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# The Lost Empire of the Incas

ARTICLE AND PHOTOGRAPHS BY  
LOREN McINTYRE

WITH A PORTFOLIO OF ART BY  
NED AND ROSALIE SEIDLER

**A**T AVENIDA LOS INCAS 465, in a suburb of Lima, the city founded by Francisco Pizarro, I lived ten years. Like many residents of this Peruvian coastal metropolis, I assumed that Pizarro, the conquistador who overthrew the Inca Empire, had drawn a curtain on the Inca past, and I never thought of Inca kings as flesh-and-blood people—until my 6-year-old son Lance returned home from his first day at school.

He marched through the house chanting, "Manco Capac, Sinchi Roca, Lloque Yupanqui, Mayta Capac, Capac Yupanqui, Inca Roca, Yahuar Huacac, Viracocha, Pachacuti, Tupa Inca Yupanqui, Huayna Capac, Huascar, Atahualpa."

"Lance, would you mind . . . ?"

He clicked his heels and spoke as if to his schoolmaster: "The Incas, our forefathers,

conquered Chile and Ecuador, señor." He saluted and stomped into the kitchen to beg a bottle of Inca Kola. "Manco Capac, Sinchi Roca, Lloque Yupanqui . . ."

In my years of Andean journeys, and recent travels on the trail of the Incas, the singsong names of that dynasty became as familiar to me as Washington and Lincoln, although I can't recite them all in one breath as Peruvian schoolchildren still learn to do.

The early Incas, dating from about A.D. 1200, were not emperors but simply lords of Cuzco, capital of a minor agricultural state on an Amazon tributary

high in the Peruvian Andes. The first four may have lived only in mythology, but the later Incas were quite human, despite the mystique they fabricated of divine descent from the sun. Their mummies—and sacred stones that represented legendary forebears—were



ATAHUALPA—IN PERUVIAN EYES, "THE BASTARD TYRANT"—DEPOSED HIS HALF BROTHER TO BECOME THE LAST ABSOLUTE LORD OF THE INCA EMPIRE AND ITS DAZZLING WEALTH. NEW YORK HISTORICAL SOCIETY



*Andean sunrise gilds Lake Titicaca, where the sun god created the fabled founder*

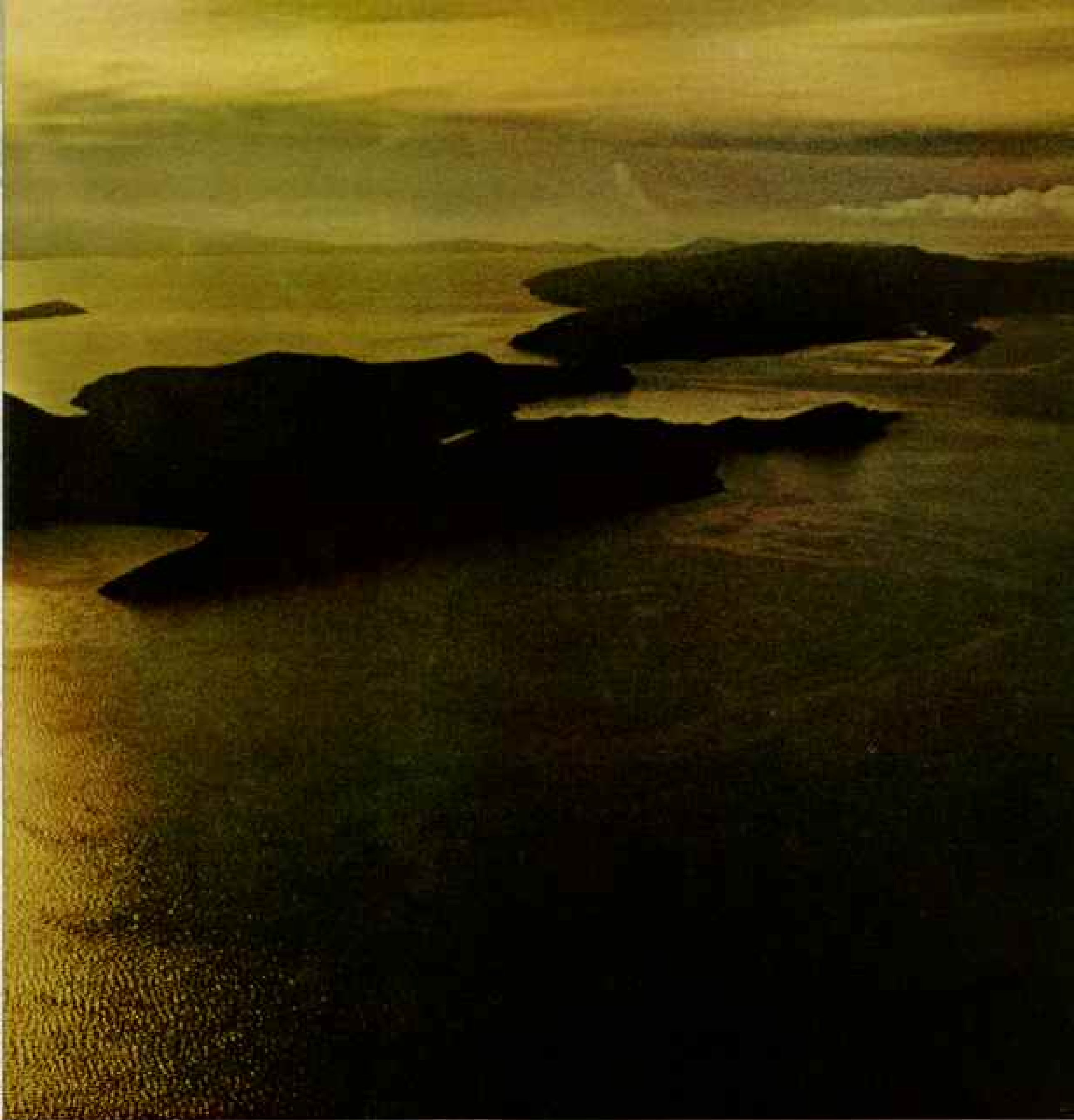
enshrined and displayed in festive parades.

About 1438, the ninth Inca, Pachacuti, set forth to conquer on a scale never before attempted in aboriginal America. By the time Columbus crossed the ocean sea in quest of the Indies, Pachacuti and his son, Tupa Inca, tenth Inca, had forged an empire nearly as far reaching and well organized as Caesar's Rome. They called it Tahuantinsuyu, the Four Quarters of the World (map, page 745).

All who were inhabitants of that empire

are termed Incas nowadays, although in olden times the title was restricted to members of the royal family, whose menfolk were distinguished from commoners by the wearing of huge earplugs; the bigger the plug, the higher the rank.

Following Tupa Inca's trail of conquest into Argentina and Chile, my wife, Sue, and I came face-to-face last year with a 500-year-old Inca. The meeting was arranged by Dr. Grete Mostny, Director of the National



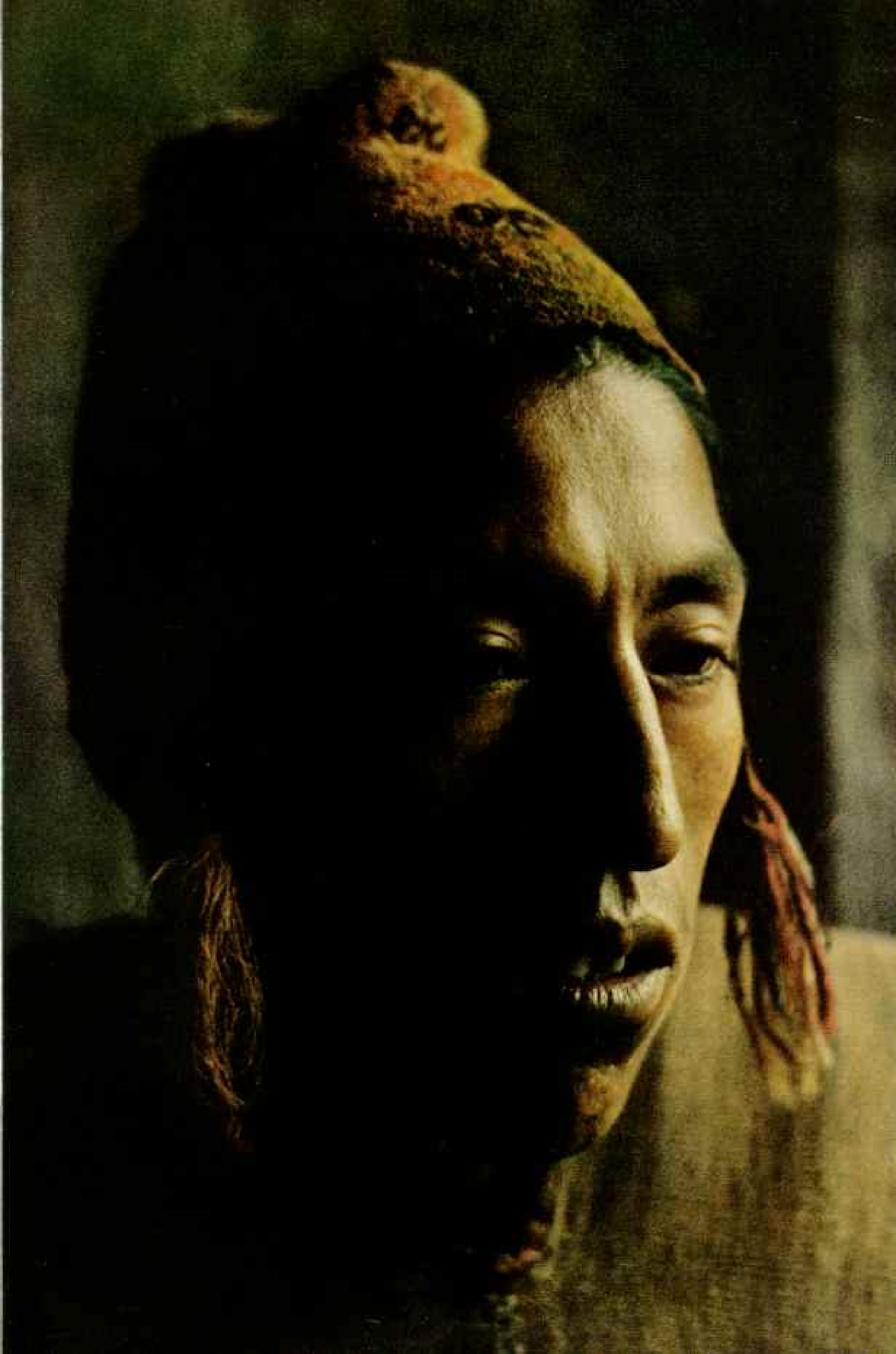
*of the Inca dynasty. Sprawling Island of the Sun guards the sacred birthplace.*

Museum of Natural History in Santiago, Chile. Her helpers lifted from a deep-freeze showcase the body of an Indian child who appeared to have fallen asleep, huddled in his llama-wool tunic. A broad silver bracelet adorned one arm, and his feet, crossed for warmth, were clad in embroidered leather moccasins (foldout, pages 733-4).

Dr. Mostny pointed out a window toward the splendid white ranges east of the city. "Because he was found over there on El

Plomo peak in 1954, we named him La Momia del Cerro El Plomo. But he's more than a mummy; he's flesh and blood, a boy 8 or 9 years old. He died of cold, maybe drugged, otherwise unharmed. He was sacrificed to the sun and left in a tomb at nearly 18,000 feet with these miniature idols and keepsakes."

Sue touched the chill cheek of the Inca boy and admired his long eyelashes. His hair was done in more than 200 braids and decorated  
*(Continued on page 738)*



History peers from the face of a present-day Andean (left) who might have posed for portraits of the Incas in Spanish artwork from the time of the conquest (pages 747-53). He dwells in the isolated Peruvian village of Queros, on the Amazon side of the Andean crests. Author-adventurer McIntyre hiked three days to reach this lofty bastion of Inca tradition.

Seemingly about to awaken after a 500-year nap, an Inca boy, 8 or 9 years of age, clasps his knees as if huddling for warmth. His frozen body, now in a deep-freeze showcase in a Santiago museum, was found at 17,712 feet on El Plomo peak in Chile, near the southern end of the Inca Empire.

Most likely sacrificed to the sun—an honor in Inca eyes—the youthful victim was entombed near an Inca shrine on the peak. Indentations from covering stones dimple his exposed flesh—the only trace of physical damage to the lad, who died of freezing. He was possibly numbed by coca; a feathered pouch of the narcotic leaves lies beside him. Other trappings of death: the silver image of an Inca goddess in doll-like costume, llama figurines of gold and shell from equatorial seas, and leather bags containing fingernail parings and baby teeth. These were included so that in the afterlife the boy would not have to hunt for missing parts of his body.

THIS PAGE FOLDS OUT







**Hanging from the clouds,** the citadel of Machu Picchu—unknown to the Spanish conquerors of the Incas—remained hidden from the outside world until discovered by explorer Hiram Bingham in 1911.

Excavations supported by the National Geographic Society and Yale University drew back the green veil of jungle to reveal the most spectacular remnant of the Incas' vast empire ever found intact. Scores of sparkling granite shrines, fountains, lodgings, and steep stairways encrust the saddle between pinnacles some 2,000 feet above the Amazon-bound Urubamba River in Peru.

Here the "Sons of the Sun," as the Inca lords called themselves, worshiped their host of gods, including the mighty Inti, who personified the sun itself. A sacred rock is called the "hitching post of the sun," reflecting a tradition that worshipers once tethered the god to it, lest he stray too far from their domain.

Bingham speculated that a remnant of Inca nobility took refuge here after the Spaniards dismembered their realm in the 1500's. Later investigators concluded that it was a military garrison. In any case, sustaining the mountaintop aerie without an empire apparently proved impossible. Its occupants eventually melted away into the jungle, which concealed Machu Picchu from outsiders' eyes for nearly four centuries.



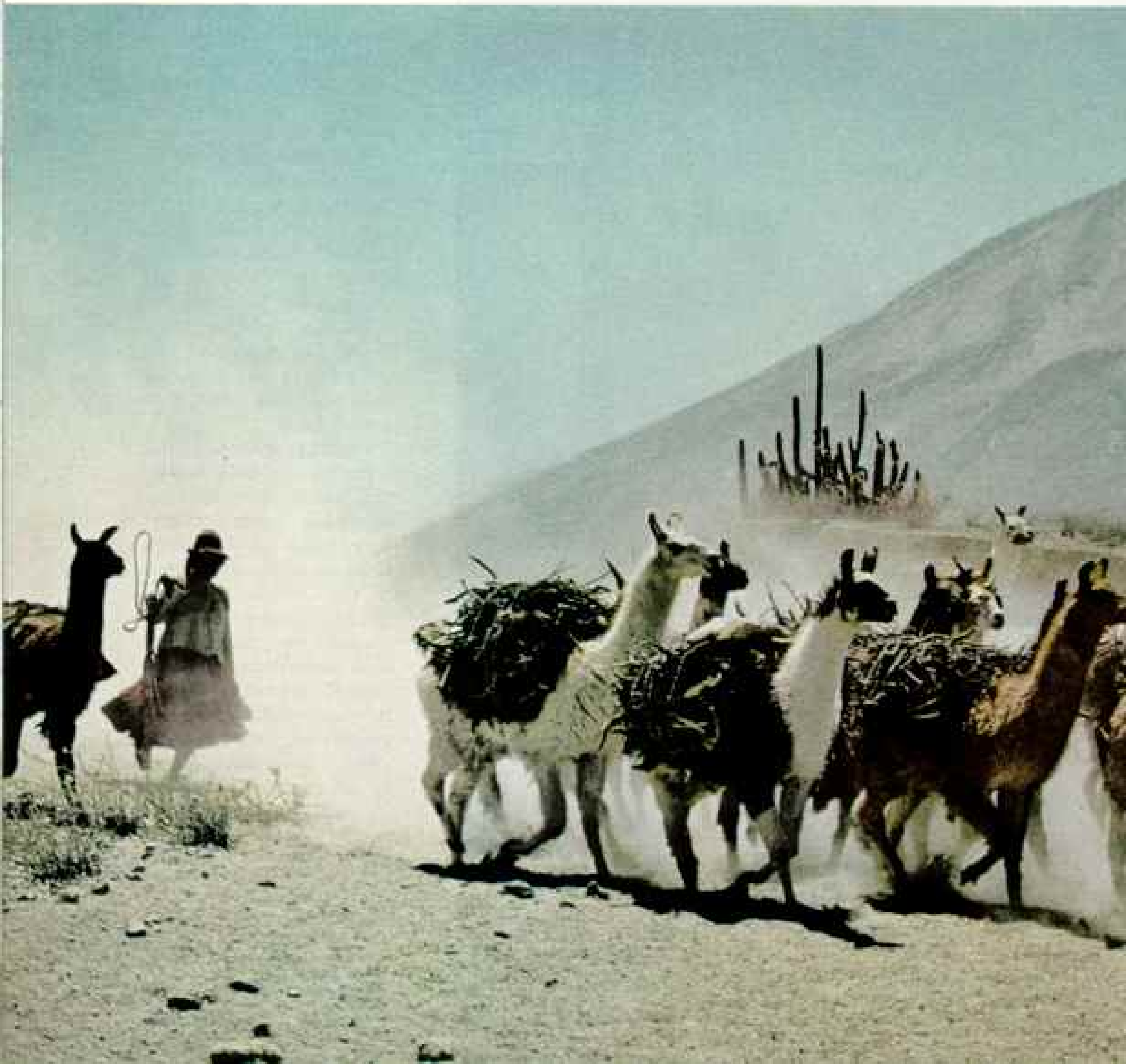
with a double half-moon of silver. The little body is so well preserved that scientists have determined its blood to be type O (universal donor), and have even tried—unsuccessfully—to revive its intestinal parasites.

**O**N THE OPPOSITE SIDE of the Andes at the University of Cuyo in Mendoza, Argentina, a wiry old explorer, Bernardo Rázquin, told us about five other finds of frozen sacrifices. In the 1950's and '60's, mountaineers had made arduous "first ascents" of the hemisphere's highest peaks along the Chile-Argentina frontier. Upon gaining the summits, many discovered to their astonishment that sandal-clad Incas had beaten them by 500 years.

On some 30 ascents, climbers have found mountaintop Inca shrines and evidence of

pilgrimages: offerings of gold and silver figurines with headdresses of jungle-bird plumes, Inca pottery, llama droppings, and bundles of wood for beacon fires. "Stone walls stand on two snowy summits rising above 22,000 feet, by far the highest archeological sites in the world," Bernardo said. "One courtyard at 20,700 feet had been leveled with nearly 100 tons of earth backpacked from below—about 4,500 loads."

Bernardo carried a centuries-old cadaver, shrunken to 40 pounds, from the windswept 20,664-foot level of El Toro peak in 1964. "That Indian, about 20, was no peasant. He had delicate hands and feet. He had been stripped to his breechcloth to quicken death by freezing. We could tell by his accouterments that he had been sacrificed around 1480, after Tupa Inca overran this region."



Tupa Inca, who took the title Yupanqui, meaning "unforgettable," is forgotten today in comparison to Alexander the Great, Genghis Khan, and other conquerors who overran vast territories—and they rode horses. Tupa Inca, soldiering on foot, vowed not to stop until he reached the uttermost sea.

Winning through Inca prestige and diplomacy as well as in open battle, he thrust north from Cuzco through the Andes to Ecuador, then south along the Peruvian coast to capture Chan Chan, capital of the Chimor Kingdom\*, and other powerful cities after years of siege.

He forayed into Amazon headwaters, then  
*(Continued on page 744)*

\*Michael E. Moseley and Carol J. Mackey described the grandeur of ancient Chan Chan in the March 1973 NATIONAL GEOGRAPHIC.

Llamas bore the burdens of empire when Inca rule stretched more than 2,500 miles, from northern Ecuador to central Chile. This packtrain, transporting brushwood from Andean highlands to Arequipa in southern Peru, lopes past 19,100-foot Misti. The volcano is one of some 30 peaks atop which shrines have been discovered.

The Incas had no knowledge of the wheel, no draft animals, and no beasts of burden other than the llama—strong enough to transport 80-pound loads over Andean trails but too frail to carry a man.





Harsh Bolivian highlands slope down to Titicaca's stony shores below peaks of the 21,000-foot Cordillera Real, revered as deities today as in Inca times. Villagers dwell at the foot of a ridge stepped with terraces built by the ancients; spring showers tint the lake with



runoff from the thin red soil. According to a legend still learned by Andean schoolchildren, the first Inca, Manco Capac, wandered northward from Titicaca. Reaching Cuzco, he founded a dynasty whose armies and disciplined society would spawn one of the world's great empires.

Tortured topography of the Incas' vast realm staggered the imagination of the Spaniards, who first probed the frontiers of the empire in 1527. Landing on Peru's northern coast, they encountered a treeless region (far right) where crescent sand dunes float like mystic scythes on trackless wastes. At the other extremity of the empire, a tidal pool (near right) patterns the Chilean shore at the mouth of the Rio Maule. In Bolivia, algae tint the waters of Laguna Colorada, or Red Lake (below). Nearby, Bolivia's Laguna Verde, or Green Lake (lower right), laps the base of northern Chile's 19,426-foot Licancábur volcano, on whose conical summit perches an Inca shrine.



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turned to quell the fierce nations of highland Bolivia. In Chile and Argentina, an area bigger than Spain yielded to his armies. Finally, forest guerrillas stopped Tupa Inca at the Rio Maule, 2,400 miles south of the Equator. He had plunged deeper into the Southern Hemisphere than any other conqueror in history.

When Sue and I reached this extremity of the Four Quarters of the World, we stayed in Constitución, a seaside resort at the mouth of the Rio Maule, 170 miles south of Santiago. At 9 p.m. the surf gleamed orange in the setting sun, and I remarked that such a lingering summer day, at 35° south latitude, must have mystified Tupa Inca, a man of the tropics. Sue thought it more likely that the long winter's night filled him with foreboding.

Whatever his motive, Tupa Inca, nearing 60, turned back to live out his years in Cuzco, closer to his ancestral sun.

**T**UPA INCA'S MASTERY of the arts of war and government was an inheritance from his father, Pachacuti, whose name means "cataclysm" or "he who transforms the earth." Pachacuti deserved the title. He was possibly the most remarkable genius the American Indian race has ever produced. His social and political innovations still touch the lives of nearly everyone in the modern Andean republics of Peru, Ecuador, and Bolivia. Derivations of his laws still govern the behavior of Indians who herd the haughty llama and spade the sun-drenched soil of rock-walled terraces built by their ancestors.

"Don't lie, don't steal, don't be lazy," farmers sometimes welcome me in the frosty highland mornings, and I answer, "*Qampus hinallatag*—And to thee likewise." Pachacuti imposed Quechua, a highland tongue, to unify conquered tribes. Scores of old languages have gradually died out, and Quechua is spoken today by some ten million people—far more than when the Incas ruled their Tahuantinsuyu.

Until Pachacuti, the Incas won little territory. His aging father even abandoned Cuzco to invasion by a neighboring tribe. But young Pachacuti rallied defenders and repelled the foe when "even the rocks turned to warriors" fighting on his side.

In 1438 Pachacuti took over the "fringe," red tassels hanging down the forehead, thus becoming the ninth Inca, and, because of his territorial conquests, the first emperor. Aided by well-armed allies and magical rocks,

Pachacuti stormed repeatedly out of Cuzco on military campaigns. Those who defied him risked having their skins made into drums and their skulls fashioned into drinking goblets to celebrate Inca victories. But he distinguished himself by unusually benign and able administration of those who submitted without a fight. In time, Pachacuti settled in Cuzco to rule his new empire with extraordinary wisdom, while his warrior son, Tupa Inca, quickened the pace of expansion.

**O**NLY WHEN I JOURNEY AFOOT, following barelegged Indian porters over mountain passes in search of vestiges of the Incas, do I grasp the magnitude of Tupa Inca's epic campaigns. On many an arduous climb, when my heavily burdened friends outdistance me, though I carry only a camera, I would give anything for a ride in the royal litter. When the glacial chill of evening pours from the peaks and follows us into a stone hut, the wiry little men share with me a thick soup of jerky and *chuño*—dehydrated potatoes—such as sustained Inca armies on the march. And when the morning light floods the potato patches at 14,000 feet, burning frost from the blue blossoms and numbness from my knees, I don't wonder that the Incas worshiped the sun.

I thought this rugged life was keeping me young—until I hiked one day to a hamlet several hours from Cuzco to interview Mariano Quispe, an Indian headman who still counts his crops on a *quipu* (opposite and page 755).

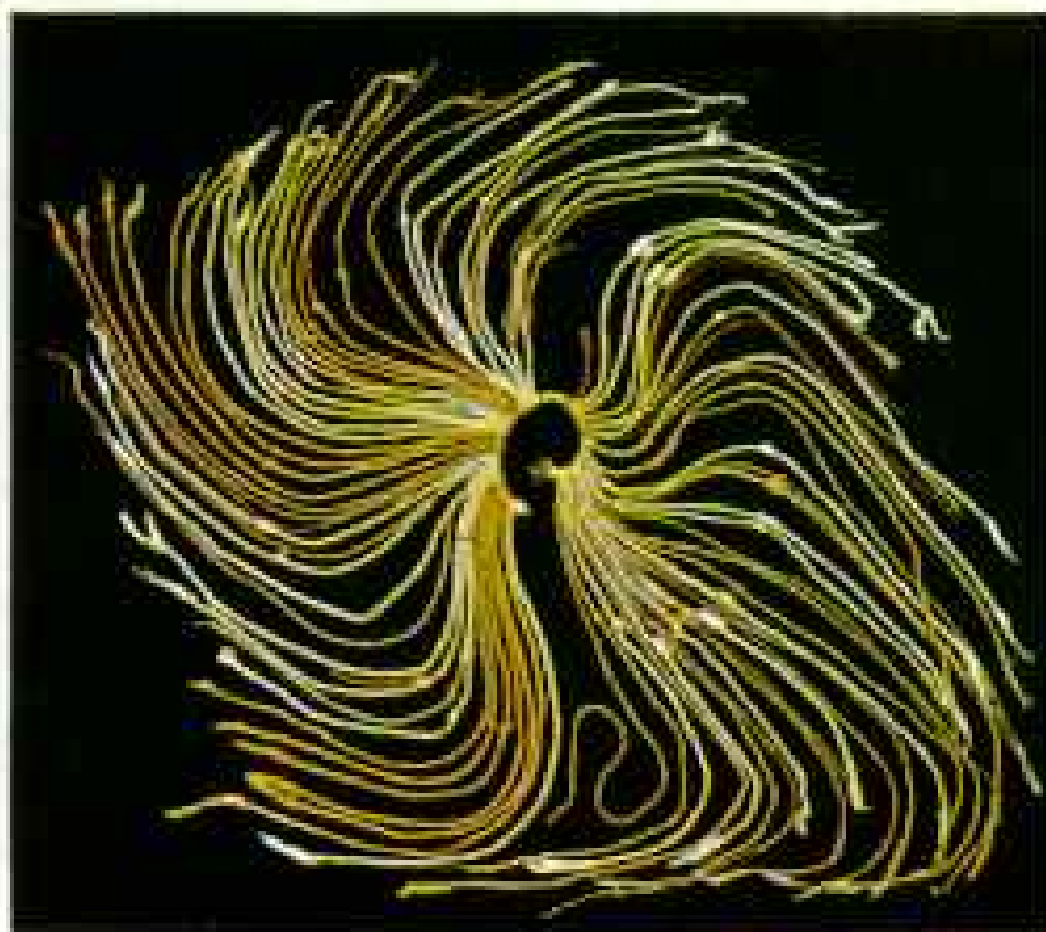
The Incas, lacking the written word, used this memory aid of knotted strings to keep statistical control of the empire: to record and transmit data on harvests, weapons, births and deaths, young men available for war, and old men skilled at building temples.

Mariano, with his long hooked nose and leathery skin, looked like an Inca. He was beardless except for a chin whisker that had escaped his bronze tweezers—exactly like those found in Inca tombs. A teen-age son interpreted while Mariano knotted me a *quipu*, showing how it worked on a decimal system.

Rejuvenated, after my exhausting jaunt, by a supper of roast llama shank, I lightly asked the youngster his father's age: a foolish question, since Indians are little concerned with the passing of years.

"He's more than a hundred," the boy replied.

"Impossible, with so many young children."



Galaxy of information: Knotted strings of a *quipu*—a kind of Inca ledger—tallied imperial resources such as population, crops, and llamas.

“Well, he’s at least a hundred . . . just about your age.”

Miffed, I regretted that the art of the quipu is dying out. That lad needed one.

*Quipu camayocs*, “keepers of the quipu,” were key Inca administrative officials. From each newly subdued province, Tupa Inca sent to Cuzco a quipu census of resources, a clay relief map, and two kinds of hostages: the most revered idols, and sons of local chiefs left to govern under Inca supervision. He made the chiefs learn Quechua and superimposed Incaic gods—the creator Viracocha and Sun, Moon, and Thunder—upon local cults. Unruly people he transferred to distant lands but he issued food and garments to the needy, aged, and infirm. Everyone had to wear regional headdress, a custom that survives (page 778). The hostage boys and royal princes were trained to be administrators. Chosen girls studied to become nobles’ wives and concubines, or Virgins of the Sun assigned to convents throughout the realm.

The Inca decreed that the finest farmland be cultivated for religion, mainly to provide vast quantities of food and textiles to be burned as offerings. The second share supported government and filled warehouses for use in war or famine. The remainder was allotted to each family: just enough land to raise food. Each household could own up to ten llamas. Quipu camayocs regulated the business of this womb-to-tomb society, where the penalty for sloth could be death.

Exacting yearly tribute from their subject chiefs, the lords of Cuzco amassed enormous



The march of empire set forth from the valley of Cuzco. Beginning in 1438 with the mighty Pachacuti—“he who transforms the earth”—Inca emperors cast the mantle of their rule over much of the Andean region, reaching the summit of their power just before the Spanish conquistador Francisco Pizarro arrived. The Incas—a word originally denoting only the lords of Cuzco but later including subjects—named their empire Tahuantinsuyu, the Four Quarters of the World.



treasure. Tupa Inca confiscated for himself all the gold in his vast domain. At his death, about 1493, Tahuantinsuyu stretched from Ecuador into central Chile, a span equal to that of ancient Rome, from Britannia to Persia. It was bounded on the east by the Amazon flatlands and to the west by Mama Cocha—Mother Sea.

**A**ND YET THE LORDS OF CUZCO were latecomers; they retold history to make themselves appear the first civilizers. But in Lima we had only to walk four blocks down Avenida Los Incas, just past Atahualpa Street, to come upon towering proof of a civilization that flourished a thousand years before the Incas.

There our sons would scamper up the crumbling adobe parapets of a temple three times as tall as the olive trees around it and a city block in length. Like priests of old, Lance and Scott could see over the rooftops to the Andes and to the southern Pacific Ocean.

That quadrilateral mound was one of thousands of holy places—the largest containing 130 million adobe bricks, the smallest no larger than a cottage—built in irrigated coastal oases of Peru by kingdoms that emerged before Christ and prospered while the Dark Ages shrouded Europe. Aridity of the coast preserved temples, tombs, mummies, jewels, ceramics (more than a million splendid vessels have been dug up), and some of the finest fabrics woven in any age. Rich independent states ruled the coast until Tupa Inca overwhelmed them in the 1460's.

Bulldozers have long since obliterated my children's pre-Inca temple playground to make room for housing. Though countless other coastal *huacas* (Quechua for "holy places or things") have been plowed under to plant cotton, so many ruins still exist that archeologists have not even listed them all. Grave robbers, however, have worked most sites—so minutely that, from the air, they look like a shell-cratered no-man's-land.

"Lima has found a pleasant way to preserve some of its biggest huacas," said Eduardo (Chachi) Dibos, an old acquaintance of mine who is now mayor of the city. On a recent Sunday we visited the Park of Legends, a zoological garden built around a complex of pre-Inca shrines. Tapirs grazed, monkeys frolicked, and an elephant reached its trunk into a picnicker's glass of beer. "The ancients used to worship here," said Chachi. "Then, as

now, plenty of potent *chicha* was drunk."

A homemade corn beer, *chicha* still fuels festivities and field work throughout the Andes. Flags at the tips of poles angling from peasant huts along the Lima-La Paz highway invite the thirsty traveler to buy a drink.

Sue and I often traveled that road after we moved to Bolivia in 1957. When we recently repeated the trip (a four-day, 1,100-mile drive via Cuzco), we followed the Pan American Highway down the coast. This route parallels the Inca post roads, which explorer-naturalist Alexander von Humboldt in 1849 ranked among the most useful and stupendous works of man.

The second day we turned inland to grind in low gear up to 15,000 feet to pick up the alternate Panamericana along the crest of the Andes. Nearing Cuzco, we crossed the gorge of the Apurimac River, once spanned by a lofty Inca suspension bridge made famous by Thornton Wilder's timeless novel *The Bridge of San Luis Rey*.

We sighted fragments of stone highways where Inca armies used to march with long supply trains of llamas, the beast of burden which was one of the keys to Inca military might. The Incas had not invented wheels, which would have been worthless anyway on such precipitous pathways. From all the Four Quarters, booty poured back into Cuzco along these roads—at a time when Spaniards were vainly seeking fortunes along Caribbean shores. Segments of Inca roads are still traveled by peasants and pack llamas.

The third day we drove southeast from Cuzco, skirting splendid ruins by the score, and that night reached Titicaca, fabled birthplace of the first Inca.\* As we rounded the southern end of the lake on the fourth day, the sun rose over Tiahuanacu, an array of carved stone monoliths on a plain 12,600 feet high. This religious center near La Paz, Bolivia, had attracted pilgrims when Cuzco was hardly more than a village.

**I**N INCA TIMES, pilgrimage shifted to Copacabana, the Place Where the Jewel Can Be Seen. Sue and I once visited several communities near that lakeshore mecca with Manuel (Manolo) de Lucca, a Bolivian anthropologist who had grown up on the nearby Island of the Sun. Manolo pointed out settlements  
*(Continued on page 754)*

\*Luis Marden visited the lofty lake and its people in the February 1971 NATIONAL GEOGRAPHIC.



## A pictorial chronicle of the Incas

**I**RONICALLY the Incas—those creators of large-scale history—left no written records. Their “rememberers” preserved oral history with the aid of data stored on quipus. After the Spanish conquest, the rememberers died out, and the quipus became lifeless strings. Meanwhile, the Spaniards all but obliterated Inca culture while fighting idolatry. Fortunately, chroniclers set down accounts culled from the dying oral tradition. About 1615 one chronicler, Felipe Guamán Poma, a minor official, completed a 1,179-page treatise—in abominable Spanish and Quechua, but with a wealth of drawings. Lost for three centuries, the book turned up in Copenhagen in 1908. Its illustrations suggested this portfolio, a tapestry of paintings re-creating the Inca era in vivid detail, by Geographic artist Ned Seidler. An accompanying frieze of line drawings by his wife Rosalie was adapted from Poma. Painting (above) shows priestly celebrants offering *chicha*, or corn beer, to the sun. A page from Poma’s chronicle (right) depicts the lord Inca and his nobles ceremonially breaking the soil with foot plows for the August planting.



ROYAL LIBRARY OF COPENHAGEN



Winding homeward through the Andes, a victorious Inca army heads for Cuzco. It is about A.D. 1450. Pachacuti, ninth Inca and first emperor, rides the imperial litter. Warriors and llamas cross

a straw bridge like that seen on pages 784-5. Bound prisoners in the foreground include captives marked for sacrifice and the scions of conquered rulers, who will be schooled in Inca



**FIRST INCA.** Manco Capac, founded the dynasty at Cuzco, according to myth. His people revered him as the "Son of the Sun."

**SISTER-WIFE** of Manco Capac was called Mama Ocllo (pronounced Oak-yol). Poma says, "She was a witch . . . but helped the poor. . . ."

**GREATEST INCA.** Pachacuti was the first to gain and hold territory well beyond the home valley of Cuzco.

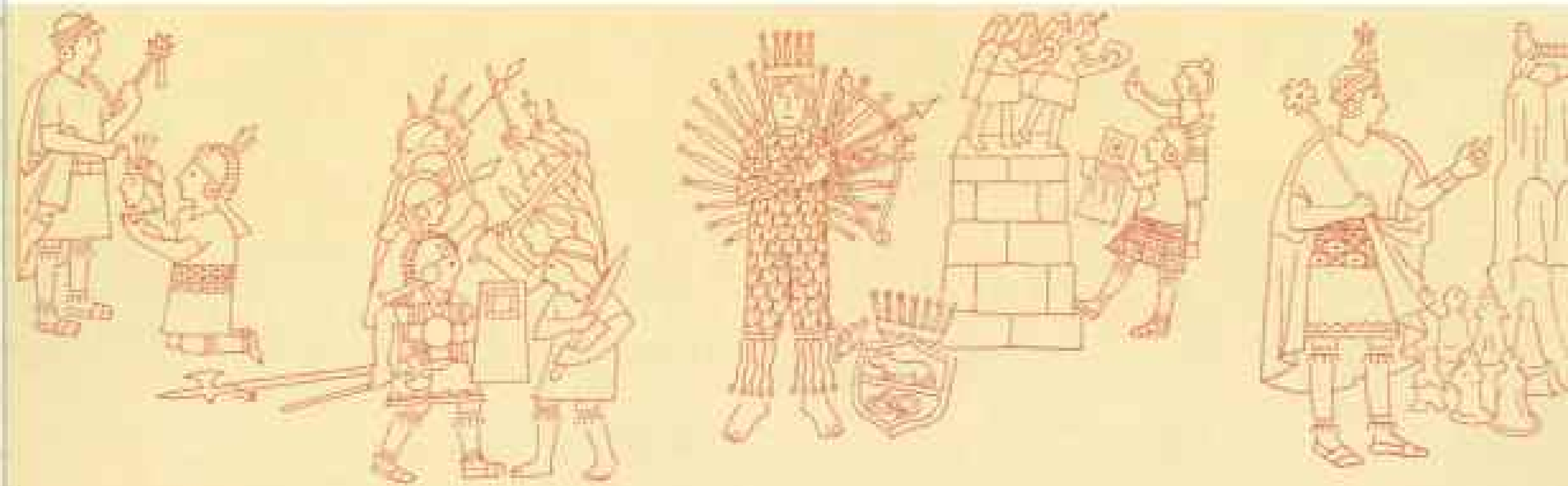
**QUICKENING** the pace of conquest, Tupa Inca—son of Pachacuti—extended Inca rule into Bolivia, Chile, and Argentina.

**GOLDEN MISSILES** fly from the sling of Huayna Capac, third emperor and conqueror of northern Ecuador.



ways and possibly returned home to rule their own people for the Inca emperor. Such caravans also bore the principal idols of subject peoples back to Cuzco. There they were reverently placed

in a ceremonial center that housed images of the Incas' chief divinities, including Viracocha, the Lord Creator, and his servants—Sun, Moon, and Thunder.



**YOUNG WARRIOR** presents his father with the head of a slain enemy. The Incas made grisly drinking cups out of the skulls of their foes.

**BRONZE WEAPONS** clash in a battle between Inca spear carriers and a tribe of Bolivian highlanders.

**AMAZONIAN FOE** of the Incas fits an arrow to his bow. The Incas themselves rarely used the bow and arrow.

**INCAS BESIEGE** a stone fortress—aided by a huaca, or idol, held aloft by one of the warriors.

**ASKING THE GODS** for advice and aid, Tupa Inca confers with his huacas before doing battle.



Emissaries bring tribute from conquered coastal peoples to Inca administrators in Cuzco. Among their gifts: rich textiles and feathered cloaks from the Ica Valley, lace from Chancay, and golden

drinking vessels from the Chimor Kingdom. Nobles accept the offerings in the name of the Inca. Each contribution is carefully recorded by the *quipu camayoc*, or keeper of the quipu, far



**SKILLED WEAVER** begins a fine fabric on a backstrap loom, a device still used by Andean weavers.

**LADY-IN-WAITING**, a girl spins wool—one of the skills she learns at an Inca equivalent of finishing school.

**OVERSEER** adds his own weight to the load while prodding workers to drag stone for a new temple.

**MASTER MASONS** lay the stone blocks of a burial tower. Such edifices still mark the Andean landscape.

**BRIDGE BOSS**, an official called a *chaca suyoyoc*, supervises all hanging bridges in the empire.



right, who acts as the royal accountant. Much of the booty will be kept in thick-walled public warehouses. Even more important to imperial finances than such material tributes was the *mita*,

an annual labor tax exacted from most men of the realm. With such a vast manpower resource, the Inca state built its great temples, fortresses, irrigation works, and empire-spanning roads.



