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R. A. AND B. T. GARDNER

Conversation with Washoe

TALKING WITH ANIMALS, once only a feat for fictional Dr. Dolittles, has come a step nearer reality with the work of two psychologists at the University of Nevada in Reno. Dr. R. Allen Gardner and his wife, Dr. Beatrice T. Gardner, received a National Geographic grant to help answer an intriguing question: Can a chimpanzee learn to converse in sign language?

During the first two years with the Gardners, Washoe mastered more than thirty signals in American Sign Language, using the gestures in

short statements or simple questions. When Washoe plays peekaboo (upper left), Allen Gardner teaches the sign for "look" (lower left). Sitting on Beatrice Gardner's lap (above), the sociable chimp studies an assistant's ticking watch, then makes the sign for "listen."

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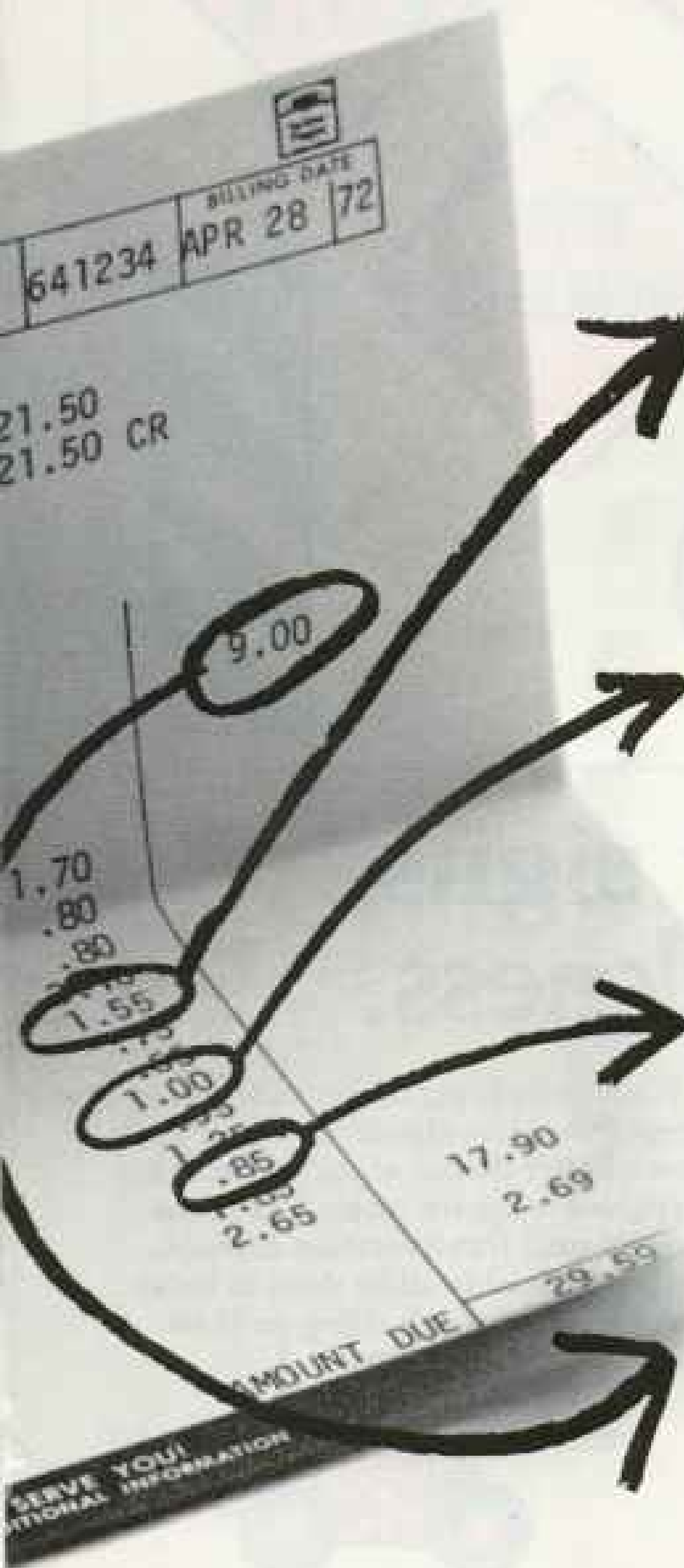
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If you're willing to talk to anyone who picks up the phone at the other end, it's cheaper to dial the number yourself and call station-to-station than to have our operator do it for you.

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3. Report long distance wrong numbers.

When you dial long distance and get a wrong number, apologize to the nice people at the other end, hang up, dial "0" right away and tell our operator all about it. We'll see to it that you get a credit for the call.

Whatever you do, don't give up, don't mutter bad words to yourself, and don't go away mad.

4. Call us when you go on vacation.

We have a special service for you if you're going to be away for more than one month. Just call our business office and we'll unhook your line temporarily at our central office, thereby saving you as much as 50% on your local service charge.

These suggestions are not presented altogether altruistically; very often, by helping you save money, we save some money ourselves. We trust that won't keep you from following Our Recommendation.

We'd love to hear someone complain that their phone bill is too low.

GENERAL TELEPHONE & ELECTRONICS



8 warning signs of road sickness.

Too many of our roads show signs they're not fit to drive on anymore.

They're dangerously narrow, with buckling surfaces, hairpin turns, unsafe passing zones, soft shoulders, poorly-marked railroad crossings. And a lot of other deadly little surprises.

The problem is, over 200,000 miles of the roads we drive today were built over 40 years ago. And we haven't done much to up-date or improve them since.

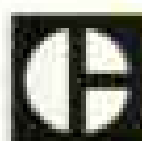
We can't ignore the situation because over 2 million people are injured and another 50,000 killed on our roads each year. And that's horrible.

We have to bring all our roads up to acceptable safety standards. So we'll all have a better chance of staying healthy.

Highways are the major link in our nation's total transportation network. We can't afford to allow them to decay. We have too much riding on them.



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THE ISLES OF GREECE

AEGEAN BIRTHPLACE OF WESTERN CULTURE

By MELVILLE BELL GROSVENOR, LL.D., Sc.D., Litt.D.

EDITOR-IN-CHIEF AND CHAIRMAN OF THE BOARD, NATIONAL GEOGRAPHIC SOCIETY

THE WIND WAS LIGHT and the sailing easy. We coasted the shore of Attica, passing rocky coves and alluring beaches where today's Athenians spend summer days swimming, spear-fishing, and sunbathing.

I was in no mood to envy them, for my own summer stretched before me with a promise to set any sailorman's heart racing. I was launched on a voyage of adventure into a sea where Ulysses had sailed, where the driving oars of shackled slaves had powered Persian war galleys to their rendezvous with death at Salamis, and where Crusaders had swept eastward to wrest the Holy Land from Saracen hands.

For two months I would cruise the Aegean, bluest of all earth's blue seas, windswept paradise of ancient islands among which our Western civilization was born. And I would

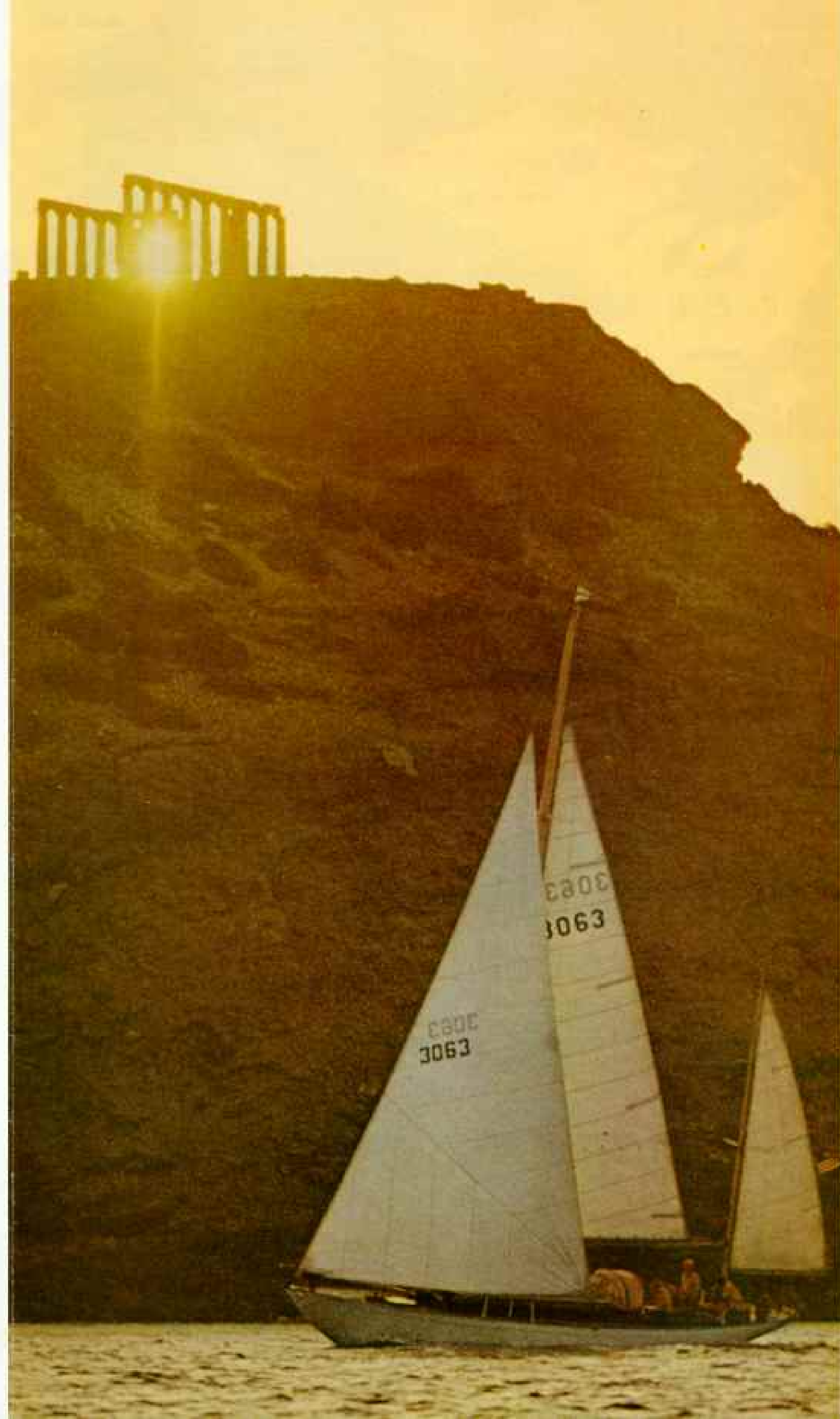
make this cruise as a sailorman should, under sail, in a small boat, with the salt spray and the scend of the waves and the sounds of the Greek sea coming to me as they had come to the men of times long lost.

In five busy days our all-amateur crew, helped by Greek yachtsmen Harry and Byron Leonidhopoulos, had unloaded our 46-foot yawl *White Mist* from an American Export Lines freighter and made her ready for sea. On an early June morning we had dropped Greece's principal seaport, Piraeus, behind us. Standing at the wheel, I looked to port. The slender columns of the long-shattered Temple of Poseidon, god of the sea, crowned Cape Sounion (foldout, right), tip of the Attica Peninsula. Ahead, a necklace of sun-drenched islands stretched across the Aegean Sea to the Turkish coast.

I put the wheel up and set course for Kea.

First and last landfall of Aegean sailors, Cape Sounion wears a temple built in the days of Pericles and dedicated to the sea-god Poseidon. From here the author sailed his yawl on a summer odyssey among legend-steeped Greek isles. Now returning, *White Mist* glides across a calm sea after a night hard-driven by the *meltemi* wind. LOWE STUART GROSVENOR

NEXT PAGE FOLDS OUT 147

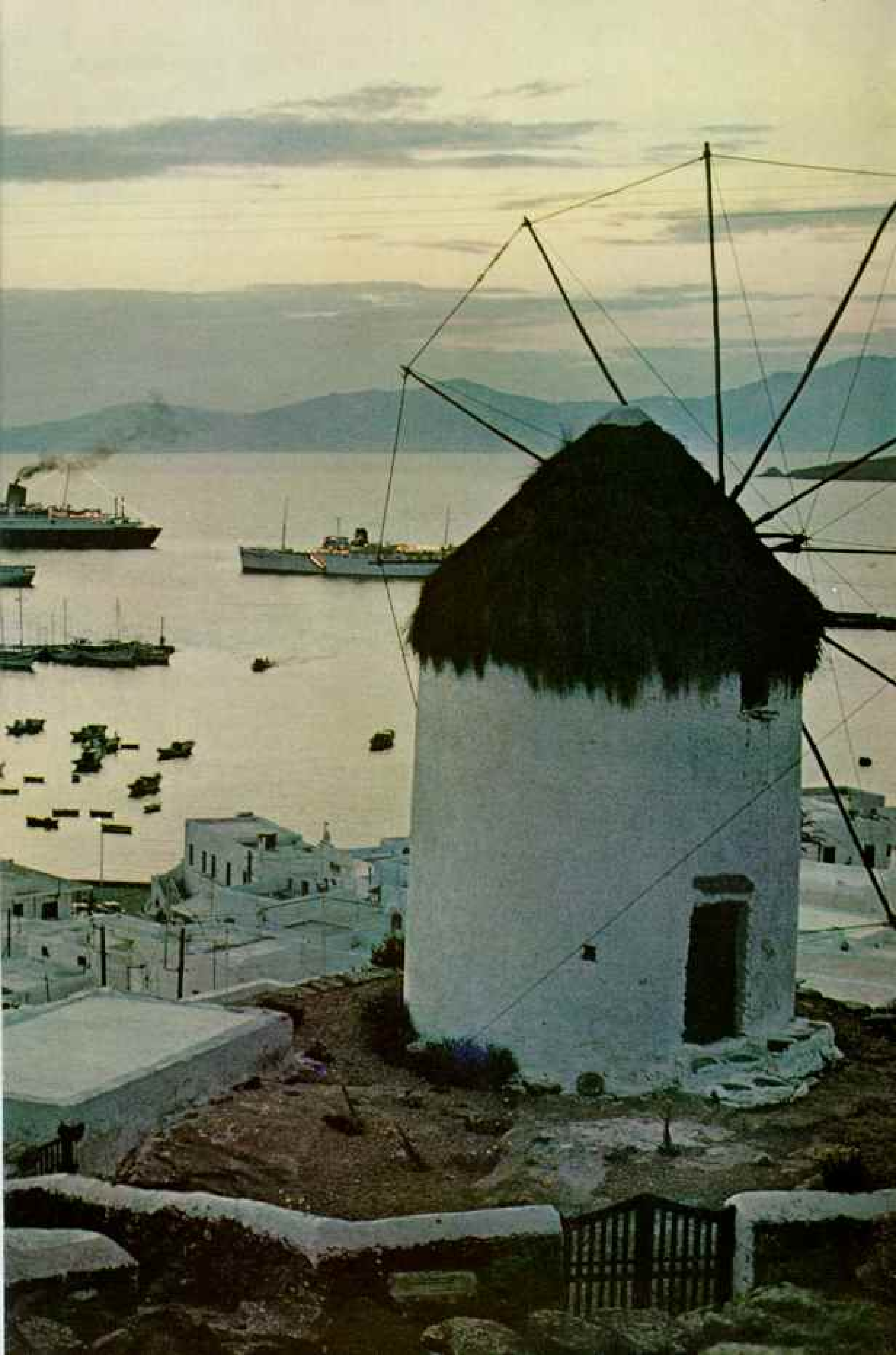




Stepping-stones to the ancient world: Sun-blessed islands (above) strew the blue Aegean like pebbles tumbled from the pouch of a giant. Here the Greeks turned to the sea for riches, becoming master sailors and traders—creators of the civilization that shaped the Western World. Following in their wake, the author appropriately made his voyage under sail. His *White Mist* anchored at 27 islands on the 1,400-mile cruise.

Evening's blue blush suffuses Mikonos and gives a deceptive air of serenity to this most popular island in the Cyclades group. Visitors from the cruise ships lying beyond the small-boat harbor swarm through the narrow streets. They buy out the island's shops, feast on its seafood, dance till dawn in its discotheques, and delight in its windmills (right). In season as many as 14 passenger vessels call here in a day.







NATIONAL GEOGRAPHIC PHOTOGRAPHER WINFIELD PERRY (MOVE AND PRECEDING PAGES)

Petros the pelican, here feasting at a favorite buffet, plays the starring role in Mikonos Harbor. The island's mayor loves to relate the unlikely tale that the bird's charm proved fatal to a pelican imported to be his mate. Failing to win the affection of Petros, the disconsolate female dive-bombed to her death at his very feet.

Before dark the anchor was down in the island's snug St. Nicholas Bay.

Kea is a place of peace and quiet beauty. Fewer than 2,000 people remain. They fish, grow olives and some lemons, keep cattle, sheep, goats, and bees.

Ancient Kea was busier. Four independent city-states shared its 50 square miles of hills and valleys. In the Bronze Age, possibly before 3000 B.C., a port on Kea was a link in the chain of island trading posts between Asia Minor and the Greek mainland. We lay at anchor in that very port; from the deck we could see the ruins of the old town. This was not by chance. In a sailing ship you travel as the ancients did; your needs are the same, and you find the same havens.

Keeled Boats Widened Greek Horizons

Man's first maritime civilization developed from this Bronze Age trade, explained Professor Spyridon Marinatos, Greece's Inspector General of Antiquities, who had spent an afternoon aboard *White Mist* in Piraeus.

"Greek islanders," the professor said, "were probably the first to invent a boat with a keel capable of navigating the high seas."

"Cycladic navigators completely mastered the Mediterranean, getting as far as Spain. We have found architectural features there similar to those on Siros, and artifacts characteristic of the Greek islands."

University of Cincinnati teams, working under the auspices of the American School of Classical Studies at Athens, have been digging for years in the ruins of the Bronze Age Kea port city off which we anchored. Their leader is Dr. John L. Caskey, Cincinnati's Professor of Classical Archaeology.

The ancient name of the port is unknown; the archeologists call it Ayia Irini, after a nearby church.

In time Crete's Minoan civilization fell, and with it vanished the Cretan navy, which had protected Kea and the island trading ports from the pirates who scourged the Greek sea. The pirates returned. The Keans went inland and built a more easily defended hill city, now the island's capital.

Modern Kea is a typically Cycladic village, a charming place of small houses lining narrow, winding streets. Dazzling whitewash covers the meticulously clean houses, some gay with flowers in window boxes.

So steep were the streets that I wearied climbing them, and sat at a table outside a

taverna, the universal small restaurant of the country. Over a Greek beer I watched the life of the town go by.

A small man with twinkling eyes introduced himself. I did not know it then, but we were to meet his counterpart in every island port. Almost always his name was Nick, and he spoke a Greco-English learned in the steel mills of Ohio or on the piers of Brooklyn. In his golden years he had come back to his native island, there to live on a pension that was the envy of his neighbors.

"I am Nick the Barber of New York," he said. "I love America. I offer you an ouzo. I will tell you all there is to tell of Kea."

I declined the ouzo, since it was too early for that fiery anise-flavored drink; I accepted Nick's offer to answer questions. Why does the island have so many tiny terraced fields on the sides of her mountains?

"Because long ago there were many more people here, and on most of the other islands as well," said Nick. "They had to terrace every bit of ground to feed themselves. But many of the terraces you see are abandoned. The people have migrated away."

Donkeys came by. One, led by a man with a flaring moustache, carried big red pottery jugs. Another carried greens from one of the terraced fields above the town, yet another sides of butchered lamb and goat.

Then a whole train clopped past, bearing small children waving wild flowers.

"They have been on a picnic," said Nick the Barber. Each bade us good morning, and since I thought I had mastered the Greek words, I returned the greeting. The children screamed with laughter.

"You greeted them with the word for 'squid'—*kalamari*," Nick said. "It sounds much like 'good morning,' which is *kali mera*."

"But the children are well aware of why you said 'squid' to them, and they loved it."

No Helping Hands in Tinos Harbor

Tinos, our next port of call, is a very special place. Here ailing Orthodox Greeks seek help at the island's celebrated Shrine of the Annunciation.

Most pilgrims come on the festival days of March 25 and August 15; arriving at a less popular time, we expected to find Tinos a quiet place. Instead, an excited, shouting crowd milled about the waterfront.

Noise, of course, is not unusual in Greece. But it was unusual that no one helped us land.

Islanders are natural seamen, and know that it is not always easy to bring a sailboat into a berth without shore help. It is especially tricky in the Aegean, where a ship lets an anchor go over the bow, turns around, and then backs into land. Not without difficulty, we put the boat into her berth unaided, set out our new stern gangway, and went ashore. We soon learned the cause of the bedlam.

The tavernas had moved their television sets outside. A soccer game was on. Nick the Brooklyn Stevedore soon spotted us as strangers and told us it was an important game in the European championship series.

"All peoples here go crazy with football, which is why the big noises," he explained.

Nun's Vision Starts a Healing Center

Greece won the game, and our guide was swallowed up in an uproarious snake dance of victory. Leaping and cheering as happily as anyone was a *papas*, a Greek Orthodox priest in a long robe, full beard, and tall black hat.

Close to the people to whose spiritual needs they minister, the priests are often seen in markets or waterfront tavernas chatting with card-playing fishermen. In Greece, many priests marry and raise large families.

Nuns of the Eastern Orthodox Church, the state religion of Greece, live a more secluded life than the *papas*.

On Tinos we called at a convent, the Monastery of Dormition, resembling a walled hill village. Quickly we were surrounded by smiling nuns in a courtyard where oleanders, bougainvillea, and hibiscus nodded in the breeze. The nuns pointed to their gift shop, where we found fine lace and handicrafts.

One who spoke English (she had lived in Rhode Island) told us a story of the Panagia—the Virgin Mary: In 1822, during the stirring days of Greece's fight for independence from the Turks, the Virgin appeared to an 80-year-old nun, Sister Pelagia, and told her that a beautiful icon was buried in a certain field. The islanders searched and found the icon, and the Shrine of the Annunciation was built over the spot. Glass protects the precious painting against the adoring but abrasive kisses of worshipers.

Silver votive offerings festoon walls and ceilings—miniature arms and legs and feet or whatever parts of the body suppliants want healed by the Madonna. There are also silver ship models, representing all types of boats that the Panagia has saved in storms.



SHUTTERSTOCK

Fleet's in, school's out: At day's end, everyone gathers on the Mikonos waterfront (above). Cafés and the town hall share a two-story building erected during the Russian occupation of 1770-74. The church at right is one of 400 shrines on the island; many testify to the gratitude of sailors for divine protection from perils of the sea.





PHOTO BY JAMES R. SODAK (BELOW), AND KIMIN STUART BRIDGEMAN

Standing the morning watch, *White Mist's* skipper, left, and Robert Watson keep an eye on the tangle of boats berthed at Mikonos (below). A high wind in the dead of night caused anchors of larger vessels to drag, threatening the yawl. Slipping her lines, *White Mist* dashed for less-crowded water. Thus the sailors got their first taste of the meltemi, the strong, dry wind that originates in southwest Asia, moves counterclockwise over the Russian steppes, and sweeps southward to air-condition the Aegean in summer.



Pull of curiosity detains a dog and his master, shopping on a Mikonos street (left). In shop after shop, high-fashion dresses and jewelry share display space with famed Mikonos handicrafts. Islanders handloom brilliant fabrics of striking designs that are made into skirts, shawls, handbags, men's shirts, belts, and bedspreads. Nimble fingers knit bulky sweaters, many featuring cable stitches, popular with sailors and skiers.

On a cloudless afternoon without a breath of wind, we set off under power for Mikonos, a dozen miles away. The heat became intolerable. All hands wanted to swim. So I stopped the engine, and when the yawl was dead in the water, we dived into a sea of crystal clarity. It was refreshingly cool, a surprise to crewmen who expected tropical water.

Bird Almost Causes an Island War

We sailed into the port of Mikonos at sunset, across a harbor brightly painted in reflections of dories and tavernas. Windows shone gold among the white cubic houses covering the dry hillside.

Early next morning a salty gentleman with dark-blue turtleneck shirt and sailor's trousers hailed us from the wharf. He introduced himself as the Mayor of Mikonos, former sea captain Costas Zouganelis.

"Welcome to Greece's most fashionable vacation spot," he said. "I have come to show you our island."

Every Greek islander boasts of his home island as the best in the Aegean, but the fame of Mikonos as an "in" place for jet setters and backpacking students is worldwide.

We strolled through the picturesque town. Holidaygoers speaking a babel of tongues crowded the narrow streets and filled chic shops. The islanders mingled easily with the visitors. Women in black dresses shopped for groceries. Their fishermen husbands sat in tavernas, jesting with mod young people.

"Your townsmen get along well with strangers," I remarked to the mayor.

"Naturally," he replied. "Think of all the outsiders who have come to Mikonos through the centuries, sometimes as visitors, all too often as conquerors: Phoenicians, Cretans, Romans, the Crusaders, Turks, Italians, Germans. Even Russia briefly ruled Mikonos in the 18th century."

At lunchtime the mayor led us to a taverna beneath a headland crowned by windmills. As I ordered *barbounia*, the incomparable red mullet of the Aegean, I heard a clattering behind me. I turned, and on a chair sat a huge pelican, rattling his beak (page 152).

"Meet Petros," said Mayor Zouganelis. "He dropped in on us during a storm in the 1950's, and liked us so much he stayed. Our summer visitors adore him, and as our prosperity depends on tourism, he is a valuable bird."

"One day he flew over to Tinos, where certain evil people clipped his wings. We demanded his immediate return. When the request was refused, our young men assembled a fleet of caiques and set forth to retrieve our property by force."

"But there was no war. The Prime Minister of Greece himself telegraphed the people of Tinos to return him, which of course they did. The island turned out to meet Petros and gave him a conqueror's welcome."

In the morning the mayor brought to the boat young George Voulgaris, a Mikonian
(Continued on page 164)

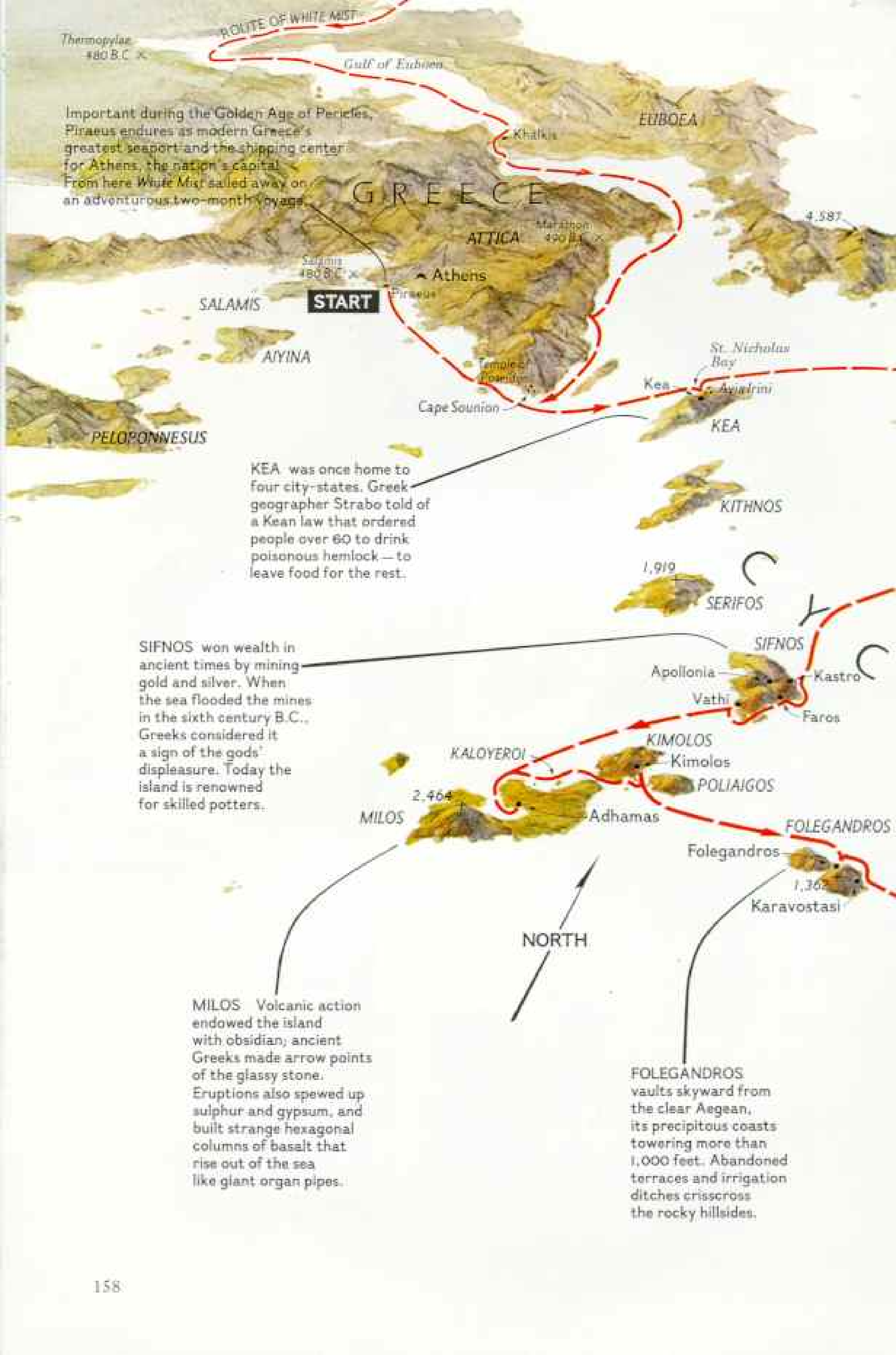


Lighthearted invaders, young people from Western Europe and the United States flock to Mikonos in summer. Footloose and full of fancies, they conquer with guitars and song, beards and beads—and Mikonos welcomes them all.

No generation gap plagues these two, who share the pleasure and profit of making sweaters. Grandmother winds yarn made of wool sheared from the family's sheep, soaked in the sea to take out oil and odor, and bleached and spun on the home stoop.

TIMOTHY STUART BRIDGE/STOCK; GARDNER AND BOBERT L'HERMITE/STOCK





Thermopylae
480 B.C. x

ROUTE OF WHITE MIST

Gulf of Euboea

Important during the Golden Age of Pericles, Piraeus endures as modern Greece's greatest seaport and the shipping center for Athens, the nation's capital. From here White Mist sailed away on an adventurous two-month voyage.

ELIBOEA

Khalkis

GREECE

4,587

Marathon
490 B.C. x

Salamis
480 B.C. x

Athens

SALAMIS

START

Piraeus

AIYINA

Temple of Poseidon

Cape Sounion

St. Nicholas Bay

Kea

Apiairini

KEA

PELOPONNESUS

KEA was once home to four city-states. Greek geographer Strabo told of a Kean law that ordered people over 60 to drink poisonous hemlock — to leave food for the rest.

KITHNOS

1,919

SERIFOS

SIFNOS won wealth in ancient times by mining gold and silver. When the sea flooded the mines in the sixth century B.C., Greeks considered it a sign of the gods' displeasure. Today the island is renowned for skilled potters.

SIFNOS

Apollonia

Vathi

Kastro

Faros

KALOYEROI

KIMOLOS

Kimolos

POLIAIGOS

2,464

MILOS

Adhamas

FOLEGANDROS

Folegandros

1,362

Karavostasi

NORTH

MILOS: Volcanic action endowed the island with obsidian; ancient Greeks made arrow points of the glassy stone. Eruptions also spewed up sulphur and gypsum, and built strange hexagonal columns of basalt that rise out of the sea like giant organ pipes.

FOLEGANDROS vaults skyward from the clear Aegean, its precipitous coasts towering more than 1,000 feet. Abandoned terraces and irrigation ditches crisscross the rocky hillsides.

SKIROS

SIROS, prosperous capital of the Cyclades, supports the archipelago's major city, Ermoupolis, home to 13,500. Islanders promenade in its handsome Italianate square, finest in the Cyclades. Until a century ago Siros claimed the busiest seaport in Greece as a refueling station for coal-burning ships. Today interisland traders crowd its harbor. Siros also raises vegetables for Athens tables.

TINOS swarms with Orthodox Greeks on the feast days of March 25 (which is also the nation's Independence Day) and August 15. They come to pray before the island's famed icon of the Madonna for their illnesses to be cured. Whitewashed houses gleam like blankets of snow on the island's hilltops.

KHIOS

DELOS reigned at various times as religious, political, and commercial hub of the Cyclades. Today the Greek Government forbids permanent residents among its sunbaked ruins.

ANDROS

TINOS

Monastery of Dormition

Mikonos

MIKONOS, onetime bastion of pirates, now flourishes as a tourist magnet; hundreds of visitors a day arrive by plane, ship, ferry, and yacht.

IKARIA

SIROS

Ermoupolis

Tinos

DELOS

MIKONOS

AEGEAN SEA

ROUTE OF WHITE MIST (To page 172)

PAROS

Paros

Pirgos Agias

Apollona

3,284

Naxos

NAXOS

AMORGOS

PAROS Sculptors since the sixth century B.C. have prized the milky marble still quarried from the slopes of Paros.

NAXOS, largest and loftiest of the Cyclades, has a few flowing streams—rare in this stony archipelago. Islanders plant rows of bamboolike cane to protect citrus trees from the buffeting winds.

SIKINOS

Ios

IOS

THIRASIA

Thera

ASPRONISI

1,857

Thera

Akrotiri

THERA (SANTORIN)

THERA, rim of an active volcano that blew its top and collapsed some 3,500 years ago, also suffers from earthquakes; In 1956 a series of tremors destroyed 2,000 houses. Recent finds prove the island to have been an outpost of Minoan culture.

ANAFI

IOS, like several other islands, claims the birthplace of the poet Homer.

× ... Battle

Elevations in feet

Relief exaggerated 4 times

In this low-angle view the archipelago appears as if seen from a satellite flying 133 miles above the sea and 240 miles south of Thera.

PAINTING BY STAFF ARTIST LLOYD W. TOWNSEND
COMPILED BY HAROLD A. HARRIS

Spinnaker ballooning, *White Mist* sleds downwind, running free on a hot June day. This breeze that sends the yawl skimming past the island of Nisiros is but a taste of the meltemi. The great wind out of the north reaches its peak in July and August.





ALL BY EDWIN STUART CROSSCROFT

Lee rail buried, the yawl heels on a close reach (left) in the meltemi season. Carrying a double-reefed mainsail, small jib, and mizzen, she drives under the lee of Kos. Sweeping up and over the island, the wind comes down in vicious white squalls, whipping the water to froth. The meltemi usually blows hardest in midafternoon, lessening after sundown.

