, head of the Mexican government's agrarian reform office in Oaxaca. "We may stupidly try to tell them, 'Why are you fighting for this piece of rubbish? It's a hill that has nothing, just rocks.' It's as though you asked me, 'Why are you insisting that this man stop standing on your father's tomb?' "

To sort out the Itunyoso-Teposlantongo conflict, I went first to Itunyoso, at an elevation of 8,600 feet. I climbed a graveled road through a foggy valley where women walked bent under loads of firewood. A shepherd boy passed with his goats, their bells ringing through the milky mist.

The village of 1,700 is known in the Trique language as Xiun—"our town." Men tend the fields; women sit by their doors weaving lush red wool *huipiles*, or tunics.

The boundary war shattered that routine for 34-year-old Teresa Demetrio Reyes, married for 16 years and widowed for less than two months. She looked lost as she stood

"I DON'T KNOW HOW I'll support myself," weeps Teresa Demetrio Reyes of San Martín Itunyoso, whose husband was shot during a decades-old battle over land.

with her three children outside their shack. Her hair was disheveled, her huipil torn. "I don't think I will be able to forget this anger, even if there is peace," she said.

In a statement signed with a purple thumbprint, her only signature, she told police that her husband, Crescencio López Martínez, had gone out to fetch a burro. Shortly after he left, Teresa heard gunshots. She found him lying in a field, but guns fired as she approached his body. Shots rang out again as she returned with village leaders and the next day with the federales. Then his body vanished. "He wasn't there," said Hilario Cruz López. "All that was there was his small black Texan hat."

Nobody dared walk the two-mile-long dirt road between the villages. I had to take the long way to Teposlantongo to hear the other side of the story. Two hours by car to the nearest city, Tlaxiaco; 90 minutes by pickup to the town of San Juan Mixtepec; then three hours on foot to Teposlantongo, population 1,200.

I explained my interests to the village leaders, who were passing a Sunday afternoon

REVERENCE FOR LAND runs deep in rural Oaxaca, where farmers live and die on small plots passed down through generations. Until his peaceful passing, Claudio García López (right) loved to hunt near the village of Magdalena Jaltepec, once a Mixtec kingdom. On family land above Teotitlán del Camino, farmers till with oxen before planting beans.

in a cavernous meeting room lit by a single bulb. They watched me narrowly and began speaking among themselves in Mixtec.

Finally Andrés Hernández Sánchez, the village secretary, acknowledged me in Spanish. "They're the ones looking for a problem, because they keep invading our lands."

Darkness fell; a bottle was passed. My questions were not welcome, and I was in a strange village with nowhere to spend the night.

I stopped my queries; the tension lifted. A young man with a beard began speaking softly, saying they were honored to have me in Teposlantongo.

I slept soundly that night with his cousin, Delfina Sánchez Reyes, a shopkeeper, in

the house she shares with her mother, grandmother, and younger sister and brother. They fed me warm cow's milk, scrambled eggs, and tortillas. Did this kind family hate the people of Itunyoso? "They are bad," Delfina said, her smile dropping to a frown.

The next morning I left town, resigned to the fact that these mountains were going to keep many secrets. Walking down to the valley I passed three young men, two of them carrying semiautomatic rifles. "AK-47s?" I inquired, recognizing the rifle's curved clip.

"Yes," one answered with a boyish smile.

"No," his companion quickly interjected as they hurried on, ".22-caliber rifles. We're going to hunt rabbits."

Santiago Yaitepec

TAKING BACK THEIR TOWN

The riders took off in teams of two, arms linked, their horses kicking up clouds of red dust on the main street of Santiago Yaitepec. At full gallop they reached up with their free hands and tried to rip the head off a live rooster hanging upside down from a wire.

Clusters of spectators quietly watched a couple of dozen riders fail before a teenager succeeded. A procession of women approached with burning incense and made the sign of the cross over the rooster's head.

On an overcast Saturday in late July the Chatino of Yaitepec were celebrating the feast day of Santiago, their patron saint. Inside the small Roman Catholic church, hundreds of candles flickered. Dozens of women, heads covered with shawls, murmured prayers in the melodic Chatino language as they knelt on the cool concrete floor.

They have reason to believe in miracles in Yaitepec. For more than ten years something extraordinary has happened in this village of 2,000 or so, once plagued with a murder rate ten times Mexico's average: A feast day that is celebrated without drinking, without fistfights, without guns and machetes.

"People used to fight a lot," said Eufronsina Clemente, offering soft drinks in the courtyard of her brick house. "When they drank mescal, the men would go crazy."

It was Yaitepec's women who led the fight to ban mescal, distilled from the fermented heart of the maguey, to ban all alcohol, on the feast day and every day of the year.

About 30,000 Chatino live in southern Oaxaca, spread among some 50 communities. Though Catholics, they have never abandoned their traditional beliefs. Each May Yaitepec's farmers plant bread and chocolate in their cornfields as offerings to the rain god. Through ritual rooster sacrifices they ask the gods to grant fertility.

But Yaitepec seemed to lose its spiritual bearings in the 1950s. Violence overtook the town as people expanded their subsistence farming to add coffee as a cash crop. As farmers jockeyed for bigger parts of the communal land, alcohol fueled their anger.

A rigid revenge system heightened the problem: The family of a Chatino murder victim traditionally seeks justice by killing not only the murderer but also an adult male member of the murderer's family.

Pulling a dark shawl around her thin frame, Marina Vásquez told of her husband, Adrián Cruz, shot to death 15 years earlier. "He was drinking with his friends, and they began to discuss things they shouldn't have."

Four years later, her 21-year-old son, Eusebio, oldest of 11 children, was shot. "I believe the murderers thought my sons were going to avenge their father's death, but it just wasn't so."

In 1982 Marina Vásquez, Eufronsina Clemente, and dozens of other angry women resolved to ban alcohol and shut the cantinas. "The *mescaleros* were even getting the police drunk," said Eufronsina.

A FRIEND IS NEVER FAR in San Andrés Huayapan, where men meet at the town hall. With little other support, Oaxacans draw strength from community bonds.

The largest cantina was owned by the town's presidente. When he refused to close, 200 men and women dragged him from his office and for ten days occupied town hall.

The prohibitionists soon rallied virtually the entire town. Now anyone caught drunk or with alcohol faces fines and prison, and other Chatino villages have followed suit. Land-use tensions also eased when Yaitepec took back 2,300 acres of communal land that had been usurped by a single wealthy family.

Against the odds the town became sober and peaceful. The loudest noises are not the clamor of cantina loudspeakers but the taps of hammers building new houses, now that people have a little more money. The former presidente has shut down his liquor business. And Marina Vásquez can rely on her surviving sons to farm the family's plot. "I am happy, because my sons don't drink mescal," she said. "If they go out, it's just for a little while, then they come home to sleep."

There have been no murders linked to alcohol since 1981.

WRAPPED IN FOG—and Christian mystery—Trique celebrate Holy Week in the highland village of San Andrés Chicahuaxtla. Like other Oaxacan Indians, the Trique are

observant Christians but also direct prayers to the stars, wind, water, and fire. Residents of Chicahuaxtla say the wind was born — and still resides — deep inside a village well.

"We Are Still Dancing"

Everything seems different in Juchitán de Zaragoza. In a state dominated by mountains, it sits 15 miles from the Pacific on a vast, flat coastal plain. Here, on the Isthmus of Tehuantepec—less than 140 miles wide—converging highways of trade have made Juchitán Oaxaca's third largest city, population 54,000. If other communities have survived through isolation, the Zapotec of Juchitán have thrived at a crossroads.

"It's a very strong culture that absorbs what it encounters," said Marinella Miano, an Italian anthropologist. For years she had studied isthmus Zapotec culture; now she was here visiting friends, dressed in a loose-fitting blouse and a long billowy skirt—the everyday costume of a Juchiteca. "It's a culture that doesn't die, that doesn't get lost."

The pattern was set before the *conquista*, when mountain Zapotec migrated to the isthmus, overwhelming smaller Indian groups. Later they absorbed successive infusions of outsiders—Spanish colonists, Chinese railroad workers, merchant immigrants from Lebanon, Syria, and France. But if Juchitecos today reflect a wide mix of races, they hold to their Zapotec heritage with undiluted pride.

Nowhere is this heritage more evident than in the women. Big, strong women. Wide-hipped, heavy-breasted, broad-backed Juchitecas stride through town, ribboned braids swinging, skirts flowing.

Their confidence stems from their economic power: Zapotec women have been traders on the isthmus for centuries. Men may govern the city, but women run the central market, backbone of Juchitán's economy. Men may catch the shrimp and snapper, grow the corn for tortillas, or craft the hammocks and huaraches, but the women's job is to sell.

At dawn, when the air fills with the wild shrieks of *zanate* birds, the first red coals light up the food stalls among the hundreds of stands that sprawl around and inside the century-old city hall. When I wandered the maze of passageways one morning, the cries of commerce relentlessly followed.

"¿Qué va a comprar, güera? ¿No va a llevar nada?—What are you going to buy, Blondie? Aren't you going to take anything?"

To one another they spoke Zapotec; to me, Spanish as they nagged, argued, bargained, challenged, charmed. Smiling as though she knew me, a large woman inside a small wooden booth motioned her plastic flyswatter toward cups of flavored gelatin. "For you, one thousand pesos, Madre," said Micaela Guerra, as if that price—equivalent to about 30 cents at the time—were the day's best bargain. "I'll sell one to you for one thousand pesos."

The 60-year-old widow supports herself selling gelatin, shakes, and juice to thirsty shoppers and vendors who come from as far as Guatemala.

She was 14 when she married and began in the market, selling cheese and milk. "I said to my husband, 'I'm going to work so our life can be softer.' "

BURSTING INTO BLOOM. Zapotec women dance at a seasonal fiesta called a *vela*. Strong, brave, and lusty, they wear their womanhood joyously.

He died when she was 37, leaving her alone to raise their five children. She works her corner seven days a week, she said, and doesn't get tired. "We like to have things of our own," she told me, smiling as she leaned over and tugged a gold earring. "We like to have this."

There was a party that night, and Micaela planned to be there, draped in gold jewelry and dressed like a tropical queen in the lavishly embroidered blouse and lace-ruffled skirt that Juchitecas save for special occasions.

This was the season for the elaborate isthmus feasts called *velas*. Juchitán celebrates more than 20 velas between April and September, usually to honor Catholic saints. Most are organized by groups of families called *sociedades*.

Two dozen families had spent a year planning the August vela for the Assumption of the Virgin. If I wanted to attend, I was told, I should arrive in party attire. This Juchiteca finery can sell for more than a thousand dollars. From the back of a store that sold

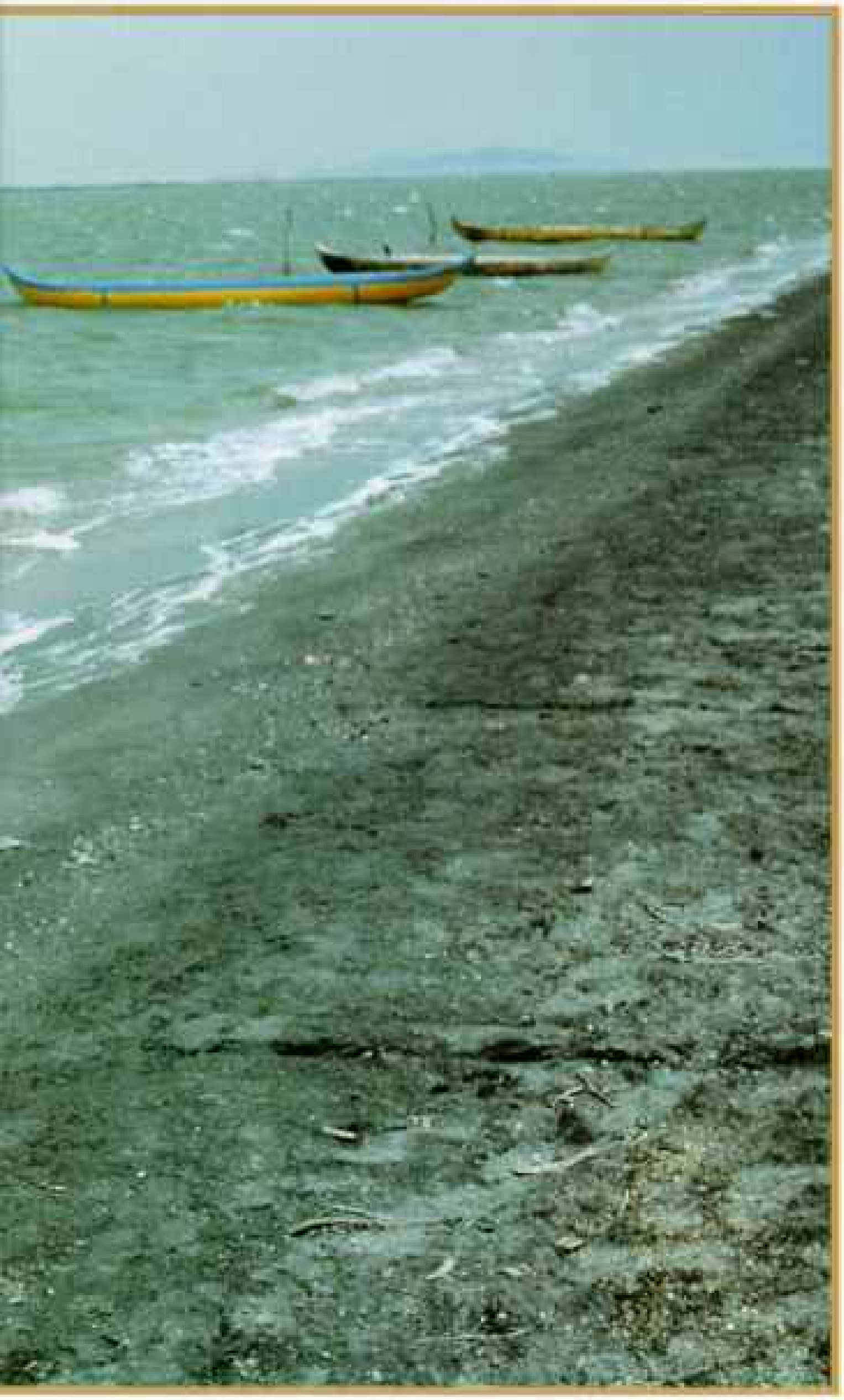
bright plastic buckets I rented a used outfit and some fake gold chains for $30. Guests are also expected to bring a case of beer; photographer David Harvey complied.

In the center of town near the market, David and I stepped into a large tent where the hosts had set up chairs around the dirt dance floor. Knowing no one, we stood, awkwardly, in the center near the stage. A smiling gray-haired woman, petite by Juchiteca standards, walked up with a pair of plates heaped with tamales, tacos, tortillas, cheese. "Would you do me the honor of being my guests?" Leyla Aquino de Canell asked.

Her family has been in this sociedad since her great-grandmother's time. Though she has married and moved to the state capital, "We always come back for the fiesta."

Someone gave me a cold beer. Someone else decided it was too warm and handed me another. Everyone came by to clink bottles.

It was raining, and water began seeping through the roof of the tent as the musicians struck up a slow, rhythmic waltz, a signal for the women to start the dancing. Each



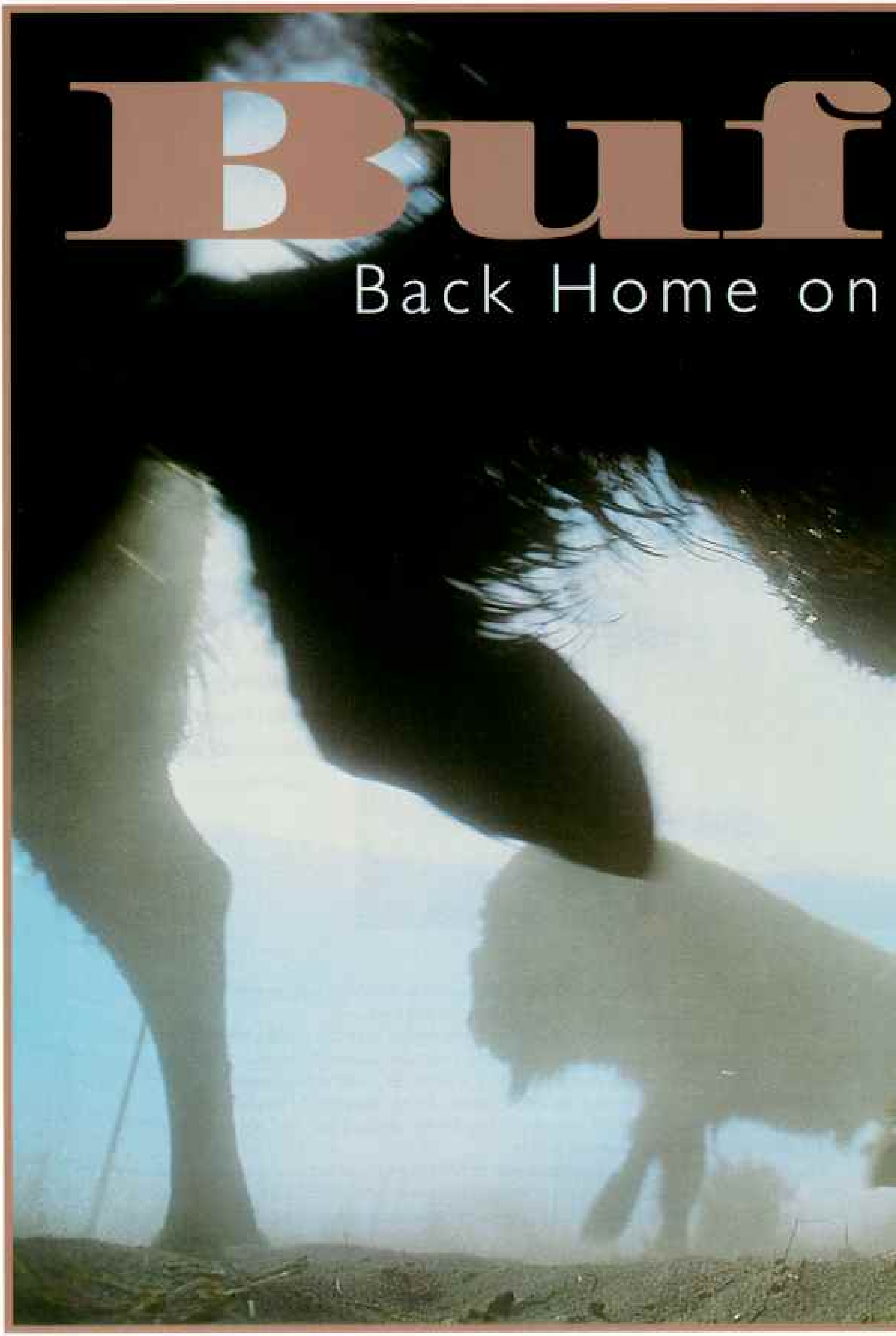
WIND AND SUN of decades have weathered the face of Margarito Zaragoza, who leases one of the fishing boats bobbing off San Mateo del Mar. At least six centuries ago Zapotec invaders pinned the Huave in this harsh region. Here they remain, bound like all Oaxaca's peoples to a cycle of harmony and discord that reaches back millennia.

woman danced alone, solemnly, ignoring the puddles, swaying side to side with tiny steps, lifting her skirt just slightly so her petticoat showed.

Then the men took to the floor, stamping their feet as they circled the women. Another song, then another, and another, and pretty soon almost everyone was dancing, husband with wife, mother with daughter, sister with sister, their ruffles sweeping the dirt.

As the rain grew stronger and the music faster, an old man swept me into the sea of dancers and twirled me around the tent. Then Leyla grabbed me, and we danced in the downpour, laughing like long-lost sisters.

The power that Juchitán's Zapotec seem to hold over outsiders was pulling me. As we spun and turned, I could feel a phrase surge within me, something a huarache vendor, worried for her alcoholic son, had told me in the market that morning. Except now the words had become my own: "That's how we are, we Juchitecas, the rain may be falling, but we are still dancing." □