**CHOSEN WOMEN**, selected for their beauty, undergo training to become Virgins of the Sun or consorts of Inca nobles.

**TURNING MARTIAL** art to everyday use, a lad captures his dinner with well-aimed toss of his bola.

**TRUMPETING** his arrival on a conch shell, a post runner alerts his relief at a road station.

**QUIPU KEEPER** does his computations on an abacus-like counter, seen here at his feet. He then records the totals with knots in his quipu.

**WAREHOUSES** of the Incas brim with foodstuffs and other needs for times of scarcity or war. Inventory is kept on quipus.



**The conqueror conquered:** Pizarro's small band, fearfully mounted on snorting, bell-jangling beasts and backed by the sporadic thunder of musket and cannon, ambushes Emperor Atahualpa in 1532 at

Cajamarca. In a litter roofed with a rainbow of feathers, the unsuspecting ruler came unarmed to parley. Battle tally for the whirlwind confrontation: gullible Incas, 6,000 killed; guileful Spaniards, 0.



**DIVINERS** sacrifice a llama to read its entrails and help select an imperial heir as Emperor Huayna Capac lies dying.

**MUMMIFIED HEAD** of Huayna Capac grins as his retainers and women drink wine and await death by strangling, in order to join him in afterlife.

**LITTER BEARERS** trudge toward Cuzco with the mummy of Huayna Capac. Soon his sons Huascar and Atahualpa wage civil war.

**LOSER** in the "war of the brothers," Huascar is captured by Atahualpa's generals, prelude to his execution.

**SPANIARDS ARRIVE** in the Inca realm, before Atahualpa can consolidate his victory.



**The final twist:** Pizarro, having plucked the Inca ruler from the midst of seeming invulnerability, holds him captive and receives a ransom for his release. Atahualpa's subjects gather a staggering

treasure that fills a spacious chamber once with gold, twice with silver. Pizarro's men, background, later bestow on Atahualpa his reward for securing them history's greatest ransom: death by garroting.



**INCA** ambassadors greet the "bearded ones" and invite them to a parley with the emperor at Cajamarca.

**SPANISH GREED** for gold amazed the Incas. Here one asks a Spaniard if he eats gold, since he seems to want it so much.

**WILY AMBLISHERS** on horseback, the Spaniards attack and capture the incautious Atahualpa at Cajamarca.

**SETTING FIRE** to the home of an Inca noble, a conquistador forces him to tell where gold is hidden.

**SPANIARDS LEAD** the last Inca to his execution — an act symbolic of the end of the Inca Empire.



with names of faraway places in the Peruvian and Ecuadorean Andes.

"One report lists people of 42 conquered tribes that Tupa Inca sent here during massive population exchanges he made to unify the empire," Manolo told us. Today, throngs of worshipers journey here to the shrine of a latter-day attraction, the Virgin of Copacabana, whose name has been borrowed by a beach in Rio and a nightclub in New York.

In La Paz we found Manolo ready to guide us into the Bolivian quarter of the Inca world. As our interpreter, he often switched languages from one village to the next, from Quechua to Aymara—the speech of more than a million highlanders around Titicaca.

"After the Incas, the Spaniards continued spreading Quechua and transferring people, mostly to the mines," Manolo said. "But now Aymara is making a comeback."

And pagan practices have never died out. Markets everywhere offer herbs and charms for "curing fright," "bettering the earth," and "attracting a lover." For 50 cents I bought a llama fetus to bury under my house for luck, as the Incas did. (When I later took it through U. S. customs, it caused a bit of a fuss.) As we followed a new paved highway into Oruro, a miners' town, we saw women kneeling before a giant frog idol.

**N**OW I'LL TAKE YOU back in time," said Manolo. "As close as you'll get to seeing how people lived before Tupa Inca came."

We drove on southward, past scores of *chullpas*, ancient burial towers, and wandered onto the Altiplano, here flat as the sea and some 12,000 feet high. We were looking for Chipayas—tribesmen whose ancestors escaped Tupa Inca by living in this salty wasteland. With no landmarks in sight and dust storms darkening the skies, we lost our way.

I sighted bicycle ruts, which we tracked long into the night, coming at last to a cluster of conical huts, silent under the moon. We found shelter with the only foreigners in the village, Frances and Ronald Olson, missionaries of the Summer Institute of Linguistics.

"Chipayas believe they are the last descendants of the chullpa builders, a people older than the sun," said Ron. "Their language has interesting similarities to Mayan."

Beside sod huts we saw women wash each other's hair in fermented human urine and braid it into multiple strands. "A hairdo like the Chilean frozen boy's!" Sue exclaimed.

Later I went with Manolo to the land of the Callawayas, medicine men of the Incas. "Callawayas Indians still roam the Andes and even practice in the big cities of South America. Sons attend universities while learning herbal art from their fathers on the side. They speak—besides Quechua—a private tongue said to be the Incas' secret language. You'll meet the headman, Octavio Magnani. That fine Italian name is a bit pretentious. He was born Mamani." I recognized the surname Mamani, meaning hawk, as one of the commonest in Bolivia.

**W**E JEEPED then walked far into the ranges northeast of Titicaca to reach Curva, a mountaintop town concealed in mist and slashing rain. There Octavio embraced Manolo and turned to me. "Ah, gringo, it will rain as long as you stay. Acomani sheds many tears whenever white men come. Always they want to steal his minerals."

"Acomani," Manolo explained, "is a mountain god, a deity peak hidden by the rain."

"But I mean to take nothing more than a picture," I protested. "Anyway, I'm only half gringo, after twenty years in South America."

"I'll let Acomani know," said Octavio.

He led us into a house as damp and chilly as the outdoors. An old lady crouched in a corner was coughing her lungs away.

"My wife has caught the mortal cough, like so many in this town," Octavio complained. "She is too weak to travel to a hospital."

"But you're the grand master of charms and herbs," said Manolo. "Can't you cure TB?"

The old man shrugged. "*Ah, me faltan antibióticos*—I have no antibiotics."

Yet I shouldn't question Octavio's powers, for the mountain god let up on the rain. I awoke to golden sunlight glistening from Acomani, a massive snow peak above the town.

Manolo announced he would take Sue and me to Titicaca's Island of the Sun, where, as a boy, he had played in labyrinthine temples built by Pachacuti. There an old Indian woman embraced Manolo like a long-lost son and wept for joy. "You have come just in time for the llama sacrifice," she said.

Amid much drinking and dancing, a white llama festooned with colored yarn arrived by reed boat (pages 771-2). One of Manolo's boyhood friends, now a sorcerer, added to the llama's backpack of offerings: a charm bundle of bread, flowers, and even a pack of Sue's

*(Continued on page 764)*



## Living Inca ways— caught in the amber of tradition

**C**USTODIAN of ancient custom, Peruvian Indian Mariano Quispe (left) tallies flock and crops on his quipu. Man and wife (below) use an Inca-style *chuqui-taclla*, or foot plow, to till their patch of soil northeast of Lake Titicaca. Driving the slender spade into the ground, the farmer levers a clod loose by heaving back on the curved handle. His wife turns the clod as he steps back to thrust the blade into the sod again. By royal edict all land once belonged to the Inca. The principal share of the harvest was burned as an offering to the gods, another share went to the government, and farmers kept only enough for their own needs.



## Enduring stones tell the Inca story

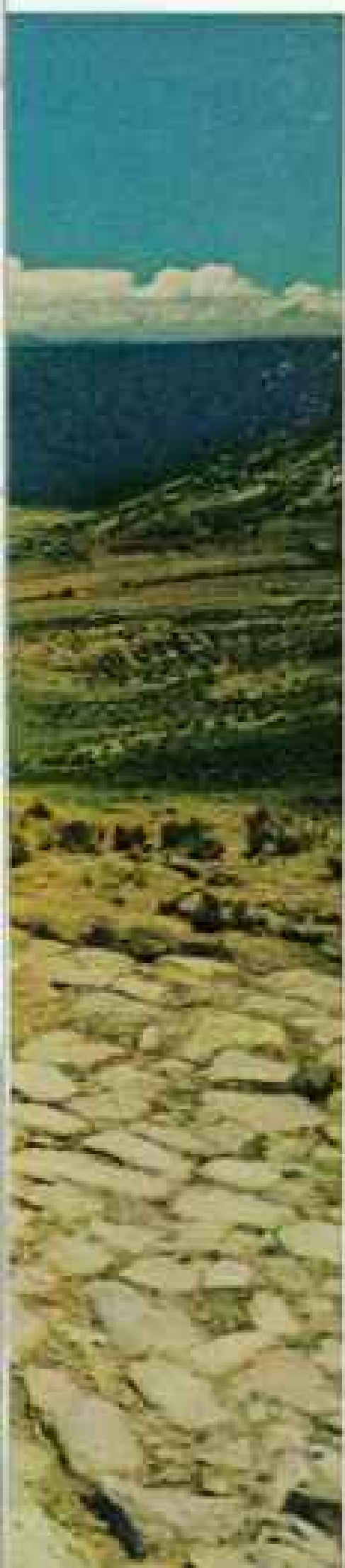
**S**ANDALED FEET polished the steps of the ceremonial center of Tarahuasi (right), as worshipers traveled the royal highway between Cuzco and the Apurimac River gorge. Orange lichens cover much of the polygonal stonework—set without mortar. Niches in the background may have housed man-size figures of gods.

Bolivian pilgrims (below) still travel a segment of a royal Inca highway leading from Copacabana on Lake Titicaca. Along such roads, relays of *chasquis*, or post runners, sped messages an average of 150 miles a day, keeping the emperor in touch with his realm.

Intricately carved boulder

about fourteen feet across (below right) sits near a high pass above the Apurimac River. Chiseled with representations of temples, terraces, gods, monkeys, and pumas, it may be a fanciful model of a town or region. Water, when poured over the top, runs down through miniature canals, rivers, fields, and terraces and drains through spouts on the sides of the granite mass. The rock may have been associated with a religious cult like those whose oracles advised the emperor. Shortly before the Spaniards arrived, one such oracle forewarned the Lord Inca of “bearded ones” about to invade the imperial realm.







## The starch of life

**D**RYING SEED CORN is rushed to cover as the regular afternoon drizzle moves up from Amazonian jungle to shadow the highland village of Queros. Villagers boil cornmeal and let it ferment into chicha—a drink that, since olden times, has made tolerable the rigorous Andean climate.

On the Inca trail to Queros, a boy and his father (right), who wears an Inca-like tunic, stomp on potatoes to squeeze out moisture in the course of making *chuño*, or dehydrated potato—an Andean staple. Alternately frozen and thawed, the potatoes yield their liquid at a slight squeeze (below). The potato originated in the Andean countries, where it is still called *papa*, as in Inca times.



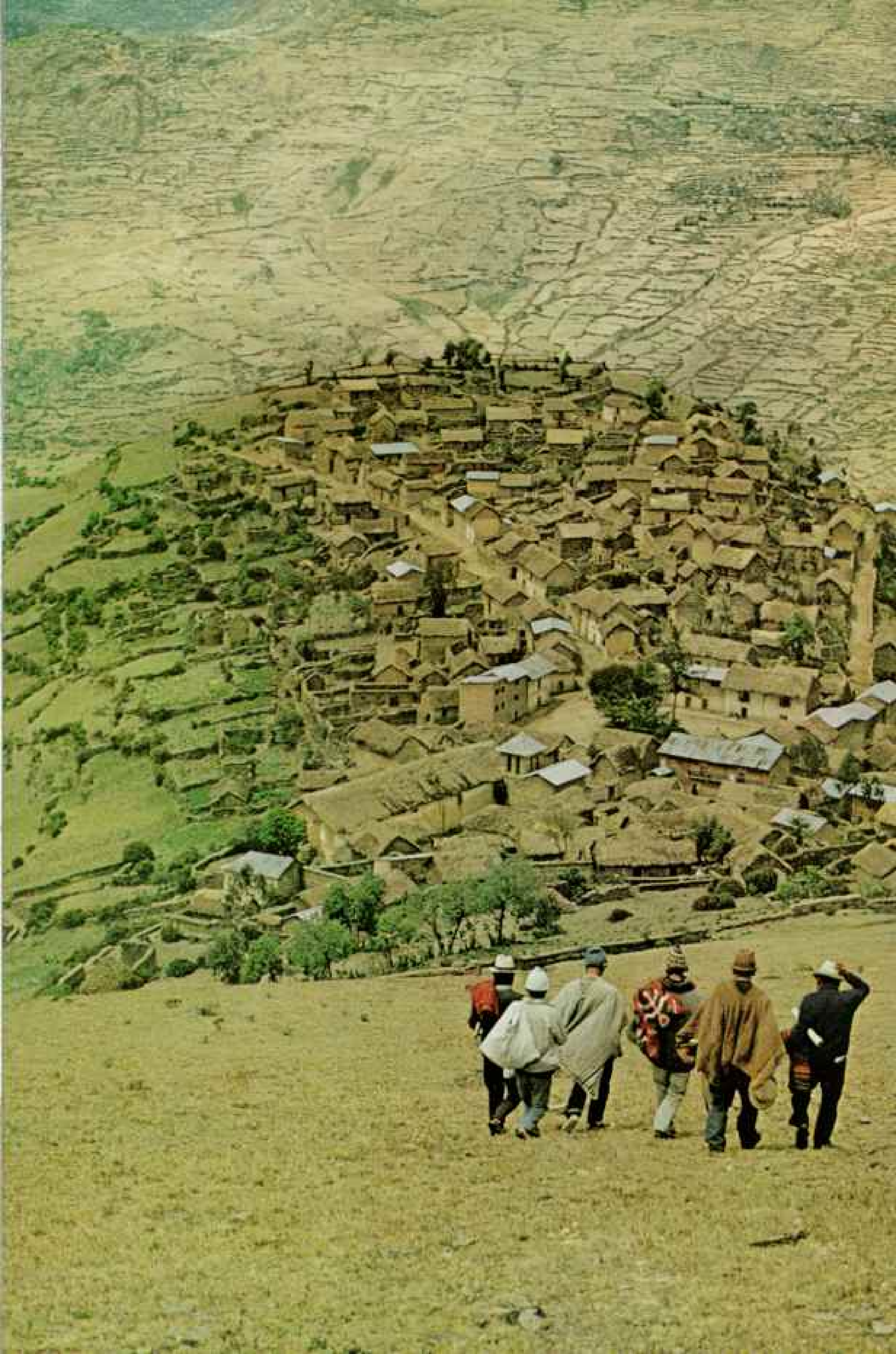


Flat as a salt pan—and about as inviting—the land of the Chipayas is lost in the vastness of southern Bolivia's 12,000-foot Altiplano. Here the Indians escaped Inca rule in the 1400's. The area then brimmed with swamps; today its dried-out soil barely yields to the Chipayas' crude digging sticks (left)—much more primitive than the Inca foot plow. For half the year dust storms howl almost every afternoon; a father and son (above) plant a few last seeds of *quinua*, a high-protein grain, before running to shelter in the sod-walled threshing yard. Up-turned clod marks a communal-plot boundary.

As wary today as in Inca times, Chipayas deal reluctantly with outsiders. The village headman (right) agreed to a photograph only if allowed to compose it himself. Flanked by wife and child, he sits beneath portraits of liberators Sucre and Bolívar, the Bolivian seal, and a photograph of President Hugo Banzer—all arrayed on the national flag.









**Heiress to Inca tradition**, a young bride in the Bolivian town of Curva wears a *wincha*, or Inca-style headband. Huge silver pins—another carry-over—fasten her handwoven garments. Her village (left), crowding a hilltop amid slopes shingled with ancient terraces, is the ancestral home of the Callawayas, medicine men to the Incas and their descendants throughout the Andes.

Though still tilled by local farmers, the terraces have deteriorated over the centuries. No longer are they tended with the scrupulous care required by Inca overlords. Subjects of the emperor were taught that idleness breeds mischief, and the penalty for repeated laziness was death.

cigarettes. He studied three perfectly shaped coca leaves to determine the most propitious site for the sacrifice to ensure a good harvest.

In Inca days, use of coca—a pain-killer and stimulant—was restricted mainly to the royal family. Today highlanders chew it to relieve fatigue. Little work gets done without it.

Stepping proudly, its big dark eyes aglow, the llama headed a serpentine line of dancers from the lake to the summit of the island. A drummer followed, then men blowing panpipes, varying from tiny treble instruments to whooping basses that scraped the ground. Women swirled multicolored petticoats.

Sue followed, warily. She loves llamas and had never seen an Indian abuse one. These intelligent creatures have lived in close association with Andean man from earliest times.

No one sang until the procession reached the windy hilltop. We watched a ceremony compounded of Incaic beliefs, Christian ritual, and a measure of magic. Manolo whispered, "Priests long ago discouraged the Inca practice of opening the llama's breast and seizing the beating heart."

The kill came at sundown, a swift stroke across the jugular. Sue averted her eyes.

The sorcerer caught blood to sprinkle on Pacha Mama—Earth Mother—while his wife ignited a tray of incense held high by a kneeling maiden (page 773). A chill breeze wafted the fragrant smoke. Helpers fashioned a straw cross to mark the cairn where they buried the llama's head and the charm bundle. The sorcerer scattered coca leaves and added some to the wad in his cheek. The sun gilded the waves west of the island and set beyond the burnished mountains of Peru.

**F**ROM THE WATERS of Titicaca—according to one Inca-origin legend—Manco Capac, the first Inca, and his sister-wife, Mama Ocllo, emerged after their creation by the sun. The couple wandered with a golden staff until they found a fertile valley where it sank easily into the earth. There they founded Cuzco, which means "navel" in Quechua and "richest of the rich" in the secret Calawayaya tongue.

Both meanings fit the great religious and political center of the empire, its temples laden with gold, its warehouses bulging with weapons and clothing. One of Pachacuti's first acts as emperor was to empty the city of inhabitants and rebuild it as a holy place.

In this land without money, the main tax

was a period of forced labor, the *mita*, Quechua for "a turn." To keep subjects out of mischief by "taking turns" at public works and mining, quipu camayocs determined how many could be spared from agriculture. Andean farm work—then and now—requires scarcely 60 days a year. So the labor tax on the six million inhabitants of the Tahuantinsuyu brought the Inca a fabulous annual income—easily more than a billion man-hours—to invest in grandeur.

Mita workmen dutifully shaped thousands of mountainsides into terraces for farming, up to 13,000 feet. In the holy city and outlying regions they built solid-stone palaces and citadels, whose existing foundations still defy time, giving Cuzco reason for its claim to be the archeological capital of the Americas.

In Cuzco Sue and I luckily fell in with John Howland Rowe, whom I regard as the world's leading expert on the Incas. "John," I asked, "after thirty years of probing Cuzco's origins, does any ruin still fascinate you?"

"Oh, yes, the most impressive of all—the fortress of Sacsahuaman."

We drove with him to the hill guarding the northern approaches to Cuzco. There we watched a woman herding llamas past Sacsahuaman's massive zigzag walls that blocked our view of the city beyond (pages 776-7).

"Explorer Hiram Bingham called it the most unbelievable achievement of ancient man in America," John said.

Megaliths up to 150 tons form a jigsaw-puzzle fortress, 1,800 feet long and 60 feet high. A striking sawtooth design forced assailants to offer their backs to defenders as they tried to scale three successive walls.

"The Spanish chronicler Cieza says 20,000 mita laborers built Sacsahuaman," John reminded us. Yet later observers doubted that Indians could haul such huge stones up here and shape them so precisely. They thought it was the devil's doing. Others insisted the Incas knew how to soften stones and mold them like clay. The latest fad attributes construction to extraterrestrial beings. John and I agreed that people seem unwilling to credit the ancestors of today's humble Indian with such engineering skill and eye for beauty.

Vestiges of great architecture and the Incas' veneration of lofty sites enthrall travelers who journey down the sacred Vilcanota River, northwest of Cuzco, and climb jungled slopes to the 8,000-foot-high citadel of Machu Picchu (pages 735-7). Most spectacular of

Inca retreats, Machu Picchu, probably built by Tupa Inca 500 years ago, went undiscovered until Bingham found it. His illustrated report fills the *NATIONAL GEOGRAPHIC* for April 1913.

No mention of Machu Picchu appears in Spanish chronicles. Some archeologists think it served as a ceremonial center of a vast forgotten network of Inca stone settlements, which Bingham and subsequent jungle explorers have found along the Amazon watershed of the Andes. But no one really knows.

**T**O EXPERIENCE the almost spiritual bewitchment of Machu Picchu, we recently stayed overnight in the small hotel at the edge of the ruins to witness sunset and sunrise from a crag overlooking the temples and

terraces. I wished aloud that I could travel back in time to visit this citadel in the sky in its days of grandeur. But Sue said, "I like it just as it is... as if held in a magic spell."

We first climbed to Machu Picchu in 1948 by muleback. In 1954, during the week we spent at the then-tiny hostel, only two other visitors came. Now daily jets fly crowds of many nationalities to Cuzco, and hundreds make the train and bus ride to Machu Picchu.

Few can stay overnight for lack of lodging. Proposals for a big hotel have aroused worldwide protest from protectionists, who point out that the splendor of the site depends on its solitude. The government minister in charge of deciding the dispute, our friend since 1946, said, "My knottiest problem is conserving Machu Picchu's enchantment,

Mysterious seal stamped on the landscape of Peru's central coast, a pre-Inca fortification rises from the brow of a rock bluff in the Casma Valley. Constructed by an unknown coastal people two millenniums ago, the fortress came in time into the orbit of the Chimu, whose dominions the Incas absorbed in the 1460's. A six-foot-high defensive wall stretches across the plain to the distant mountains. Numerous Peruvian civilizations preceded that of the Incas, who themselves were but a minor tribe in the Cuzco valley until the era of the great Pachacuti.



while making it available to all who've traveled a long way to discover for themselves the lost city of the Incas."

**H**UAYNA CAPAC—Valiant Youth—surely visited Machu Picchu after he succeeded Tupa Inca in 1493, for he devoted years to a grand tour of his inherited Four Quarters of the World. Seeking new worlds to conquer, the eleventh Inca marched north beyond Ecuador to the land of Pasto in Colombia to attack rich goldsmithing cultures. Then uprisings in Ecuador pulled him back in anger.

One day in Ecuador, as Sue and I cast lures into a lake under equatorial snow peaks, our boatman reminded us that Huayna Capac had massacred his ancestors. No wonder, for we were fishing Yaguarcocha, Quechua for "bloody lake"; the blood of our boatman's ancestors had once reddened these waters.

Huayna Capac settled down in Ecuador with his hundreds of wives and concubines, occupying a sumptuous palace of which no trace remains. Today the chief reminders of the brief Inca occupation of Ecuador are Quechua-speaking Indian communities of diverse tribal origins—some from distant Bolivia—found along the Pan American Highway.\*

The emperor's warrior son, Atahualpa, became a favorite of the battle-tested armies that carried on the northern border campaigns. Meanwhile premonitions of doom haunted Huayna Capac. *Chasquis*, post runners who carried quipus along the royal roads, delivered many a dire message to Ecuador. One from the oracle at the Apurimac River bridge, 1,000 miles away, warned that bearded beings would subvert the empire. A chasqui from the coast reported that such men had appeared on floating houses but soon sailed out of sight. Then many runners warned that pestilence was sweeping the realm—the first of many mortal blows that weakened the empire on the eve of the holocaust to come.

About 1525 Huayna Capac was stricken—possibly by smallpox introduced into the continent by Europeans probing its coastline. Twice he named an heir and twice his priests, hurriedly performing the *calpa* ceremony—divination by examining llama viscera—predicted dire reigns for his choices. Before he could choose again, he died.

In Cuzco the high priest conferred the royal fringe on Huascar, a son of Huayna

\*The author told the story of ancient and modern Ecuador in the February 1968 NATIONAL GEOGRAPHIC.

**Toothaches and headaches** afflicted the Incas, as they do people today. Silver crowns for capping teeth (**below**), made by an Inca prosthetist half a millennium ago, display an astonishing similarity to crowns used in 20th-century dentistry.

Holes in an Inca skull (**right**) were incised with bronze trepanning instruments like those on the

facing page—knife, tweezers, chisels, hammer, scalpel, and needle. Trepanning was a surprisingly successful operation for mace wounds, skull fractures, tumors, headaches, and—very likely—exorcism of evil spirits. In 1953, Peruvian surgeons preparing a treatise on Inca trepanning sharpened this very set of tools to prove their



Capac and his sister-wife, the queen. But Atahualpa, Huascar's half brother, governor of Quito, reportedly refused to accompany his father's mummy to Cuzco and render homage. His generals, veterans of Ecuadorean wars, backed his insurgency, and civil war flared.

Huascar sent a huge inexperienced army against Atahualpa, but it perished in battle near Ambato, Ecuador. The chronicler Cieza, who saw the skeleton-strewn battlefield twenty years later, wrote that the body count of 15 or 16 thousand was an underestimate.

Huascar conscripted army after army, including peasants from as far away as Argentina. Thousands who had escaped the plague now fell under the northerner's onslaughts. Perhaps 200,000 men fought in the final battle near Cuzco. The unthinkable occurred: Atahualpa's generals tumbled Huascar from his golden litter. Cuzco's defenders fled in terror. The Son of the Sun had fallen.

The generals dressed the emperor in women's clothes. They forced him to eat excrement in Cuzco's streets and watch the extermination of his multitudinous family and courtiers.

Bitterness engendered by the war between the brothers persists to this day. "Bad blood between Peru and Ecuador began with Inca

politics and culminated in our 1941 border war," a neighbor declared when I lived on Los Incas, between Huascar and Atahualpa streets. "Ecuadoreans call Atahualpa an emperor, but in my history book he was just a bastard usurper."

**A**TAHUALLPA had left Quito to make triumphal entry into Cuzco when he got word of his generals' victory. But at this moment coastal chiefs warned him of Pizarro's approach. A mere 62 cavalymen and 106 foot soldiers, armed with Toledo blades and a few guns and crossbows, were winding slowly into the mountains of northern Peru.

The Spaniards passed smoldering ruins and corpses swinging from trees, mute evidence of the war between the brothers. In their own words, Pizarro's men wet their pants with fear, but they had lunatic nerve—and military expertise honed by centuries of holy war against the Moors. Their intention was to conquer Peru just as Cortés had won Mexico, by exploiting civil strife to gain allies, by surprise attack, and by capture of the king.

Curious to see the strangers, their beasts, and their magic staves that commanded the  
*(Continued on page 779)*

utility. They operated on a man suffering speech impairment from a brain lesion, using a tourniquet around his head Inca-style to stop bleeding. The man recovered. Ceramic jug from the coast (right) shows a doctor straddling his patient while performing a trepanation. Use of narcotic coca may explain the patient's placid expression.



ARMAND MUSEUM, LIMA (RIGHT), AND MUSEUM AND INSTITUTE OF ARCHEOLOGY, UNIVERSITY OF SAN ANTONIO REAL, CUZCO





## A way of life quickens again in works of art

**L**IKE THE CONTENTS of a time capsule, Peruvian artifacts offer an intriguing glimpse into the daily life of the Incas and their subjects. Perforated lobes of a gold figure (left) identify an *orejón*, or "big ear"—one of the Inca nobility, who alone were allowed to wear huge golden earplugs. Another figure of an *orejón* (below) was

found encased in dried mud, perhaps accidentally, or perhaps to depict him taking a mud bath. In their pampered luxury Inca nobles took frequent baths—bounty of a hydraulics technology that blessed them with irrigation for their fields and running water piped in to their ceremonial centers.

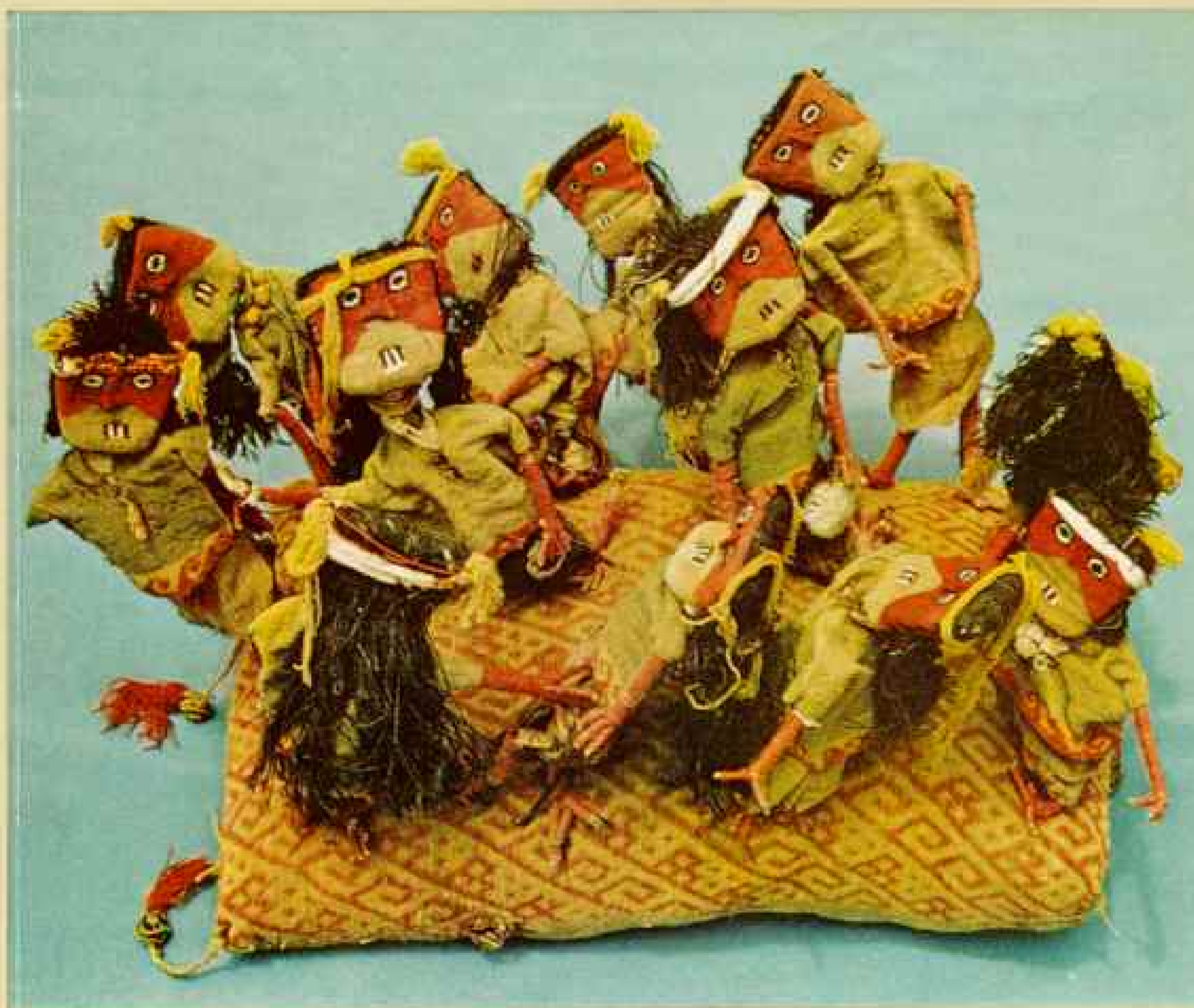


Coastal noble peers from his throne on a ceremonial drinking pot of Chimor blackware. Near his knees hang ears of corn— charms still used in the Andes.  
NATIONAL MUSEUM OF NATIHOPOLE, LIMA

Blind drummer adorns a ceramic pot of a pre-Inca people, the Mochicas. Then as now, the blind often made a living through music.  
AMANO MUSEUM, LIMA



Walled home in miniature appears to be getting a coat of paint from its owner in this Inca ceramic. Steep roofs typify mountain villages, where rainstorms are frequent.  
MUSEUM AND INSTITUTE OF ARCHITECTURE UNIVERSITY OF SAN ANTONIO ABAD, CUSCO (LEFT) AND PAUC, PERU



Dance of the manikins: A troupe of stick-and-cloth men circles drunkenly atop a pillow from the coastal valley of Chancay. The seemingly whimsical creation probably had a solemn, ritualistic use.  
AMANO MUSEUM, LIMA (LEFT) AND BELOW

Brimming with humor, the full-jowled face of a Mochica gentleman peers from a drinking vessel. Ceramic art of the Mochicas stressed lifelike portraiture, in contrast to the austere decorations of the Incas.







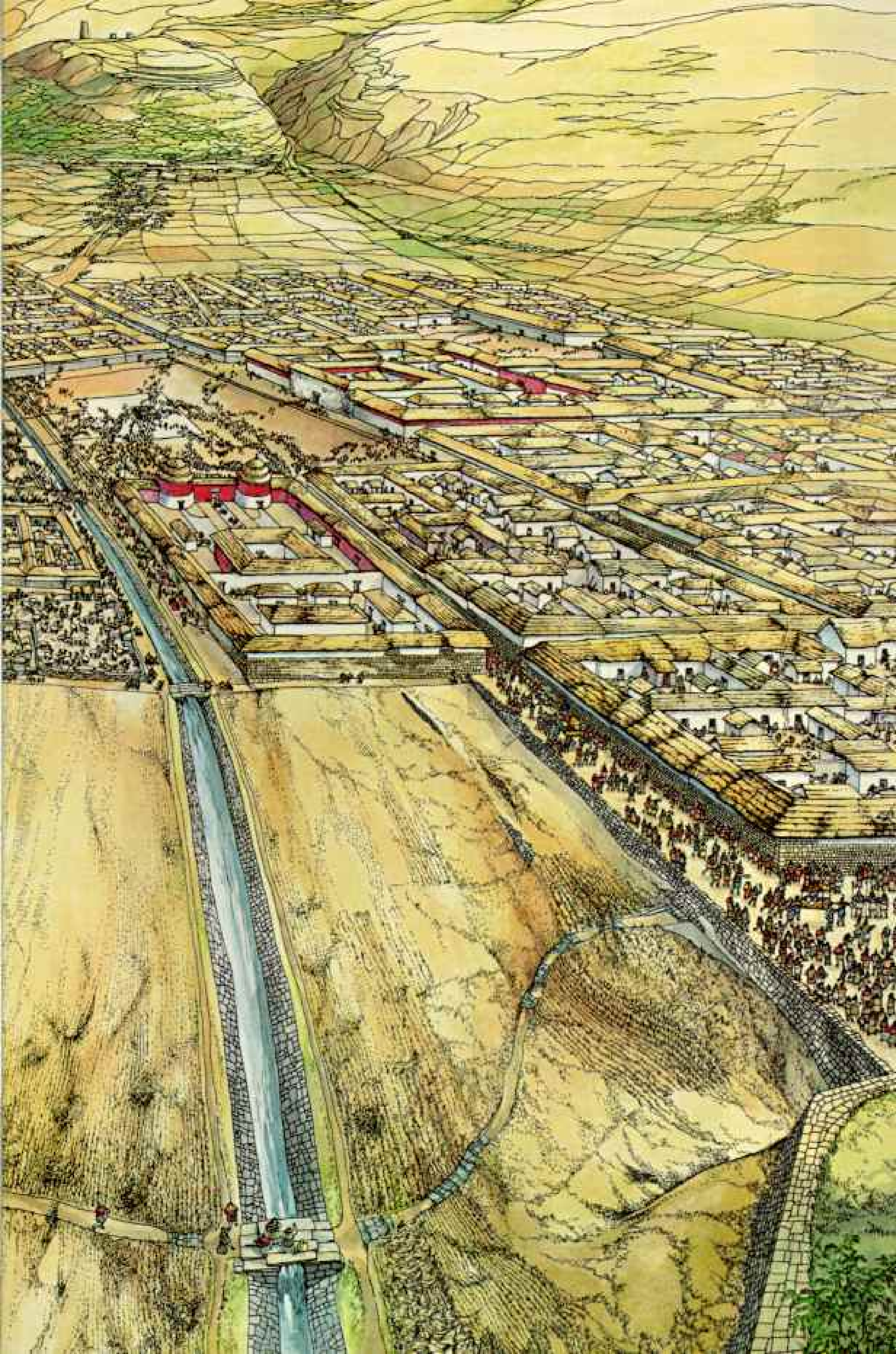
For the Earth Mother, a pure white llama in exchange for good crops. Such is the supplication each fall from Aymara Indians on Titicaca's Island of the Sun to an age-old deity still petitioned centuries after the Spanish imposed Christianity.

An islander paddles the sacrificial offering (left) to the annual ceremony. His boat of reeds has been constructed for this occasion alone. Because *totora*

reeds are in short supply here, islanders build *warajas*—truncated versions of the larger, symmetrical balsas found elsewhere on the lake.

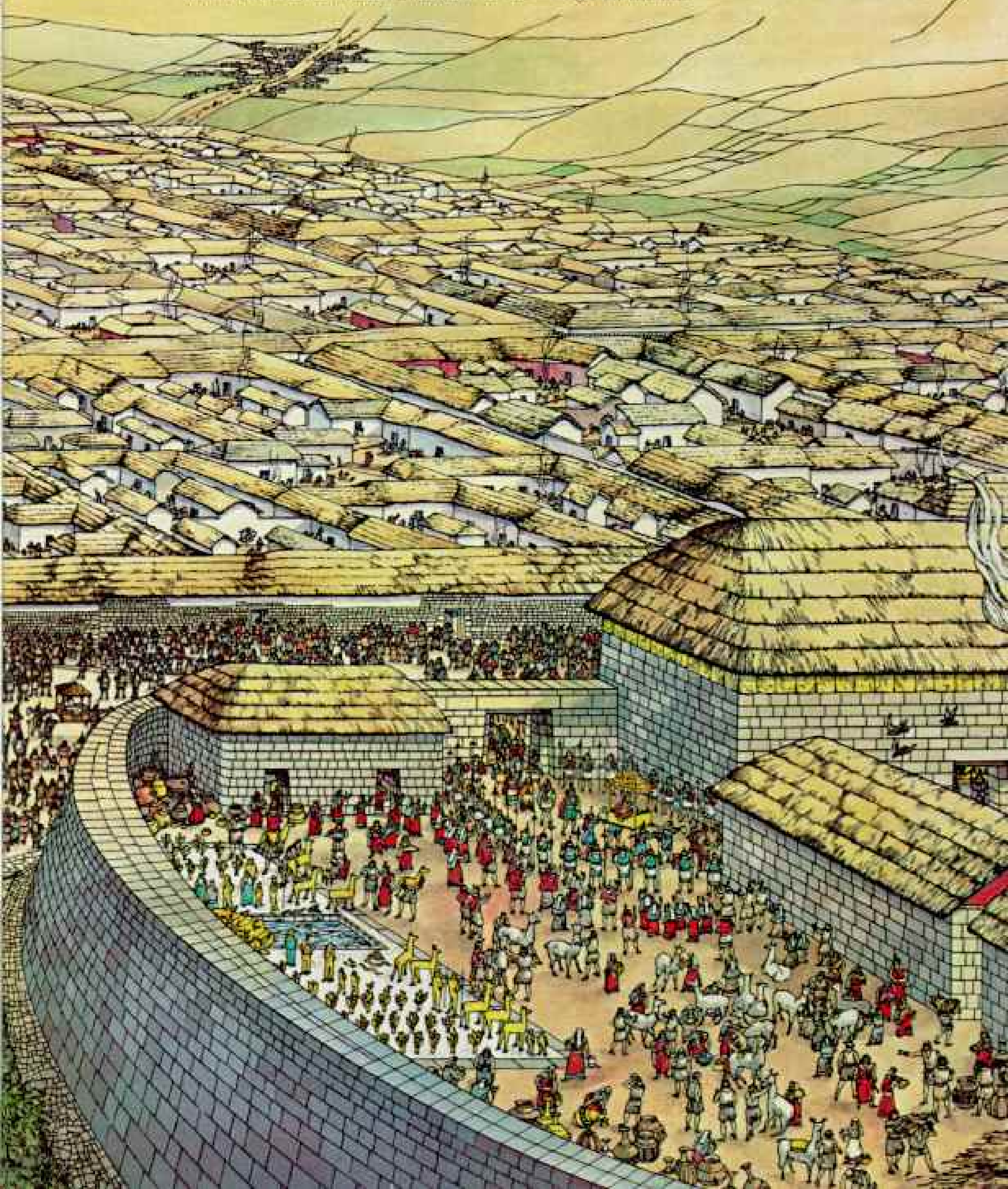
During the ceremony (below) a local sorceress pours incense—the same as that used in Andean Roman Catholic churches—onto flaming coals strewn with dried coca leaves. Blood of the sacrificed llama will be sprinkled onto Pacha-Mama—Earth Mother.