Showered with wind-whipped spray, *White Mist* sails in a wild meltemi. Throughout the passage from Simi to Khios, she battled head winds. At one stage, the wind blew so hard that all small ships in the eastern Aegean were held in port for two days.





DOWN STUART SHOOTING LABOUEL, JOSEPH P. BEAR (LOWER LEFT), AND JOHN L. GARRETT



Risen from her tomb, a terra-cotta lady of Kea links that island to the great Minoan civilization centered in Crete. The life-size figure, perhaps a temple dancer, displays the bare breasts in vogue among Cretans during the Bronze Age. Thumb-size treasure from the temple at Ayia Irini (left) shows the hairstyle fashionable 3,500 years ago.

Remnants of glory, marble fragments of temples, mansions, and theaters litter tiny Delos (above). Once countless pilgrims came, laden with gifts, to honor at his birthplace the deity they loved most: Apollo, god of beauty and light, of the arts, of the intellect. A veritable treasure-house, Delos stood at the pinnacle of power in the second century B.C. Then in 88 B.C. Mithridates the Great, tyrannical ruler of the kingdom of Pontus in Asia Minor, ravaged the island.

In an exquisite mosaic (left), graceful dolphins give a boy of Delos a ride.



who had gone to college in the United States.

"I have asked George to go with you," said the mayor. "He speaks five languages."

We sailed to nearby Delos with George lending a hand on the foredeck. Our new companion took to sea life so well that he sailed with us for several weeks.

Although one of the smallest of the Cyclades, Delos was in classical times the most famous of all. Today it is a place of silent ruins, adorned by a row of marble lions. No one lives on the island except archeologists and caretakers who protect the ruins and tend a museum.

For centuries visitors helped themselves to statues, inscriptions, marbles. Museums the world over have Delian treasures—and so does many a private home in Greece and elsewhere. Many priceless marbles went into kilns merely to make whitewash.

Prosperity of Delos Led to Its Fall

The early Greeks believed Apollo was born on Delos, and they erected a temple and a colossal statue here to the god. The isle became a shrine revered all over the Greek world.

City-states built treasuries at Delos and filled them with offerings. Wealthy citizens sent valuable gifts; pilgrims came from distant lands. When Athens in its day of greatest power assembled an Aegean empire, it established its treasury at Delos. It also attempted, by passing a law, to prevent birth and death from occurring on the sacred island.

Delos was a truly international center, where Greeks, Romans, Egyptians, and others were allowed to build their own temples and establish commercial agencies in the port. We wandered through the ruins of the old maritime quarter, then up to see the temples.

In time, holy Delos became an inordinately wealthy trading port, and that was its undoing. In 88 B.C., jealous of the island's commercial importance, the king of Pontus in Asia Minor sent a force that sacked the place, massacring thousands of people.

In the centuries of solitude that followed, Delos acquired a large population of lizards and vipers. I saw a lizard slither out of a crack in an ancient wall on which children of long ago had scratched a verse deriding a playmate. George translated:

*Demetrios is blind
And does not see
Hermios stealing
His marbles. . . .*

That evening we returned to Mikonos and tied to the quay. At four bells in the middle watch—two o'clock in the morning—a gale erupted out of the north. Anchors dragged all along the jetty. Fearful of being crushed between giant boats, we clawed off the land to an anchorage in the harbor.

That sudden gale, abnormal so early in summer, was the year's first *meltemi*, the powerful northerly that blows over the Aegean from June until early September.

In this season, winds racing over the Russian steppes bring dry air southward to the Aegean. These are the *meltemis*. From ancient times, they have been a blessing to the Greek islanders. They air-condition the Aegean.

My friend Professor Marinatos had told me that the ancients were not often caught out in dangerous storms.

"They learned to forecast weather 24 hours in advance, plenty of time to moor well in a safe harbor," he said. The art has not been lost. Many times island fishermen told us what tomorrow's weather would be, and they were almost always right.*

Seaport Banks on Farms, Not Ships

Bound for Siros, we cleared Mikonos and headed westward with the *meltemi* still blowing 45 knots and the water a maelstrom of racing white horses. With shortened sail the yawl moved slowly in the steep and confused seas, so we turned on the sturdy diesel to help her along.

Until a hundred years ago Siros was the most important Greek seaport. Today, while they still repair ships, the islanders count on truck farms for ready cash. They raise vegetables under huge plastic sheets and catch the season's first markets in Athens.

Leaving Siros, we set sail for Sifnos, the envy of the ancient Greek world because of its gold mines. If city-states had been awarded a prize for the finest treasury building in the sacred city of Delphi, Sifnos would have won it easily.

The famed oracle at Delphi demanded of Sifnos an annual tribute of an ostrich-size golden egg. The islanders sent a gilded rock. Discovering the fraud, the oracle prophesied the failure of the Sifniote mines.

In time the prophecy came true. The mines

*Cruising visitors and sailors in these waters will find invaluable information in Capt. H. M. Denham's book *The Aegean: A Sea-Guide to Its Coasts and Islands*. London, John Murray, 2d edition, 1970.

Harvesting wild bounty on Siros, a girl picks the buds of caper flowers as her father casts his net for fish. Pinkish-white blooms of the prickly shrub add beauty to the landscape, but nipping them in the bud brings profit. Pickled, they add a spicy tang to salads and seafood. From the fisherman the author learned that boiled capers staved off starvation for islanders during World War II.

Herbs familiar to every chef grow wild throughout the islands. As they cruised, crewmen gathered thyme, oregano, rosemary, bay leaves, and basil, among others, to enhance shipboard cookery.



EDWIN STUART BRIDGEMAN

were exhausted, and some of the shafts flooded. Instead of digging for gold, today's Sifniotes make lovely pottery and play host to summer visitors.

Our yawl stopped next at Adhamas on Milos, an island famous as the home of one of the most beautiful women in the world. She is the "Venus de Milo," the marble statue gracing the Louvre in Paris. She was carved about 100 B.C., in Hellenistic times, probably by an artist from Asia Minor.

We visited an olive grove on the hillside site of an ancient city of Milos, where the beautiful lady was discovered in 1820. A

French consul, one story goes, sought to buy her. While he was away collecting the money, she was turned over to the Turks, then rulers of Milos. The islanders will tell you that the Turks had Venus aboard a boat ready to be shipped to Constantinople when the French diplomat returned with both money and friends. Some say there was a fight; in any event, the French recovered the statue.

Everybody wants to know, naturally, what happened to her arms.

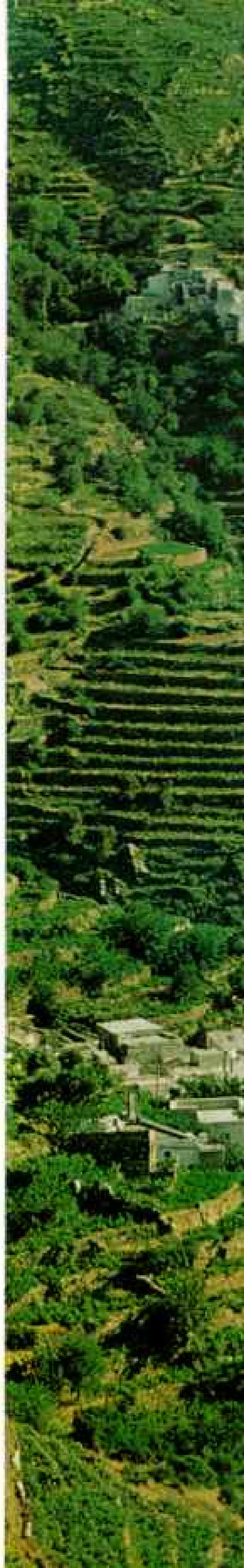
"Who knows?" said George Voulgaris. "The lime kilns, most likely. But people have dug all over the island looking for them."

Drink of kings, gift of the god Dionysus, wine changed the very face of the Aegean. In ancient times, farmers carved mountainsides into terraces to plant the grape. Island vintages won renown, especially those from Khios, Lesbos, Kos, and Rhodes. Here on Naxos, white villages and chapels dot stair-step hills still clothed in vineyards (right).

Today much of the Aegean's grape harvest goes to commercial wineries. But in a small village on Rhodes, this family continues to make its own supply in traditional ways (below). Girls in the background trample grapes in a stone trough. Father balances a basin of the fruit on the edge of a wooden wine press. The first flow of juice from both vat and press makes the best wine. Some of the juice may be cooked and strained to become a sweet gelatin-like dessert called *moustalevria*.



EDWIN STUART GOODENOW (LEFT) AND WINTFIELD PARKER





On the way back to the port, we stopped off in a taverna. The name of the establishment: The Arms of Venus.

From Milos we set out on the longest passage of the cruise so far—for Thera, 52 miles away (map, page 159). We sailed all night, and when the sun rose we were coasting by the lofty island of Folegandros. High in a cliff we spotted a cave, its mouth blocked by walls. Obviously, people had used it, but we could see no way to enter.

To explore it, I led a shore party off in our Boston Whaler, a fast seaworthy tender I tow, while the crew took *White Mist* into port.

Despite the chop, we jumped off onto a ledge and began a difficult climb. At one place 75 feet up we inched across a sheer rock face, tiny cracks our handholds.

In the cave we found that the walls we had seen were sides of two very old cisterns, one filled with clear water. Stalactites hung from the ceiling; winter rains had dripped down them, filling the reservoir.

With flashlights we explored the vast, dark recesses behind the cisterns. The light picked out niches in the walls. In them lay heaps of assorted bones—among them, human skulls.

It was an eerie place, and we did not linger, but slid down to the moored Whaler and rejoined the yawl. The crew was ashore, watching a fisherman tenderizing his day's catch of octopuses by beating them on a rock.

When we asked about the cave, the people of Karavostasi made the sign of the Cross.

"We never go there," one old man told us. "It is a place of *kalikantzaroi*." These are



Fresh without question, delicious bread comes from the oven as a customer waits. Each morning housewives on Thera, as elsewhere in the Aegean, visit the bakery for their day's supply. Around noon they return with pans of uncooked food—meat and vegetables—to be baked in the ovens.

Cliff-hung staircase zigzags from sea-shore to Thera town, 700 feet up. On the way, mules bearing travelers hug the outside stair wall, scraping riders' legs and threatening a tumble. Here, near the top, the animals line up on the safe side—now that there are no riders to frighten.

gremlins, and they could very well outnumber humans in this sparsely populated island.

Later I showed a piece of broken pottery I had found in the cave to Dr. Christos Doumas, an associate of Professor Marinatos, and asked if it were old.

"Oh, no, it's recent," he replied.

"How recent?"

"I would say maybe from Roman times."

Named after Saint Irene, Santorin—as its Venetian overlords of the Middle Ages called it—now bears the official name Thera. The volcanic island has known many eruptions, and its volcano is still active. As recently as 1956, it produced a series of earthquakes that devastated 2,000 homes. The large and very deep harbor, in which we would tie up, is actually the caldera of the volcano.

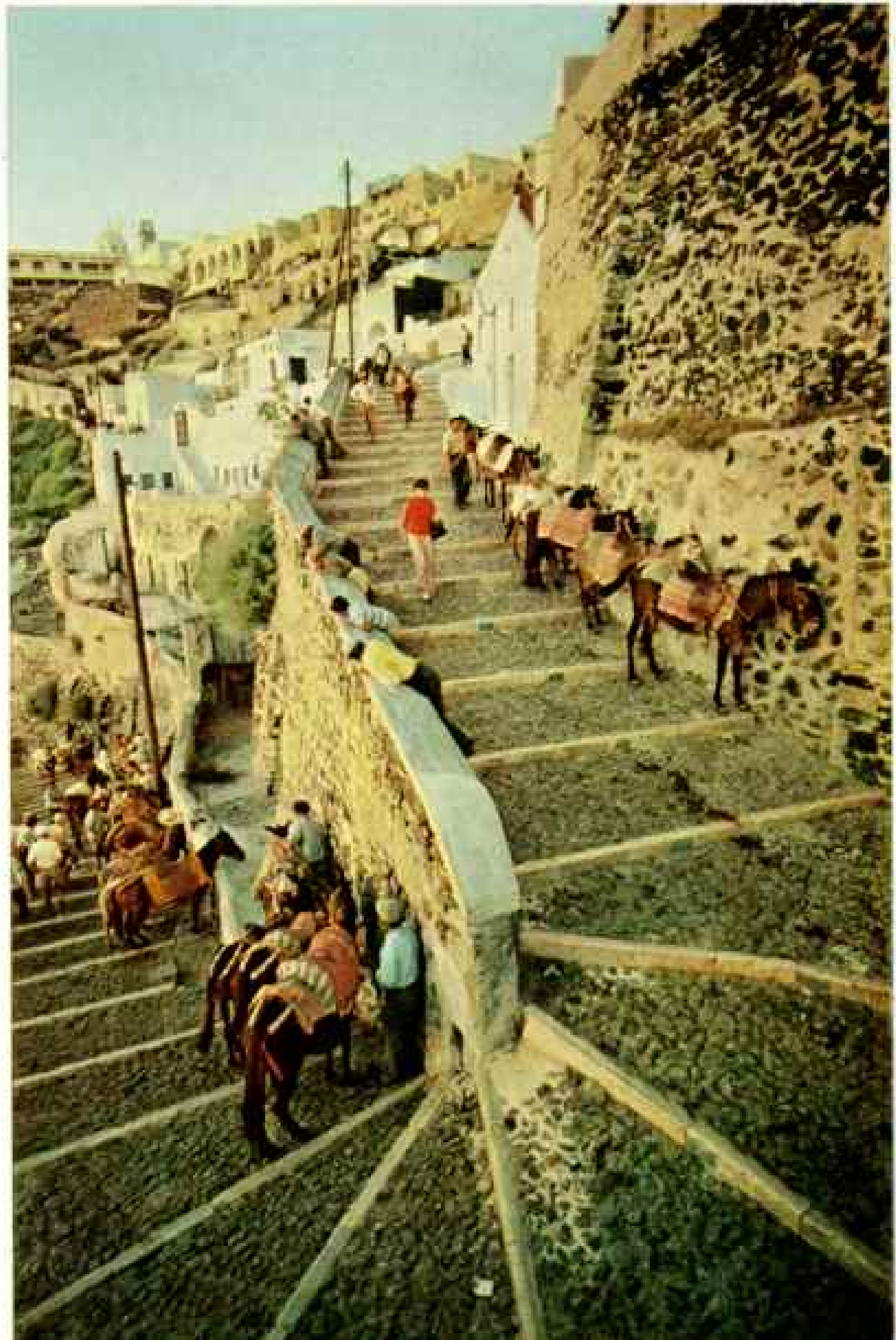
Into Thera's harbor we romped with a boisterous breeze in the sails. From every wave the bow flung into the air a glittering burst of salt spray. The sun seized on each and painted upon it a tiny rainbow that quickly vanished.

Three great white cruise ships, regular callers at this most spectacular of the Aegean islands, lay to huge sea buoys off the quay. Caiques carried gaily dressed passengers between ships and shore. On the jetty the tourists boarded mules, the only means, other than walking, of scaling the 700-foot cliff to Thera town.

Sometime in the Bronze Age—Professor Marinatos believes 1520 to 1500 B.C.—Thera's volcano exploded with inconceivable force. He says the blast was four times as powerful



BOON BY NATIONAL GEOGRAPHIC
PHOTOGRAPHER JIM HANCOCK





as that of Krakatoa in 1883, one of the greatest eruptions on record.

Eventually the cone of Thera collapsed. The sea roared in, filling the bowl, or caldera—25 square miles of deep water—that exists today; the three islands of Thera, Thirasia, and Aspronisi encircle it.

Tidal waves following the collapse may have been 300 feet high. They affected virtually all Aegean civilizations, wiping out the flourishing Minoan culture of Crete, and causing extensive damage on far-distant Mediterranean shores.

Several ancient towns on Thera not smashed by the blast were buried under volcanic debris. Pumice from the eruption makes good cement and is a major island export, along with the excellent wine.

As at Pompeii, it was the debris that preserved the mansions of Akrotiri. Professor Marinatos told the story vividly for readers of the *GEOGRAPHIC* in this year's May issue. Christos Doumas took us to the excavations, many of them protected by large roofs.

We marveled most at the comforts with

which the Cretan emigrants who lived here so long ago surrounded themselves. They had bathtubs, and must have enjoyed a sophisticated cuisine, for they had a great variety of earthenware food vessels.

Friendliness Replaces Piracy

We returned to *White Mist* to find her riding out a northerly blow, but it relented by morning, and we sailed north.

Ios is a charming island. Its little port, a popular pirates' lair in days gone by, has the typical whitewashed Cycladic houses built one above the other on the side of a steep hill. Just how steep the streets are I discovered when the big paper bag in which I was carrying groceries broke.

Everything in the bag happened to be round. Oranges, lemons, a melon, round loaves of bread went bounding down the street with no one in sight to stop them.

But then from every door erupted a child, a housewife, an old man, to field my runaway provisions as deftly as any baseball shortstop. Someone produced a new bag, a strong plastic

At home with history, Katina Parara lives on Naxos in a medieval tower called Pirgos Agias (left); once it was a fortress-monastery, sanctuary for monks under attack by pirates. She and her sister take special pride in the achievements of their children and grandchildren. Asked about family portraits, Katina explained, "This is my son, a doctor in Athens, that lady a schoolteacher. Several of our family hold Ph.D. degrees from European universities."

Luscious clusters of figs fall to a picker on Rhodes, where growers ensure a bountiful harvest by paying special honor to the trees. Each St. Constantine's Day—May 21—orchardists adorn the branches of their fig trees with wild marjoram, an act called "getting engaged." If the ritual is omitted, say islanders, the trees think their owners are dead and, out of sadness, fail to bear.



LENN STUART/SHOOTING STARVE AND PROCEEDING PHOTO

one, and my things were handed me with dazzling smiles.

Back on board, I found in the bag a sprig of basil I had not bought. Greeks love this sweet-smelling plant and grow it in kitchen windows and around doorsteps. Sometimes they welcome a stranger with a bit of basil—and even wear a sprig behind the ear.

Now we were hurrying; the real meltemi season could set in anytime, and both Paros and Naxos, next on our itinerary, would lie in the teeth of northerly winds. But we were lucky this time and reached up to Paros under full sail, while flying fish sprouted lazily from the wake, and an occasional dolphin gamboled under the bow:

Paros, like Naxos, is largely marble. The great Grecian sculptor Praxiteles liked to work in the fine-grained and enduring Parian stone, a material of uncommon translucence, a challenge to sculptors and architects alike. At the ancient quarries, the favored grades lie deep beneath a mountain.

To reach this marble, the islanders of old sank shafts at such steep angles that one

wonders how they ever managed to slide the heavy quarried blocks up and out. Standing in the shaft entrances and shivering in the chill air emanating from the dark depths, you can picture gangs of slaves straining at heavy tackles, dragging the beautiful marble inch by inch up the incline. But little Parian marble leaves the island these days.

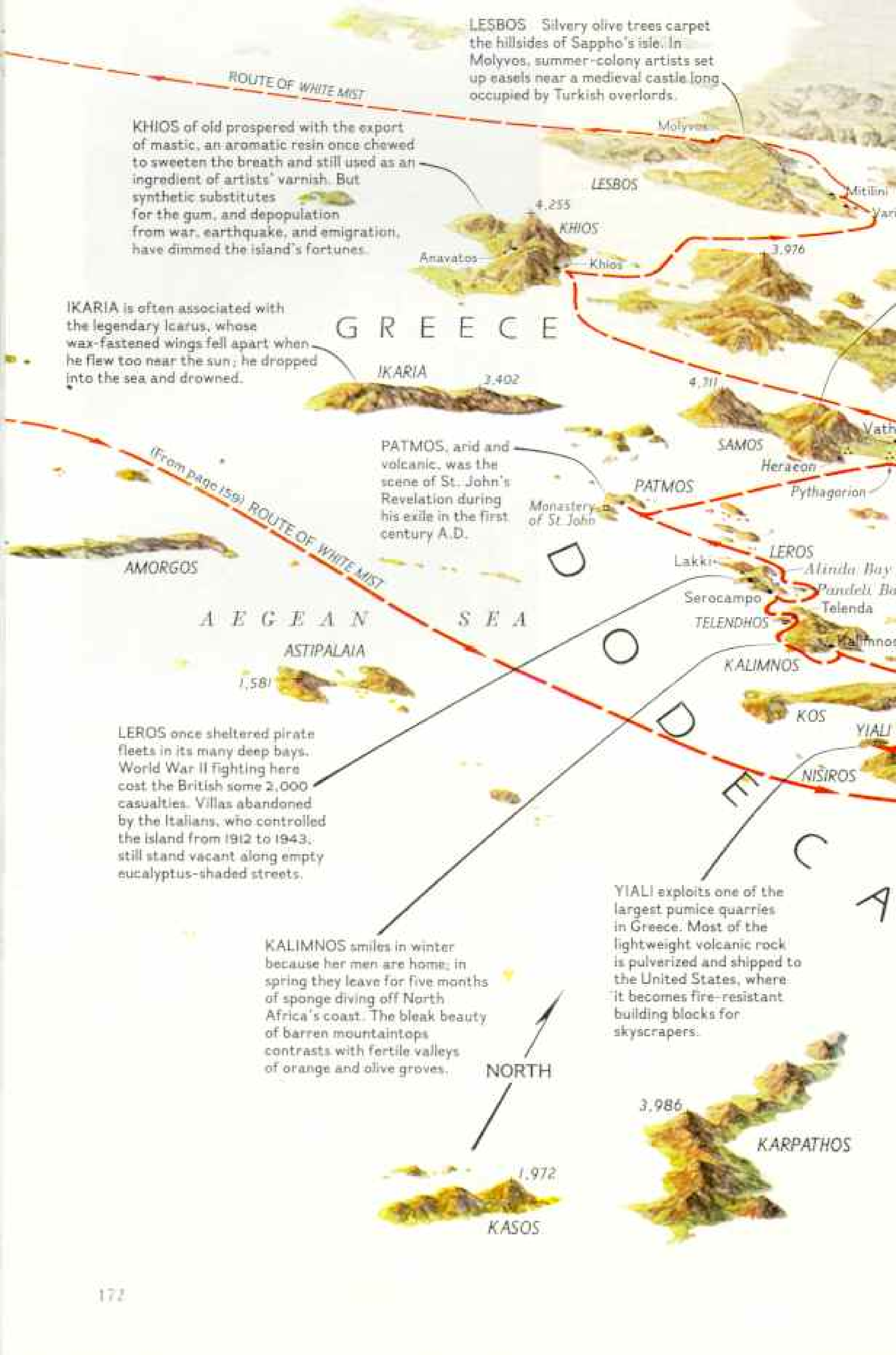
Islanders Charmed by Exotic Strains

From a swing around the island I returned at dusk to the port town of Paros. Music of Mozart, played by a chamber ensemble, rose from a crowd gathered before a taverna.

That was unusual. Generally the Greek islander likes the wailing minor-key music that Westerners associate with Eastern lands. But here were the people of Paros obviously enjoying music with which they had had little experience.

"I can explain," offered a man standing beside me in the crowd. He was Brett Taylor, formerly a teacher at Temple University, who now directs his own Aegean School of Fine

(Continued on page 178)



LESBOS Silvery olive trees carpet the hillsides of Sappho's isle. In Molyvos, summer-colony artists set up easels near a medieval castle long occupied by Turkish overlords.

KHIOS of old prospered with the export of mastic, an aromatic resin once chewed to sweeten the breath and still used as an ingredient of artists' varnish. But synthetic substitutes for the gum, and depopulation from war, earthquake, and emigration, have dimmed the island's fortunes.

IKARIA is often associated with the legendary Icarus, whose wax-fastened wings fell apart when he flew too near the sun; he dropped into the sea and drowned.

PATMOS, arid and volcanic, was the scene of St. John's Revelation during his exile in the first century A.D.

LEROS once sheltered pirate fleets in its many deep bays. World War II fighting here cost the British some 2,000 casualties. Villas abandoned by the Italians, who controlled the island from 1912 to 1943, still stand vacant along empty eucalyptus-shaded streets.

KALIMNOS smiles in winter because her men are home; in spring they leave for five months of sponge diving off North Africa's coast. The bleak beauty of barren mountaintops contrasts with fertile valleys of orange and olive groves.

YIALI exploits one of the largest pumice quarries in Greece. Most of the lightweight volcanic rock is pulverized and shipped to the United States, where it becomes fire-resistant building blocks for skyscrapers.

SAMOS still produces the wine celebrated by Lord Byron. On this pine-scented isle in the sixth century B.C., Samians dazzled ancient Greece by building a huge temple to the goddess Hera.

KOS won fame in ancient times for its wines, purple dye, and dresses of transparent silk. In a sacred grove here, the Greeks erected a temple to Asclepius, god of medicine.

SIMI, once renowned for its sponge divers, now turns to custom boatbuilding to eke out a living.



TURKEY

Izmir
Smyrna

Samos Strait
Kusadasi

Kos

Asclepion

2,136

TILOS

SIMI

Panormiti

Simi
Pedhi

KHALKI

3,986

Rhodes

N
E
S
E

RHODES

Lindos

St. Paul Bay

TILOS Medieval mapmakers labeled this mountainous isle Episkopi — "lookout" — for its many watchtowers strategically placed to guard against enemies.

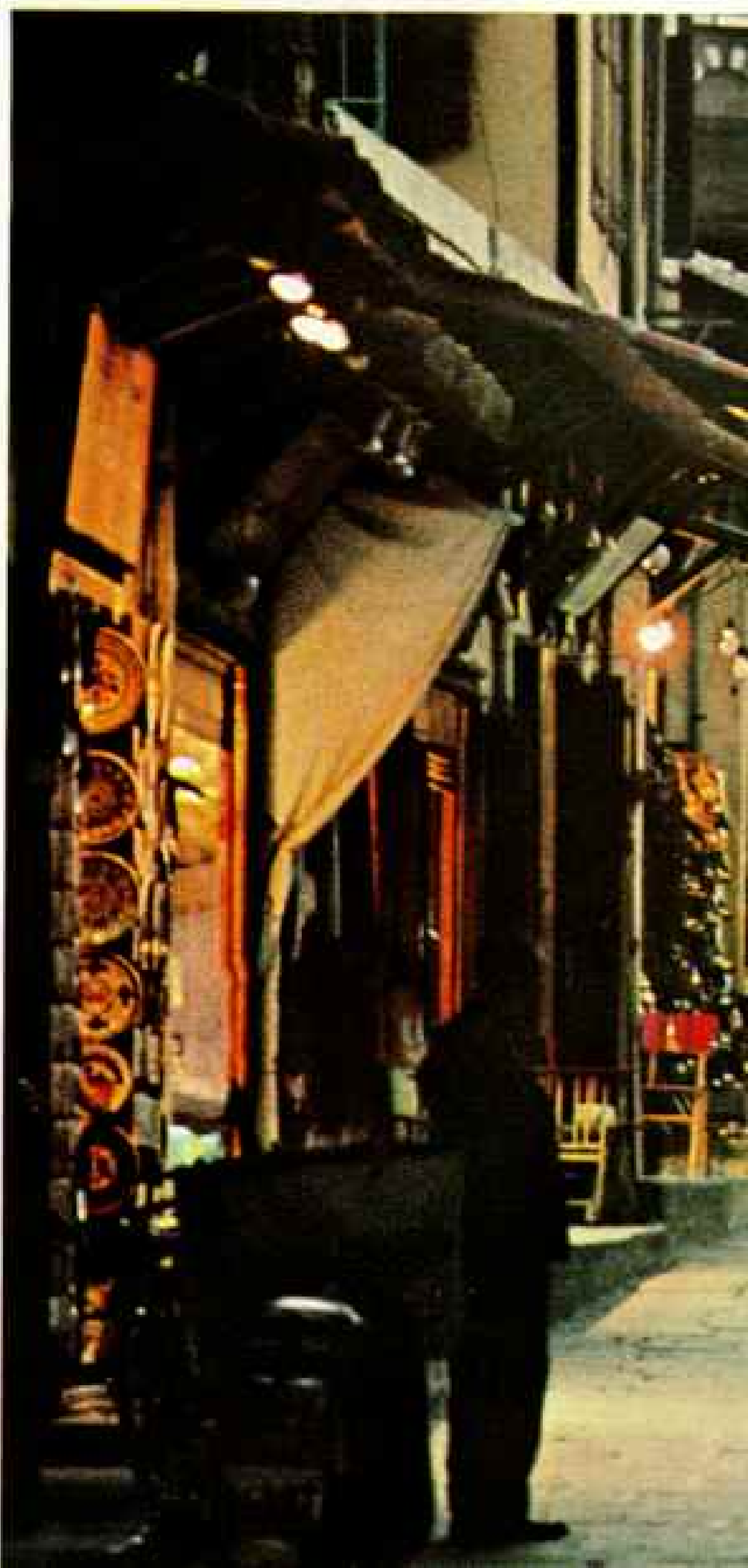
RHODES, largest and most populous island of the Dodecanese, lies only 11 miles from the Asian mainland. The city of Rhodes bears the marks of many invaders, including the Knights of St. John. Their medieval ramparts still recall two centuries of rule by the Crusader order.

Elevations in feet
Relief exaggerated 4 times
The islands appear here as if seen from a point 115 miles above the sea and 320 miles south of Rhodes.

PRINTING BY CLARE ARISTO LLOYD & COMPANY
COMPILED BY HAROLD A. HANSON



Welcome to Rhodes: Bronze deer atop twin columns flank the entrance to Mandraki Harbor. Beyond lies Fort St. Nicholas, built in the 15th century on ancient Greek foundations. The Colossus of Rhodes, one of the Seven Wonders of the Ancient World, once overlooked the harbor.

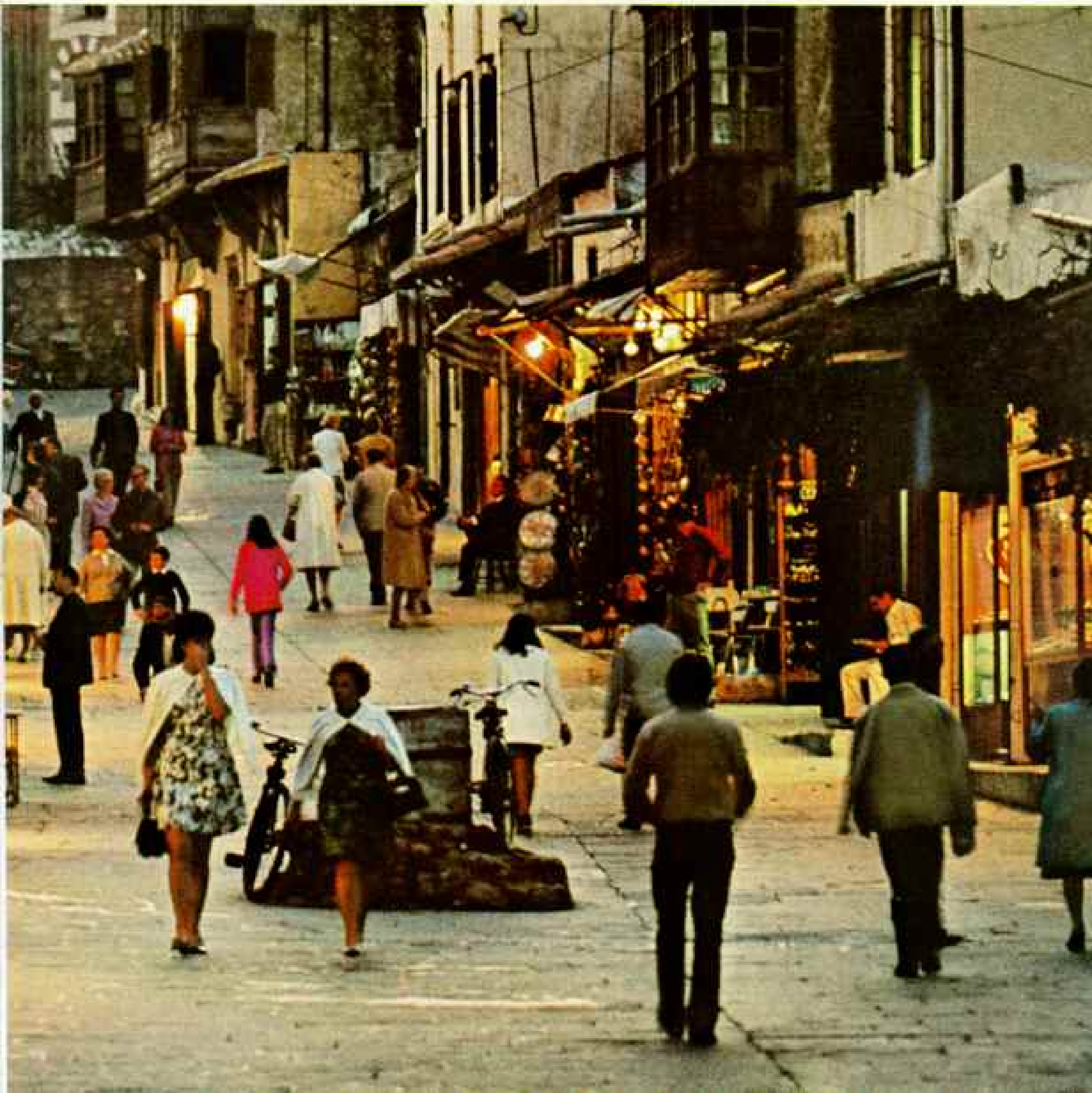




"City... superior to all others," marveled Greek geographer Strabo. But the existing splendors of Rhodes date more from Crusader than from ancient times. Here at dusk, lights of arcades lining Mandraki Harbor wink on beneath a brooding castle built by the Knights of St. John of Jerusalem in the 1300's. The stronghold faced its bravest hour in 1522 when Suleiman the Magnificent laid siege with a force vastly outnumbering the knights. Though vanquished, the defenders fought so valiantly they were permitted to escape with their lives.

Motor traffic banned, pedestrians in Old Town stroll where knights once clanked in armor.