Back Home on

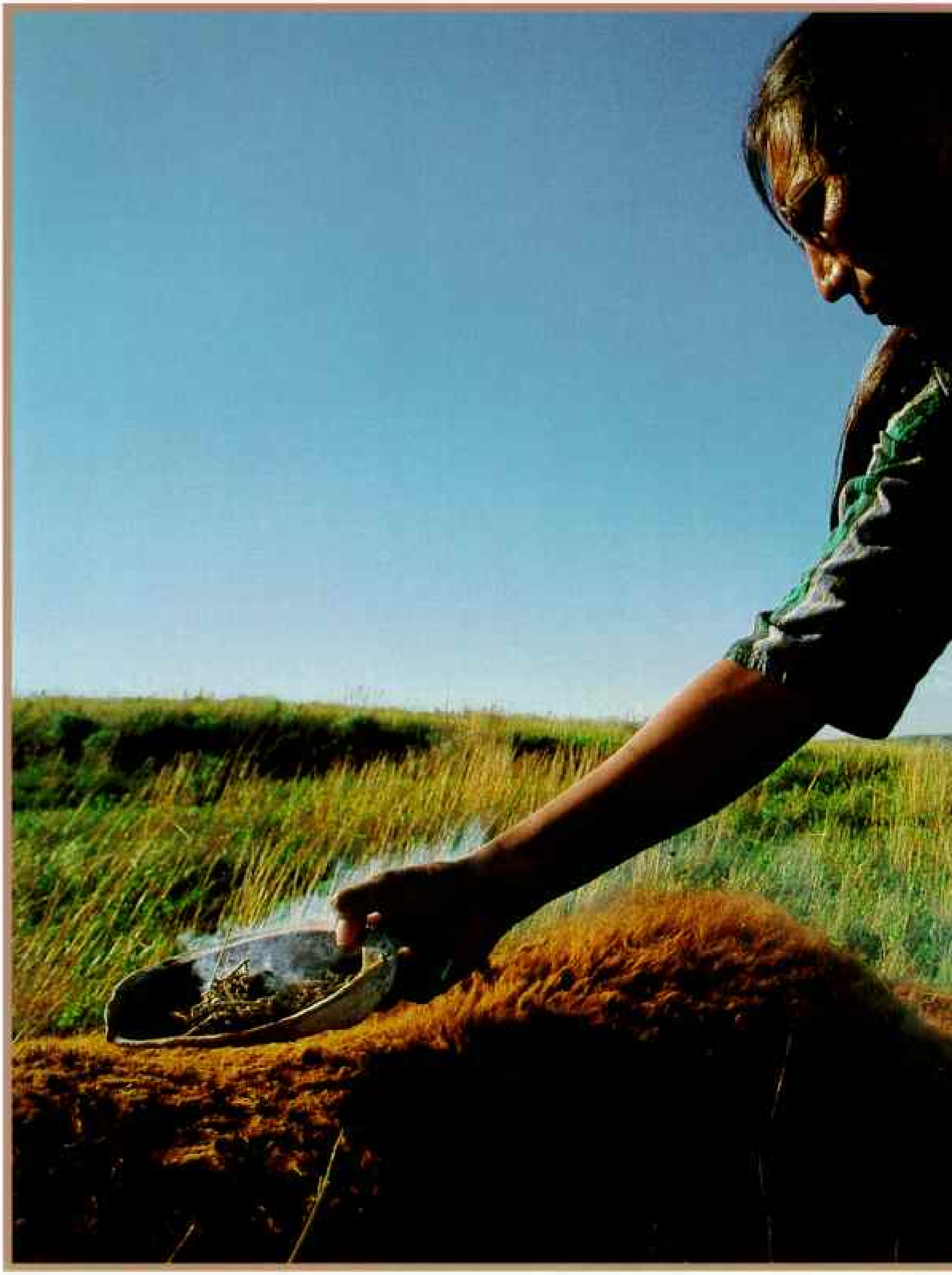
fallo

the Range

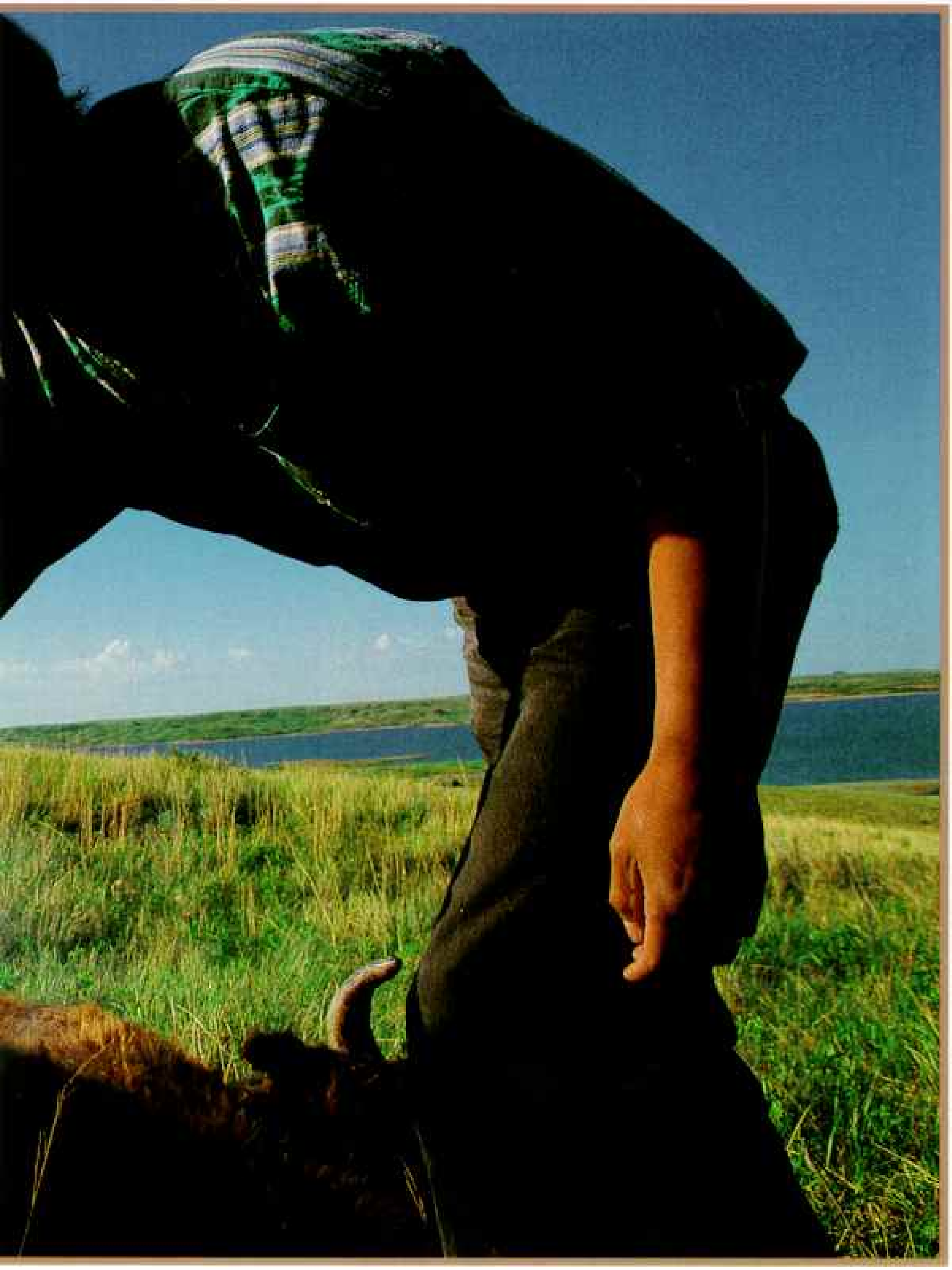
Thundering back from near extinction, American bison kick up a dust storm at Colorado's Rocky Mountain Bison Ranch. The herd, now 2,800-strong, is being bred for meat. The bulky, bearded buffalo, almost wiped out a century ago, also feeds the nation's sense of responsibility toward its natural heritage.

By Bryan Hodgson

Photographs by Sarah Leen



"YOU HAVE GIVEN YOUR LIFE so the people will get strength," intones Arvol Looking Horse, a Lakota spiritual leader, praying by the Missouri River in South Dakota for a ritually slaughtered bison. He purifies the animal with sage and cedar burned in an



abalone shell. Butchered on the spot, it fed families on the Cheyenne River Indian Reservation. Essential to Plains Indians' religion and lore, the bison is honored as a life giver. Its virtual eradication by white men helped crush the region's tribes.

"Buffalo were dark rich clouds moving upon the rolling hills and plains of America. And then the flashing steel came upon bone and flesh."

Simon J. Ortiz, Acoma Pueblo poet

THE BUFFALO BULL charges uphill at full gallop, eyes glittering, black curved horns cocked menacingly, sharp hoofs hurling divots of South Dakota dirt. Fred DuBray races alongside like an Indian buffalo hunter of old, horn blaring, all four wheels of his red pickup grabbing for traction as he hassles the bull away from a buffalo cow and her newborn calf.

"He wants to mate. Young bulls can't tell a cow in heat from one that's just given birth," he says, watching the frustrated animal slouch back to a group of 75 buffalo grazing placidly nearby. "That calf would probably have been stomped to death. I need to get some older animals to teach the social customs of the herd."

Fred is a Lakota. He raises buffalo on the Cheyenne River Indian Reservation; he also is a founder of the InterTribal Bison Cooperative, whose 28 member tribes are pledged to restore the buffalo to Indian culture.

Why? He likes the question:

"Well, we had 50 million of them once. . . ."

Once was the time before an orgy of buffalo hunting left only a thousand or so survivors scattered around North America, most in zoos and private herds, by the last decade of the 19th century.

Today this formidable-looking creature—*Bison bison* to its scientific friends—is enjoying a comeback. As many as 200,000 range public lands and private ranches. Growers marvel at their ability to confront blizzards that make cattle turn tail and die. Conservationists praise their grazing habits, ideally suited to Great Plains native grasses. Consumers are discovering that their tasty meat contains less fat than beef, less cholesterol than chicken.

But now the American passion for high-tech farm management and genetic tinkering poses a different threat: breeding a docile, fenced-in animal shorn of its horns, separated from its young, and stuffed with corn in feedlots to meet mass-marketing tastes.

"Buffalo are wild animals," says Fred DuBray. "Their survival instincts are still fully intact. The worst thing you could do is teach them to be cows. Cows trample the areas around streams and water holes. They overgraze, and that helps prairie dogs, who like bare ground. Poison set out for prairie dogs goes right through the food chain—wipes out natural predators like ferrets, falcons, hawks, eagles, coyotes, badgers, and foxes."

For Native Americans there's much more to buffalo than flesh

IN THE BOOTSTEPS of Buffalo Bill Cody, Wild West showman T. C. Thorstenson greets the crowd at a racetrack near Buffalo, New York. He tours with sidekick Harvey Wallbanger, Jr., riding the six-year-old bull jockey style and challenging Thoroughbred horses to sprint races. "Harvey has won 21 out of 26," boasts Thorstenson. "At 38

BRYAN HODGSON, recently retired after nearly 30 years on staff, is now a freelancer based in Alexandria, Virginia. SARAH LEEN's most recent story for the magazine, also with Hodgson, was on Kamchatka (April 1994).

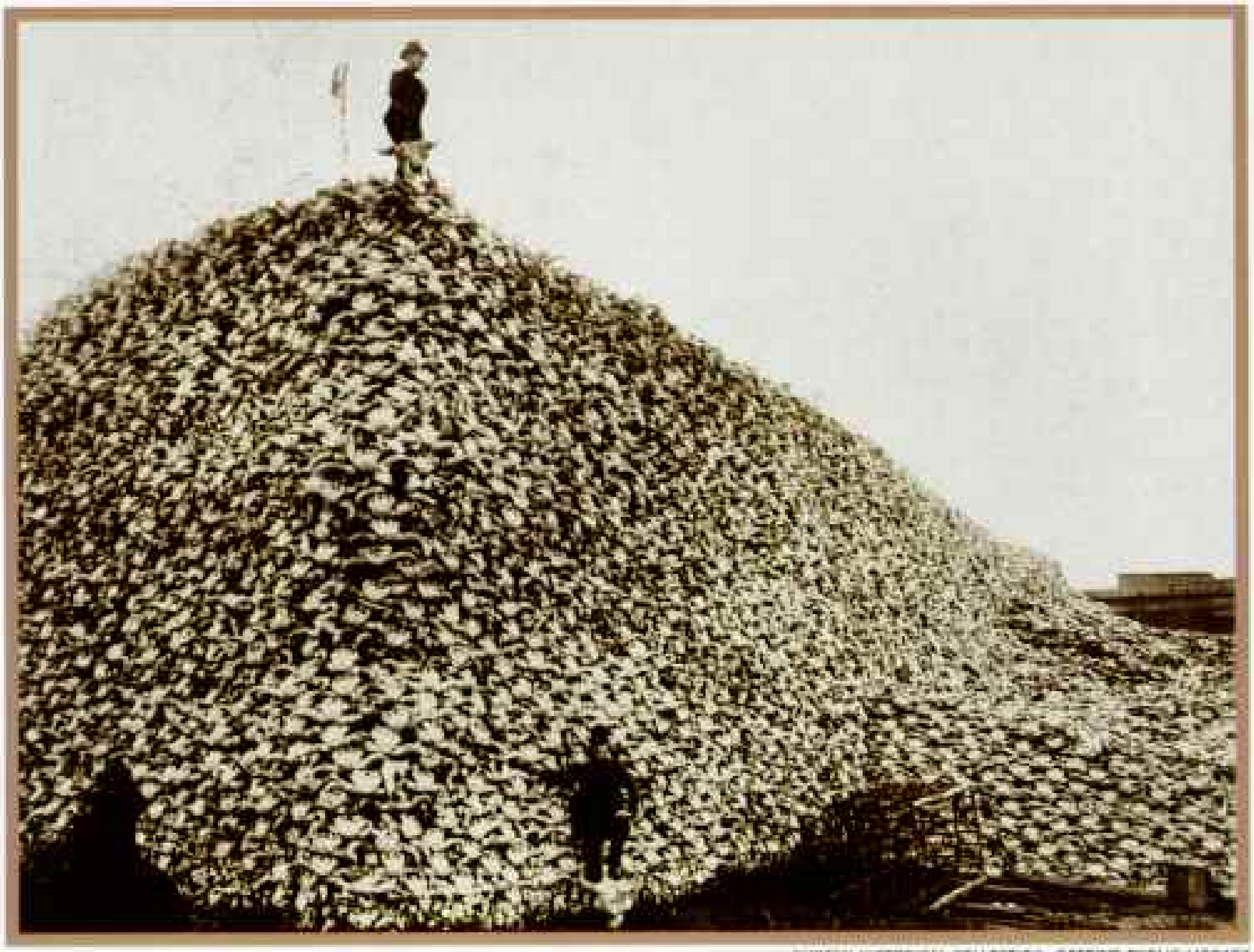
miles per hour, he's like a car with front-end power." As for posturing atop his partner, he says, "I let him lie on top of me, so it's fair." A century ago Wild West shows produced by Cody—who killed 4,280 bison in 18 months—drew attention to the animal's dwindling numbers. In 1913 a Bronx Zoo bison was immortalized on the nickel (opposite).

and bone. The Lakota knew them as *Pte Oyate*, Buffalo Nation, and honored them in religious ritual that was at once a thanksgiving and a communion.

"When the Creator made the buffalo, he put a power in them," says Les Ducheneaux, former guardian and ceremonial slaughterer of the Cheyenne River herd. "When you eat the meat, that power goes into you, heals the body and spirit. Now we have the poorest diet. We have alcoholism. We have juvenile and adult diabetes. When our spirituality comes back, when we see buffalo as our grandfathers saw them, then we'll be on the road to recovery."

IF YOU DINE on buffalo, history makes a bitter sauce. The indiscriminate slaughter of millions of animals on the frontier provoked outrage in Congress, which in 1874 voted overwhelmingly to end it in the federally controlled territories. The bill was pocket vetoed by President Ulysses S. Grant, whose army was losing as many as 25 troopers for every Indian killed in a campaign to confine them to reservations.

In 1876, when the bill was debated again, Representative James



BURTON HISTORICAL COLLECTION, DETROIT PUBLIC LIBRARY

Where the buffalo roamed

"The moving multitude . . . darkened the whole plains," wrote Lewis and Clark, who encountered a herd at South Dakota's White River in 1806. Later came the carnage—spurred by the transcontinental railroad—as hunters mowed down entire herds for meat, skins, and sport. The slaughter turned the Great Plains into a vast boneyard, scavenged by bone pickers who filled wagons with skeletons. Shipped by rail to plants like the Michigan Carbon Works in Detroit (opposite), mountains of skulls were crushed into fertilizer.

Throckmorton of Texas summed up the administration's de facto policy with stark precision: "There is no question that, so long as there are millions of buffaloes in the West, so long the Indians cannot be controlled, even by the strong arm of the Government. I believe it would be a great step forward in the civilization of the Indians and the preservation of peace on the border if there was not a buffalo in existence."

In 1882 Col. Richard Dodge, a veteran Indian fighter who had come to respect his adversaries, reported the results of unrestrained hunting: "Ten years ago the Plains Indians had an ample supply of food. . . . Now everything is gone, and they are reduced to the condition of paupers, without food, shelter, clothing, or any of those necessaries of life which came from the buffalo. . . ."

BUFFALO WERE BORN in the Black Hills of South Dakota, according to Indian tradition. Today the hills are an Eden of sorts, where graceful forests and glades nurture some 2,000 buffalo in separate herds at Custer State Park and Wind Cave National Park. Many of them are descended from animals collected in 1881 by a French-Canadian rancher named Fred Dupree, who started a herd from five calves captured north of the Cheyenne River. Other survivors wound up in New York's Bronx Zoo, whose director, William T. Hornaday, shipped 14 animals to Wind Cave in 1913.

"Our herd has helped start hundreds of others," says Ron Walker, Custer's resource program manager. "We've auctioned animals to breeders since 1966. Nowadays we get an average of $1,300 a head. Maybe that's not your pure vision of buffalo ranging free. But this isn't nostalgia. It's an enterprise, a major tourist attraction.

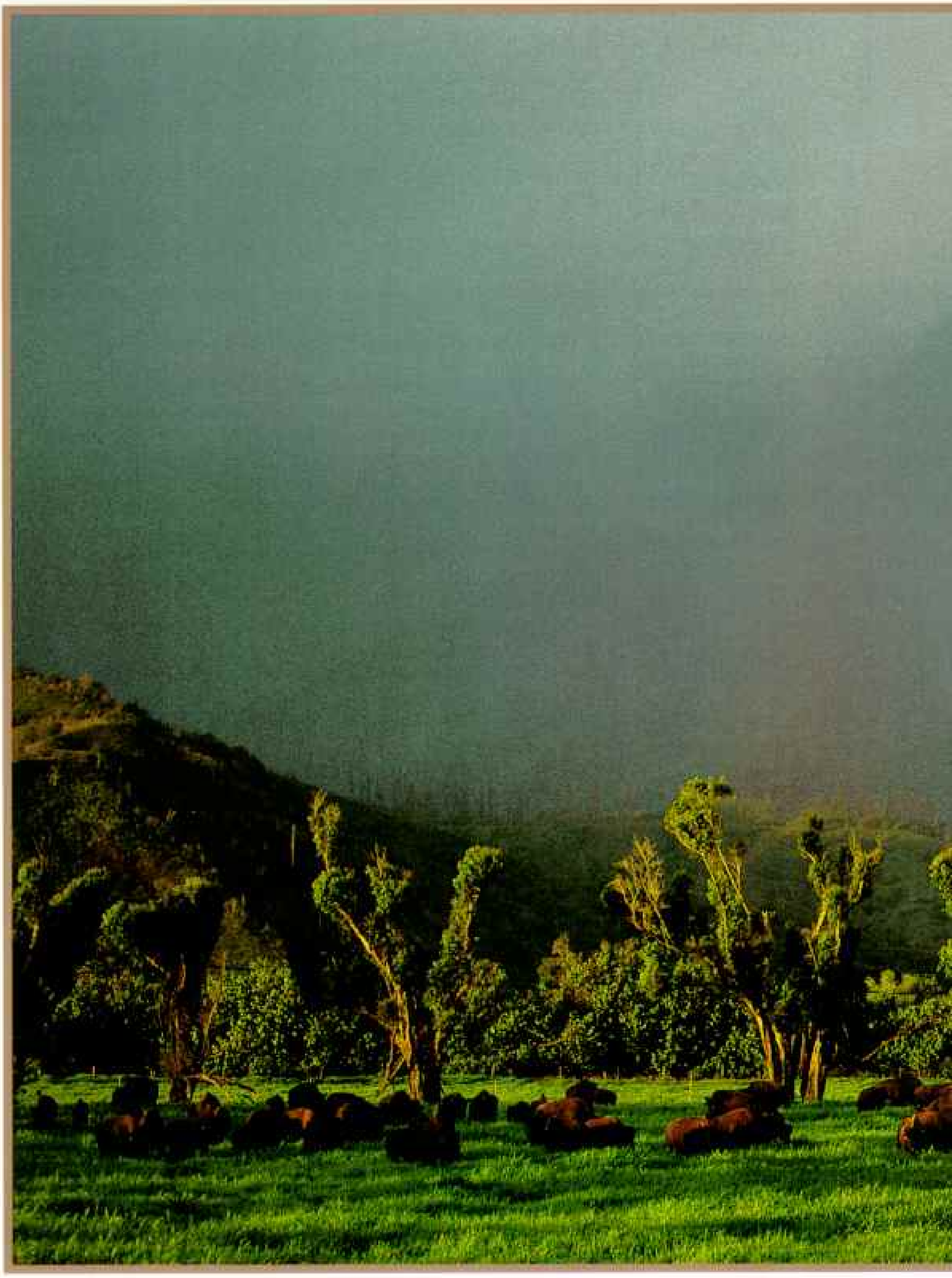
"Our rangelands are all native grasses—big and little bluestem for the warm season, western wheatgrass and green needle for the cool season—and all in good to excellent condition. People can see typical large-herd behavior, such as bulls fighting and calves nursing, and learn what these animals are really like."

Nowhere do people get closer to buffalo than in Yellowstone National Park, where some 4,000 buffalo range at will over 2.2 million acres of forest, mountains, and eerie volcanic terrain.

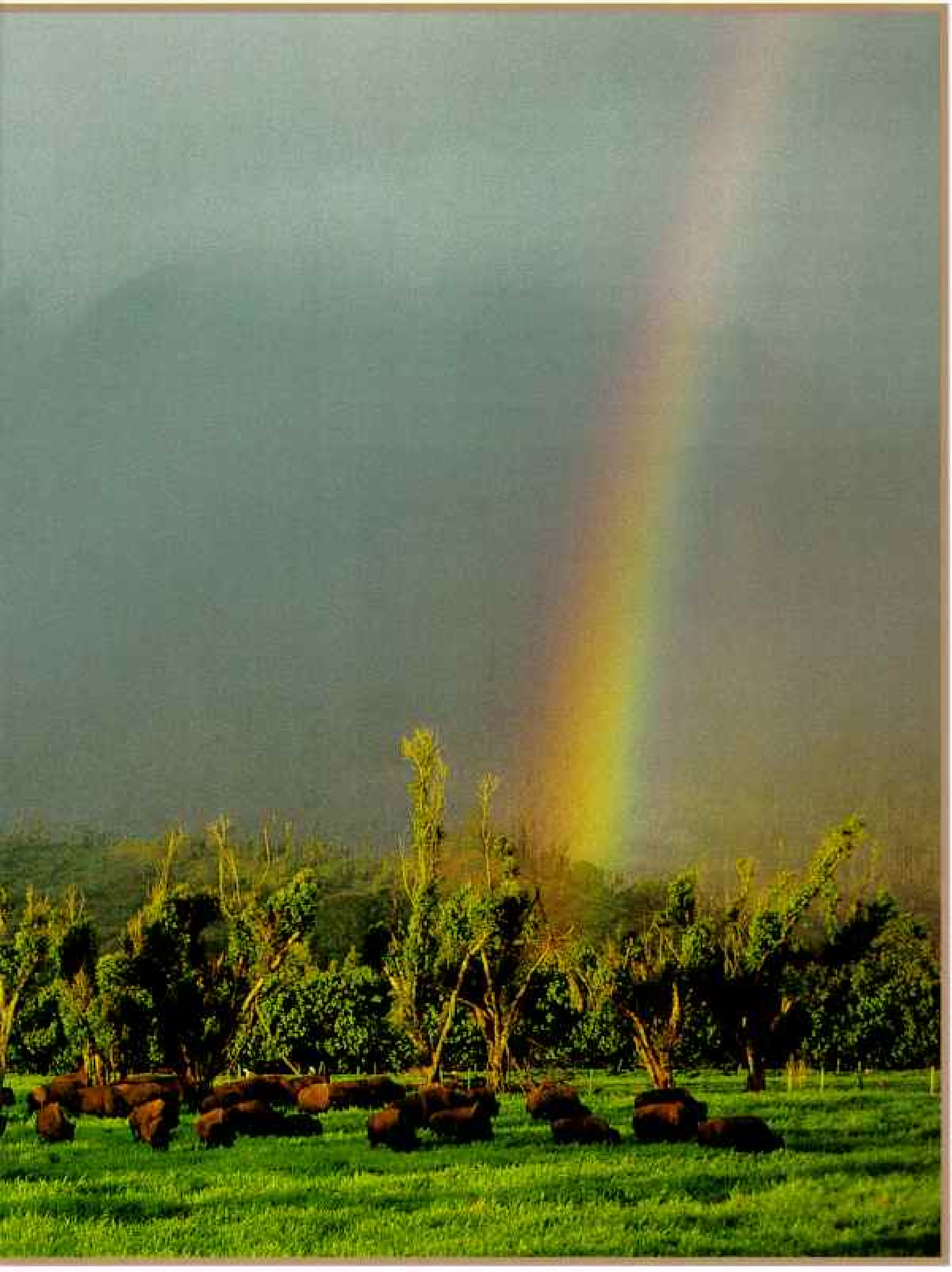
Intimacy poses hazards: "THESE ANIMALS MAY APPEAR TAME BUT ARE WILD, UNPREDICTABLE, AND DANGEROUS," say warning signs, adding that an average buffalo can sprint at 30 miles an hour, three times faster than an average tourist can run. Since 1983 more than 50 tourists have ignored the warnings and been gored—two fatally—when they violated a buffalo's personal space.

"This herd is a window on a vanished world," says research biologist Mary Meagher, who has been studying the park's buffalo for 33 years. "Bison have occupied the Yellowstone region since the end of the Pleistocene. Their fundamental behavior hasn't changed. They take the world head-on. They are animated snowplows, able to reach forage by moving snow aside with their heads. They learn very quickly where the best grazing is. They'll pick up and move if they don't like things."

Since 1966 Yellowstone has had a hands-off management policy, allowing the herd to range freely so researchers can observe



EIGHTY INCHES of annual rain keeps the buffalo grass growing for 300 head of bison at Hanalei Garden Farms on Kauai, Hawaii. While Hurricane Iniki nearly stripped the ranch's Java plum trees in 1992, "the bison loved every minute of it," recalls rancher Bill Mowry.



"I was huddled in the basement; they were lying down chewing their cud." Bill and his wife, Marty, imported their first bison 13 years ago; now their dream is to export meat to Japan. As adaptable as they are hardy, bison also range in Alaska.

natural migratory patterns. At first, long, savage winters kept population in check as weaker animals—young and old—found deep snows too much for them. That changed a few years ago after the park was opened in winter for thousands of snowmobile tourists. Although they trail blue smoke and a noise like battalions of chain saws, and on occasion harass wild animals to exhaustion, the machines have made life easier for the buffalo by providing packed-down snow trails, which allow them to migrate to better sources of food.

"Opening the park to winter visitors has removed the natural fence of snow depth," says Dr. Meagher. "As a result, winter kills have declined, and the population has been inflated by at least 1,500 animals. We have screwed up the system royally."

Overpopulation has created serious problems. Despite the popular image of herds traveling en masse, buffalo often travel in smaller groups. In recent years some of them have invaded private

lands north and west of park boundaries, casually breaking or leaping over cattle fences to fill up on choice pasture grass.