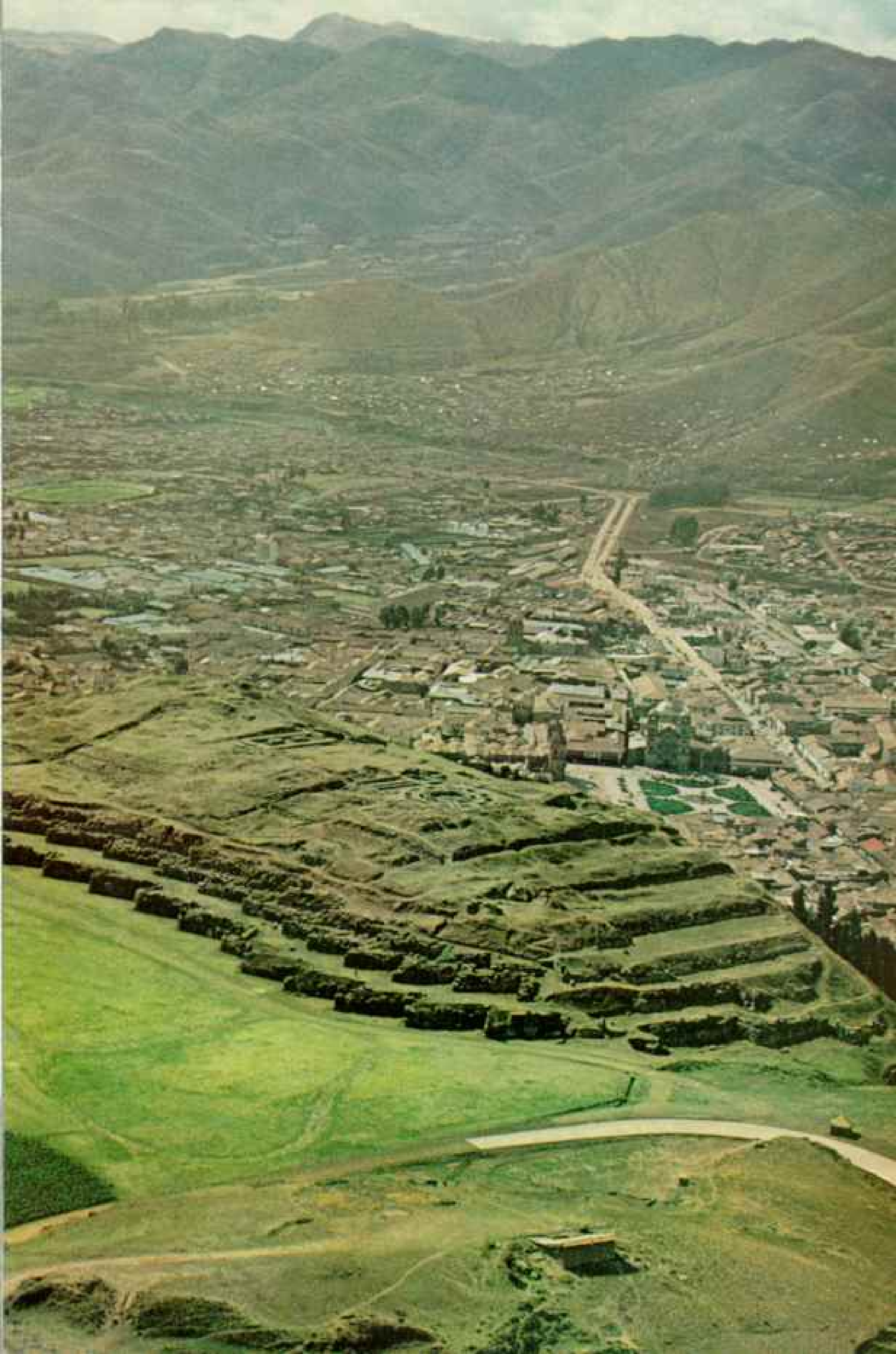
"Navel of the world," they called it—Cuzco, capital of the Inca Empire. From sketchy Spanish accounts, artist Donald A. Mackay has reconstructed the city on its still-surviving foundations. Thatch-roofed palaces and warehouses bulge with tribute from subject peoples. Royal highways from the Four Quarters of the World meet at the main plaza, left center, crowded at the festival of Inti Raymi, the winter solstice. High-ranking celebrants pour into the curve-walled Golden Enclosure of the

Temple of the Sun, below right, led by the Lord Inca Huascar in a golden litter. Within, white llamas await sacrifice; gold sculptures of beasts and plants glint in the rarefied air, as does a golden frieze on the temple. A politico-religious center, Cuzco housed only Inca nobility, officials, and retinues; commoners lived in 12 satellite towns. The Huatanay River's paved channel brought water and carried away sewage. Towers of Sacsahuaman fortress stood vigil on the hill.



Rocks of ages underpin much of modern Cuzco, a city of 109,000, sprawling in the valley beyond the massive hilltop fortress of Sacsahuaman. Pachacuti in the 1400's began rebuilding the city, oldest continually inhabited metropolis in the Americas. A Cuzco woman (below) wends past precisely fitted Inca stonemasonry that has resisted conqueror and earthquake alike for more than 500 years. Atop such imperturbable stones the Spaniards built their own edifices, including the Church of Santo Domingo, twice tumbled by quakes, which rises on the still-firm foundations of the Inca's once-glorious Temple of the Sun.







Telltale hats mark residents of the Cuzco area; staff of office identifies one as a village headman. Though of colonial derivation, the bowl-shaped *montera* perpetuates an Inca decree that headgear should reveal the place of one's birth.

lightning, Atahualpa broke his journey at Cajamarca, 600 miles northwest of Cuzco. He ordered the town evacuated, sent gifts to Pizarro, and waited at nearby thermal baths, attended by his wives and nobles. Tents of his army blanketed surrounding hills, although his best troops were pillaging Cuzco. He had consulted the oracles, and they had reassured him of his invincibility.

Meanwhile, the citizens of faraway Cuzco had found new hope. They thought Pizarro was coming in answer to their prayers to the supreme being, Viracocha, for deliverance from Atahualpa. After the creation, Viracocha had set off across the Pacific walking on the waters. People believed he would reappear in times of crises. Surely the bearded saviors were sent by Viracocha!

Ironically, the white man inherited the god's name. I get an eerie feeling when Indians in remote villages address me with that ghostly title.

**F**ROM THE HEIGHTS where Pizarro first sighted Atahualpa's camp, I looked down one frosty morning on the green fields of Cajamarca, where scalding overflow from the Inca's Bath still wends through lush grass and fills the valley with vapor. As the sun rose, it lifted the mist from the stage of one of the most dramatic confrontations in history.

Pizarro sent an interpreter and 15 riders under Hernando de Soto (who later discovered the Mississippi River) to offer his services in arms and to ask the emperor to dine next day. The seated Inca offered ceremonial chicha, accepted the invitation, and told his guests to occupy the town plaza. Before leaving, De Soto galloped up to Atahualpa and reared his charger. Nobles flinched. The Inca sat unmoved on the royal stool.

That night Atahualpa executed the cowardly nobles. The Spaniards prayed till dawn.

Pizarro set the trap that the Inca had unwittingly provided him. In the great triangular plaza, with an entrance at its apex, he laid an ambush. He hid his forces inside buildings that had doorways, high enough for horse and rider, facing into the walled plaza.

On Saturday, November 16, 1532, the Inca delayed his social call until sundown, supposing horses to be of no use after dark, and bemused by reports that the bearded men were hiding in fear. Then he capped his spate of bad decisions by going unarmed to sup and spend the night in town.

Preceded by hundreds of sweepers, whose cries of triumph, said one of the conquistadors, "sounded like the songs of hell," the Inca entered the plaza on his golden litter, attended by richly dressed nobles and "five or six thousand menials." The only Spaniard in sight, a Dominican friar, came forward with a prayer book and read aloud. Atahualpa examined the book, but as it failed to talk to him he threw it down.

Suddenly bugles blew, guns belched thunder, and the old Spanish war cry rang out, "Santiago [St. James]! And at them!"

Hoofed monsters charged out of trapezoidal doorways and trampled Indian flesh. Toledo blades turned crimson. Panic seized the courtiers; in their surge to escape, they demolished a chunk of the plaza wall.

Then, for the second time that year, a golden litter capsized and a Son of the Sun fell to earth. Within minutes Pizarro had plucked the Inca from the midst of his armies without the loss of a man. Spaniards pursued Indians into the night, killing, they reported, more than 6,000.

**H**OW A FEW SPANISH CAVALRYMEN could demoralize and crush an Inca army I learned for myself in the mountains south of Cuzco, where I became an isolated foot soldier amid rampaging riders in a deadly ritual war performed yearly since Inca times.

It happened when Sue and I called on a peasant friend, Luis Choqueneira, whose stone hut perches at 13,000 feet on the edge of the Apurimac River gorge in Canas Province. Luis and his scattered neighbors stem from aggressive ancestors; some resisted Pachacuti, and others inspired bloody neo-Incan revolts that spread through the Andes in 1780.

"We'll show you how tough we are," boasted Luis. "We're going to fight with whips and slings and bolas like this." He whirled a cord with three weights attached and sent it spinning. It tangled in the legs and curled-up tail of a yellow-eyed Inca dog, which tumbled over, yipping. "Some of us will get killed, trying to capture the enemy's girls."

"The enemy? Who's the enemy?"

"Well . . . our friends of Chumbivilcas Province become enemies for a day. When they're short of men, we lend them some of ours."

In a flurry of midsummer snow we climbed Tocto, a nearby summit 900 feet higher than the Matterhorn, to join hundreds of Canas peasants picnicking in embroidered woolens



and hats bedecked with fresh flowers. Women joined hands and circled in the wet snow, chanting mournfully. Slingmen gathered stones the size of golf balls. Riders galloped bareback over rocks and crocuses, shouting to summon their nerve and pausing only to gulp straight shots of cane alcohol. Atop a hill a mile away, Chumbivilcan cavalry pranced, silhouetted against the murky sky.

Suddenly I realized our slingmen were storming the far hill. I chased after them with my camera. Slings cracked like whips. Rocks whooshed with astonishing range. I couldn't tell yelling friend from hollering foe. Communications were nil: no trumpet calls, no signs of leadership. A riderless stallion galloped by. Luis tugged me to haven behind a boulder, warning, "Get back to Tocto!"

I didn't heed him but followed our cavalry up the enemy hill. Chumbivilcan girls fled screaming into the next valley, though some dawdled in hopes of being captured by doughty Canas bachelors. Then Chumbivilcas counterattacked, and I learned all too vividly how the Inca foot soldier must have felt when run down by Spanish knights.

A Chumbivilcan cavalry charge trapped me in the valley. Riders thundered down the slope, whips cracking like rifle shots. I ran for my life. A hail of Canas slingstones toppled one assailant. Others veered as I dived behind my favorite boulder. I felt as helpless as if caught in an avalanche.

That evening, at Luis's hut, combatants proudly displayed their wounds. As his wife applied a coca-leaf poultice to an ugly bruise on his temple, Luis reported, "Only two dead. Chumbivilcans."

**W**E HAD MET Luis while looking for remnants of Inca suspension bridges over the Apurimac, whose enormous gorge isolated Cuzco from the northern reaches of the empire. Yellowing manuscripts describe giddy crossings. But to visualize the bridges, we could find only a few woodcuts, including a century-old sketch of the great span whose resident oracle warned Huayna Capac of the coming of the bearded men. That marvelous "Bridge of San Luis Rey" collapsed about 1890 after five centuries of heavy usage.

At three other sites we found that steel cables had replaced fiber ropes which villagers kept renewing long after Inca times. In vain we sought a fifth, unreported span I thought I'd spotted a year before while flying up the

Apurimac to pinpoint the Amazon's source.\*

At Cuzco University we consulted Dr. Luis Barreda Murillo, an archeologist. He relayed our quest to the university's 5,000 students over the public-address system. One student responded. In Canas Province he'd seen an abandoned *keshwa chaca*, a rope bridge.

Within a week Sue, Barreda, and I were jumping with joy on the brink of the upper Apurimac gorge, our shouts echoing from the opposite cliff. We had found the *chaca still hanging!* Three hundred feet below us, swaying over a deep green pool, it gleamed like Inca gold. Downstream the voice of the Great Speaker, the Apurimac, warned of rapids beyond a dark defile.

We clawed down the precipice to approach the span, which hung 60 feet above the river.

Suddenly a voice cautioned, "Don't cross! The bridge is dying!" It was our first meeting with Luis Choqueneira.

He told us: "I am one of the *chaca camayocs* [keepers of the bridge]. My people feel sad about abandoning the *keshwa chaca* for a new steel bridge upstream. So we're going to

\*The author traced the Amazon from source to mouth in the October 1971 NATIONAL GEOGRAPHIC.



UNIVERSITY OF SAN ANTONIO MUSEUM, C1223

**The sling's the thing:** Inca warrior on a ceramic jug wears a sling on his head wrap-around fashion, ready in an instant. Indians of Peru's Canas Province still use this favored weapon of the Incas during an annual free-for-all called the Tocto war (right). In an Andean Sadie Hawkins Day in reverse, two normally friendly peoples become enemies for a few violent hours and abduct brides from each other's domain.

rebuild it when the New Year comes, just as we have done every year since Tupa Inca ordered our ancestors to do so. Come back in January if you want to see."

**S**O BACK WE CAME. A week after the Tocto war, hundreds of Canas and Chumbivilcas peasants—no longer enemies and wearing fresh flowers in their hats—toted to the bridge site about 22,000 feet of hand-spun rope, finger thick. While men twisted and braided it into six big cables, children pounded sheaves of *coyo*, a tough bunchgrass, to make it pliable, and from the *coyo* women spun more cordage.

The next day, work narrowed to a hundred members of Luis's community, responsible since empire days for actually hanging the bridge. Boys floated straw rope from opposite sides of the river until it tangled in midstream, thus passing over a messenger line. Men then hauled the big cables across, tightening and securing them by sheer muscle power to horizontal stone bollards anchored in bedrock.

Snug lashings caged the sides, from hand

ropes to foot cables, so that not even a child might fall (following pages). On the last day three wise old *chaca camayo*s wove a footing of twigs. And that was all. It had taken just 14 working hours for the complete rebuilding of the 100-foot-long bridge. During all three days, offerings of sequin-spangled corn and coca leaves smoldered by the foundations.

They let Sue and me be first to cross. We stepped out over a torrent now swollen with summer rain. In mid-span I paused to look back. Ritual smoke wreathed the faces of the men of Canas, battered by the Tocto war. They cheered us on and toasted the health of the *keshwa chaca*. Some tossed their hats into the air, scattering the little bouquets.

I gripped the wet hand ropes and swallowed hard. Those tough and wonderful friends had fulfilled the wish I made at Machu Picchu . . . to be transported back to Inca times . . . to draw a breath of life as it was before the event at Cajamarca 441 years ago, when Europeans fell upon the empire like invaders from outer space.

*(Continued on page 786)*





**Sinews of empire**, straw bridges such as this rare surviving span once carried Inca armies to and from their imperial conquests. Author McIntyre found this Inca-style *keshtwa chaca* on the upper reaches of the Apurimac River, nearly 12,000 feet high in the Peruvian Andes.

Neighboring farmers rebuild the bridge every year, a responsibility they have fulfilled since Inca times. When new, the span of braided straw can support dozens of people at a time; in its deteriorated condition, as seen here (right), no one dares cross it.

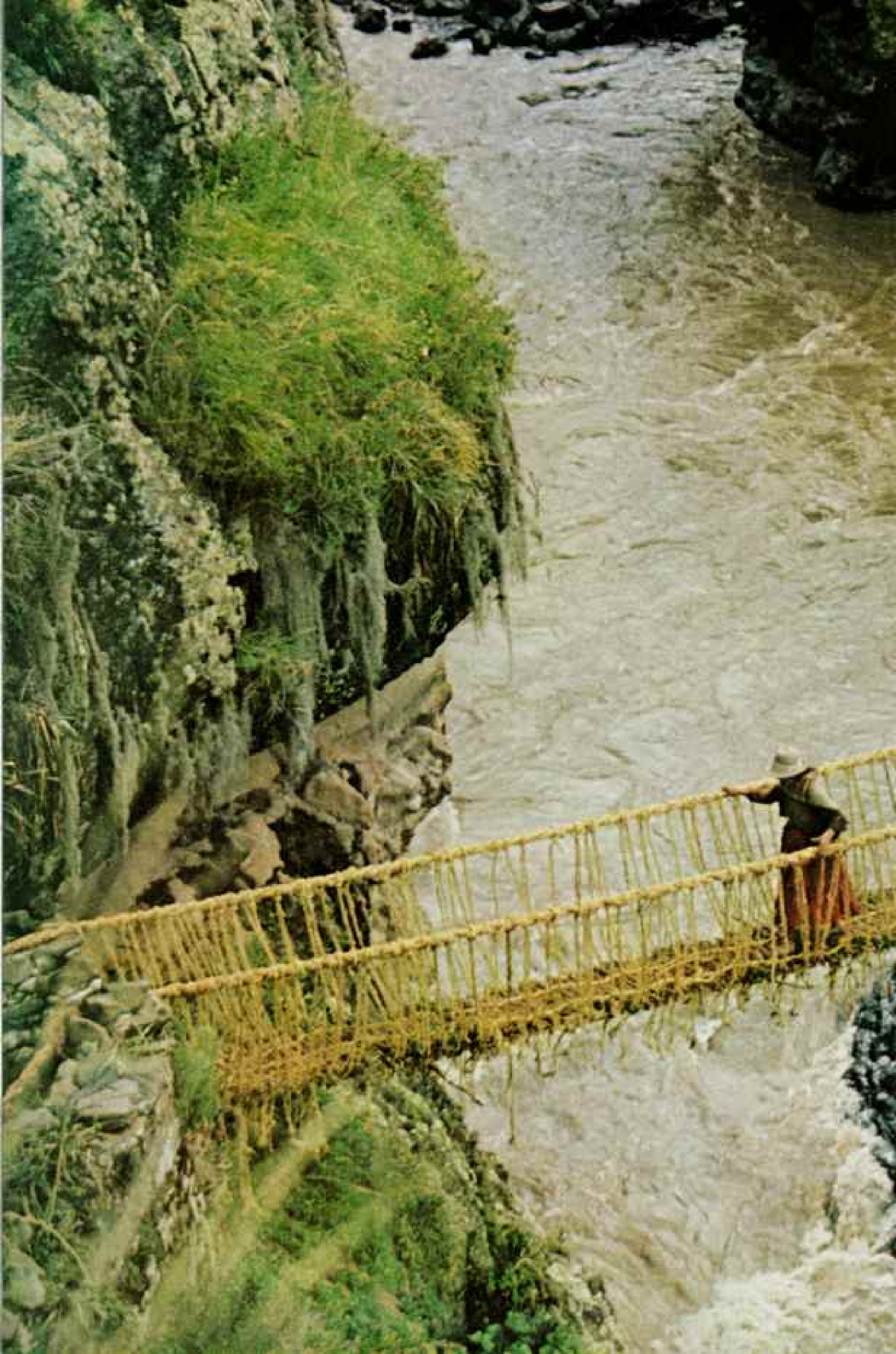
Villagers (above) transport one of the heavy braided cables used in rebuilding the bridge. In all, some 22,000 feet of hand-spun rope go into reconstruction of the span, which sways 60 feet above the river.

Once the six main cables have been strung across the gorge and anchored to rock bollards, the bridge builders cage the sides with smaller ropes (facing page) so that not even a child can fall through. Finally, a footing of twigs is laid down.

**Completed span** carries highlanders over the Apurimac's boiling torrent (pages 784-5), a scene often witnessed and marveled at by early Spanish chroniclers.











MICHICA GOLD MUSEUM, LIMA

**Gold—the Incas' undoing.** Dreams of treasure lured Francisco Pizarro to the realm of the Incas. By a daring stratagem, he ambushed and captured the Inca Atahualpa in 1532. Ceremonial gloves of beaten gold from a Mochica tomb (above) recall the tons of glittering ransom that Pizarro exacted for Atahualpa's release. The execution of Atahualpa brought to a shattering end the glory of the Inca Empire, though its headless body would writhe another forty years before Spanish domination was complete. To this day the fabled wealth of that lost empire lures latter-day Pizarros—plunderers who for centuries have ravaged pre-Columbian graveyards like this one near Lima (facing page). Their obsession: to eke a last few ounces of treasure from this golden chapter of South America's history.

**A**FTER THE SPANIARDS captured Atahualpa, he ruled for eight months from a prison compound in the triangular plaza, keeping his lordly mien, his authority unquestioned by any subject of the empire. Female attendants dressed him in robes of vampire-bat fur, held food to his mouth, and ceremonially burned everything he discarded. Great chiefs trembled in his presence, and he even had his brother Huascar executed.

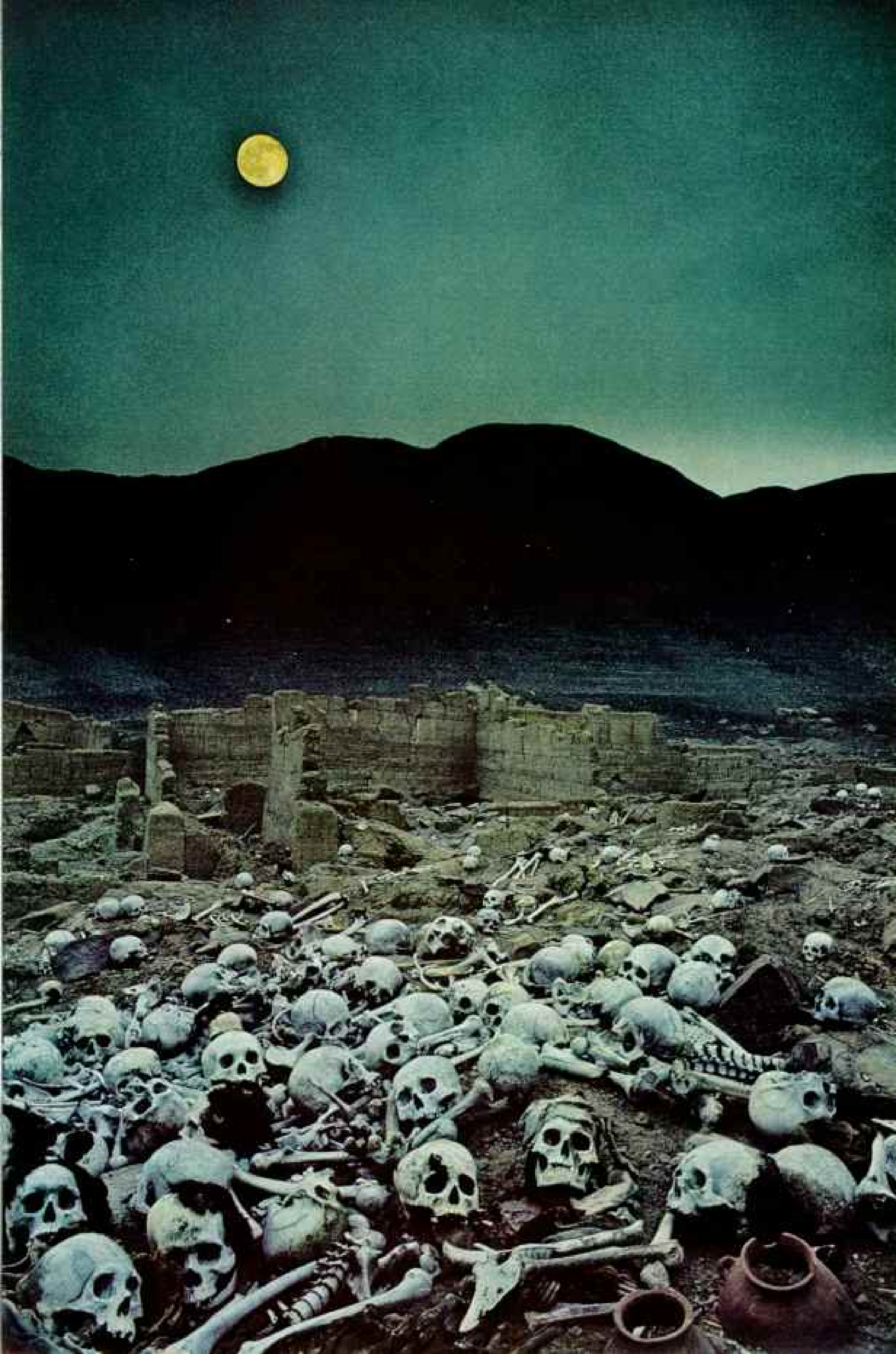
To secure his release, Atahualpa decreed that the realm be ransacked to fill a 17-by-22-foot room once with gold, as high as he could reach, and twice with silver. Totally unaware that Pizarro's men spearheaded a massive European invasion of the Tahuantinsuyu, he presumed the bearded ones would go away once they had received their booty.

By July 1533 more than 24 tons of exquisite treasure had been collected: idols and chalices, necklaces and nuggets, accumulated through centuries of placer mining. Though this was only a fraction of the plunder that awaited the Spaniards elsewhere in the Four Quarters of the World, Atahualpa's ransom, as duly recorded in the Spanish archives, was worth at least 25 million dollars at today's bullion values for gold and silver.

Nine forges worked for months to reduce the creations of master craftsmen to lumps of gleaming metal. Each horseman's share was 90 pounds of gold and 180 of silver; a foot-soldier got half as much. Pizarro refrained from melting down many magnificent pieces and sent them to Spain as part of the king's share, the "royal fifth," but the king promptly turned them into coin. Not a relic remains of that fabulous roomful, not even the 200-pound golden litter Pizarro saved for himself. It's anyone's guess whether it eventually became a bag of barnacled ingots calcified into a Caribbean reef, a bar in a Swiss bank, or the protective sheath of a space probe.

Spaniards newly arrived from Panama, denied an equal share of the ransom, clamored to get on with the conquest. The last of the Inca emperors was not freed but sentenced to death for treason against the strangers within his own realm.

To avoid the horror of being burned as a heretic and thus deprived of mummification, Atahualpa accepted baptism and took Pizarro's Christian name: Francisco. Then the Spaniards garroted Francisco Atahualpa, thirteenth Inca, and marched down the royal road to Cuzco. □





# A town . . . a mountain . . . a way of life

ARTICLE AND PHOTOGRAPHS BY  
JILL DURRANCE AND  
DICK DURRANCE II  
NATIONAL GEOGRAPHIC PHOTOGRAPHERS

**P**LUNGING DEEP in the powder snow, Jill and I swoop through woods and untracked glades as we ski a wilderness trail on the back of Colorado's Aspen Mountain. About halfway down we float into the clearing above Hurricane Gulch.

Suddenly a loud "whomp" breaks the stillness, and a fracture rips the snow behind me. A hundred-foot-wide slab avalanches me into the trees.

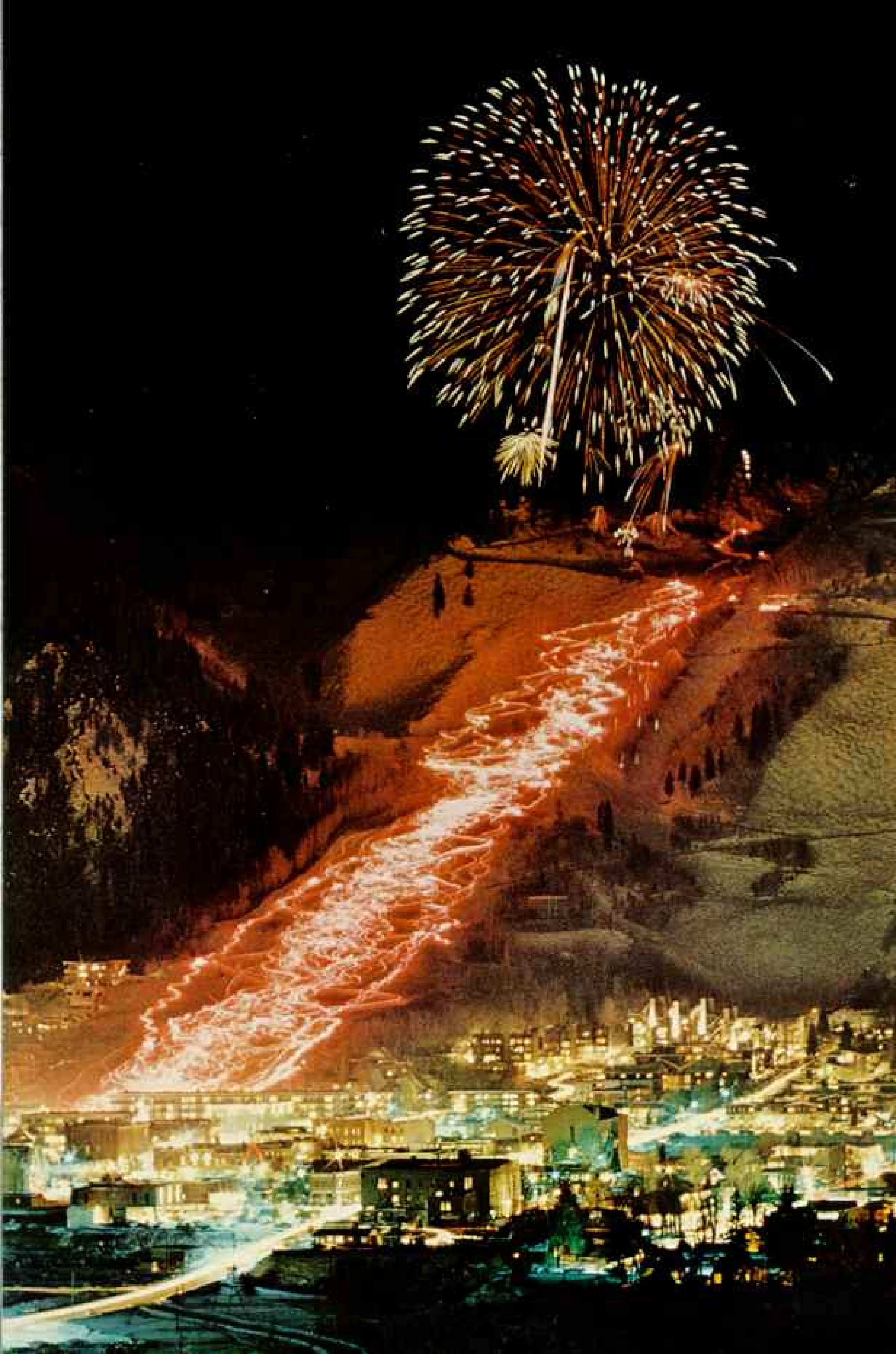
I grab a trunk. Churning snow pulls me away. I reach for a branch but miss. Slammed into another tree, I cling to it with all my strength. Below me the speeding mass drops three hundred feet into a ravine.

Through the settling snow I can see Jill safely above the fracture line. Frightened and humbled by the awesome power the mountain has unleashed, my wife and I make our way cautiously to the bottom. When I was a boy growing up in Aspen, my parents had taught me to be wary of avalanches, but living away from Aspen for the past ten years, I had forgotten how dangerous they can be.

**Flying a plume of snow, a skier knifes through deep powder on Colorado's Aspen Mountain. At its foot lies Aspen itself, hub of the nation's largest ski complex. An equally lively magnet in summer, the restored mining town throbs with concerts, conferences, and classes in the arts.**









The Aspen my family moved to in 1947 was a Colorado mining town, 8,000 feet high in the Rockies. Its crumbling Victorian mansions told of better days, and its dusty streets were so quiet my mother rode her horse downtown to get the mail.

My father was attracted to Aspen by industrialist Walter Paepcke, an energetic idealist whose sharp features concealed a broad mind and a gentle wit. Paepcke had begun in 1945 to forge in Aspen a community where men could live a balanced life of work, leisure, and play.

He provided work by raising money for Friedl Pfeifer to build two ski lifts, which he asked my father, a national ski champion, to manage. For leisure, which he defined as time spent for self-education, Paepcke established a music festival and a center for humanistic studies. Play he left for the mountains, lakes, and streams to provide.

### Minds and Bodies Both Get Attention

When I returned to Aspen with Jill in mid-1972, we found Paepcke's dream flourishing.

We bicycled to the Aspen Music Festival's amphitheater to hear renowned cellist Leonard Rose perform Ernest Bloch's rhapsody *Schelomo*. As we sat among the couples, children, and dogs on the lawn surrounding the tent, Rose's music mingled with the sound of rustling aspen leaves, for which the town was named.

At the secluded Aspen Institute for Humanistic Studies, Robert O. Anderson, the urbane chairman of Atlantic Richfield Corporation, who assumed responsibility for the institute when Paepcke died in 1960, described it as a crucible for thought and action. "The backbone of the institute is the Aspen Executive Program, where we bring business executives together with scholars and leaders of labor and government for two weeks of mind-limbering discussions on such topics as the roots of power, as well as body-loosening exercises at the health center.

"Coordinated with the executive seminars, we have scheduled sixty conferences and workshops on subjects ranging from international arms control to early childhood learning. Experts in these areas may come for just one session or, if they participate in our Scholars- and Artists-in-Residence Programs, stay as long as three months."

Daniel Schorr, veteran CBS news commentator, says of the programs: "They are exciting for me because I think about things I don't usually think about, and I meet people I would not otherwise get to know. I find it difficult to pinpoint any specific changes wrought by

**Volcano of light,** Aspen Mountain erupts with fireworks while flare-bearing skiers create a glowing river on its flank. The annual spectacle highlights Winterskol—"winter cheer"—a four-day festival of zany parades and contests. In one wacky race competitors wobble along on bicycles—each overladen with four riders and a dog.





the experience. What changes do occur, I think probably are subconscious."

We found Paepcke's concept of leisure reaching far beyond the institutions he fostered to organizations taking root all around Aspen. At the Living Arts Foundation, *T'ai chi ch'uan* master Marshall Ho'o led us slowly through ancient Chinese exercise postures. In the academic format of the ancient Greeks we sat at the feet of celebrated architect Louis Kahn during the 23rd annual International Design Conference as he described his plan for the Salk Institute in California. We

watched potter Jim Romberg throw a vase from a spinning lump of clay for a craft class in the Brand Building studio, and I gave a class in photojournalism at the Center of the Eye photography school.

#### Success Came to Aspen on Skis

A key to the success of Paepcke's dream has been the growth of the ski complex. Since my father left the skiing corporation to start a film company in 1950, the ski facilities have spread to three more locations—Buttermilk, Snowmass, and Highlands (map, page 791).



Treasuring its old-time look, Aspen recalls the past with Victorian facades and a stovepipe-hatted sandwich man (left). Born a rough-and-tumble mining camp in 1879, the town toiled its way to prosperity, wrenching as much as ten million dollars a year in silver from ore-laden mountains close by. One nearly pure nugget (below) weighed 1,840 pounds—not 2,330, as the figures in this 1894 photograph suggest. Even so, it was too heavy to get up the mine shaft intact, and its finders had to break it into three pieces.



ASPEN HISTORICAL SOCIETY

At the four areas 33 lifts serve 300 miles of groomed trails.

"I never, never figured Aspen would get this big," laughed Friedl Pfeifer, the permanently tanned Austrian ski promoter who, after working to establish the ski corporation in 1945, ran the ski school and the Buttermilk ski area—also founded by him—until 1963. His husky voice rose above the boisterous Christmas-holiday din at the Red Onion, Aspen's oldest saloon. "It is hard to believe now, but in the early 1950's we had to pull investors in by their shoestrings."

From our window table we could see a light snow falling on the after-ski crowd strolling from prosperous old false-front stores to restaurants named to retain the mining-town flavor—Mother Lode, Shaft, Aspen Mine Co.

Grade-school kids amid the throng hawked the *Aspen Times*. A quick look through the weekly's list of activities would have swelled Walter Paepcke's chest with pride. It's difficult to imagine a mountain activity or cultural pursuit not advertised.

Clearly, Aspen has become a consummate resort. In 1972 it lured some 300,000 visitors



Arena for the humanities, Aspen attracts such summer visitors as architect Louis Kahn (above), here lecturing at the annual International Design Conference. Resident musicians accompany guest cellist Leonard Rose during the music festival (facing page).

These and other adventures in enlightenment reflect the lifelong dream of Aspen developer Walter Paepcke, who in 1945 envisioned the town as haven for the "full man," one who loves both arts and sports.

Sequestered in their mountain home, *Exodus* author Leon Uris and wife, Jill, mull over photographs she made for their forthcoming book on Ireland (right).









to its streets and surrounding mountains.

As the tourist business grew, so did the community. The town's 1947 population of 700 had expanded to some 3,000 year-round residents in 1972. The new arrivals refurbished peeling old mansions and covered the surrounding mountainsides with spectacular cantilevered homes. They were excited about discovering what one Aspenite called their "lotus land": a small town, bursting with big-city culture, surrounded by wilderness.

One resident who returned to Aspen after an eight-year absence is sculptor Bill Jamison. Lean and weathered like much of his work, Jamison led us up groaning mine-beam stairs to the third-story cupola of his studio, an old mine shed he rebuilt with timbers, bricks, and spikes salvaged from the nearby Durant Mine.

"Aspen is a great town for an artist. I feel free here, free to build this shed as a work of

Living a life of glamour, Aspenites gather at the home of Edgar B. Stern, board member of Sears, Roebuck. Aspen regularly lures many other notables, among them actress Jill St. John and World Bank President Robert S. McNamara.

art. All my work is done with recycled materials. I made my tools out of scraps of iron dug from the dirt floor of this shed, and found the six-ton stone I'm sculpting for the town mall in an abandoned marble quarry."

As we lounged on pillows in his cupola watching Aspen's lights flicker on, Jamison continued: "There is a lot of energy in this town, a lot going on all the time. Eight years ago few people were interested in art. Now the town wants sculpture on the mall."

#### Too Popular for Its Own Good?

Many Aspenites, including Jamison, fear that their freedom, as well as the surrounding wilderness and the small-town atmosphere, are threatened by the ever-swelling flood of visitors and new residents.

D. R. C. Brown, whose thick western drawl was shaped on his father's ranch 30 miles down the valley, has been president of the Aspen Skiing Corporation since 1957. Today he is battling to provide skiing facilities to meet the demand created by continuing real-estate development in the Aspen area.

"We have here the world's best skiing at our back door, and it is reaching its saturation point," Brown said, running a hand over his bald, freckled head. "We just cannot let everyone go up the mountain who wants to. Last year we had to limit the number of season passes in order to ensure good skiing for the tourists." It was a decision that embittered many townspeople who had moved to Aspen especially for the skiing.