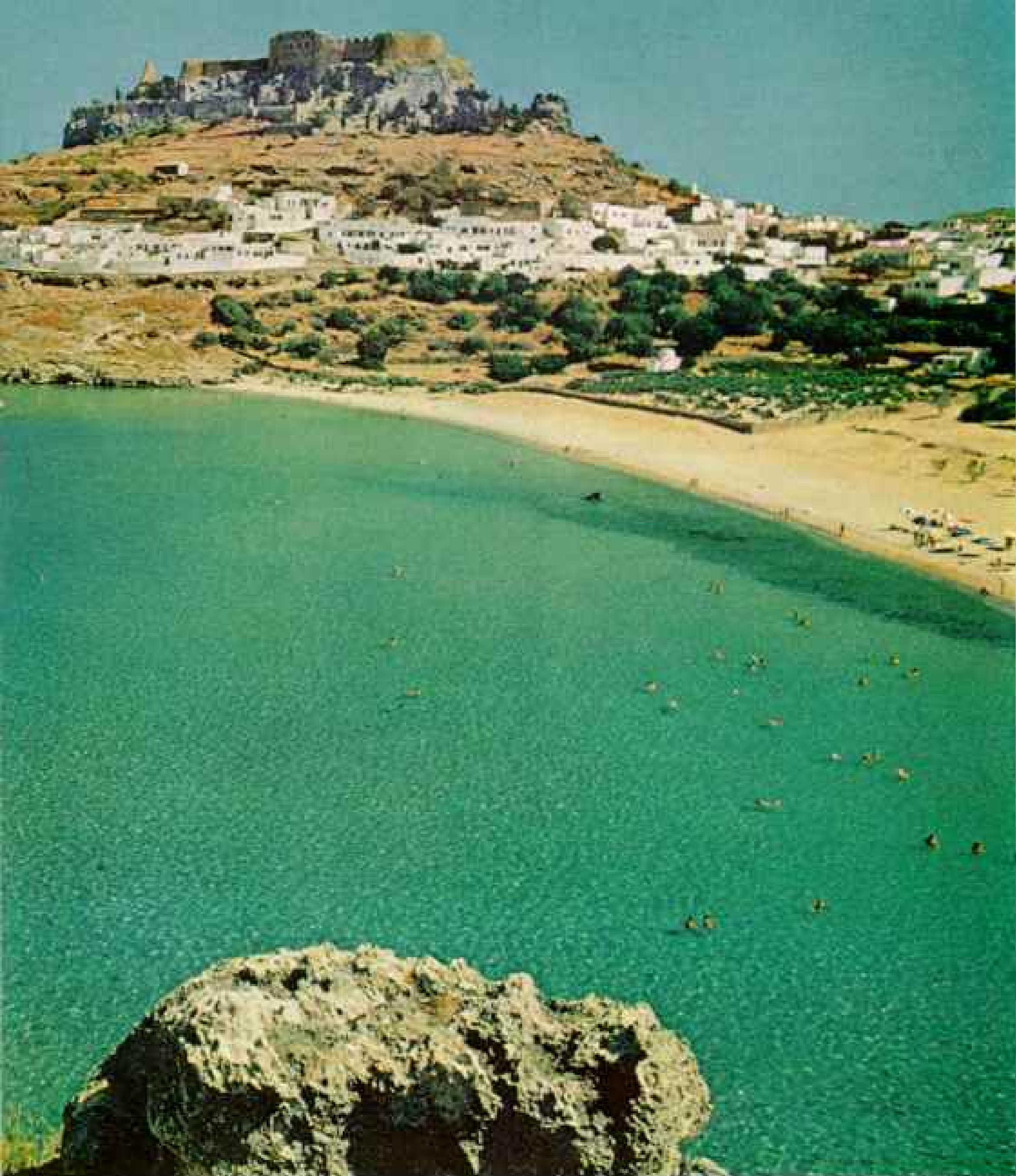
EDWIN STUART GROSVENOR (ARCADE) AND LORNE (LEFT) AND WISFELLS PERKY





Archeological jewel set in a blue-green sea, Lindos on Rhodes spreads below its acropolis. Behind the ramparts of the knights' fort stand ruins of a columned temple to the goddess Athena. To preserve Lindos and its treasures, the Greek Government has forbidden any major alteration of the town's external appearance.

Lindos remembers St. Paul. The Apostle preached throughout the eastern Mediterranean, and—*island tradition has it—he stopped here.* Each year villagers commemorate his visit with a night of revelry. *White Mist* rides at anchor in the narrow-necked harbor named for the Apostle, and lights pick out a chapel dedicated to his memory. After a service, costumed dancers entertain villagers and visitors, many of whom have come by boat.



VIEW BY WINFIELD FORD



Arts on Paros. "Greeks are naturally musical and instinctively like any kind of good music. The ensemble, professionals in residence at the school, started giving café concerts as an experiment and discovered one of the most appreciative audiences they have ever had."

Most of the students are Americans, taking such subjects as painting, photography, writing, drama, and classical guitar. Many board with island families and have learned modern Greek very well.

Venetian Influence Pervades Naxos

Only a few miles of rollicking blue sea separate Paros from Naxos.

The early inhabitants of Naxos carved curious marble idols that archeologists find in island graves. The local museum has a wealth of these, with stylized heads and bodies.

It was the Naxians who gave holy Delos its famed marble lions and colossal Apollo.

The Naxian era that most intrigues me is the Middle Ages, when the history of this one island typified that of the Aegean. The chapter opened when the Fourth Crusade, deviating from its mission of battling Islam, sacked Constantinople and dismantled the sagging Byzantine Empire.

Marco Sanudo, a member of a great Venetian family, took Naxos and others of the Cyclades as his share of the spoils. For much of the next 300 years, the Sanudi and their heirs ruled the island; today the port city of Naxos retains a strong Venetian flavor.

Exploring the island of Naxos with my friend Ralph Bates, New York University professor emeritus of literature and a Naxos resident for five years, we came upon a ravine so filled with blooms that the islanders call it the "river of oleanders." All sorts of plants have been imported into the Aegean islands—bougainvillea, cactus, agave—but the oleander is native.

Pleasant valleys, their sides terraced to the last foot, lie among the mountains of the Naxian hinterland (pages 166-7). Roads wind in breathtaking fashion from village to village, always narrow, sometimes skirting sheer cliffs.

A group of sculptors must have been established on Naxos, for here archeologists find pieces that were never finished. The largest, near Apollona, is a colossus some 34 feet long; had it been completed, it would have been the statue of a young man.

But the sculptor left it lying on its back,



Like frames of movie film, portraits of intrepid tourists hang clipped against a wall in Lindos (above). On the half-hour donkey or mule ride to the acropolis most visitors depend on the animal's handler, who alternates between pulling the beast along and whacking it on the rear. With infinite trust, one tourist faces backward (right) to record the view on the climb. Occasionally a visitor rides out alone. Then the animal is the master and given to meanderings and impromptu races.



BOTH BY WINTFIELD PRATT





MELVILLE BELL GREENBERG

Delight in his cats enlivens the declining years of Anastasios Patacas, a retired pensioned seaman on Simi. Once the island prospered as a builder of wooden fishing boats; now its shipyards cater to yachtsmen. Abandoning sponge fishing, another important occupation in times past, island men seek more lucrative livelihoods as seamen aboard oceangoing ships.

still attached to the marble of the hill. Why was it abandoned?

Some say because it developed cracks, still visible today, one across the face. Professor Bates told me the faults were probably caused by badly placed wedges, which were to have helped split it free of the mountain.

"See this slot carved under the back?" he asked, brushing away loose earth. "Wedges would have been driven into several such slots, then water poured on to swell and expand the wood until the statue broke loose."

Close by the sea we stopped at Pirgos Agias, a medieval tower with no openings at ground level. The door was on the second floor at the top of an outside staircase; in the old days there would have been only a ladder. We found this grim place inhabited by two delightful elderly widows, who invited us inside (page 170). One of them told us that the tower had been a monastery.

"It was fortified against pirates," Katina Parara continued. "From the top you can see a long way to sea. When the pirates came, the monks had time to call their colleagues in from the fields; pull up their stairway ladder, and make ready their arms."

We had noticed a flock of chickens as we came in, so we asked if we could buy eggs. The ladies produced a dozen—and on each was handwritten the date it had been laid.

Hazardous Entrance Takes Its Toll

We took our eggs back to *White Mist* and sailed east for Rhodes, main island of the Dodecanese group (map, pages 172-3). The populations of these islands are predominantly Greek, and remained so even under four centuries of Turkish rule; yet only since 1947 has the flag of Greece flown over them.

A powerful wind blew up, catching us as we rolled past the small, steep-sided island of Nisiros. All our fair-weather sails were set, including a big spinnaker (page 160). *White Mist* shouldered into her work, making a steady nine knots. It was glorious sailing, and the ship must have been a brave sight charging onward against a background of mountains flecked with white villages.

It was dark when we came to Mandraki Harbor, the haven where the galleys lay in days past, now the small-boat shelter in the port of Rhodes. It has a narrow entrance, with hazards on either side. We moved with caution: On an earlier visit I had seen a U.S. destroyer wrecked on the rocks to starboard.

Modern Rhodes is a popular resort where

lights blaze all night. Partially blinded by the brightness, we found it difficult to separate navigation lights from taverna signs, street-lamps, and automobiles' red taillights.

Still we came safely into port, guided by the historic St. Nicholas Fort. Backing into a berth, we found ourselves in the heart of Rhodes at dinner time, with hundreds of people eating at dockside tables no more than 30 feet from our stern.

Like sailormen everywhere, the crew made for shore as soon as the gangway was down, but I stayed aboard. From the port's great knights' castle above me came the sound of martial music. History had been made in this very spot, and I wanted time to savor it.

Age of Chivalry Flavors Rhodes

Easternmost big island of modern Greece, Rhodes appears to have been a marine power in the late Bronze Age. Yet its port makes me think of medieval times, not antiquity. Everything about it bespeaks the age of chivalry, of knights in armor, of a day when this city with its Gothic fortifications was a major Christian outpost on the frontier of Islam.

Here, in the early 14th century, came the Knights of St. John of Jerusalem, driven from the Holy Land, to build crenellated walls and stone towers that were the era's last word in military architecture. For some two centuries the knights ruled Rhodes.

In 1522 the Turks drove them out, but they left architecture of such solidity that it has withstood the test of time. The Ottomans held Rhodes until the Italians took it in 1912. But, save for a few minarets and one old city quarter, now a place of tourist shops, there is little that is Turkish about the port.

The Italians, who held on until they lost the island in World War II, beautified it with public gardens, parks, and statuary. The medieval architecture they carefully restored—some say too carefully.

The music on shore came to an end. I looked back to the harbor entrance. One story goes that the famed Colossus of Rhodes, a 100-foot bronze statue of Helios, the sun-god, straddled the entrance.

The legend is patently false. The Colossus stood *beside* the water not far from where I sat. One of the Seven Wonders of the Ancient World, it was built to commemorate the unsuccessful siege by Demetrius of Macedonia in 304 B.C. It stood less than 75 years before being toppled by an earthquake. Nine centuries later, Arabs succeeded where Demetrius



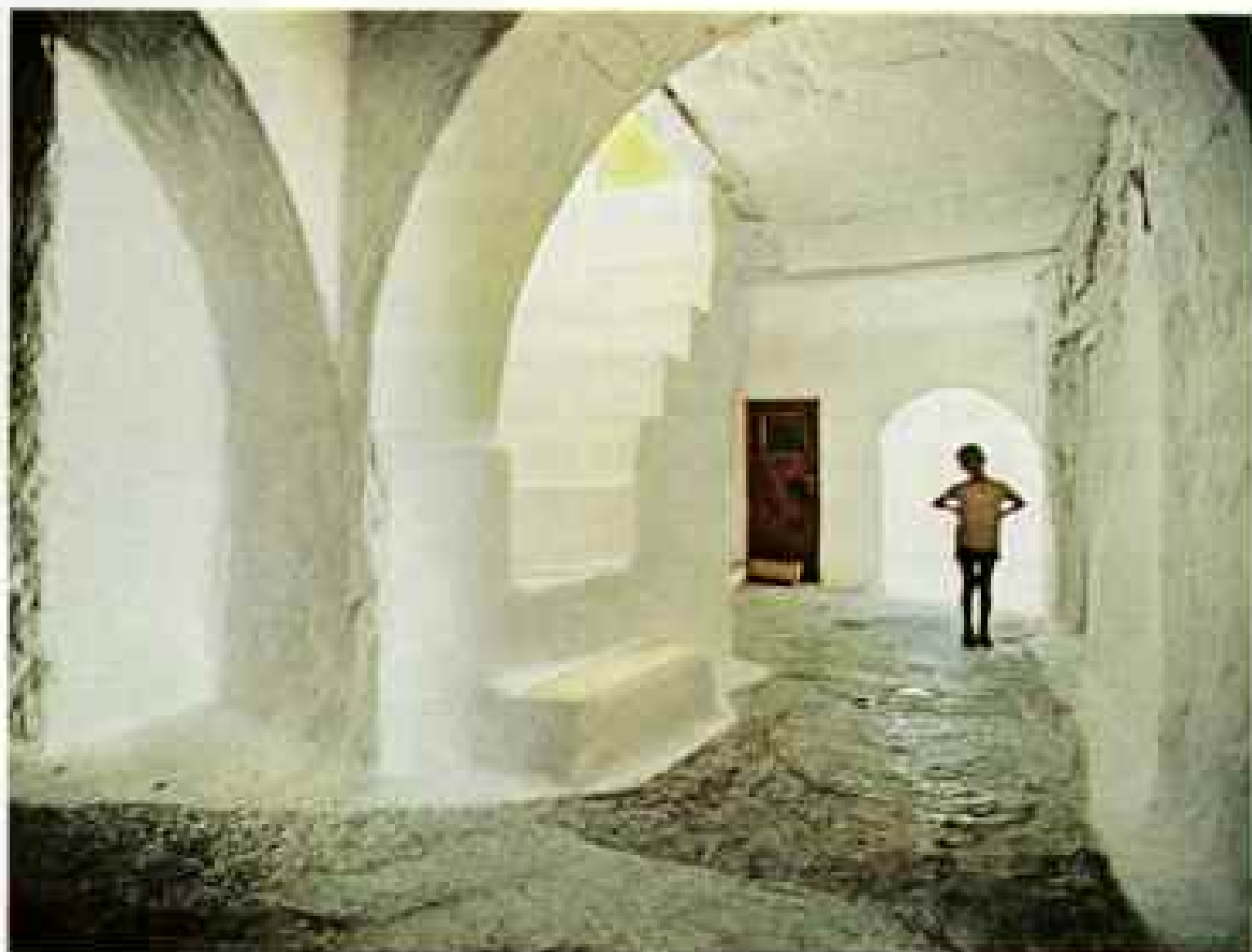
EDWIN STUART GROSSEROW

Surrounded by medieval wonders, a monk meditates in the 11th-century Monastery of St. John on Patmos. Exiled to this island, St. John the Divine heard "a great voice, as of a trumpet" commanding him to write "What thou seest." His visions inspired the Book of Revelation.

In 1956 an earthquake damaged 17th-century frescoes which, experts discovered, concealed paintings executed 500 years earlier. Wooden beams give support to the time-weakened walls.

Snow-white cubes and cupolas, archways, and stair-step streets—towns of the Aegean isles reflect a sameness while retaining their individuality.

Modern architects talk of the revolutionary concept of living accommodations above highways—a centuries-old practice in the Aegean isles. Here, in the old section of Naxos, a narrow street underlies a house (right).



EDWIN STUART GROSVENOR (ABOVE AND LOWER RIGHT), JILL HODSON (LOWER LEFT), JAMES G. SUGAR



On Milos, evening tints the white of day to soft blue (above). Flat roofs offer work and lounging space, and even serve as footpaths to other houses.

A more vibrant blue—disconcerting to eyes accustomed to the white of island towns—attests to the Greek love of freedom. The people of Kalimnos

(near right) painted many houses blue during the Italian occupation, to remind the unwelcome residents of the blue-and-white Greek flag.

Walls, terraces, and zig-zagging stairways interlock and buttress each building on Thera (facing page), an island often racked by earthquake.







EDWIN STUART GOSWELL





With lights as lures, fishermen harvest the Aegean. Setting forth at dusk, a mother ship tows her brood of dories to a fishing ground. Here the larger vessel and a companion longboat prepare to play out a purse net around fish attracted by the lamps of the dory in the foreground.

Night catch goes on sale from a donkey's back in the early morning at Milos. Gourmets prize the red Aegean mullet, at left, known as *barbounia*.

JENNIFER SHIP WHEELER PHOTO



failed, and took Rhodes. Finding the metal of the great statue, they sold it, so that today nothing remains.

But one day there may be a new Colossus of Rhodes by Felix de Weldon, the sculptor of the Iwo Jima Marine War Memorial at Washington, D. C. I saw the bronze model of the proposed Colossus in Rhodes and was told that plans for it are going ahead.

More than half a million visitors come to Rhodes each year. They come from everywhere. Wandering the port city where most of them congregate, we amused ourselves counting languages. We recognized nine, and there were others we could not identify.

We visited the old Infirmary of the Knights, whose order was founded to care for sick pilgrims in the Holy Land. Now the building, a museum, holds treasures of the Rhodian past, and that of the other Dodecanese islands.

One room houses a magnificent collection of vases, ranging from the times of Minoan Crete and Mycenae to the era of Alexander the Great. I admired an especially good one, painted with a scene from the *Odyssey*. An hour later, I met our shipboard photographer, Ed Grosvenor, walking up the street carrying what I could have sworn was the same vase.

"I didn't steal it," he growled. "Peppas made it for me." Peppas runs one of several shops where potters make duplicates of the vases in the museum for sale to visitors.

"We are legitimate, honest forgers," Peppas told Ed, "and you have a beautiful, very ancient vase—made right before your eyes."

Tiny Port Fetes a Great Saint

One morning we made sail and cruised along the island shore to Lindos, one of the three main Rhodian cities of ancient times. The coast here is steep; the sea at the foot of the cliffs is so deep that it is possible to sail directly to the rock. I lay on deck with my head over the bow. Slicing the sea, the prow changed the water instantaneously from azure to snow white, an act of alchemy that never ceases to fascinate me.

The approach to Lindos by sea is spectacular. From afar we could see, atop a 375-foot cliff, the graceful ruins of a temple to Athena, and a solid knights' fort (pages 176-7). On arrival, we rode up to this ancient acropolis on donkeys and saw, far below the dizzy eminence, a toylike *White Mist* waiting in the little bay of St. Paul.

The port gets its name from the legend that St. Paul found refuge here. We arrived on

June 28, the day of his festival, and stayed for the night celebration.

As evening fell, lights were strung along the waterfront. There were bright costumes and songs and folk dances (page 177). Families came in small boats; others walked down from the mountains.

The climax was a feast of *souvlaki*, as the Greeks call shish kebab, and fish cooked on outdoor fires and washed down with beer or *retsina*—wine flavored with resin. Not until dawn did the people go back to their boats. They sailed away laughing and singing, past where we sat in the cockpit of the yawl, barely able to keep our eyes open.

From one boat that passed very near to us something flew out of the dark and landed on the deck at my feet. It was a sprig of basil.

We quit Rhodes on a lovely morning, bound for Simi. On our starboard hand rose the high coast of Turkey. Here is a dry, desolate land, with no houses on the shore, no white chapels crowning the hilltops.

As we rounded the island's northeast point, Simi village burst upon us. It was dramatic in

the setting sun, its colorful houses stepping up the hillside as in an enormous amphitheater.

But, seen at close range, some houses of the town are mere shells—the work of German bombs in World War II. Simi is an island with its share of hard luck.

And yet the Simiotes were the friendliest and most hospitable of all the friendly, hospitable Greek islanders. We visited a chapel above the harbor. The lady caretaker immediately rang the church bells in rapid-fire fashion to let the town know it had visitors. After that we were showered with flowers, cookies, and dazzling smiles everywhere we went, and not permitted to pay for anything.

Simi's Mayor Lives a Double Life

From ancient times Simi was a center for sponge fishing, but today the islanders look elsewhere for a living.

"Once we built some of the finest wooden boats in Greek waters," said Mayor George Nikitiadis, who is also a doctor. "Did you know that, according to the *Iliad*, our island sent three ships to help Agamemnon at Troy? Homer said the commander was handsome, but not an especially good fighter.

"There used to be 15,000 people on the island. Now 3,000 live here, mainly on money sent by their children working in Australia, the United States, and Canada."

Simi's most recent catastrophe was the failure of a solar seawater distillation plant with which it had had high hopes of alleviating a perpetual shortage of fresh water. It lay abandoned at the time of our visit.

"Still," said Dr. Nikitiadis, "I think what Simi needs most is a road between our two principal ports, Simi town and Panormiti. The trip now takes four hours by donkey. There are no good roads on the entire island, and, of course, no automobiles."

Bound for the big island of Kos, we ran into strong northerly winds and decided to shelter overnight at Yiali. From now until we turned west at Lesbos to make for the Greek



WINFIELD PETERS

Kos takes pride in its prime tomatoes, which it exports all over the world in the form of tomato paste. The island's favorite son, Hippocrates, "Father of Medicine," was born here about 460 B.C. and lived for nearly a century. In his memory, an International Hippocratic Institute is being built on Kos as a gathering place for the medical world.

mainland, we would have the wind from dead ahead, and almost always too much of it for comfortable sailing.

Yiali is an island of volcanic pumice that is mined and sold, mostly in the United States, for making building blocks. It is fire resistant and extremely light; builders of skyscrapers favor it for use in upper stories.

It was blowing even harder when we resumed our voyage to Kos on July third. Full meltemi season. From the shore where pumice was being loaded into a ship, a cloud of the powdery stuff blew down the wind, marking Yiali's position from miles away.

In late afternoon we came close under the lee of mountainous Kos, where one might expect shelter from the raging wind. But no, violent squalls struck us time after time, sometimes laying the boat flat on her side. In the Aegean, gale winds come over the tops of mountains, then funnel down their lee sides in furious gusts.

Kos Claims the "Father of Medicine"

The town of Kos struck me as Rhodes on a smaller scale—buzzing with vacationists, Italianate in its wide esplanade and public gardens filled with flowering semitropical shrubs, medieval where the great castle of the knights stands beside the harbor. To build the fortress, the Crusaders mercilessly ravaged earlier Greek and Roman structures for the necessary materials.

But Kos also has a unique distinction: It was the birthplace of Hippocrates, the "Father of Medicine." A statue of the famed physician, legendary composer of the oath to which doctors still adhere, occupies a place of honor in the port's little museum.

In the center of town grows a fantastic plane tree, its sprawling limbs so heavy they must be supported. All sorts of braces keep them in place; these include marble columns from nearby ancient ruins.

"Hippocrates lectured beneath this very tree," said an American with whom I fell into

conversation. He touched the bark with reverence, for he was, it turned out, a surgeon. But tree experts say the plane tree lives 500 years at most, and Hippocrates died some 23 centuries ago.

I met the same surgeon when I visited the Asclepieion, the ancient temple of healing not far from the port city. The ruins, restored by the Italians, are on the side of a hill in three tiers connected by a broad stone staircase. A guide told us that the patients were treated on the lower level, where they drank from a clear spring that still flows into a mossy pool.

"Drink and you will never grow old," he said, and I did so.

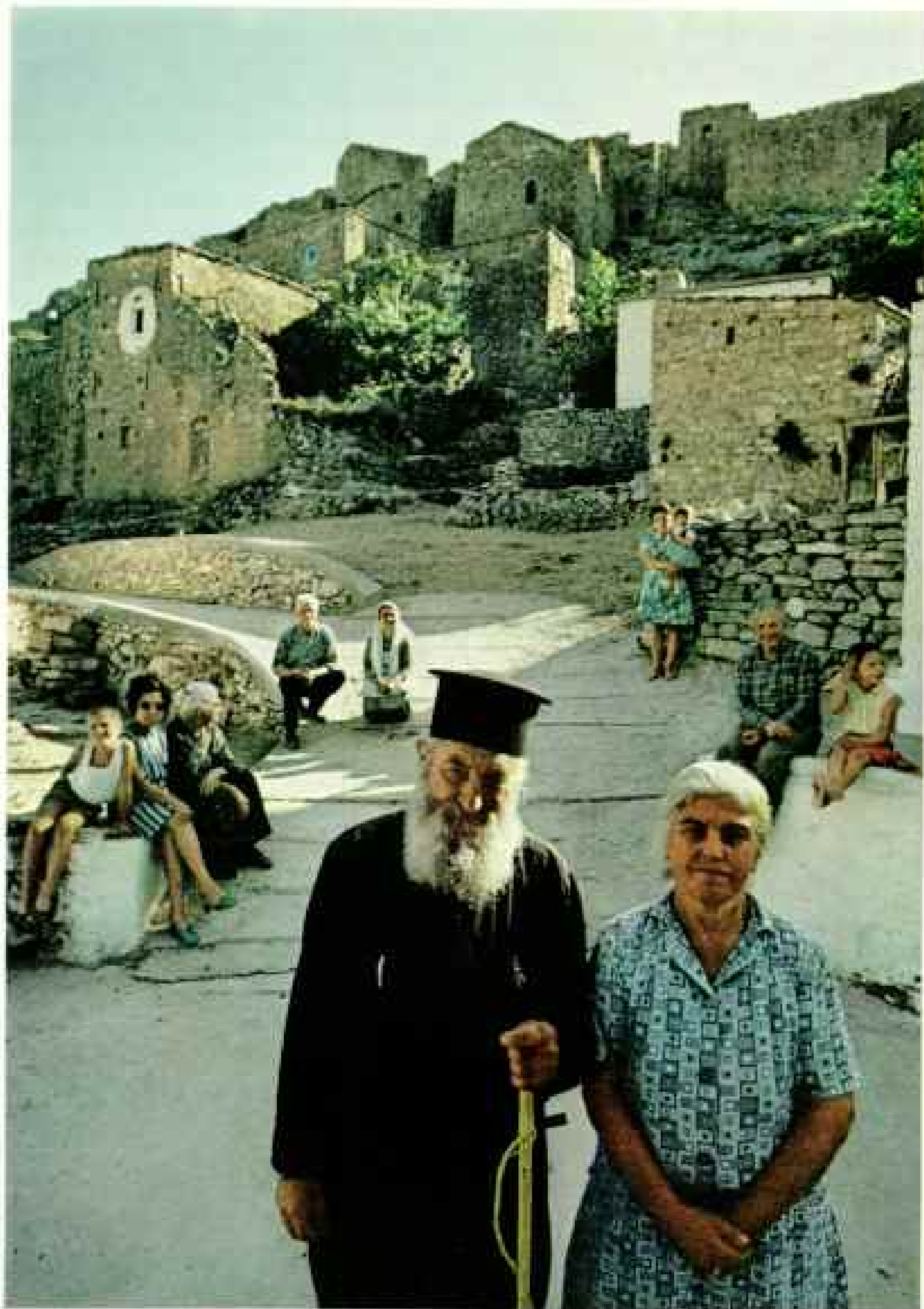
Not the doctor, however.

"The guide may be right," he smiled. "The germs in that water might kill you before you have a chance to grow old!"

On the Fourth of July, Kos's contingent of retired Greek-Americans came to *White Mist's* gangway to drink an Independence Day toast to the United States. The wind was so strong that it almost blew them off the quay, and our visitors advised us not to sail



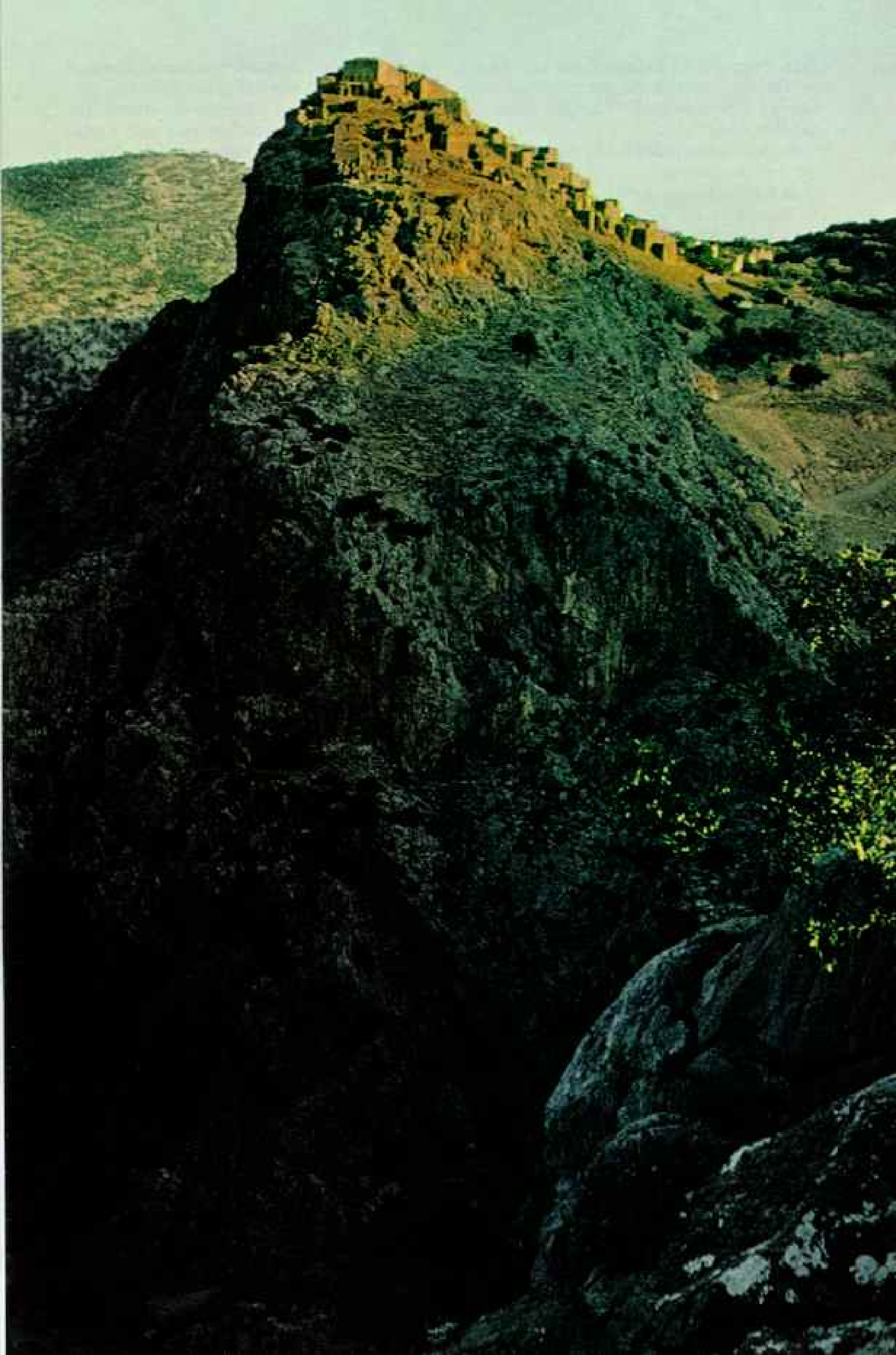
With joy set to music, a wedding party on Kos turns a village street into a festival hall. All day, crowds followed the young couple, center, along tradition's road: The groom entertains at the coffeehouse, the bride watches a barber shave her betrothed while his friends sing, gifts are exchanged, and, finally, marriage vows are taken.



SEEN BY MARSHALL PERMAN

Eleven remain on a clifftop haunted by horror. During Greece's war for independence, in 1822, Turkish soldiers swept the island of Chios in a rampage of killing and rape. Crowning a mountaintop, the castle at Anavatos (right) held out. But, says an island account, starvation threatened. Some defenders tried to escape but were spotted as they clung halfway down a wall and picked off by sharpshooters. Finally one

desperate old woman made her way down the mountain by a secret path to gather greens for her hungry family. She was captured and tortured until she revealed the hidden way. The soldiers climbed into Anavatos and slaughtered men, women, and children. Many leaped to their deaths rather than fall into the enemy's hands. Today, as if memory of the tragedy still blights the eyrie, only this handful of islanders—the entire population of Anavatos village—lives beside the crumbling castle.



that afternoon for Kalimnos, our next island.

"Go very early in the morning," an experienced fisherman said. "Then the meltemi is at its quietest."

It was excellent advice, and we had a pleasant sail the next day.

In Kalimnos port, men sat at taverna tables in the sun; some were barely able to move crippled arms and legs. Former sponge divers, they had been ravaged by the bends, an ailment that comes from rising too quickly from the depths.

We sailed around the island into the narrow channel between Kalimnos and Tenedhos, a mere islet, and anchored off its little fishing village of Telenda. Here Giorgio, a retired sponge diver, told us that an ancient city lay on the bottom of the channel, its weed-covered arches and walls visible through the crystal water if one looked through a sponger's glass-bottomed bucket.

With Giorgio as guide, we set out for the site in the Whaler. When we went to anchor, Giorgio tossed the hook over without checking the knot on its line, and we lost it.

Using the bucket, we failed to find the anchor, but I saw long, straight, dark lines of

walls or foundations. Archeologists know of the site, but no one has yet explored it.

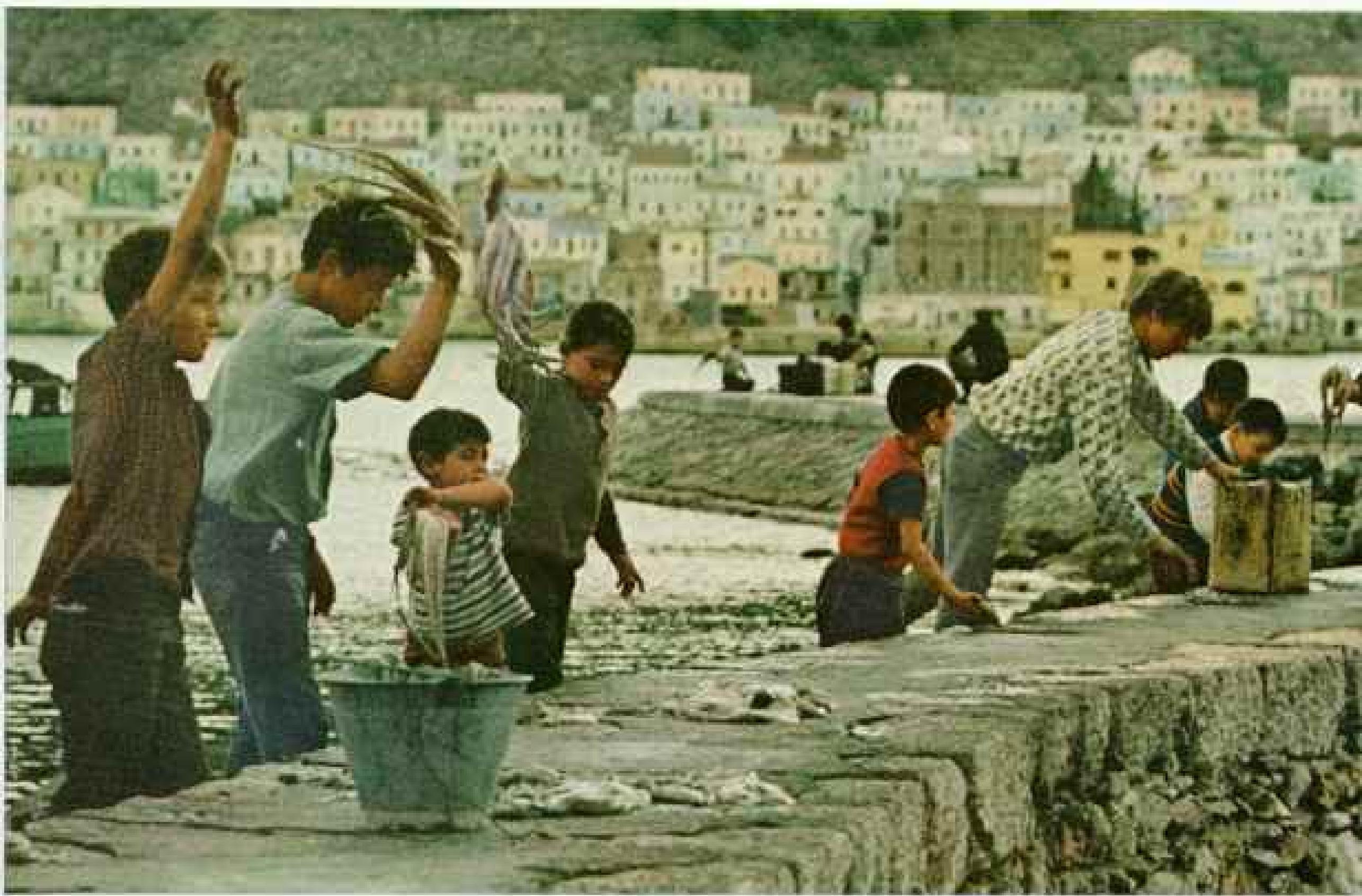
That evening we sat under the arbor of the single taverna and watched, on a quay a hundred yards away, the comings and goings of a ferry caique to Kalimnos. On one trip a woman and her children arrived. They had with them six dining-room chairs and a table.