This provokes outrage among cattlemen, who fear the buffalo will spread a dreaded disease called brucellosis, which causes spontaneous abortion in domestic livestock. Humans who handle meat infected with the *Brucella abortus* bacterium can fall victim to a debilitating disease called undulant fever, often difficult to diagnose.

The organism is believed to have arrived in cattle brought from Europe and has been found in Yellowstone's buffalo for more than 75 years and in its elk herds nearly as long. Federal and state governments have been trying to eradicate the disease for almost a century, banning the shipment of live animals that may carry it and requiring cattle ranchers to quarantine or slaughter infected herds.

"The only way to tell for sure if an animal is infected is by taking tissue samples from a carcass," says Margaret Meyer, who has studied the disease for years at the University of California at Davis School of Veterinary Medicine. "There are those who seriously believe that the Yellowstone herd should be destroyed to

COME SUMMER, bison shed their winter coats and roll in shallow prairie depressions. Hurling himself flat on one side (above left), a bull wallows gloriously, kicking his legs, gouging the turf with his horns, and covering his body with a dusty coat that protects his vulnerable hide from biting insects. A bison's sharp hoofs stir up hard-packed prairie soil, allowing it to retain moisture, which encourages new grass

growth. During the three-month breeding season, bulls guard their chosen mates, glowering at intruders and scaring them off with lionlike roars (above).

It is not unusual for a buffalo to live 20 years, and a female may calve every year after reaching maturity at age 3. One female in Wyoming, purchased in 1922, gave birth almost every year until her death 41 years later.

eradicate the disease—even though there has never been a proven case of free-ranging bison infecting cattle."

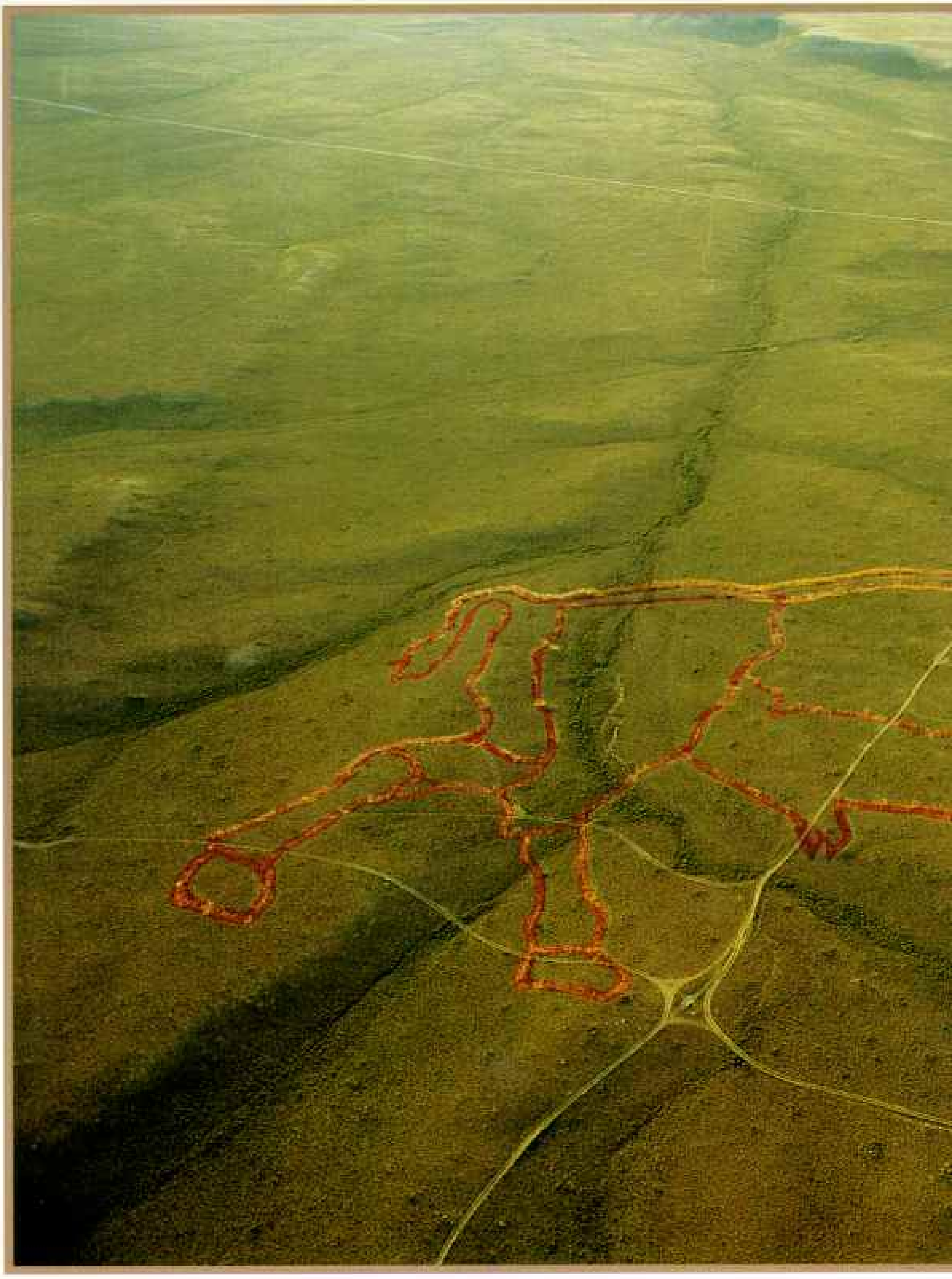
In the winter of 1988–89 fear of infection led the state of Montana to authorize hunters and wardens to kill some 600 buffalo outlaws.

"It was a nightmare," says Edward Francis, manager of a ranch owned by the Church Universal and Triumphant just north of the park. "Buffalo don't act like game animals; they just stand there to be shot. Television showed the whole thing, and animal rights groups took the state and the park to court. Now we're waiting for all the agencies to come up with a management plan."

Since Yellowstone's buffalo cannot be shipped alive, the plan may result in deliberate reduction of the herd.

NOT FAR FROM BELEAGUERED YELLOWSTONE, on the Flying D Ranch south of Bozeman, Montana, television mogul Ted Turner is seeking a balance between management and nature while raising the world's largest private herd.

"I guess I've gone buffalo batty," he says. "I've got about 5,700 buffalo here, including 1,800 calves, and another 2,100 in New



HALF A MILE FROM HEAD TO TAIL, a buffalo outlined in red-dyed straw near Lander, Wyoming, will be re-created in crushed stone at a permanent site elsewhere in the state. The Great Buffalo Herd Monument—a memorial to America's vanishing herds—

will corral not live animals but a thousand life-size buffalo cast in bronze. Says creator Robert Berks, who sculpted the Washington, D. C., statue of Albert Einstein, "Adults respond to buffalo like kids to dinosaurs—you can see it in their eyes."

Mexico. I'm getting ready to stock another ranch soon. My immediate goal is to have 10,000 animals.

"The more intense the management, the higher the return. But I'm trying for a low level of management."

So far he has removed 250 miles of fence to allow buffalo to range free. "I want the herd to have the whole family grouping—massive bulls as well as the young animals. When we buy animals with tags in their ears, I order them removed. The managers say they can't tell them apart without tags, and I tell them to get to know them by their first names.

"All we want to do is raise an animal that was born and bred on this land, not imported from Europe. I'm a pretty good marketer, and I'm getting ready to market buffalo meat. Right now it's a novelty. We need to make it a staple."

Gradually, the meat is appearing in neighborhood supermarkets, and specialty shops and mail-order firms sell buffalo-burger meat for $4 a pound, T-bones and sirloin steaks for $15, and corn-fed filet mignon for more than $30.

Perhaps the most enthusiastic purveyor is Sam Arnold, a

HELICOPTERS CHASE BISON into pens at Wind Cave National Park in South Dakota (above). The animals will be weighed and vaccinated. Some rebellious bulls "try to horn the helicopter," says ranger Ross Rice. At the nearby Triple 7 Ranch, bulls that keep breaking down fences pay the price (right). Says rancher Duane Lammers, "If you're a buffalo due for the processing plant, might as well die out there eating grass."

Denver food historian whose restaurant, The Fort, serves 50,000 buffalo dinners a year, consuming 24,000 pounds of prime meat plus several tons of delicacies such as testicles, tongue, marrowbones, and hump.

Sometimes it requires a little sales psychology:

"I first tried to sell buffalo tongue as an hors d'oeuvre at $1.75 and had no takers," he says. "So I priced it at $6.75, set a limit of two to a customer, and sold out every night."

To the industry he offers advice with a warning: "Growers must have high standards if they want the market to expand. We've learned that one tough steak can sour a person on buffalo for life, and he'll tell his friends."

Pursuit of standards—and standardization—has led some producers to adopt beef-industry methods, rendering cows more docile by dehorning them and slaughtering young bulls, which tend to become unruly at three years of age.

THE BISON BAR'S DOOR has swung for 50 years as ranchers from around Miles City, Montana, duck in to rinse prairie dust from their throats (right). The nearest bison ranch is a hundred miles away, says owner Rob Bartholomew, "but a lot of my customers come that far."

Bison was on the menu when the International Bison Conference convened last year in La Crosse, Wisconsin (left). "The buffalo herds could have been such a wonderful resource—could have fed us and clothed us," says surgeon Bill Cummings, wearing a beaded vest made by his 94-year-old mother. In the 1970s Cummings worked on a University of Minnesota study that tried to tap the bison's strong immune system for a cancer vaccine.

For producers, Oklahoma State University zoologist Jim Shaw has another warning:

"That could endanger the species," he says. "In nature the older males are the dominant breeders—and they carry the traits of survival. Systematic culling for desired characteristics reduces genetic variety. Herds should be culled randomly. We should keep aggressive cows, disfigured bulls. Above all, we shouldn't breed for pretty."

Dr. Shaw speaks with urgency because he knows how miraculous it seems that any buffalo survived at all.

"Most of today's buffalo descend from 77 animals in five founding herds," he says. "They escaped inbreeding problems only because the numbers increased fairly rapidly after 1900, and there was a lot of interchange between the herds. The Bronx Zoo was pivotal, because it acquired bison from various herds. A few animals can contain much variation, but not for many generations.

"We're a long way from an inbreeding crisis. We can still afford a few mistakes. But I'd hate to see a uniformity of herds."


BISON
PULL

SIXTY TONS OF CONCRETE on the hoof, the world's largest buffalo statue grazes near the National Buffalo Museum in Jamestown, North Dakota. Bison, though distant relatives of true buffalo found in Africa and Asia, are closely related to the rare, smaller

European bison, or wisent. While ranchers use the bison's proper name, most Americans refuse to surrender the buffalo label. Hence, popular idiom has given rise to buffalo grass, buffaloberry, buffalo fish, and bison-inspired towns throughout the nation.

Paul Hines, a former director of the National Buffalo Association, raises 19 animals on his 60-acre farm in Churchville, Maryland. His philosophy is more succinct: "What God made perfect, just leave alone."

THE LONELIEST LAND IN THE NATION is not the unpopulated wilderness but the vast tracts of semiarid plains where farming, ranching, and mining are dying industries and the population is dwindling. Frank Popper, a land-use planner, and his wife, Deborah, a geographer, suggest turning thousands of square miles of such marginal land into a vast nature preserve they

call the Buffalo Commons, a sort of American Serengeti where native animals could roam freely.

Frank got the idea after years of traveling the West. "We saw ghost towns dotting the plains, communities with boarded-up storefronts and empty farmhouses. We wandered around, talking to people, wondering why do towns look this way, what does it mean, what comes next?"

The Poppers consider the plains as lying between the Rockies and the 98th meridian, and ranging from Montana to Texas. Their study shows 110 counties with such signs of distress as population loss, high poverty, or four people or fewer to the square mile. Most land is used for cattle, not crops.

Plains dwellers initially denounced them as eastern intellectuals who wanted to take away their land and livelihood.

"Now," says Frank, "we see that local private-sector initiatives

are beginning." One initiative is the Big Open proposal for eastern Montana, which could support 75,000 buffalo, 150,000 deer, 40,000 elk, and 40,000 pronghorn. A 10,000-acre ranch in this region could expect to earn a comfortable profit from hunting and tourism. In addition, the area would gain hundreds of new jobs, according to Bob Scott, the environmental entrepreneur who originated the idea in 1986.

"The Buffalo Commons is part proposal, part metaphor for a long-term series of land-use changes, and an appeal for rethinking plains possibilities," Frank says. "We want to *offer* something to the people of the plains, not take something away."

SKIN AND BONES of the bison enrich North America's Western culture. Relaxing outside their buffalo-hide tepee (left), Ed and Virginia Morgan celebrate their wedding anniversary at an Old West rendezvous near Grand Junction, Colorado. Thousands of enthusiasts gather for such events, but nearly all have replica tepees made of canvas. "Ours is made from female buffalo hide," says Ed. "It weighs 130 pounds." A tepee of bull hide, which is thicker, would weigh 80 pounds more.

Nineteen bison skins, stitched with bison-muscle sinew, make up the shell. Its creator, South Dakota artisan Larry Belitz, uses bison brain to tan the hides. "It's the Sioux way," says Belitz. "You rub brains into the hide for an hour."

Bison bone marrow is the favorite appetizer at The Fort restaurant outside Denver. Chef Mike Barnett (right) serves up two tons of bones a year. "You slice a bone lengthwise to expose the marrow, and broil it," says owner Sam Arnold. "Then you spread it on toast. In the old days they used to call it prairie butter."

A DISTINCTLY UNCOMMON BUFFALO named Cody has changed the lives of Mike and Robin Fogel, who raise 250 animals on their 385-acre ranch near Houston, Minnesota.

"I was planting trees one day and looked around to see he was unplanting them for me," says Robin. "I chased him back to his pen with a shovel. But he loved company, so we started paying him more attention."

That wound up making him the most famous buffalo in the United States. Among other things, Cody had a speaking part in the movie *Radio Flyer*, where he played alter ego to a lonely young boy; he also posed for glamorous footage in the frontier movie epic *Dances With Wolves*. Less glamorously, he has been stampeded down Wall Street by a toy rabbit in a battery commercial on network television.

But mostly Cody shares star billing with Robin, who dons her sequined Buffalo Gal costume when she saddles up to ride him in parades and country fairs. I saw them first in La Crosse, Wisconsin, opening the International Bison Conference in July 1993. If he looks fluffier than his brethren, it's because the Fogels take him to a car wash before the parade—"A hand car wash, not the automatic kind," says Robin.

How do you train a buffalo?

"Well, I think maybe he trained us. He was an orphan, and he always wanted to be around people, to see what you were doing."

Cody's sweet disposition may owe something to his sweet tooth. "He'll even take cookies right out of your mouth," Robin said. "Kids just love him."

THE REAL ROLE OF BUFFALO lies somewhere between being a national symbol and being a national pet. On the Triple 7 Ranch near Hermosa, South Dakota, manager Duane Lammers moves easily on this new frontier. He earned his college degrees in agricultural economics and animal science, learned the techniques of genetic breeding, and was a successful working cattleman before starting to raise buffalo in 1988.

"YOU CAN TELL by the width of his head, the set of his horns, that he was *tatanka*, the big bull," says Lakota teacher Harry Charger, picking through skulls at the Cheyenne River Indian Reservation. This skull he will place at the entrance to his sweat lodge, a place of ceremony and prayer.

Recalling the time when bison fed the Plains Indians, instructor Dickie Moss (above, in baseball cap) demonstrates the use of traditional butchering tools at an elementary school on the Wind River Indian Reservation in Wyoming. "Today we go to the grocery store to buy food," explains Moss. "This animal was our store."

"We started seeing the difference right away. If you turn a buffalo into a binful of grain, it won't overeat. Turn them into an alfalfa field, and they won't bloat. On Forest Service lands we monitored the state of the range, and we discovered that perennial grass plants had doubled where the buffalo had grazed. They have sharp hoofs. They break up the soil. That's improved the turf and improved its ability to hold water as well. Some springs have been regenerated. And since buffalo don't gang up around water like cattle, we've noticed an increase in nesting waterfowl as well."

A savage prairie blizzard drove the message home. "The first year we raised buffalo, we also had hundreds of pregnant beef cows," he said. "The blizzard hit at the end of April when the cows were calving, and we worked 24-hour days doing obstetrics to take care of them. But the buffalo just stopped calving during the blizzard and waited until afterward to give birth. That's when we realized that this is one hell of an animal that nature created.

"And that's when we sold off all our beef."

DRIFTING WITH THE SEASONS, a Yellowstone bison winters comfortably in the snowpack. Some of the park's 4,000 bison, the nation's only "unmanaged" herd, carry brucellosis, dangerous to cattle. Unfenced, the bison wander onto ranchland, where they

SARAH LEEN, MATRIX

are shot for fear of their infecting livestock. Still, man and bison seem to have reached an equilibrium. "Brother Buffalo kept us from starving, kept us clothed, kept us housed, kept us company," says Harry Charger. "He paid the price, and now we sustain him." □

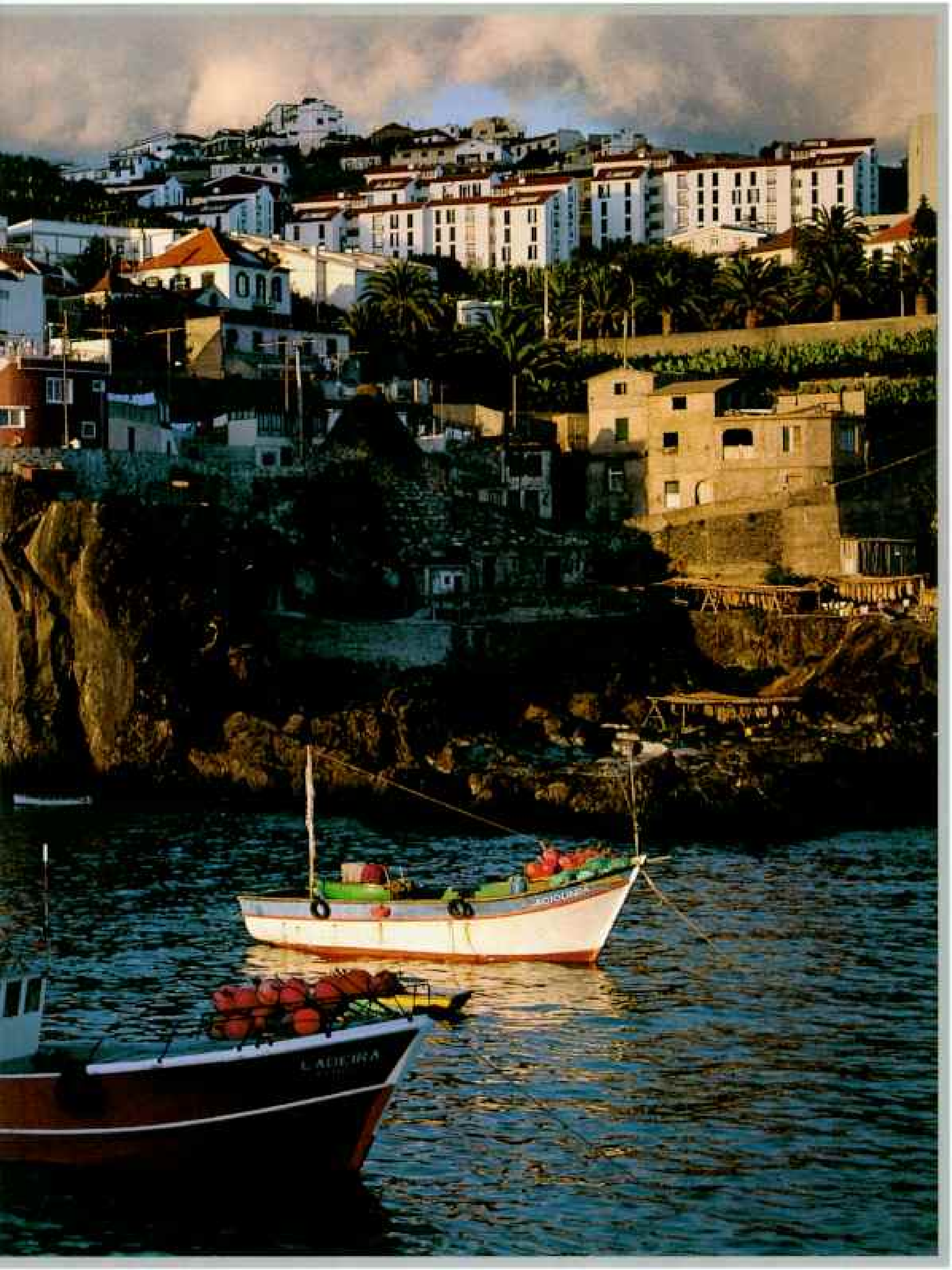
A Sunday shower can't keep the Roman Catholic faithful from church on the island of Madeira, home of sweet wine and independent spirits. A politically autonomous region of Portugal since 1976, Madeira now finds itself pulled into the fray of Europe's new common market, while wondering: What must we give up to grow up?

MADEIRA TOASTS

BY JOHN McCARRY

PHOTOGRAPHS BY MEDFORD TAYLOR

THE FUTURE



Steep slopes squeeze houses in the fishing village of Câmara de Lobos and elsewhere on Madeira: With 865 people per square mile, the island is one of Europe's most densely populated regions.

I AM WALKING THROUGH A CLOUD, and Álvaro Silva is showing me the way. Propelling himself with a wooden staff that is as tall as he, Silva, 76, leads me through an otherworldly landscape of mossy pastures and enormous gnarled trees. We are on Fanal, a plateau region on Madeira, the principal island of the archipelago of the same name, and though the sun rose more than an hour ago, the thick fog that has settled all around us seems to swallow all its light.

Silva has come to shear his sheep. In the distance, through the fog, we can hear them calling with thin, anxious voices. Silva pauses to pour some watery red wine into a cup made from a bull's horn. "We're losing this land," he tells me, "because nobody cares anymore. Everything is finished for the Madeira Islands."

Hours later I am standing on a stretch of flawless white sand beach on the edge of Porto Santo, Madeira's sister island. A stiff wind sweeps over the turquoise waters from Morocco, 400 miles east of here, lifting the hair of a girl in a bikini who is navigating

her way to shore aboard one of Duarte Drummond's sailboards.

Drummond, a 25-year-old entrepreneur who rents sailboards to tourists, stands beside me. A sturdy young man with a well-developed tan, he wears only a bathing suit and a watch that is set not to local time but an hour ahead, to continental European time.

In a voice plummy with confidence, he tells me, "Now is when everything is beginning for the Madeiras. This is the moment when everything is going to take off."

Such contrasts are not uncommon in the Madeira Islands, a region of Portugal cast between the Azores and Africa that includes Madeira, Porto Santo, and two groups of uninhabited isles known as the Desertas and the Selvagens. Thought by romantics to be part of Plato's lost continent of Atlantis, these pristine islands of farmers and fishermen remained virtually unchanged for centuries (maps, page 97).

That is until 1974, when a revolution in Lisbon ended 42 years of dictatorship in Portugal and the Madeira Islands.

For the first time since the islands were originally inhabited in the 15th century, Madeirans took hold of their own destiny. Losing no time, the newly elected local government mapped out a bold path of economic growth: While aggressively promoting tourism, which today has replaced small-scale farming as the islands' economic mainstay, the region also made plans to turn itself into an international center of offshore commerce.

Madeiran prosperity was given a vigorous boost in 1986 when Portugal—and the archipelago along with it—joined the European Community, now called the European Union (EU). A cacophony of construction is audible in almost every corner of the main island; half visible through churning clouds of dust are signboards proclaiming yet another project funded by the EU. The regional capital, Funchal, bustles with the kinetic, coin-jangling energy of any European city.

Yet with growth have come difficulties. Conflict and contradiction have slowed the process of integration in all parts of the EU—and the Madeira Islands are no exception. Although generous amounts of European money have done much to stoke the engine of the incipient service economy, strict EU directives are transforming agricultural production, which still employs 21 percent of the workforce. While young people have embraced these sudden and dramatic changes, an extremely cautious older generation has, for the most part, been left confused and intimidated by them. But if there is a generational rift among Madeirans, one thing that unites them is their deep and touching devotion to their island home.