"The developers building subdivisions for new residents," Brown continued, "have to recognize that their demand for additional ski facilities must now compete with the growing public demand for wilderness preservation. Our ability to expand is limited."

By 1972 the developers had alarmed so many townspeople that two young lawyers campaigning on growth-control platforms were elected to the three-man board of county commissioners, the body most responsible for development in Aspen and surrounding Pitkin County.

Living a life of her own, quiltmaker Cheryl Burrows reads tarot, or fortune-telling, cards in her homemade tepee four miles from Aspen. Without electricity and running water, she finds happiness amid the solitude of her mountain world.

"Why do we have to grow?" asked new commissioner Dwight Shellman. "We have 15,000 guest beds in Aspen. There is demand from all over the world for those beds, and there is no way we can meet an unlimited demand. We may as well stop now and save what we've got, because the pressures to expand are not going to go away."

My former ski coach, Gale Spence, now co-owner of a successful sports shop, has lived through Aspen's leaner years. Spence and other longtime Aspenites view growth from a different perspective.

"Sure I'm concerned about growth. But, dammit, it used to be that a man couldn't make a living here. The guys that really make me mad are the Johnny-come-latelies who don't want to let anyone else in. They don't know anything about the days when a guy had to cut trees on a trail crew for a dollar an hour just to stay alive. If those guys stop all growth, this town will dry up."

The battle over growth is waged every Monday in the small green commissioners' room at the county courthouse. Through a strict interpretation of established laws, the new commissioners have begun denying building permits to many developers.

"I've followed everything that is required by the state and the county. What more can I do?" asked one infuriated developer when refused a building permit. "Do you really think you are being fair?"

"Tom, we have to deal with this problem, and you are just one of the first guys up," answered Commissioner Shellman.

"Well," replied the developer, "all I can say is that you're going to be the cause of 21 good men getting laid off tonight."

#### Silver, Not Snow, Brought First Boom

Aspen had boomed before. The silver strike of 1879 brought 11,000 people, two railroads, an opera house, ten churches, 43 saloons, a literary society, and a telephone exchange. It was a flourishing community shipping out millions of dollars' worth of silver. Then, just as dramatically as it began, Aspen crashed



into bankruptcy in 1893 when the United States repealed the Sherman Silver Purchase Act. That ended the government's obligation to buy the metal, and the Colorado silver fever came to a cold halt.

"Let me tell you about the men who made Aspen one of the richest towns in the West," beckoned John Herron, 82-year-old former mine operator, as he perched on the edge of his rocking chair. Lumps of silver ore were encased like objects of art in the tidy parlor of his Victorian house.

"B. Clark Wheeler. He was a swash-buckler! He weighed 220 pounds and stood about 6 foot 5. He wore great big boots, and they said when they heard him coming down the street it was like the cavalry moving into town. He's the one who named the settlement 'Aspen.'"

John reached into his ore collection and proudly handed me a silver nugget the size of



LEE REMICK (OPPOSITE PAGE)





Pied Piper in a cowboy hat, itinerant flutist Anthony Gordon (above) vainly tries to captivate a youngster. Aspen's summery ambience draws many another wayfaring minstrel, whose tunes echo from parks and street corners in casual counterpoint to formal concerts by world-famed musicians.

"The perfect place for me," says singer John Denver (left) of his hometown, where snow-peaked crags inspired his best-selling record "Rocky Mountain High."

a softball. "This came from one of the mines my father worked. But you should have seen the nugget they found in the Smuggler Mine in 1894. It was the biggest ever discovered. The miners called up the owner, David Hyman, in Denver, and the railroad company gave him a special car for all his family and friends to come see it. The cavern was encrusted in silver, and right there on the top was that 1,840-pound nugget [page 793]. Hyman said he never saw such a beautiful sight in his life. Of course, he could say that because he owned it."

John clenched his fists in excitement at the thought of so much silver in one stope. Then he changed the subject. When did I think the first skiers had come to Aspen? I suggested 1936.

"No, 1880," he answered gleefully. "In March of 1880 H. B. Gillespie and Henry Staats skied over Independence Pass on eight-foot-long 'Norwegian snow-shoes.' They traveled at night on the frozen spring slush and beat the horde of prospectors rushing to the tiny tent settlement at Aspen."

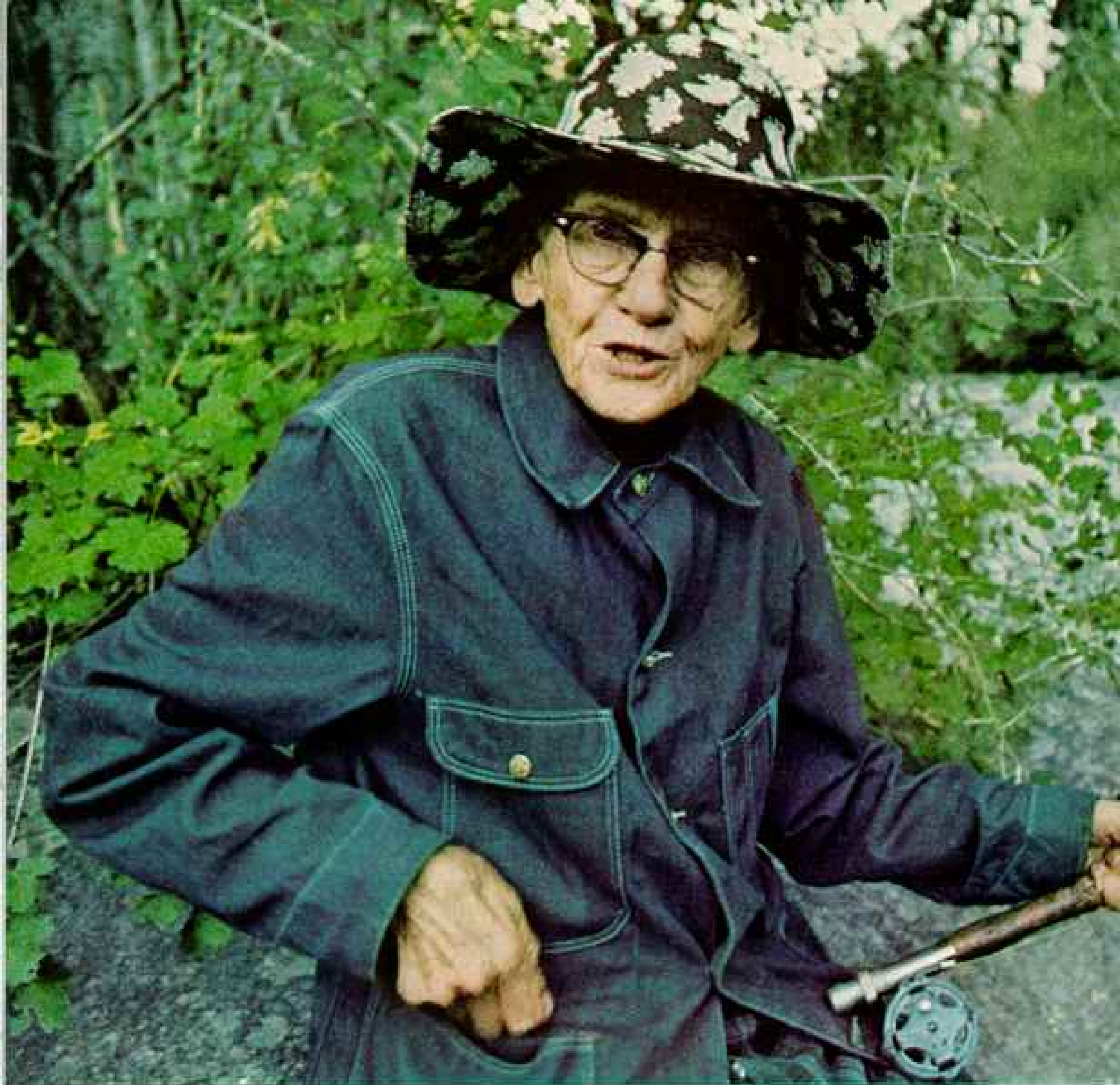
#### Backcountry Retains Its Wild Aspect

Like most Aspenites, Jill and I spent a lot of our time exploring the backcountry. A good part of Pitkin County is still as wild as it was the night Gillespie and Staats skied into Aspen. Some 750 of the county's 974 square miles are national forest, and 111 square miles are designated as the Maroon Bells-Snowmass Wilderness area (pages 804-805).

Early one January morning we snapped on our 32-ounce descendants of those eight-foot Norwegian snow-shoes of 1880 and set out for an overnight ski tour into the Maroon Bells-Snowmass area. By the time the morning sun broke over Highland Peak, our fresh tracks cut deep into the wilderness. The only sound was cold snow squeaking underfoot.

Wind was ripping a plume of snow off the 14,156-foot summit of Maroon Peak when we reached Maroon Lake that afternoon. Fearing a storm, we quickly trampled down a tent site, gathered dead branches for tent stakes and firewood, and dug a deep pit to shelter our fire from the wind.

As we settled in the pit to eat dinner and watch the full moon rise, the wind turned on us, blowing smoke into our eyes and snow down our necks. We took a quick moonlit tour to get a better look at the glowing mountains, then burrowed into our goose-down



*Still fishing at 82, Sylvia Maurin works Castle Creek, where she hooked a*

sleeping bags. The winds lashed our tent all night. By morning we had to dig ourselves out from under a snowdrift before starting our unhurried tour back to town.

#### **Summer Sojourn in a Miner's Cabin**

As the winter wilderness was austere, so the summer wilderness was gentle and lush. One July afternoon Jill and I hiked up through a carpet of lavender columbine, black-eyed Susans turning with the wind, and fragrant wild roses to a miner's hand-hewn cabin high on Aspen Mountain. Some friends had asked us to look after the eighty-year-old cabin while they hiked into the backcountry.

Gradually easing into the slow rhythm of mountain living, we hauled water from the spring, weeded the garden, ground grain, and baked bread. In the afternoons we basked in the sun or hiked over Richmond Hill.

Splitting logs to fire the stove each day, I acquired a towering admiration for the miners who in the 1880's felled, trimmed, squared, and notched by hand the logs for their mines and cabins.

Each night after dinner and a cup of rose-hip tea, Jill and I walked through the blue lupine and closing dandelions to a point overlooking Castle and Conundrum Creeks, where we watched the last sunlight linger on the



*record rainbow trout in 1969.*

snowy face of 13,561-foot-high Hayden Peak.

We hiked the four miles down from our mountain retreat to Aspen one morning to go fishing with 82-year-old Sylvia Maurin (above). She was sitting by the screen door of her cottage, her lean shoulders bent like a brittle bow over the tangle of fishing line in her lap. A modish wide-brimmed hat nearly hid the bashful smile that eased across her small thin face. "Sometimes it takes a lot of patience when things go wrong and you want to go fishing," she said.

With a can full of earthworms in her satchel and her fishing rod slung jauntily over her shoulder, she led us along Castle Creek to

the spot where, at age 78, she had caught the biggest fish ever hooked in the creek, a five-and-a-half-pound rainbow trout.

As a child in 1900, Mrs. Maurin had played along the creek while her father loaded ore at the nearby mine. "I'm gonna tell you something," she said, leaning toward us. "My parents named me Silver Dollar, but I was afraid the kids would call me Two Bits or something, so I called myself Sylvia. I thought it sounded more sensible."

Within an hour she had caught the limit, and then she gave them to me. "I love to fish," she said. "Guess it's because I feel close to God and nature when I'm fishing. But I don't like to eat them."

Walking back to town, she reminisced about Aspen during the mining days. "We had really nice things here then. On Saturday nights the band always played. The streets were crowded. Everyone was dressed up fit to kill. I kind of enjoyed that way of living. It seemed more refined in some ways."

#### *Crazy's the Word for Winterskol*

The Aspenites Mrs. Maurin recalled were certainly more dignified than the bicyclist we saw pedaling down snow-mantled Main Street with half a kayak on his head and a ski on his left foot, leading the 22d annual Winterskol parade. Aspen has always been a fun-loving town, and everyone puts together a costume for the January festival's rollicking parade. Draped in togas, members of the Rugby Club tossed candy from their Roman-orgy float. Behind them, doctors from the Aspen Clinic staged a shoot-out on their rolling recreation of a mining-days bordello.

Jill and I and two friends raced as a team we called Fickle Finger Fotographics into the finals of the Winterskol ski championships, where, unfortunately, costume did not count as much as speed. We joined a cheering crowd at the Willoughby jump as daredevils somersaulted into the air (pages 802-3), trying to throw the most spectacular flip of the day. The crowd "ooohed" as they sailed through the air and roared encouragement when they somehow staggered to their feet after horrendous crash landings.

Jill joined in Winterskol's climax, a night descent of Aspen Mountain commemorating the miners who hiked down from their mines by torchlight. Cameras ready, I stood across the valley shivering and stamping my feet

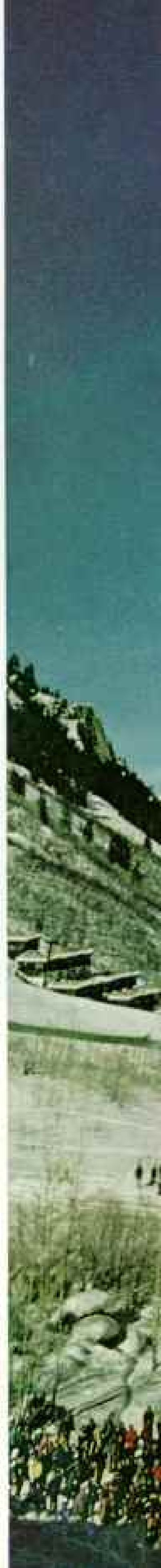
*(Continued on page 806)*



Playground of thrill seekers, Aspen draws aficionados of nearly every mountain sport. One daredevil's high-flying somersault (right) wins points in the Winter-skol "hot-dog" event, a competition for stunt men on skis. Boldly contorting in gainers, helicopter spins, and other acrobatics, contestants strive to make the most hair-raising jumps. Crash landings last January produced at least one broken nose and four cases of crushed vertebrae.

Slumped in defeat, a motorcycle racer (left) straddles his wrecked bike seconds after spinning off a rain-soaked dirt track.

Kayak instructor Kirk Baker (below) muscles his way through rapids of the Roaring Fork River. Aspen's domain also challenges outdoorsmen with rock-climbing, hiking, fishing, deer and elk hunting, and horseback riding.









*Fleeting gift of the Rockies' brief summer, sunflowers glow against a snow-dappled backdrop in the Maroon Bells-Snowmass Wilderness area. Largely national forest,*



JILL BURRANCE

Aspen's Pitkin County annually blazes with color. Wild flowers burst forth by the millions beneath towering evergreens and the shimmering highland trees for which Aspen is named.



JILL DURRANCE

for warmth when the long-awaited signal, an arching firework, exploded above the lights of Aspen (pages 790-91). Jill and the other 250 exhilarated torchbearers sparked their flares and skied into the darkness.

"It was like a cascade of fireflies pouring off the mountain and into town," I told Jill, as we sat later that evening in the quietest place we knew, Bruce LeFavour's Paragon restaurant. Sequestered in the Victorian splendor of a private dining room, we celebrated the end of Winterskol with an excellent wine and superbly prepared veal.

Had we been able to muster the energy after dinner, we might have joined the throbbing mob dancing to a big-name rock group at Danny's or the Gallery, or cheered Joan and Mead Metcalf singing cabaret hits at the Crystal Palace. Instead, we swirled our cognac in a quiet corner of Jake's Abbey. Listening to balladeer Chris Cox, we wondered if he would go on, as did Glenn Yarbrough and John Denver (page 798), from a bistro in Aspen to international stardom.

Many of the celebrities who pass through Aspen come back to stay.

"Like Sleeping Beauty," says Mrs. Walter Paepcke (left) of the Aspen she first saw in 1938 and later introduced to her developer-husband. Since its 1890's heyday, the town had slumbered, a backwater with an Old West atmosphere. Mr. Paepcke sought to preserve that flavor as he aroused and rejuvenated Aspen.

Today his widow lives here part of the year, finding joy in her garden and philanthropies, which include a wildlife research station and pathobiology laboratory.

Oasis on Main Street, Pierre Pelletier's lemonade stand (right) bespeaks the small town that still tempers Aspen's big-city awareness and ski-resort appeal. Visitors from all over the world bring the town its present success—and dilemma. If growth continues unchecked, can the town's distinctive personality survive?

Leon Uris, author of the best-selling novel *Exodus*, moved to Aspen nine years ago (page 794). "As a writer I can live anywhere," explained the ruddy, amicable author as he and his wife, Jill, showed us through their baronial mountain compound filled with mementos from a lifetime of traveling. "I chose to live here because there is a quality of life in Aspen that most of the country is crying for. It is disappearing not only in America but all over the world."

Uris's words reaffirmed what Robert O. Anderson had told us at the Aspen Institute for Humanistic Studies.

"No other town I have ever known has such a complete grip on people once they've been exposed to it. On paper Aspen has everything—highly educated people, wilderness, skiing, and small-town atmosphere. Yet it is floundering in terms of direction because there are as many opinions about growth as there are people. If Aspen cannot come to grips with this problem, I don't think any community can.

"Oh yes," he added with a smile, "of course I'll stay. I have to see the next chapter." □



ICE  
LE

HEAVY



*"...I ponder... what seems like a certain rendezvous with death."*

# Alone to Antarctica

By DAVID LEWIS

DRAWINGS BY NOEL SICKLES

**T**HE SITUATION is not encouraging. My 32-foot steel sloop *Ice Bird* lies dismantled, wallowing uncontrollably in the wild seas of the sixtieth southern parallel, swept by zero-temperature winds and snow showers.

Water spouts through the split coach roof at every roll. The motor is finished, the self-steering gear shattered, radios waterlogged, stove broken. But all these are of little moment compared with the loss of the 36-foot mast—and my agonizingly frostbitten hands.

*Ice Bird* and I are 3,600 nautical miles and six weeks out of Sydney, Australia, on the first attempt by a single-handed sailor to reach the blizzard-swept ice and rock escarpments of the Antarctic. Now she lies badly injured after being rolled completely over by a raging storm, still 2,500 miles from our destination and near the world's most distant point from land (map, pages 810-11).

As I sit disconsolately in the shambles of the cabin, I ponder the overmastering urge that has led me into the lonely wastes of the southern ocean, to what seems like a certain rendezvous with death.

I had long been obsessed by Antarctica—that vast white continent at the bottom of the globe. It lies entrenched behind grinding pack ice and tall bergs, moated by the furious storms of the screaming sixties. Waiting. Challenging. To try for it, relying entirely on my own resources, was to accept the ultimate challenge of the sea.

No lone sailor had made the voyage, even in a stout and seaworthy vessel, and not even across the relatively narrow Drake Passage from South America. How could my wreck now achieve the impossible?

I had firsthand knowledge—indeed, I had made a lifelong study—of other challenges of the sea. I had sailed alone across the North Atlantic three times, circumnavigated the world in a catamaran, and spent years crisscrossing the Pacific, using navigational methods invented by ancient Polynesians. Still, the sea track to Antarctica always beckoned.

As early as 1964 I had consulted Sir Vivian Fuchs, head of the British Antarctic Survey. Through his advice and that of others, I realized that Australia was really a most unsuitable point of departure. The only portion of the Antarctic Continent readily accessible to small craft was the Antarctic Peninsula, whose western coastline was free of pack ice

during only three to four months of the year. But it was 6,000 miles, a fourth of the earth's circumference, away from Sydney.

I found I must sail by mid-October if I hoped to be near the peninsula in time to take advantage of the December breakup of the pack ice. Unfortunately, this would place me southeast of New Zealand and over the Pacific-Antarctic Ridge, a zone notorious for converging storm tracks, at the time of the dangerous spring gales. In this region, according to the Soviet Antarctic Atlas, monstrous waves more than a hundred feet high are sometimes encountered.

*Ice Bird* had to be able to take a battering from sea and ice that to my knowledge no vessel of her size had ever been asked to withstand. She had to be watertight above and below. Her deep two-and-a-half-ton keel ensured that she would right herself even in the dreaded event of a capsize, but only if her deck, hatches, and windows remained intact to prevent swamping.

One friend described *Ice Bird* as a "coffin." Actually, in the great, cold seas that lay ahead, the only practical way to sail was from below decks. I fitted my little yacht with steel plates over the windows, a self-steering gear, and a roof dome, like a shield, of clear plastic. With virtually 24 hours of daylight at that season, I could stay sheltered below and still see ahead to avoid floating ice. When outside the cabin, I always wore a long safety line.

**A**N AUSTRALIAN FRIEND who describes himself as a "racing man" called to ask, "How are you off for food?"

"None yet," I replied wearily.

"Cheer up, she'll come good. You order \$400 worth and charge it to me."

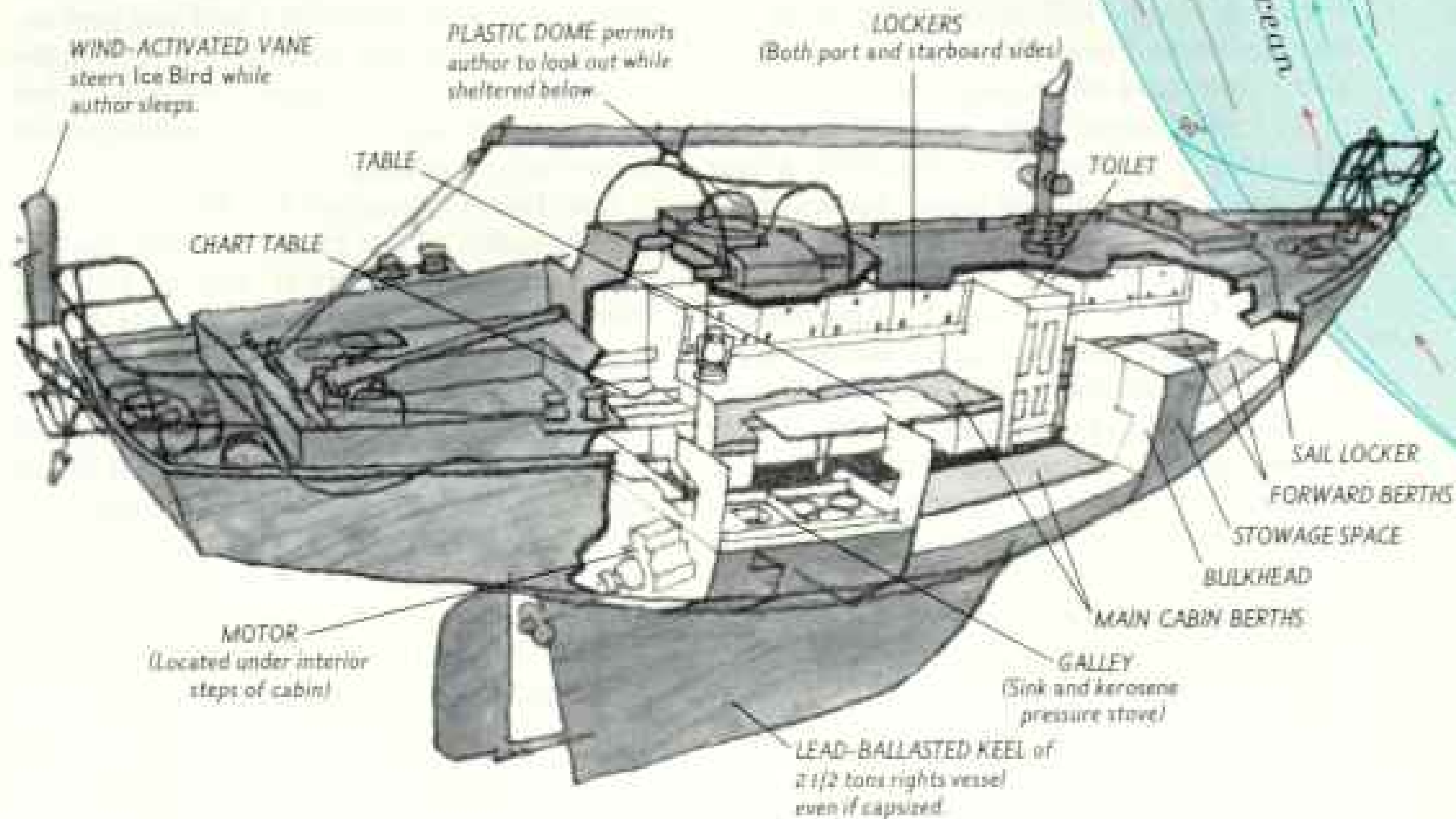
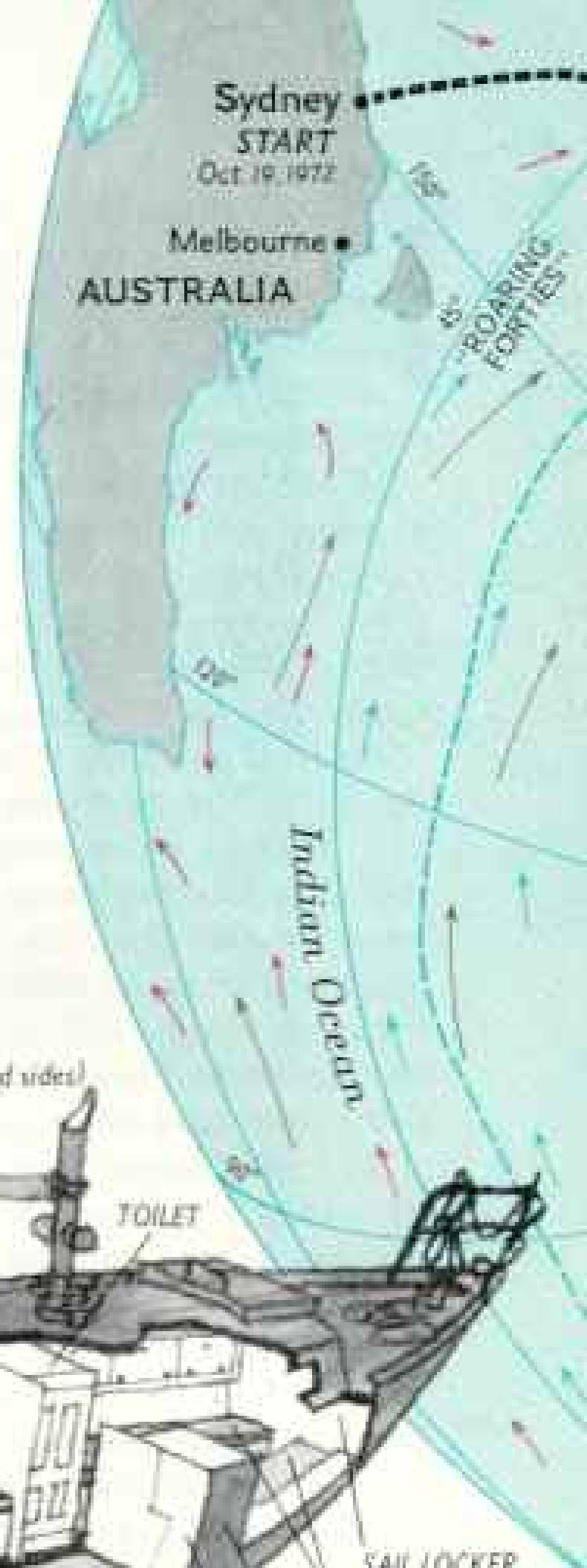
An equally generous sportsman presented me with a \$500 Beaufort life raft. (It is now blowing round and round the world along the sixtieth parallel. Should any reader happen to come across it—the serial number is 3514—I should be glad to have it back.) My expensive self-steering gear was the gift of an American.

One government department was particularly anxious for me to contact them. I telephoned Melbourne. Was I acquainted with the Antarctic Treaty? Did I know that blue whales were very strictly protected?

"Do you think," I asked, my mind boggling

Setting out in 1895 in the 37-foot sloop *Spray*, Capt. Joshua Slocum became the first man to circumnavigate the globe alone. His feat continues to fire the imaginations of small-boat sailors. In the past decade Sir Francis Chichester earned knighthood by sailing *Gipsy Moth IV* around the world with only a single stop. Another Briton, Robin Knox-Johnson, went him one better by driving his 32-foot *Suhaili* around the world nonstop. The youngest single-hander, teen-ager Robin Lee Graham, told of his lonely voyage in the October 1968, April 1969, and October 1970 NATIONAL GEOGRAPHICS.

Now Dr. David Lewis—already a veteran of three solo Atlantic crossings—is halfway to completion of one of the last great small-boat challenges: circumnavigating Antarctica alone, through earth's stormiest waters. As you read this account of the first leg of his incredible voyage, he is once again at sea. *Ice Bird* has been refitted with a new self-steering mechanism and a new mast. Her sails and stove have been repaired. We at National Geographic wish Dr. Lewis and his gallant yacht fair winds and Godspeed.—THE EDITOR



at the thought of tiny *Ice Bird* at grips with the world's largest creature, "that blue whales would be in much danger from me?"

"Well, no, perhaps not."

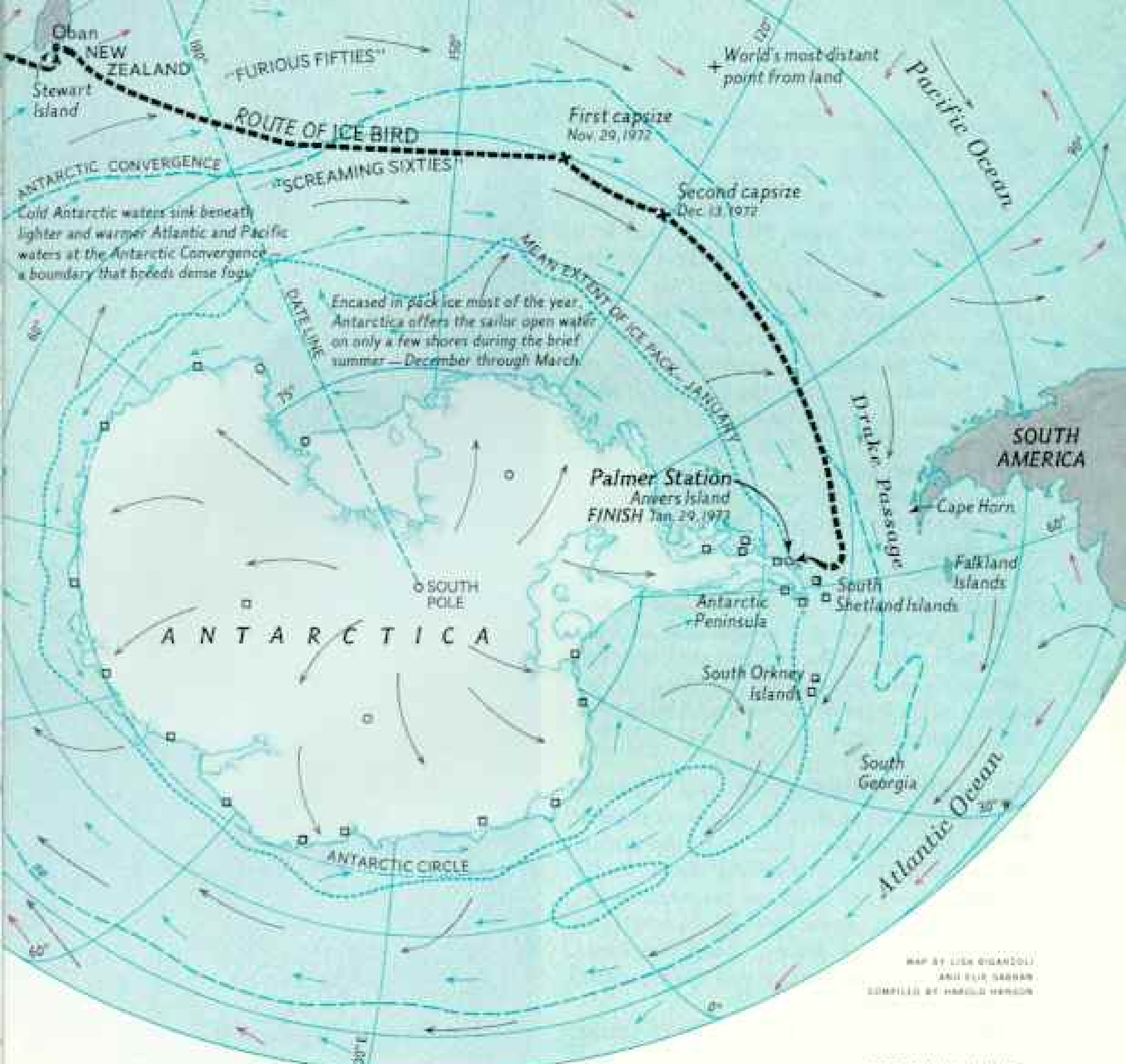
I OPENED MY LOGBOOK on October 19, 1972: *Port Jackson toward Antarctic Peninsula, under way 1 p.m. (Toward, never to. No sailor would dream of so tempting providence.)*

Outside Sydney Heads a few accompanying vessels took their leave. The motor sailer carrying my daughters, 11-year-old Susie and 10-year-old Vicky, circled *Ice*

*Bird* for the last time. How painful was this last wave good-bye. Then I was alone.

That first midnight found me tethered by my safety line on the reeling foredeck, changing down headsails, ruefully aware that I had forgotten how breathtaking were the swoops and plunges of a yacht standing to windward. An unknown ship's lights glowed to port, the first and the last vessel I would encounter at sea during the voyage.

Thirteen days out from Sydney I flung my line ashore at Oban, on Stewart Island, the southernmost town in New Zealand. A figure in overalls jumped aboard.



MAP BY LUCA DIAMANTI AND ELLI SARRAN  
 COMPILED BY HAROLD HANSON

**STATIONS**

- UNITED STATES
- OTHER COUNTRIES

- PREVAILING WINDS
- COLD CURRENTS
- WARM CURRENTS

"I'm the cop," he greeted me. "Come and have a beer." These were the formalities of entry. How good it was to be back in my homeland, New Zealand, once again.

That night the aurora australis flooded the whole southern sky with curtains of pale greenish fire. Beautiful it was, but unearthly cold and remote, and it chilled my heart like a warning.

On November 2, topped up with water and fuel, I motored out of the bay. My plan was to head southeast to latitude 60° S., then to run east for 2,000 or more miles on a track where, according to the pilot charts, there was a

good chance of consistent westerly winds and minimal ice risks. When north of the Antarctic Peninsula, in about longitude 65° W., I would turn due south and sail to a landfall.

As *Ice Bird* and I crossed the fiftieth parallel, on November 5, I felt as if we were entering a wild animal's preserve. At any moment from now on the southern ocean might pounce with overwhelming fury. A taste of its power was provided on the 11th by a gale that blew us across the Date Line. Great smoking seas out of the southeast pounded the little yacht, periodically breaking completely over her. *The rattle of wind-driven*



*snow . . . shows we are getting somewhere. Relax, I advised myself in the log.*

In mid-November I finally reached the sixties and turned my boat toward the east. The temperature inside the cabin was well below freezing. Indoors I wore three woolen jerseys, a Dacron-quilted flying suit, and a padded parka. For any excursions outside, a waterproof jacket, trousers, and my safety belt had to be donned. I kept everything on for days on end during bad weather. My boots, often worn day and night, were insulated; my feet were always wet from sweat but remained warm.

For that matter, the rest of my clothing and the cabin itself functioned in the same way. My clothes were always damp, the sleeping bag clammy, and the mattresses sodden. Everything was wet from condensation and from spray and snow that managed to penetrate the cabin, but the hull and deck shielded me from wind chill and cut heat loss. Nevertheless, some form of heater would have been more than welcome.

**[**LOGBOOK, NOVEMBER 16: *Another gale. How eerie it is to watch snow driving across watery hills that themselves are sweeping by with frothing crests. Radio antenna, lines, and mast are sheathed in ice, and the plastic dome thickly covered with snow. A flock of prions, small ice birds, weaves astern, as ghostly and insubstantial as the very snowflakes.*

Despite the weather I was able to fry ham, pineapple, and two eggs, and make coffee.

I continued to make steady progress toward the east. I was now south of the Antarctic Convergence, that irregular boundary of north-flowing Antarctic water and warmer Pacific water. Fog was frequent and persistent; heavy snow showers were the rule. The fresh water in the tank froze, and I had to fall back on the supply in plastic cans that remained unfrozen inside the cabin. An attempt to make radio contact with Sydney was unsuccessful because of battery failure.

Navigation was not easy: a quick sight of the sun emerging momentarily from cloud

*"Then the huge wave exploded,  
hurling Ice Bird  
crashing onto her side."*





“... *The lower seven feet  
of the mast leaned drunkenly  
over the starboard side...*”

cover, a dubious horizon as *Ice Bird*, rolling wildly, lifted on a crest, while numbed fingers worked feverishly at the sextant.

**E**VENING, NOVEMBER 26: *The worst gale so far is raging, a 50-knot northwester that drives long lines of foam down the faces of enormous waves and literally rips away their crests. Each time a breaking sea slams into Ice Bird everything loose in the cabin goes flying. I am forever thankful for the steel plates protecting the windows.*

*I keep Ice Bird under storm jib, running before the seas at about 20° from a dead run. She's bloody near airborne. Looking astern, it looks as if she cannot rise, but she does easily. Are my tactics right?*

This last is a perennial self-query in gales. Vito Dumas, who circumnavigated the world in the roaring forties in a yacht the size of *Ice Bird*, never took in his jib. Veteran Cape Horner Bernard Moitessier had also suggested the tactics I was adopting—running before gales at an angle under headsail only.

But so many had come to grief in these southern seas. Of the 130 vessels that left European ports for the Pacific in the early summer of 1905, 53 had vanished forever in Cape Horn waters by late July.

The first small yacht to round Cape Horn, the 37-foot Australian yawl *Pandora*, was capsized and dismasted off the Falkland Islands in 1911. *Tzu Hang* was once pitchpoled and then capsized in her first two attempts at rounding the awesome cape, and only last year the 34-foot *Damien* was rolled over three times off South Georgia.

Frankly, I was frightened. The rising gale appeared to confirm what I modestly term Lewis's Law—for every point the wind increases, your boat shrinks one foot.

Nevertheless, there have been brilliant Antarctic successes. H. W. (Bill) Tilman in his 45-foot pilot cutter *Mischief* reached the South Shetland Islands in 1966. In 1970-71 the 53-foot yacht *Awahnee*, with a company of six, circumnavigated the Antarctic Continent along much the same route I was now attempting to follow. At the Antarctic Peninsula,



*Awahnee* encountered an Italian yacht, *San Giuseppe Due*, also a 53-footer.

I was brought back from my musing about other voyages by bilge water surging up the side of the bunk as *Ice Bird* was hurled over on her beam ends. It had not been possible to remove my clothing, safety belt, or boots for the last two nights and days. The seas were wild and irregular, and I was exhausted. Everything was an effort. I made constant mistakes of every kind in sights and workings.



I could not grasp simple concepts. Twice I imagined I heard ill-defined shouts.

**O**N NOVEMBER 29, the dreaded thing happened: The "bottom fell out of the glass"—the barometer's pointer moved right off the scale and continued downward. But long before that it was apparent that something altogether new had burst upon us, a gale nearing hurricane intensity. This was the home of the unthinkable hundred-foot

waves. A breaking sea half as tall, falling upon *Ice Bird*, would pound us flat.

The waves increased in height and steepness with unbelievable rapidity. I had experienced the fury of North Atlantic autumn gales, but never anything like this. By evening the estimated wind speed was more than 60 knots, the seas some 40 feet high and growing taller—great hollow rollers whose wind-torn crests thundered over and broke with fearful violence. The air was full of driving spray.

*Ice Bird* was running downwind under her storm jib as before. Everything was battened down. Suddenly the stern went up and the yacht slued uncontrollably, despite my hauling frantically on the tiller lines. Then the huge wave exploded, hurling *Ice Bird* crashing onto her side. The galley shelves tore loose from their fastenings and smashed across the cabin with their contents.