"They will join the father, a shepherd who brought his flock over earlier for the summer grazing," said Giorgio. "Each year I see them come here, always with the table and chairs.

"But there is a sad sight on the quay as well. Do you see that other mother and her children on the caique? They are bound for Australia. They will join her husband in a new life, and they will never come back to Tenedhos.

"Look again. The old woman in black, weeping, is the grandmother. When the caique leaves, she will be all alone, all the rest of her life."

Then the ferry put out into the stream, and the grandmother watched as it faded into the gathering dusk. From boat or beach, no one waved. A small straight figure wiping her eyes with an apron corner, the grandmother turned



very slowly on her heel and walked past us.

Thanks to Giorgio and his friend Nick, we had a delightful stay at Telenda. Nick?

"I am not Nick," he said. "I am Gus. I was a puddler in a steel mill in Gary, Indiana."

Gus introduced us to an old fisherman repairing a net—a bobbin behind one ear, another stuck in the hair, the third in the right hand, big toe holding the net taut.

"A mender of nets wears no shoes or socks," said Gus a bit redundantly.

"Nylon?" I asked the old man.

"Nailon," he replied.

"I see you have learned some Greek," Gus said to me.

Book of Revelation Written on Patmos

Again outwitting the meltemi with an early start, we paid a quick call on Leros, scene of fierce fighting in World War II, then ran on to Patmos. From afar we saw the island's trademark, the great fortified Monastery of St. John high on a hilltop. As we tacked for the harbor entrance, I noticed a cottony cloud just under a mountain peak.

"Let's get the sail off fast," I said. "That cloud probably signals a strong meltemi."

Sure enough, just as our anchor hit the bottom minutes later, a wall of wind struck us, laying the ship far down.

Patmos is a place of importance to the Christian world. To this isle St. John the Divine was banished during the reign of the Roman Emperor Domitian. Here he wrote the Revelation, last book of the New Testament.

According to local tradition, God spoke to him in a grotto, halfway down the hill from the monastery, now a place of pilgrimage. We found a young monk there studying. He pointed to three cracks in the ceiling.

"Through them God spoke to John," he said. "And here," he indicated a place on the floor, "the good saint rested his head."

Founded by St. Christodoulos, the monastery dates from the 11th century and houses, along with priceless icons and other treasures of Byzantine art, one of the world's great collections of Christian documents.

A pleasant young monk showed us through its library; he said it contained some 3,000 precious books, of which nearly a thousand are handwritten manuscripts dating from the sixth to the nineteenth century. With special pride he pointed to one.



BOYS BY JAMES H. TIGHE

Beating octopuses—"the Boneless Ones," as the ancient poet Hesiod called them—youngsters at Kalimnos tenderize the meat. Like boxes stacked one atop the other, houses climb a rocky slope.

Pounding sponges, workers expel animal tissue and soften the fibers, then trim the harvest for export. Aegean sponge beds are nearly played out, and Kalimnos fishermen sail to the North African coast for their haul. Many of the island men bear the price of their trade: arms and legs rendered limp and useless by the bends—a malady caused by too quick an ascent from the depths.



Mirror smooth and aglow with reflected light, the harbor of Molyvos on Lesbos signals that the end of the *White Mist* voyage draws near. Sailing in by night, the yawl squeezed through a narrow opening at the right of the house at center. From here *White Mist* sailed west, then south, setting course for Cape Sounion and her overseas base at Piraeus—with a treasure of memories in her sea chest.



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"It is the Codex Purpureus, our finest treasure," he said. It was a fragment of the Gospel of St. Mark, handwritten on purple vellum in the sixth century.

Thanks to the monastery's strong defenses, the library has never been looted, but time and insects have taken their toll. Now scholars are cataloguing and restoring the books.

We watched an international team led by Dr. John L. Sharpe III, of Duke University, teaching monks to microfilm the documents.

"The abbot of St. John's is in Athens seeing about air-conditioning equipment which he suggested should be installed to better preserve the documents," Dr. Sharpe said. "I'm sorry you weren't able to meet this really outstanding theologian."

Sure enough, the machinery arrived sometime after our visit. But how to carry it into the monastery through a gate wide enough only for men and donkeys? A big U. S. Navy Sixth Fleet helicopter lifted it and set it gently on the hilltop.

Young monks will run the modern equipment. Until recently, these same theologians ate on their knees before a stone table in the Byzantine refectory.

Scent of Pine Lures Sailors to Samos

If the sailor's eyes identify Patmos for him, then his nose lets him know when Samos lies to weather. Most Aegean islands smell of thyme, sage, oregano, and of jasmine when the night is still and warm. But Samos blends with these the scent of pine woods, rare in islands where most of the trees have long since been cut. With Samian perfumes go sounds of lowing cows and hee-hawing donkeys.

Lofty Samos produced her share of great Greeks, including Pythagoras the mathematician, who claimed the earth was round, and the philosopher Epicurus.

Then there was the conqueror and tyrant Polycrates, who improved the port of Pythagorion, in which we tied up. To bring it fresh water, he ordered a tunnel almost two-thirds

of a mile long cut through a mountain. Thousands of workers did the job.

Costas J. Ptinis, a Samian who has written an island guidebook, took us into this wonder of its age. Armed with flashlights, we half-walked, half-slid down a steep ramp to a walkway above the aqueduct itself.

At intervals there were narrow manholes through which men descended into the water tunnel below to cleanse it of debris.

"Ship masts were floated through the conduit to clear it of obstacles," Costas said. "Imagine a worker ordered into one of these dark holes, wondering when a great timber would come booming through the tunnel!"

That night we dined in Vathi, the island's principal harbor and largest of Samos's sixty towns and villages. But I was glad *White Mist* lay snug in Pythagorion, for Vathi is a rough place in a north wind. We saw a small boat break from its mooring and take heavy damage against a seawall.

Lesbos, Where "Burning Sappho" Sang

Making for Lesbos, we sailed quietly all night. As we approached the island of "burning Sappho," we moved over a sea blazing with blobs of white light; the meltemi was slackening, and the Lesbos fishing fleet, which had been long weathered in, was out in force.

We sailed into Mitilini harbor at dawn, surrounded by strings of fishing boats. Backing the yawl into the only open berth, we settled down for a few hours' sleep.

But then bedlam broke loose. We had moored alongside the fishermen's wharf, and now, at 5:30 a.m., the buyers arrived. If there is anything noisier than an Aegean island fish market, I do not know what it could be. A fine breakfast of fresh fish, however, was our reward.

I spoke of "burning Sappho." The phrase is Byron's: The woman he described was born in the seventh century B.C.; she was one of the great lyric poets of all time. But only fragments of her poems survive. A small modern statue of her graces the Mitilini waterfront.

A popular tourist spot of modern Lesbos is Molyvos, a delightful town with a tiny sheltered harbor (facing page). There we squeezed into a berth among the fishing caiques. We walked up to the town, a place of cool sun-dappled shade even on a high summer's midday, for vines of grape, wisteria, and jasmine flesh out trellises that cross the cobbled streets from house to house.

Many artists visit Molyvos. They frequently set up their easels just under the battlements of a great medieval castle.

The island's best-known artist came from the little village of Varia. He was Theophilos, who died in 1934. Critics liken this primitive artist to the late Grandma Moses, an equally untrained painter.

Poor Theophilos! While he lived, his fellow Greeks had little regard for his talent, and he sometimes paid for meals with paintings done on taverna walls and doors. Now Mitilini has a museum with scores of valuable Theophilos paintings and frescoes.

In Molyvos we took on the stores we would need for the long run back across the Aegean. Time was running out; the ship's complement had dates with Olympic Airways to take them home.

Now the meltemi was going our way. It sped us into the sunset, and we raced the seabirds down the singing wind.

White Mist coasted Alonnisos, but without slackening pace. We stopped for dinner at Panormos on the wooded isle of Skopelos, anchoring for the night in its landlocked harbor where Cretan mariners moored to waterside pines 3,000 years ago. We called at fashionable Skiathos, then ran in on the mainland between Thessaly and Cape Artemision at the northern end of Euboea, a very big island. Here in 480 B.C. a great wind, almost certainly a meltemi, wrecked much of the Persian fleet of the invader Xerxes.

Down the Gulf of Euboea we flew, passing through the swing bridge at Khalkis, where Aristotle, student of Plato and teacher of Alexander the Great, died in 322 B.C.

Skipper Says It With Basil

And then we came at last to the end of our journey, Cape Sounion. Aurora, daughter of the dawn, had just brushed her rosy fingers across Homer's "wine-dark sea" when we passed for the second and last time beneath Poseidon's temple.

Crewman Nat Kenney came on deck carrying a glass of retsina and said, "For a libation to Poseidon. He heard our prayers and kept us off the rocks."

"Keep the retsina," I said. "I have a better offering—not only for Poseidon, but for all the wonderful Greek people who have helped us along our way."

I tossed a sprig of basil onto the Aegean foam. □



North With the Wheat Cutters

By NOEL GROVE

NATIONAL GEOGRAPHIC STAFF

Photographs by JAMES A. SUGAR

Endless hours in harvest fields spell exhaustion for Mike Grout, one of a crew that gathers wheat each summer across the Great Plains. In a race against time and weather, burly machines slice through ripened grain day and night. As two combines fill a truck (right), scoopers level the load in a fog of dust. To capture the frantic pace of one of the largest food-gathering operations in the world, the author and the photographer followed one team across six states.



BY 11 A.M. the combines are still not running. Like parasitic beetles they cling to the backs of four trucks that sit motionless along a Kansas road. Since sunup the caravan has traveled 150 miles from shaved fields near the Oklahoma border north to rippling oceans of uncut grain.

Standing beside the gravel road, I watch Max Louder's face grow taut. Yesterday I heard him scold a young hired hand merely for stopping his wheat-cutting combine momentarily to wipe dust from its windshield. The success of Max's harvesting operation

and the security of a farmer's crop depend on the almost continuous operation of these big machines. The sight of them standing idle while wind hisses through ripe wheat gnaws deep into his patience.

A truck has been backed into a ditch so the combine can be driven off. But this ditch is too shallow. "Dig it out!" someone yells, and the truck inches forward again. Shovels fly, scooping grooves for the rear wheels.

The nagging delay triggers an argument between 17-year-old Karen Louder and Matt Dillon, one of the hired combine operators.



Sharp words fly until, tight-lipped, Matt showers Karen with a shovelful of dirt that leaves her bristling in silent fury.

The digging continues until the truck can back into the twin ruts in the gray, dry earth. At last the combines are driven off onto the ground to be coupled with the wide cutting attachments that had been removed for transporting. The trucks, now free to haul grain, are fitted with sideboards. It is past noon and still no wheat has been cut today.

Feverishly, crewmen struggle with the heavy, unwieldy truck walls. A wind gust sends a sideboard crashing into a man and he staggers back, a crimson stream coloring his face. Karen washes and bandages the cut; work barely slackens.

By 1 p.m., three combines are ready. "Get going!" yells Max, and three drivers sprint out to their machines and send them snarling into the awaiting field.

Gradually the tension eases. In wordless apology, Matt playfully threatens Karen with

a grease gun, and she grins. Max pours himself a drink from the water bucket and tweaks the belly of his 5-year-old son Mikel.

The combines are running.

An Army of Cutters Sweeps the Plains

Haste rules the long summer of the wheat combiner. Some 2,000 crews conduct the largest single food-gathering operation in the United States as they harvest and haul for farmers of the Great Plains—the grain-rich belt that stretches from Texas to Canada and produces most of the country's 1.5-billion-bushel wheat crop.

Photographer Jim Sugar and I met Max Louder's crew in Texas, where the first wheat ripens in May. By mid-September, when his machines pulled out of their last wheat field, 12 miles from Canada, Max's crew had harvested more than half a million bushels of ripened grain, enough to meet the annual bread needs of 125,000 American families.

Every stalk was cut with one eye on the



clock and the other on the clouds. Rain or hail can destroy a crop as it stands in the field. When it is ripe, farmers want it cut immediately, but many cannot afford to keep expensive machines that would sit idle 11 months of the year. So they hire "custom cutters" like Max Louder and his crew.

"I figure when one of my combines is running, it brings me 25 cents a minute, besides moving a farmer's crop closer to storage so he'll ask me back next year," says Max, a 46-year-old Kansan with a boyish grin and the slim-hipped build of a cowboy.

In the combiners' race against time, action focuses on the rumbling machines that shave a 20-foot path through a field at an average speed of three miles an hour. In front of the operator's enclosed cab the reciprocating cutter bar snicks off the wheat and the churning paddle reel lays the severed stalks onto the broad platform. An auger carries them into a metal maw, where a high-speed cylinder knocks the grain loose. Finally, the

Breadbasket trail begins in Texas, where an early spring first ripens the hard red winter wheat that was planted the previous fall. No other harvest touches so many American tables; the high-protein grain produces most of the Nation's daily bread.

The Max Louder family of Mankato, Kansas, and their seven crew members launch their harvest near Munday and migrate steadily northwest. Late July finds the custom cutters on a highway near Casper, Wyoming (left), moving from one job to another, their combines perched atop grain-hauling trucks.

Only rice rivals wheat among the world's food crops, and only the Soviet Union grows more wheat than the United States.

battered straw and chaff are spat from the rear in a yellow cloud.

Max's annual trek begins in early May, when his four combine-laden trucks, two pickups, and two house trailers for family and crew pull away from the Louder home, 11 miles from the Nebraska line, near Mankato, Kansas. Similar caravans from the Dakotas, Nebraska, Kansas, Colorado, and Oklahoma rendezvous on the plains of northwest Texas to follow the march of ripening wheat. Growling into golden fields, the army of iron locusts blitzes its way toward Canada at the rate of some 15 miles a day (map, preceding page).

"In 1946, fresh out of the service, I bought a combine and came down here with my uncle, who had three machines," says Max, as we drive past the stucco city hall of Munday, Texas, his annual starting point. "I haven't missed a harvest since."

As I join his crew at selected points along the 1,750-mile odyssey, I see Max plot a course and deploy his equipment with Napoleonic precision. I watch his young crewmen, bone tired and dust grimed, clomp into their trailer as late as 1:30 a.m. to grab a shower and a few hours' precious rest. Tempers are rubbed raw by the hectic pace. But fatigue can be a balm as well.

One day I circle a field in a truck with Viet Nam veteran Denny Mallard as he relieves brimful combines of their loads of grain. As the morning wears on, talk drifts to friends he lost in the war, and to months spent in a hospital for wounds that do not show. Shells shatter nerves as well as bodies.

"I'm a lot better now, working out here," he says quietly. "It's good to be so busy."

There are less busy moments too, with time to sit alone in a truck after night folds over a brilliant prairie sunset. Then harvest shows its tranquil side, in fields large enough to sweep the cobwebs from a crowded mind, under stars that dazzle in an ink-black sky.

Tarantula Hints of Desert's Nearness

Strange harbinger of harvest, a dark brown tarantula picks its way across the road, its legs arching and falling like the disembodied fingers of a piano player.

"They start to crawl around this time of year, just before the combines come," says Floyd Bowman, a wheat farmer near Munday. "Must be their mating season."

I had always thought of tarantulas as desert, not farmland, creatures. In fact, however, the wheat country of northwest Texas

lies along the fringes of the arid Southwest. And in 1970-71, as happens with disturbing frequency, the desert seemingly has spilled into the neighboring prairies in a crushing drought.

"This is going to be a lazy harvest down here this year," says Max, on a day when airborne Knox County dust dims the sun at midday. "A lot of cutters didn't even come. But I figure it's worth it to keep my regular customers and break in a new crew."

Rigid Rules Govern the Harvest

Training begins immediately. The combines and trucks must synchronize their movements carefully to assure fast and efficient harvesting in fields that range from five to nearly a thousand acres. Cutting in diminishing rectangles (pages 210-11), the combines can run all day and into the night without stopping, if no breakdowns occur. Even the machine's 115-bushel bin is unloaded on the go, as truck and combine run side by side while a stream of wheat pours from harvester to hauler. When filled, each truck often must travel miles to town storage bins, wait in line to unload, then speed back to the field. Two-way radios in Max's vehicles crackle with instructions coordinating the entire operation.

There are rules to be learned. "Don't park one vehicle behind another in the field," he lectures his crew of seven young men. "Someone may back into it."

"Always leave the keys in the combines at night. I've heard of lightning starting a fire in a field, and when neighbors tried to drive the combines out, they couldn't start them. The machines burned up."

Ramrod for the crew in Max's absence is his 22-year-old son-in-law, Mike Grout, a college senior and one of three veterans of last year's harvest. The two others are Charles (Matt) Dillon, also 22, of Superior, Nebraska, a redhead as rawboned as his television namesake, and Dick Wiggans, a quiet, capable 23-year-old from Chanute, Kansas.

Of the other four crewmen, three are Midwestern farm boys. The fourth, another redhead, is known to his crewmates only as Brick. He is a long-haired young man from North Carolina whose last job, he says, was "helping organize Mayday peace demonstrations in Washington." Brick's fire-red ponytail draws sidelong glances from crew members, longer looks from Texas townsfolk. But success in the wheat field follows a physical rather than a philosophical route.

A summer of demanding work lies ahead, and most crewmen will fail to complete it; one lasts only three days. They call him Tiny, a jest that only accentuates his nearly 300 pounds. Studious in thick-lensed glasses, he seems better suited to a research lab than a wheat field, even though he was raised on a Kansas farm.

Outwardly he cheerfully accepts the friendly gibes about his size, but privately he admits they work like acid on his ego. His large body is as unwieldy as his brain is agile. His mind can grasp theories on the fall of the Roman Empire, but his body cannot squeeze between the drive wheel and combine frame to reach a grease point. On the third day, word gets around that Tiny has been canned.

"I know I'm big and clumsy," he mumbles as we pause for a drink at the water bucket. "I'm happiest in school, studying to be a teacher. I don't belong here."

Max offers him a parting ride. Without a job, but too proud to return home, Tiny picks a nearby town at random and is dropped at the fading two-story frame hotel. Several times, at night, I picture him—a hulking figure plodding the streets of an unfamiliar town in his huge, bulbous-toed work shoes, or sitting alone in a dim hotel room.

Whole Family Joins the Team

All of the Louder family are veterans of the harvest: Max's wife, Wanda; daughters Karen, a college student, and Janis, 11; married daughter Linda, 22, who commutes from graduate school in Kansas for weekends with her husband, Mike Grout; and Mikel, the 5-year-old.

Having spent his summers in the company of field hands, and basking in the indulgence afforded the only male heir, Mikel seems less a child than a miniature adult. He walks with a swagger, a Lilliputian drill sergeant with the saltiest vocabulary I've ever known in a preschooler. But long hours betray the youngster's years.

"Daddy, I'm tired," he whimpers in the trailer one evening, then quickly catches himself. Chin out. "Think I'll hit the sack."

Tireless Karen proves the equal of any of the hired drivers, piloting the tandem-wheeled, ten-gear trucks with the unconscious ease of a co-ed in a sports car. She has left a steady boyfriend back in Mankato, but soon a dark-haired youth from another crew offers a stern test of her loyalty by coming to call after cutting hours. Karen somehow



HOLL BRONK

His crop withered, his patience tried, Texas farmer Ken Baker kicks at the dust of a wheat field scorched by drought. The area's desertlike dryness in 1970-71 yielded barely enough to provide seed for the next planting. As they have for the past 26 years, the Baker family hired the Louder combiners to harvest their meager crop.



Golden sea of plenty surrounds wheat cutter Louder, his head bowed as he checks the ripeness of a client's field in Oklahoma. Brittleness of kernels crunched between the teeth tells how soon the grain may be reaped. Scouting ahead by car, Max lines up work for his harvest caravan.

Chewing into the fat of the land, a phalanx of combines sweeps over a Kansas field. Each of the five machines—Louder's four plus a rented one—shaves a 20-foot swath. Trucks haul cargoes to storage or to grain dealers. Even as drought ravaged Texas, capricious prairie weather bestowed a bumper crop of wheat on Kansas.







Comely wheat cutter, 17-year-old Karen Louder pilots a roaring machine from inside its air-conditioned cab.

Field general Max Louder studies the movements of machines and crewmen. Paid by the acre, he must orchestrate speed with careful cutting to ensure the financial success of his operation.

Straw-gorged combine poses a prickly problem for shirtless Willie Thull, who must clear his jammed machine.

finds time for long talks in front of the Louder trailer.

The real crush of harvest is still weeks away. Work stops at an early 9 p.m., for there is little danger of rain in Texas this year, and not much wheat to cut.

Planted late in the year, hard red winter wheat feeds the Nation two courses—meat and bread. Beef cattle fatten on its green autumn growth, then are removed in early spring so the plant's flour-producing seed can develop. In 1971, however, cattle were left in many Texas fields until summer, for it was evident that most of the wheat here would not yield grain worth gathering.

Deep Cultivation Reduces Erosion

"All the years I farmed this field, it never failed to produce until now. Must be drier than Dust Bowl days," says retired farmer Pitzer Baker, 71, as we stand in an empty expanse ribbed with upturned clods the size of basketballs. Touched by little more than dust-settling rains since the previous summer, the stunted crop has been plowed under. At least, he shrugs, the soil doesn't move the way it did in the thirties, when moaning winds blew away great chunks of Texas, Oklahoma, and Kansas, a layer at a time. "They farm better now."

"We have equipment that can dig deep and bring moist earth to the top to hold the dry soil down," explains Pitzer's son, Ken Baker. "Dad didn't have the implements to do that when he farmed."

To the best of wheat-cutting operations come mechanical problems that erode both profits and patience. Even with new machines, trouble soon reaches Max's crew. The steel rim of a combine wheel breaks, nearly dumping the machine on its side. Three hours pass before the wheel can be replaced.

Cutting low to reach the drought-stunted wheat, a combine picks up a rock the size of two fists. It creates havoc inside the precise mechanism, bending and breaking steel into twisted debris. Switching quickly from field commander to mechanic, Max severs the ruined pieces with an acetylene torch and replaces them with new parts. Repairs continue past midnight, the torchlight illuminating his glistening face. Next morning the machine grows back to the field.

Meanwhile, several crewmen are having their own troubles, outside work hours. Eating at a Texas café near midnight, they receive the territorial threat-symbol of the





small-town male—the hostile stare. One of the crew makes the mistake of staring back, and soon enough local muscle for one and a half football teams rings their table. A waitress shouts at the locals, “Leave those boys alone—they’ve behaved real nice in here!”

Grunts. Snorts. Shuffling of feet on the tiled floor. “Where you from?”

“Kansas,” comes a crewman’s reply, and the encounter dissolves into a chat about harvest, hometowns, wages, and women.

Meals Come in “Wanda’s Wonder Wagon”

“Let your crew hang around town too much, and you’ll have headaches every time,” says Wanda. If not born to the wheat field, Max’s wife is at least wedded to it. “I had just graduated from high school,” she recalls, while fixing dinner for a dozen hungry harvesters. “Max had already left for Texas that year, and he was going to drive back on a Wednesday night so we could be married.”

“On Tuesday he called and said his machines were broken down and he’d be there as soon as he could. We were married on Saturday and left next day for harvest.”

I’ve never heard another woman with a voice like Wanda Louder’s. Every sentence is a peppery pronouncement that rings with a Wanda-against-the-world timbre. Yet the friendliness comes through. “Arsenic coffee or cyanide milk?” she barks the first morning I stumble into the Louder trailer for breakfast. Somehow, I feel welcome.

During the long summer she hauls two of the three large meals each day to the fields in the back of her car—“Wanda’s Wonder Wagon,” the crew dubs it. Amid 100-degree-plus heat and blowing, suffocating dust, she serves delicious repasts of lumberjack proportions (page 213).

The finest spareribs I have ever eaten come off a paper plate balanced against a shirt-rattling wind, while Wanda harps at crewmen to go easy on her dwindling supply of sugar in their iced tea.

Yet her explosive rhetoric serves as a safety

valve for Max’s nerves. The more excited she gets about problems in the field, the calmer he becomes.

“Max likes this pressure. It seems to give him energy,” she tells me. “I just can’t handle it quietly the way he does.”

The Texas drought has cost Max some \$10,000 in lost cutting. In Oklahoma, rain eats into his profits. Max gives me a lesson in harvest economics one day as we sit in a roadside café, sipping tea from plastic glasses.

“I figure that before I can make money, my annual income has to be \$130,000. That’s how much I have invested in machinery.” On a paper napkin, he lists pieces of equipment and their costs. Four combines, at \$14,500 each. Four hauling trucks, \$9,000 apiece. Pickups, travel trailers, two-way radios, spare parts.

To meet that investment, Max charges about \$4 to cut an acre of wheat that may bring the farmer \$50. In addition, he charges an average of \$25 for each load his trucks haul. On a good day, a combine can cut 100 acres. On an idle day, it is a financial drone. I begin to understand the concern about delays for rain and repairs.

Driving a “Prairie Lawn Mower”

“Ever run one of these things?” asks Matt Dillon, as I share his combine cab one day. He is out of the seat and I am behind the wheel almost before I quit shaking my head.

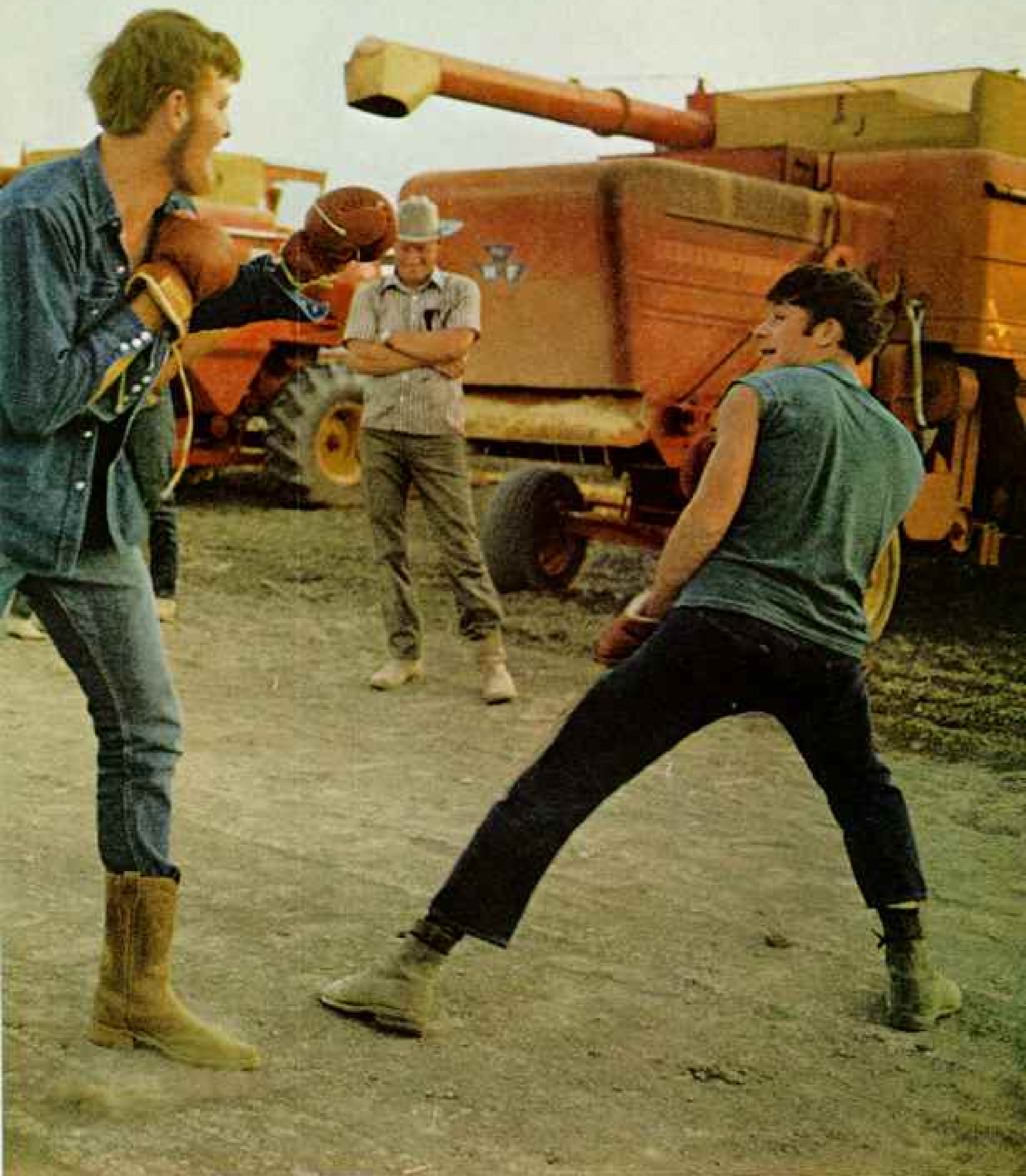
At my right, three important levers: One controls the height of the cut; another raises and lowers the whirling reel that urges the severed wheat into the metal mouth; the third controls ground speed. If I adjust the cutter bar too high, I may miss wheat. Too low, and I engorge too much straw, straining machinery and risking a breakdown. If I advance too fast, grain slips through unthreshed. Too slow, and I’m costing Max time and money.

Up comes a truck beside me to load. Now I must watch not only the wheat in front but also the vehicle alongside, in case it veers away and our precious cargo falls to the

Work grinds on beneath a crescent moon as a combine’s headlights show the way to standing grain. When winter wheat finally ripens—some nine months after planting, nervous farmers want it gathered quickly to escape damage from rain, hail, or prairie fire. To secure their crop and increase his own earnings, Mr. Louder sometimes operates his combines 16 to 18 hours a day.

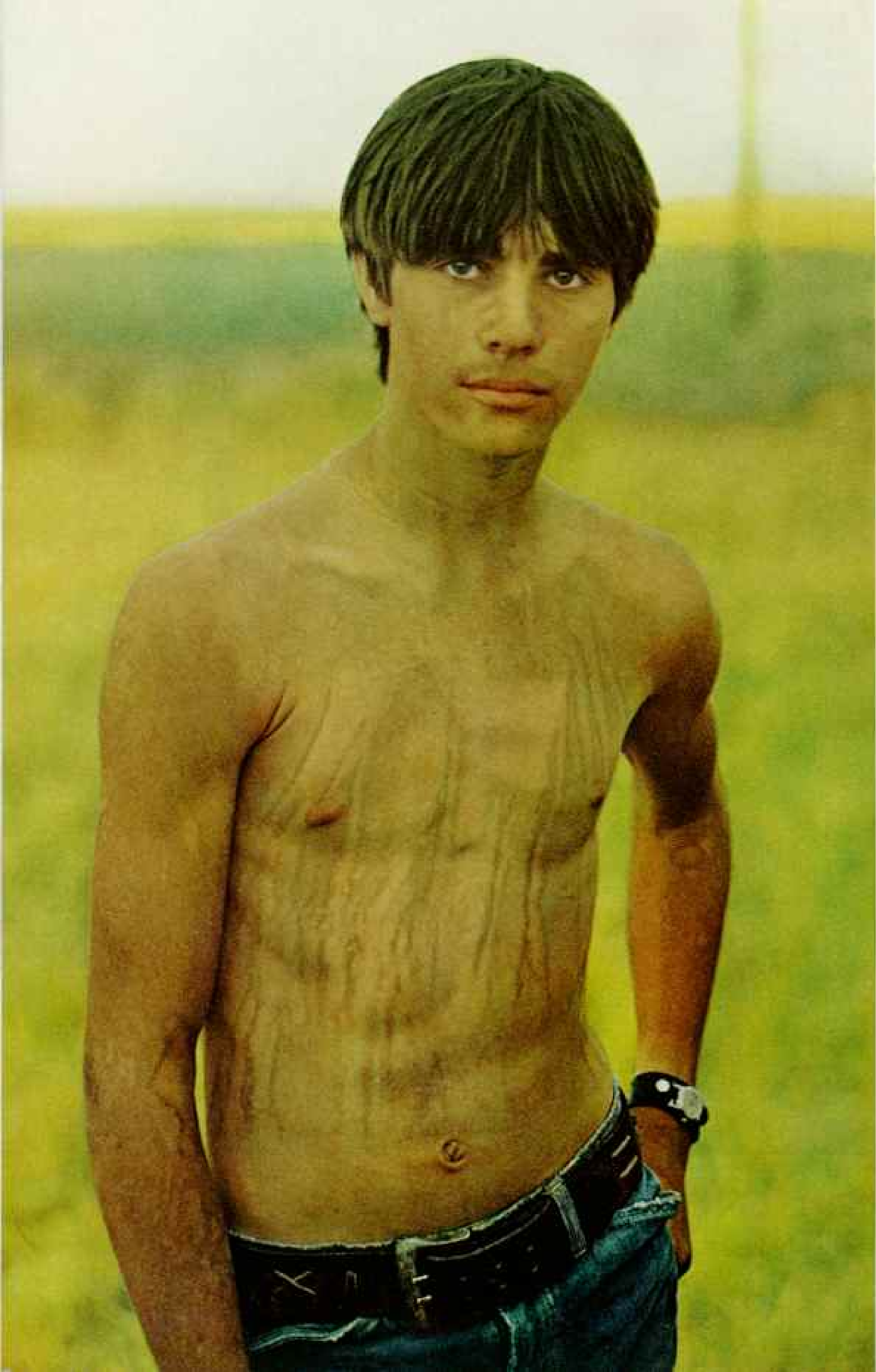


Prairie pugilists Charles (Matt) Dillon, center, and Willie Thull square off in a friendly boxing match after rain idles the combines near Fort Benton, Montana. Referee Denny Mallard, far left, once fought in Golden Gloves competition.