Standing on a hillside in the arid and empty interior of Porto Santo, Maria Emília Menezes lovingly groomed a calf with a stone. A smiling woman in a straw hat the color of the wheat fields before us, she told me, "Porto Santo is the painting God made."

Twenty-five miles away, on Madeira itself, I felt no less close to the divine. Soon after arriving on the island, I set out on a drive along the rugged north coast. The experience, meant to be an exploratory jaunt, turned out to be a motor tour through the morning of creation. In contrast to the spare, dry beauty of Porto Santo, Madeira blooms like a garden. Iridescent waterfalls crash over the treacherously narrow road. Dreamlike flowers glimmer through a mist of rainbows. Exotic fruits dangle from primeval tree limbs.

Dragging their boat ashore, fishermen in Porto Moniz will face a stiff challenge from better equipped fishing fleets soon to arrive from the Continent. To compete, Madeirans will need to buy bigger boats and stay at sea for weeks, an unpleasant prospect for family men. "They're worried they'll get lonely out there," says one young bachelor.

Feeling dizzy from this endless roadside psychedelia, I stopped the car and wandered into a garden. There I saw a pink rose, perfect and enormous. "I've never seen such a huge rose!" I exclaimed to an old woman who had appeared at my side.

Snapping its stem, the woman handed me the flawless blossom.

"I have," she said.

Madeirans' loyalty to their soil is matched only by their loyalty to one another. Again and again during my visit I was told, "We are like one big family." Mention the name of one Madeiran to another Madeiran and if he does not know him personally, he will rack his brains trying to place him somewhere on the islands' family tree.

The Madeiras' low unemployment rate—just 4 percent compared with the Portuguese national average of around 5.5 percent when I was there last year—might perhaps be attributable to this extraordinary familiarity. Cecília Albino, a young woman from Lisbon who has lived on Madeira for more than a year, said to me one afternoon over coffee, "Every Madeiran loves Madeira. And why do you think that is? Because they never need anything. You need a job? Ask your uncle. You need a parking ticket fixed? Talk to your friend's father."

At the café tables around us, people exchanged kisses, hugs, jokes. Although it is unlikely that any of these young office workers had spent more than 24 hours apart, the collective rendezvous seemed more like a high school reunion than a daily lunch break.

More than a quarter of a million people crowd onto these tiny islands. Nevertheless Madeirans are intensely private people. In a

God and government make a powerful pair in Funchal, where the Church of St. John the Evangelist rubs elbows with City Hall. Because most Madeirans are Catholic, the church exerts pressure on politicians, most of whom belong to the powerful Social Democratic Party (SDP). "If God could vote," priests have been known to sermonize, "he'd vote for the SDP."

JOHN MCCARRY, a journalist based in Washington, D. C., last wrote for the magazine on Hunza (March 1994). Freelance photographer MEDFORD TAYLOR's most recent story was on Lake Superior (December 1993).

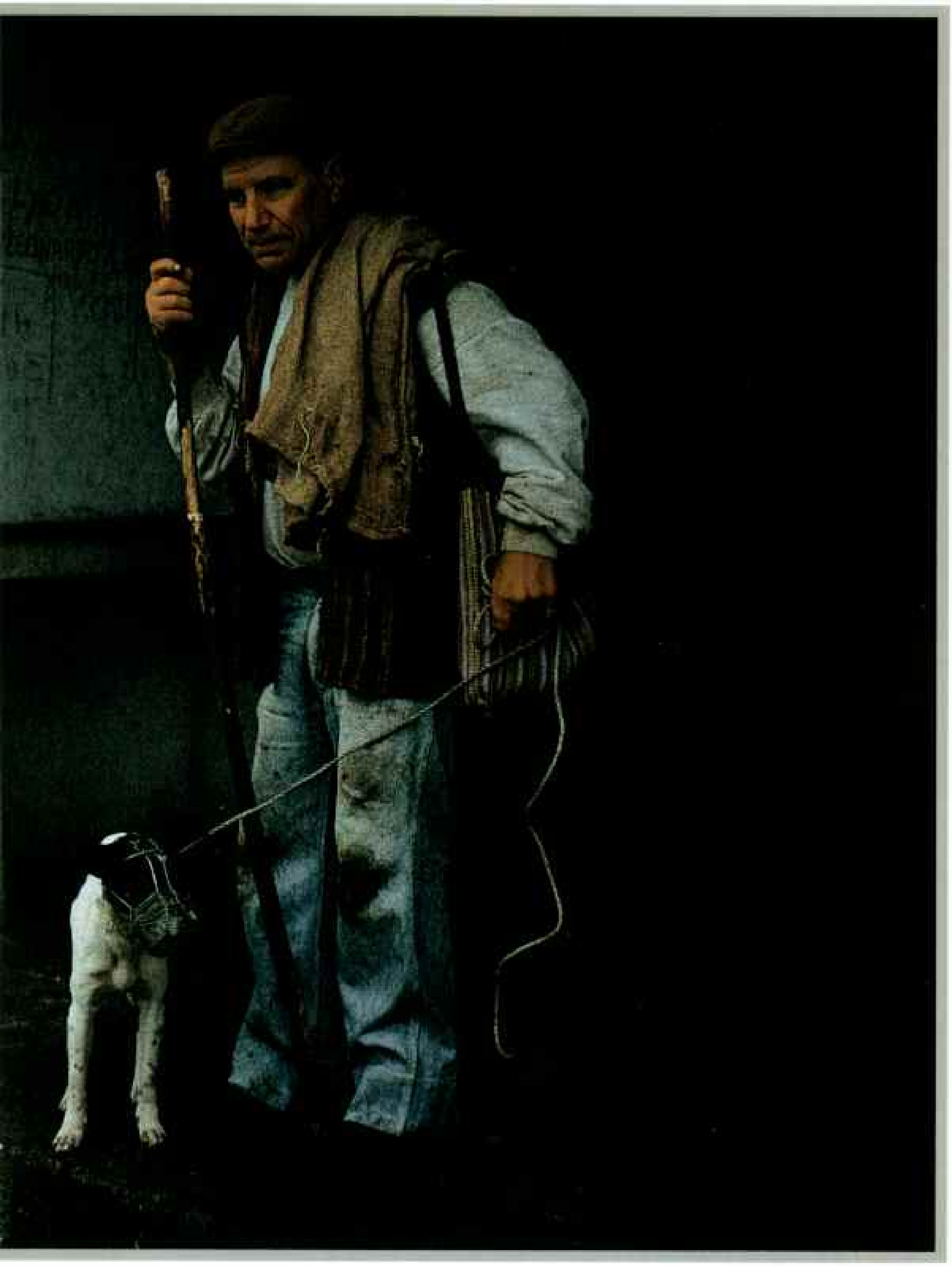
place where anonymity is impossible, the only seclusion available seems to be in one's own mind. As a result, I found, Madeirans can be contemplative to the point of morbidity. Wandering through the ghostly interior of Porto Santo in pitch darkness one night, a Madeiran friend turned to me, her face spectral in a wash of moonlight, and said, "My only concern, John, is that you may not be sad or lonely enough to really understand this place."

Sadness is a virtue, loneliness an accomplishment for Madeirans. Like my friend on Porto Santo, many believe that no outsider is sad or lonely enough to really understand them—not an American journalist, and certainly not someone from Portugal.

SOON AFTER THE BLOODLESS COUP in Lisbon in 1974, a separatist movement called FLAMA emerged on the Madeiras. FLAMA, led by political conservatives fearful that the national communist government wanted to expropriate their lands, vociferously opposed Lisbon's "colonial" grip on local affairs.

The archipelago gained autonomy in 1976, and in the same year Alberto João Jardim became president. Perceived by many Madeirans as a man with the backbone to stand up to both the national government in Lisbon and EU headquarters in Brussels (and the acumen to extract ever increasing subsidies from them), Jardim enjoys extraordinary support from the public. There are no strong opposition parties on the islands, and most Madeirans agree that Jardim, who has been in power for the past 18 years, will no doubt be in power for the next 18.

Rising about 17,000 feet from the floor of the Atlantic Ocean, a chain of mountain peaks form the Madeira Islands. Two island groups —the Desertas and the Selvagens—lack freshwater and are uninhabited. Porto Santo has water and about 5,000 year-round residents, but its chalky soil limits farming. Madeira itself is a loamy, lush parfait of five microclimates—from subtropical coastline to snow-flecked mountaintops.



Counting sheep keeps two shepherds awake as they work in the pastures of Fanal—a plateau region. Muzzles prevent the dogs from biting the flock and the wildlife; burlap bags neutralize the nip in the air.

NOWHERE is prosperity Jardim-style more apparent than at Caniço de Baixo, an area southeast of Funchal that has been transformed from a sleepy farming community into an outpost of Teutonic suburbia. Attracted by its stunning coastline, developers from Germany constructed a holiday refuge there for their wealthy compatriots about ten years ago. Today neat rows of identical stucco houses line the town's impeccably maintained streets; glossy BMWs glide past faux Bavarian beer halls.

Not everyone in Caniço de Baixo lives an affluent life, however. Walking along the waterfront, I noticed a modest house standing alone in a rubble of construction, an albino dog tethered to its front gate. Several small children with grubby faces played in the shadow of the enormous luxury hotel that was under construction just across the rough dirt road. A young woman emerged from the simple dwelling to hang laundry on a line. A housewife whose husband works in construction, she told me that this was the house where she grew up. I asked her what will happen to her home when the hotel is finished.

"They'll tear it down, of course," she said flatly.

Didn't that make her sad? She shrugged. "Why should it? The land was there. Why not build something on it?"

And build they have. Between 1990 and 1993 the EU invested 370 million dollars in the islands. Much of this money has gone into modernizing roads, bridges, clinics, and schools. But a good deal of it has also gone into the construction of big luxury hotels and apartment complexes.

Not all the money from Europe has fed the construction frenzy, however. Over the past three years 70 million dollars has been invested in an organization called the Centro Regional de Formação Profissional, a job-training facility located outside Funchal that has prepared 28,000 young Madeirans for the burgeoning marketplace. The center, which has programs in everything from computers to industrial design to hairdressing, has provided direction for a whole new generation, especially for women.

Young women like Suzie Mary de Freitas, whom I met at a village called Cruzinhas in the northeastern part of Madeira Island, have their own notions of progress. I first glimpsed Suzie as she sturdily trudged up a steep hill, an unwieldy bundle of green willows on her back. She carried her cargo to some old men, who were soaking the stalks in water so they could peel and dry them and then weave them into furniture and baskets.

Astonished to see a 20-year-old woman engaged in a supposedly dying business, I asked her about the industry's future.

Suzie responded in impeccable East London English, "Oh, I couldn't really tell you about all of that. I'm just helping out a friend of the family for the day."

She said her parents are Madeiran, but she grew up in London.

I asked if, having tried wickerwork, she would return to London.

"No way," she retorted. "I want to stay here, where it's healthy. I'm going to take a course at the center and learn to be a chef. You can make good money, working at one of the fancy hotels in Funchal."

Before autonomy, most Madeirans in search of a better life had no choice but to emigrate. About a million still live overseas—most of them in South Africa and Venezuela. Today, however, emigration has decreased dramatically, and young Madeirans like Suzie have begun to return to the Madeiras to find work.

Nestled in the heart of Madeira, Curral das Freiras was once so remote that in the 16th century nuns would flee here to hide from pirates who periodically pillaged the island. Today the village is a 30-minute drive from Funchal. New roads and bridges seem to be sprouting everywhere, especially on the eastern coast, where a grand plan takes shape to turn that part of Madeira into a different type of refuge: a free-trade zone that shelters businesses from the tax man.

But while the tourism industry and the service sector are booming as a result of this influx, traditional industries are suffering.

Worst hit, many say, are the farmers. Once Europe's largest producer of sugar, Madeira gradually converted its land to viticulture to supply grapes for a growing wine industry. About a decade ago, the agricultural balance changed again when many farmers, realizing bananas could fetch a higher price per acre than grapes, replanted some of their vineyards with banana trees. Now the island's biggest agricultural export, about 25,000 tons of Madeiran bananas are sent to Portugal each year.

SINCE PORTUGAL ENTERED THE EU, the security that growing bananas once gave has been badly shaken. Convinced that bananas are an ideal health food (and may even contain a natural antidepressant), Germans have, over the past few decades, developed a passion for the fruit.

The rub is that the Germans like to buy their bananas from the leading Latin American producers, who offer bigger, cheaper fruit. The French, the English, the Spanish, and the Portuguese, on the other hand, prefer to buy their bananas from their territories and former colonies. It looks as if, in the name of free trade, the Madeiran banana will lose its privileged position on the Portuguese market. Facing the fact that the EU's generous subsidies come with a price, the Madeiran government plans to reduce the land used for banana production by 29 percent by the year 1996, cutting total output by one-fourth.

This appears to be a sensible strategy to everyone but the Madeiran banana grower. One such farmer is Maria Edite Ferreira. Left a widow before the age of 40 by a man who worked himself to death as an emigrant to Venezuela, Mrs. Ferreira relies on the income her bananas give to survive. Receiving me at her pretty home in São Martinho, she told me that she sells about three tons of bananas during the summer season. Wholesaling at 30 escudos a pound, her bananas bring in an income of about $1,125. And at these prices, Mrs. Ferreira said, she finds it difficult to make ends meet.

"Since everybody started growing bananas, the price has remained at 65 escudos [40 U. S. cents] a kilo," she explained. "The problem is that the cost of living has doubled in that time."

Screwing up my courage, I asked my hostess what she will do if changes in Europe make it impossible for her to grow bananas at all. Her body suddenly stiffening, she surveyed the expanse of small banana plots that gracefully descend to the sea.

"I don't even want to think about it," she replied.

Sitting with Mrs. Ferreira on the sunny terrace of her house were her daughter, Nubélia, 25, and her son, Manuel, 31. Nubélia works at a Funchal travel agency and also disc-jockeys a weekly radio program of the latest British and American music. Manuel is an artist who studied design in New York City on a scholarship. They led me through the terraced garden that provides their mother's livelihood.

I saw far more than bananas there. Because of the precipitous landscape, only about one-third of Madeira's rich soil can be cultivated, and that only by hand. As a result, it is common for vegetables to be grown under vines to double plot capacity. In Mrs. Ferreira's garden, spinach, sweet potatoes, lettuce, beets, and green beans compete for precious space beneath a translucent canopy of grapevines.

A dark look of concern clouding her pretty features, Nubélia told

Losing ground after every rain, the Madeiras suffer from soil erosion. To help stem the muddy flow, the government has reduced the amount of grazing land available, thereby preventing sheep and goats from eating grass that would otherwise root the soil in place.

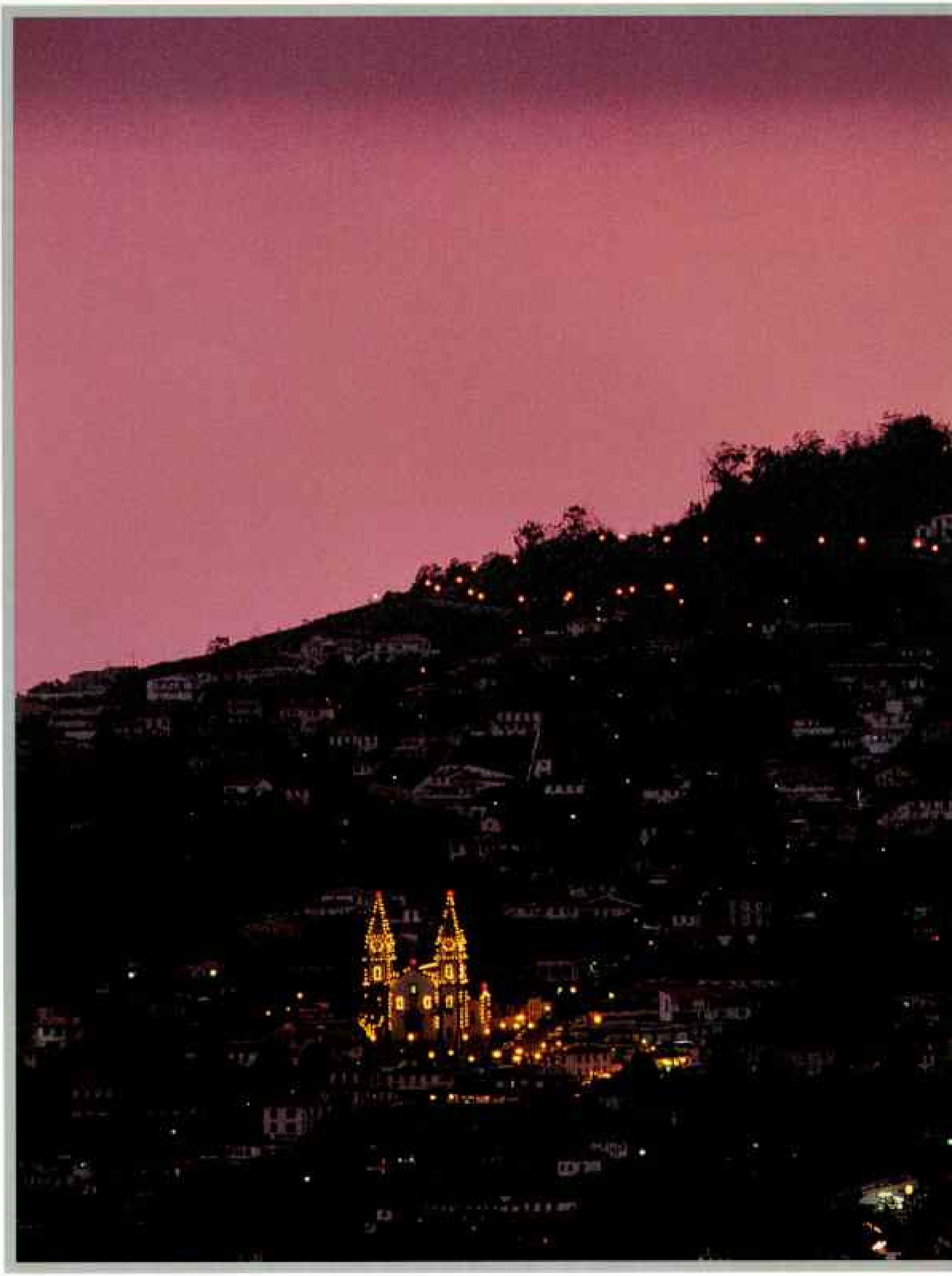
Despite these efforts, farmers face a hard road. Demand for Madeiran bananas has been undercut by bigger, cheaper ones from Latin America, and meager profits reflect a new economic order that puts farming in the back seat while tourism takes the wheel.

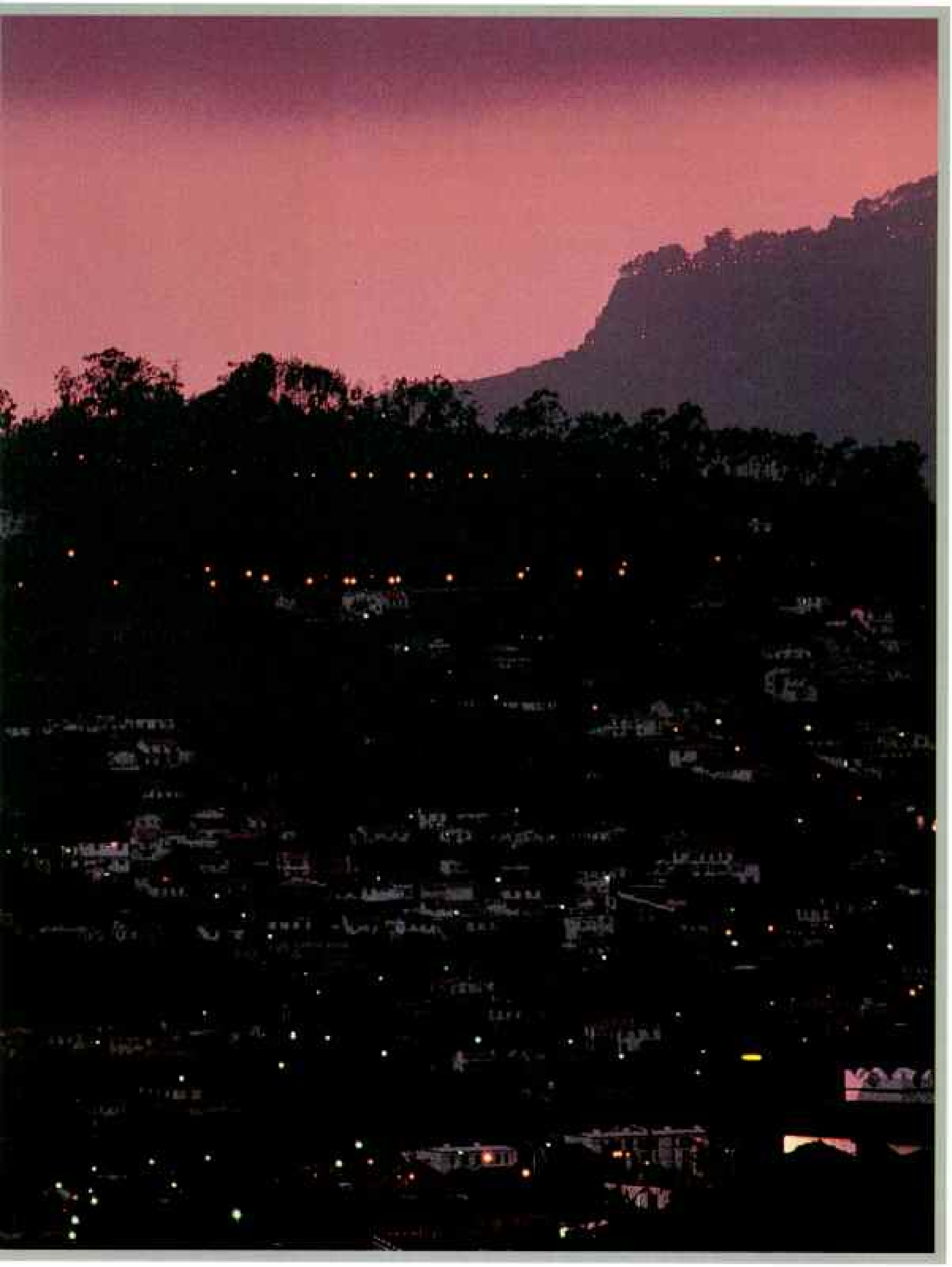
me that she has been trying to convince her mother that the banana is finished as a cash crop, that she should replant her garden with other fruit trees. "But like a lot of older people," she sighed, "she simply doesn't want to believe that things are changing."

Equally stubborn are the island's grape growers. According to EU directives, hybrid grapes such as the ones commonly grown by the island's small farmers must be replaced by four "noble grape" varieties for the production of Madeira's famous wines—the Verdelho, the Malmsey, the Bual, and the Sercial.

"This has not been easy," said Américo Campos, then a manager of the Madeira Wine Company, the island's biggest wine producer. "We have had to change not only the habits but also the thinking of the local grape growers on the island."

The company has its work cut out for it. Wine is a way of life here. Stop to ask directions on a drive through the countryside and you will, without fail, be offered a glass of wine. It is considered shockingly impolite to refuse, and then, having accepted, it is equally discourteous to decline an invitation to see the place where it was made.





Decked out for a festival, the steeples of Santo António overlook Funchal, where cinemas and cafés, boutiques and BMWs add continental élan to the city's subtropical surroundings.

There are roughly 5,000 small farmers engaged in viticulture on the island, and all of them appear to have their own wine cellar—usually a musty, dimly lit cavern dominated by a medieval-looking wooden apparatus that seems more suitable to the needs of the Spanish Inquisition than to the pressing of grapes. There you will be required to drink more wine, the alcoholic content of which appears to increase exponentially with each glass.

Before I had become aware of the inevitable consequences of such a proposition, I was lured into a wine cellar at Seixal. Handing me a glass, my eager host told me, "Drink this and you won't have to brush your teeth tomorrow morning." By the end of the visit, I was drinking pure firewater. "And if you drink *this*, you won't have to brush your teeth for a month," my beaming host advised. Gratefully finishing the taste testing, I headed straight for a four-poster bed. My head swimming on the crisp linen, I wondered if I had any teeth left.