The precious self-steering vane was gone, its vital gearing shattered. I am not sure whether the storm jib was split at the same time or later, as my recollections are confused. At any rate I went onto the heaving foredeck and hauled the jib down, half blinded as I was by stinging salt spray, gulping for air that was being sucked past by the screaming wind while I tried to keep from being swept away. Finally I crawled back to the cabin, thankfully pulling the hatch shut after me.

The wind kept rising until, for the first time in all my years of seagoing, I heard the scream of hurricane-force winds rising beyond 70 knots. The whole sea was white now. Sheets of foam acres across were continually churned by fresh cataracts. These are not seas, I thought, they are the Snowy Mountains of Australia—and they are rolling over us. I wedged myself on my bunk, clutching the tiller lines, my stomach hollow with fear.

Then my heart seemed to stop as my whole world reared up, seized by an irresistible force, to spin through giddy darkness and then smash down violently into daylight. Daylight! I saw with horror the light streaming through the now-gaping forehatch. My protective cabin had been broken open. *Ice Bird* had been rolled completely over and had righted herself. In that second *Ice Bird* had become a shambles.

I splashed my way forward through knee-high water, the first thought in my mind to close that yawning opening where the forehatch cover had been. My second—I dared not think it—was of the mast. I stumbled over rolling cans, pushed aside the flotsam of clothing, mattresses, sleeping bag, splintered woodwork, and charts. Sure enough, the lower seven feet of the mast leaned drunkenly over the starboard side, the top 29 feet, held by a tortured strip of aluminum and the

shrouds, tilted across smashed lifelines far down into the water, pounding and screeching as the hulk wallowed.

**E**VERYTHING HAS CHANGED in this moment of capsizing. The proud yacht of a moment before has become a wreck. Perhaps everything is coming to an end. Now I must fight to remain alive.

The forehatch has been wrenched open and its hinges sprung. I force it as nearly closed as it will go and bouse it down with the bosun's-chair block and tackle. I notice incredulously that eight feet of the cabin to starboard have been dented in as if by a steam hammer; a six-inch split between the windows spurts water at every roll. What unimaginable force has done this to 1/8th-inch steel?

My wristwatch, kept on Greenwich time for navigation, is still going. The radios are shorted out, so I must now rely upon the watch for longitude, estimating the probable error as best I can.

A hurried search for gloves is fruitless. Well, I may not need them if *Ice Bird* sinks. The pump is broken. Seizing a bucket, I begin bailing for life.

After six hours the yacht is empty down to the floorboards. Then, CRASH! I pick myself up from the corner where I have been hurled, to find us flooded again and the carefully salvaged logbook, charts, and sleeping bag awash once more. When I start bailing again, I see that the life raft is gone.

I am an automaton, bailing hour after hour, actuated only by an instinct to survive. The gale has backed into the southwest, and the glass is rising. The sun breaks through momentarily, illuminating a scene of awesome grandeur. At least I have seen the sun again.

By noon, *Ice Bird* is dry. I pick up a pencil with numb hands, open the sodden logbook, and record the accident: *Gale moderating, force 10-9. Heavy seas breaking against us. Everything soaked and destroyed. Must rest.*

But the thumping of the mast against the hull soon has me on my feet again. I laboriously loosen rigging screws until the sunken mast is held only by two wires, never noticing that as I gash my left hand deeply in two

*"In that second Ice Bird had become a shambles."*



places the wounds neither hurt nor bleed. And incredibly I fail to realize what is wrong.

In the morning my fingers are too numb to feel the winder on my wristwatch, and I realize that my hands are frostbitten.

The remaining shroud and the backstay part at 9:30 a.m., and *Ice Bird* floats free of the wreckage. I hoist 35 buckets of water out of the companionway; later, 18 more. The stove will not light. By now it is evening again. Pressing my unfeeling hands against my body, I doze the miserable night away.

**D**ECEMBER 1: Working in swirling snow, my hands again protected by wet woolen gloves, I clear away the remaining wreckage and rig halyards on the fragile spinnaker pole. I will try to raise it as a jury mast when the weather allows. The motor is useless, soaked by brine. I succeed in getting a burner going on my spare Primus stove, with the aid of waterproof matches, and heat stew and coffee. Sipping it, I think, "This must be Christmas."

The following day frozen seawater coats the deck and snow pelts down steadily, but it is calm. Enough to raise the sorry ten-foot mast and hoist the knotted No. 2 storm jib. How futile seems the gesture. The stark ice barriers of the Antarctic Peninsula are as far from us as New York City is from Seattle. With a pathetic rag of sail and a speed of a good mile an hour, I turn the bow for grim and distant shelter.

*Ice Bird* has to be steered, by tiller lines from the cabin, only when the wind is from astern. With wind abeam she can be left to follow her own erratic course.

Heavy doses of the antibiotic Tetracycline offer the only hope of saving my badly frost-bitten fingers.

As *Ice Bird* crawls slowly eastward through the stormiest ocean on earth, the makeshift mast keeps breaking away. Surprisingly, dying does not seem very important, merely extremely disappointing. The thought, however, of my little girls being left fatherless is intolerable.

On December 9 I write: *I must earn . . . my membership in humanity . . . every day*, and proceed to try for that day's quota by emptying 24 bucketfuls of bilge water and clearing a jammed halyard in a snowstorm. I find myself shouting with pain from my frostbitten fingers. Are they healing?

I longed to be able to pray, to cry out for help, but strangely I was not lonely. My drama was being played out on the vast stage of the ocean, with death lurking in the wings, but my solitude was never lonely. I never experienced total isolation like someone friendless in a big city.

**D**ECEMBER 13: Four inches of the ever-shrinking little mast have broken away during the night. I lower sail in driving snow and spray that stings like hail and tighten shrouds to secure the mast. Inside the cabin I lash down the table and anything else movable in dire anticipation of a growing storm. By early afternoon a huge new storm is raging. Soon killer waves begin to rise.

Comes the dreaded shock, the awful lift, and, for a heartbeat that seemed an age, I stand on my head, before *Ice Bird* crashes over right side up once more. My preparations have paid off. Even though the typewriter is ruined, sodden crackers plaster the cabin, and the sleeping bag is floating, the charts and logbook are safe in plastic bags, and the table has not moved. Stuffing the ventilators with rags has kept water intake down to 21 buckets.

Incongruous notes are struck in the next day's log: *14 December: My paper on Polynesian astronomy is being read before The Royal Society in London today! . . . Night chilly . . . wet sleeping bag—not damp . . . Morale very shaky now . . . no progress. Near despair.*

But this was the darkest hour. The key to survival had come into my head.

The ideal jury mast would be the robust 11-foot-6-inch wooden boom. But it is too heavy and unmanageable for me to lift upright by hand. I have worked out an idea as to how it can be done.

Though the sea still runs very high, I manage to fit one end of the boom into the mast step, the other in the boom crutch. I then attach the mainsheet, the strongest line aboard, and lead it to the bow, then aft to a halyard winch. These preparations, done at the crawl on the tossing deck, take from 8 a.m. to 4:30 p.m. without a break. But too much, life itself, depends upon the outcome.

I begin winching, tense with anxiety. The boom rises a foot, slues, then sticks fast. But only the foot has jammed. On a second attempt the boom mounts steadily, inch by

inch, to the vertical. An hour more and an old cotton staysail, folded in half along the center seam, is hoisted.

A reliable mast at last! One that can stand up to all the sail I can string from it! That night I drink rum and milk in celebration of hope reborn.

I am only too conscious that December 24 is Christmas Day across the Date Line in Australia. Mine is a white Christmas. I toss a Christmas dinner of crumbled crackers to the friendly ice birds. My own bonus is a clearing sky and the first good navigation sights in ten days. If progress continues at this rate—and the strong boom mast is the best guarantee—*Ice Bird* and I will reach land well before freeze-up. I have the chance of a future after all.

**A**S *ICE BIRD* CREEPS eastward into the new year, the question of destination becomes crucial. I decide to make for the U. S. base, Palmer Station, instead of the British Argentine Islands Station. They are only 40 miles apart, but Palmer is infinitely easier of access.

But can I dry out the sodden charts enough for them to be usable? Will an unreliable compass and an uncorrected wristwatch suffice for a fearfully difficult landfall? Will my drinking water hold out?

On January 18 we pass Cape Horn. What matter if it lies 360 miles to the north? I have “rounded” it under sail and am entitled to traditional privileges like toasting the Queen’s health with one foot on the table. Not very elegantly, however. My clothing is rank with the smell of stale urine. My insulated boots have been worn day and night for two months.

For a few days I have had welcome company, two sei whales, whom I name Sniffy and Snuffy. They are about *Ice Bird*’s size and weave across her bow. After nine days they depart, taking with them my flock of ice birds. I alter course sharply south toward Palmer Station, now 300 miles away.

As we continue southward, black-and-white Commerson’s dolphins play alongside and unfamiliar large petrels appear overhead. Three icebergs float by—brilliant sugar icing on a blue, white-flecked sea. The flaming colors of sunset to starboard merge without a break into the tints of dawn to port.

Again the angry sea tries to turn me back. Head winds spring up. Snow showers begin.



*“My paper on Polynesian astronomy is being read before The Royal Society in London today!”*



*"I am still trembling when the growing daylight enables me to . . . enter sheltered water for the first time. . . ."*

By evening the yacht is fully battened down before a northerly gale. Spray explodes against the hull. The howl of the wind is deafening. My hands are in agony. There is no chance of keeping a lookout for ice in these conditions. I creep into my chilly sleeping bag, and for the first time ever I fall sound asleep in a gale.

**A**STONISHINGLY, I do not wake till next morning, Australia Day, January 26. The gale is blowing itself out. The cabin temperature is a bleak 28° F. But there, beyond the high seas, gaps in the cloud rack reveal ice fields sweeping up to vast snow mountains and, nearer, a jagged rock pinnacle and a bevy of pallid bergs. I do not feel triumphant at this first sight of land in almost three months.

A difficult noon sight confirms the landfall as the west coast of Anvers Island, on whose southern shore stands Palmer Station. The weather moderates with such rapidity that we are becalmed from about 4:30 in the afternoon onward.

Now I appreciate the magnificent panorama—sixty miles of ice cap, with 9,000-foot peaks rising from the sea. I sit in the cockpit choked with emotion. Close alongside, parties of penguins call as they porpoise out of the water, landing with little plops.

The light begins to fade. A waning moon hangs over the empty land in a pastel-green sky, changing into pale gold. The forbidding ice cliffs of the great bergs turn from blue to mauve to violet, then to deep purple. I stand southeast toward an island I identify from the chart, only to find next morning that it is an iceberg.

We round the corner of Anvers Island and, in 13 hours of steering by hand, thread a nerve-racking way between rock skerries and grounded bergs until Palmer is only ten miles off. But these short miles are dead into the eye of the wind and, with my inadequate rig, may take days to cover.

As darkness falls, I take in the jib so that *Ice Bird* moves slowly but carefully forward under her trysail. I dare do no more than doze.

Then, at 1 a.m., I am electrified to see Palmer Station's tantalizingly inaccessible

light. I let off a flare, which at that range accomplishes no more than burning my fingers. Soon afterward the wind rises from near calm to a shrieking gale that sends the yacht forereaching fast through the smooth water. A fanged rock slides past no more than a stone's throw away.

At 11 the next morning we reach a position only 200 yards to windward of where we had been at 11 the night before.

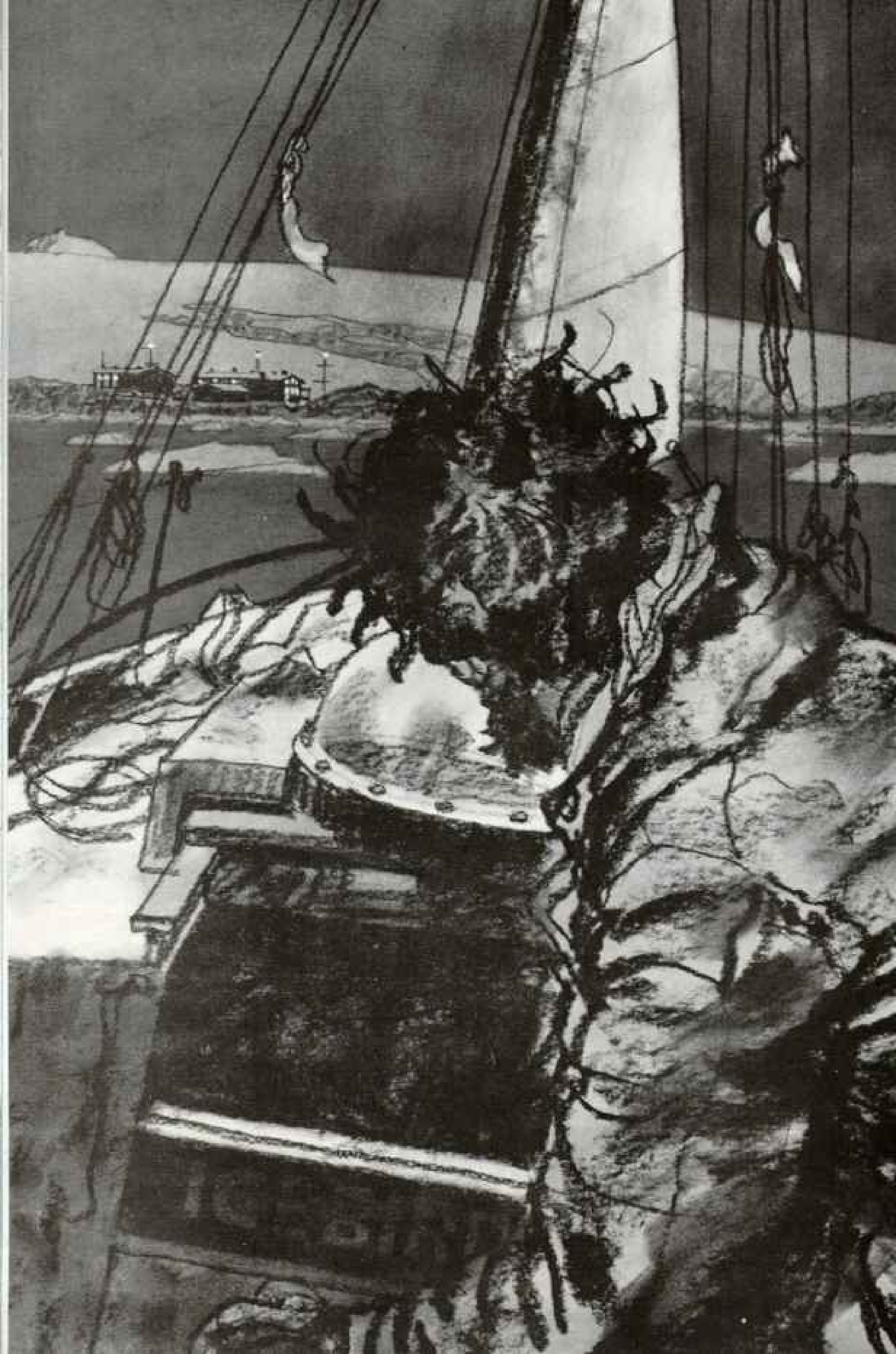
Several times *Ice Bird* brings up hard against growlers—small icebergs—and I bless her steel hull. The ghostly outline of an enormous berg looms out of the murk, and I come about with all speed. The yacht repeatedly plows her way through crackling brash ice that gives out a musical tinkling—air bubbles, trapped 10,000 years ago, being released as the ice melts in the sea.

Next day, with dawn at hand and the wind at last fair for Palmer, comes a moment of deadly peril. Without warning *Ice Bird* rises up on a swell. We are in the midst of breakers over a rocky shoal. Three times the yacht is picked up and surfs forward through white frothing turmoil while I cling to the tiller, expecting the keel to strike at almost any moment and the adventure, and my life, to end among jagged rocks and freezing water—within a mile of safety.

The six-foot keel must have passed over the rocks with no more than inches to spare. I am still trembling when the growing daylight enables me to round Litchfield Island and enter sheltered water for the first time since leaving New Zealand. It is 2:30 a.m. on January 29. The gallant little yacht has come 6,100 miles from Sydney. Since being dismasted, *Ice Bird* has traversed 2,500 miles at a creditable average of 41 miles a day.

The buildings at Palmer are silhouetted clearly now against a background of looming ice. There is a rock pier, alongside which a small ship, aquanaut Jacques Cousteau's *Calypso*, is lying. I drop anchor beside her and call out, "Is anyone awake? Do you mind if I tie up alongside?"

The saloon door crashes open, and a very startled figure appears. I throw him a line and make fast. The first single-handed voyage to Antarctica is over. □





*Beyond the  
north wind  
with the **Snow  
Goose***

Leading the flock, Des Bartlett films powerful wingbeats from a station wagon in the Arizona desert. Orphan snow geese raised by the authors provided intimate glimpses into the lives of these magnificent creatures.

*ARTICLE AND PHOTOGRAPHS BY DES AND JEN BARTLETT*



**E**ACH DAY NOW the beat of broad black-tipped wings broke the tundra stillness. Snow geese by the tens of thousands were coming home to nest—home to the bleak and treeless lands bordering Hudson Bay.

From our newly erected camp on the McConnell River, three miles west of its juncture with the bay, we joyfully welcomed the subjects of our study. To understand the yearlong life cycle of the lesser snow goose, we would keep the great birds company from the Canadian subarctic to the Gulf of Mexico, 2,500 miles away, including visits to migration way-stops.

We had arrived a few days earlier, on May 15, aboard a LambAir ski-plane chartered in Churchill, 150 miles south. After following the frozen shore of Hudson Bay for nearly two hours, the single-engine craft landed us on crusted snow beside the partly thawed McConnell River (map, page 827).

I left the plane with my four companions: my wife, Jen; our 18-year-old nephew, Les Bartlett, from Queensland, Australia; Lee Lyon, a young woman from Palo Alto, California; and Dr. Charles MacInnes, an associate professor of zoology at the University of Western Ontario. Warm in down-filled jackets and hoods, we looked upon the land



**I**SOLATED on puddle-pocked terrain for more than three months, the Bartletts observed the seldom-seen nesting and molting of the lesser snow geese. Clutches of three to eight eggs, cushioned in down, appear in early June (top). About three weeks later, peeping balls of golden fuzz emerge (above). Thick coats protect the goslings from the cold.

**B**LIZZARD OF MAJESTIC BIRDS swirls over tundra on the west coast of Hudson Bay, summer nesting ground for thousands of lesser snows, among the handsomest and most abundant of North America's wild geese.





where we would live for three and a half months while beginning a documentary film for Survival Anglia Limited of London.

Soon almost a quarter of a million snow geese would breed on the delta flats where the McConnell empties into the bay. Others would fly farther north to Southampton Island. The largest concentration, a million birds, would gather on Canada's huge Baffin Island.

As we surveyed our new home, two young men and a woman approached from a nearby plywood hut, the only structure in sight. They were students of Dr. MacInnes's—Charlie, as he likes to be called. Our zoologist friend was spending his tenth season in arctic regions with students, studying geese.

The students helped us unload our gear, and we waved good-bye to the pilot, the last outsider we were likely to see until August. Once the snow melted, we would be virtually cut off from the outside, for lakes and coastal reaches of the bay are too shallow and rocky for floatplanes to alight safely.

Light snow was falling as we erected our tents on the riverbank, seventy yards from the hut used by Charlie and the students. Unable to drive pegs into the permafrost, we tied the guy ropes to rocks.

That evening the temperature dipped to about zero, requiring us to make other adjustments. I learned, for example, not to take the toothbrush from my mouth until the job was done, lest the bristles freeze solid in a matter of seconds.

#### Ptarmigan Play King of the Mountain

We had arrived before the snow geese, but willow ptarmigan immediately took up residence near our tents. About 4 a.m. daily a courting male would perch on the highest point around—the ridgepole of our tent—and cackle aggressively. Usually a combative second male dislodged him. Drowsily we'd watch their shadows slip and slide down the stiff, frosty canvas.

The first geese arrived, and by late May we could count 300 passing hourly. The flocks included white-fronted and Canada geese, but most were snow and blue geese—the snows outnumbering the blues, a color variant of the same species, by three to one.

These beautiful waterfowl are perfectly named, for snow governs the very rhythm of their lives. Each spring vast formations pass over villages of northern Canada, en route to

distant breeding grounds. For years no one knew their destination, other than somewhere "beyond the north wind," as their former scientific name—*Chen hyperborea*—indicated. Today, ornithologists know the lesser snow as *Chen caerulescens caerulescens*—literally, blue goose.

In the fall they wing back to the south, musically honking several thousand feet above the ground and stirring the imagination of many a schoolboy in bed at night on farmlands of Manitoba and the Dakotas.

Jen and I often are asked why we photographed and studied the snow goose. "Is it threatened with extinction?" friends wonder.

"On the contrary," I'm happy to reply. "It's a success story, perhaps one of the greatest conservation success stories of all." Though hunters shoot nearly half a million annually, the species prospers, thanks to careful management by the Canadian, United States, and Mexican Governments.

#### "... But Geese Don't Count"

As the snow geese reached their McConnell River site, experienced nesters from previous years appeared to be the first to claim breeding territories, with nests roughly twenty yards apart. We erected eight blinds within a radius of three miles of camp.

To enter our blinds without frightening nesting birds, we resorted to deception. As we approached a blind, the geese would walk away. But when we emerged from the blind and left, they would return to their nests. Actually one person fewer exited than entered each blind—but geese don't count!

Les accompanied us to the blinds and returned for us about 12 hours later. During the interim he helped to locate an astounding variety of nesting birds: King and common eider, oldsquaw, greater scaup, pintail, Arctic tern, herring gull, parasitic jaeger, Arctic and red-throated loon, northern and red phalarope, dunlin, golden and semipalmated plover, Savannah and tree sparrow, Lapland longspur, horned lark, Ross' goose, whistling swan, Canada goose, semipalmated, pectoral, and stilt sandpiper.

At the outset we had difficulty locating the very nest we had come so far to see—that of the lesser snow goose. Cautious geese cover their first egg with moss and grass, which help to insulate it against the cold. Each day the female returns, lays another egg, and leaves the nest camouflaged

and warm under a thick layer of vegetation.

Lee Lyon found the first nest. Kneeling, we uncovered a well-hidden egg about three inches long. Thirty feet away we erected a blind, then left the area quickly so that the geese would settle down.

On subsequent days we watched the female lay four more eggs. Using her bill, she then lined the nest with down from her body and began incubating. Through two severe rainstorms, the goose warmed her eggs while the gander stood guard. Neither left the area until the eggs hatched some three weeks later.

Most geese began to incubate during the first week of June, when we had long hours of light for observation and photography. The sun, after setting for only 5½ hours, rose about 3 a.m. Two hours later, if it wasn't raining, snowing, or excessively foggy, I would awaken the others. We'd have a quick breakfast and leave camp by 6 a.m., packing sandwiches and tea.

After walking miles on the tundra and spending hours in the blinds, what a blessed relief it was to return to camp and remove our heavy backpacks and hip waders.

Usually we ate the evening meal with Charlie and his colleagues in their oil-heated hut, then washed the dishes and wrote up our notes before crawling into sleeping bags about midnight. We were almost sleepwalking after several weeks of this 19-hour-a-day routine. But with so much to see during the short northern summer, we had to make the most of the light.

#### Gander Bravely Routs a Raider

Early one June morning we awoke to discover that the shallow ponds had frozen overnight. In the nesting colony snow and blue geese were skating on the ice. Skillfully they slid on one foot, then the other. A comical male ptarmigan displayed a different style: When he started to fall, he let his rump touch down on the ice for extra support.

Another day Lee and I, sharing a blind near the coast, heard a sandhill crane calling as it approached on the wing. It landed behind our blind, prompting an immediate commotion among the nesting snow geese.

"Des, the crane is raiding a goose nest," Lee whispered, peering through a slit in the canvas. She held back the canvas while I pointed the camera lens through the slit.

"What's happening?" she asked.

"The two geese are just standing there,



**AUTUMN TRIGGERS** an epic journey when lesser snow geese head south from arctic regions. Cruising as high as 6,000 feet, they fly to distant wintering grounds.

With government permission the authors adopted several lost goslings. In a process called imprinting, the babies immediately accepted their benefactors as parents (below).









LES BARTLETT (ABOVE)



**NIT-PICKING PROTÉGÉS**, the orphan geese—now half-grown—feast on mosquitoes clinging to the trousers of the Bartletts' nephew, Les, who shared their camp near the juncture of McConnell River and Hudson Bay. Tent-rattling winds up to 45 miles an hour periodically drove away the mosquitoes but hampered sound recordings for a television film about the snow geese. Despite such hazards, the Bartletts won an Emmy award for cinematography.

Like eager children, the young geese lead the Australian couple across a tundra pond (top).

The birds' tugging instinct creates a nuisance on washday. Crowding around Jen Bartlett (above), the orphans pick at clean clothes with muddy bills and busily untie her shoestrings. "They awakened us many mornings by yanking on the tent ropes," said Jen. Darker birds are blue geese, a color variation of the snows.

A keen naturalist since his childhood in the rain forests of Queensland, Australia, Des Bartlett, with his wife, has filmed wildlife around the world and has written and illustrated two books about African animals. Their daughter, Julie, 16, joins them during school holidays.



**F**UZZY TARGETS of marauders, wild goslings run a gantlet of dangers and discomforts. Some eggs never hatch at all. Severe weather destroys others. Rapacious jaegers also take a toll. One of the hawklike seabirds (left) flies off, carrying an egg by the exposed embryo. Herring gulls continue the dive-bombing attacks when hatchlings arrive. A smaller winged pest perches on a gosling's bill in search of soft skin (above). Young geese at rest often obligingly pluck mosquitoes from one another. Alert for enemies, a goose takes her goslings down the McConnell River (below) to feed along the shore of Hudson Bay.



watching the crane eat their egg. No, wait—there goes the gander. He's chasing the crane away. Now the goose is walking to the nest and looking over the damage."

Then the female did something that amazed me: She ate the yolk of her own egg. Perhaps she needed the nourishment. Or she may simply have wanted to keep predators from getting it. Afterward she settled down to incubate the three remaining eggs.

That goose became a very special one for us, and we kept close watch on her until she successfully hatched three goslings.

Predators and foul weather claim at least 10 percent of a colony's eggs each season. But with an average clutch of five eggs, this leaves a hatch of approximately 450,000 goslings at the McConnell River site.

Hatching starts toward the end of June. It begins with a star-shaped fracture of the shell, caused when the gosling taps persistently with its pointed egg tooth—a protuberance on the tip of its bill. A few pushes, and shell pieces break away, leaving a small hole through which the infant breathes and chirps. Almost 24 hours later, with an energetic heave, the tiny bird struggles free. It dries into a yellow-gray ball of fluff with a bright yellow halo and tips of fine down that glow like spun gold (page 824).

The eggs of a clutch usually hatch within a few hours of each other, and the goslings leave their nest a day later. We followed four that pecked busily at greenery and mosquitoes as they trailed their parents toward the river. One gosling awkwardly climbed over a nesting ptarmigan's back. In the river the parents sandwiched their goslings between them while they swam through small rapids. The youngsters bobbed like corks.

### Photographers Become Foster Parents

Occasionally one gosling hatches later than the others and is too weak to follow when they leave the nest. Then it may become prey to herring gulls that cruise watchfully above the colony.

Before traveling north, I had obtained permission from the Canadian Wildlife Service to collect some of these orphan goslings. We rescued our first one in late June. Gulls circled overhead as Les raced across the tundra, beating them to their prey. By the hatching season's close, we had saved eleven snow goslings and three blues.

All the goslings adopted us as their parents,

a phenomenon scientists call imprinting. Wherever we went, the youngsters tried to follow. At first they couldn't keep pace, so we carried them in a small cardboard box. When outside the box, they peeped constantly and scurried about feeding on plants and picking mosquitoes off our clothing.

Trying to imitate their high-pitched sounds, we called, "Cheep, cheep." Gradually this became "Creep, creep." And our snow geese became known as the "Creeps."

In three weeks each Creep weighed almost three pounds—thanks to a special diet of crumbled dog food—and feathers started to sprout on their wings and tails. The snows turned light gray, the blues a darker shade. They became ungainly.

### Long-legged Fred Joins the Creeps

The Creeps had a foster brother as well as foster parents. He entered their lives, and ours, one cold and rainy day in late June. We were warming up in the hut when Charlie entered, chilled after a long search for Canada goose nests.

"Hey, I have something for you," he said, smiling. From a jacket pocket he brought out an orange bundle of fluff with pointed beak, large eyes, and long, thick legs.

"A baby sandhill crane!" Lee cried, cupping it in her hands.

"I couldn't leave it on the tundra," Charlie explained. "It was wet and stiff with cold, and its parents were a quarter of a mile away, tending to another chick. Obviously they'd forgotten this one."

We named it Red. After its color changed, it became Fred, and an extremely close companion to us and the Creeps (pages 843-7).

By mid-July the adult geese were molting their primary feathers, an annual process that grounds them for three or four weeks. Nature has scheduled this period to coincide with the flightlessness of goslings. Scientists make use of this time to conduct banding drives across the tundra, resulting in detailed records of sex and other data useful in conservation. Should a banded goose be shot by a hunter, the metal leg marker is sent to the U. S. Fish and Wildlife Service in Washington, D. C.

When a month and a half old, the goslings learned to fly, and their parents also were airborne again. Our Creeps now were making short flights around camp, often ending with a bumpy landing. One day they flew out onto the tundra and surprised us in our blinds.



**C**LASH OF PARENTAL INSTINCTS pits two geese against a pair of sandhill cranes, one of several dozen bird species that checkerboard the tundra with territorial nesting claims. En route to water, the goose family passes too near the cranes' nest, sparking an attack from the larger birds. Here, wings spread to add bluff to size, the male crane glares at the intruders (top). The geese honk in alarm, and the gander mantles the goslings protectively. Leaping into the air, the crane lashes out with its feet as the gander gamely tries to nip with his bill (above). One well-aimed leg thrust by the crane forces back the goose's head (right). The bloodless battle ends when the fighters drift out of crane territory.







*To slip earth's bonds, flapping five-week-olds race behind Les Bartlett, who heads into the*

Later in August they often disappeared with a flock of wild geese, returning to camp a few hours later, much to our relief.

It was time to prepare for the migration. We cleared an upriver landing strip and radioed Churchill for a plane to pick us up. Three days later we took off, the Creeps and Fred riding in boxes of plywood and wire netting. As we gained altitude, the plane passed scores of southward-flying geese. Their migration was under way, and so was ours.

Our first stop was Churchill, near which we camped beside a lake for almost a month, chartering a helicopter to film geese migrating along the shore of Hudson Bay.

By the first of September the goose-hunting season had started. For the Creeps' safety, we reluctantly confined them to a wire enclosure edging into the lake, so they could swim.

Throughout our journey south we would

risk the chance of our birds being shot. And yet we felt they needed some measure of freedom. As a precaution, therefore, wherever we stopped, we usually released only three or four at a time, so they would be less likely to fly far.

Many geese passed over our camp bound for the southern shores of Hudson Bay. There they paused to feed for two or three weeks, building up strength for the long flight ahead. Some flocks then flew nonstop to Louisiana's coastal marshes 1,500 miles away (map, page 827). Others traveled more leisurely, resting and feeding along the way, just as an aircraft makes refueling stops.

When we left Churchill by train, the Creeps rode inside their boxes in the baggage car. At The Pas, in western Manitoba, we collected our Land-Rover and station wagon, with an enclosed trailer for our birds. Les was



wind, carrying a feed pan. Soon the young geese will begin test flights for their first migration.

watching a mechanic service our vehicles when an American motorist remarked on his Australian accent. He asked Les what brought him to Manitoba.

"We're following snow geese," Les replied.

The motorist looked puzzled. "What are snuggies?" he asked.

#### Flying Geese Prove a Point

To obtain clearance for us and our birds, we passed through the border post at Pembina, North Dakota. A U. S. Customs official checked our documents and asked, "Mr. Bartlett, could you place a value on these birds for us?"

"I'm afraid not," I replied, explaining we couldn't ever sell them.

The man persisted. "But they must have some value?" I insisted not.

A veterinary officer arrived and conferred

with the customs men. They agreed that the birds, though of undetermined value, could be admitted duty free into the United States for scientific studies. Thanking them, I mentioned that we could have avoided the issue by allowing the birds to fly across the border.

Noting their look of skepticism, I asked, "Would you like to see them fly free?"

"As a matter of fact, I would," one customs man said.

While he held up traffic, we released ten Creeps. Quickly they flew north, out of sight. A minute passed, then another.

After several minutes a customs man said, a little sadly, "I'm afraid you'll never see them again."

Jen, scanning the horizon through binoculars, called, "I see them."

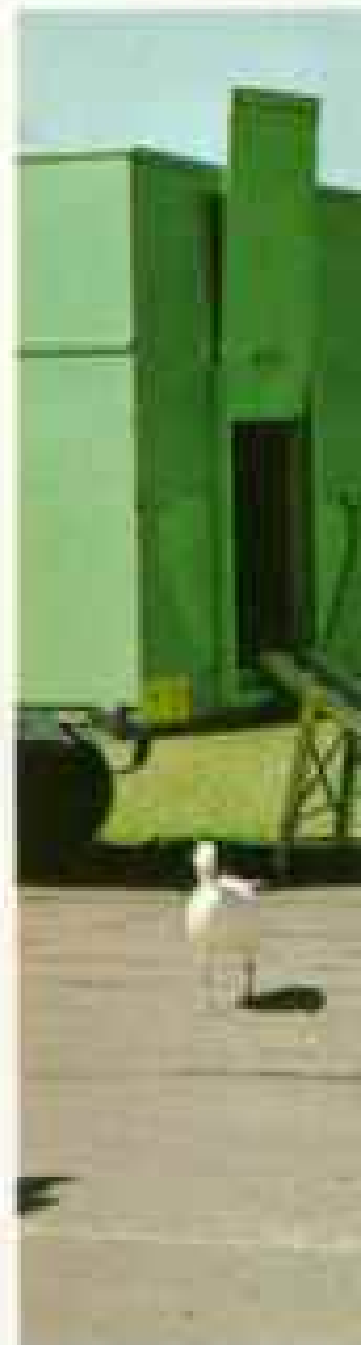
The geese landed beside us, jabbering





**M**IGRATING BY MOTORCAR along the Central Flyway, the Bartletts and their trailer-borne companions baffle United States Customs officials at the North Dakota border. "At first they thought we should pay duty on the geese," said Des. "We explained that we did not own the birds and that normally they would enter the U. S. anyway, as natural migrators." The authors proved their point by releasing the orphans, who made a short flight into Canada, then recrossed the border, and glided down to rejoin the caravan in the U. S. (below).

Where free-flying snows stopped to feed and rest along the route, the authors released their charges for exercise. Several times the orphans mingled with huge flocks but returned to reenter their trailer.





away. The customs men appeared impressed.

We proceeded south. At Sand Lake National Wildlife Refuge in northeastern South Dakota, our first major stopover in the United States, we found 60,000 snow geese. With refuge manager Lyle Schoonover we watched them feed in a large field while a machine was noisily harvesting corn.

"The geese move from one field to another shortly after the pickers arrive," Lyle told us, "because grain lost by the machines is easy for them to get."

"Just look," Jen said. "They let the operator get within 30 feet."

"Yes," Lyle said, "but if I walked toward the geese, they'd take to the air before I got within a hundred yards."

We watched with fascination as the usually skittish geese ignored the picker. "It's almost as if they know the man is picking corn for their benefit," Les remarked.

We remained in the field as a huge orange moon slowly lifted above the horizon. Flying to the grainfields from Sand Lake, geese passed in formation before the bright lunar face. Suddenly a roar of wings and the clamor of thousands of protesting voices erupted. Something unseen by us had spooked the flock, and the geese raced through the sky, nearly eclipsing the moon (pages 840-41).

After a night afloat on Sand Lake many geese fly off to feed in fields 10 to 20 miles away. The journey involves considerable risk, for the birds run a gantlet of hunters outside the refuge. Waiting in well-concealed blinds, some hunters shoot only when the birds are near enough for a clean kill. But others blaze away at geese out of range and sometimes wound them.

#### Lone Predator Alarms 60,000 Geese

In late October the season's first winter storm struck. On the Sand Lake refuge every twig and berry, every blade of grass, the wire of every fence donned a coat of crystal-clear ice.

By mid-November virtually every snow goose had left. We moved on, too, bound for De Soto National Wildlife Refuge on the Missouri River. There an oxbow of calm water, cut off from the main flow, provides a resting-place for the geese when they return from feeding outside the refuge.

We were watching them enjoy this favorite spot one day when suddenly the entire flock lifted with a roar of wings. Perhaps 60,000



**S**TUNT-FLYING GEESE dazzled the Bartletts with a maneuver known as whiffing—a quick roll to a near-inverted position. “Geese in the wild do it to lose altitude quickly,” said Jen. “Ours often did it when they flew over us, as if they were showing off.”



birds filled the sky. Peering through binoculars, Jen spotted the cause.

"A lone bald eagle," she said.

The eagle, soaring 500 feet above, moved away, and the geese returned.

Snow geese, we learned, have much keener vision than our own. The Creeps always spotted birds of prey long before we did, and sidled closer to us until the danger passed.

We introduced our own "bird of prey" with a 6-foot wingspan—a radio-controlled model plane on which we mounted a small movie camera. Though they shied away from it, the 60-mile-an-hour plane easily kept pace with the wild geese, and enabled us to get film from an unusual viewpoint.

### Feathered Family Loses Four Members

During this period, when our 14 Creeps weren't flying free, a few at a time, they spent their days in a roomy enclosure on the grass and nights in an unused grain silo. One bitterly cold day we released Fred and five Creeps. Obviously excited by the wind, they circled the field four times, then quickly flew out of sight. Fred returned later—alone.

We searched the sky and shouted, "Creep, Creep!" toward every wild flock we saw. Next day, after we'd almost given up hope, a refuge employee appeared at the silo with a wounded snow goose he'd found. It seemed so tame he felt sure it was ours.

Indeed it was. Apart from a bloody patch on its right breast, caused by a shotgun pellet, it seemed fine. The bird soon recovered. But of the four missing geese we saw nothing. We could only hope they stayed with a wild flock and learned to fear man.

Saddened, we moved south with the remaining Creeps, following the geese to the Squaw Creek National Wildlife Refuge in Missouri. Some of the refuge's 200,000 geese were swimming in ponds.

"Many of the geese leave here shortly after dawn to feed in harvested cornfields as far as 30 miles away. They return around 10:30 a.m.," said manager Harold Burgess. "But they often don't fly out again until sunset for their evening meal."

"Perhaps they've learned that hunting ceases after sunset," Jen suggested.

Returning from their morning meal, the geese cleared nearby hills, then spiraled hundreds of feet to the water. They tumbled spectacularly, losing altitude by sideslipping, or whiffling (facing page), an impressive

**C**LOUDING A FULL MOON, restless snow geese rise above Sand Lake National Wildlife Refuge in South Dakota (following pages), way station on the Central Flyway for some half a million geese.

Strict hunting regulations and preservation of nesting grounds now protect these beautiful harbingers of the changing seasons.

maneuver in which their bodies revolve nearly 180° while their heads remain right side up.

"We control the levels of the pools to attract geese," Burgess explained, "but the mud banks and shallow waters freeze first as winter approaches. That encourages the waterfowl to continue their migration south."

A few days later, formations of geese passed over in the most amazing scene of mass migration we had witnessed. For hours, long lines stretched from horizon to horizon. Next morning, to our surprise, the ground was thick with snow, aftermath of a storm that the geese apparently had foreseen.

Leaving Squaw Creek, we detoured from the Central Flyway to a ranch near Tucson, Arizona, where the Creeps could fly over an abandoned airstrip without the danger of being shot. While Les drove the station wagon, I sat on the tailgate to photograph the birds (pages 822-3 and 842). Our teen-age daughter, Julie, who had flown in from Australia on her school vacation, ran behind the slow-moving car and kept the geese together. Then we drove at 45 miles an hour. They flew so near that I could reach up to scratch a feathered belly suspended in flight.