Like most custom combiners, Louder, in striped shirt, draws his hired help from students on vacation and footloose young men not yet tied to a career. They earn room and board and an average of \$450 a month. Wet weather offers rare moments

of respite from work that often stretches into weeks without a day off. "We once cut for four weeks straight," said the owner of another custom-cutting outfit. "By the time we reached South Dakota, even I was praying for rain."



ground. Despite the air-conditioned cab, I break into a sweat. Yet with experience comes a sense of satisfaction as the wheat spills into the bin behind my head and the big reel pounds into golden surf like a land-going *Delta Queen*.

Originally known as the "combination harvester and thresher," the combine represents a marriage of Cyrus McCormick's reaper and the stationary threshing machine. Consolidating the two takes away the back-straining work of pitching wheat into the thresher and cuts harvesting time from 10 minutes per bushel to 20 seconds.

Bumper Crop Stretches the Workday

As the crew crosses the Oklahoma-Kansas border, the harvest goes unmistakably into high gear. Kansas, the biggest wheat producer in the Great Plains, is having a bumper year. Like Texas, much of its eastern portion undulates with gentle hills, but most of the western section stretches like a vast tabletop spread with grain. The wind sets fields billowing in the rhythmic motions of the sea, and the waves break on islands of towns huddled around "prairie cathedrals"—pearl-white grain elevators. Retired farmers people many of these little grain-centered communities—Manter, Iuka, Bazine—towns so small that everybody lives on the outskirts.

Now hours grow long, as workdays stretch into the early morning. Max himself is last to bed, often first to rise. He makes up for loss of sleep with incredible catnaps.

One night near 1 a.m., as I sit in one of his trucks, he pulls alongside in the pickup that serves as his command vehicle. "We'll quit as soon as those two combines get to this end," he announces. The twin sets of lights are 400 yards away. "Until they get here, I think I'll take a little snooze." He swings around in the seat, cocks his feet out the window, and sleeps—for five minutes.

Late one afternoon in June, Max and I head north on a scouting trip. By midnight, when we reach Tribune, Kansas, near the

Colorado line, he has nailed down 500 acres of future cutting that will occupy two combines for a couple of days. Up before dawn, we are wading through Colorado fields with local farmers by 9 a.m.

In his mind, Max carefully catalogues his customers' fields, their locations, their varying stages of ripeness. He calculates the progress of his machines and when they'll be free to move on. I never see him take a written note, but the concentration leaves him little time for mental diversions. Sports and current events can wait until winter. "My mind is like a bucket," he says. "If I get too much in it at once, some of it runs over."

Midway through Kansas the crew has changed faces several times. Some have been fired. Some sense failure and quit. Some come with a vision of adventure and instead find dust, fatigue, hot winds, and wheat chaff.

Most of all, Max seeks competent men to stay with him when he harvests corn and grain sorghum in Arizona and Washington. "Full-season" men receive a bonus, a percentage of the total take. "With my room and board provided, I should clear \$3,000 for six months' work," one crewman tells me.

Crew Rookie Begains His Status

Among the sagas of failure and success in Max's crew, probably the most dramatic is that of Denny Mallard, the wiry, sandy-haired war veteran. He joins the crew in northern Oklahoma, bringing to it the double disadvantages of inexperience and his jangled war nerves. His first days are nightmares of errors. Twice he brushes and scars trucks with his combine, barely avoiding time-consuming repair work. The second such incident sends him leaping out of the combine cab like an uncoiled spring, mouth twisted in a yell of agonized frustration.

"I don't think we can keep him," Max says sadly. "He'll mess up bad sometime."

Denny is demoted to leveling truckloads, a menial task. But he stays on, and gradually his confidence returns until he is driving

Sweat-streaked truck jockey Jerry Wagoner of Downs, Kansas, joined the Louders in Oklahoma to earn money for college. Driving alongside moving combines, he carefully adjusts his speed to theirs as wheat pours through a spout into the truck with no loss in cutting time.

Restless pawns on a giant chessboard, dust-plumed combines gnaw at a stand of wheat in northern Oklahoma (following pages). Dark areas are tracts cultivated for feed grains and fields lying fallow while they regain moisture and plant-nourishing nitrogen.







Summer nomad, Wanda Louder rests on her car seat after bringing hungry combiners a hot meal cooked in the Louder house trailer. A wheat-field veteran, Mrs. Louder married the custom cutter just after she graduated from high school. They honeymooned on the harvest circuit.

Dinner à la car: An open station wagon holds the noon meal as the crew feasts in the shade of a truck. Members usually eat in shifts to keep their machines rolling; drizzle delayed cutting on this day until the wheat dried. "We work our help hard, but they eat well," says Mrs. Louder, who scorns the common practice of feeding crews sandwiches and restaurant fare.

again. The renewed self-assurance comes partly from experience, and partly from another talent. Denny is a fighter in the old Western-hero, multiple-opponent tradition.

In a Montana tavern one night he leaps into a brawling crowd to "try to break it up." A harvest hand with another outfit later gave an eyewitness account: "I was knocked down early, and I just stayed down and watched," he said. "Six men jumped Denny, and I never saw one man move so fast. Guys were just flying away from him right and left."

Combine Crew Turns Fire Brigade

Day after rainless day blesses the combines as they leave Kansas and head into eastern Colorado. Working their way westward, they come within sight of the towering Rockies—a hazy blue shadow on the horizon. And now, suddenly, the dryness becomes the enemy. Rain, hail, competition, and breakdowns all occupy a cutter's thoughts, but in the back of his mind lurks a special nightmare: Wheat fire!

Flame pushed by a stiff prairie wind through bearded heads of wheat can leap 50 yards at a gust, growing and roaring like an inferno of jellied gasoline. It can start from a broken combine bearing that throws sparks, or from a carelessly discarded cigarette. But most start the way Max Louder's fire did on a July day near Sterling, Colorado. Loose straw, jammed around the muffler of a straining truck, ignited.

Mike Grout, driving one of the two combines operating in the field, spotted the flames first. "Truck two, you're on fire, drive out of the wheat!" he yelled into his radio.

"I was at the other corner of the field," Mike told me later. "When I first saw it, the fire was no bigger than a tabletop. I just glanced down to shift gears, and when I looked up again, it was the size of a tennis court, spreading downwind."

Mike drove his machine across the field at full speed, bouncing over ridged terraces. Matt Dillon, operating the other combine, hurried to join him. Together, they cut two swaths ahead of the flames, but the fire leaped the gap and roared on.

Moving ahead of it again, the combines completed another strip and started back to widen it.

"Matt was ahead of me this time," said Mike. "I saw that the fire was catching him from behind. Finally I couldn't see his machine at all behind the wall of flames."

With Mike yelling into the radio, Matt



finally gave up and outran the flames. By then neighbors and crewmen had beaten back some of the fire with wet coats and sacks, and another neighbor had arrived with a plow to turn up an earthen firebreak. Nevertheless, some 15 acres lay blackened, leaving the distinct smell of cooked cereal. Fortunately, insurance covered the loss.

Less lucky was young Jerry West, Karen Louder's friend from the Texas harvest. Eighty miles away another wheat fire, also started by a truck muffler, suffocated the engine of his combine, stranding him inside a blazing ring. Desperately sprinting through the flames, he suffered first-degree burns that hospitalized him for three weeks.

Fields Harbor an Odorous Hazard

In Montana, where wheat is often cut and laid down in windrows so it will ripen evenly, I learn of yet another hazard. A pickup attachment replaces the cutter bar in these fields, and rotating tines lift the wheat off the ground and into the combine.

"Sometimes," says Max, "a skunk hides in a windrow and gets pulled through the machine. Then the wheat smells so bad the local grain elevators won't accept it.

"You start a smudge fire upwind and let the machine pull the smoke through and cut the smell. Then if you run a couple loads of grain through and dump them on the ground, you've got most of it cleared up."

We harvest no skunks this season. Hail, the heartbreaker, passes us by as well, although it is ever on Max's mind. One day, as gray clouds churn overhead, I hear his voice over the radio urging combine operators to speed up.

"Think of that wheat as so many dollar bills waving in the breeze," he tells them. "It's just a question of time as to who gets it first, you or the hail."

A question of time. How it sums up the wheat cutter's summer, I catch the urgent rhythm myself, as I wait with bare-chested young drivers in a line of trucks backed up

a quarter of a mile from an elevator that unloads them with painful slowness.

I gun my empty back to the field in a cloud of dust to relieve the peaked-up bins of the combines. Urging the burdened brute back to the elevator, I recall the instructions of my truck-driver tutor, Karen Louder:

"Remember, begin shifting down for corners a quarter of a mile before you get there. You've got at least 20 tons of weight behind you, and that's too much for the brakes to handle alone."

A strange skill for a petite art student at the University of Denver? She thinks not.

"I don't regret my years in the wheat harvest," says Karen. "For one thing, not many of my girl friends can drive a truck or fix a tire. Also, Dad's always taught me to think independently. He tells me that if I get in a jam in the field I better figure it out for myself because he might not be around to call on. I think that's worth learning, no matter what you do in life."

Doubts Arise as Summer Wanes

It's a family enterprise, from trailer-cooked meals to daughter-driven trucks. But the hurry and strain take their toll. Hot-tempered Karen and her single-minded father lock horns in word battles almost daily. Janis, in the dreamy world of adolescence, arouses her mother's ire with her forgetfulness as cook's helper. Even little Mikel reaches his limit.

"Bring me a screwdriver, Mike," says Max one day as he tinkers with a truck that needs repairs. Tired, hot, and cranky, the boy sulks. The request comes again, with similar response, and Mikel is hoisted and walloped.

The memory takes some of the brass out of the youngster's voice when he confides to me later, "Man, did he burn my butt!"

Toward the end of the long summer, family talk of quitting this nerve-gnawing business grows more and more convincing.

Calling on a prospective customer, Max and I drive across the pasture paths of Montana's backcountry. Every turn brings a vista

Finessing a low overpass, crewmen inch a truck through as a train thunders overhead. By moving to the left side of the highway and then releasing air from the combine's tires, they gained the necessary clearance. Flagmen warned motorists, but seconds after this photograph was taken, a car slipped past and struck the rig. No one was hurt. "My stomach just churns on moving days," says Mrs. Louder, "with those big machines sticking way up there on the trucks and everyone in a hurry to get to the next job."



SANTA FE
CLEARANCE 14 FT. 6 IN.

FORD



of grassy plains beneath brooding buttes, while far to the west the peaks in Glacier National Park stab at the sky. Herds of Hereford and Angus cattle spread before us.

Topping a hill, we finally overlook a story-book ranch set beside a meandering, glacier-fed stream in a green-stroked valley. Near the modern house stands the original dwelling, a 75-year-old log cabin, now converted to a tool shed, but serving as a reminder of a former way of life that seems less hectic, less complicated. We knock, and in the easy informality of the West, open the kitchen door and shout, but receive no answer.

Quiet Life Tempts, But Action Wins

The placid setting has a strong effect on Max. He grows quiet, and as we drive back up the dusty road, he suddenly says, "Maybe I should get out of the flurry of combining and get me a place like this and raise cattle."

As Wanda packs to return to Kansas with Mikel and Janis, who must go back to school, I ask her how seriously she regards Max's talk of quitting.

"Harvest starts to get to him late every season," she says. "But we've done this so long it's a way of life with us. I can't see him

running a tractor around a field or driving out to a pasture to check the cattle. He's got to have a challenge."

Late on my last day I make the rounds to bid farewell to the crew. Shouting good-byes above the roar of machines, I head for a solitary truck parked in a field of stubble. There I find Max kneeling in the dust, pulling an axle from the ailing vehicle.

It has not been a good day. Damp air had descended the night before, delaying cutting until noon. Two of his combines had strayed into the wrong field and cut swaths of a non-customer's wheat. A straw chopper at the rear of one machine had worked loose and idled the combine for half an hour.

I feel like a deserter leaving an embattled commander. But the sweat-streaked face that turns from the truck wheels is lighted by that boyish grin.

"Oh, we'll have the transmission out of this thing in an hour or so, then run it down to Great Falls tonight to be fixed," he says. "I'll have this truck running again tomorrow afternoon, and we'll be ready for whatever happens after that."

More problems. More challenges. He seems delighted at the prospect. □



A father first, Max spends a moment comforting his son Mikel. Exposed to the wheat-cutting operation every summer of his young life, the 5-year-old sprinkles his speech with harvest terminology. He has already operated a combine from his father's lap.

Snatching a quick nap, the weary wheat cutter sprawls over his pickup. After wheat season, his family returns to Kansas, and Max goes on to harvest other grains. Home by early winter, he repairs equipment before moving south for a new year's wheat.



THE TASADAYS

Stone Age Cavemen of Mindanao

By KENNETH MACLEISH

SENIOR ASSISTANT EDITOR

Photographs by

JOHN LAUNOIS

BLACK STAR

In naked innocence, a Tasaday boy toys with a bright bloom plucked from the wilds of a primeval Eden. His father nibbles a wild fruit. An amazed world marveled at the discovery of this Philippine tribe—24 people who live much as our ancestors did thousands of years ago.

Perched in the Stone Age, the Tasadays stare down from the tribe's main cave (following pages) at their Space Age visitors. Author MacLeish and photographer Launois accompanied the first expedition to penetrate the mountainous, forest-armed wilderness that has hidden the Tasadays from the world—and the world from the Tasadays.

THE RAZORBACK RIDGES above the near-vertical slopes of the Mindanao rain forest amputate the evening hours; the sun sinks early behind these high horizons. The canopy of giant trees further dims the jungle dusk, while the outside world—the world of clearings and huts, of sea and beach, of fields and villages—lies still alight.

Balayem, squatting at the edge of his cave to watch the coming of the night, knows nothing of this outside world. He is a Tasaday, born into an untouched and all but impenetrable forest sanctuary where the Stone Age survives. As Stone Age cave dwellers, he and his people are unique: Their like has not been found before in our time and, outside the limits of their unscarred wilderness, may never be found again.

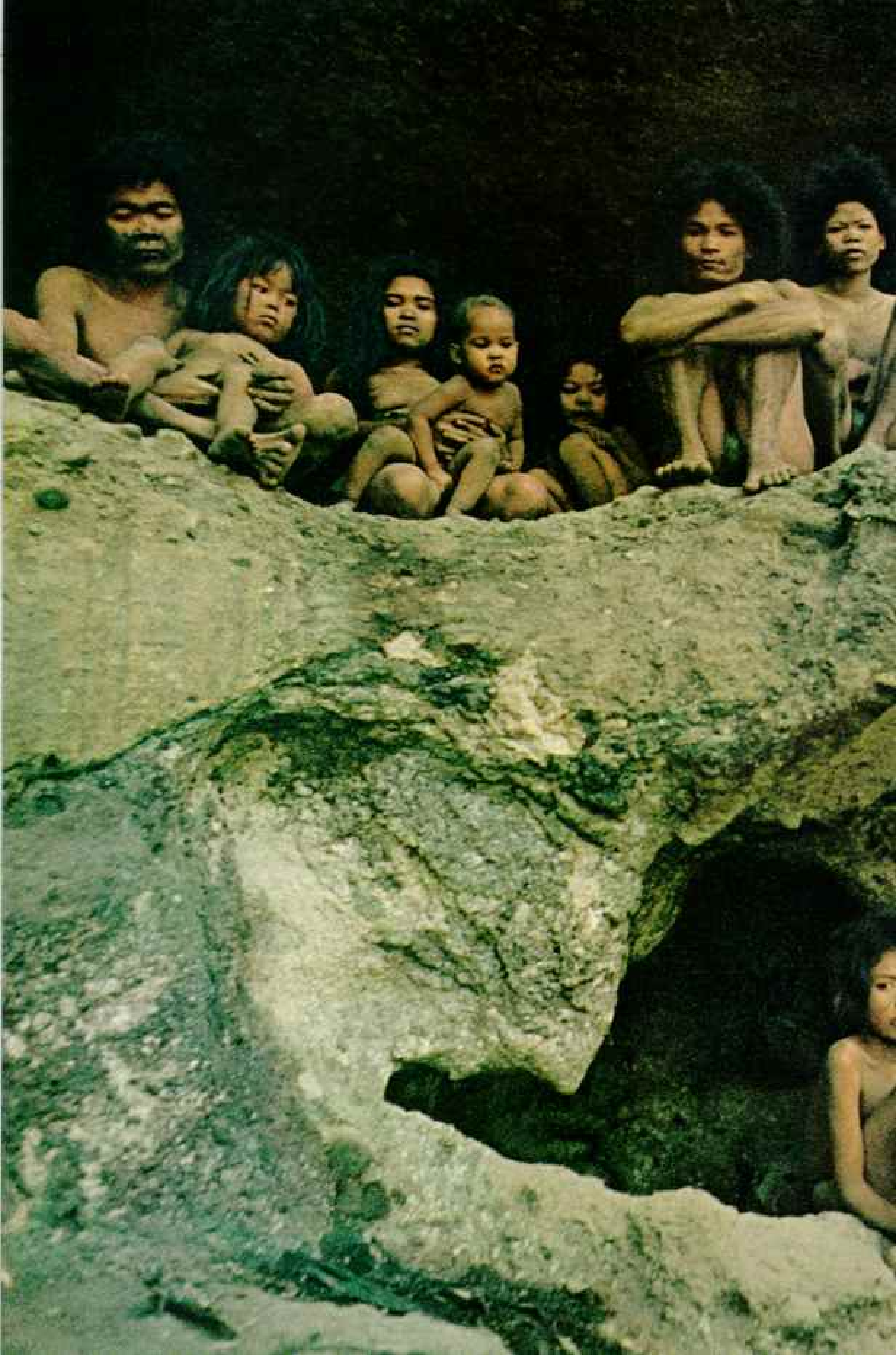
Balayem rises, a slender, smooth-muscled young man, naked except for an orchid-leaf loin cover. He peers down into the lower valley where, 200 yards away, strange lights glow. Visitors from a distant realm (possibly the sky, he tells himself) have entered Tasaday lands for the first time. They are altogether amazing, but they are not frightening. They are companions of Momo Dakel Diwata Tasaday—Great Bringer of Good Fortune to the Tasadays—and they are here by invitation.

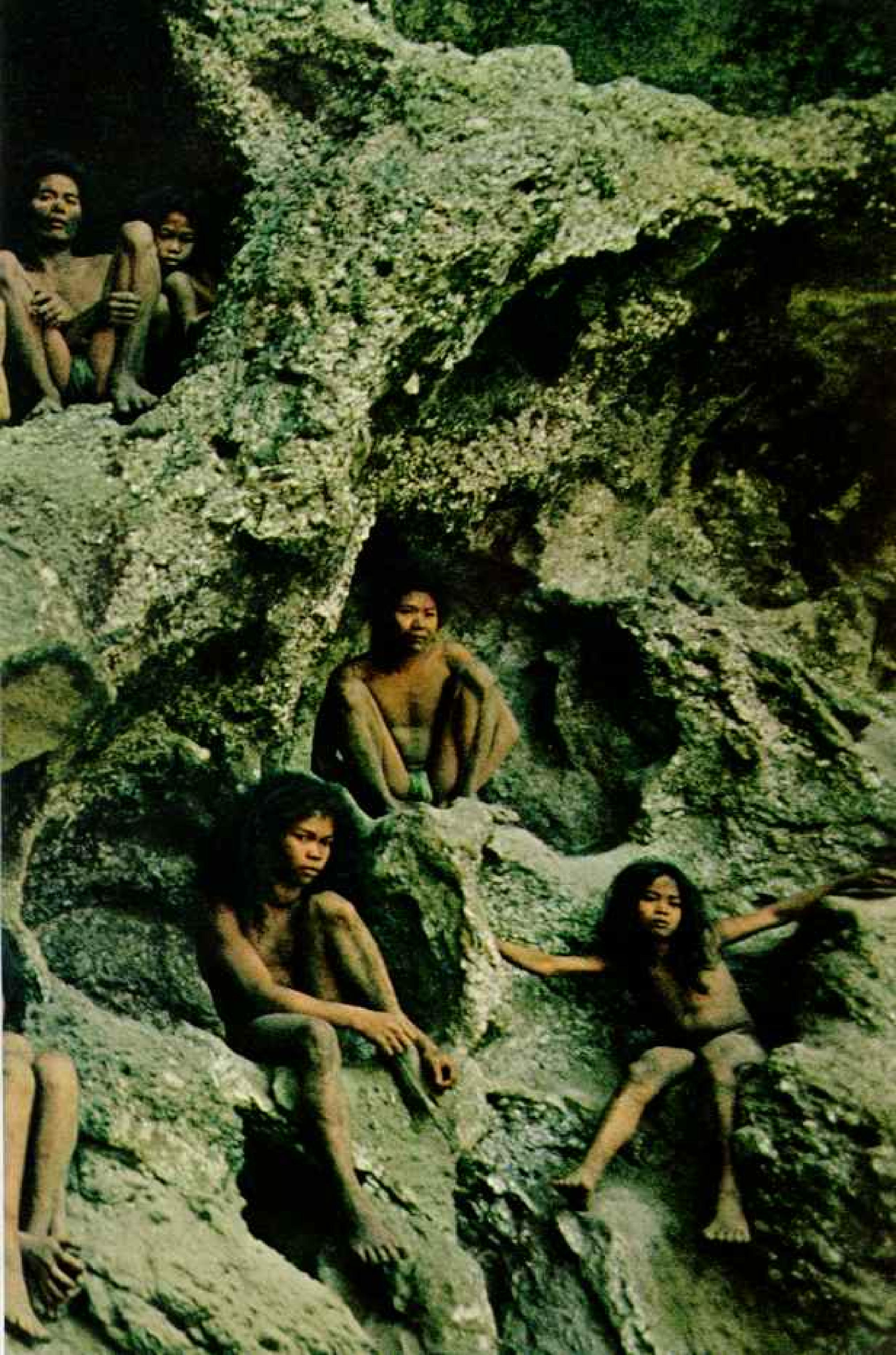
Balayem turns to face the others, huddled deep in the cave by fires where roots bake and leaf-wrapped tadpoles steam.

"Our ancestors told us never to leave this place of ours. They told us the god of our people would come if we remained here. Their words have been proven true by the coming of Momo Dakel Diwata Tasaday."

Mahayag, seated beside his

(Continued on page 226)







Helicopters can't land in the unbroken rain forest that sheathes the knife-ridged uplands of southern Mindanao. Rather than cut a clearing that might invite unwanted intruders, a small group of T'boli tribesmen hiked in for six days and erected a



temporary 75-foot-high treetop perch (left). The visitors jumped from the hovering copter onto this shuddering platform—barely visible from the air (above, center).

A Tasaday named Balayem, at left, hugs Manuel Elizalde, Jr., chief of Panamin—the Philippine Presidential Arm for National Minorities—who led this historic expedition.

The Tasadays call the idealistic official the Great Bringer of Good Fortune, as foretold in their legends. Tradition also promises that as long as the Tasadays keep to their homeland, they will always find health and refuge. Secretary Elizalde hopes to see that promise fulfilled, now that Philippine President Ferdinand E. Marcos has set aside 50,000 acres for a Tasaday reserve.



1960s, the Tasaday were discovered by a group of American anthropologists. They were living in a remote, mountainous region of Mindanao, Philippines, and were described as a primitive, Stone Age people. The discovery of the Tasaday was widely publicized, and they became a subject of intense interest and speculation. However, subsequent research and investigation have revealed that the Tasaday were not a distinct, primitive tribe, but rather a group of people who had been isolated and isolated from the rest of the world for many years. They were found to be a mix of different ethnic groups, and their culture was a blend of different traditions. The Tasaday were eventually assimilated into the mainstream Philippine society, and their unique way of life disappeared.

Twilight dwellers, the Tasadays inhabit a dappled realm pillared by 200-foot trees. Young Lubu (left) scampers through the forest, climbing vines and slender trunks with the ease of a monkey. His domain, which outsiders once thought all but impenetrable, now draws the covetous eyes of Philippine lumbermen. Already three logging roads converge on the area. Oblivious to such concerns, young bachelor Balayem (right) lounges in his own private cave, one of the niches that pock the rocky height where the Tasadays have their ancestral home. His major worry: lack of a mate. Only five of the Tasadays are women, and all have husbands. Perhaps, he suggests, Elizalde can bring him a wife....



leaf-girdled wife Dulak, answers. "All men and women must cling to Momo Dakel Diwata Tasaday with their right hand. We told him about our home when we met him first outside the edge of our forest, and now he has come here despite great difficulties. All you women, you have to keep that within you. If we had not met Momo Dakel Diwata Tasaday, we would probably have died in darkness without seeing the prophecy of our ancestors come true. We can see how he loves us. He has eyes and ears with us now."



Summit of Tasaday technology:

Balayem holds a rattan-tied stone ax, used to smash hard fruits and break open stems and rotted logs in the search for food. These, plus digging sticks, stone scrapers, and sharpened bamboo knives, were the tribesmen's main implements until the outsiders came. The Tasadays do not look on their stone tools as weapons, and have no word in their vocabulary for war.

"**M**AHAYAG was dead right on that last point," I told Momo Dakel Diwata Tasaday (alias Manuel "Manda" Elizalde, Jr.) as we listened next morning to a translation of a tape recording made by a machine left running in the cave. It was Secretary Elizalde, head of Panamin—the Presidential Arm for National Minorities—who had planned and led our expedition.

"Right," Manda said. "Also about the difficulties of getting in here."

I wouldn't soon forget the trip in. I had looked forward to meeting the Tasadays ever since their existence had been reported in June 1971. At that time a Manobo Blit hunter named Dafal (the only outsider the Tasadays had ever seen) persuaded them to walk out of their forest and meet a great man who would love them and help them. That first meeting with the Tasadays was recorded in a December 1971 National Geographic television special, "The Last Tribes of Mindanao." But no one knew just where the Tasadays lived, or how. Not even Dafal, who could find their country, had seen their home.

The Tasadays greeted Manda's arrival as a fulfillment of their ancestors' promise, and invited him to visit them in their hidden valley. In time Manda accepted their offer. He asked National Geographic to join him.

In previous travels with Manda, I had landed on instant helipads cut out of the brush or partially cleared land.* But the Tasadays lived in climax forest, where trees could grow 200 feet tall. They had no knowledge of agriculture, hence no clearings. Their mountains were as steep as mountains could be and still carry forest, with crests that formed edges, not surfaces.

"I don't want to go in and carve out a helipad, even if we can find level ground," Manda had told me. "It would take too long, and it would mark the spot for the loggers and others who hope to exploit the forest. And give them a place to land. Our business is to protect the Tasadays. The only way to do that is to locate them, determine the area they use, and ask the President to declare it a reservation. He's all for it. But we have to hurry; three logging roads are being pushed toward the Tasaday area now.

"So we can walk in, which might take a week; or we can send in a group to build a sort of nest in the top of a tree, and drop onto it from the hovering helicopter. The nest would be destroyed when we leave."

"Beautiful!" I said. Not everyone agreed.

It was quite an operation. An advance team—including Dafal—was flown to the edge of the jungle and went in to find a suitable tree, and the Tasadays. After three days our scouts had the tree picked, but had seen nothing of the people except an occasional footprint. A group of two dozen T'boli tribesmen walked in to join them, carrying two

chain saws and supplies. The two parties met, cleared out a few treetops around the landing tree, and built a stick-and-rattan platform high among its truncated branches.

Although we had radio contact with the men at the landing site, they couldn't tell us exactly where they were. Our job was to spot the platform from the air and land on it. Manda, John Launois, and I went in first, along with John Nance, who had come to document the expedition for Panamin. We flew low over the ridges and valleys, squeezing between the high ground and the low clouds. Suddenly a red flare burst up out of the forest ahead of us. "Bart" Bartolo, the pilot, put the Alouette 3 into a tight turn.

There it was, directly below us. Big as a postage stamp, frail as a mat of matchsticks. Or so it appeared.

WE DROPPED DOWN for a closer look. The platform was roughly eight by ten feet and made of two- to three-inch saplings lashed together (page 222). Sticks tied to the tree trunk provided a way to climb down to the steep slope 75 feet below. The whole structure was made as only stilt-house-building tribesmen could have made it, easily strong enough to support the men and baggage it was to receive. But the weight of the two-ton copter—or even a strong nudge from it—would obviously smash the platform.

Two men waved us in, grinning. We slid the door open and unbelted. Manda went first, scrambling out as soon as the platform was under us. He reeled toward the edge. A man steadied him. Launois went next, sprawled, held on. I felt the copter touch, jumped blindly, and ducked.

The tree swayed and the platform shook as Bart tried to free two wheels that had hooked into the structure. We lay flat as the copter screamed and wavered just above us, blasting us with its downdraft. We could see that a forward thrust would throw the aircraft out of control and bring it and us crashing to the ground. But Bart rose straight up.

"My God," I said, "what a wonderful way to get into a mountain forest."

"It was almost a wonderful way to get dead," said John. "A very tricky minute." Then, "Duck, he's coming back."

Bart swung in again to drop John Nance. The copter touched again. I could see a dent in its underside as it skimmed away.

The climb down to the ground was almost

*See "Help for Philippine Tribes in Trouble," by Kenneth MacLeish, NATIONAL GEOGRAPHIC, August 1971.



Miracle of fire assumes glowing shape as two Tasadays take turns spinning a wooden drill between their hands. After ten laborious minutes, a spark finally sprouts, kindles a swatch of dry fibers, and crackles into flame (right). Other Philippine tribes have all but forgotten this ancient technique for making fire.





anticlimactic. There were footholds enough for a safe descent, given any kind of luck. We watched the chopper bring in Panamin's Dr. Saturnino Rebono, the T'boli leader Mai Tuan and the Manobo Blit woman Igna, who would serve as our two-stage translating team, Panamin personnel to set up camp and radio communications, and supplies.

Almost forty people were ranged along the ridge now. Some would stay there, to guard the site. Others would come with us to make a camp near the Tasaday home. They would keep away from the cave itself.

But where was the cave? Hours before our landing, a Tasaday had approached the advance party and left a message: When Momo Dakel Diwata Tasaday descended from his bird, he, Balayem, would return to guide him and his companions to the Tasadays' "big home," which lay "that way, not so near and not so far."

AS THE BIG BIRD flew away, Balayem came back. No one saw him coming, but suddenly a slim naked figure stood beside Manda. The caveman and the President's envoy embraced. Balayem stayed at Manda's side, holding him, as the foreign tribesmen and strange white visitors assembled their gear. Then he turned and led the way—straight down the slope.

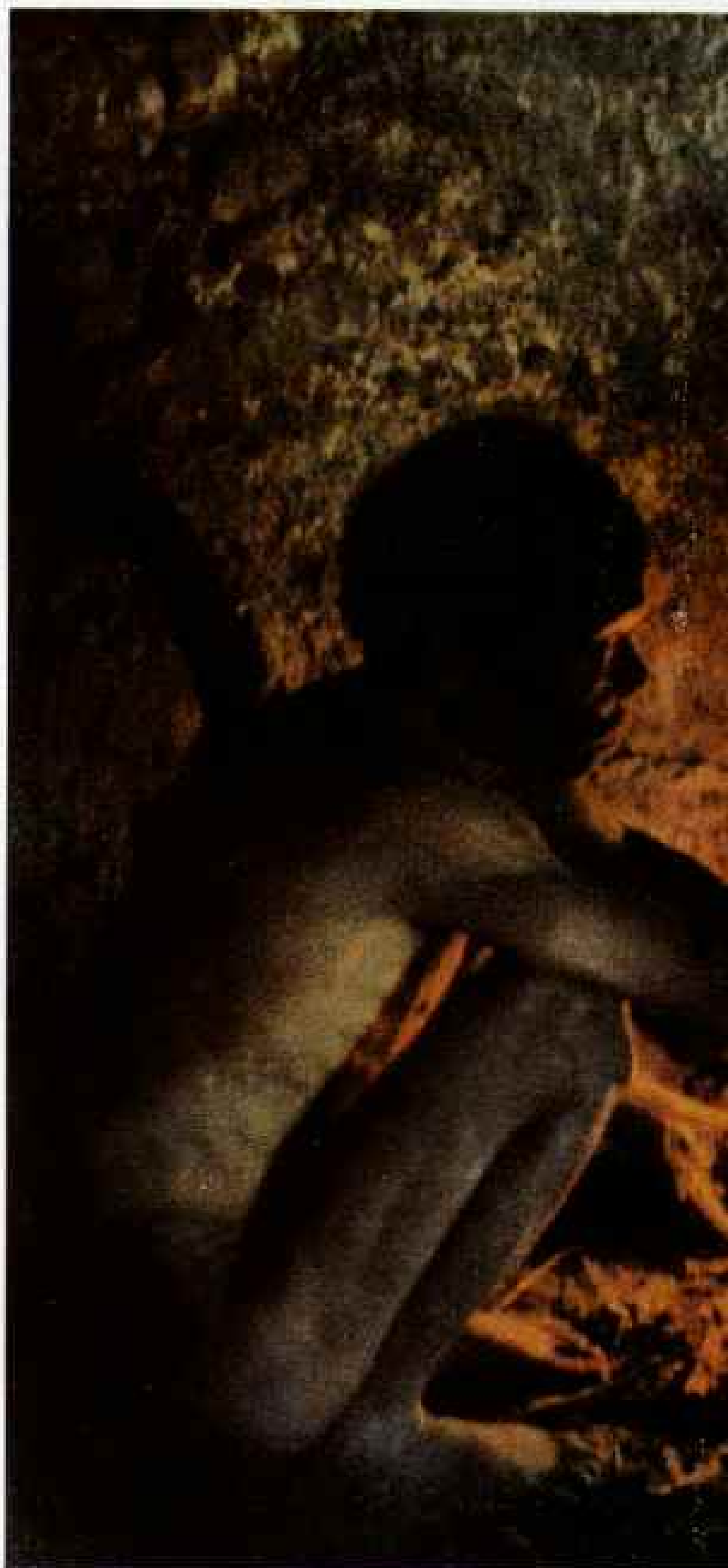
The Tasadays do not depend on trails. Balayem was off the ground as much as on it, skittering down fallen trunks and sliding on vines down almost sheer drops.