AT SANTA MARIA MADALENA'S festival in honor of Santa Rita, the saint from Portugal who, when all other saints fail, can make miracles happen, enough wine was flowing to make even an atheist see visions. I arrived a little before seven, just as the sun was setting. The narrow road that passes through the center of town was filled with people.

I pushed toward the focus of all the excitement: A temporary stage set up in front of the village church, where a local band dressed in tight black trousers and gold-lamé jackets was performing a Portuguese-accented version of "Volare."

Soon I detected a disruption in the rhythmic swaying of the dancers, and a couple of teenage boys crashed through the crowd and onto the pavement in front of me. Rolling on the blacktop, they drunkenly pummeled one another. After a while their friends descended upon them and pulled them apart. Seamlessly reassembling itself, the crowd again happily danced as one for about 15 minutes, when another fistfight broke out.

The next morning I returned to Santa. The village, now shrouded in an impenetrable fog, was empty. Following the strangled sound of a bell, I made my way to the small church and there found the entire population of the village wedged inside. I spotted the boys who had rolled at my feet the night before, sitting side by side in the back pews. Their hair slicked back, their faces swollen and bruised, they bowed their heads in respectful prayer.

Religious festivals like the one at Santa are constant events in the Madeiras, and drinking, it seems, is part of the ritual of such celebrations. In a place where even the slightest eccentric act can cause people to knit their fingers—a uniquely Madeiran gesture in which you move your fingers as if knitting and then swoop your right hand over your head to prepare the listener for a piece of gossip—religious festivals offer a kind of socially sanctioned excuse to tie one on.

Some worry, however, that Madeirans are increasingly finding reasons outside of festivals to drink too much. According to a recent investigation by the leading daily newspaper, *O Diário de Notícias*, alcohol is involved in more than 90 percent of homicides. This rise in alcohol-related crime has occurred not in urban areas, where one might expect, but in the countryside. When asked about this unsettling trend, many Madeirans will tell you that it is the fault of American TV.

The grapes that made Madeira famous get picked, pressed, fermented, then heated to produce a heavy, sweet wine—too heavy and sweet for many of today's wine drinkers. Now local vineyards also grow grapes (above) that produce a lighter, drier wine that goes nicely with, say, tuna steaks—selling for a few hundred escudos at Funchal's central market.

With a glide in their stride after attending a friend's wedding, Lucina Branco and her boyfriend, Manuel Calaça, check out the scene at Caniçal's annual summer festa. Music, food, floats, and the traditional procession of fishing boats across the harbor—it's all intended

While 20 years ago much of the news from the outside world was gleaned from scratchy radio broadcasts from the Canary Islands, today television sets are found at almost every turn: In restaurants, in the front windows of stores, above the checkout lines at the *hipermercados*—hypermarkets, or really, really big supermarkets.

A teenager from Câmara de Lobos, which—fairly or unfairly—is known around Madeira as a village of toughs, dismissed the television theory, however. One of the island's three principal fishing villages, Câmara de Lobos lies on the most crowded flank of the island. Leading me through labyrinthine alleys, where houses are virtually stacked up on top of one another, the young man said, "You want to know why people on Madeira get violent? Just look at the way we live. We're practically sleeping in one another's pockets. When you live like this, you get sensitive. Here in Câmara de Lobos, the worst insult you can give someone is to say they're messy."

Messy?

"Yes, well, a messy person is someone who doesn't sweep up, who leaves trash lying around. Someone who doesn't respect his

to bring good fortune and favor from Nossa Senhora da Piedade, *Our Lady of Piety. "I don't believe in that 100 percent," says Lucina, but she doesn't let her skepticism spoil a good time. She and Manuel danced, ate, and drank wine with friends until dawn.*

neighbors. You have a couple of drinks, you get mad, you call someone messy. And then, well, things happen."

Messiness is known not only in Câmara de Lobos. Despite the Madeiran people's respect for their land, many are incorrigible litterers. It is virtually impossible to admire one of the islands' breathtaking views without noticing, from the corner of your eye, the glint of an empty bottle or the glitter of a discarded Coke can.

What to do with garbage is a problem that concerns all islands. The Madeiras' answer is a series of landfills, including the main island's principal dump at Santo da Serra, where bulldozers relentlessly gouge the arcadian landscape as they work to bury the increasing supply of hipermercado refuse.

For Raimundo Quintal, Madeira's leading environmental activist, it is junked cars, the surest sign of prosperity, that concerns him the most. Quintal estimates that about 3,600 new cars enter the port of Funchal each year. "It's a cultural problem as much as an environmental one," Quintal told me. "Cars have become an accessible status symbol now. Everyone wants one. Because Madeirans think that if you are in a car, you are a different person—a better person."

Newly rich, Madeira's golden youth is doing its best to accelerate the pace of life. When they are not in their cars, they can be seen at Funchal's many high-tech dance clubs, frantically spending cash. Visiting one such establishment on a Friday night, I fell into conversation with a 30-year-old banker, who disdainfully regarded the throng of nattily dressed, Scotch-drinking teenagers that surrounded him and remarked, "Look at these people. Just look at them. Materialism has infected them like a disease."

Before there were discos on the islands there were *tascas*, a kind of bar-cum-convenience store-cum-neighborhood living room. There, amid cans of Vim detergent and Dum Dum insecticide, old men still gather to drink house wine and eat olives.

At one cramped tasca in the old part of Funchal, a group of day laborers playing a game of dominoes invited me to join them. Wearing traditional *barretes de orelhas*, or ear caps, which are woolen hats with earflaps and a big pompom stitched to the top, they filled a glass for me and told me that they have been coming here to drink wine and play dominoes for more than 40 years.

Slapping yellowed dominoes against a scarred wooden tabletop, one man said, "I don't know where we'll play when they close this old place down."

They're closing your tasca? I asked.

"The government says they're not 'dignified.' But let me ask you this: What dignity will we have when all of our traditions have been outlawed?"

OTHERS FRET that the good life might not be so good if the EU stops sending money. Madeirans like Francisco Costa, chairman of the local development company and the force behind Madeira's international business schemes, are attempting to ensure that prosperity continues with or without hefty subsidies from Europe. Costa told me, "Everybody in Madeira—or at least everybody who matters—recognizes that traditional activities are facing severe difficulties. Of course, we have tourism. But to base our economy on one industry is a risk we can't afford."

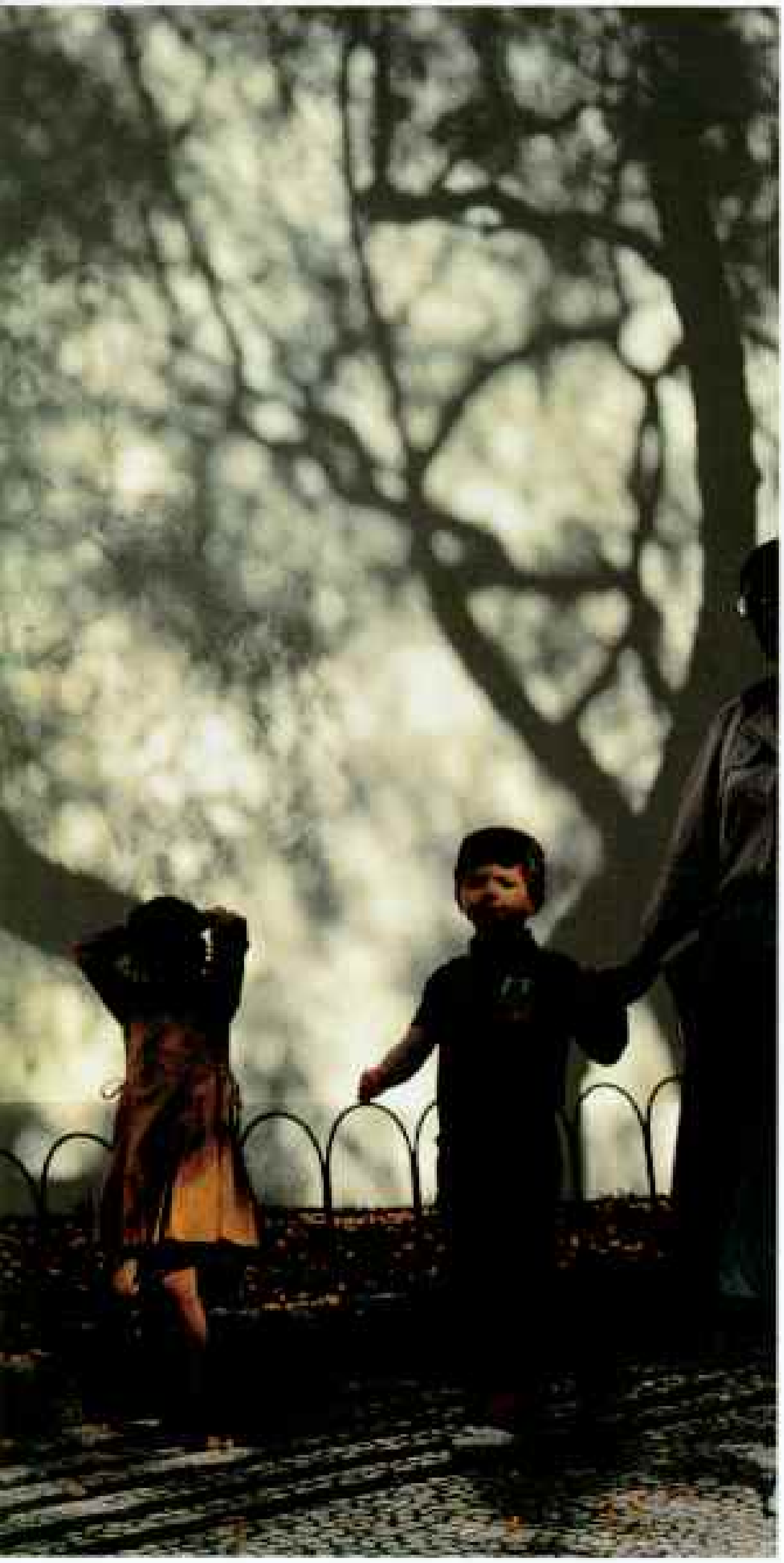
Compared with the offshore banking and financial services, the

No stone goes unturned in Seixal, where residents utilize every square foot of arable or buildable land. In the 1800s farmers cultivated terraced tracts that were accessible only by rope.

free-trade zone—an initiative to attract foreign industries by exempting them from taxes on profits until the year 2011—has gotten off to a slow start. According to Costa, this is because they had to build an entire infrastructure from nothing. With 80 acres of an industrial park already set up, another 19 under construction, an additional 197 acres in the planning stages, and with deep-sea port facilities at last completed, Costa believes that the zone is poised to take off.

The free-trade zone has been set up at Caniçal, a fishing village on the eastern end of the island. To get there, one must pass through a rough-hewn tunnel that first connected the settlement to the rest of the island in the 1950s. Historically isolated, Caniçal had only fishing and a little farming to support itself before the arrival of the zone. Today the village looks like a boomtown about to happen. Ribbons of blacktop lead to freshly constructed industrial plots; suburban-style bungalows stand ready for occupancy among ramshackle fishermen's huts.

Spirits are high in the Madeiras, where, in years past, young people grew up, then emigrated to find jobs. In that exodus there was an echo: "Little islands are all large prisons," wrote one visitor to Madeira in the mid-1800s. "One cannot look at the sea without wishing for



the wings of the swallow."
Yet today many young adults are migrating back for more than jobs. Alicia Camacho, a 32-year-old native, returned to her roots after getting a taste of the Continent. "I had to come back home," says Alicia. "I missed the sound and smell of the sea."

Having spoken to "everybody who matters" about the zone's prospects, I set out to find out what the local residents thought.

What I discovered was probably best summed up by Mario Correia, a local bar owner, who told me, "People here aren't stupid. We're just waiting for the zone to fail so that we can keep the nice new streets and the new harbor for ourselves."

UP THE ROAD FROM CANIÇAL, at Ponta de São Lourenço you can just make out the profile of Porto Santo if the weather is clear. And there, in the dry, disused interior, Carlos Manuel Afonso is making the desert bloom.

A city kid from Funchal with matinee idol looks, Afonso got the idea of making his garden about four years ago. Having found a plot of land, he consulted with some engineers, but they told him that the land was too dry and the winds too violent. Afonso planted anyway.

On Porto Santo you feel close to North Africa. The landscape is a composition of sunbaked tans; the winds that sweep from over the ocean are stiff with salt. An overwhelming sense of emptiness hangs in the air: Farms lie abandoned by owners who have gone to Funchal or beyond to make an easier living; fields lie parched and forgotten. Amid this moody landscape, Afonso's aesthetic arrangement of vines and fruits and vegetables rises like a mirage.

Afonso tells me that he had heard at first that the EU was giving out agricultural subsidies, but so far he has received no money. Shrugging his shoulders, he tells me that he doesn't care now. He is able to keep the farm going himself, although so far he has made nothing even close to a profit.

I ask him how he does it.

He answers that several times a week he brings water in a truck from the other side of the island, but now he has plans to construct a tank so that he won't have to make the trip so often.

Okay. Then *why* does he do it?

Afonso surveys his garden, admiring its fertile symmetry. His handsome tanned face slowly opens into a smile. It is the smile of a poet.

"I dream."

So often during my stay I had heard that the stubbornness of the Madeiran farmer was the islands' biggest obstacle to success. Yet wandering through Afonso's farm, it occurred to me that that undeniable quality may just be the Madeiran people's greatest strength. Guided only by the gloomy poetry of his soul, Afonso, like his ancestors, is making an impossible dream come true. And like them, he is making it happen without anyone's help—not Brussels', not Lisbon's, not even Funchal's. □

REBIRTH

of a Deep-sea Vent

More than a mile and a half down in the Pacific Ocean, giant tube worms flourish in warm water bubbling through a 35-foot lava pillar. The worms escaped recent lava flows that buried other colonies near 10° north off the west coast of Mexico. Here in 1991 we were the first to witness a deep-sea eruption. Now on return visits we are documenting the phoenix-like rebirth of hydrothermal vent communities.

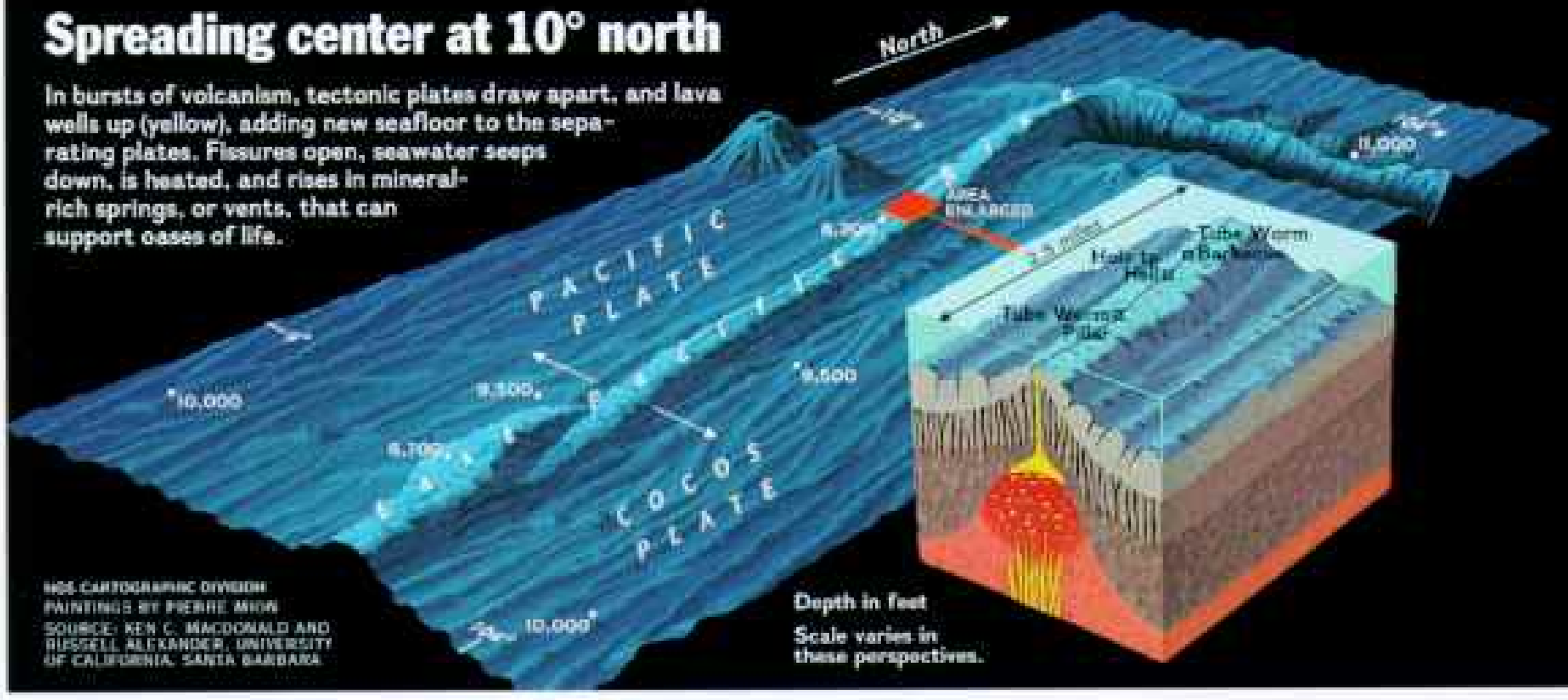
EMORY KRISTOF

By RICHARD A. LUTZ and RACHEL M. HAYMON

Photographs by EMORY KRISTOF and AL GIDDINGS

Spreading center at 10° north

In bursts of volcanism, tectonic plates draw apart, and lava wells up (yellow), adding new seafloor to the separating plates. Fissures open, seawater seeps down, is heated, and rises in mineral-rich springs, or vents, that can support oases of life.



NGS CARTOGRAPHIC DIVISION
PAINTINGS BY PIERRE MION
SOURCE: KEN C. MACDONALD AND RUSSELL ALEXANDER, UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Penetrating the icy darkness in the research submersible *Alvin*, we reached the seafloor after an hour-and-a-half descent and looked out on a scene of catastrophe. Instead of the vibrant colonies of life we expected, we saw fresh lava flows that had overwhelmed tube worms, then hardened in the cold seawater. Other flows had collapsed and shattered like broken plates of black glass. Hot, smoky fluids jetted directly from the bare seafloor.

The temperature gauge outside *Alvin* began to rise. We realized we had arrived while a volcanic eruption was in progress. Pilot Pat Hickey (below) exclaimed: "If you see lava move, we're out of here!"

We didn't see movement, but we saw enough to know we were the first to witness the creation of seafloor on one of the ocean's spreading centers, the East Pacific Rise (maps, left).

The date was April 1991, but for us it marked zero on a new time line. We had stumbled on an opportunity to chronicle, on return visits, successive changes in the geochemistry and geology at new hydrothermal vents, as well as the colonization and growth of their animal life.

We had come to this spot on the seafloor to investigate a fast-spreading section of the rise, photographed and mapped in 1989 by a towed imaging sled. Those photographs revealed to us numerous active hot springs that supported colonies of organisms resembling the oases east of the Galápagos Islands and at 21° north (GEOGRAPHIC, October 1977 and November 1979). But here there was a difference that proved critical: A slight swelling of the East Pacific Rise suggested the potential for eruption, and that's what we saw firsthand in 1991.

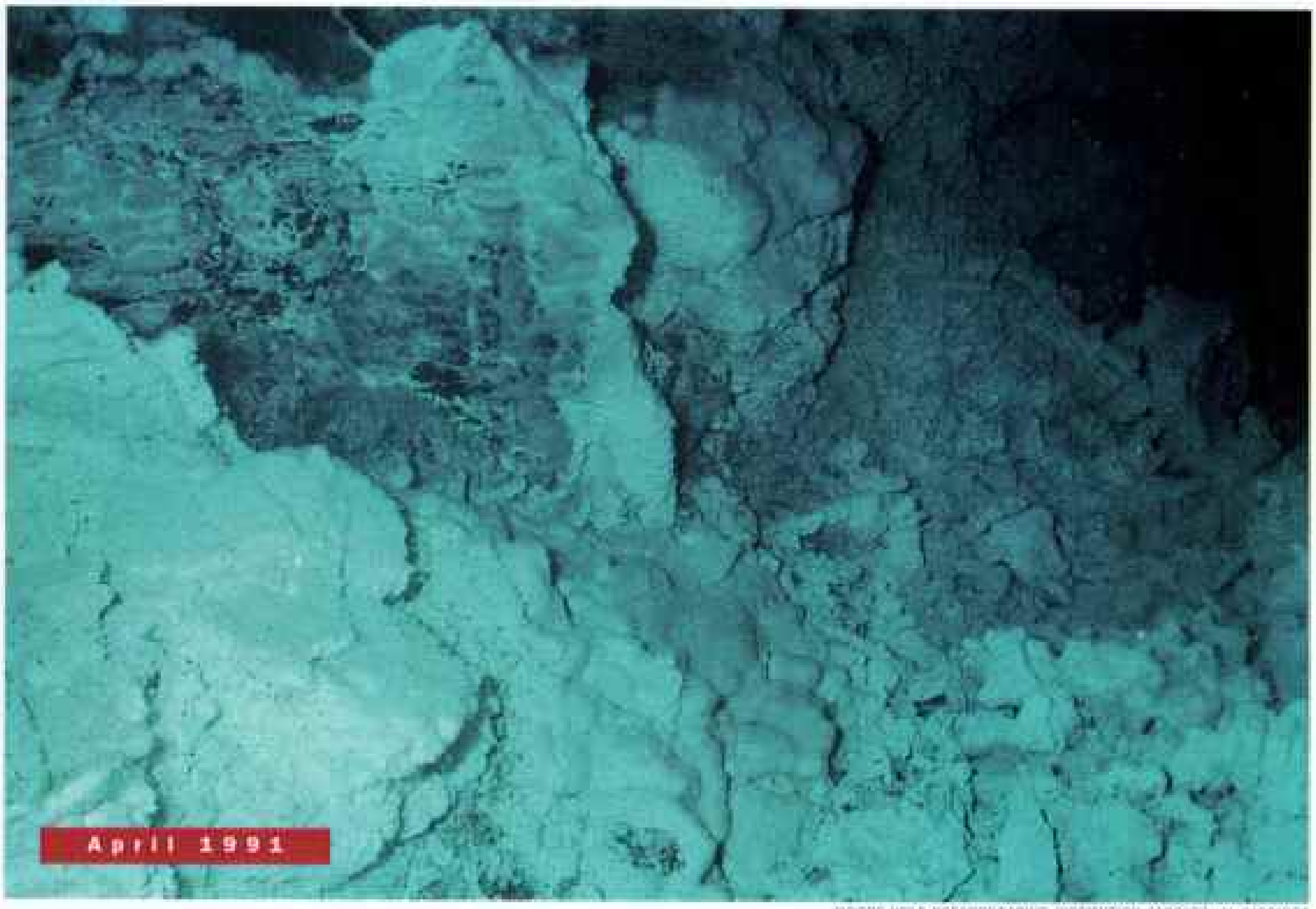
Since then scientists have returned several times to document changes. On our December 1993 expedition (above left), *Alvin* carried a high-resolution Sony video system, provided by Woods Hole Oceanographic Institution, that recorded 40 hours on the bottom, including scenes by Al Giddings reproduced in this article. The sub was also equipped with National Geographic gear: a 35-mm camera and two video cameras to make 3-D images. Lasers emitting four red beams allowed precise measurements.

AL GIDDINGS (BOTH)

Thousands of hot springs occur along the East Pacific Rise, part of the 46,600-mile world-circling Mid-Ocean Ridge, where plates separate and ocean floor forms. This section runs up the Gulf of California into the San Andreas Fault.