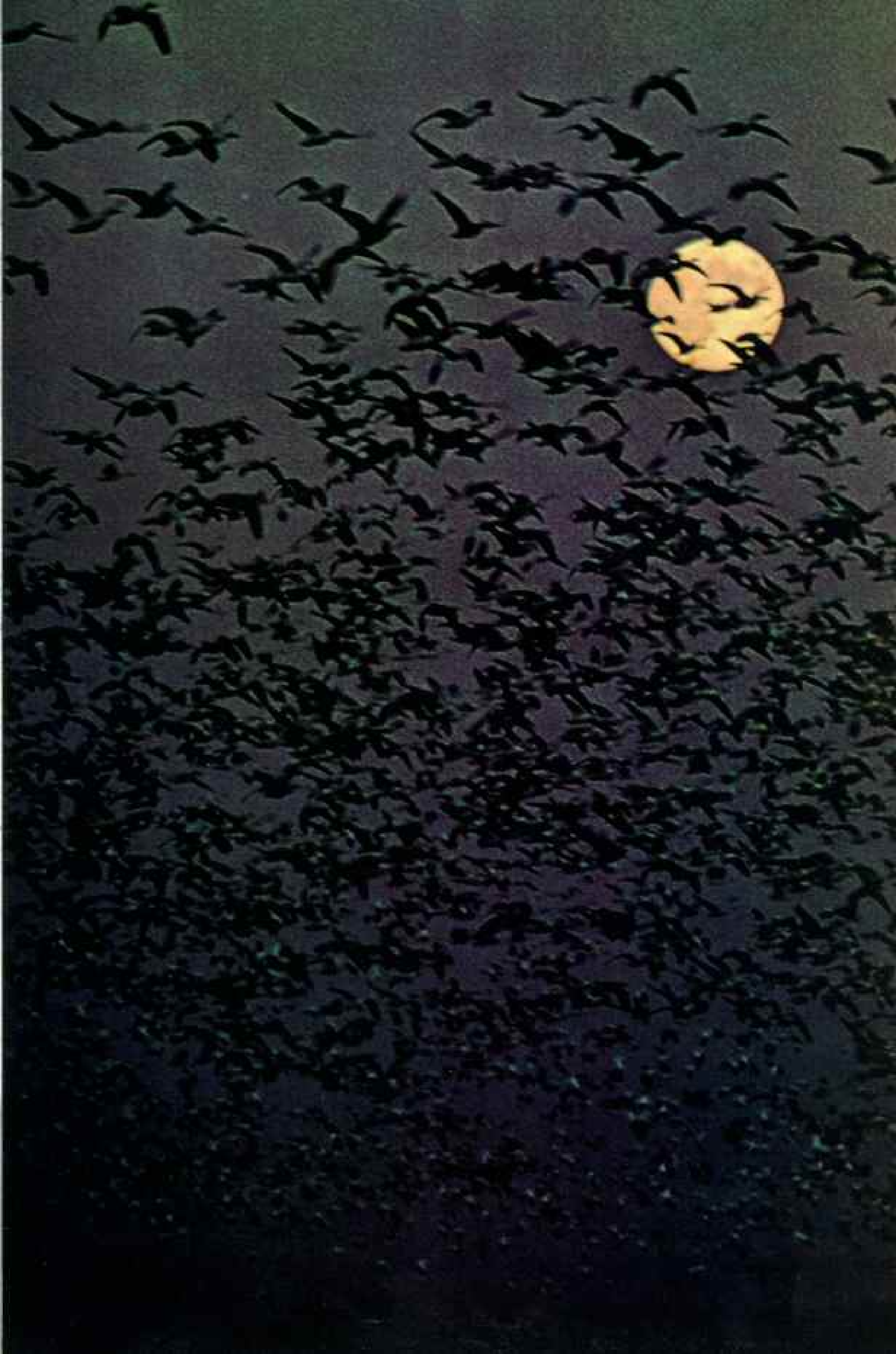
### Creeps Baffle Local Residents

After hunting season ended in Texas in January, we rejoined the migratory geese. We found their biggest concentrations on harvested rice fields west of Houston. Other flocks stayed close to the gulf along the Louisiana and Texas coasts.

As we traveled, Fred and our free-flying Creeps often fascinated spectators. A farmer who watched us told his family what he'd seen. We heard about it from a banker to whom he'd repeated his story.

The farmer's wife doubted the tale, said the banker. I asked why.

"Well, she believed her husband when he said he saw some people let geese out of a trailer. But then he said that the geese flew





over and mixed with 10,000 wild ones, returned to the strangers, and they walked the birds up a ramp into the trailer and drove off. That was too much!"

In early March, when wild flowers bloomed in southern Texas, the wild geese became restless. One evening we heard an unmistakable gabbling. The flocks were turning north again. Now our photographic study began its final phase.

Reversing our course to follow the wild geese, and still accompanied by the Creeps and Fred, we reached Hudson Bay in two months. This time we camped 30 miles east of Churchill, near a snow and blue goose colony at La Pérouse Bay.

Tramping across the tundra one day in late June, we noticed that one of our Creeps walked while the others flew. We examined him and saw that several primary feathers were missing from the left wing. The molt had begun. Each day the other Creeps flew off to

feed, but our early molter was a goose apart, remaining with us, never letting us out of his sight. We were his only protection.

A few nights later we were awakened by jabbering, the calling of distant geese to others near camp. It sounded as if the Creeps had split up and were arguing. At breakfast time they and Fred were gone. In midmorning Fred came flying alone into camp.

"I guess we'll have to look for them," Jen said. "Now that some of the Creeps are molting, the others won't fly back even though they are still able."

We radiated from camp like spokes of a wheel, shouting "Creeps, Creeps!" That evening we were hoarse, but the Creeps hadn't turned up, and we didn't feel much like talking anyway.

The next day we searched the coastal flats. When we approached wild geese and their young, they swam into the bay, their only escape during the molt. With polar bears

*Des films a feathered friend before taking the orphans back to their wild home.*



and wolves in the area, they had to be constantly on guard.

At dinner that evening, Jen broke the silence. "I'm beginning to think they wanted to leave," she said. "It could be an instinctive thing this time of year, something stronger than imprinting."

We realized, too, that by shutting ourselves in tents at night, we had left the molting Creeps defenseless. They did what was best for them. Almost certainly, we felt, they had joined the wild geese on the coastal flats. Sadly, we ended our search.

At 3:30 a.m. several days later Fred called loudly from outside the tent, and we heard far-off geese answer. Then Fred took off, his calls sounding farther and farther away. Finally he arrived somewhere on the coast, and we could not mistake the enthusiastic greeting he received. We were certain Fred had found the Creeps.

Excited, we hurried to the coast. Wild geese were swimming at low tide a long way out among rocks. At the water's edge we shouted. Fred suddenly flew from behind a distant rock and landed beside us. Though we could not identify the Creeps, we were sure that Fred had been with them, or he wouldn't have ventured out so far.

It was nearly time to leave Canada, but we decided to stay until the geese were able to fly. If we left sooner, we'd always wonder if the Creeps had looked for us.

#### Birds Circle Camp in Farewell Flight

One morning in August, when most of the geese could fly, Les burst into our tent.

"Fred's out there flying with snow geese," he said. In close formation, Fred and five of our snow geese were circling the camp. We cheered them on.

"Come on, Creeps!" we shouted. The geese banked around camp, then flew down to the coast to join a wild flock. Fred returned to us.

The Creeps were alive and well. Soon they would journey south again, but under their own power. They had made the transition to a flock and would be guided by its actions.

Though our lives would never be quite the same, we were thankful for the happy times and experiences we had shared. How our blood would surge when we heard the magical sounds of wild geese calling to each other high overhead! We would always listen for the call of the Creeps; we could hear it in the voice of every snow goose. □

## ...and then there was Fred...

**S**TATELY COMPANION of the Bartletts, a sandhill crane named Fred suffers a temporary loss of dignity. A serious illness in South Dakota left the slate-gray bird suspended from a sling while he recovered the use of his stiltlike legs.

Found abandoned during a rainstorm on the tundra, Fred—then a tiny chick—joined the orphan goslings at camp, and, like them, accepted the authors as his parents. "He followed us around like a dog," Jen recalls.





**WHEN FRED FIRST ARRIVED** at camp, the young crane's endless appetite kept the Bartletts busy catching insects. "We even caught fish and ground them up for protein and calcium so he'd develop strong bones," said Jen. Foraging ended with the introduction of crumbled dog food into the chick's diet, a simple adjustment for a species that relishes a wide variety of foods.

Sandhill cranes once stalked marshes and prairies from the Arctic to the Gulf of Mexico in search of grain, roots, fruit, insects, small birds



**P**LAIN CRANE of the camp flock, Fred appears to stare unbelievably at his own puddle image (above), like the fabled ugly duckling. "For a while he really seemed to think he was a gosling," said Des. "When the geese swam, he plunged after them, although without webbed feet he lagged behind." Exhausted by catch-up efforts, the chick collapses for a nap on the tundra (right). Later, when he neared his full stature of three feet from toes to red crown, Fred ruled the flock with light jabs of his sharp beak.



and mammals, lizards and frogs. Fattened by autumn grains, thousands fell as game, although their elusiveness was legendary. The young nation's most famous bird-watcher, John James Audubon, said of the crane, "The wariness of this species is so remarkable that it takes all the cunning and care of an Indian hunter to approach it." Finally, hunting, drainage of wetlands, and massive cultivation drove most of the birds from central portions of the United States to the Northwest and Canada. Small enclaves survived in Michigan, the Gulf States,

and Cuba. By 1918 sandhill cranes had become so rare that federal law had to quiet hunters' guns.

Wariness still leaves much of the bird's life—and thus, Fred's behavior—cloaked in mystery. The authors found amusing, but puzzling, their pet's habit of rubbing himself with a towel after a swim (*below*), much as a bather might vigorously dry himself. "Any rubbing motion on our part would prompt him to do it," said Des. "One day we washed our car, and when we were drying it, Fred snatched a cloth and did the same to himself."

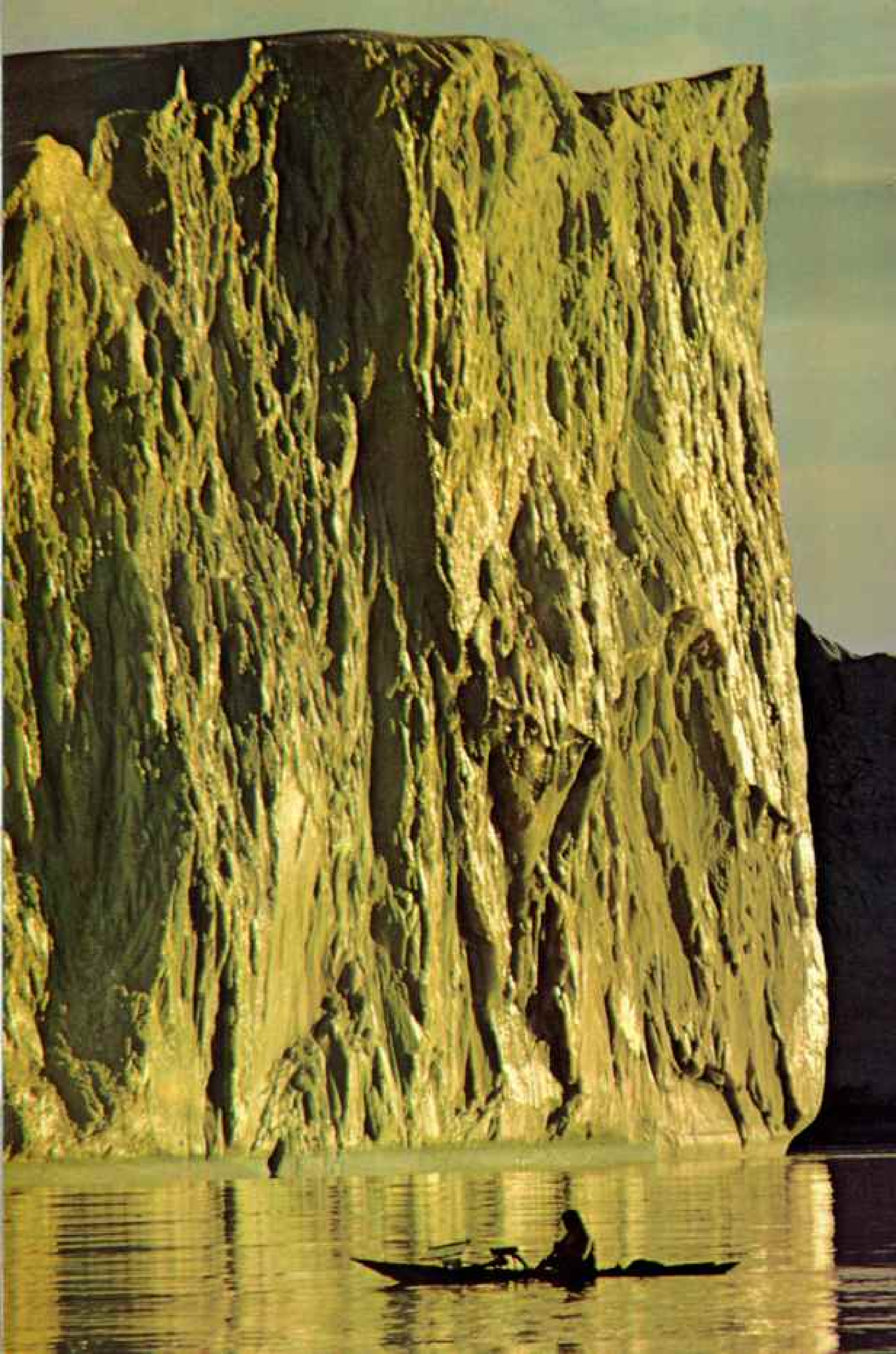


**W**HEN FLYING SINGLE FILE with deliberate, plodding wing strokes, sandhill cranes appear deceptively slow moving. In fact, however, Fred easily outsped the smaller snow geese. Flying at the slow pace of Les Bartlett's bicycle (right), the bird could barely keep himself aloft. Full glide displays the powerful wings, measuring five feet from tip to tip (below, right). Long legs trailing behind act as rudders in flight.

Seeking a reward of cheese from a neighbor in Arizona, Fred rings a bell that announces arrivals at the ranch gate (below, left). "He was not only clever and fun to watch, but useful as well," Jen remembers. "In the far north he called out in alarm whenever polar bears approached our camp." When the authors left to photograph Patagonia's wildlife for NATIONAL GEOGRAPHIC, Fred remained at a refuge in North Dakota. "They have three other cranes there," said Jen. "Perhaps Fred will find a mate." □







**T**HE SUN has ceased to rise now. A week ago it shone for the last time this year above the barrier range of snow-covered hills to the south. Today it will be no more than a faint smear of crimson at noon, silhouetting the giant peaks and ice ridges. Soon there will be only the darkness and deep cold of *kausuitsup unna*, as my Greenlandic neighbors call the polar night.

We are well prepared for it. During the summer months of endless daylight, ships from Denmark had made the long voyage up the barren west coast of Greenland, bringing just about everything an Arctic community needs to survive during eight weeks of darkness and six months in the grip of ice.

Now it is early December and the last ship has left for home, groping its way down Disko Bay past the great masses of floating ice that give our town its Greenlandic name, Ilulissat—Place by the Icebergs.

All is in readiness for the grueling winter ahead, as my 6-year-old daughter, Clara Louise, announced to her mother and me this morning. We can relax, for she has checked with the local store and has been assured that the supply of ice cream will hold out until the first ship arrives next May.

#### “Perhaps” Is Often the Only Answer

Such matters are of grave importance to Clara Louise and her young friends, for life in the Arctic is uncertain at the best of times. Whether the question concerns ice cream, a hunting trip, or the weather, the answer more than likely will begin with that indispensable Greenlandic word *imaq’a*—perhaps.

Clara Louise, her mother and I, and her two older sisters are among the 450 Danish residents of Ilulissat, or Jakobshavn (Jakob’s Harbor), to use the Danish name derived from the town’s 18th-century founder. With some 2,900 Greenlanders and their 6,000 sledge dogs, we live beside Disko Bay, 180 miles above the Arctic Circle (maps, next page). For a living we trawl the bay’s rich waters in search of shrimp. Occasionally we fish for Greenland halibut or hunt seals.

Legally we are all Danes, for Greenland is part of Denmark. Moreover, many native Greenlanders bear Danish names, the result of intermarriage of our two peoples for centuries. The Greenlanders’ tongue is a legacy of their Eskimo forebears.

“Hurry up, or we’ll be late for school,” I warn Clara Louise and her sisters, Bodil and

## Greenland’s “Place by the Icebergs”



Frosted Greenlander braves the treacherous ice near Jakobshavn, a fishing and hunting community teeming with sledge dogs and flanked by towering icebergs. Golden glaze of sunset (opposite) silhouettes a seal hunter at the foot of a giant berg.

By MOGENS BLOCH  
POULSEN

Photographs by  
THOMAS NEBBIA



Icebergs and snowflakes on its coat of arms reflect the landscape of Jakobshavn (VOK-olshavn). Pegged to the shore of Disko Bay, some 180 miles north of the Arctic Circle, the town is the third largest on Greenland. Discovered by Norsemen, frequented by European whalers, the island—long a Danish colony—became an integral part of Denmark in 1953.



Still anchored in April ice, Jakobshavn endures a freeze that began in November. Black against the snow, modern apartments, center, stairstep a hill. The town's shrimp processing plant, lower left, lies idle.

On the first of December the polar night descends, softening to a pewterlike glow only at midday. Many of the town's 2,900 Greenlanders and 450 Danes, accompanied by some of its 6,000 sledge dogs, trek south over the mountains on January 13 to greet the returning sun as it takes a five-minute peep over the horizon.

May's whispers of warmth awaken Jakobshavn's Glacier, whose output of ice is the greatest in Greenland. With a roar like distant artillery the icy river calves platoons of bergs, giving the town its Greenlandic name Ilulissat—Place by the Icebergs.

Greenlanders trace ancestry to Eskimos who started migrating to the island—earth's largest—nearly 5,000 years ago. Danes serve as teachers, administrators, and managers, helping Greenlanders make the transition from sealskin kayak to diesel-powered shrimp trawler.



Annemarie. I say "we," for I am a teacher in the school that serves 920 students between the ages of 6 and 16.

In the cold twilight we leave our snug apartment house, grateful as always to our countrymen at home. Like the school, the town shrimp factory, and a number of other modern projects, the apartment was financed and built by the Danish Government. My wife, Sigrid, leaves us for her job as a nurse in the town's day-care center, while the girls and I head for school.

"Will the helicopter come today?" Bodil asks, as we cross the snow past rows of warmly lighted windows in neat frame houses. To an 11-year-old with her heart set on Christmas, the arrival of the helicopter from the supply station at Søndre Strømfjord 160 miles to the south is a momentous event. Three times a week—*imaq'a*, depending on weather and the need for rescue operations—the helicopter delivers passengers, mail, and small cargo from Denmark and other Greenland towns. During winter the flights are our only physical link with the outside world.

I assure Bodil that the prospects are excellent, and the four of us part at the school door, they for their classrooms and I for mine. My first-graders are already in their seats and prepared to greet the day with a Greenlandic hymn. "*Māna kujangārpunga . . .*" we begin together:

*I thank You, God,  
My guardian,  
As You have watched over me  
In the darkness of the night,  
So You will be with me  
With Your Grace today.*

As we start the first lesson, I note a certain restlessness in class, particularly among the boys. They seem unable to concentrate, but fidget in their seats and continually glance toward the windows, though there is nothing beyond but darkness.

After nine years in the Arctic, seven of them as a teacher, I am well aware of the reason. Winter has arrived, the season of sledges and dog teams. The children long to be out beyond the windows with those thousands of other devotees of ice and snow, who are straining at their leashes to be off and running. And I, for one, cannot blame them.

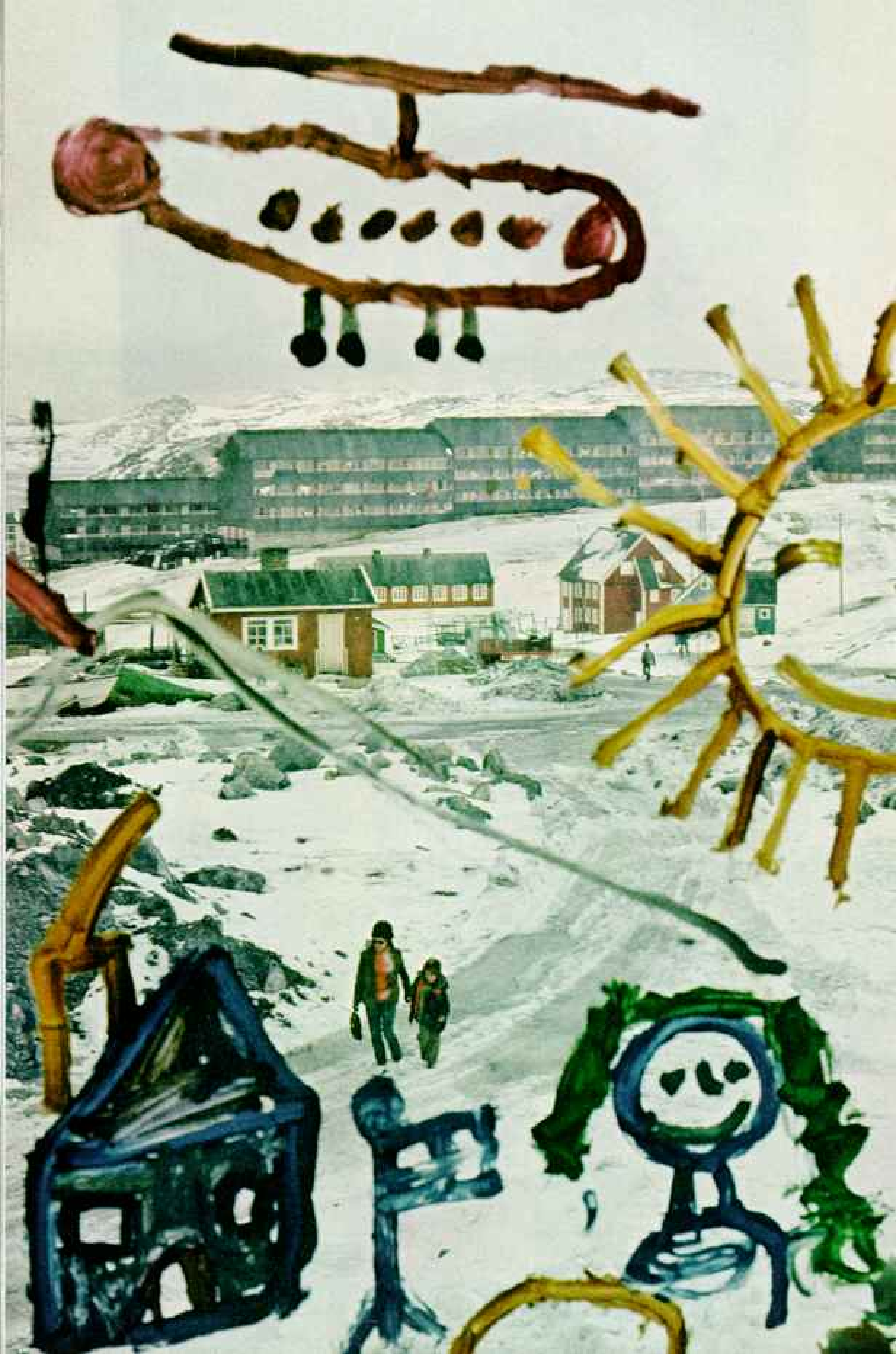
In Jakobshavn sledge dogs are a necessity of life and at the same time an occasional threat to it. Nearly every year at least one

Monarchs of the frozen trails, Jakobshavn dogs trot in a fan formation (right) that is practical in Greenland because of the lack of trees. Teams race to the halibut grounds in the Ice Fjord (below). They will return in a few days pulling sledges, each loaded with a quarter ton of fish.

People are wary of the dogs because of their occasional aggressiveness. Few years pass that wandering dogs do not attack and kill a child or an elderly person. Police warn the owner of a loose animal once. Next time the dog is shot.









Winter lifeline, a helicopter—finger-painted by a child—hovers on a kindergarten window (left). The Danish Government built the blocks of apartments cresting the hill.

Dorte Elmström, enjoying a pipe after her lunch (above), teaches in the elementary school, where first-graders learn of Peter Nysgerrig—Curious Peter—an adventurous monkey (below).



villager—a wandering child or an elderly person—is attacked and killed before help can arrive.

Chained throughout the long days of summer, many dogs slip loose and roam the town in search of food. I teach my children to be wary of them at all times. While Clara Louise and her playmates are not above sharing their ice cream with a pup, any grown dog that ventures too near gets a resounding kick in the ribs.

Roving dogs are a real danger, for they often travel in groups and are quick to seize any advantage. Custom requires that if a man becomes tipsy at a party, one of his fellow guests must accompany him home. In his state, if he should fall or lie down to rest, his chances of survival would be slim.

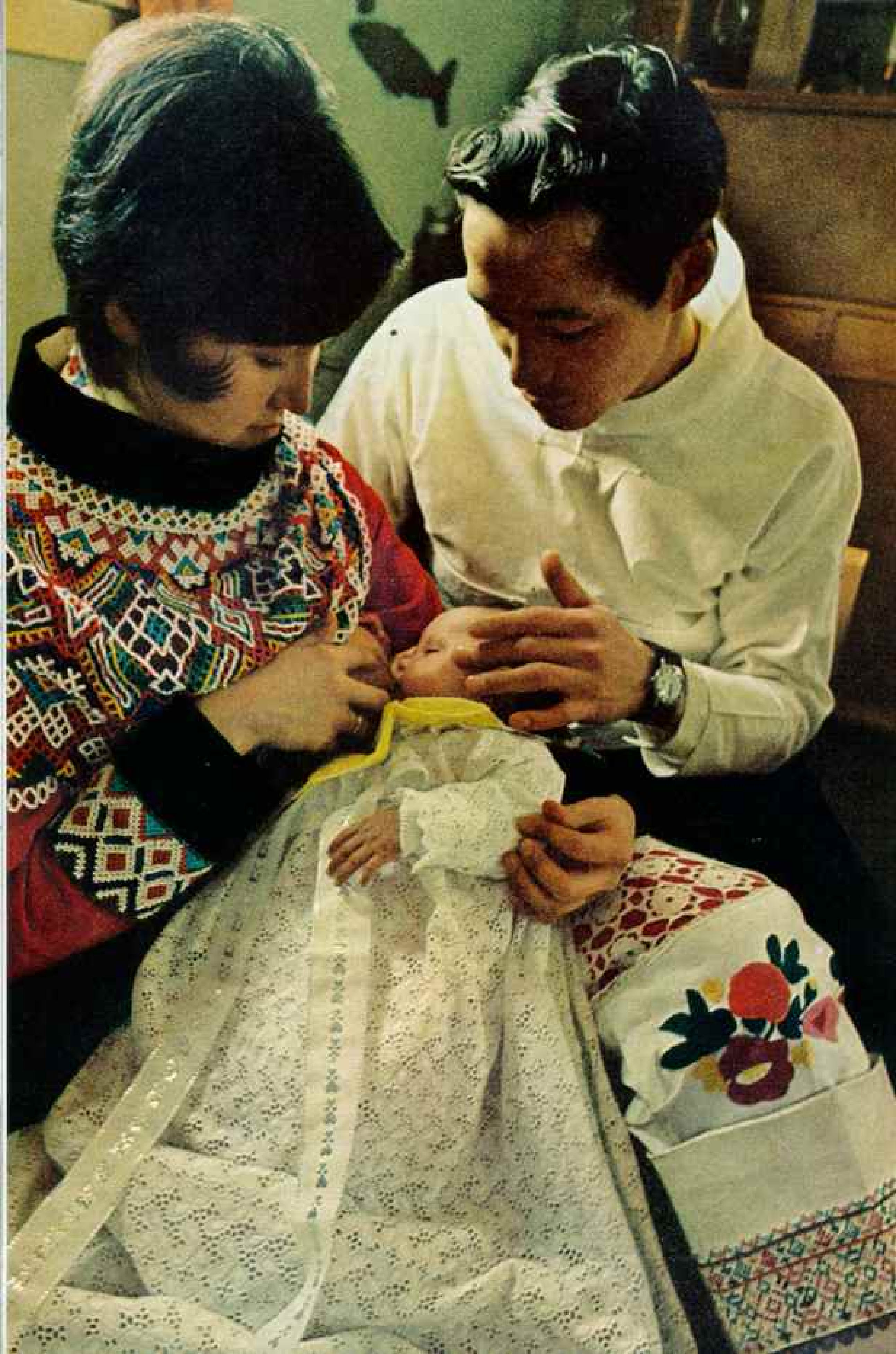
As a result our local police are ruthless with strays. "Any dog that is loose and appears homeless," says Chief Helmar Nielsen, "is shot on sight. If the dog is loose but still near home, we give the owner a single warning. Next time the dog is shot. Every year we are forced to destroy between 500 and 600 dogs." He shakes his head. "It is hard, but it is better than losing people."

#### Eager Dogs Howl the Winter In

In winter, however, the dogs come into their own. No other vehicle in the world, whether tracked or equipped with skis, can match the Greenland dog sledge for speed and versatility over rough terrain. Well before the first snow accumulates on the ground and ice begins to pave the fjord, the dogs sense the coming of winter. As the long polar night approaches, excitement sweeps through the teams like an epidemic, and life in the town is orchestrated to an endless chorus of yaps and howls.

Excitement, too, overtakes Jakobshavn's several hundred sledge owners as they put the final touches on harnesses and equipment. At such times I often think of Knud Rasmussen, the Arctic explorer and a native son of Jakobshavn, who declared, "Give me winter, give me dogs, and you can have the rest."

In Jakobshavn sledges haul both passengers and freight, and in either case enjoy the right-of-way over the town's hundred or so automobiles. For the newcomer it can be a horrifying experience to witness an encounter between a fully loaded sledge careering down a steep grade and a car climbing up it.



As the two vehicles approach each other, the team's dozen dogs are spread out in traditional Greenland fan formation, covering the entire road. The newcomer envisions a hideous tangle of dogs to the left of the car, dogs to the right, and dogs underneath, with the two points of the runners catching the headlights dead center and passengers or freight strewn all over the landscape.

But there are no Sunday drivers among Jakobshavn's sledge owners—and no Sunday dogs, for that matter. With barely a word from their master the team bunches and swerves at the last moment, slipping neatly past the car with inches to spare and fanning out once more on the other side.

Jakobshavn dogs have earned a reputation as the finest in Greenland because of their strength and ability to work so well together. When the Englishman Sir Vivian Fuchs made his epic traverse of Antarctica in the winter of 1957-58, he chose Jakobshavn dogs to pull his trail-blazing sledges.

#### Seals and Halibut Add to Income

During winter the dogs are used for both ice fishing and seal hunting on the fjord. Although minor in comparison to the income from shrimping (equivalent to about a million dollars a year), the halibut catch brings us another \$54,000. Sealing produces only \$2,000 or so, but, of course, we keep most of the seals for ourselves.

Once the fjord is frozen, the fishermen begin regular sledge runs over five or six miles of rugged mountain terrain and ten miles across treacherous ice to the fishing grounds.

Although the ice by then may average more than a foot thick, the powerful Greenland tides are constantly at work beneath it, lifting and buckling it, and scouring away the underside until many areas are perilously thin. With a covering of snow such patches are often impossible to detect, especially in the darkness of the Arctic night. Last winter Abraham Jensen, one of our most experienced drivers, vanished through a sudden crack in the ice. But for rare luck and incredible endurance my friend Henrik Vetterlain might have ended the same way.

I heard Henrik's story during an ice-fishing expedition last winter. With five other sledge drivers we left town early one February morning, when the winter night had begun to lift. Amid cries of "*Gamma, gamma! Go, go!*" the teams set off on the first leg.

"It happened several years ago," Henrik said of the accident, when we paused to catch our breath. "Luckily for me it was April, so there was light, although the temperature was still well below zero. I was fishing alone near the mouth of the fjord, when the ice around me suddenly began to break up. Somehow I managed to make it onto a small floe.

#### One Danger Succeeds Another

"In the scramble I lost everything—dogs, sledge, fishing gear, and worst of all, my cap and gloves. The floe was no bigger than my parlor rug, and I could barely keep my balance on it. I knew I mustn't lie down, or eventually I would fall asleep and freeze.

"To keep my circulation going," he continued, "I hopped up and down as cautiously as I could, so as not to tip the floe over."

"What about frostbite?" I asked, for at such temperatures exposed hands and ears can freeze almost before a man realizes it.

"Without cap or gloves that was a real problem," Henrik said. "I worked out a system of putting my hands over my ears for a time and then putting my hands in my pockets to give them back life."

Eventually the floe drifted out of the shelter of the fjord into open water, and Henrik faced a new danger. "The floe began to rock so hard in the waves," he said, "I thought I would be thrown off it at any moment or that it would simply break up. In either case I would be finished. Then to make matters worse, the sun went down."

Darkness ruled out all chance of rescue; Henrik could only hope he would survive the night, so that search boats or a helicopter diverted from its scheduled run might find him the next morning. Desperately hopping up and down on the tiny floe and trying to save his hands and ears, he continued his grim dance for life.

*(Continued on page 865)*

**In the lap of tenderness**, infant Diana Lennert nurses after her christening. Her mother, Eleonora, wears a beaded, high-necked *limiak*, sealskin boots, and hip-length leggings decorated at the knees with roses—the "romantic flower," she says. While her husband, Hans, delivers telegrams and drives one of the town's nine taxis, Eleonora works as an accountant. Diana is watched over in a day-care center, the *Vuggestue*, or Rocking Room.





Sunglasses for snow's glare: a necessity when winter sun slants through Arctic skies. Supermarket clerk Anne Margrethe Leander selects a durable—and fashionable—pair.

"You go snow blind if you don't wear them," says author Poulsen, a Danish teacher. "Your head aches, and your eyes feel as if they were filled with sand."

Snug for an afternoon outing, brightly clad Greenlandic tots trudge over April snow with Aase Hansen, the Danish housewife who adopted them (opposite). Wearing only her regular glasses on this brief outdoor excursion, Mrs. Hansen keeps her head down to avoid looking at the dazzling white expanse.



To ward off winter's cold, Greenlanders count on animal skins. Ice Fjord fishermen wear socks and trousers made of dog-skin; a pelt hangs second from left. Seal-skin, right, will be made into women's boots, center, here flanking seal-fur socks. Men wear cotton *anordks*, or windbreakers, left, on dress occasions.

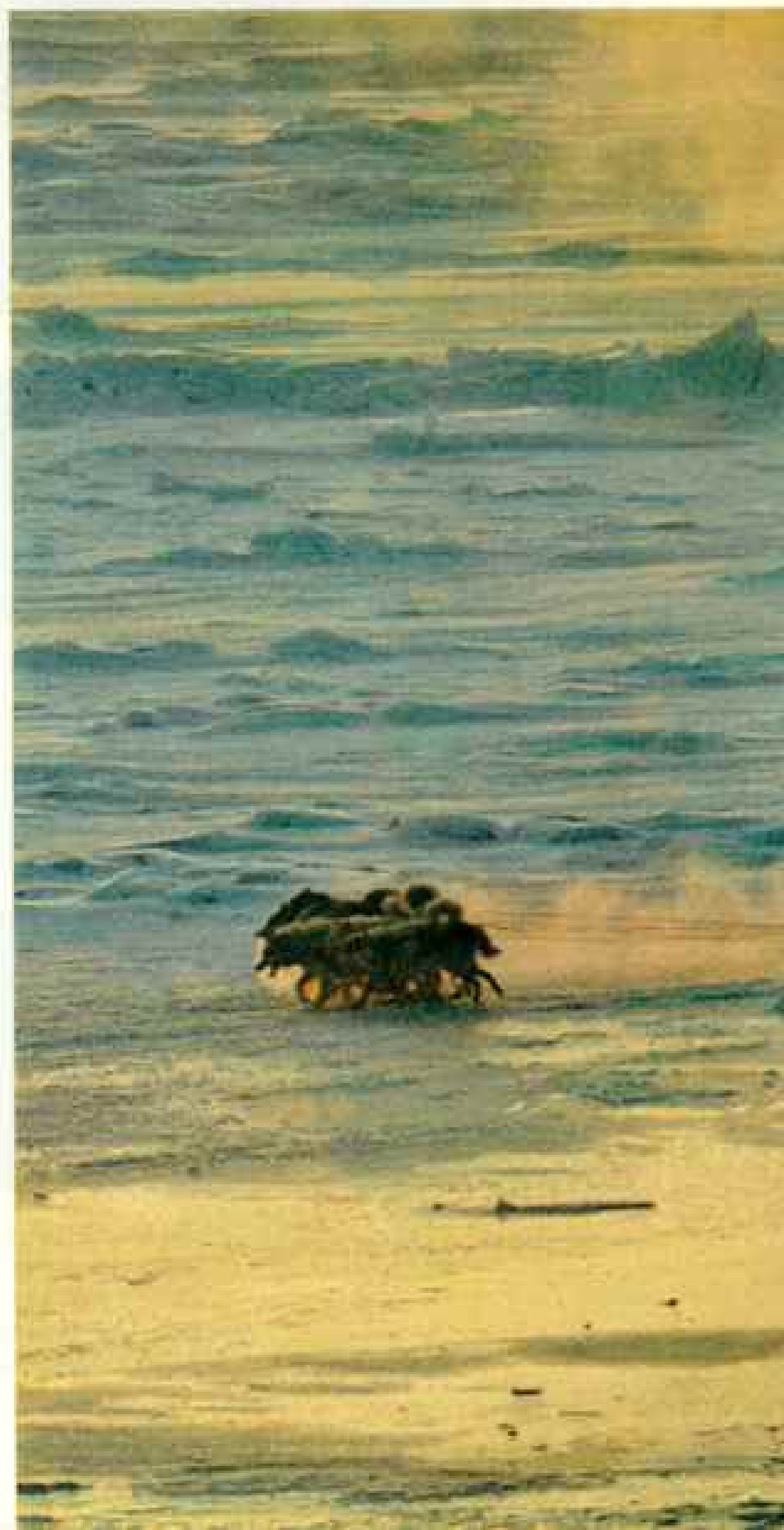


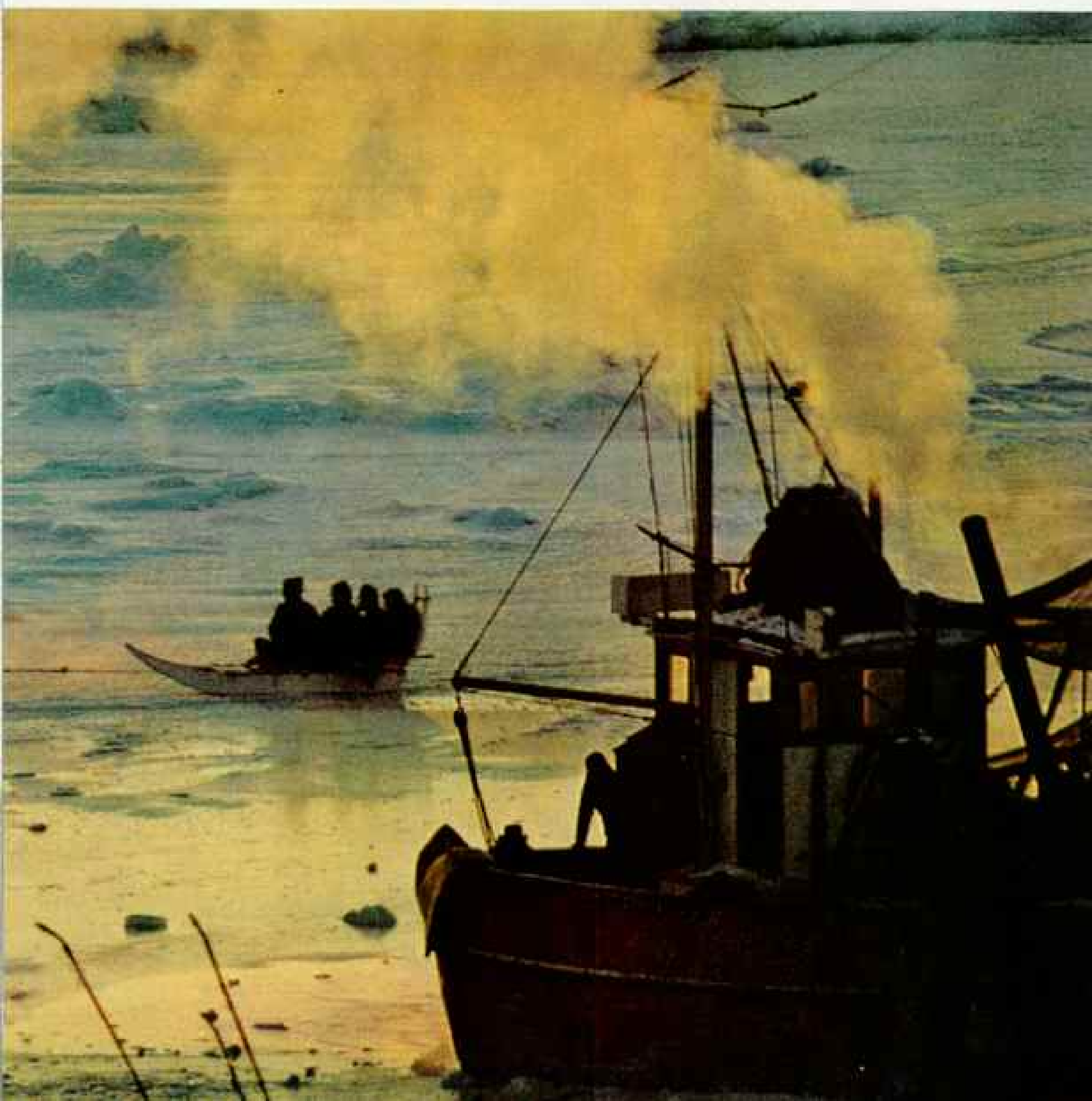
**Matterhorn of the Ice Fjord**, a lofty berg floats serenely on Disko Bay (below). Measured at 689 feet by Danish surveyors, the monster's weight was estimated at about seven million tons. During the summer months Jakobshavn's Glacier moves as much as 100 feet a day—sprint speed for a river of ice. Like gray ghosts the glacier's icebergs steal toward Davis Strait and the Labrador Current that ferries some as far south as Newfoundland.