Manda and I followed close, putting our hands and feet where Balayem had put his. The others fell behind. We reached a stream and followed it for half a mile, hopping from rock to rock along the clear, sun-dappled waterway.

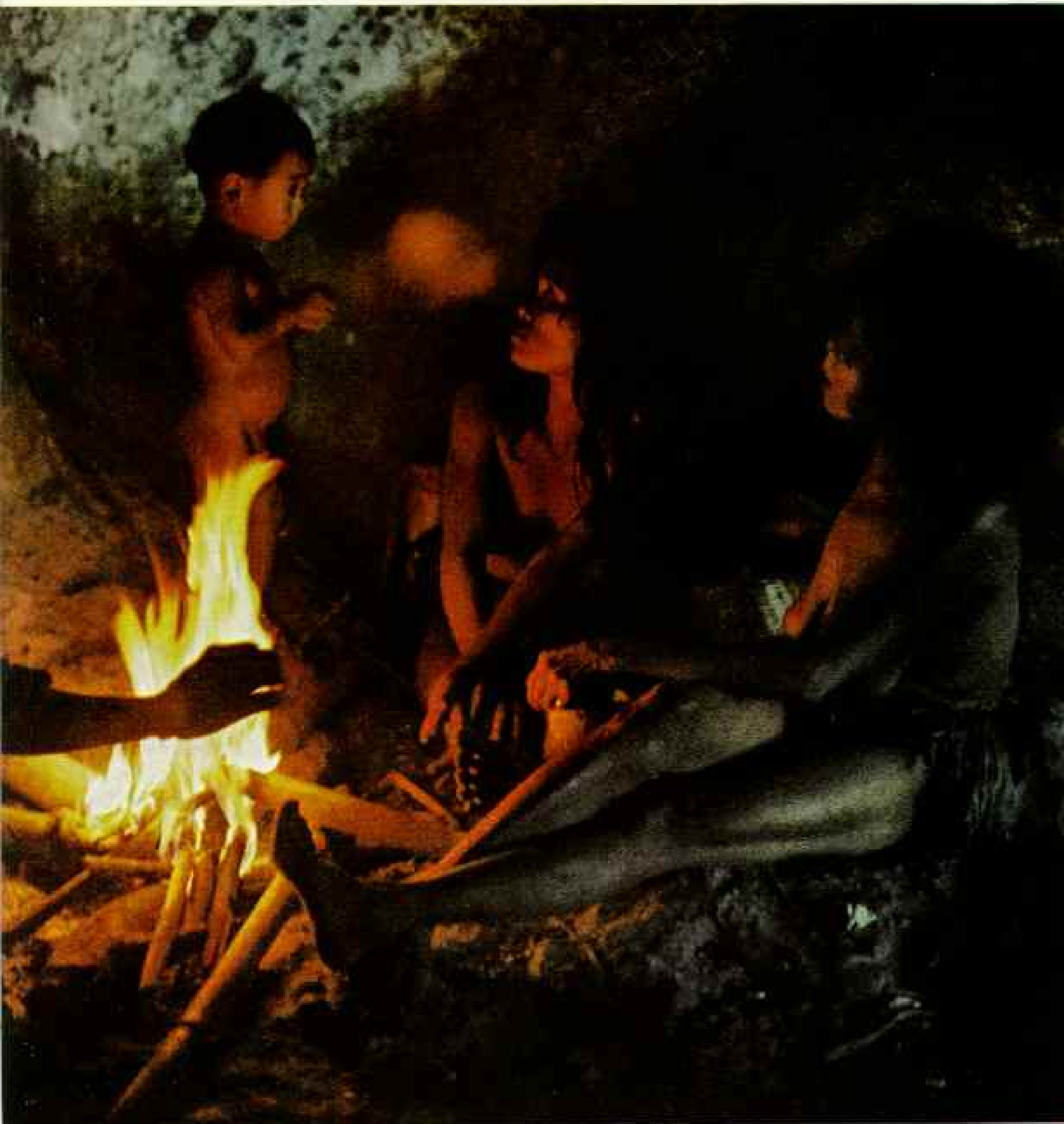
Then Balayem pointed up a slope as steep as the one we had descended. We went straight up it. And up, and up, finding footholds in the grease-slick loam at the base of saplings or above exposed roots. Voices faded behind us, extinguished in the silence of the forest. Sweating, panting, sometimes crawling, we moved up the mountain. Balayem stopped, turned to catch our eyes, and glanced up ahead. Naked rock gleamed gray between the soaring boles of the forest giants.

"That's it," Manda whispered. "That must be it!" We moved closer. Balayem called out. A voice answered.

We stepped into the Stone Age.



Three caves gaped dark in the cliff face. The largest and lowest was unoccupied. Loose boulders littered its interior, and a small stream showered down beside it. A well-worn path angled up under the sheer rock to the highest cavern. A smaller chamber between the two was accessible only by a narrow shelf and a slender tree that rose across its mouth. Vines hung across the cave complex, and dense undisturbed jungle crowded close.



We paused close to the foot of the cliff.
"We'll sit here for a while," Manda said.
"Give them a chance to look at us."

And so we two, visitors where none had visited before, sat in silence, dazed as travelers in a time machine might be dazed upon arriving at their most distant destination. Faces appeared in the upper caves. Brown, dark-eyed faces framed in long black hair. Some smiling, some wide-eyed. We, skyborne

Wrapped in a fire's warmth, an old man, two women, and a child escape the pervading dampness of the forest. Clad only in orchid-leaf loin coverings and leafy skirts, the Tasadays feed two fires in the main cave to keep out the wet and chill; a slight but constant breeze clears out the smoke.

creatures of man's most advanced and tormented society, and they, perhaps the last of the world's innocents, watched each other across the full span of cultural evolution. And felt love for each other.

I was grateful for our pause. My own stunned emotions needed steadying. An old man, naked except for his loin covering, came down and sat beside me. He embraced my raised knee and patted it reassuringly.

Two young women followed, leaf-skirted, bare-breasted, shapely. They knelt shyly beside us, smiling briefly in response to a light caress. Balayem crouched by Manda, who threw an arm across his shoulders and spoke to him fondly in words whose meaning the caveman could not fathom, but whose tone he understood.

We remained so, close, quiet, bridging the immense cultural gap between us through physical contact, to show that there was no human gap at all. The children on the ledges above saw and responded. A chubby toddler balanced at the very edge of the cave mouth, grinning and twisting like any coy 3-year-old. A beautiful boy of 10 or so leapt into a limber sapling and swung back and forth like an inverted pendulum, showing off for all he was worth.

In time, some of our companions joined us: John Launois, John Nance, Mai, and Igna.

"You photographers can get some shots from here," Manda said. "Then we'll go down and make camp out of sight of this place. We won't go into the cave until tomorrow. We've made it; let's not push it."

"If you insist," I said. "But in the morning all this will have vanished like Brigadoon. It's not real. Or maybe we're not."

"When we get down," said Manda, "have Doc Rebong treat you for culture shock."

THE SLOPE on which topography required us to camp was such that any round object released upon it would roll nonstop (except for collisions with the odd tree) to the stream 300 feet below. This required terracing and platform-making to produce spaces large enough to lie on. When we were done, our tarpaulins covered a sort

of giant stairway some hundred feet high.

In the late afternoon Balayem and two other men came to sit with us. Through Igna and Mai we were able to put questions and get answers. Mai translated from English to T'boli, and Igna, whose own Manobo Blit language is somewhat similar to Tasaday, translated from T'boli, which she understands fairly well, to Tasaday, which she understands imperfectly.

Fragments of information emerged. We treasured them. Almost everything we learned was being learned for the first time.

We asked about the makeup of the Tasaday group. Balayem listed the names of men, then women, ticking them off on his fingers. The Tasadays seemed to have no words for numbers. But Balayem gave us 24 names; later, we counted 24 people.

"Our men are [he listed ten]. Of these [he listed five] have wives. Most of our children are male. I, Balayem, have no wife, and some other men have no wives. But I also have no father or mother or brother or sister. All others have someone. Only I am alone."

Since women were few and no new wives could be found within the group, did they share women?

"No. A man and woman stay together until their hair is all white. But there is no woman here for me."

Were there not other groups like the Tasadays in the forest?

"There were others. Sandukas and Tasa-fangs." He pointed in different directions. "Good people. Bilangan's wife Itut is a Sanduka. His father found her in the forest and brought her to him. But we do not know if there are any people in those places now. It would be good if there were; we might find more wives among them."

How long had they lived in their caves?

"Always. Our father's father and his father were there. We know of no other place where Tasadays have ever lived. Our ancestor had a very good dream there; he told us never to leave that place. There we would have only small coughing, but if we left we would be sick. And if we stayed, our Bringer of Good Fortune would come." He smiled at Manda.

Loving touch washes away dirt and tears at a brook near the tribal cave. Such rivulets are pathways for the Tasadays, who skip from rock to rock or wade the stream beds in their expeditions for food. They carry and store water from the stream in sections of bamboo, as well as taking drinking water directly from living bamboo stems.





The camera's intrusive stare erases the normally friendly,



open-faced look of the Tasadays. Bamboo water vessels lie on the ledge.



Rain rattled on the cloth cover overhead. The Tasadays crouched closer to our fire.

What food do you eat, we asked, and how do you find it?

"Before Dafal came [he came five years ago and at least four times since then. The Tasadays could not tell us this, for they cannot reckon time], *biking*, the wild yam, was our staple food. Our streams gave us all else that we needed: tadpoles, frogs, crabs, little fish. We killed no forest animals. We had no traps or hunting weapons. Our ancestors were friends of the deer and could touch them.

"We also found berries and flowers that are good to eat. One red flower and one yellow one. And wild bananas, and grubs that live in rotten logs.

"We still eat all these things, but now we have new foods as well. Dafal taught us to make traps that could kill deer and pig and monkey and mouse. We found that their meat is good, but we do not need it. He taught us to smoke pig and deer meat so it would last many days. In exchange for this meat he gave us some cloth and a bolo with a sharp blade, also bows and arrows made by his people. These bows are not useful.

"The cloth is good. We can cover ourselves with it at night. But the bolo is more important. With it and the knowledge he gave us we are able to find and collect the foods we now love best: *ubud* and *natok*. These are inside certain palm trees that we could not cut without a blade, and so our ancestors did not know of them.

"*Ubud* is the pith of young trees and can be eaten raw or cooked. *Natok* is found inside one kind of large palm and must be pounded and strained and cooked. It is difficult to make, but it is our favorite."

It was dark when the men slipped away. We could hear the voices of children from above and see the orange flicker of reflected firelight on the cliff face above the cave.

WE WENT BACK to the cave in the morning. This time we entered. Again we felt the mind-bending sense of having returned to human origins. The arched entrance, roughly 15 feet high by 35 wide, gave on a chamber about 50 feet deep.

In the depths of the cave two groups, separated by a narrow, shoulder-high buttress, squatted by small fires. To the left of the buttress, in a nestlike space of not more

(Continued on page 242)

◀ **The gift of steel:** A young boy of 4 or 5 clutches a bolo (facing page), a tool new to the Tasadays. Quick to learn, he wields it with some expertise, despite its weight. Dafal, a hunter-trader from another tribe who made the first contact with the Tasadays and persuaded them to meet with Elizalde, gave the tribe their first bolo. Panamin eventually gave the Tasadays enough knives for each adult male and one extra; no one in this unmaterialistic society seemed interested in the surplus.



Forest delicacy with the taste of artichoke heart, *ubud* comes from a palm trunk. The Tasadays do not cut *ubud* near their cave because they think doing so may cause the weather to turn bad.



Banquet of Tasaday food—almost their complete diet—spreads over a banana leaf. The food gatherer often eats his fill while collecting for his family—a job that takes only a few hours a day. Deft hands grab tadpoles, frogs, and freshwater crabs from swift-flowing streams. These are wrapped in orchid leaves and put next to hot coals for cooking.



The staple of the Tasaday diet—*biking*, far right, next to the white ubud stalks—is a wild yam, a root dug with a sharpened stick. Rotted logs provide fat grubs, lower right, a favorite of the tribe. Of the edible fruits and leaves, botanists have identified only a variety of palm fruit, second from upper left, and the wild bananas on the yellowed leaf.



New entrée in the meager Tasaday menu, *natok* quickly became a favorite. The secret of extracting the starch arrived with Dafal (left, with hat). Known as "he who walks through the forest like the wind," Dafal first penetrated the forbidding realm in 1967 to set traps for deer and pig. Stumbling on a band of frightened Tasadays, he spoke to them in his related dialect and won their confidence; ultimately he led them from their forest fastness to a traumatic first contact with Panamin in 1971. Meanwhile, so the Tasadays would not disturb his traps, Dafal taught them how to coax nutritious *natok* from certain palms—an instruction he repeated four times before the tribesmen mastered it.

Aided by Dafal, the Tasaday team at upper left lashes together a sturdy stick platform that they will cover with ferns and leaves to form a filter. Banana-stem gutters beneath it will carry off the strained liquid.

Simultaneously, men wielding L-shaped bamboo mallets pulverize the pithy cores of split palm logs, loosening pulp from fiber (left). Smashing blows land within a quarter-inch of their feet.

A woman with child in arms nimbly presses the pulverized pith through a leafy filter with her feet, while a man sluices on water with a bark ladle. As the leaves filter out the palm fibers, water carries the *natok* starch down the gutters and into a bark settling trough. There the water escapes over the rim, while the heavier starch settles to the bottom.





than 8 by 8 feet, were Bilangan, his wife Itut, and their four children, Lolo, Lubu, Natok (presumably named for their palm-starch food, pages 240-41), and an unnamed baby. The rest of the Tasadays clustered in a large bay at the right.

We sat at once, unobtrusive as possible. Men we knew came forward to embrace us and sit by us. Quietly we watched the routine of cave life. Babies sucked at their mothers' breasts or lay in their fathers' arms. Children scampered about, urinating on the floor, climbing the skin-polished dividing buttress-like monkeys, squatting at the cave's lip. Women roasted bits of biking in the coals, turning them with bamboo tongs. Green lengths of water-filled bamboo leaned against the walls; occasionally people drank from them.

The cave interior seemed to be much as some age-old water action had left it. There were no signs of decoration or deliberate shaping of the walls, but natural niches had been put to use. In one of these lay deer antlers and pig jaws; children took turns sitting there and playing with them. Bows, arrows, and bolos were stacked on a ledge—gifts from Dafal or Panamin. On a small shelf lay three stone axes.

Stone axes! Catching my fascinated stare, a man rose and brought them to me. They were crude, as crude as the oldest tools of the European Paleolithic: Split pebbles, polished along their cutting edge and bound with vine into cleft sticks about a foot long (page 226). What was their use? To open hard fruits or stems, to hack off lengths of vine, to break into rotten logs. They could not cut hardwood. Were there other stone tools? Yes, scrapers for making knives of bamboo or for shaping the smooth wooden fire drill.

Fire drill! Another device from prehistory. They brought one out, a slender rod that, set in a wooden socket and whirled back and forth between a man's palms, produced a spark to be nursed into flame with dried threads of vegetable fiber (pages 228-9).

And that seemed to be all of the Tasadays' own material culture. No agricultural implements; the Tasadays cultivate no plants. No woven cloth; leaves serve as clothing. No pipes; the Tasadays are perhaps the only people in the world who do not know tobacco. No pottery; leaves and bamboo sections are their containers. No weapons; they trap but do not hunt and have no word for war.

Some scholars consider man to be a killer

animal, the only hominoid who bases his life on death. Our ancestor the Cro-Magnon man killed frequently and included men among his victims. We, his descendants, are supposed to be innately murderous, and the actions of all civilized nations suggest strongly that we are. But the Tasadays, perhaps the simplest of living humans and those closest to nature, are gentle and affectionate.

I tried a few more questions through Mai and Igna, attempting to make my tape recorder inconspicuous. Nance had told me that when the Tasadays came out of the forest to meet Manda, they complained later that they didn't like "the little black one, the one who steals the voice."

I learned that Tasaday men usually come home before dark and never stay away more than three nights. There is no division of labor; each man does what he can do best. Food is divided; if there is little, children eat first.

There is no special sense of property; all may use the stone axes or the new bolos. When the bolos were given to the Tasadays by Panamin, there was one left over. No one took it. "We each have one," they said.

"Have you a leader?" I asked. Balayem fielded the question. He fielded questions often enough to raise this one in my mind.

"No," he said. "We decide things together." Yet our tape recordings and observations proved that this young orphan did influence the actions of the rest. He admitted that he persuaded the entire group to go out of the forest last year to meet Momo Dakel Diwata Tasaday, "so all our eyes can see this man. I said they should go, and they did."

As we rose to leave, Balayem said he was happy that we had come. "When I look at you," he told us, "you seem all shiny."

NEXT MORNING Balayem, Bilangan, and Lubu came to see us, carrying a flashlight Manda had given them at their first meeting. It would not make light, they said. Manda put in fresh batteries and showed them again how to operate the switch.

They laughed with amazed delight as the light went on. Then Balayem took up a bit of wood, held it close to the lens, and blew on it.

"We cannot live with this," he told us sadly. "It will not make fire."

We explained that it was made for showing the way at night.

"You should not go out at night," said Bilangan. "Thorns and snakes can hurt you.

Even in daytime there is danger from falling limbs and the Big Word [thunder], but at night the dangers are greater."

Balayem said, "There is a bird we respect. When we hear it, we know it is warning us and we do not go out. It goes 'Hoooo... hotal hotal hotal hotal.' If we went out when we heard that, we might die."

What is done with one who dies?

"The body is left in the forest. Or, if a man dies in the cave, we take him out and cover him with leaves. We do not always take our dead to the same place."

Do the Tasadays have souls?

"We do not know. All we know outside our daily life comes from the dreams we have. But we do not know what dreams are."

The men tired of talking. They said that they were going to the stream to collect food. John and I followed.

Lubu, a graceful boy of about 10, skipped

down the stream bed like a water spider, long hair flying, long legs leaping, small feet sure and deft on the rounded stones. Whenever he came to rest he squatted, settling down in a fluid motion that blended with his last leap. Cats and monkeys move like that. Most people don't.

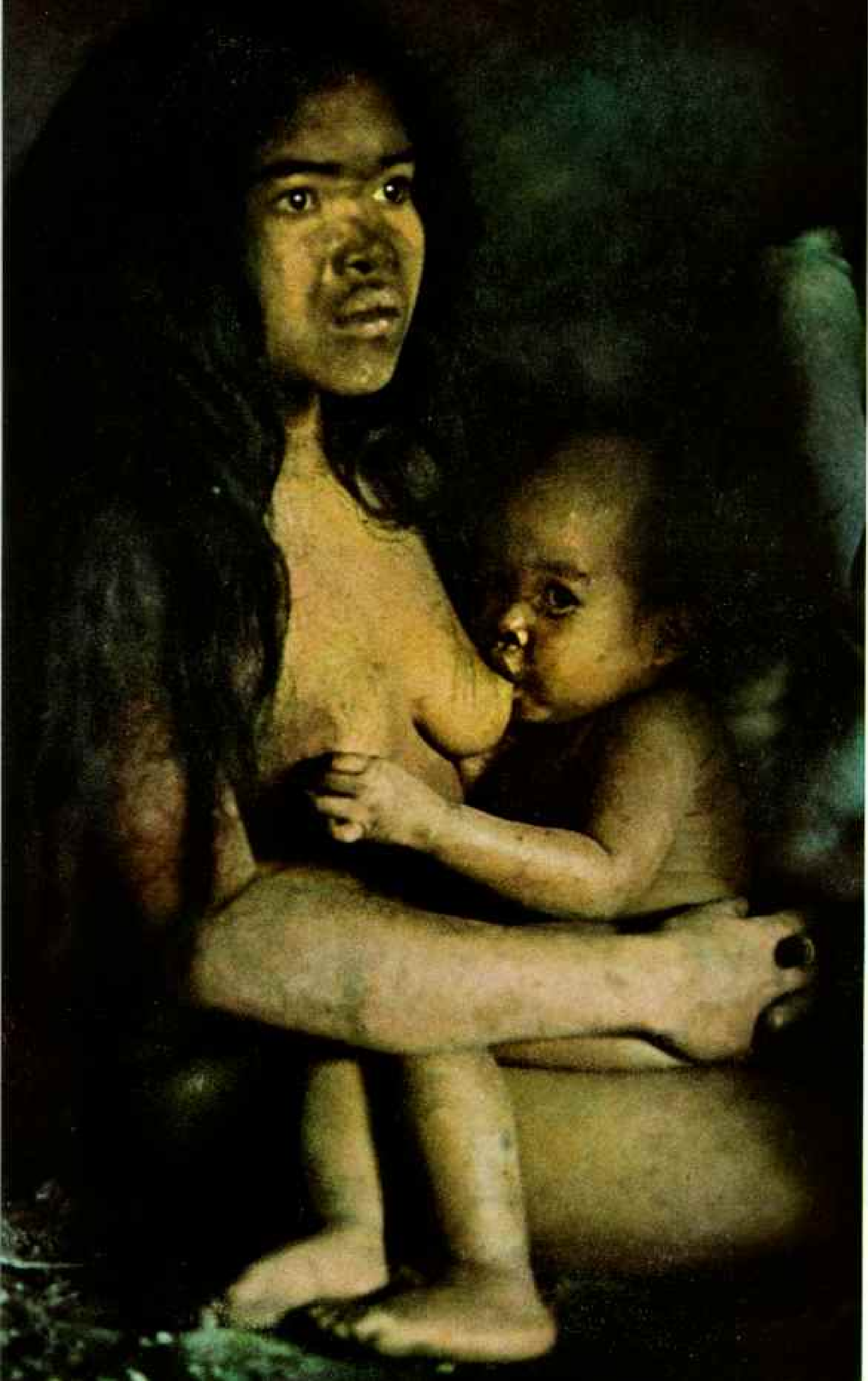
He made a neat cone out of a green orchid leaf and held it expectantly while the two men searched under rocks with darting hands. At once they began catching fat tadpoles and small crabs. The cone began to fill. When it was full enough, Bilangan folded it into a neat package and tied it to his waist string with a thread of vine. Then the three climbed the mountainside to search for biking.

A few strokes of a bolo produced a pair of pointed digging sticks. With these in hand the men prowled the slope, looking for the long heart-shaped leaf of the biking vine.

It took Bilangan half an hour to find a vine



From trough to fire to mouth: Tasadays gather around the fire and eagerly heat little cakes of natok paste.



with a full-grown root. He and Balayem dug it out of the hillside, working fast and taking turns. As they worked, Balayem sang a biking song, thanking the plant and expressing his gratitude at having found food.

On the way back, Balayem spotted a small palm, perhaps seven inches thick, which he said was full of *ubud*. He felled it easily, cut off its top, and peeled the trunk down to a core about four inches across. The whole piece was tender, moist, and delicately flavored.

As we headed back for the cave, I checked my watch. My friends had been gathering for about two hours and had enough food to carry Bilangan's family of six and the solitary Balayem through at least a day.

If other Tasadays do as well—and they probably do—then the group can live off a fairly small area (perhaps traveling no more than five miles from the cave) and make their living in only a few of their waking hours.

"And that," said anthropologist Carlos Fernandez, who had come in to observe the Tasadays, "should make this the true affluent society in the Galbraithian sense, if by affluent you mean able to support itself with large amounts of leisure time left over."

Anthropologists have long held that food gatherers who must spend all their time scrounging for bare essentials remain primitive, and must keep constantly on the move so as not to exhaust the meager food supply of any one area. They are not settled enough to build and invent, even if they had time to dream up inventions. Yet the Tasadays have a permanent home and plenty of time, and still create no technology.

Why? In this layman's opinion, because they lack for nothing. They know of nothing *to* want, except more women—and no one can invent *them*. They have no other needs, and so cannot suffer privation. Everything that they know to be good they find in their forest, apart from the steel blade. And for centuries they lived without that.

Back in the cave Balayem, Bilangan, and Lubu gave their foodstuff to the women and proceeded to demonstrate their Galbraithian affluence. Bilangan sat by his fire and played with his small son Natok. Lubu climbed a

vine to the top of the cave entrance and lay in its slender curve, balancing himself fifty feet in the air with one foot and enjoying my astounded admiration. Balayem, who lived by himself in the small separate cave, reclined gracefully on its sill and said happily, "I am Balayem."

HAVING WALKED the jungle (walked? climbed!) with the Tasadays to watch their ancient food-gathering ways, I wanted to round out my picture of their lives by observing their two newly acquired practices: trapping and *natok*-making.

Lefonok and Mahayag were going to tend their traps and invited me to come along. I brought Dafal, who had taught them about traps in the first place.

We headed up a side stream to a rudimentary shed of sticks and banana leaves covering a pile of old ashes. Dafal indicated that meat was smoked here. We went on to the traps themselves.

The *balatik* trap, a sort of set spear powered by a bent sapling, will impale a deer, a pig, or, in other and more troubled areas where human predators menace, a man. I trod warily. Such traps are often invisible to unaccustomed eyes.

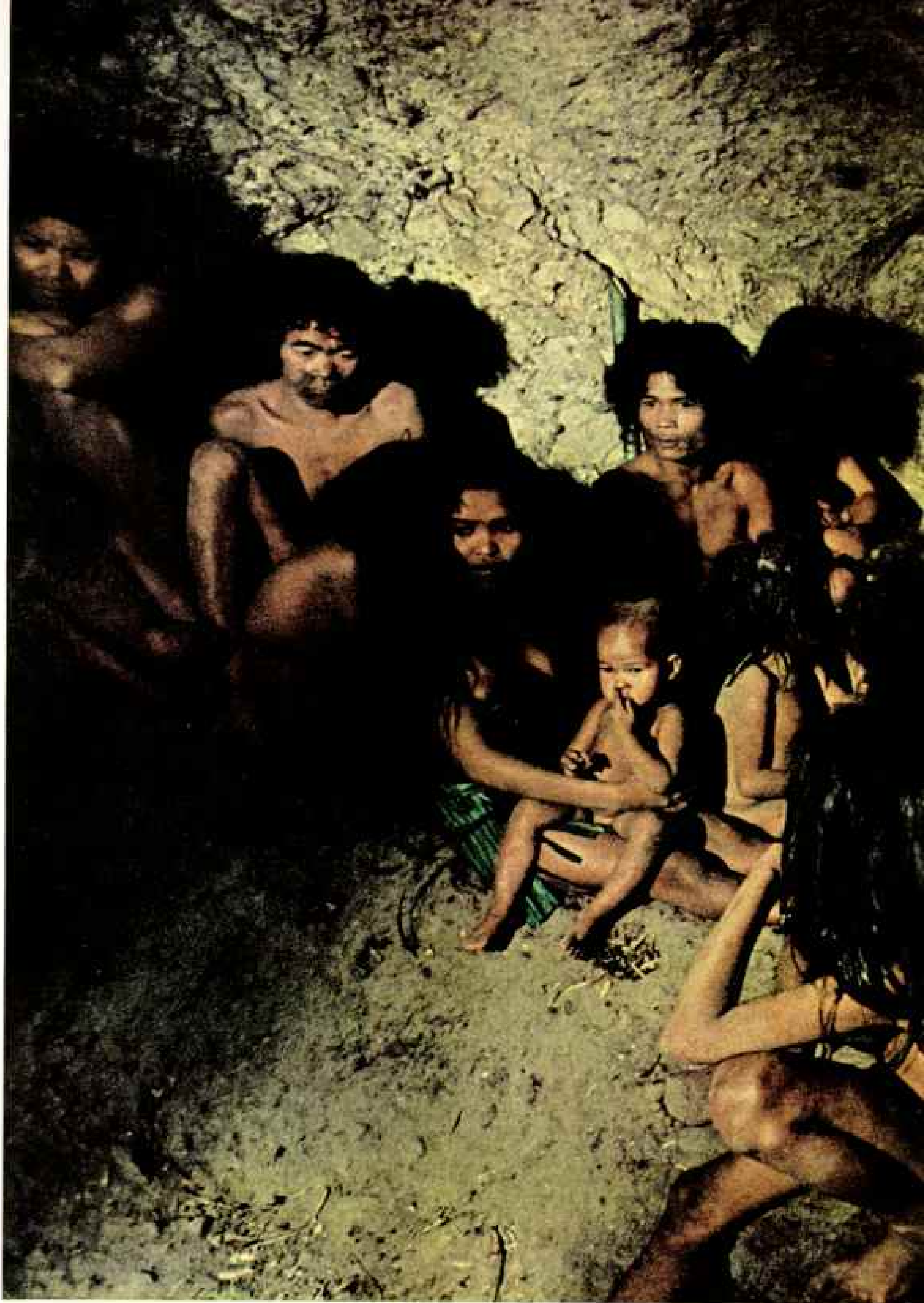
We checked three *balatiks* and four dead-fall monkey traps, all empty. No one seemed surprised. Animal kills, obviously, were rare, and meat no more than a luxury.

Not so *natok*. Later, as I watched *natok*-making, I saw that the Tasadays had learned well from their teacher Dafal (pages 240-41).

Before leaving the Tasadays, I wanted to come up with as good a guess as possible about who and what they are, and how they came to be. Manda and Carlos helped.

"At first," Manda said, "some anthropologists opined that they were simply a group of Manubos who had fled into the forest a few decades ago, possibly to avoid a plague, and who then retrogressed. Our most recent information does not support that view. Do agriculturalists forget agriculture? All the surrounding tribes have been agriculturalists for centuries. Do men who have used steel blades forget steel? Do people reinvent long-lost

Still nursing at 3 years, a child clings to its mother, reflecting the affection that permeates all Tasaday life. Despite the ratio among adults of two men to each woman, wives are not shared. Both parents help with child-rearing and food-gathering chores. They occasionally scold youngsters, but do not strike them.



Portrait of a people captures five-sixths of Tasaday society—
20 tribal members huddled in the rear of their cave. Intensely



gregarious, they often just sit silently together. Pale skin and red hair of the child at lower right indicate albino characteristics.

arts, like making fire with a fire drill? Does a language change so that many of its words differ from those of the nearest linguistic group in half a century or so?

"I don't think these things happen. The Tasadays follow the oldest lifeways in the Philippines. To my mind they are not an offshoot—they may be the last of the old people from whom *other* tribes split off. Where else could such a group exist? Where else is there such total isolation?"

Said Carlos: "We're not yet sure just how the Tasadays began. But by current estimates they have lived a separate existence for 500 to 1,000 years."

"What should be done now?" I asked Manda. "How do you protect these people?"

"That's a tough one. In most tribal situations we concede that change is needed, that people have to learn to deal with a dominant Westernized Christian culture, even if they don't become absorbed by it. We insist only that changes be made with dignity and freedom of choice.

"But can the Tasadays, so simple, so vulnerable, accept such changes? I don't know. We must study them to determine what can be done to help them in the long run. Right now they need a proclaimed reservation, and that the Tasadays should soon have from the President. When that proclamation is made, no one sets foot in here without good reason.

"The Tasadays will become a corporation without knowing it. They'll own their land jointly (you can't apportion a forest into pieces), but they'll *own* it. No one can take it from them. The same will apply to any other groups that may still exist in the area. To the people who will say we ourselves should never have come in, I say 'OK, you've got a point. But it was us or the lumbermen. We had to move.'

"Maybe we ought to look back to primitive peoples to find out where the world went wrong. There seems to be a growing sense that it has gone wrong. Maybe we can learn from the Tasadays."

I went to the cave to say good-bye. Igna and one of the Tholis came to translate. Some of the people were out gathering. But Balayem

and Udelen were there with two women and half a dozen children. We sat contentedly for a while.

"*Kakai Ken*," said Balayem in a fond lilt-ing voice. "*Kakai Tasaday*." "Friend Ken, friend of the Tasadays."

"*Kakai Balayem*," I said, and went round naming and embracing each person left.

As I turned to go, Balayem put his arms around me and said, "You cannot know how I will remember you when you are gone. You must think of us." And then, jokingly, "I will not let you go."

But in a moment he did, and I went down to spend a last thoughtful night on my shelf on the slope, watching the fire flicker on the cliff above.

In the morning I listened to the tape recorded in the Tasadays' cave after dark.

Mahayag says, "We are only natok-making people, but now we have found a friend in Momo Dakel Diwata Tasaday. His companions are good to our women and children."

Another voice: "We must unite in gathering food, but someone must always be here in case our visitors come. They find our big home here very beautiful."

Balayem starts playing his *kubing*, a bamboo jew's harp that is the only instrument of the group and a gift from Dafal. He says as if to himself, "If I play my *kubing*, it is because someone is listening. I really know how to play the *kubing*."

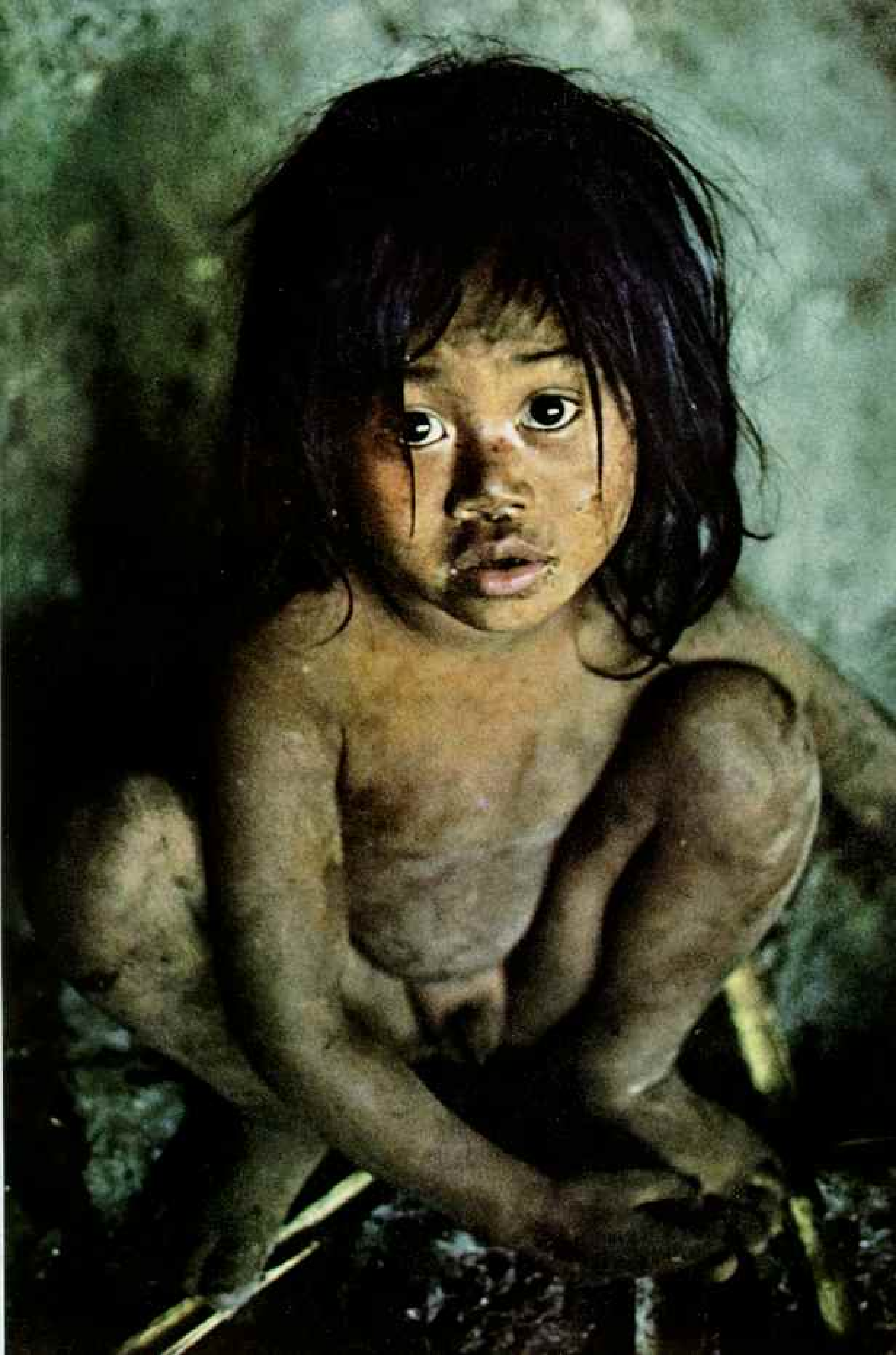
Dul says to her children, "Let us lie down together. We want to sleep. Don't cry, baby. You may disturb those below."