WOODS HOLE OCEANOGRAPHIC INSTITUTION (ABOVE AND BELOW)

Over the past three years, return visits to the eruption site revealed extraordinarily rapid change. On our April 14, 1991, dive (above) it was obvious that an eruption had just occurred. Dusted by fine gray ash, fresh lava lay in shards, which we later learned were less than two weeks old. It seemed we had barely missed an explosion. Dead tube worms looked like spent firecrackers. Since the specimens we carried to the surface had freshly charred flesh, we dubbed the spot Tube Worm Barbecue. At a gaping new fissure we called Hole to Hell (opposite, top), lava was blanketed by acres of



WOODS HOLE OCEANOGRAPHIC INSTITUTION (ABOVE); AL GIDDINGS

thick, white mats of bacteria. A year later at Hole to Hell (opposite, bottom) brachyuran crabs had arrived and were scrambling around like Pac-Men of video-game fame, stuffing their mouths with bacteria. Foot-long Jericho worms *(Tevnia jerichonana)* with accordion-like tubes were reaching toward the shimmering new vent. We dropped marker 9 in a mile-long trail of foot-wide signposts—like a yellow brick road—for future voyagers. At this same spot only 21 months later (below) giant tube worms *(Riftia pachyptila)* had grown to four feet, engulfing the Jericho worms and marker 9.

"Black smokers"—the mineral chimneys that vent dark hydrothermal fluids—are familiar structures to those of us who dive on hot springs. But now for the first time we could track from birth the development of a hydrothermal plumbing system.

To do this, we took samples of minerals and water for later analysis in our laboratories. With *Alvin*'s claw, we grabbed fragments of chimneys and poked thermometers into the hot fluids. We siphoned water by reaching into chimneys with angled tubes to fill heat-resistant titanium bottles (right).

During our 1991 visit superheated water gushed from the seafloor, revealing startling and ever changing characteristics. At this depth the pressure of 250 atmospheres, or nearly two tons per square inch, prevents seawater from boiling until it reaches 730°F. Fluids in one fissure here hit 757°F—among the hottest ever recorded on the seafloor.

Surprisingly, too, the fluid was almost fresh, bearing only one-twelfth the salt of normal seawater. It was, however, highly acidic and carried large amounts of hydrogen sulfide—the most concentrated yet observed in the ocean.

Within days new vents became rimmed with white calcium sulfate, a base for the deposition of mineral chimneys. Metals, including iron, zinc, and copper, rising in hot vent fluids were quenched by cold seawater and precipitated out to line the chimney walls.

WOODS HOLE OCEANOGRAPHIC INSTITUTION

EMORY KRISTOF

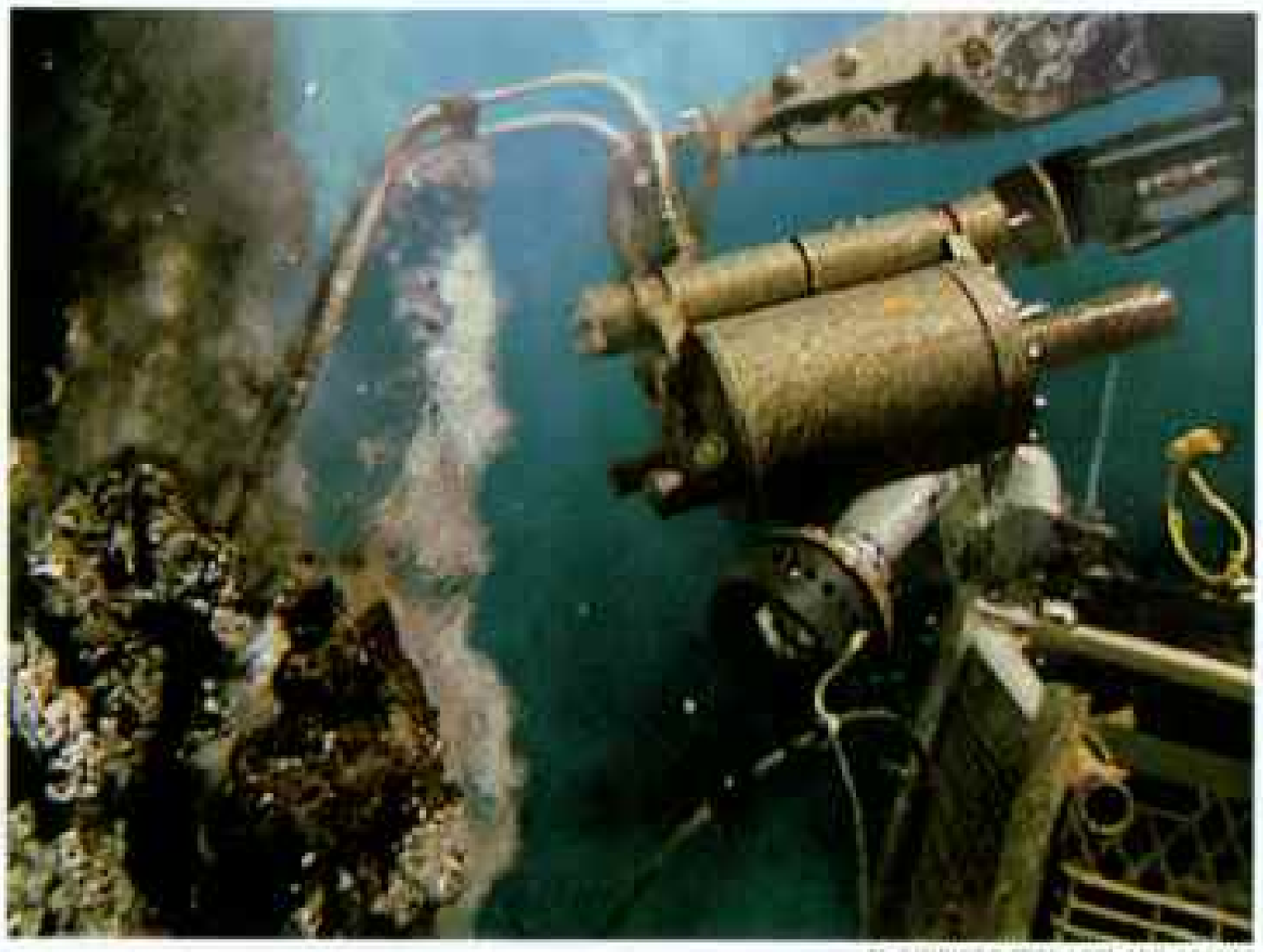
As chimneys were created by this continuous flow, they often assumed bizarre configurations. The onion-domed chimneys (left) rose 23 feet in three years. Tiny white alvinellid worms colonized the spires, becoming part of the structure.

By accident *Alvin* knocked over a 33-foot chimney; when we returned three months later, it had grown back 20 feet.

Geologists have been astonished that polymetallic deposits were laid down in such concentrations so quickly—in months and years, not millennia. The same process built up some of the rich mineral deposits we see on land.

During the April 1991 eruption we also encountered blizzards of bacteria (top) spewing from newly opened fissures and billowing 160 feet high. We called them snowblowers.

The profusion of bacteria reminded us of algal blooms set off by phosphates and nitrates dumped in a freshwater marsh. Bacteria form the base of the food chain around the vents. On the seafloor, energy was supplied not by sunlight but by hydrogen sulfide, discharged in enormous quantities from new vents.



AL GIDDINGS (TOP LEFT AND ABOVE)

A dying community outlines the fissure that once gave it life. The eruption in 1991 started a new vent. By March 1992 nutrients in the spring were supporting a colony of Jericho worms. But in December 1993 the worms were dead or dying (right), starved by the shutdown of the spring. Only jellyfish-like siphonophores, nicknamed dandelions, were alive (below). These animals, about the size of Ping-Pong balls, shoot minute stinging tentacles into the current to capture food.

Living in this dangerous and unstable environment, all vent fauna are governed by the dictum: Live fast, die young.

EMORY KRISTOF; AL GIDDINGS (INSET)

Two octopuses loom on *Alvin*'s video monitor during a dive near Hole to Hell. Both creatures are male, with the characteristic arm adapted for depositing sperm packets in the female. The small white octopus is reaching that arm into the mantle cavity of the larger male of another species, the first time same-sex mating behavior has been observed between octopuses in the wild —and the first ever between different species.

Not far from another vent a two-foot-long bottom-feeding *Bathysaurus* fish (right), lies motionless, its lower jaw giving it a comical grin. Such nonresident predators and scavengers are rare.

For vent species there's literally no place like home. The animals' adaptations make it impossible for them to survive away from hot springs. Resident creatures seem to luxuriate in the shimmering vent waters (above right). Both this pinkish eelpout of the Zoarcidae family and the brachyuran crabs are omnivorous and occasionally nibble on the fleshy plumes of tube worms.

Since deep-sea vents were discovered on the Galápagos Rift in 1977, biologists have been investigating how creatures can survive in conditions that on land would resemble a toxic-waste site.

It turns out that the gills of vent crabs somehow detoxify the sulfides in vent fluids. Tube worms are much more complicated. Adults have no mouth and no digestive tract. Instead,

AL GIDDINGS (ALL)

they exist in a symbiotic relationship with gardens of bacteria living in their interior sac.

The red hemoglobin in a worm's plume has components that bind hydrogen sulfide from vent fluids and carry it to the bacteria within. The bacteria have the ability to oxidize the hydrogen sulfide and convert large amounts of carbon dioxide from seawater into organic carbon. The carbon is absorbed by the worms in a process that we do not yet understand. The question also remains as to how the tube worms acquire the bacteria in the first place.

Other bacteria living freely outside a host provide fodder for tiny crustaceans. Whenever we used a "slurp gun" to suck up bacteria samples for study, we also captured hundreds of minute crustaceans feeding on the microbes.

Tube worms have distinct—but indistinguishable—sexes, and we and our colleagues observed them spawning on several occasions. Females expel clouds of eggs, males puffs of sperm. We were amazed to see that these animals had grown to sexual maturity and were spawning in only 21 months.

Many questions about vent ecology are still unanswered. How, for instance, do bivalves and attached worms colonize vents? Do their larvae float from nearby vents? The East Pacific Rise is continuous from the Galápagos region to the Gulf of California, and we find many of the same species from one vent area to the next.

Are some larvae able to ride on currents for great distances, delaying metamorphosis to adulthood until chemicals from vents cue them to settle and grow? We hope clues to relationships among far-flung vents will come from genetic studies of vent creatures.

In the meantime, we continue to study the 300 new species—in 90 new genera, 20 new families, and one new phylum—that we have already sampled and identified.

EMORY KRISTOF (BOTH)

After a long day's night in the deep, *Alvin* returns to its floating dock, the research vessel *Atlantis II*. Both vessels are operated by the Woods Hole Oceanographic Institution in Massachusetts. On *Atlantis*'s deck (below) we discuss the day's findings.

Geologists, chemists, and biologists collaborate closely, because volcanic processes and life at the vents are interrelated.

For nearly two decades scientists have known that the Mid-Ocean Ridge is a self-renewing factory of chemicals and minerals. They have also known that vents stimulate a chain of life based on chemicals rather than sunlight. Now our research as well as that of our colleagues is dramatically altering views about the rates of biologic and geologic change on the seafloor.

The vents at 10° north are among the most intensely studied in the Pacific. To preserve them for scientific inquiry, we marine scientists have agreed to treat the area as the first deep-sea sanctuary in international waters. We will undertake only nonintrusive sampling. Though this agreement is informal, we hope that it will be respected for all time. □

RACHEL M. HAYMON, a marine geologist at the University of California, Santa Barbara (left, at left), and RICHARD A. LUTZ, a marine ecologist at the Institute of Marine and Coastal Sciences, Rutgers University, at right, have each led expeditions to 10° north, funded by the National Science Foundation. Contributing colleagues include D. J. Fornari, M. D. Lilley, and K. L. Von Damm.

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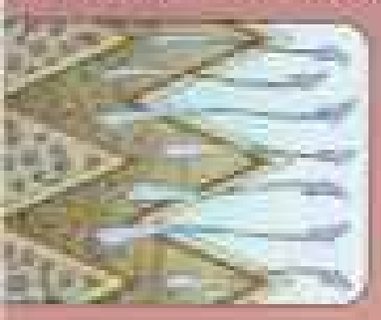

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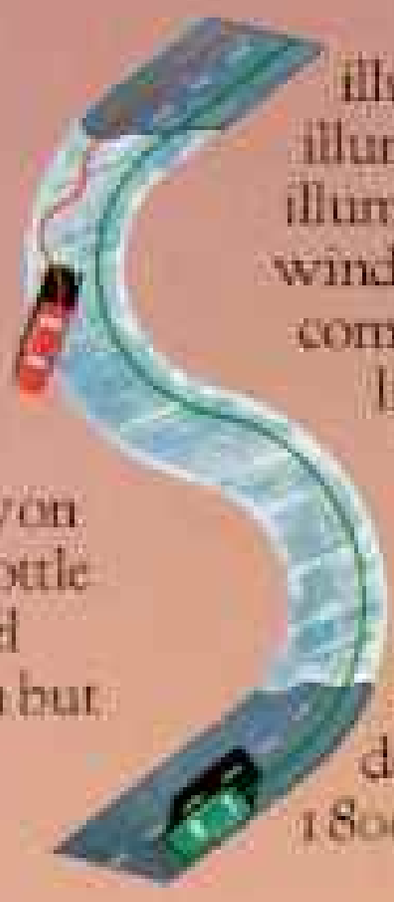

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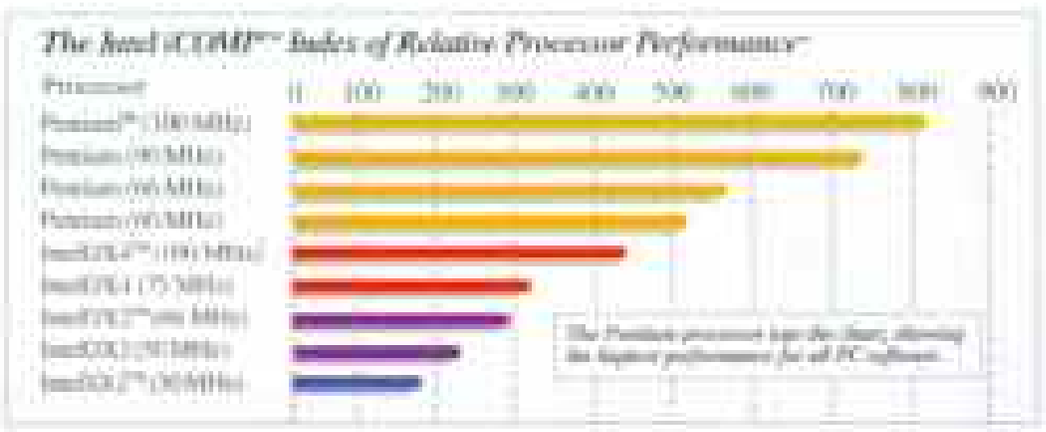

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Forum

Boston

"Boston"? . . . I'll skim this (July 1994). Then I meet people, see places, read every word. And end up wishing.

ALAN S. HEMMINGS
Cheddar, Somerset, England

I too enjoyed listening to George Sanborn—when I was an intern in the State Transportation Building two years ago. But Mr. Sanborn would tell you that MBTA stands for Massachusetts Bay Transportation Authority, not Metropolitan Boston Transit Authority. MTA stood for Metropolitan Transit Authority. The GEOGRAPHIC has now joined the masses of Bostonians confused by the deceptively similar initials.

SAM MARTLAND
Roslindale, Massachusetts

Some other charms of my adopted city: Frederick Law Olmsted's "emerald necklace" of linked city parks, beautiful South End with its Victorian row houses, and the Southwest Corridor Park, which replaced a proposed freeway. The article did drive home the important truth that Boston is one of the most livable cities in the country.

PHIL RINEHART
Boston, Massachusetts

Which "Bostonians of Italian ancestry" did author William Ellis interview to justify his claim that we are most likely to claim mobsters as "ours"? Was it that easy to brush off our Bostonian Italian-American CEOs, our Lt. Governor A. Paul Cellucci, and our mezzo-Italiano state treasurer? Or is it just easier to mention "Italian" and "Mafia" in the same breath?

ANDREA DEFUSCO
Methuen, Massachusetts

If William Ellis waited for the beer vendor to appear in the stands at Fenway Park, he had a very long wait. They haven't sold beer in the stands since 1978.

LINDA J. BUCK
Boston, Massachusetts

Now Bill understands why the vendor never came. Beer lovers at Fenway must purchase their suds at ground-floor booths.

Megalopolis Map

The "Boston to Washington circa 1830" map is delightful. Researching the mid-1800s, I found out

Central American Squirrel Monkey *Genus:* Saimiri *Species:* oerstedii *Adult size:* Body length, 28–33 cm; tail, 35–43 cm *Adult weight:* Male, 700–1100 g; female, 500–750 g *Habitat:* Lowland forests on the Pacific coast of Costa Rica and Panama *Surviving number:* Estimated at less than 3,000 in Costa Rica; unknown in Panama Photographed by Michael Herzog

WILDLIFE AS CANON SEES IT

Languidly draped over a branch, a Central American squirrel monkey seeks relief from the heat beneath the forest canopy. Otherwise, this inquisitive little monkey spends the day pouncing on insects, foraging for fruit, or agilely traveling along arboreal pathways. With most of its former range converted to pasture and farmland, the Central American squirrel monkey is restricted to a few fragmented patches of remaining forest. 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.

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Canon

The *Wildlife As Canon Sees It* photo book is available for US$25.00 from Mediahouse Inc., C.P.O. Box 1333, Tokyo, Japan.

very quickly that the canals and railroads were pivotal in changing our lives and the face of this country forever. The map lays it all out very clearly.

BERNICE S. COLVARD
Annandale, Virginia

You showed the Naval Submarine Base at Groton, Connecticut, but did not indicate the U. S. Coast Guard Academy at New London. My son is there, and my concern is basic fair recognition.

CHARLES J. HUDSON
Sarasota, Florida

Tale of the *San Diego*

The presence of a woman on board the Spanish galleon that sank in Philippine waters in 1600 may not be as surprising as author Franck Goddio believes. Since the *San Diego* sailed for war, it would not have had any passengers, male or female. The people on board for that voyage would have been soldiers and crew. There have been accounts of women on Spanish galleons sailing between Manila and Acapulco. These were Filipino women, either conscripted or signed on to provide services such as cooking, cleaning, laundry, serving, and sex.

ANTONIO J. A. PIDO
Lansing, Michigan

Viruses

To say that I enjoyed reading this timely article would be to convey the wrong sentiment. Only hours earlier, I had discussed the deadly Four Corners or Death Canyon hantavirus with an epidemiologist from the Canada Ministry of Health. My concerns were sparked by the appearance of this hantavirus in our province and by my current occupation. I am assisting my husband in trapping and radio collaring red-backed voles and deer mice for a population study in an experimental forest. Your story about "a piece of bad news wrapped in protein" was fascinating, frightening, and humbling. We are now two concerned and apprehensive biologists.

LISA MAHON
Smithers, British Columbia

You show the last known polio patient in the Western Hemisphere. But as long as there are still people—like members of the "black stocking" churches in the Netherlands—who strongly oppose vaccination, polio will not completely disappear. Here polio cases occur with some regularity among children whose parents believe illness might be God's will.

STEEF VAN DEN BERG
Alphen aan den Rijn, the Netherlands

The caption on pages 62-3 raises the question: How many more deadly viruses lie hidden in tropical reservoirs? I wonder how many more cures await introduction from the rain forests to counter these diseases. I believe that if we stop burning the forests long enough to search, we may just answer that question.

JEREMY S. FREEMAN
Idaho Falls, Idaho

I appreciated the beautiful photograph (pages 74-5) of Brazilian twins nursing [a protection against diseases]. As a new mother I try to convince expectant mothers that this is the only way to go.

Sadly, your article reminded me that formula companies attempt to recruit people in developing countries. Formulas lower children's resistance. Now you have educated me about the additional problem of using contaminated water in powdered formula.

JENNIFER DURHAM
Leslie, Georgia

As a student and teacher of human anatomy, I had a general idea of what viruses are, but your article made it a lot clearer. It also helped me understand how the AIDS virus works and gave me a more human perspective on it. Indeed, if the AIDS virus can mutate to an airborne variety, we will all be in danger and unable to hide behind monogamy or safe-sex practices. I will add this article to my course bibliography.

LOUISE LABROSSE
Montreal, Quebec

Recycling

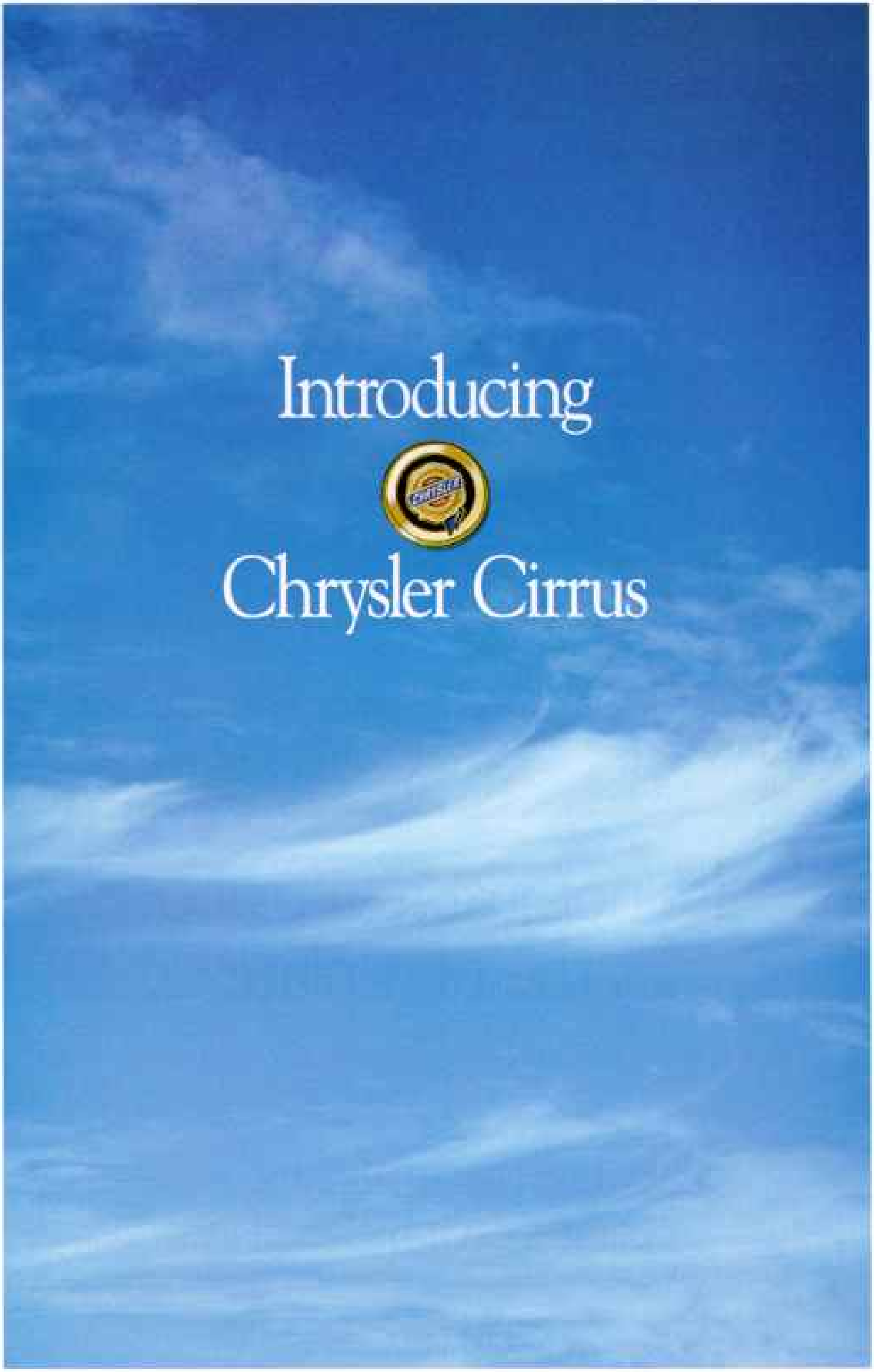
Noel Grove's article was timely and framed beautifully by José Azel's photography. However, the presentation of one recycled product—compost—was inadequate. I have done work for EPA's Office of Solid Waste and have done backyard composting for over 20 years. There are many types of compost made from different organic materials, such as winery and potato sludges, animal manures, yard debris, and solid wastes. The uses of mature, cured composts, sometimes referred to as "black gold," include prevention of erosion and water-runoff pollution, soil rebuilding, plant disease suppression, reduced need for fertilizers and pesticides, and the absorption of volatile organic compounds.