Jakobshavn residents snare bergy bits—minibergs the size of a small cottage—and tow them to the harbor. There, a machine chops them into drink-size lumps that are

shipped abroad to chill cocktails in Copenhagen, London, Tokyo, and New York. Immersed in liquid, the ice crackles and fizzes as bubbles of compressed air escape—a song that began millenniums ago on Greenland's spine, when snowflakes became ice and began their frozen trek toward the sea.

Fringe ice stops shrimp trawlers (right), though tidal currents or an occasional thaw may release them for a couple of weeks of fishing before the next freeze. A sinking sun silhouettes four captains (below) as they head for home after firing their ships' engines to keep them in condition—a daily chore when winter grips their craft.







Soccer warms the blood as Greenlanders and their Danish advisers engage in friendly contest (above). Townspeople cheer their favorites with lusty claps and yells (top right). "The Danes hardly ever win," says Mr. Poulsen. "We Europeans have the technique, but the Greenlanders have the stamina. They develop fantastic endurance from running after their dog teams."

Winner of the annual sledge race, Hans-Lukas Rosbach (right) is hoisted—iron-runnered sledge and all—after he crosses the finish line. Following his boss dog, Nagtoralik—Sea Eagle—and 11 other sturdy animals, he covered a 20-mile course over frozen tundra and rock-strewn mountains in 2¼ hours.

Captain of his father's shrimp trawler in summer, Hans-Lukas fishes in winter for the Ice Fjord's 25-pound halibut, frozen for export to Denmark. He takes his sledge—and his chances—on the ice, where new snow may mask cracks.

"I've been stranded on ice floes several times," he says. The longest? "Four days," comes the reply, with a nonchalance only his countrymen can understand. "The floe pitched many times in the waves. I brewed tea, ate some halibut, and finally drifted to a shelf of solid ice."







Sunrise came and neither a ship nor a helicopter appeared. With growing alarm Henrik discovered that his floe had become smaller overnight from constant battering by the waves. He watched helplessly as bits of it broke off and floated away.

The day wore on and exhaustion overtook him. Finally, when both the floe and Henrik were nearly gone, a shrimp boat happened by. He had been adrift for 36 hours and had floated ten miles out to sea.

### Bergs Capsize With a Roar

No such adventure highlighted my trip with Henrik, though ice fishing itself can be hazardous. Reaching smooth fjord ice after a two-hour trek overland, we jumped aboard the sledges and picked up speed, skimming along a well-traveled route. It gave a wide berth to the fleet of icebergs launched by the enormously productive Jakobshavns Glacier, which were now locked by winter in the fjord.

Though seemingly harmless at such times, the bergs present a serious danger. Eroded at the waterline by tides, the towering masses of ice gradually become top-heavy. Finally a berg will capsize with a deafening roar, shattering the frozen surface of the fjord and dooming any passing driver and team.

Once on the fishing ground, we staked the dogs far enough apart to prevent fights and unloaded the fishing gear. Since the water at that point is 2,000 feet deep, the heavy lines, each fitted with some 150 hooks, must be three-quarters of a mile or more in length. Chopping two-foot-wide holes in the ice with our iron-tipped *tuks*, we baited the hooks with capelin, a type of smelt.

Ice fishing in Greenland is a little like flying a kite, though the medium is water rather than air. In former times a fisherman could use only one hook to a line, lowering it straight down to the bottom, where halibut feed. Nowadays fishermen attach a stone sinker and a thin metal panel to the lower end of the line, to catch the currents beneath the ice and

draw the line downward at an angle from the hole. When the panel touches bottom, the fisherman pays out the line so that the hooks are distributed across the ocean floor. Then it is only a matter of waiting for the halibut.

After we had set the lines, we melted snow on a Primus stove and brewed cups of tea. Despite our heavy dogskin trousers and socks, sealskin boots, and reindeer-hide parkas, it was cold sitting idly on the sledges. Søren Frederiksen, a veteran hunter and fisherman in his late 30's, surveyed me with a smile.

"Chilly work, *iliniartitsissok* [school-teacher]," he remarked, "yet I would not change jobs with you. I have fished on the fjord since I was a boy, and it's in my blood. Here I am my own master, free to do what I want whenever I want—I do not have to report to the classroom every morning at eight o'clock sharp."

Talk turned to some of the drawbacks of ice fishing, notably Greenland sharks. These monsters, some of them weighing as much as a ton, can strip a halibut line clean of a hundred fish in less than an hour.

"Sometimes," Søren admitted grimly, "I bring up nothing but halibut heads after a long day's work. But when I am lucky"—he grinned—"as I'll be today, of course, I can fill the sledge with 400 pounds of halibut and make 300 kroner [roughly \$50]. Whatever I can't sell, like wolffish, cuskeel, and dab, I feed to the dogs."

### Timely Arrival Saves Men and Dogs

More than one Greenlandic fisherman or hunter has been forced to reverse this procedure and eat his dogs, but only once have I known a man who deliberately risked starvation rather than do that. Steen Malmquist knew that a single mouthful of dog meat might kill him or cripple him.

Steen is a former member of the Sledge Patrol, a group of expert drivers hired by the Danish Government to patrol Greenland's

"I grew up in a kayak," says 67-year-old James Knudsen, who still takes to his one-man craft at an age when most Greenlanders are taking their ease. Perched on a vise he uses to make barrel staves, Knudsen tells of danger-filled days when he hunted the seal—his people's mainstay for food and clothing. "I was ten miles from home once," he says, "when the *avanaq*—the north wind—came and the sky grew dark. The waves were as high as this room. It seemed I was under them for minutes at a time but I never capsized. When I got ashore, my cousin said, 'I knew you would be safe because a wild raven died in the village today. His life was taken in exchange for yours.'"



sparsely populated east coast. Years ago, while on winter tour in the far north, Steen and his partner ran into trouble.

"We were crossing a frozen inlet," he recalls, "when we went through the ice, losing our food and nearly all our equipment except two sleeping bags and a tent. We scrambled ashore with the dogs.

"I knew there was a trappers' hut up the coast, probably with a cache of food. In the meantime we could always eat the dogs in an emergency—or so I thought, until the weather took a sudden warm turn.

"You see," Steen explains, "some Greenland dogs, like others in the Arctic, carry trichinosis. Dogs seem to be only mildly affected by this disease, which is caused by small worms. To humans, it can be fatal.

"To kill the worms, you either cook the meat or let it stand for several days at below-zero temperatures. The only trouble was that we had lost our stove fuel, and the temperature stayed above zero."

In fact, it stayed above zero for three weeks, while a snowstorm raged. In their tent, the men grew weaker each day. At last the snow stopped, and they managed to walk and crawl to the hut—followed by the dogs, who were even weaker than they. A trapper making his rounds finally rescued them.

#### Teacher Learns From Pupils' Virtues

By the end of our day on the fjord, Søren Frederiksen had filled his sledge with halibut, as had Henrik and the other four fishermen. Fortunately the sharks were elsewhere that day, and the fish were intact. Hitching up the dogs, we reached home by early evening and delivered the catch to the freezing plant. Next morning I was back in the classroom, teaching my first-graders a lesson in basic Danish.

Often I think it is the students who teach me, for we Danes have much to learn from Greenlanders. Although our modern technology has had enormous impact on life in the Arctic, many of the Greenlanders' old traditions and values still survive. One of these is instinctive honesty.

Years ago I made friends with James Knudsen, an expert seal hunter and one of Jakobshavn's most respected men. One day I made some small remark that was clearly more polite than accurate. James gave me a kindly look. "We Greenlanders speak the truth, and we expect it from others," he said. "There is no need to lie to us."

Food for Jakobshavn dogs, small halibut dry in the September sun (opposite). Thriving on the fish diet, the animals grow to 90 pounds and are regarded as the finest sledge dogs in Greenland. Polar expeditions have staked success on their tireless legs.



**Home is the hunter:** A fat ringed seal will yield meat for Hendrik Petersen's family and a skin worth about \$25. Petersen, a skillful seal hunter, also works as a plumber.

Like many of Jakobshavn's people, he welcomes modern ways but still enjoys the old ones. "If the weather is good, I go hunting," he says. "If not, I work at my job. Here I have the best of both worlds."





In other ways, too, Greenlandic and Danish customs differ, as in the rearing of children.

"You Danes trounce your children and pamper your dogs," my friend Marius Sivertsen observes. "We Greenlanders whip our dogs, for they understand and respect force, but we never strike our children and only rarely scold them. On the contrary, we treat them as equals."

#### Ancestral Gifts Survive Through Children

James Knudsen insists that striking or scolding a child can endanger its life.

"Every Greenlandic mother," he told me, "believes from the day of her child's birth that the tiny and wonderful creature is a complete personality, and that the wisdom and insight of our forefathers is seeking expression through this newest member of the family.

"Such a soul," James continued, "should not be chastised, for to do so would be to chastise one's ancestors and cause them to withdraw their magic gifts."

"What gifts?" I asked.

"The gifts of wisdom and the will to survive," James answered. "Both are essential in our hostile world. One must cherish the spirit in every child: If it is ignored or mistreated, it might go so far as to leave its new abode. In that case the child will die."

A more earthly magic benefits Greenlandic children today—the magic of medical research and treatment. Within the space of a single decade the war on such traditional killers as tuberculosis and measles has increased life expectancy in Greenland from an average of 42 years to 63. At the same time family planning has brought Greenland's explosive birthrate under control. The figure has dropped from 50 per thousand inhabitants in 1960 to 21 per thousand today.

Despite the trend Jakobshavn continues to grow, as more and more families forsake the remote settlements and migrate to what in Greenland is a big city. With more than 700 dwellings, we are indeed an Arctic metropolis.

Nor is Jakobshavn's growth confined to the land. When Sigrid and I came here, the port had only ten shrimp boats. Today we have a fleet of 36 modern vessels, and even that is

not enough. Every summer a dozen more come up from the south of Greenland to share in the shrimp harvest.

Along with people come new industries and ideas, one of them perhaps unique. Besides sealskin, shrimp, and halibut, Jakobshavn now exports its most plentiful resource, ice, with an unusual guarantee: Every shipment has aged for at least 2,000 years and is virtually free of pollution. Each summer as many as ten icebergs are reduced to cocktail-size chunks, and shipped abroad under the label "Greenland Ice Cap Rocks."

#### Which Way Lies the Future?

On the surface, at least, we have become a modern town, with our helicopter service, automobiles, movies, electrical gadgets, and even television sets on which we view taped programs from Denmark. Actually these are luxuries beyond our means. Denmark spends more than \$100,000,000 a year to support Jakobshavn and other Greenland towns.

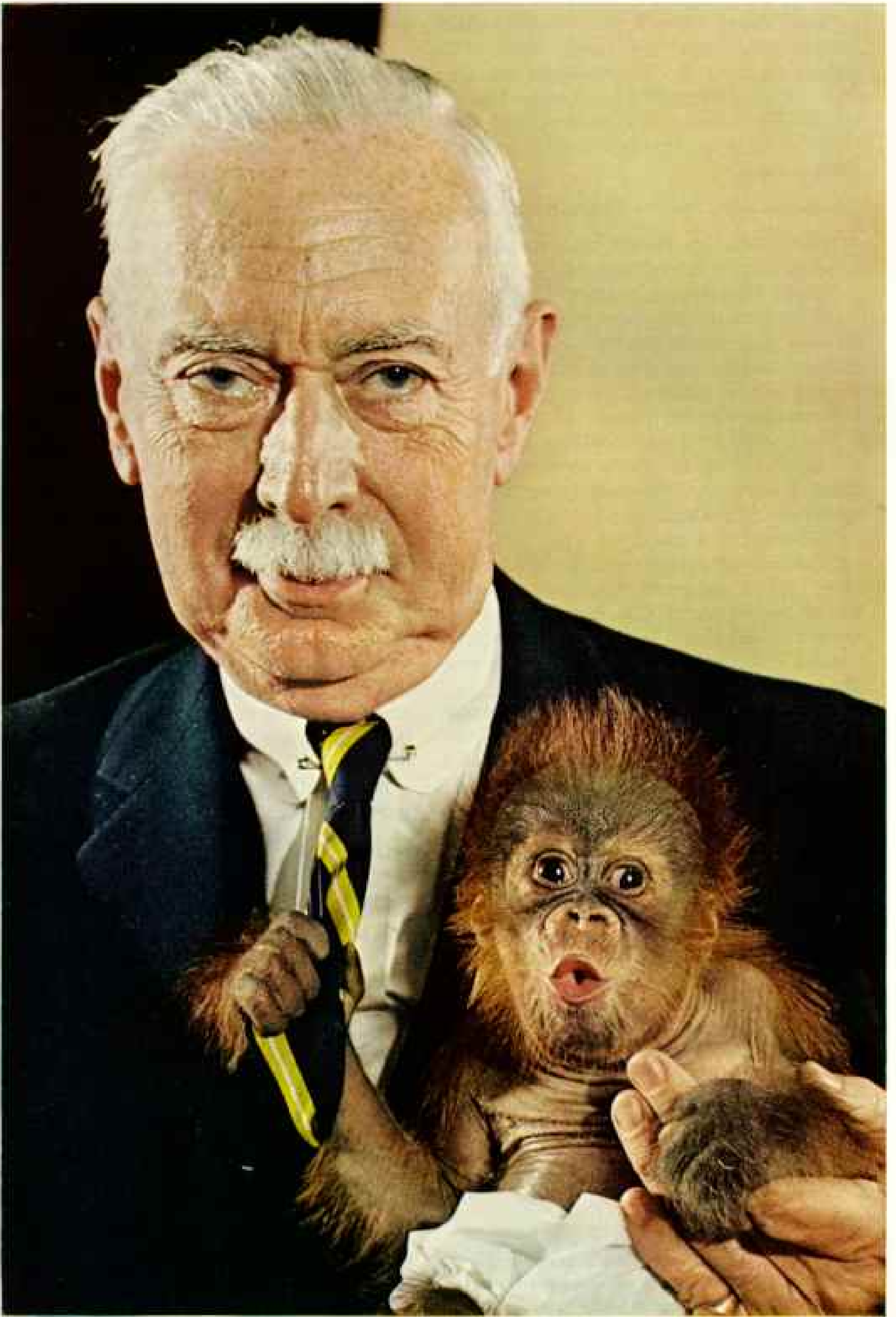
Sooner or later we must reach a balance between what we can afford from outside and what we provide on our own. As I watch my students grow, I am impressed by their ability to master new techniques while retaining the best of the old. The boys who tinker with outboard motors and radios are equally at home making dog harnesses, hunting sledges, fishing nets, and halibut lines in the age-old fashion of their people.

Along with their interest in clothes and the latest cosmetics, Jakobshavn girls learn how to prepare seal meat, dress and stitch furs, and handle weapons almost as well as boys do—skills that a woman in the Arctic still needs in order to marry and raise a family.

Whether we can apply those skills to life in the future remains a question, though with outside help there is a chance. One of our growing industries is tourism, and every summer more and more people make their way up the coast of Greenland to the Place by the Icebergs. When one of them asks me if Jakobshavn can preserve its unique character while adapting to new ways, my answer is always the same:

"Imaq'a—perhaps." □

**Crammed with shrimp** and still trawling for more, the *Karl Birgithe* idles along while owner Marius Mathiassen checks his radio antenna. A skipper can clear as much as \$14,000 annually. Machines peel the shrimp, which were once stripped laboriously by hand. "A few years ago we were slaves," says a Greenlander. "Now I relax and rejoice at all my slave machines."



# Leonard Carmichael: An Appreciation

By MELVIN M. PAYNE, Sc.D.

PRESIDENT, NATIONAL GEOGRAPHIC SOCIETY

**H**E WAS TALL, six feet three inches, and weighed a solid 200 pounds. For the last nine of his nearly 75 years he was a familiar figure in the headquarters building of the National Geographic Society—a courtly man with white hair and a white moustache who always seemed to tower above his fellows.

For those nine years Dr. Leonard C. Carmichael—author of several books and dozens of articles, holder of 23 honorary degrees—served the Society with flair and devotion. As Vice President for Research and Exploration, he directed our campaigns on the frontiers of knowledge. He did so with scholarship, with elegance, and with wit. When he died on September 16—full of years, full of accomplishment, full of honors—he left an enormous void in our nation's intellectual ranks. And he left a similar void in the hearts of those who had known him.

Leonard Carmichael's knowledge and experience seemed to encompass every field of human attainment. He was a scientist who could clinch an argument by quoting a poet, an administrator who found solace in the intricate harmonies of Johann Sebastian Bach. Like the art critic Bernard Berenson, he would say that he counted each day lost in which he did not write something for publication. But with typical charm and wit he would hasten to observe that "there have been many lost days."

Trained as a psychologist, he early left his

mark on a discipline that still honors his name and his work. In 1926, at a time when most psychologists believed that heredity played only a minor role in development and that virtually everything had to be learned, Dr. Carmichael performed an experiment that remains a model of its kind. He anesthetized some salamander larvae in a solution of chloretone—a drug that permitted structural growth, but no movement—while a control group matured normally. Later the first group was allowed to recover consciousness; soon they were swimming as well as the others, proving that salamanders inherit rather than learn this vital function.

**H**E WAS AMONG the first scientists to study and catalogue the earliest development of children, noting precisely at which age an infant would commence a particular function. A book he compiled and edited, called *Manual of Child Psychology*, became a classic. For the past 20 years every graduate student in psychology has referred to this manual.

Leonard loved laboratory work, and he loved teaching. As a young man, he served on the faculties of Princeton, Clark, and Harvard, and became a full professor at Brown while still in his twenties. In 1936 he went to the University of Rochester as Dean of the Faculty of Arts and Sciences, and in 1938—at the age of 39—assumed the presidency of Tufts University.

**Newborn friend**, a baby orangutan perches contentedly on Dr. Carmichael's arm. This portrait of the scientist, a noted student of primate behavior, captures the wry smile that was so familiar to those who knew his warmth, wisdom, and ready wit. For nine years a Vice President of the National Geographic Society, he brought to it the fruits of a lifetime of achievement as author, psychologist, wartime administrator, teacher, museum director, and university president. NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES L. STANFIELD





JANE VAN LAWICK, (ABOVE), JAMES A. SHOGAN



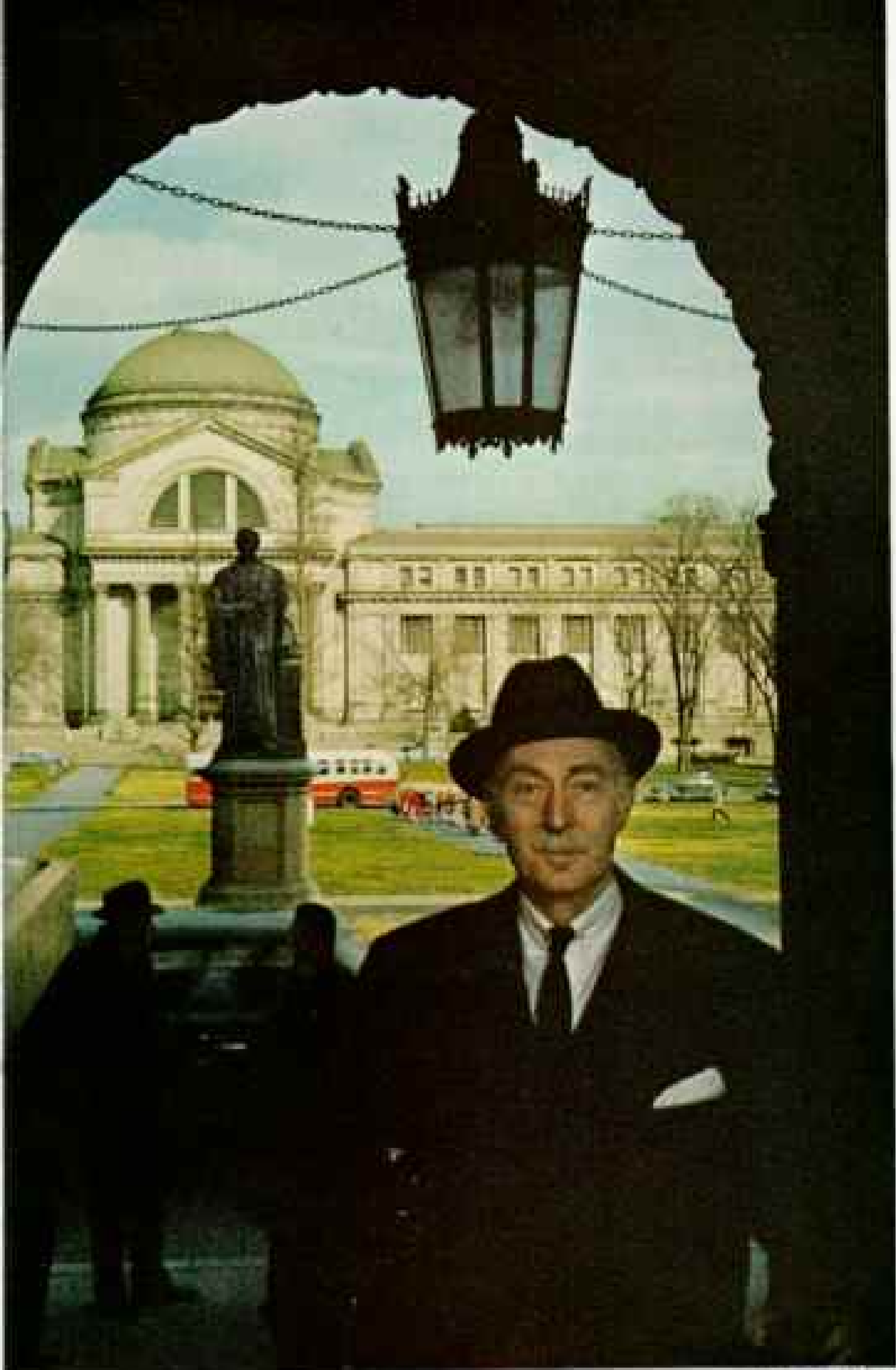
Fourteen years later he moved to Washington, D. C., to become chief executive of the fabled Smithsonian Institution. Under his leadership, Washington acquired a new landmark, the magnificent \$36,000,000 Museum of History and Technology. He hailed the day of its authorization by Congress as one worthy of fireworks. "Let's not send up those safe little sparklers," he told his staff, "but real Roman candles."

Evaluating his eleven years at the Smithsonian, a fellow psychologist said: "He won respect as the First Scientist of America, a kind of ambassador representing the scientific community both to the government and to the public."

**U**PON RETIRING from his post at the Smithsonian in 1964, this incredibly versatile man undertook yet another career. As a Vice President of the National Geographic Society, he took over responsibility for our programs in research and exploration. Under his aegis, the Society in recent years expended more than \$1,000,000 annually on a series of exciting projects: Exploring the remote past of our species with the Leakeys in East Africa, bringing new knowledge of the behavior of primates through the work of Jane van Lawick-Goodall and Dian Fossey, also in Africa, investigating the strange creatures of the Galapagos Islands, resurrecting the Greco-Roman city of Aphrodisias in Turkey, probing for archeological treasures beneath the Mediterranean.

Leonard's relationships with scientists in the field lent a humanistic tone to such research. Reports Richard Leakey, whose discoveries in the Lake Rudolf area of Kenya are revolutionizing our knowledge of man's

**Giant among giants**, Dr. Carmichael chaired a "brain trust" (left) at the National Geographic Society—the 16-member Committee for Research and Exploration, which lends support to scientists in every corner of the globe. He traveled from the peaks of Peru to Greco-Roman temples of Turkey; his "most thrilling experience" came in Africa with close friends and fellow committee members Melvin M. Payne, President of the National Geographic Society (above, center), and anthropologist T. Dale Stewart. Together they visited the camp of Jane van Lawick-Goodall, whose pioneering chimpanzee research expanded man's insights into his own past.



© ANTHONY STEWART

Far-sighted Secretary of the Smithsonian Institution from 1953 to 1964, Dr. Carmichael presided over the greatest growth in its history, building the Museum of History and Technology and adding two wings to the Museum of Natural History, behind him. During his lifetime he was accorded more than twenty honorary degrees; he earned his doctorate at Harvard. In recognition of preeminence in the realm of learning, he served the last three years of his life as president of the nation's oldest scholarly body, the American Philosophical Society.

development: "He was one of the greatest men I have ever met. His foresight, and his ability to see the human aspect of research and to inspire people, have contributed substantially to our present store of knowledge."

Leonard played a key role in guiding the results of the Society's more important research projects into the pages of the magazine, serving as godfather to many a vivid account of work in the field. His familiarity with the entire spectrum of the sciences produced a steady stream of story suggestions to the editors. Most important, he placed his vast knowledge at the service of any member of the staff who sought it.

**P**ERHAPS the honor that Leonard prized most highly was the presidency of the American Philosophical Society. He presided from 1970 until April 1973 over this

august assembly of the learned. Among his predecessors in office: Benjamin Franklin and Thomas Jefferson.

I will always cherish my own memories of Leonard Carmichael: the two of us fishing serenely from a small boat in the Galapagos, surrounded by the enthralling wonderland that had crystallized Darwin's theories, the two of us laboring through the African bush this past summer, visiting distant outposts of scientific investigation, even though he knew that his life was measured in months.

I remember something that he once said: "Treasure troves have a way of retreating as you reach for them." In the chronicle of human endeavor—so often sad, so often tragic—who can deny this? Yet, Leonard Carmichael's life proved a happy exception. He reached high, and the treasure trove of achievement did not elude him. □

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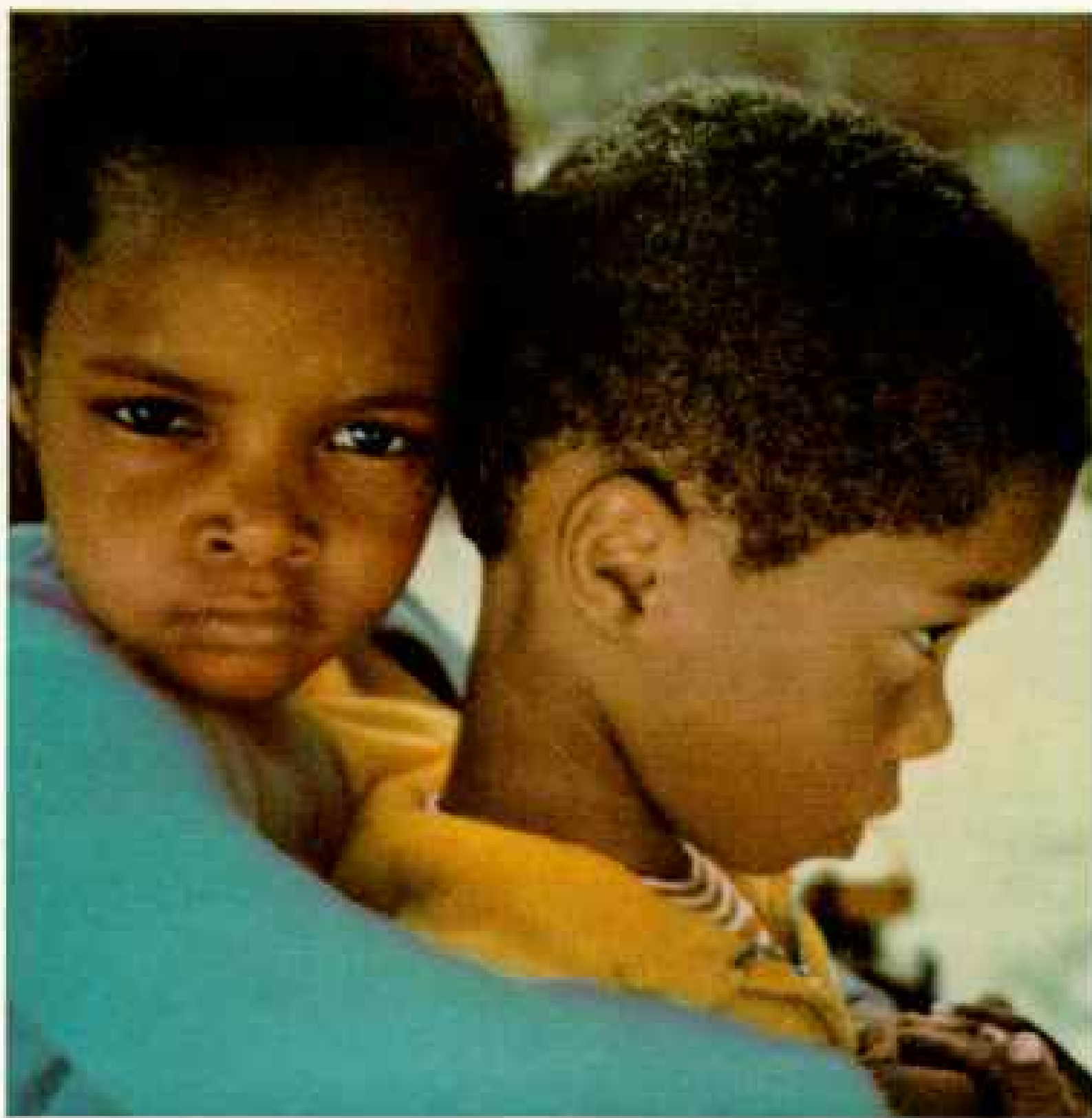
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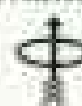
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**Risk.** There is none. Parker guarantees it, in writing. If the 75 Classic fails due to defects during its owner's lifetime, we will repair or replace it—free.

**Appreciation Rate.** At \$12, the pen is an outstanding buy, an investment certain to make memorable both gift and giver. Someone you know deserves one.



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The Parker 75 Classic Ball Pen in sterling is \$12; in vermeil, \$25; in 22K gold electroplate, \$3.50; in brushed stainless steel, \$5. Matching pencils. You'll find the distinctive arrow clip trademark on every Parker, from the famous \$1.98 Jotter Ball Pen to the \$150 Parker 75 Presidential Pen.





# We'd like you to know

“World energy relationships are now at a turning point. The earth is not running out of potential sources of energy, but it will take a major effort and considerable lead time to develop resources to meet our future needs.”

J. K. Jamieson, Chairman  
Exxon Corporation





This Exxon refinery at Baytown, Texas is being expanded to boost production of gasoline and other products by 15 million gallons a day. Smaller expansion programs will take place at several of Exxon's other refineries in the United States and abroad.

**A**lmost every American is aware that our country is facing a serious energy problem. But the fact is, the problem is not ours alone—it involves the entire world.

It is not easy to explain in brief how the situation came about. Complex factors are involved—ranging from increasing consumption to disappointing discoveries to environmental considerations to world political relationships. And solutions are not around the corner.

One thing is sure. The earth is not running out of potential sources of energy. But it will take a major effort and considerable lead time to develop resources to meet future needs.

On the following pages we review the energy situation and tell what Exxon is doing both short-term and long-term to meet the needs of its customers.

### **We need all the energy we can get.**

Looking first at the current supply-demand situation in the United States, it is clear that this country needs all the energy it can get from all available sources.

Exxon has responded to the immediate need by producing domestic crude oil at maximum efficient capacity. We have in-

creased imports of crude oil and petroleum products, and have kept our refineries running at an all-out pace.

Exxon has a major refinery expansion program under way that will increase Exxon's U.S. capacity by almost 15 million gallons a day, or about 30 percent. A small part of the increase will be available soon, and the full amount by 1976.

Until new domestic refining capacity is brought on stream, substantial volumes of imported petroleum products will be required to meet the needs of U.S. consumers. Even with the refinery expansions that Exxon and others have so far announced, it is not certain that the rapidly



Every day the average man, woman and child in the U.S. uses nearly four gallons of oil, 300 cubic feet of natural gas, 15 pounds of coal and smaller amounts of other energy—substantially more than the average of other industrial countries and eight times as much as the world average.





Exxon is looking for oil on land and off the coasts of more than 40 countries around the world. This platform is located in the North Sea where frequent storms bring 75-mile-an-hour winds and 65-foot waves.



On Alaska's North Slope the temperature may plummet to minus 60° in the winter. Industry production from the Slope is expected to total about 2 million barrels (84 million gallons) of oil a day.

increasing demand anticipated for the next few years can be satisfied.

Raising U.S. refinery capacity to adequate levels on a basis that satisfies environmental requirements will not in itself end U.S. energy supply problems. Worldwide, crude oil supplies will be tight in relation to the high demand now forecast.

### **Demand rising 7% a year.**

Oil and gas now account for about 65 percent of total world energy consumption, and their relative position is still increasing. Supplies of other fuels have not grown as fast as energy demand, and oil has been called upon to make up the difference. As a result, world petroleum demand, now rising at an annual rate of about 7 percent, could double by 1985.

The United States will remain the largest oil-consuming country during this period, and will become increasingly dependent on imported oil. Discoveries in the U.S. have not kept up with consumption for some time, and production is now actually declining.

### **An enormous goal.**

Present and future demand for oil is massive. To meet the expected growth, the industry would have to add about 4

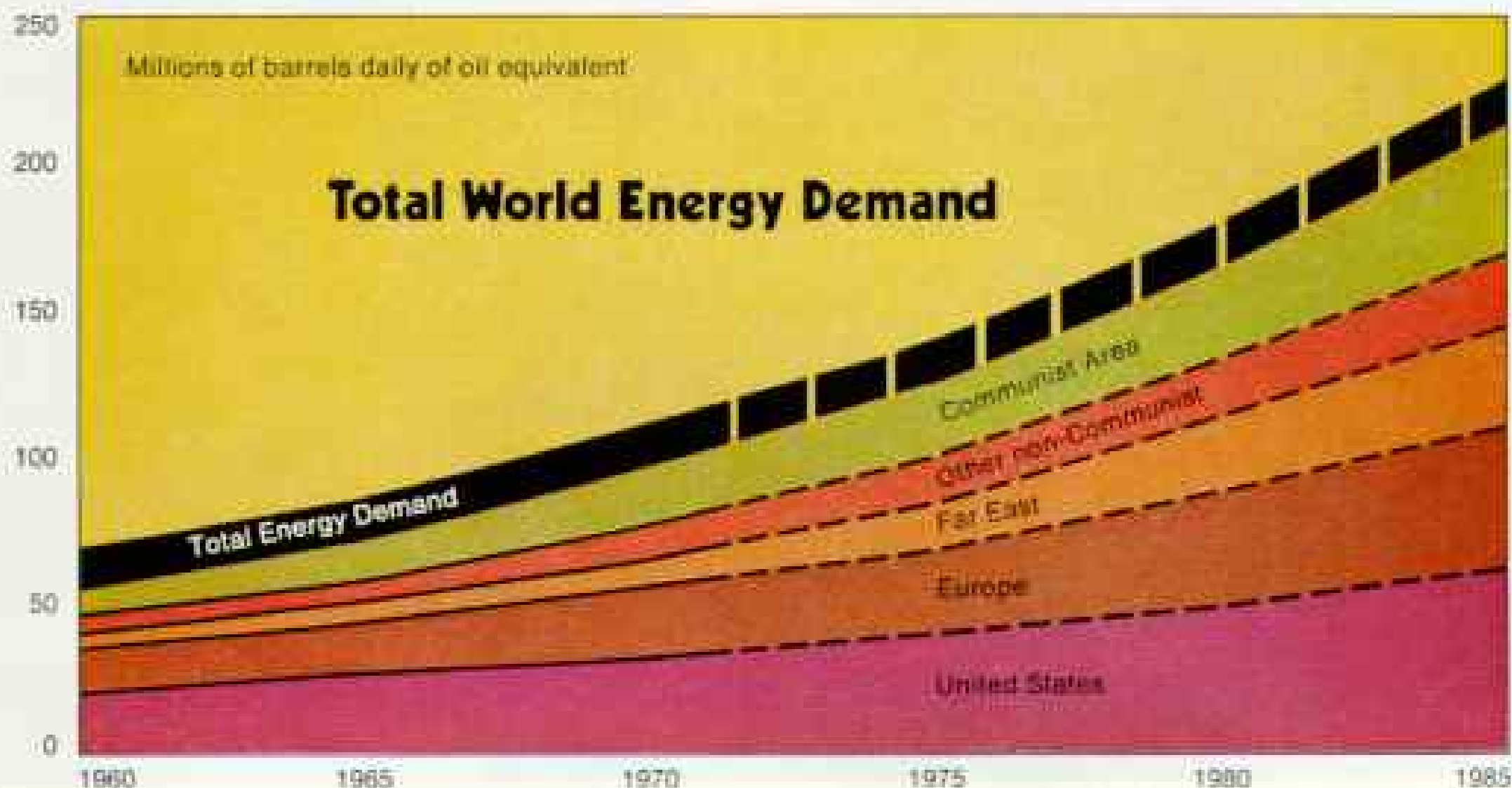
million barrels a day of producing capacity each year. To produce this much oil, the industry would have to find about 20 billion barrels a year—the equivalent of two fields the size of Alaska's Prudhoe Bay. By 1980, the required amount could be 30 billion barrels a year.

The physical and financial challenge of finding and producing this much new oil each year is enormous.

At the present time, about two-thirds of the world's known oil reserves are in the Middle East and North Africa. About half of total reserves are in the countries bordering the Persian—or Arabian—Gulf.