THE HELICOPTER climbed clear of the forest. We circled three times over the hidden valley we had just left, but saw no sign of the cave or its cliff. The jungle below seemed primeval, untouched, as in all important ways it still was.

"It's hard to believe we were ever there," John said.

"I'm glad we were, though," I said. "Our friends have given me a new measure for man. If our ancient ancestors were like the Tasadays, we come of far better stock than I had thought." □

"Nothing is more gentle than man in his primitive state," wrote French philosopher Jean Jacques Rousseau two centuries ago. His theory about the human condition seems borne out by this Tasaday child and his defenseless kin, who must now depend on the protection of 20th-century man for their very survival as a people.







GIANT KELP

Sequoias of the Sea

By WHEELER J. NORTH

PROFESSOR OF ENVIRONMENTAL SCIENCES
CALIFORNIA INSTITUTE OF TECHNOLOGY

Photographs by

BATES LITTLEHALES

NATIONAL GEOGRAPHIC PHOTOGRAPHER

AT DAY'S END I often relax by lazily roaming the upper branches of the tall forests where I work. Creatures bizarre and beautiful swarm about me; overhead the tangled foliage almost obscures the daylight. But I need no wings or tree-climbing irons, only swim fins; the air I breathe is carried on my back. I am a scuba forester, and the "trees" I tend are giant kelp, rising in vinelike streamers from the ocean floor off the coast of southern California. It is my job to see that this valuable seaweed, *Macrocystis*, does not vanish—a circumstance that seemed inevitable a few years ago.

The monster seaweed occurs in widely scattered regions of the Southern Hemisphere, though never off coasts washed by tropical waters, which it cannot abide. In the Northern

Teeming world of giant kelp surrounds a diver in sun-spangled waters off Baja California. Earth's fastest-growing plants, the algae extend towering fronds as much as two feet a day, reaching lengths of 200 feet. Ravaged by sea urchins, many California beds a decade ago faced extinction but today flourish again, thanks in large measure to the author's work.



Hemisphere, however, it appears only along the Pacific coasts of Canada, the United States, and Mexico's Baja California.

From base to tip of frond, this prodigy of the sea sometimes measures 200 feet in length. To reach such size in its brief lifetime, giant kelp grows faster than any other plant in the world—two feet and more in a single day. Nutrients from the water and energy from the sun, trapped by photosynthesis in the plant's thick canopy, support this amazing growth. A remarkable system of translocation takes the nourishment downward to spur development in dimly lit regions; without this mechanism, kelp could not mass into the dense, shadowy forests so attractive to countless marine animals.

After four or five months of hectic growth, mature strands begin to die. Fortunately, new branchlike fronds continually shoot up to replace aging ones. Thus, under normal conditions, a kelp forest completely regenerates itself about twice a year.

Does this mean a kelp plant is never more than six months old? No. Though new fronds constantly replace old ones, the plant's holdfast keeps on going. This rootlike clump of pencil-size strands attaches the plant to the bottom. Its basal tips cling to rock crevices with tenacious grip.

In generally calm waters off Santa Barbara, I have seen clumps of holdfasts eight to ten feet thick and four to five feet high. Probably they are at least a decade old.

Myriad Creatures Roam Marine Jungles

I am constantly intrigued with the wealth of marine life found among these giant plants. Conical top snails and camouflaged kelp crabs graze along the fronds, awaiting their fate as food for larger creatures. Hosts of invertebrates encrust the narrow, flat blades—which laymen would call leaves, and which stretch from small gas-filled bladders that keep the fronds afloat (left).

Hundreds of little fish hover near the kelp columns, looking like dust motes in the dim light. Suddenly the schools vanish into the

dense vegetation. A barracuda passes by in search of prey. Then, as if by magic, the small fish reappear, to swim languidly in the upper parts of the forest, picking at particles suspended in the water or lazily nibbling on a corrugated kelp blade. For them, the forest provides both food and security.

Nuisance to Some, Bounty to Others

The time finally comes when I must go ashore. As my boat pulls up to the pier, a friendly onlooker often asks, "What did you catch?" I admit to some embarrassment when I answer, "Not a thing, sir. I was out there cultivating kelp."

My occupation does not endear me to those who know kelp only as a nuisance that blights beaches and fouls fishlines. But work like mine is essential if man is to continue to take rich harvests from the sea. For the time is fast approaching when ocean crops, like those on land, must have a helping hand.

The uses of giant kelp go far beyond the food and shelter it gives numerous saltwater species—although this is reason enough for its preservation. The plant yields an unusual chemical called algin. It is this substance that gives tall seaweeds the resilience to withstand the tugging force of wave surge.

Extracted, algin has extraordinary powers. As an emulsifier, it binds oily and watery fluids together; processors use it to prevent salad dressings and other products from separating in the container. As a suspender, it helps keep pigment particles mixed with the carrying liquid, and so finds use in such items as paints, cosmetics, and pharmaceuticals. As an aid in controlling viscosity, it can do such things as make ice cream smoother and packaged cake icings stiffer.

Originally, giant kelp was harvested simply by gathering loose strands washed ashore. As demand increased, collectors in boats cut it with knives on long poles. Today ships push huge cutting racks through the water; hedge-clipper knives mow a swath 20 feet wide, and conveyors carry the kelp aboard (page 266). State regulation limits cutting to no more than

Crescent of pea-size balloons buoys newly formed saw-toothed blades at the tip of a kelp frond. The gas-filled bladders—called pneumatocysts—grow to golf-ball size, supporting the massive stalk as it reaches to the sunlit surface. Perhaps the most widespread of the family of brown seaweeds, *Macrocystis* occurs in cool coastal waters in the Southern Hemisphere and off Pacific North America.



SEMPORA ABRAE, *PIYIDILUS CALTHIFOLIA*, ABOUT SIX INCHES LONG



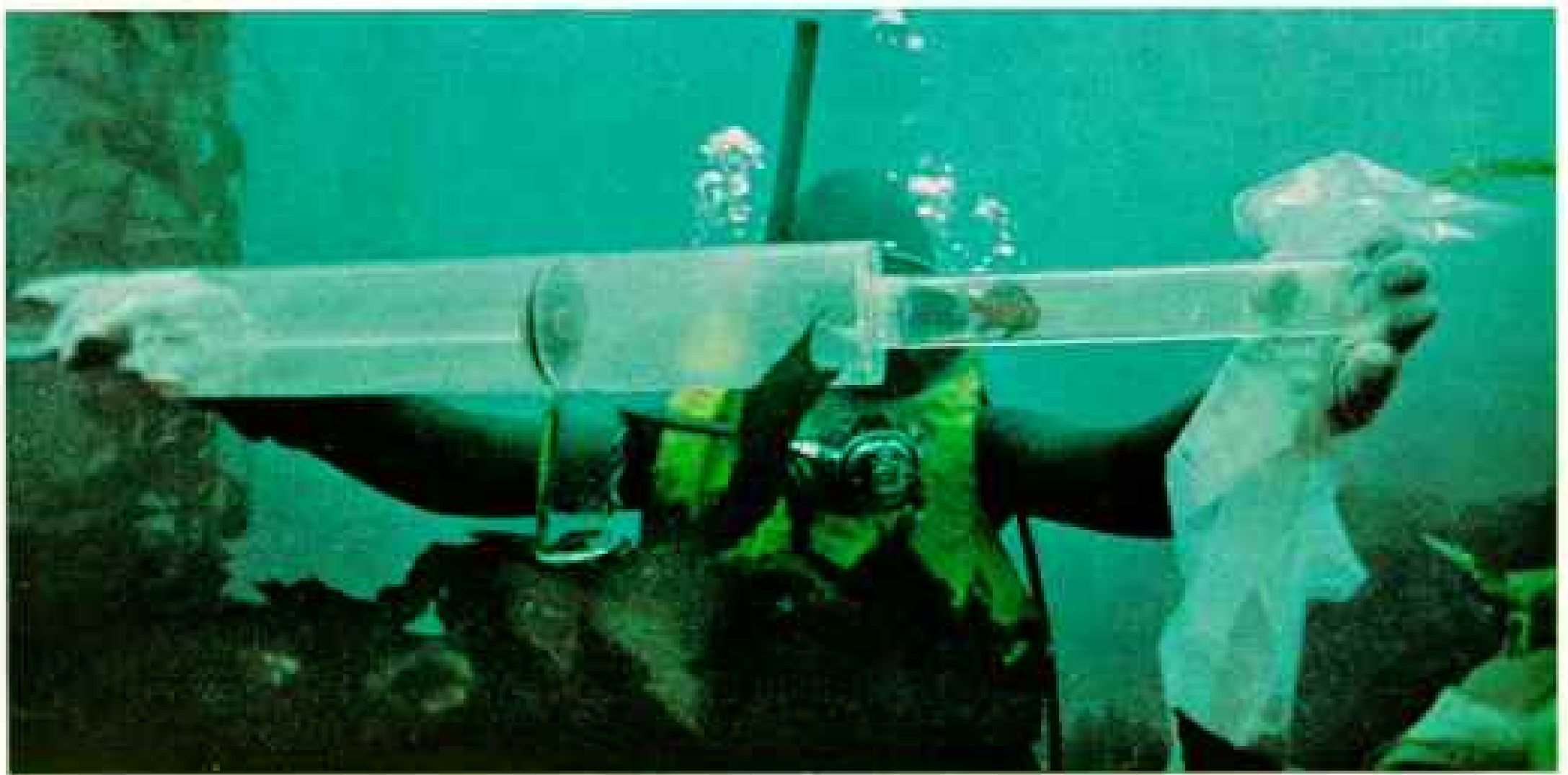
Victim of its own buoyancy: Kelp normally clings to the rocky sea bottom, but the plant above took hold on an abalone shell. As the seaweed put forth more pneumatocysts, it floated free and drifted off with the shell. A wrasse here nibbles at the passing plant.

Pillars of mature kelp (upper right) may contain fifty or more densely packed fronds, all rising to a canopy at the surface. Invertebrates speckle the blades like snowflakes. Actually brown, the plants here appear green, because the water has filtered out most of the red from the sunlight.

Colorful standout in the kelp bed, a tiny blue-banded goby (right) nestles beneath the sharp spines of a sea urchin. This bright bottom-dweller is a home aquarium favorite, often caught by "slurp gun" (far right), a plastic cylinder-and-piston that sucks up small fish.



FLASH PHOTOGRAPH OF *LITTORIDINUS DALII*, ABOUT ONE INCH LONG



four feet below the surface. Cutting any lower might endanger the plants' reproductivity.

The wet kelp is taken ashore, ground, and chemically processed to extract the algin, which emerges as a dry powder. The size of the kelp industry is best indicated by the fact that 155,560 wet tons were harvested last year off California.

Algin is not the only thing of value found in the underwater forests. The luxurious growth attracts rockfish, perch, croaker, and kelp bass. Such sought-after shellfish as the California spiny lobster, abalone, and rock scallop abound there. Kelp thus benefits both sport and commercial fishermen. Adding together all uses of California's kelp beds, I would estimate their worth at tens of millions of dollars a year—perhaps a million dollars for each of the nearly 90 square miles of kelp forests surviving in state waters.

Diving Scientist Takes a New Job

Two decades ago a few people began to suspect that the giant kelp beds were dwindling. There was no alarm at first, because kelp has good years and bad. But it finally became apparent that the kelp was indeed in serious trouble. Deterioration had already halted harvesting in the once-lovely forests fringing the rugged shoreline along the Palos Verdes Hills south of Los Angeles; off San Diego the Point Loma bed, which during World War I yielded an average of 75,000 tons of kelp a year, had all but disappeared.

There was no agreement as to why the seaweed was vanishing. Some thought over-cutting was the cause; others blamed pollution. An extensive underwater study might clear up the mystery—but it would require a scientist who could dive.

In those days, when most marine biologists were still wading around in tidal pools, I had learned to dive to collect sea anemones for experiments I was then conducting at the Scripps Institution of Oceanography in La Jolla, California. But sea anemones and kelp ecology obviously are not closely related, so I was a bit surprised when Professor Charles D. Wheelock, Director of the University of California's Institute of Marine Resources in San Diego, said to me one day: "Wheeler, you're the right man for the kelp study. How about taking it on?"

True, I had the basic qualifications—an advanced degree and diving experience. I knew from personal observation that several once-flourishing kelp forests were on the



Unlikely partners

TOOOTHY MAW of a kelp-dwelling moray eel signals a meal to "cleaner" shrimp surrounding it (above). The shrimp troop over the gaping beast, gleaning tiny parasites from its skin. Sated, the cleaners soon left, but their mottled host opened wide again, apparently dissatisfied with the once-over. Its friends returned to their job with renewed vigor (right), unafraid despite the moray's penchant for eating its benefactors.



CALIFORNIA WEASL, *SYNTHLIPSIS BOREALIS*, TWO TO FIVE FEET LONG; CLEMMER SHRIMP, *LESTHEUS CALIFORNICUS*, TWO TO THREE INCHES LONG







AT LEFT: GIANT KELPFISH, *HETEROSTICHUS ROSTRATUS*, SIX TO SEVENTEEN INCHES LONG; ABOVE: ORTOLINGUS PICTUS, FOUR TO SIX INCHES LONG

Tenants of a sea-floor forest

SEEKING safety and food, many of Neptune's finned attendants hide, nearly invisible, in the seaweed forest. Tangled stalks protect a giant kelpfish (left), whose color blends with its noodlelike surroundings. Mottled camouflage conceals a painted greenling (above), foraging for worms and small crustaceans.

Nearby, the branch-browed disguise of a yellowfin fringehead (middle) resembles seaweed, and may protect the bottom dweller from predatory morays, rockfish, and sea bass. Favorite haunts of various types of fringeheads include holes, crevices, and discarded beer bottles, from which only the snout may protrude.

No drab masquerader, the bright-hued garibaldi (right) relies on pugnacity, not camouflage, to drive off its enemies. Fiercely territorial, it will attack a submerged bottle or camera lens, seeing a rival in its own reflection.



NEDELINUS STEPHENSII, ONE TO THREE INCHES LONG



SPYGLASS SURGEON, SIX TO THIRTEEN INCHES LONG

Cavorting trio of young sea lions frolics off Baja California near underwater cliffs crowned with waving surfgrass. The commonest large carnivores frequenting West Coast kelp beds, sea lions seek the abundant fish sheltered in the seaweed forests.

verge of extinction. The thought of so much living wealth perishing was overwhelming. I accepted the assignment. The California Department of Fish and Game and the Water Pollution Control Board joined the Institute of Marine Resources in sponsoring the study.

One of my earliest observations was that kelp forests change with the seasons as do terrestrial ones. But because the plant is sensitive to warm water, summer rather than fall is leaf-shedding time. By late August, yellow and orange blades drift slowly down, reminding me of a New England autumn.

Sometimes I find myself in an underwater thicket that resembles a land forest after the first snowfall. The entire kelp plant is lightly dusted with white patches formed by colonies of microscopic shelled animals.

Spring is mating and multiplying time. Kelp produces the most spores then, sometimes liberating millions a minute from specialized blades at the fronds' bases. These spores settle, attach, and develop, provided there is adequate light on the bottom. Amid a dense kelp forest, bottom light is often insufficient unless an adult plant has been torn away, creating a hole where the sunlight can penetrate. Kelp harvesters also improve the submarine light climate when they reduce the canopy.

For me, spring's star attraction is the flaming orange garibaldi (preceding page), a spectacular fish that prepares a nest by removing all plants and encrustations from a few square feet of rock. Here the female deposits her bright yellow eggs, which the male guards during their several weeks of development. He will attack creatures many times his size if they venture too close. I know—for many a protective parent has tried to bump me away from a nest site.

Differences as well as similarities exist between land and sea forests. Kelp foliage, though it appears green underwater, is really a rich brown. There are no massive tree trunks, only clusters of slender vinelike stipes. At a distance these could be mistaken for a solid mass, except for their rhythmic movements caused by wave surge.



Fauna here is perhaps more friendly than are wild creatures on land. At first the animals may keep a prudent distance, but if they are not disturbed, they soon approach for a closer look. Curiosity satisfied, they go about their business—or even follow me. I am often engulfed by schools of happy-go-lucky fish that accept food from my hand or nibble at my forefinger if I wiggle it worm fashion.

The Culprits: Pincushions of the Sea

As my study progressed, I virtually lived in the kelp beds, alone at first and then, as more scientists took up scuba diving, with various colleagues.

We dropped into turbid waters near sewer



EXCLUSIVE CALIFORNIA

outfalls to see if toxic substances were affecting kelp plants. We ran our tiny skiff into the teeth of gales to measure the force exerted by passing swells on kelp holdfasts. We swam among killer whales and elephant seals and saw boulders shifting along the bottom during violent storms. Ranging from Magdalena Bay in Baja California to Monterey Bay in central California, we collected reams of new and valuable basic information about giant kelp—but still we could not determine what was causing its decline.

Close and continuous observation of the forests finally revealed—as we had long hoped—the reason for their regression. To our surprise, the true culprit was a little

pincushiony creature—the lowly sea urchin.

Like locust plagues on land, hordes of these bottom grazers move through the forests devouring the lower parts of plants (page 265). The severed fronds then drift away. And so, too, do the animals when deprived of the shade, safety, and food conferred by kelp.

An urchin front has been recorded as moving at 30 feet a month, leaving little behind but barren rock. I have even seen urchins chewing the wax off sunken milk cartons.

Now we knew that man was not the direct cause of kelp decline but, unfortunately, he has contributed to it. Not by polluting coastal waters, as some had contended, for we found that giant kelp often flourishes near sewer



1

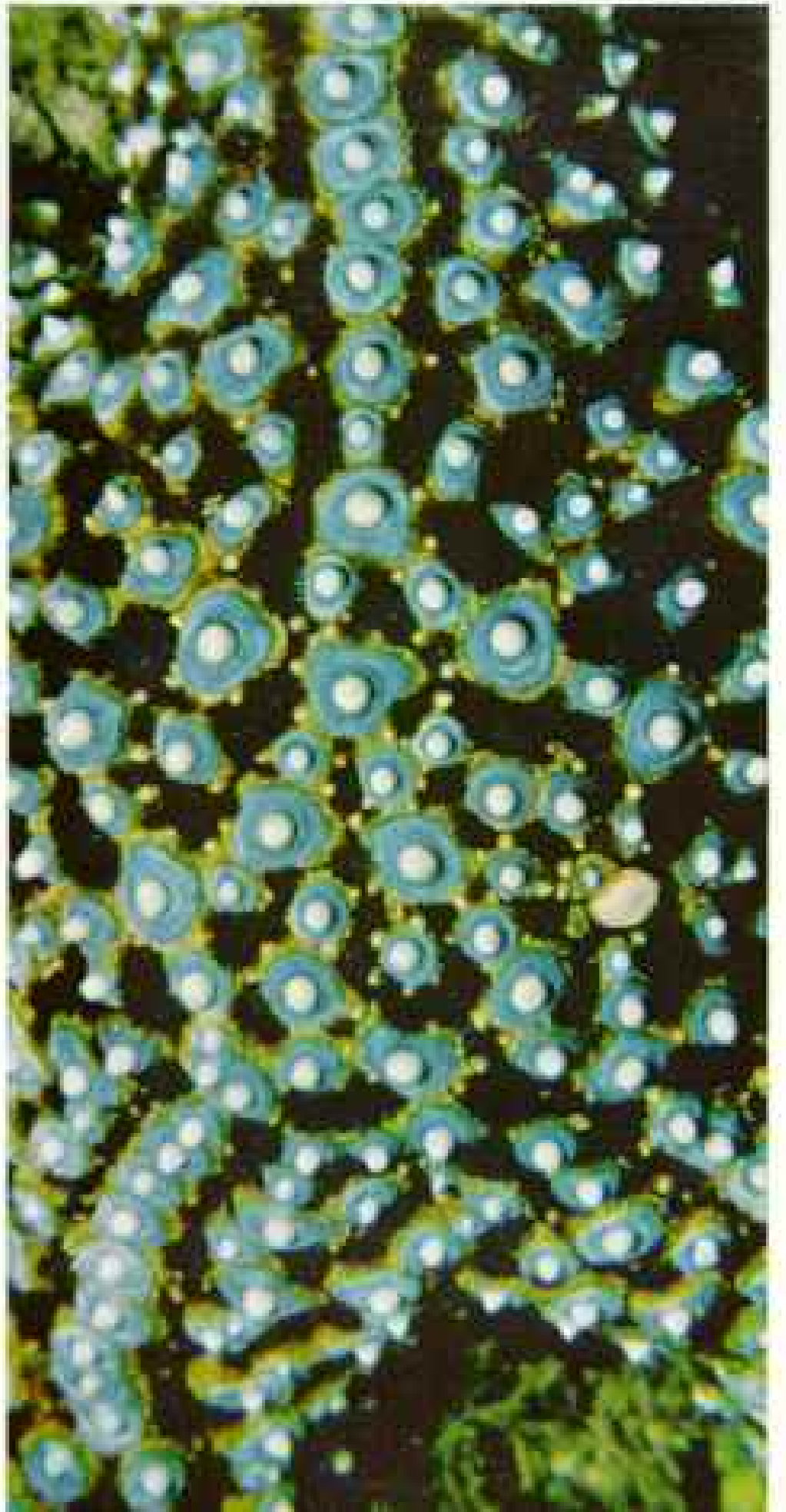
ERYTHROCYTHO CALIFORNICUS, EACH ONE-HALF INCH IN DIAMETER

POGONIS SIGARTELLA, THREE TO FIFTEEN INCHES IN DIAMETER



12

ANTHOPLEURA ANTHRACINA, FOUR TO SIX INCHES IN DIAMETER



3

Underworld ablaze with color

AN EYE-ASSAULTING ARRAY of textures and hues greets the visitor to California's kelp beds. Colony of tentacled anemones (1) encircles a member that has yet to unfold its delicate arms. Plantlike in appearance, these carnivorous animals are close cousins to jellyfish and corals. Another species (2) acquires its green cast from living algae imbedded within its tissues. The anemone feeds on nutrients produced by the algae, as well as on crabs, worms, and the like.

Galaxy of blue-ringed spines studs the back of a starfish (3), drawn to kelp beds in search of scallops, clams, and other shellfish. Sparkling with teardrop



4 *FEEDING ON HYDROPHORES, ONE TO TWO FEET APART*



5 *FLABELLINOPSIS SEDINA, ONE HALF TO ONE INCH*



6 *PATULA MINATA, ONE TO SEVEN INCHES*

spines, a related 20-armed sun star (4) sprawls in the company of another starfish. Thought to breathe through the bright-colored, gill-like growth fringing its back, a sea slug (5) stalks seaweed for hydroids, small jellyfish-related creatures equipped with pressure-sensitive capsules that rupture to release tiny poison-tipped darts. In eating its prey, the sea slug somehow manages not to trigger these defense mechanisms. Instead it transfers them intact through its own body to the ends of the protruding growths—thus incorporating the defenses of the hydroid within itself.

Raised paisley design envelops a bat star (6). The light central plate is a sieve, a natural filter at the entrance to the animal's water-filled interior.



EDWARD LUTHE

outfalls. Instead, mankind has almost exterminated the urchins' most effective enemy—the sea otter.

The kelp-urchin-otter relationship became apparent to me when I learned that a beautiful thick kelp bed had reappeared off Pacific Grove and Point Pinos, in a part of Monterey Bay that held a heavily protected herd of some fifty otters.* When I had surveyed the area earlier, urchins dominated the bottom, and there were no significant stands of kelp. Now, where I descended among the lush new fronds for another look, I found only piles of broken tests—the urchins' shell-like body coverings—and windrows of spines. The otters had devoured the rest.

Old Weapon Enlisted for a New War

I have often watched through binoculars as a shy sea otter enjoys its urchin fare. Surfacing from a dive, the animal brings up an urchin and a flat stone with its dextrous forepaws. Then, floating on its back and using its chest as a table, it breaks the urchin against the rock and eats the flesh.

With otters along the kelp-bearing coast numbering only 800 or 900 where tens of thousands once roamed, it was obvious we

could not look to them for urchin control. Learning the cause of kelp regression had given us only half an answer to the problem.

We were almost sure that pollution, of itself, did not kill kelp. But there were places where waste seemed to nurture unusually large urchin populations and they, in turn, prevented plant growth. To be certain of this conclusion, we decided to clear an outfall area of all urchins and see what would happen. But how?

"Why not try quicklime?" David L. Leighton, of our research team, suggested. "It's used to rid oyster beds of predaceous starfish. Perhaps it'll work as well on their relatives the urchins."

After preliminary experiments, we dropped lime from a boat over an urchin-infested reef in picturesque Abalone Cove, on the Palos Verdes Peninsula. The urchins perished, and within two months we had a thriving little kelp patch. When we suspended the project, the urchins returned and the kelp disappeared. But we had introduced a successful weapon in the sea urchin war.

Now we had to make sure more widespread

*Karl W. Kenyon described the sea otter's dramatic comeback in the October 1971 NATIONAL GEOGRAPHIC.

Kelp's best friend, a young sea otter (left) heads for the surface with an urchin. Otters once kept the pests in check, but 19th-century fur hunters nearly exterminated the mammals. Now protected by law, California's sea otter population has increased to more than a thousand animals.

Prickly armor shields the sea urchin from most predators as it munches on a kelp holdfast. Grazing wastefully, this juggernaut chews through the seaweed's base, causing the buoyant fronds to be washed ashore or carried away by currents. The author pinpointed the urchins' role in the kelp's decline and has wiped out thousands of them with caustic quicklime.



SPHONDOCELENTERON PEARLICORNAE, THREE TO SIX INCHES ACROSS

use of quicklime would not endanger other marine life, and that large-scale applications could be made at reasonable cost.

To do this, the Kelco Company, a large California kelp processor, awarded a generous grant to the University of California for an intensive research program. Man was at last filling the niche left vacant by the slaughtered sea otters.

Storm Waves Finish Off the Enemy

Months of hard work followed. Eventually a colleague, Laurence G. Jones, and I came up with a quicklime dosage we believed was strong enough to eliminate urchins but too weak to affect other species. To test our formula, I selected the inshore margin of the last sizable kelp patch at Point Loma. Here urchins were so densely concentrated that smaller ones were climbing three or four feet up the kelp stipes in search of food, most unusual behavior for such bottom dwellers.

Skipper Don Noland and I put to sea in a lumbering war-surplus buoy boat. I was worried that we might capsize and be caught in a scalding rain from the two tons of quicklime we had aboard.

But Don said, "Don't worry, this old bucket

will make it." And sure enough, despite my qualms, we wallowed safely through the waves and spent the day crisscrossing the area, spreading the lime in a grid pattern.

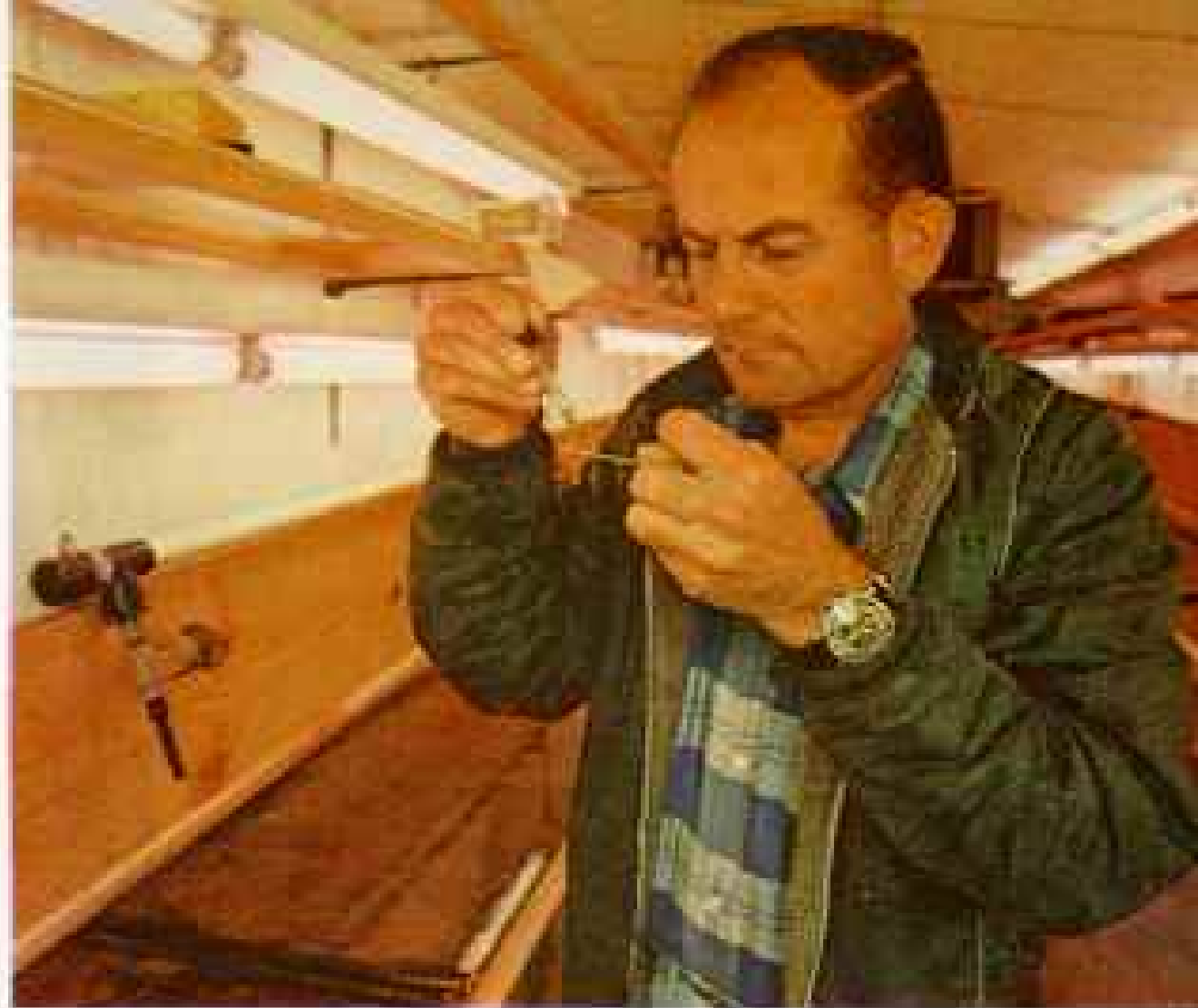
A storm kept us on the beach for a week, as I worried over whether I had limed the test area correctly. Finally the sea flattened, and we hurried out. At the surface the kelp looked fine; I jumped overboard to look below.

One glance and I knew that victory was total. The bottom was littered with urchin fragments. Quicklime particles settling on urchins had burned and killed. But equally important, the chemical suspended in the water had caused the untouched urchins to withdraw their delicate tube feet, releasing their suckerlike holds on the bottom. Storm surge had then rolled the loose animals back and forth, completely shattering them against rocks and ledges. We were later to prove that the most effective kill came when strong wave action enhanced the quicklime's effect.

Further lime treatments created more urchin-free territory, until about four acres were cleared. Within a few months, the first tiny bladelets of seaweed appeared—forerunners of what soon developed into a fine stand of giant kelp. This time we did not abandon

Undersea farmer, author Wheeler North has spent more than a decade studying and restoring California's depleted kelp beds. Quickliming urchin-infested areas, he then transplanted mature kelp, towing it from miles away. He also set up a seaweed nursery ashore to cultivate kelp spores by the billions.

Flanked by culture tanks, Dr. North prepares a microscope slide. Spores placed in the tanks become male and female gametophytes (1). They produce eggs and sperm that combine to form the embryonic zygote (2), which soon develops into a minute kelp plant (3). The new generation is then scattered on the sea bottom. Urchin-smashing diver (lower right) helps assure that enough plants mature—one in 100,000—to reestablish the beds.





1

400 TIMES LIFE SIZE
CHARLES F. WELLS, JR.



2

400 TIMES LIFE SIZE



3

400 TIMES LIFE SIZE



Moving backward, a kelp ship slashes a swath through the Point Loma bed, once virtually wiped out. Aft conveyor belts haul the cut seaweed aboard.

Judicious harvesting helps kelp growth by thinning dense canopies that block needed sunlight. California's kelp not only harbors valuable seafood but is also the major source of algin, a chemical used to smooth and thicken more than 300 preparations, from ice cream to paints, sauces, and toothpaste.

the experiment to the hungry hordes. Instead, as the animals pressed in on the borders of our brown garden, we spread more lime and crushed the few survivors with hammers. The young kelp grew vigorously. Then a strange thing happened—the urchins stopped encroaching.

Investigation soon showed why. The kelp had grown so large that pieces were being broken loose by wave action. Currents carried this debris to the urchins, where it was captured and consumed. Dave Leighton and I pondered the implications.

"I'll bet that hungry urchins forage, but well-fed ones remain sedentary," I said.

Events confirmed my supposition. It was no longer necessary to kill urchins to protect this kelp patch, for we had reestablished ecological stability.

Kelp Itself Tips the Scales

Only one question remained. If we expanded our experiment, would increased debris keep urchins satisfied and stationary, permitting young kelp to grow in areas never treated with quicklime?