ROSALIE E. GREEN
Manassas Park, Virginia

I was involved in the sludge-to-Texas move (page 109) and know firsthand that this is an excellent fertilizer to make scrublands green and stable against wind. Yet an activist prefers cluttering up landfills to vital land enhancement. Problems with recycling remain: Finding a market, finding money to move the product to the buyer, and the BANANAs (Build Absolutely Nothing Anytime Near Anything).

WILLIAM R. WRIGHT
Cranford, New Jersey

No mention was made of the most effective way to encourage recycling, the bottle bill. Ten states (29 percent of the U. S. population), most Canadian provinces, and many other countries require refundable deposits on many recyclables. Judging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all those roads that look like ~~~ feel like ——

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Indeed, over 300 different aspects of the new Cirrus were targeted to meet or exceed current benchmarks in automotive design, right down to the turn signals (which, by the way, meet ten). It's not just a sports car. It's not just a luxury car. It's not just a family car. It is, in fact, all three. And it comes at a price less than you might expect to pay for just one. Starting at a remarkable $17,970* including destination charge.

*Base MSRP. LXi model shown: $19,900 including destination charge. Tax extra.

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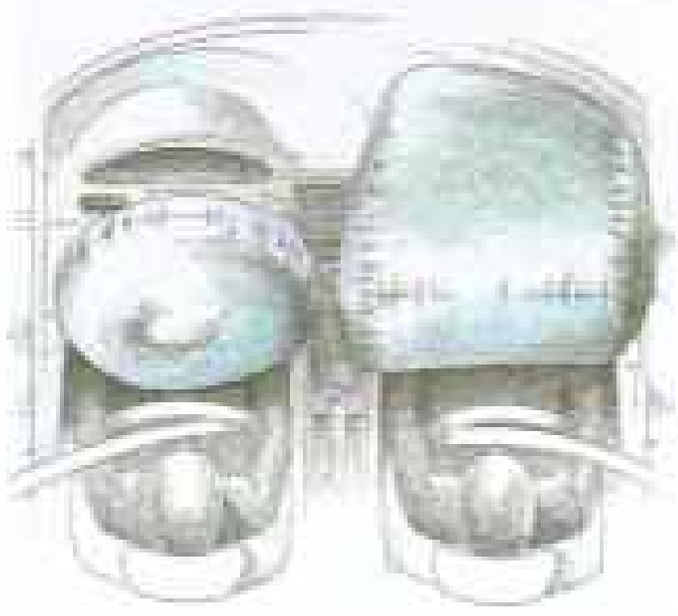

In front, there's room for new seats that can actually help reduce driving fatigue. As well as a dual air bag system with its own backup electrical source. In back, there's room for additional heating and cooling ducts. Along with an available integrated child safety seat. And all around, there's room for the most innovative of thoughts: Foam-covered electrical wiring to further eliminate cabin noise. A driver's seat that easily adjusts to accommodate drivers from the big and tall to the short and cute. Even power door locks that can be set to automatically engage. Perhaps the only thing cab-forward design doesn't leave room for...is improvement.

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†Always wear your seat belt.

from the experience of deposit-law states, a national deposit law would generate more than 100,000 new jobs.

NED FORD
Cincinnati, Ohio

Last November Worcester started charging residents 50 cents for each bag of trash and using the income for free curbside collection of recyclables. Our recycling rate for nonorganic materials zoomed to 39 percent, comparable to the rate for Seattle, called the pacesetter in recycling. We have shown that even an old industrial city with a diverse population can achieve a high recycling rate with a "pay as you throw" and curbside recycling program.

ELISE B. WELLINGTON
Worcester, Massachusetts

Recycling did not start in World War II. Under the names common sense and thrift it existed through all the generations until the arrival of TV, plastic, and disposable everythings. Grandma had two toasters in her lifetime; the second still works and is easily repaired. How many unrepairable small appliances are discarded today? How many pieces of clothing? Grandma snipped off buttons for reuse, cut out good parts for quilts or comforters, and used the rest for scrub rags or the rag rugs the author remembers.

M. J. READING
Grants, New Mexico

Governments, local authorities, and community groups should actively promote recycled alternatives by name. Not enough information is available to the public in the form of brand names to allow consumers a choice in buying decisions.

FRANK WILLOUGHBY
Helensburgh, Scotland

Northern Goshawks

While the photography was captivating, for me Michael S. Quinton's simple, accurate descriptions of the goshawk's family structure and behavioral displays were the most impressive aspect of the article. As a University of Toronto student who has taken a course in animal behavior, I have a new appreciation for field researchers.

YISHAI WISE
Toronto, Ontario

Geographica

Regarding the "Earliest Lincoln Portrait?" I conclude that the subject of the 1843 daguerreotype is not Lincoln. Among other clues, the ears are a very distinctive component of appearance. Lincoln's ears protrude and the configuration of his ear fold is totally different from the mystery subject's.

GARY BARTLETT
Adrian, Michigan

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Geographica

BOTH BY JEFFREY L. CARNEY

How Two Towns Cope After the Flood of '93

In the aftermath of the worst flood in U. S. history (NATIONAL GEOGRAPHIC, January 1994), and with future flooding inevitable, towns along the Mississippi and Missouri Rivers faced a hard choice: Move or stay put. Damages are estimated at between 12 and 16 billion dollars. More than 70,000 families were made homeless, including the 900 residents of Valmeyer, Illinois. They had watched their homes, four miles from the Mississippi, disappear under as much as 16 feet of water.

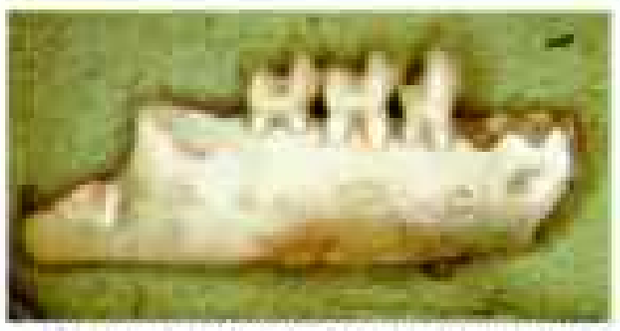
If they had stayed, "federal regulations would have required us to rebuild homes on ten-foot-high stilts," says Mayor Dennis Knobloch (above left). Citizens voted instead to use federal funds to create a new town on a 400-foot-high bluff nearby. "Basically, we're turning a cornfield into a town," says Knobloch. The old site will become a park and wetland. Most residents are living in mobile homes provided by the Federal Emergency Management Agency until houses are ready. "By Christmas," Knobloch says.

For the 131 residents of Hartsburg, Missouri, there was no retreat. The community had finally finished paying off 25 miles of levees that ordinarily held the Missouri in check. But in July 1993 the defenses burst in a dozen places. Water rose to 13 feet in many Hartsburg buildings. Rushing across the surrounding 3,500 acres of bottomland, the surge undercut Orion Beckmeyer's grain bins and buried his fields in sand. But Beckmeyer plowed deep to bring up topsoil and planted soybeans (above). Other farmers tried sunflowers. More than half the levees have been rebuilt. Most homes have been repaired. "The good thing is," says Beckmeyer, "the flood brought this community together."

NANCY J. PERKINS

China Yields New Fossils of Early Primates

A tiny jaw found in a quarry at Shanghuang west of Shanghai adds weight to a revolutionary theory that higher primates first scrambled around Asia, not Africa. The jaw (right, three times actual size) belonged to a mouse-size primate (left) that lived during the Eocene 45 million years ago, long before monkeys, apes, and humans evolved. Four other new primitive primates have also been excavated, including the earliest tarsier and a squirrel-like primate resembling one found in Wyoming. Mary Dawson and Christopher Beard of the Carnegie Museum of Natural History and Chinese colleagues made these finds and similar ones on the Yellow River in northern China, where they worked with support from the National Geographic Society.



ROBINIAE SINENSIS, CARNEGIE MUSEUM OF NATURAL HISTORY, PITTSBURGH

The diversity of early primates at Shanghuang is unprecedented in Asia and led one expert on primate fossils to dub the site "a primate Garden of Eden."

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Geographica

NATIONAL MARITIME MUSEUM, GREENWICH, ENGLAND

In the Arctic, the Taint of Cannibalism

BARRY RANFORD

It ranked among the 19th century's most famous mysteries: the disappearance of Sir John Franklin, his two ships, and 128 crewmen as they sought an Arctic passage between the Atlantic and Pacific. Now, in a grisly new twist, it appears that some of the men resorted to cannibalism in a vain effort to survive.

Franklin set sail from England in 1845. When nothing was heard from him by 1848, a series of searches were mounted that ironically helped map much of the high Arctic. Searchers learned that Franklin died in 1847, and Inuit said that his ships had been locked in the ice and that his men had set out on foot, dragging lifeboats (above).

One lifeboat was found in 1859 on King William Island at Erebus Bay. Nearby, in 1992, amateur historian Barry Ranford of Orangeville, Ontario, discovered expedition relics: wood, likely from another lifeboat, a brass button worn by 19th-century British Navy officers, shoe leather, and hundreds of human bones.

Anne Keenleyside, an anthropologist at McMaster University in Ontario, examined the bones and concluded that they represent at least eight European males, one only 12 to 15 years old. Knife marks on many bones suggest the crew's desperation. "The cuts were on ribs, vertebrae, limb and pelvic bones, even hand and foot bones," says Keenleyside. The find, including this cut finger bone, supports early rumors of cannibalism.

A Gender-bending Fish Switches to Suit Itself

TRIMMA OKINAWAE, KOJI NAKAMURA, JAPAN UNDERWATER FILMS

Found along Japan's shores, this orange-colored goby (below left) is small, rarely longer than one and a quarter inches. But every bit of size is crucial: It determines whether an individual remains a female, becomes a male, or switches back and forth.

When seven female gobies were placed in an aquarium, the largest turned male, fertilizing and guarding eggs laid by a female. Then researchers Tomoki Sunobe and Akinobu Nakazono put that male in a second tank with a smaller male. The resident became female. Meanwhile, the largest female in the first tank transformed into a male. But when he too was moved to the second tank, he again became female.

Many gobies possess both female and male reproductive capabilities. In their social groups, the largest fish exercises dominance by becoming male. Other fish can change their sex, but *Trimma okinawae* is among the few known to change back and forth.

Extinction Looms for Many Livestock Breeds

This Ossabaw Island swine looks healthy, but it's on a critical list. So are the Florida Cracker cow, Gulf Coast Native sheep, and American Mammoth Jackstock ass. These and eight other heritage breeds are unique to North America, and now each produces fewer than 200 offspring every year. The special breeds singled out for conservation by the American Livestock Breeds Conservancy have been declining because agribusiness breeds for uniformity and maximum production.

MARIA STENZEL

"We've tried to impose an industrial model on agriculture," says Donald Bixby, the conservancy's executive director. "But diversity is as important for agriculture as it is for rain forests, making adaptation to change possible."

National Geographic, November 1994

EL CASTILLO, CHICHEN ITZA, STATE OF YUCATAN.
"THE CASTLE," ONE OF THE BEST-KNOWN
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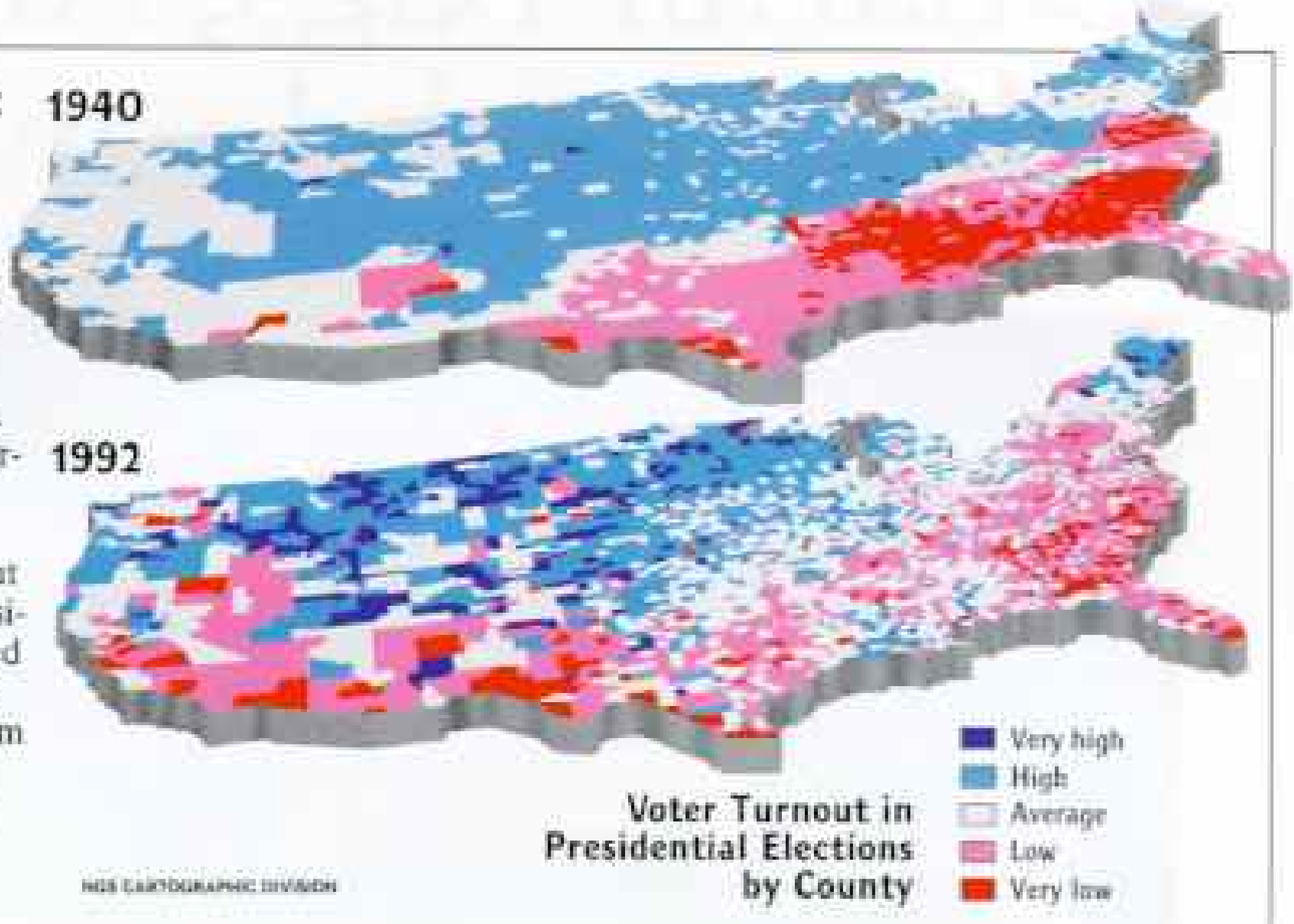
Geographica

Mapping Voter Turnout: Does Location Matter?

No one is quite sure what drives U. S. citizens to the polls on Election Day Tuesday in November—or keeps them home. Only 55 percent of those eligible voted in 1992, down from 63 percent in 1960 and 60 percent in 1940.

A new study shows a major change in the geography of turnout as well. Roger A. Hunt, a University of Wyoming geographer, plotted turnout at the county level for the past 14 presidential elections. From 1940 through 1960, northerners voted at a higher rate than southerners. Beginning in the 1960s, turnout fell heavily in the industrial tier of counties from New York to Missouri while increasing in the South.

But the real story, Hunt says, is that "by 1992 regional patterns had shattered. The map is a jigsaw puzzle of high and low turnout counties. Location doesn't count as much."



Voter Turnout in Presidential Elections by County

NGS CARTOGRAPHIC DIVISION

BØRGE OUSLAND

Solo to the North Pole—the Ultimate Journey

"When I got to the North Pole, I cried," recalls Børge Ousland, here with frozen tears on April 22, 1994. "It was the most happy feeling I ever experienced. This was the toughest trip of my life but also the best."

Ousland made the 606-mile trek from Siberia in a fast 52½ days, becoming the first person to ski to the Pole alone without airdrops, dogs, or vehicles. Earlier, he and fellow Norwegian Erling Kagge had skied there together from Canada (GEOGRAPHIC, March 1991).

The 31-year-old Ousland dragged a 286-pound sledge loaded with a tent, fuel, and food—porridge, nuts, raisins, dried meat and fish, mashed potatoes, and soya oil, adding up to 6,200 calories a day. On his son's sixth birthday, he treated himself to a piece of almond cake. Still, he lost 45 pounds. Some days he traveled 14 hours in temperatures that plummeted to minus 44°F.

"I always managed to think positive, to look beyond the pain to the future," Ousland says. "To be there alone was the best part of the whole expedition: You get closer to yourself and to nature." For company he read the Bible and listened to an appropriate Jimi Hendrix tape: *The Ultimate Experience*.

Melon, Millet, Succory: Famed Farmer's Letters

"Two of my sons traveling in England . . . received some melon seed, of two species, brought from Persia," John Campbell White of Baltimore wrote to a Virginia farmer in 1816. "It has a high character. I have . . . much pleasure in sending a portion of it."

Former President Thomas Jefferson replied: "It is by multiplying the good things of life that the mass of human happiness is increased."

The exchange turned up in a

MARK THIESSEN

packet of 11 letters to and from Jefferson found by a U. S. Department of Agriculture historian, Anne Effland, among uncataloged papers at the National Agricultural Library. A collector gave them to the secretary of agriculture in 1915. In two, Jefferson enclosed seeds of millet and succory, or chicory (above), with planting instructions.

—BORIS WEINTRAUB

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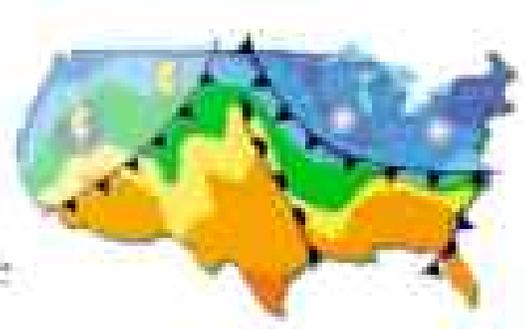

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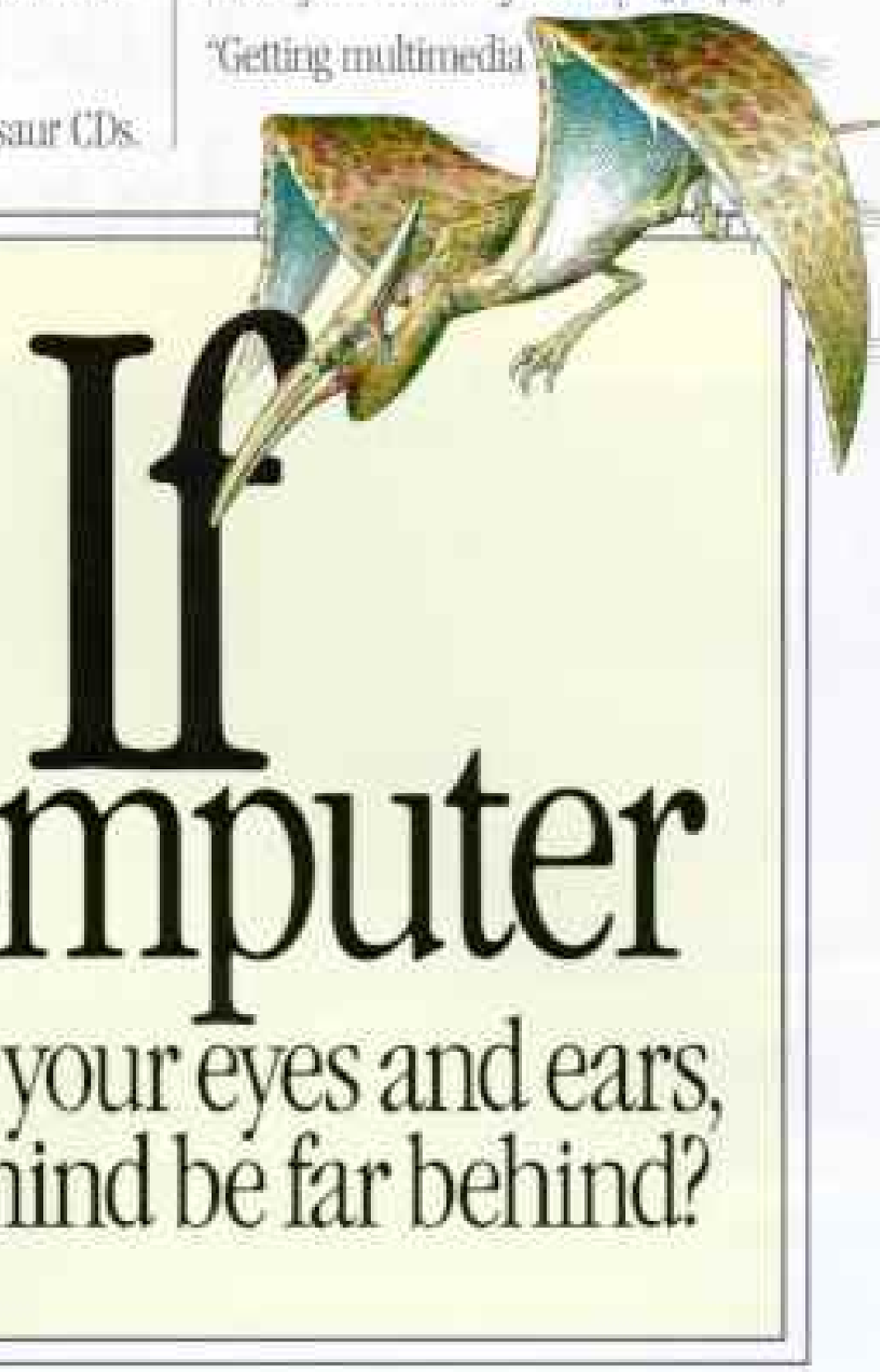

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Why is Macintosh better?