Despite the fact that significant recent discoveries have been made in the North Sea and other areas, they are small in relation to demand. Therefore the world will necessarily be dependent on the Middle East for an increasing share of its oil supplies for some years to come. Raising Middle East production at an adequate rate will require an all-out effort.

Even Middle East supplies are not limitless, and Middle East governments can be expected to watch closely the rate at which their resources are depleted. Furthermore, continued expansion in the Middle East could be affected by the concern of some Middle Eastern countries over their ability

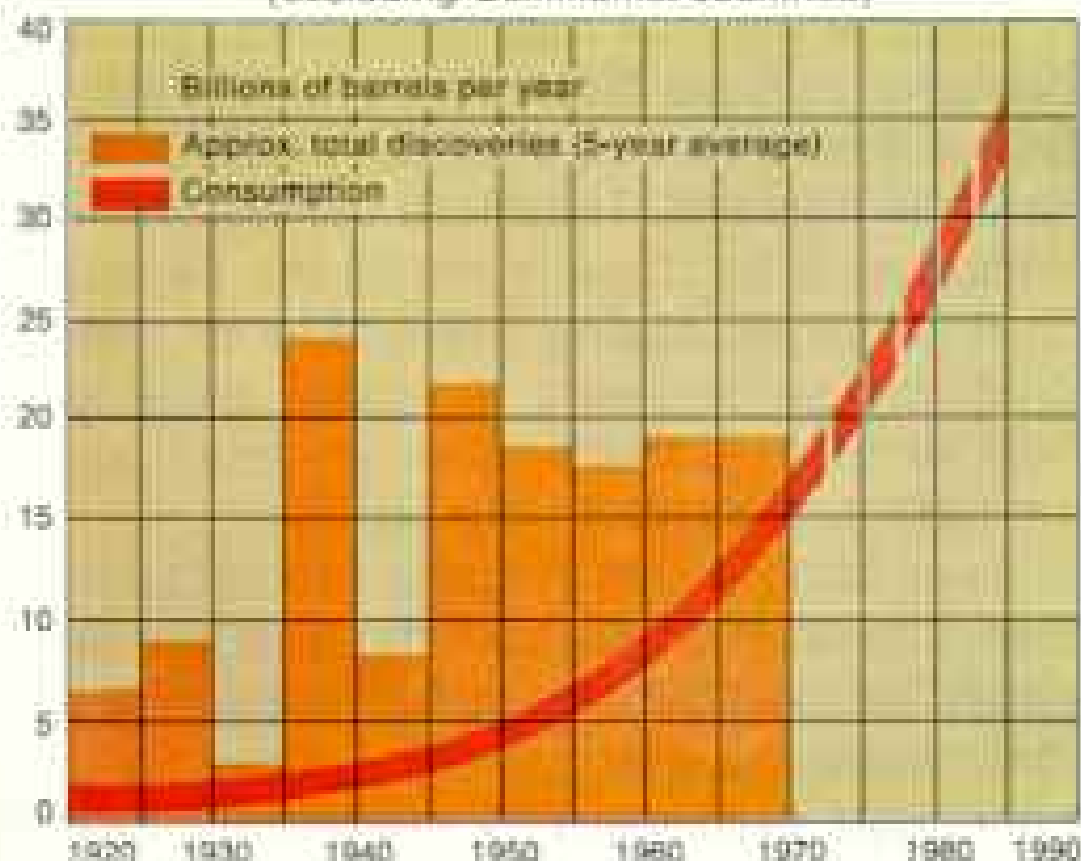


Demand has been growing steadily. Assuming no significant limitations in available supply, the outlook is for sustained growth, almost doubling world consumption by 1985.

to invest additional income gained from increased oil production.

It is important then to continue our efforts to find oil in all parts of the world. Although the industry may find itself with a modest surplus from time to time, consumers will probably have to live with the fact that surges in demand, delays in planned oil-producing capacity, unexpected restrictions by governments of producing countries, or any other major supply disruption could lead to shortages in the U.S. and other world markets.

Annual Rate of World Oil Discoveries and Consumption (excluding Communist countries)



Oil discoveries until now have exceeded consumption. Most experts agree that future discoveries are unlikely to keep pace with consumption.

### Why it's harder to find new oil.

The effort to find new oil has been accelerating in recent years, but it's not as easy as it used to be. Our industry has to search in increasingly difficult environments such as the Arctic and North Sea.

Despite the industry's best efforts, oil findings (See chart below) have held at a fairly constant rate in recent years.

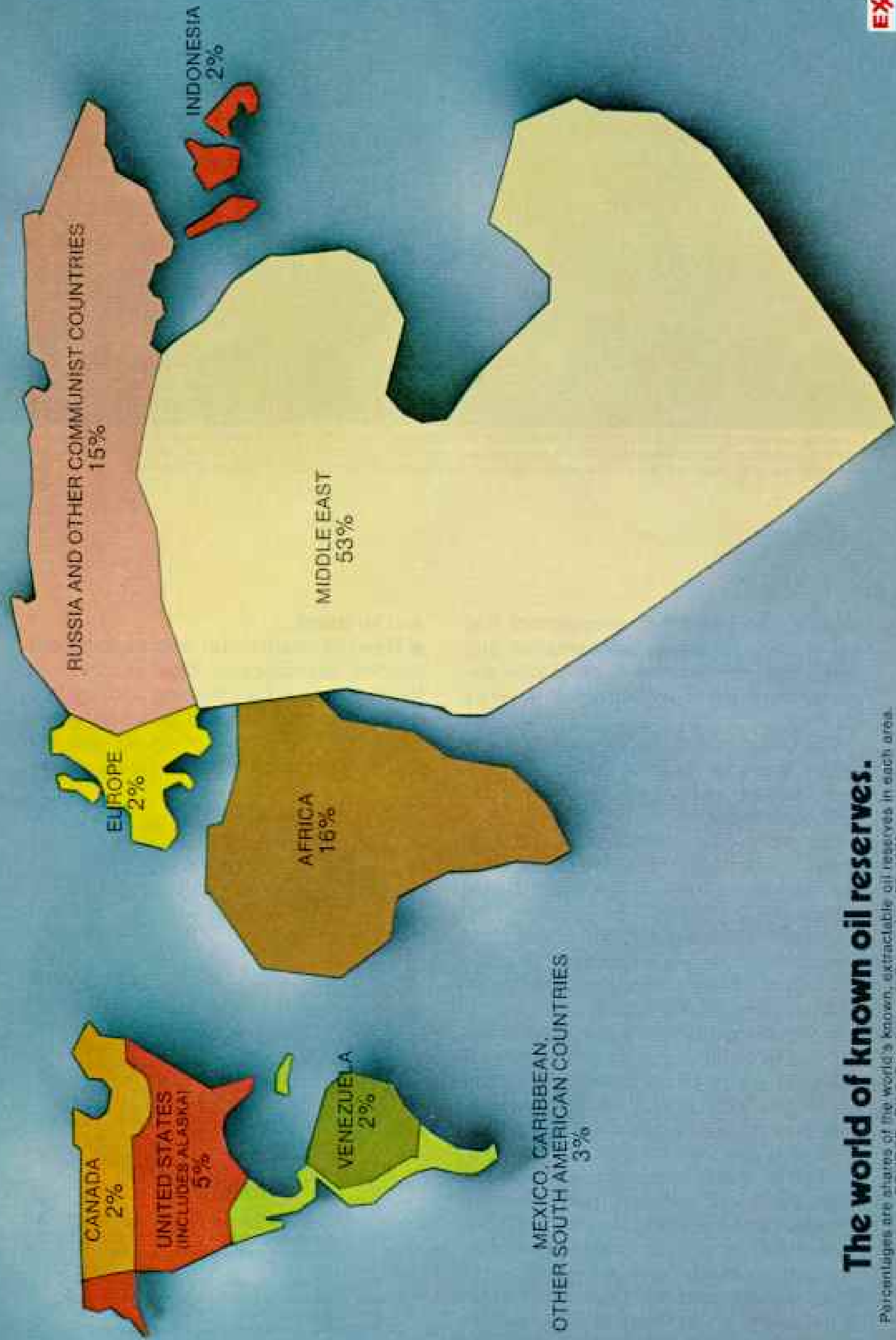
The very large fields of the Middle East represent discoveries whose size is unmatched in the history of oil. It is hard to foresee any other prospective area that could make such a contribution in the future.

It would thus seem imprudent to plan the world's energy supplies on the assumption that it would be possible to accelerate discoveries of crude oil to parallel the rising consumption.

Even if demand growth is moderated—as we believe it must be—we need to face the fact that the world's conventional oil resources will not indefinitely support increases in production.

### Two important things we must all do.

To prepare for such a situation, and for an orderly transition into a new energy era, every consuming nation must create a



## The world of known oil reserves.

Percentages are shares of the world's known, extractable oil reserves in each area.  
 SOURCE: Oil & Gas Journal—December 25, 1972



Extending beyond U.S. shores is an enormous undersea ledge called the continental shelf. This land mass is rich in oil and natural gas deposits. Some geologists estimate there may be nearly as much oil under this shelf as has ever been found onshore in the U.S. There has been active exploration and production only off Louisiana, Texas and California.

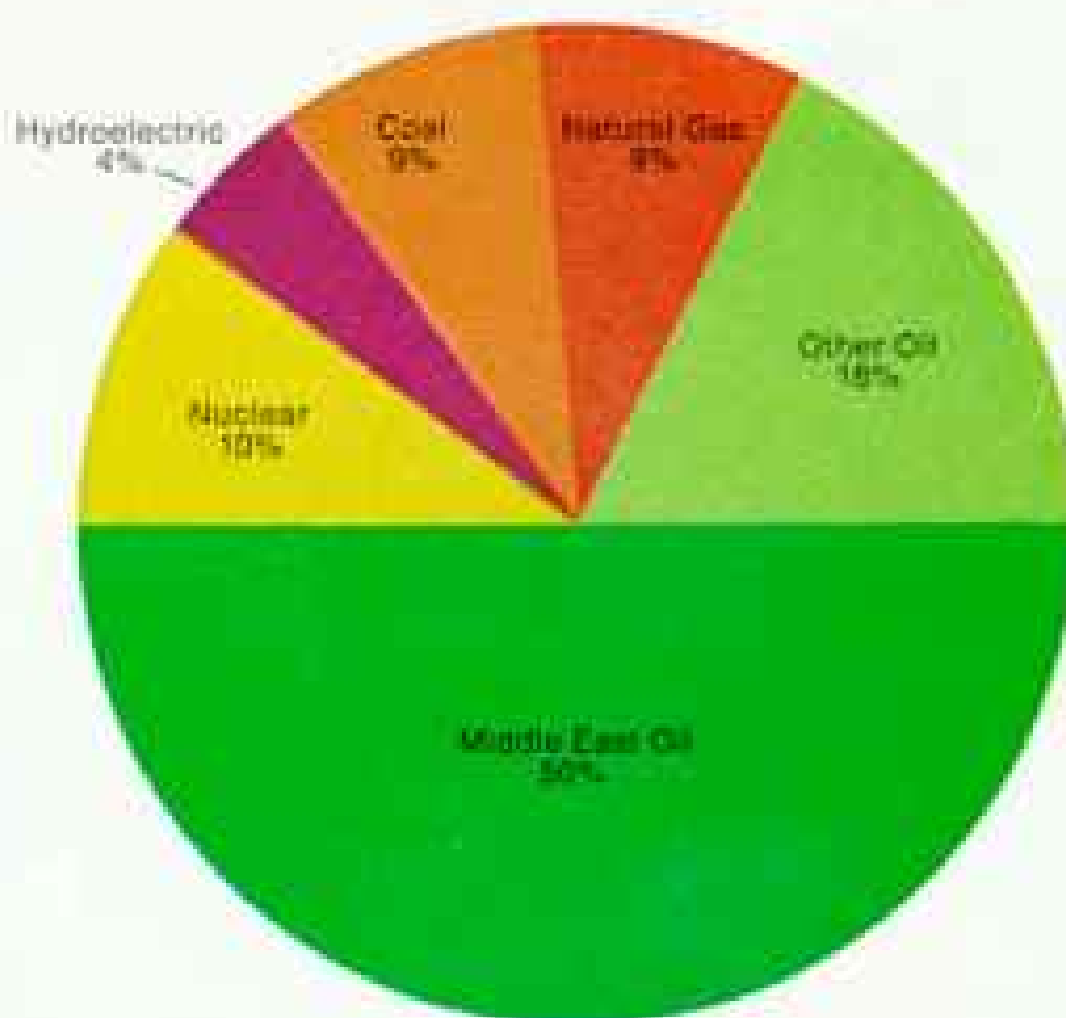
political and economic environment that will encourage energy conservation and speed the development of other conventional and nonconventional energy sources.

The U.S. has wider choices than many other nations because of the scale of our basic energy resources. We have such options as these:

- Use more coal, both directly and as a source of synthetic oil and gas. America has perhaps a third of the world's coal supply.
- Speed the pace of nuclear power plant construction. Increase research on more advanced nuclear technology and the direct recovery of solar energy.
- Implement government programs to advance the commercial development of shale oil. Large deposits exist, but there are long-term technological and environmental problems to be solved.
- Reduce gasoline consumption through the use of lighter, more efficient automobiles; car pools; better vehicle operation and maintenance; and auto emission controls and other devices designed with fuel economy in mind.
- Improve rail and bus systems for short to moderate length interurban transportation, to provide a better balance with auto

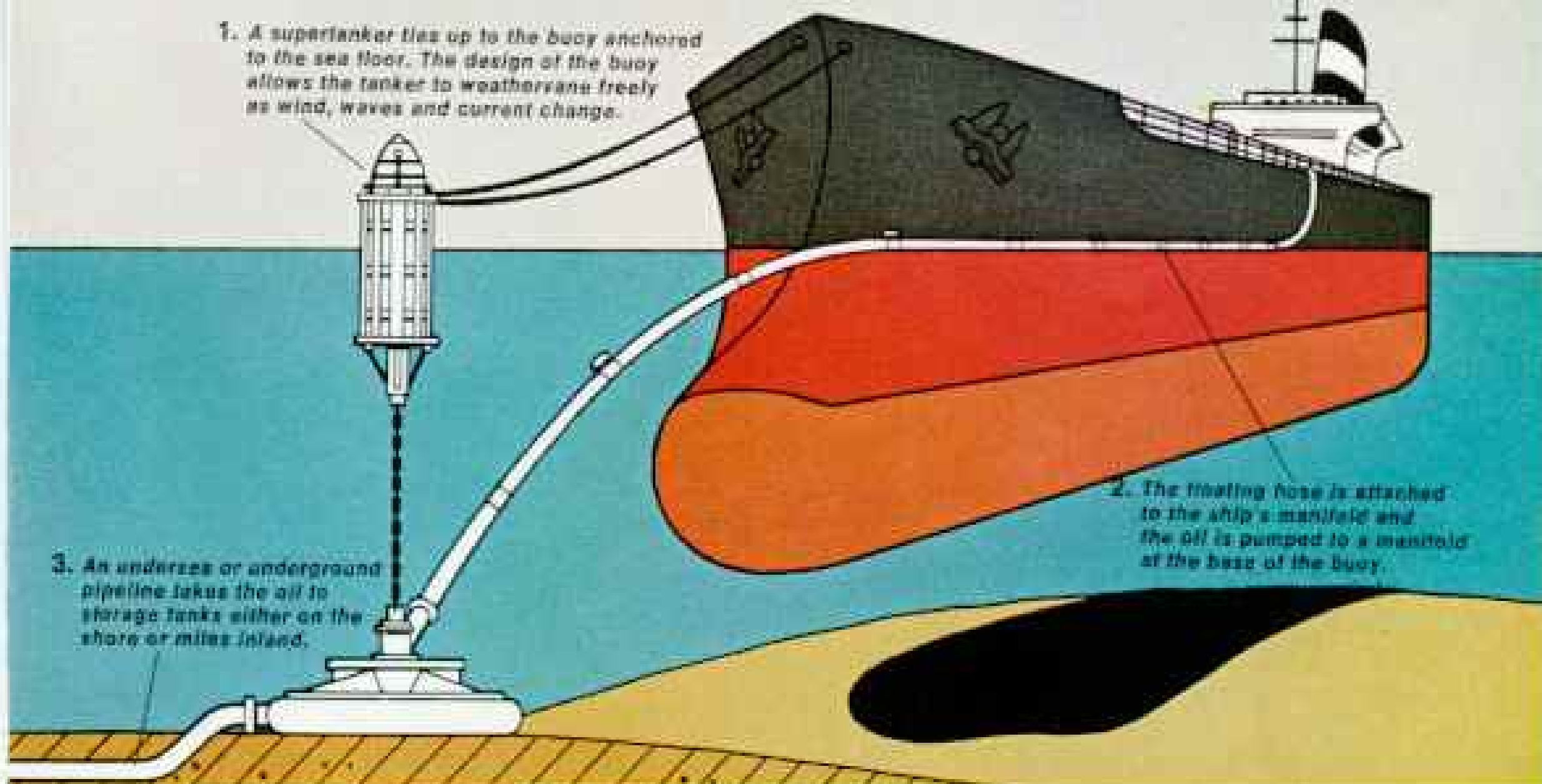
and air travel.

- Rewrite residential and commercial building standards to save energy used for heating, air conditioning and lighting.
- Develop new ways to generate power more efficiently, controlling air pollution and energy consumption at the same time.



Where the increase in the non-Communist world's energy supply might come from between now and 1976

These figures reflect economic, safety and environmental restrictions on the production and use of coal; reserve and transportation limitations on natural gas; and continued delays in nuclear power development.



A deepwater terminal allows supertankers to load or unload miles from shore. There are over 100 deepwater terminals around the world. They permit countries that have no deepwater ports to take advantage of the economies of supertankers. Because the U.S. has no deepwater ports, this system is being proposed for sections of the East and Gulf Coasts.

■ Resolve conflicts between environmental goals and energy resource development through appropriate government processes.

There is no time to waste if the United States and other major energy-consuming countries are to adjust to the changed situation that lies ahead. Government leadership will be essential in setting goals and policies. In the United States a start on an energy program has been made.

In this context, the President has directed the Council on Environmental Quality to prepare within one year environmental impact statements for exploration and development in the Atlantic and Gulf of Alaska outer continental shelf areas. This is a useful step even though significant production cannot be obtained from these areas in this decade.

This country also needs deepwater terminals to handle—with greater safety and efficiency than existing facilities—increasing amounts of imported crude and heavy fuel oil.

It may be necessary for both American industry and citizens to alter some of the ways they work and live.

In our desire to achieve rapid economic growth and higher standards of living, we Americans have been prodigal with re-

sources that once seemed limitless. Recent developments have made us all more conscious that energy resources, as well as air, water and usable space, are finite.

With new attitudes on these matters, it should be possible to achieve coordinated goals and a balanced, more satisfying way of life—without having to choose between running out of fuel or running out of clean air and water.

### **What Exxon is doing today for tomorrow.**

We have already pointed out what Exxon is doing to increase its output of gasoline and other products for the next several years. Our efforts are also directed at developing alternate forms of energy and synthetic energy sources for the future. To highlight a few of these efforts:

■ Exxon is exploring for uranium in the U.S. and abroad. From our mine in Wyoming, we are extracting 2800 tons of uranium ore a day.

Exxon Nuclear Company is a major supplier of uranium and plutonium fission reactor fuels. We are providing finished fuel and services to ten nuclear plants in the U.S. and to three in Europe.

■ To date we have invested over \$20 million in research aimed at converting coal



Pellets of enriched uranium (left) and fuel assemblies (right) are made by Exxon Nuclear Company. The pellets are inserted into rods, and the rods are grouped to form assemblies which make up the core or "furnace" of a nuclear reactor. An assembly, like the one shown, can generate enough electricity to run 16,000 average homes for a year.

into synthetic fuels. One process turns coal into a gas which can be upgraded to a fuel comparable to natural gas. Work at our pilot plant indicates that this process may be less complex and less expensive than other gasification processes being developed.

Another Exxon process turns coal into low-sulfur fuel oil or synthetic crude oil. This may be applicable to low- and high-sulfur coal.

It will take several years and over \$150 million in development costs before either Exxon process is available for commercial use.

■ Exxon is also developing processes that would allow utility companies to use the high-sulfur coal that our country has in abundance. When high-sulfur coal is burned today, it produces sulfur oxides, which can pollute our air.

One process, being developed for the

U.S. Government, would reduce sulfur oxide formation as the coal is burned. The other process, being developed with a major power plant builder and several electric utilities, would remove most sulfur oxides from the flue gas—after combustion but before the gas escapes from the stack.

Again, both processes look promising, and one of them—flue gas desulfurization—is ready to be demonstrated commercially.

These are some of the things Exxon is doing to help expand our nation's energy supplies. We will continue to work on new energy technology and look for more efficient systems for the use of energy.

And we will be cooperating fully with the government and the public in this country, and in all the countries in which we do business, to help build a better economic and human environment.



**We'd like you to know.**

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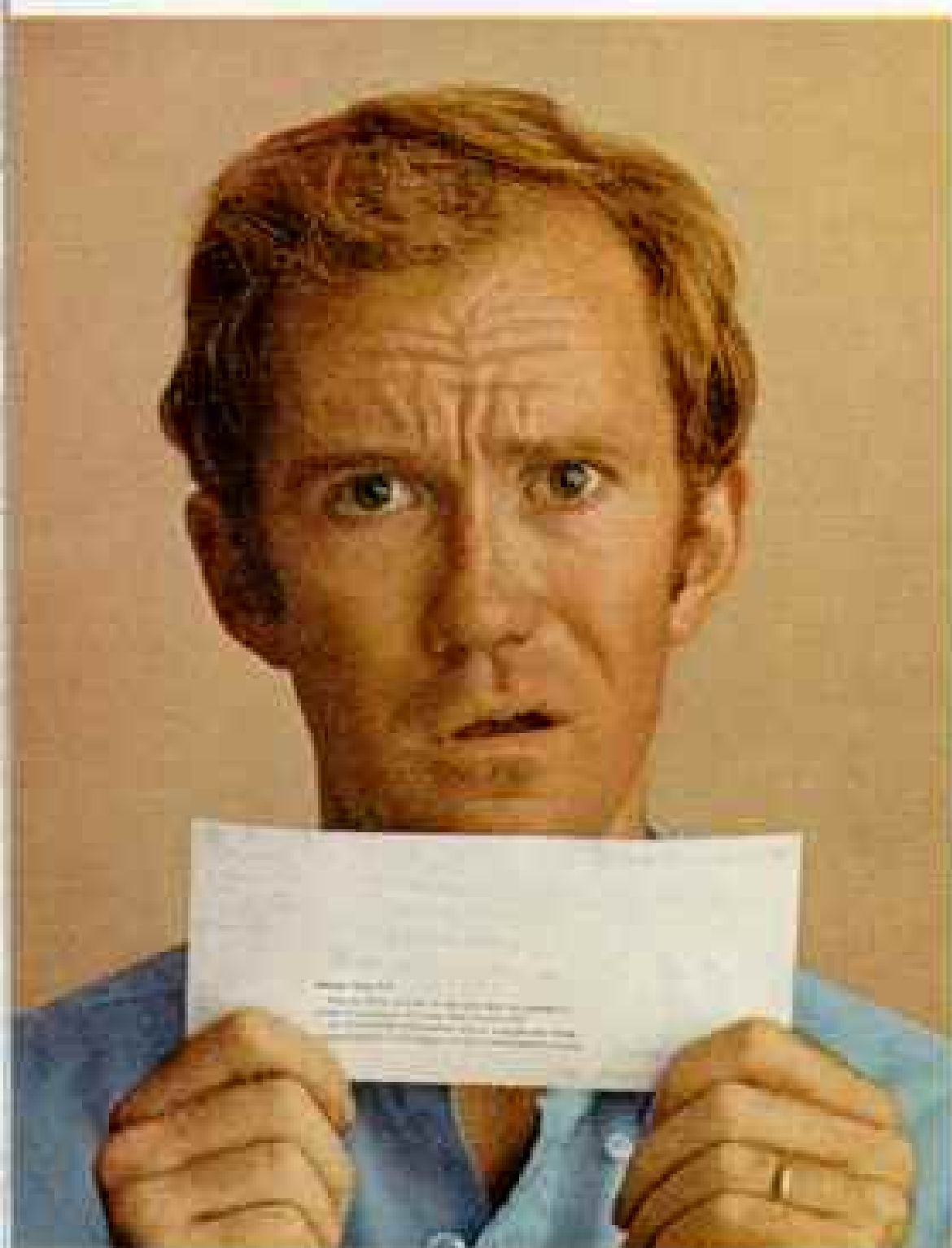
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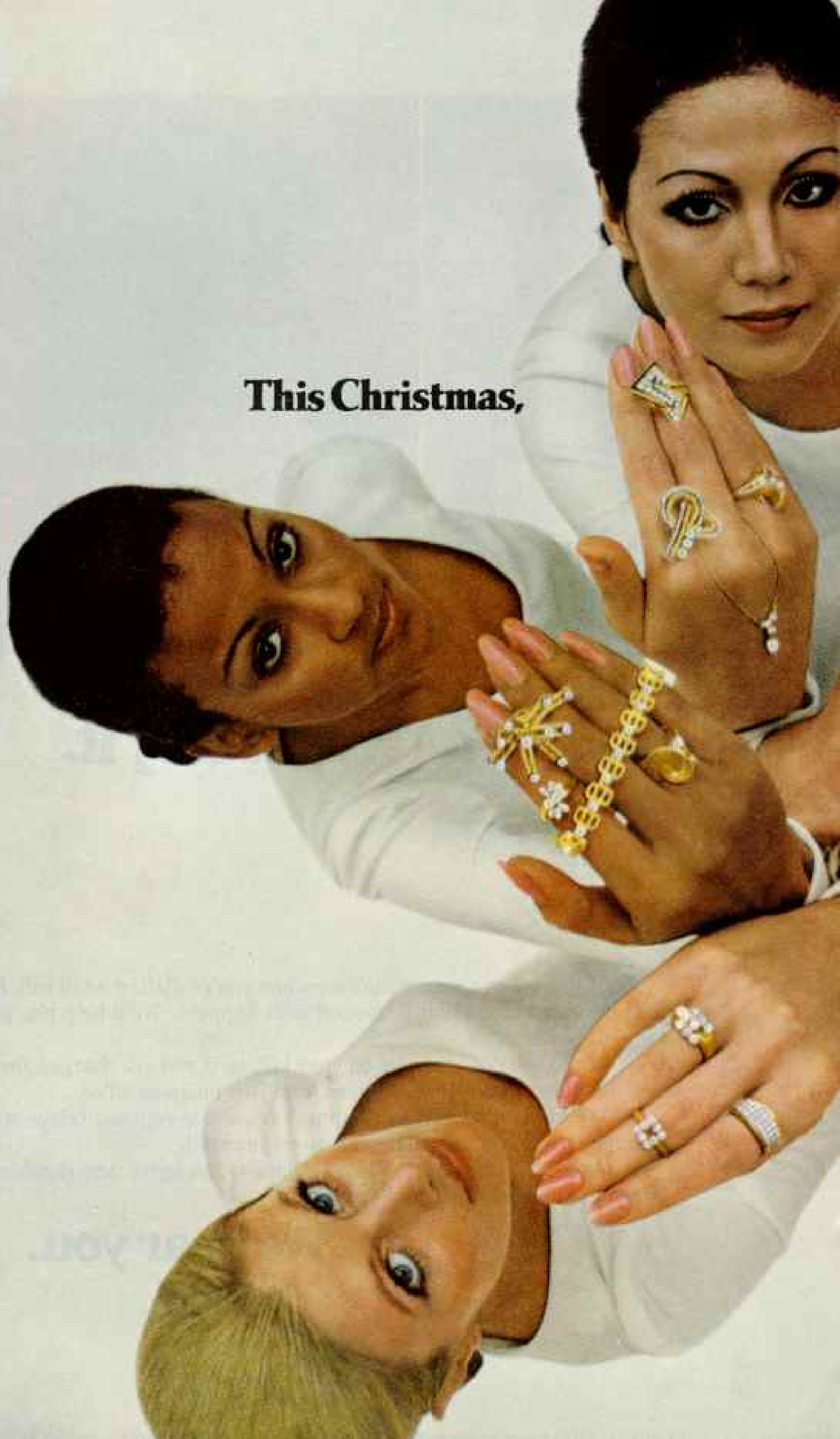
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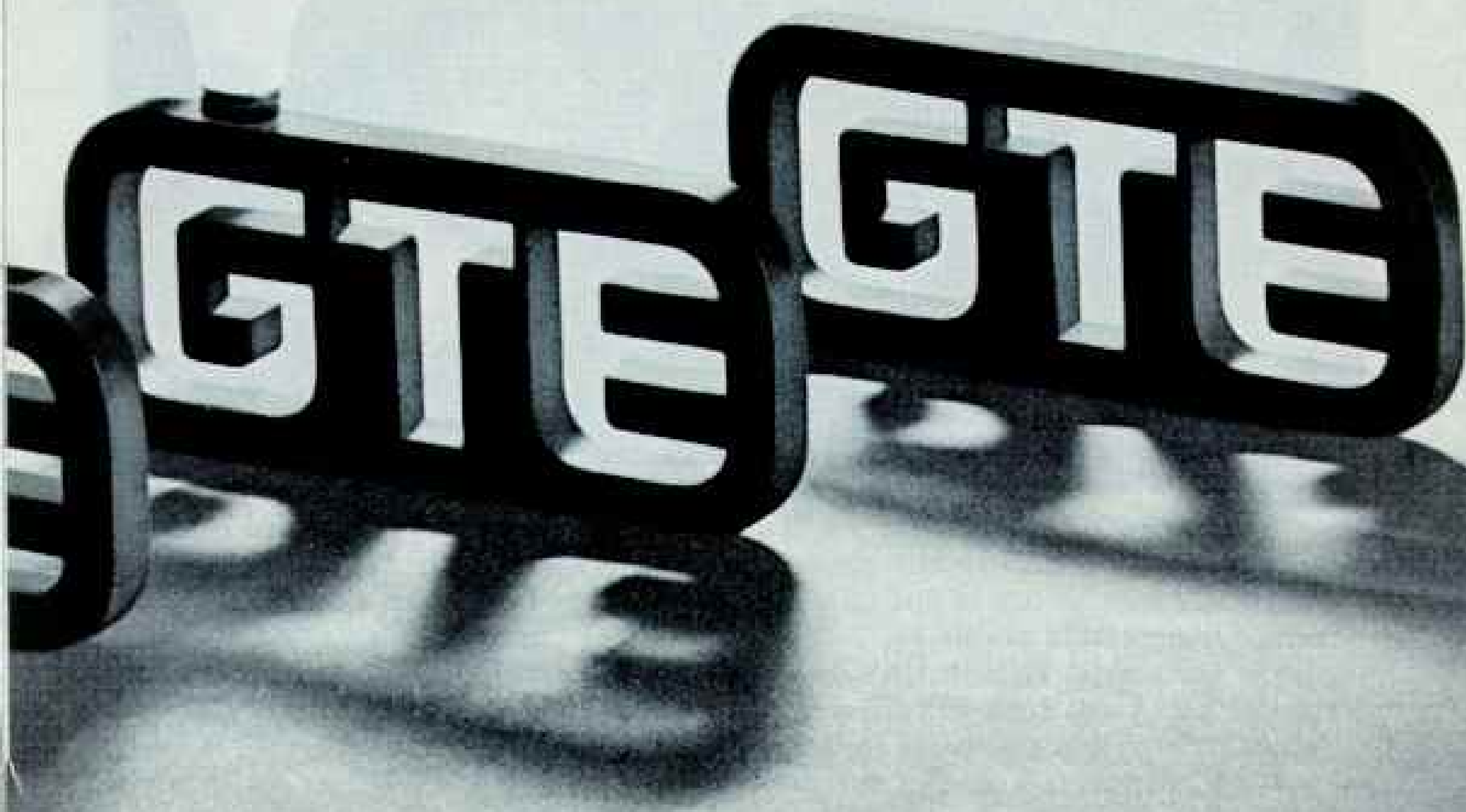


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**ANSWERS:**

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Brand G	2%
Brand H	2%
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**How the survey was made.**  
For the second consecutive year, one of the best known research firms in America conducted telephone interviews with independent TV service technicians in more than 170 cities from coast to coast. To eliminate the factor of loyalty to a single brand, the study included only shops which serviced more than one brand of TV.

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# THE MORE IT COSTS TO SURVIVE IN AMERICA, THE LESS IT COSTS TO RECUPERATE IN AUSTRALIA.

## YOUR HAMBURGER IS UP TO \$1.10 A POUND. OUR ROYAL ROAD FLY-DRIVE TOUR IS DOWN TO \$678.\*

Living in the Land of the Free in 1973 is exciting, enriching and rewarding.

However, it can hardly be done for free.

As you know all too well, your cost of surviving—let alone living—is climbing faster than a koala in a eucalyptus tree.

So much for American economics. And on to an Australian contrast.

Qantas is pleased to announce a delightful drop in the cost of our most popular Royal Road Australian tour.

Fly-Drive Australia: \$678 complete.

For this startlingly low price, you get:

- Roundtrip jet flight to Sydney
- A Ford Falcon from Avis
- 500 free miles
- 10 nights at the Gazebo Hotel, Kings Cross in Sydney

### NO BUS. NO GUIDE. NO SCHEDULES. NO TOURISTS. (EXCEPT YOU.)

Please do not be put off by the word, "Tour." Qantas Fly-Drive does not include scheduled excursions to gift

shops. Nor will you be forced to view Australian Points of Interest, along with a small mob of fellow American tourists.

On the contrary.

When you land in Sydney, you'll be driven to the famous Gazebo Hotel, where your Avis car will be delivered, along with detailed maps.

And then we set you free.

For 10 days, you're on your own, with your own car—in another world.

### YOUR COUNTRY HAS BEEN DISCOVERED, PIONEERED, SETTLED AND CIVILIZED.

#### OURS HASN'T.

Imagine the entire continental United States, inhabited only by the population of Pennsylvania.

That's Australia.

60 million years ago, Australia was cut off from the rest of the world. And developed into a world of its own. A world where you'll meet implausible creatures from centuries ago.

You can shake hands with a kangaroo. Swim, then walk with a platypus. Laugh it up with a kookaburra. (You don't need a Berlitz course to communicate with human Australians, either. We speak English.)

The land itself resembles nothing so much as a set of a science fiction movie. You can spend a day, for example, watching Ayers Rock turn from bright red, to orange, to crimson, to brown in the sun. Or the Mount Olga Range, which, from a distance, appears to be a herd of

enormous elephants, sleeping in the desert.

In Australia, there's not only room to breathe.

There's room to gasp.

### YOU WORK HARD FIFTY WEEKS A YEAR. THE OTHER TWO SHOULD BE RATHER SPECTACULAR.

We believe that since the stakes have increased in the game of survival in America, the payoffs ought to be Big Time, too.

Simply by living and working in America, you've earned a trip to Australia.

Haven't you?

Qantas, 350 Post Street, San Francisco, CA 94108. Or call toll-free: 800-227-4500. (In California, 800-622-0850.) You bet I've earned a trip to Australia. Please send me detailed brochures on your Fly-Drive Tour.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_  
My Travel Agent is \_\_\_\_\_

"The longer you spend with me, the longer it'll take me to recuperate from you"



We'd like to take you home with us.  
**QANTAS**

\*From the West Coast. From New York: \$867. From Chicago: \$813. From St. Louis: \$805. Per person, double occupancy, group economy class departures leaving San Francisco and Vancouver every Friday. Individual fare slightly higher. All fares subject to government approval.



Be ready for that one radiant smile. All you need is the holiday spirit and a camera that won't slow you down. A Minolta SR-T.

This is a 35mm reflex you'll be comfortable with from the moment you pick it up. It lets you concentrate on the picture because the viewfinder shows all the information you need for focusing and correct exposure. You never have to look away from the finder to adjust a Minolta SR-T, so you're ready to catch the photograph that could never be taken again.

And when subjects call for a different perspective, Minolta SR-T cameras accept a complete system of interchangeable lenses from "fisheye" wide angle to super-telephoto.

Christmas smiles come but once a year. Be ready for them with a Minolta SR-T. For more information, see your photo dealer or write Minolta Corporation, 200 Park Avenue South, New York, N.Y. 10003. In Canada: Anglophoto Ltd., P.O.

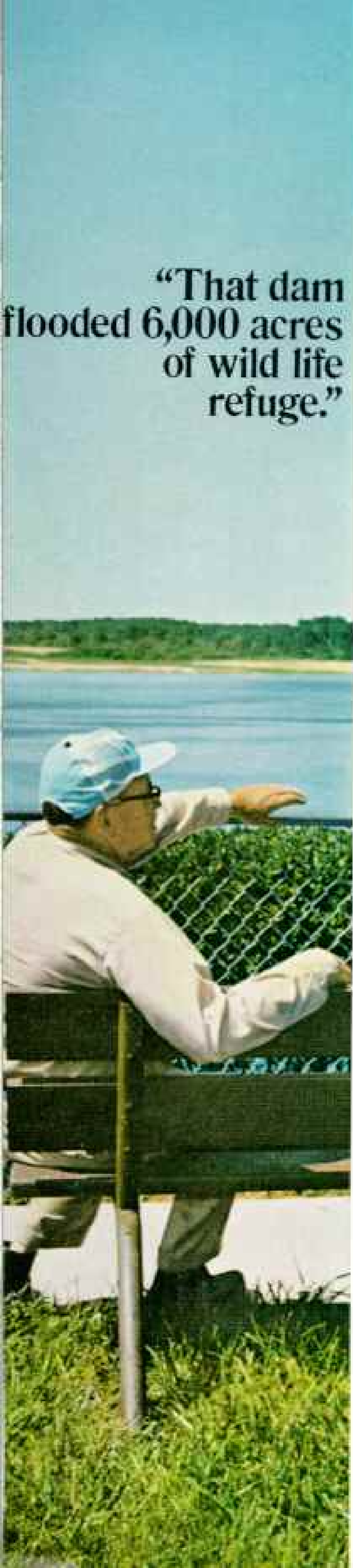


Minolta SR-T 102/Minolta SR-T 101

## Minolta helps you capture the smiles of Christmas.



*When identified by a factory-sealed "M" tag, Minolta 35mm reflex cameras are warranted by Minolta Corp. against defects in workmanship and materials for two years from date of purchase, excluding user-inflicted damage. The camera will be serviced at no charge provided it is returned within the warranty period, postpaid, securely packaged, including \$2.00 for mailing, handling and insurance.*



**“That dam  
flooded 6,000 acres  
of wild life  
refuge.”**

Some people think dams are bad. They flood valuable farm land, force whole villages to move and submerge historical sites and wildlife habitat. The arguments are worth listening to.

Ironically our high standard of living resulted from a hard-charging way of thinking that often failed to consider the effects of our actions on environment. Today we are more inclined to weigh environmental effects as well as the economics involved.

Take the Mississippi River flood control system, for instance. Work on the project began in 1928—before most of us heard of ecology. Encompassing 2,200 miles of levees and overflow basins, the project is now 80% complete. It shelters over 10 million acres of flood plains and cost \$1.8 billion to date.


But, during the floods of '73 this project alone saved more than \$7 billion in crop losses—over three times its initial cost.

The saving includes over two hundred million bushels of soybeans, two million bales of cotton and one hundred million bushels of rice that would have been flooded out.

If those farm commodities had been lost it could very well have meant even higher prices on many things from underwear to beefsteak.

No one believes we should dam every rivulet and stream. Rechannel every river. But neither can we deny the value of flood control and water management. Those projects should remain high on the nation's list of things to do. But—with full consideration of all long range results. To find out more, write: "Water," Dept. 3078G, Caterpillar Tractor Co., Peoria, Illinois 61602.

**There are no  
simple solutions.  
Only  
intelligent  
choices.**



**“And it saved  
80,000 acres of  
crop land.”**



**CATERPILLAR**

Caterpillar, Cat and  are Trademarks of Caterpillar Tractor Co.