Walter Mossberg noted in *The Wall Street Journal* on January 13, 1994, "Getting multimedia hardware and, especially, software to run on a typical IBM-compatible computer can be a frustrating—even impossible—task.... In general, users of Apple's Macintosh computers face very few of these problems, because a single company—Apple...has made sound, graphics and video a priority."*

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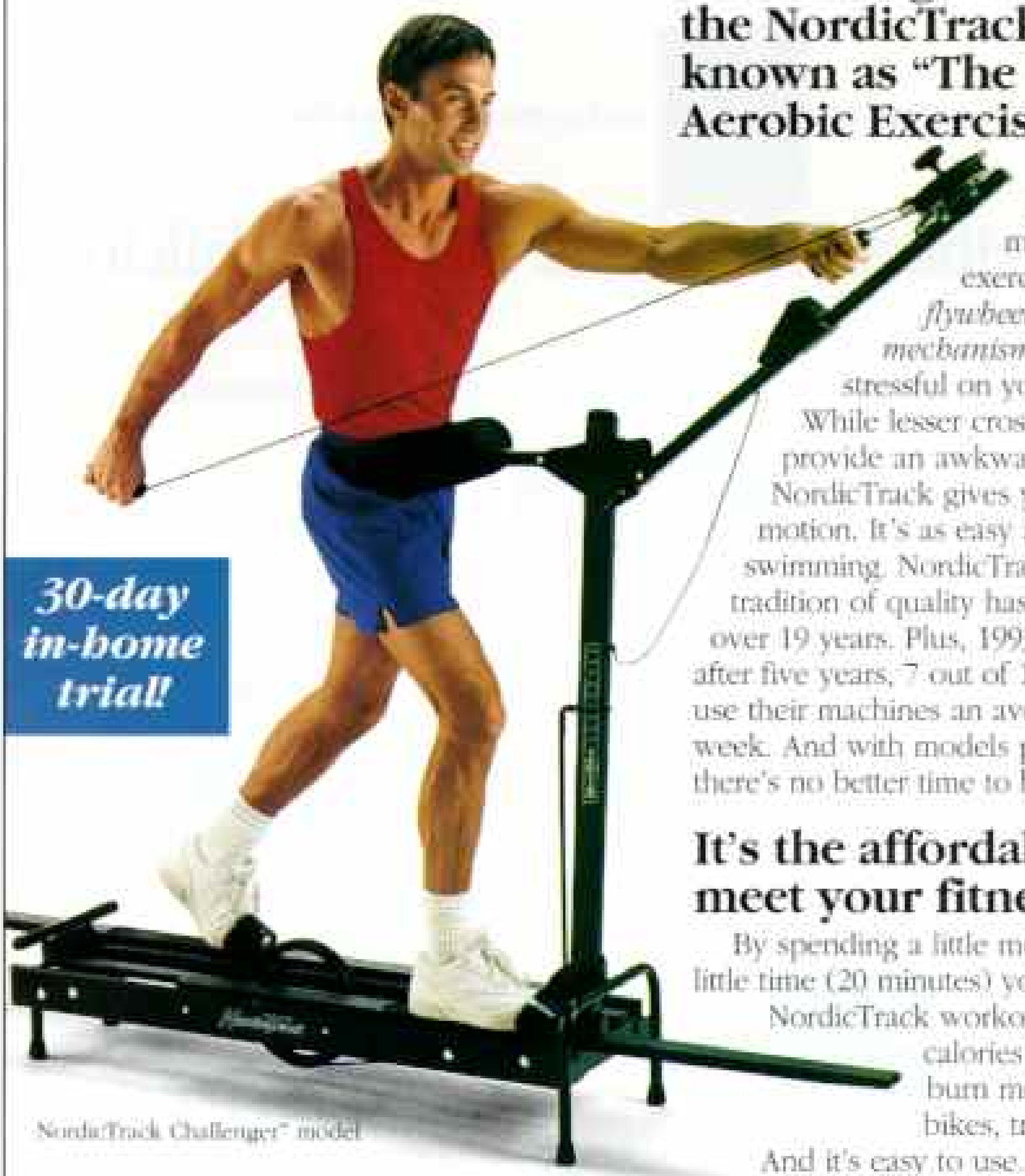

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NATIONAL GEOGRAPHIC MAGAZINE

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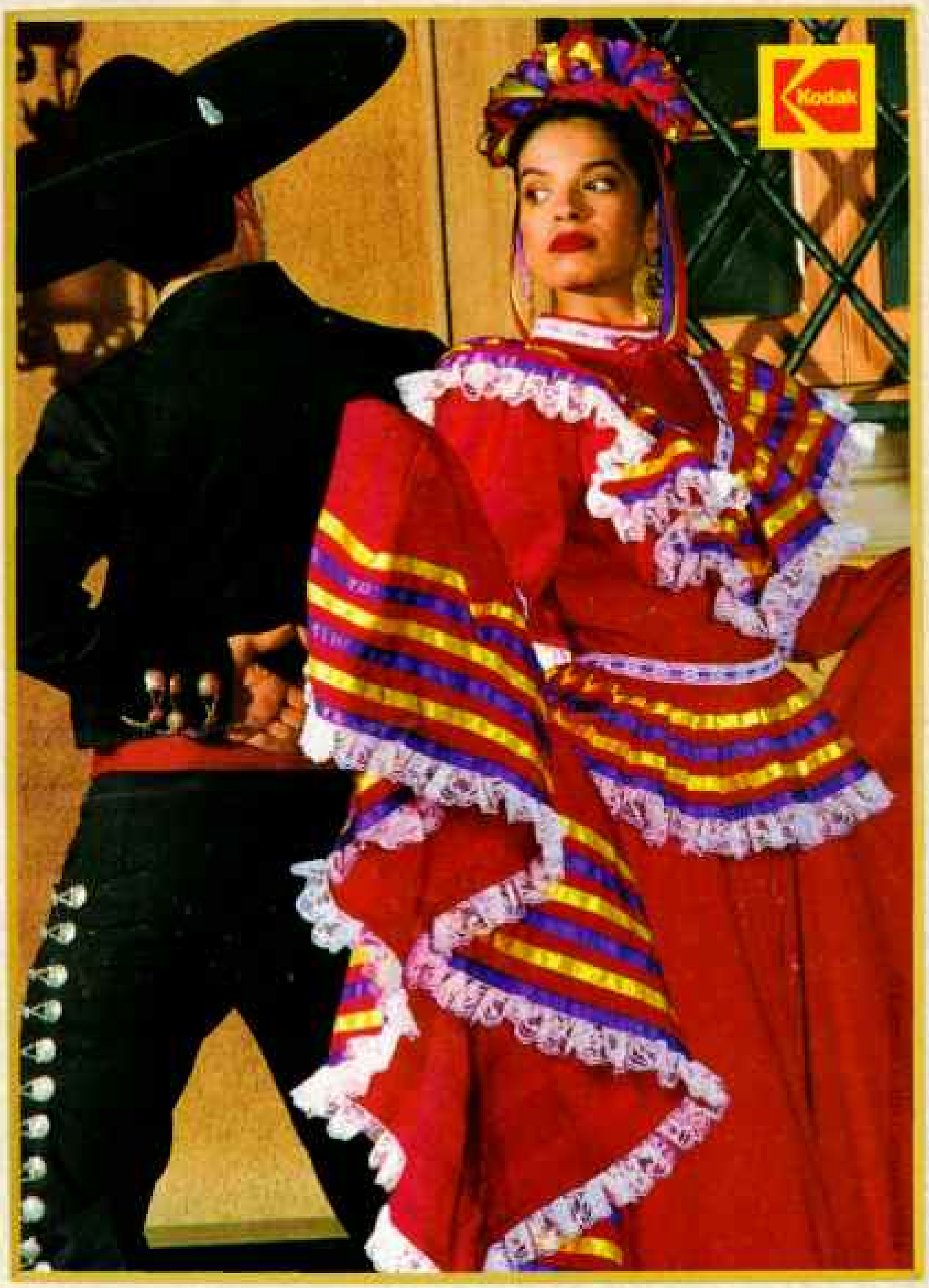

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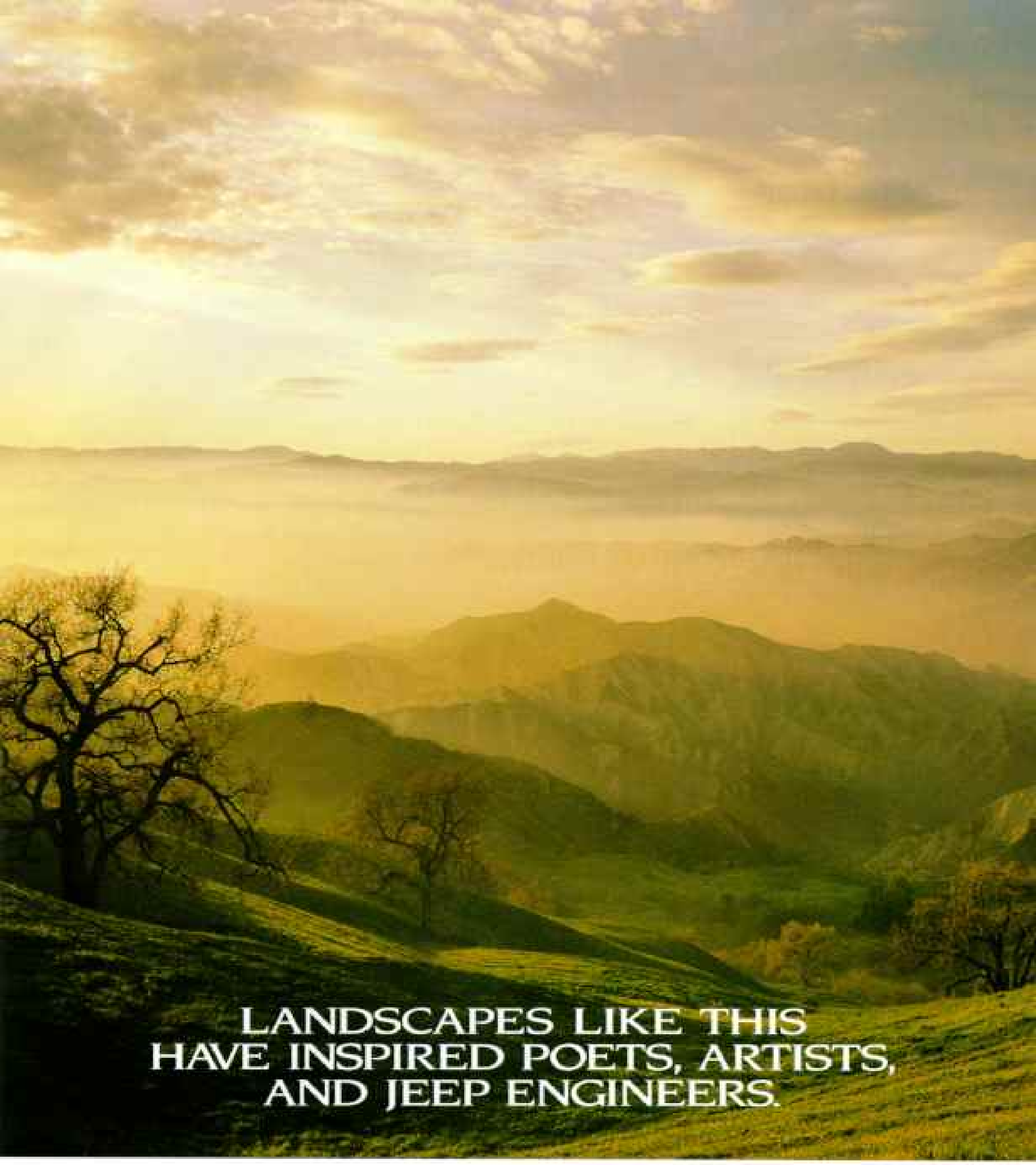

Some of the most impressive works of art are the result of nature's inspiration. Like the masterpiece of advanced design and engineering displayed here — Jeep® Grand Cherokee Limited.

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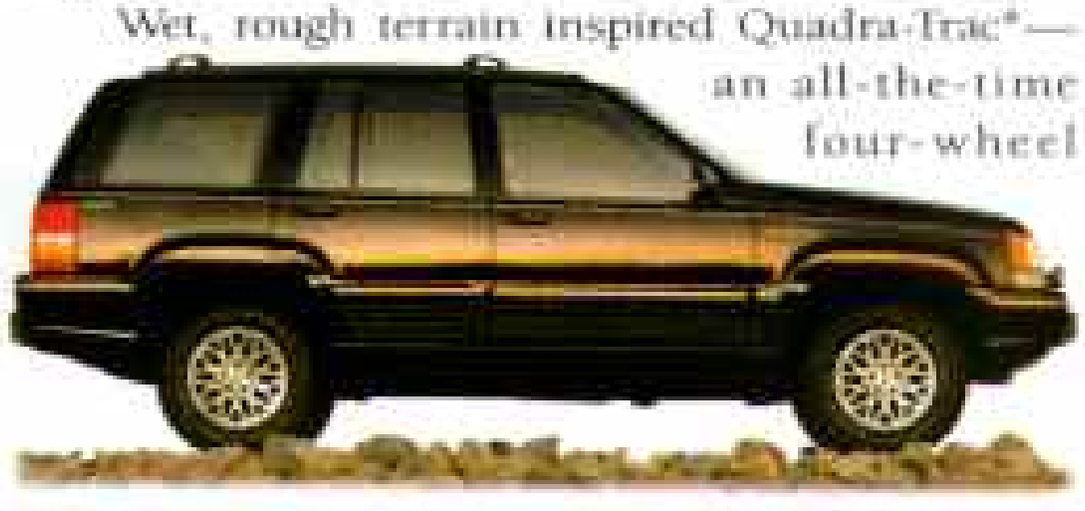

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On Television

REALLY WILD ANIMALS

Three More Home Videos for Kids 5 to 10

To escape winter's chill, Japanese macaques, or snow monkeys, huddle in the mountains of Jigokudani (right). They also hit the hot pool at Club Macaque in "Adventures in Asia," one of three new videos in the *Really Wild Animals* series. In "Amazing North America," polar bears invade Churchill, Manitoba, on their migration to the Arctic, while in "Totally Tropical Rain Forest" an odd bird, the hoatzin, has a close call when a baby leaves the nest and meets a boa. Mom flies to the rescue. Dorothy G. Singer of Yale, educational consultant for the series, says the videos explain "how animals travel, adjust to climate, and bring up babies," and she urges parents to watch with their kids.

***Really Wild Animals** is available through National Geographic Home Video Club and in video stores.*

STEVE KAUFMAN, DRK PHOTO

EMORY KRISTOF

A Light in the Abyss Reveals Life

In the glare of ultrabright lights, two fish sweep past red-tipped tube worms. Their location: a vent 8,600 feet down in the Pacific Ocean off the coast of Mexico. The use of sophisticated HMI lights in the deep sea is the innovation of National Geographic staff photographer Emory Kristof, who used them to record still images of vent life. Combined with a high-resolution video camera, the lights also enabled photographer Al Giddings to capture scenes on videotape that were sharp enough to run as photographs in the GEOGRAPHIC.

Viewers meet Kristof, a guiding light in underwater photography for more than three decades, in a segment of Short Takes, a new feature of EXPLORER. On the eve of his retirement, Kristof conducts a personal voyage to the seafloor. "All that innovation over the years was directed toward one goal," he says: "bringing home the image."

Short Takes airs on EXPLORER, Sundays at 9 p.m. ET on TBS Superstation. Tune in November 27.

What makes you fall in love with the 1995 Galant? Meaningful luxury.

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Earth Almanac

JOSÉ AZEL, AURORA

Taking Antarctic Tourists Out of This Picture

Penguins in Antarctica are finding peace and quiet harder to come by. Since 1986 the number of visitors to the frozen continent has made a tenfold leap, to 8,000 last year. Some tourists just can't get close enough to the wildlife, especially penguins on Nelson Island (above). To reduce such problems, the 42 nations that have signed the Antarctic Treaty of 1959 adopted guidelines for tourists last spring.

The guidelines incorporate an earlier code of conduct that had been distributed to visitors. Because Antarctica has no park rangers or police, tour operators are asked to enforce the new code. It directs tourists to refrain from doing anything that causes a bird or seal to alter its behavior. Special caution is urged during breeding and molting seasons. People also should avoid hiking on delicate moss beds and lichen-covered rocky slopes.

The graffiti-minded are admonished not to paint their names on rocks or buildings. Nor should souvenir hunters collect rock specimens, bones, eggs, fossils, or artifacts. Meanwhile, the National Science Foundation, which oversees all U. S. activity in the Antarctic, is measuring the impact of visitors on one popular tourist site where some 10,000 pairs of Adélie penguins come to nest.

Under the new guidelines tour organizers are asked to register with their own national supervisory agencies. Two bills now before Congress would go further, requiring federal licensing of U. S. tour operators.

JONATHAN BLAIR

Star-spangled Confusion: Dyed Diesel Fuel

Why does diesel fuel come in a patriotic ensemble of red, clear, and blue? Too many federal agencies mixing the palette.

Low-sulfur diesel fuel—mandated by the Environmental Protection Agency for highway use since 1993—is clear. High-sulfur diesel fuel, legal for use as heating oil and for construction equipment, should be dyed blue, said the EPA.

Government vehicles and some farm equipment use low-sulfur diesel fuel that is not taxed. The Internal Revenue Service decided that this untaxed diesel fuel should be red.

Next, the Federal Aviation Administration pointed out that the blue high-sulfur diesel fuel was the same color as a grade of gasoline used by small aircraft. If the high-sulfur blue was accidentally pumped into a plane, a crash could result. The decision: Change the high-sulfur diesel fuel from blue to red, like the tax-exempt fuel. It's enough to turn a taxpayer purple.

National Geographic, November 1994

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Earth Almanac

The Nautilus: No Longer Just a Living Fossil

Considered an evolutionary relic little changed for 65 million years, the chambered nautilus has surprised scientists who have found that it is still evolving. Ancestors of this mollusk numbered some 3,000 species. Nearly all perished in the mass extinction that wiped out the dinosaurs.

The few remaining species inhabit Indo-Pacific waters. After DNA studies, paleontologist W. Bruce Saunders and colleagues found unsuspected genetic differences between two—the chambered nautilus (below, at left) and the rare king nautilus. The king nautilus is so different from the chambered nautilus that it may be reclassified as a new genus. They also found that the chambered nautilus has five geographic variants.

CHAMBERED NAUTILUS, *NAUTILUS POMPILIUS*; KING NAUTILUS, *N. SCROBICULATUS*; W. BRUCE SAUNDERS

"Islanders of Papua New Guinea adorn their canoes with carvings of both species," says Saunders. "They call the king nautilus 'kind with a hole in the middle.'"

The nautilus has always been difficult to study. When the animal dies, its body sinks, while its shell floats. Nautilus is from the Greek for "sailor," so named by the ancients, who found only the empty shells riding the currents.

Nautilus ancestors with parrotlike beaks amid their tentacles were the first animals to seize prey such as shrimp. Ironically, their relative, the octopus, is another predator with a beak—and it often uses it on nautiluses.

—JOHN L. ELIOT

IRA BLOCK

Six Environmental Defenders Win Coveted Awards

"I was 16 when I carried my first sign: 'Beavers are the only ones allowed to build dams,'" says Matthew Coon Come, Grand Chief of the Cree of Quebec. For leading his people against the James Bay hydroelectric project that would flood Cree lands, he received one of the annual Goldman Environmental Prizes. The National Geographic Society was among 19 nominating institutions.

The tribal leader, here paddling on Lake Mistassini on a Cree reservation, organized a canoe trip of elders down the Hudson River to New York City in 1990 to spark opposition to the dam project. Although the first phase is nearing completion, Cree opposition has helped stall the next phase.

The other Goldman winners:

■ Ildiko Schücking, a German activist, is pushing the World Bank to make its projects in developing countries more environmentally sensitive. She dramatized her nation's role in the destruction of tropical rain forests by dumping sawdust on her chancellor's doorstep.

■ Andrew Simmons, a conservationist in St. Vincent and the Grenadines, led a campaign to restore an important forest reserve in his country. His group reversed local attitudes toward the forest, convincing the community to join in its protection.

■ Laila Kamel, an Egyptian environmentalist, works with Cairo's large community of garbage collectors. She has helped them gain fair compensation for trash-recycling programs. "I feel that I have built the Pyramids all over again," she says.

■ Luis Macas, a Quichua Indian from the Andes of Ecuador, spearheaded a drive to give indigenous peoples control of their own land, opposing multinational oil companies already drilling in the Ecuadorian Amazon. He continues to lead ongoing negotiations in an effort to preserve the region's fragile environment.

■ Tuenjai Deetes helped restore an important watershed in northern Thailand near its borders with Myanmar and Laos. She has done so while working to develop self-sustaining communities among the nation's hill tribes in the region.

National Geographic, November 1994

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On Assignment

JAMES L. STANFIELD

"I graduated from college on a Sunday and started work at National Geographic the next day," says master printer Frank Oliverio, Assistant Vice President for Production Services (above, center). That was 36 years and three-and-a-half billion magazines ago. During that first year, Frank recalls, "I worked on Luis Marden's 'The Islands Called Fiji.' So I really enjoyed finally showing him our presses." Now retired, Luis, at right, among myriad exploits, discovered the wreck of H.M.S. *Bounty*. He and Associate Editors William L. Allen, at left, and Robert M. Poole look over pages at the Ringier America plant in Corinth, Mississippi, where the magazine is printed. Says Frank of Luis, "He is a real part of Society history."

As is Frank, who retired in September. "You don't stay somewhere for this long without a lot of pride in the organization," he says.

Writers are always looking for strong leads—even on the dance floor. Sandra Dibble (right, at right), who wrote about Oaxaca in this issue, takes a turn with Leyla Aquino de Canell at a festival in Juchitán, "where the first dance is just for women," says Sandra. "The men there are the wallflowers."

The highlands of Oaxaca with their precolonial traditions are a magical place to Sandra. Born in Egypt and raised in Europe and the Middle East, she could speak Arabic, French, and Spanish before she earned a master's degree in journalism at Columbia University. During ten years at the *Miami Herald* she specialized in immigrant communities and shared a Pulitzer Prize for coverage of the Nicaraguan contras. She now reports from Tijuana for the *San Diego Union-Tribune*.

DAVID ALAN HARVEY

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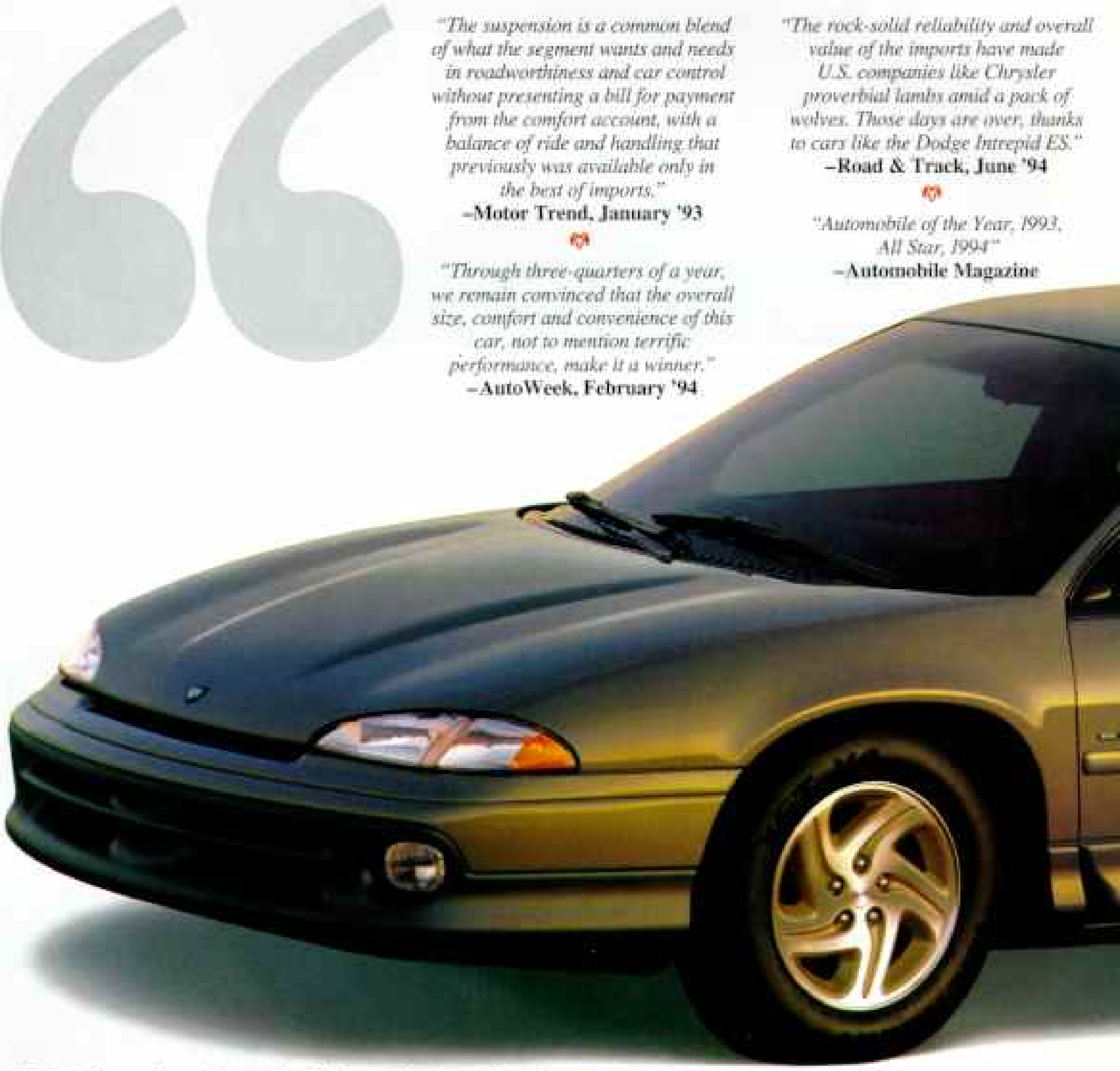

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