Back to sea we went, this time in a Kelco harvesting vessel loaded with 40 tons of lime. We spent a long day spreading it all at strategic places off Point Loma and La Jolla.

At first kelp appeared, as anticipated, only where urchins had been eliminated. Months passed, and the plants became large enough to generate debris.

Then, one wonderful day, our predictions came true. I surfaced from a dive excitedly to shout to my associates in the support boat, "There's a big patch of tiny brown kelp plants growing in an unlimed area!"

The ecological balance now was tipped in favor of kelp.

At first we saw only a few hundred new plants, close by the quicklimed areas. Then the numbers swelled to thousands, extending outward for substantial distances. The natural fecundity of kelp was manifesting itself.

Over the next two years, Point Loma's great submarine forest was reborn; today it is nearing the generous boundaries occupied some sixty years ago. And harvesting has been resumed off La Jolla, devoid of all except a few patches of plants in 1965.

The Kelco Company has recently assumed responsibility for urchin control in these beds, leaving us free to concentrate on preservation and restoration at other locations along the coast of southern California.

Since this phase of our work began, I have learned that the land farmer and I share many parallel problems. Climate is one of them—for giant-kelp canopies deteriorate in late summer when surface water temperatures exceed 68° F. for several weeks. To combat this, we are culturing a warmth-tolerant strain from Baja California.

Transplanting, once a trial-and-error science, eventually became more successful and exact. We switched from slow towing of adult plants underwater to rapid, safer topside transportation.

When transplants suffered blade damage from grazing fishes, we isolated them and their offspring in a big tent of tuna netting. Those were days when I ignored all queries about my occupation. How could I explain I was an underwater seamstress, mending tears in a greenhouse of the sea?

An Underwater World Reborn

To advance aquiculture, we borrowed other techniques from agriculture. We now weed around mature *Macrocystis* stands so that descending spores will not be smothered by competitive plants. And we have turned to artificial seeding where natural dispersal is absent or inadequate. My major purpose these days is to improve the present survival rate: one maturing plant for every 100,000 "infants" dispersed in the sea by divers.

I still return frequently to Point Loma to make sure everything is proceeding in order. Everywhere now there are schools of young fish hovering just beneath the canopy of kelp fronds. They dart busily from their homes among the kelp columns into open spaces in mid-water, devouring specks of food. Beneath rocks and in crevices I find an abundance of developing abalone, juvenile crustaceans, and other kelp-bed animals.

The diverse and wonderful fauna is slowly returning. Perhaps a time will even come when this lush forest, like that off Monterey, is blessed again with a herd of frolicking sea otters. □

Like Jack on the beanstalk, a lone diver explores the mysterious realm of giant kelp. As earth's resources dwindle, man turns increasingly to the sea for survival, and to cultivating such bountiful forms of marine life.



Escalante Canyon— Wilderness at the Crossroads

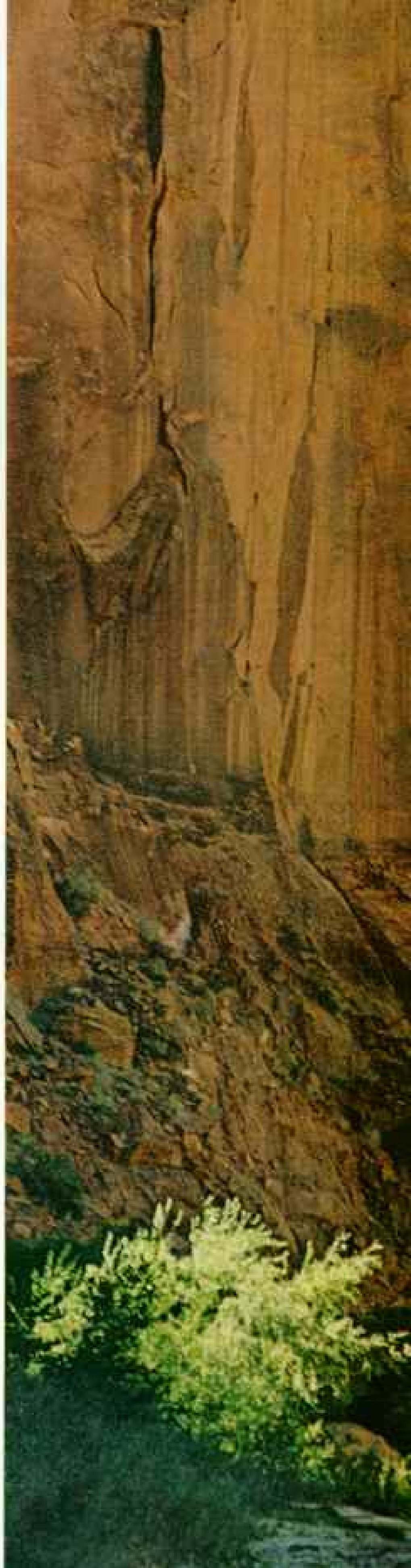
PHOTOGRAPHS AND TEXT BY
JON SCHNEEBERGER

NATIONAL GEOGRAPHIC SENIOR

CHILD of a stone-gnawing river, Escalante Canyon slashes a twisting 185-mile path through the desolate badlands of Utah. It's not the deepest canyon in the world, or the longest. But the Escalante is unique, with its river-carved gorges, majestic cliffs, and sun-speckled alcoves—a pocket of wilderness that has been called “a symphony of rock, water, and time.”

Backpackers in this rugged clutter of slickrock and sand find few trails to guide them through the gullies, no signs to direct them to shelter. In this gnarled land that Indians abandoned and settlers shunned, man deals with nature on her terms—and his grateful soul tallies the rewards.

But the winds of change gust nearer. Today the future of Escalante Canyon hinges on the outcome of a rolling controversy, pitting those who would preserve its wild state intact against those who would use it to benefit nearby communities.

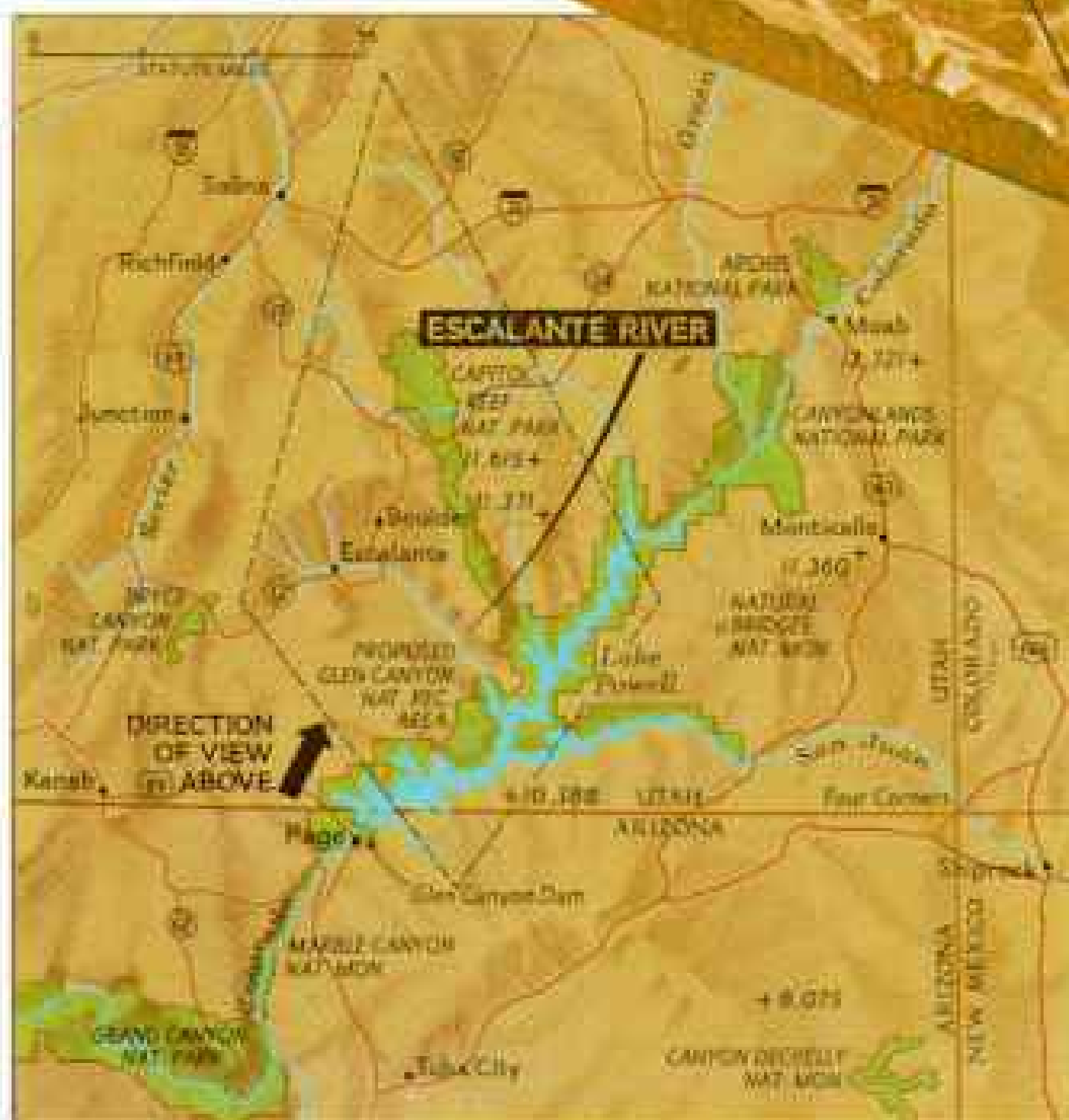
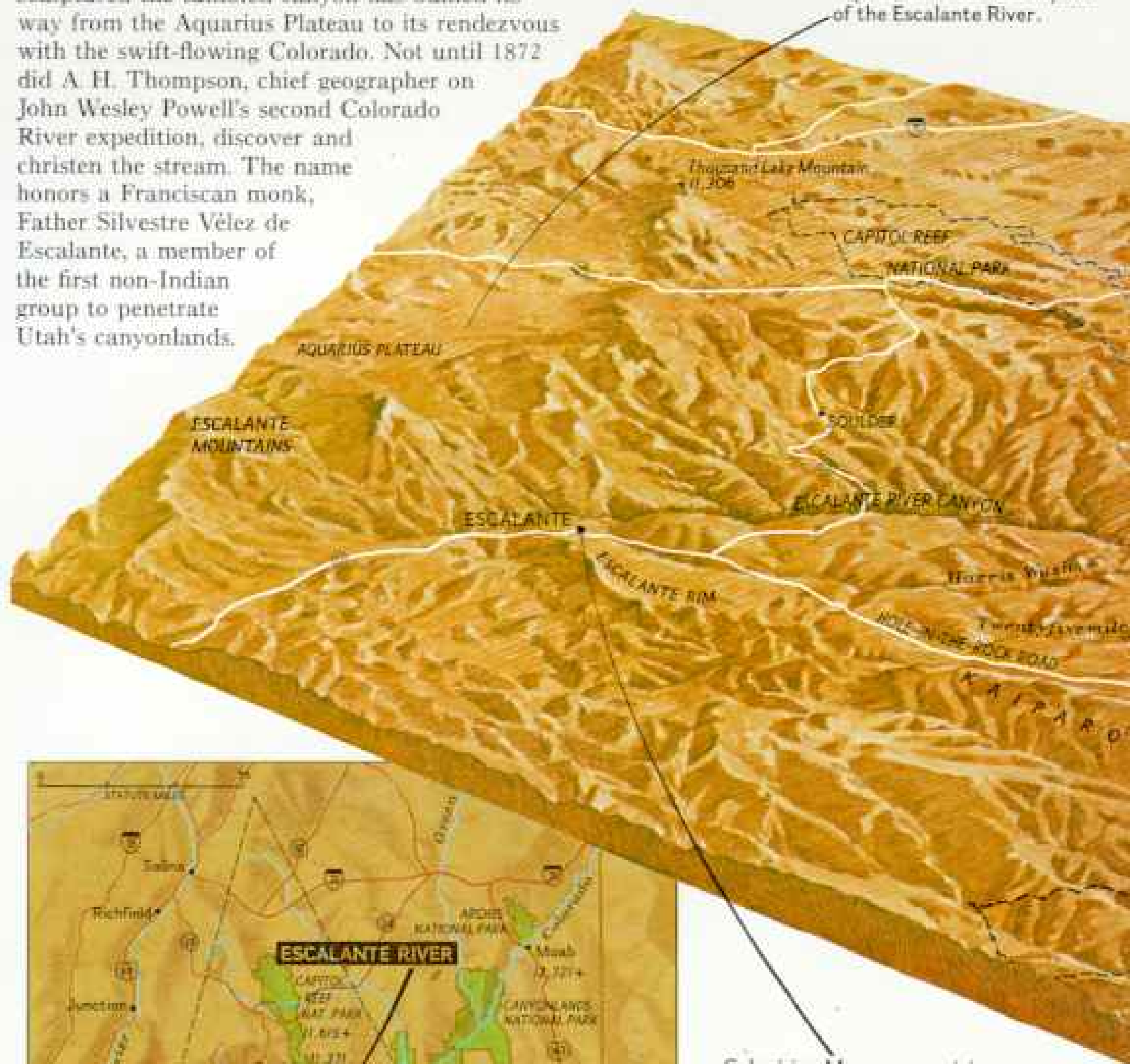




Escalante Country

LOCKED DEEP in the fastness of southern Utah, Escalante Canyon is part of the last-explored region of the contiguous United States. For some ten million years the river that sculptured the tumbled canyon has bullied its way from the Aquarius Plateau to its rendezvous with the swift-flowing Colorado. Not until 1872 did A. H. Thompson, chief geographer on John Wesley Powell's second Colorado River expedition, discover and christen the stream. The name honors a Franciscan monk, Father Silvestre Vélez de Escalante, a member of the first non-Indian group to penetrate Utah's canyonlands.

"A prettier mountain region than this could not be imagined," noted an 1872 explorer of 11,000-foot Aquarius Plateau, birthplace of the Escalante River.

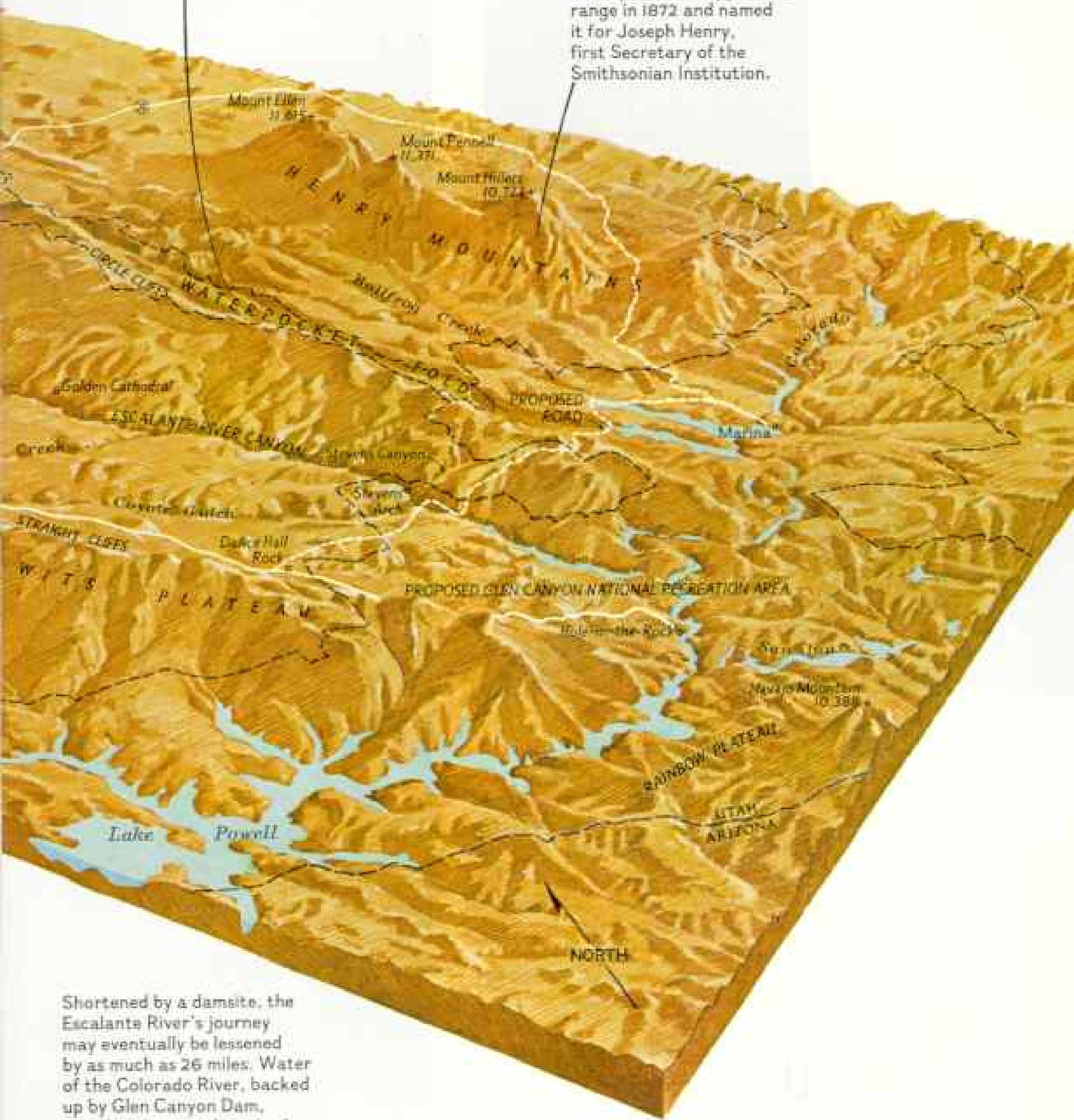


Colonizing Mormons, arriving here in 1875, named their new settlement in honor of the region's first explorer.

Carving for centuries through slowly rising sandstone, the Escalante River with its quiet might has fashioned awesome arches, overhangs, and a chasm that dips in places to 1,200 feet.

Named for rain-trapping hollows pocking its barren sandstone, Waterpocket Fold marks the northeastern boundary of the 1.1-million-acre basin traversed by Escalante Canyon — an area 98 percent publicly owned. Ranchers must pay for grazing privileges in most of the region.

“Unknown Mountains,” explorer John Wesley Powell called these peaks upon first sighting them in 1869. His expedition mapped the range in 1872 and named it for Joseph Henry, first Secretary of the Smithsonian Institution.



Shortened by a damsite, the Escalante River's journey may eventually be lessened by as much as 26 miles. Water of the Colorado River, backed up by Glen Canyon Dam, has already turned much of the Escalante's lowest reaches into a part of Lake Powell.

Elevations in feet
 DRAWING BY MICHAEL SCHEIDT



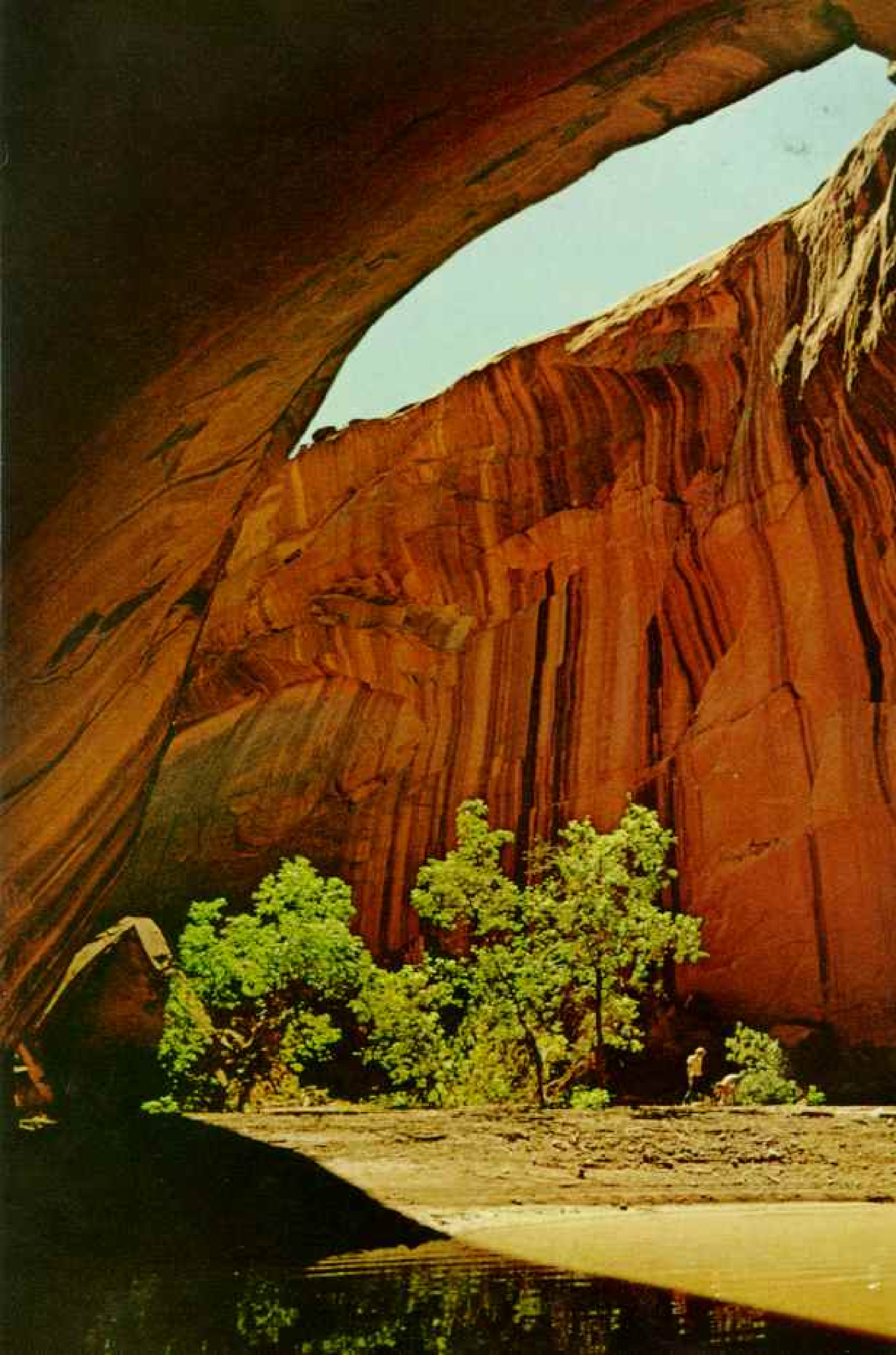
CANYON CLOSE-UPS reveal a hidden world of life in a region renowned for barrenness. Sharing the rock-ribbed habitat of more familiar desert creatures, mallards flock on a sandy bank of the Escalante, where wild asters bask at summer's end.

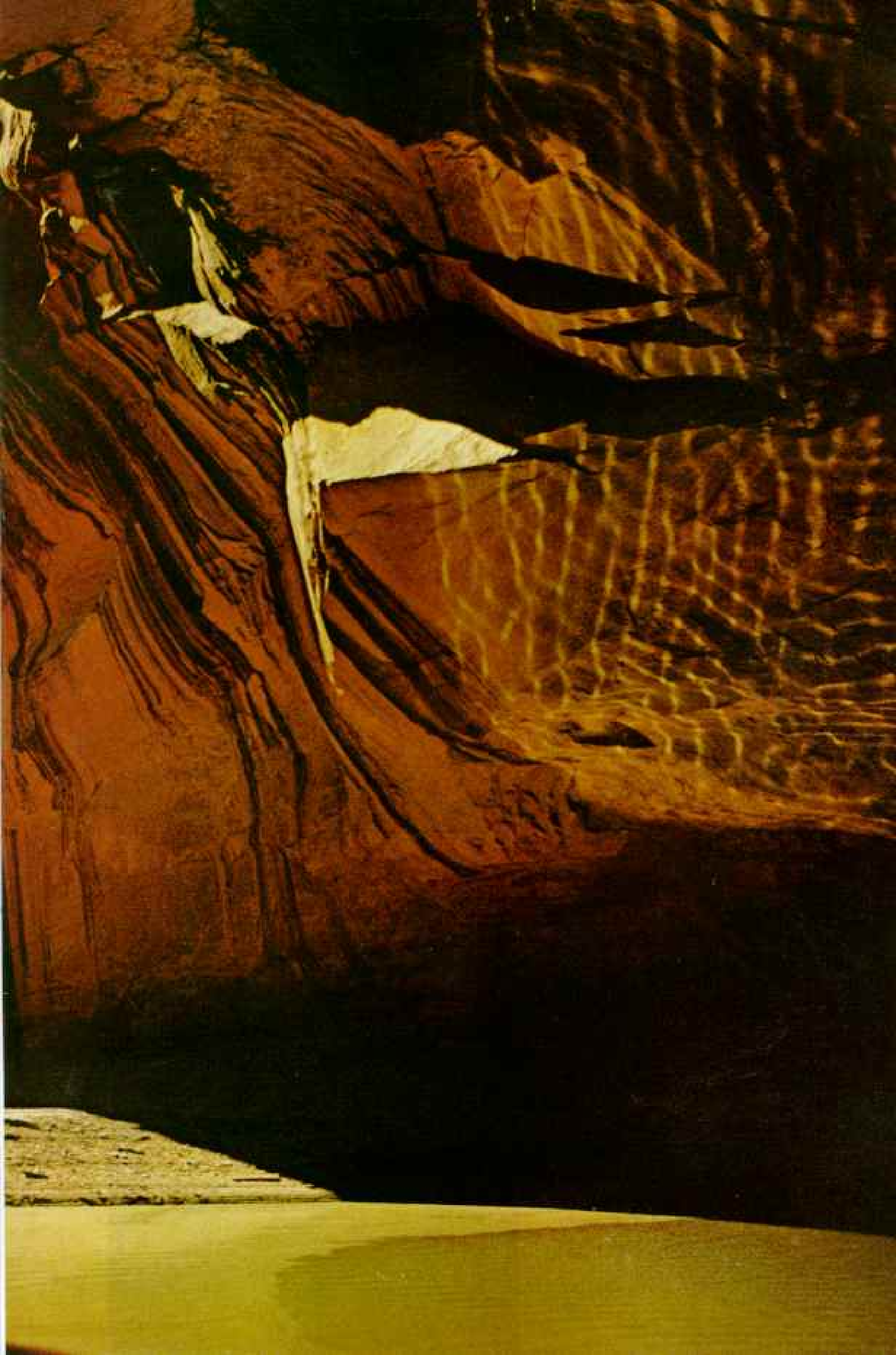
A backpacker beats the heat in a Coyote Gulch cataract.

“DESERT VARNISH,” caused by iron and manganese seepage, streaks the Golden Cathedral, a yawning pool-bottomed cavern (following pages).









TOURISTS have already left their marks on Dance Hall Rock, a natural amphitheater 40 miles from the town of Escalante. Here, in 1879, Mormons camped and danced while traveling to the San Juan Valley east of the Colorado River.

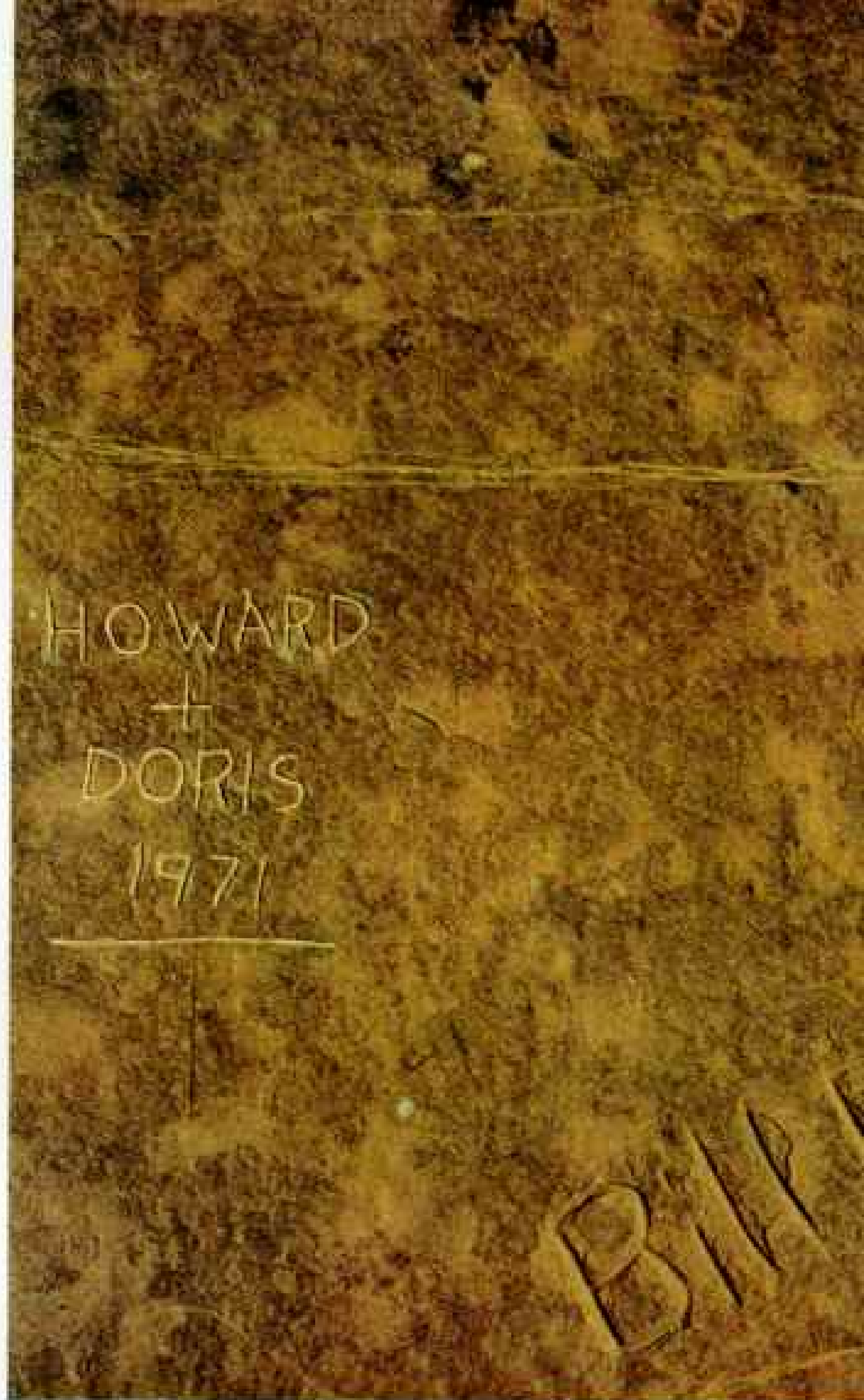
The vandalism disturbs Jack McLellan (upper right) of Salt Lake City, leader of the conservationist Escalante Wilderness Committee. He sees the graffiti as harbingers of the future, unless measures are taken instantly to prevent further desecration of the primitive wonderland.

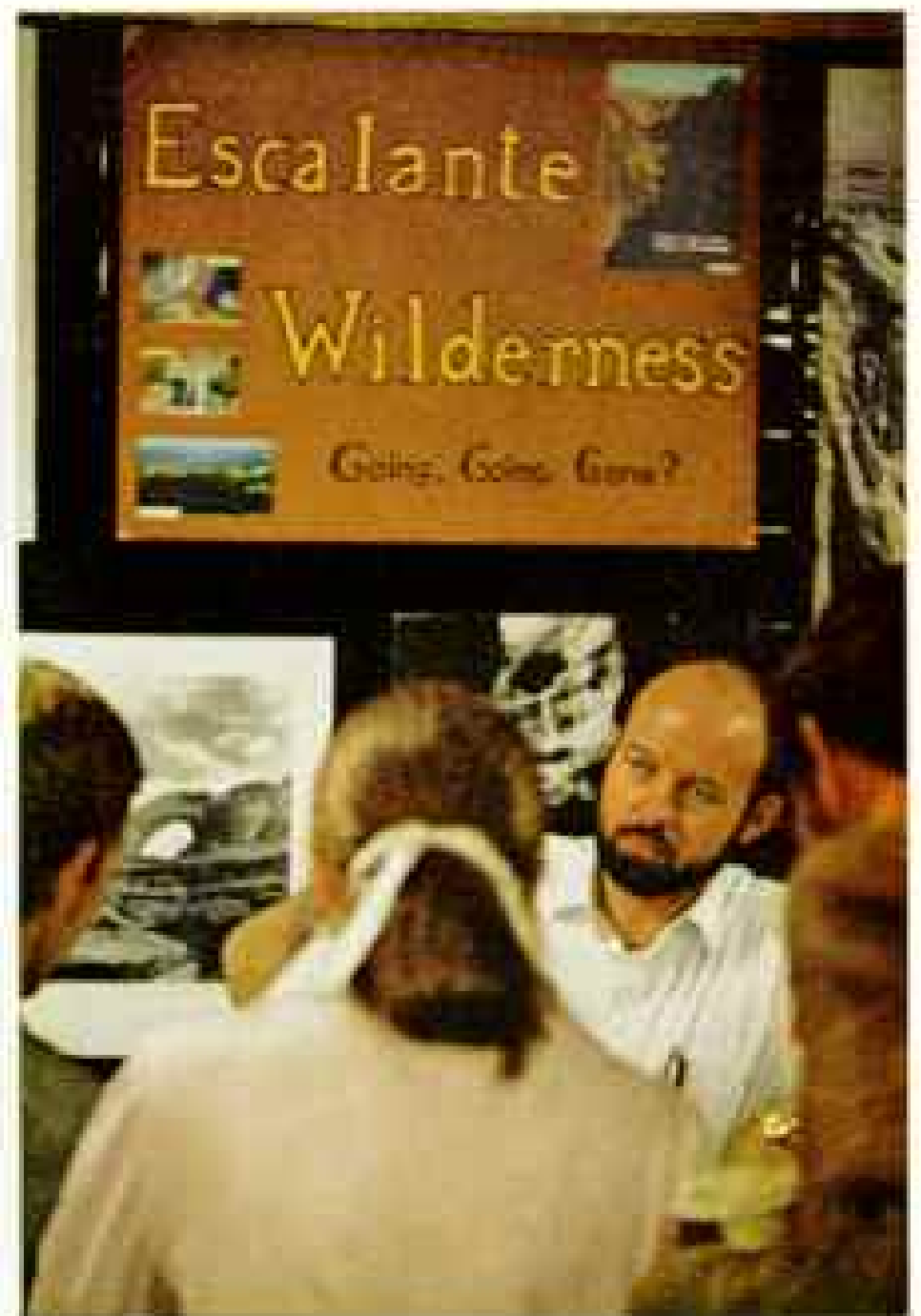
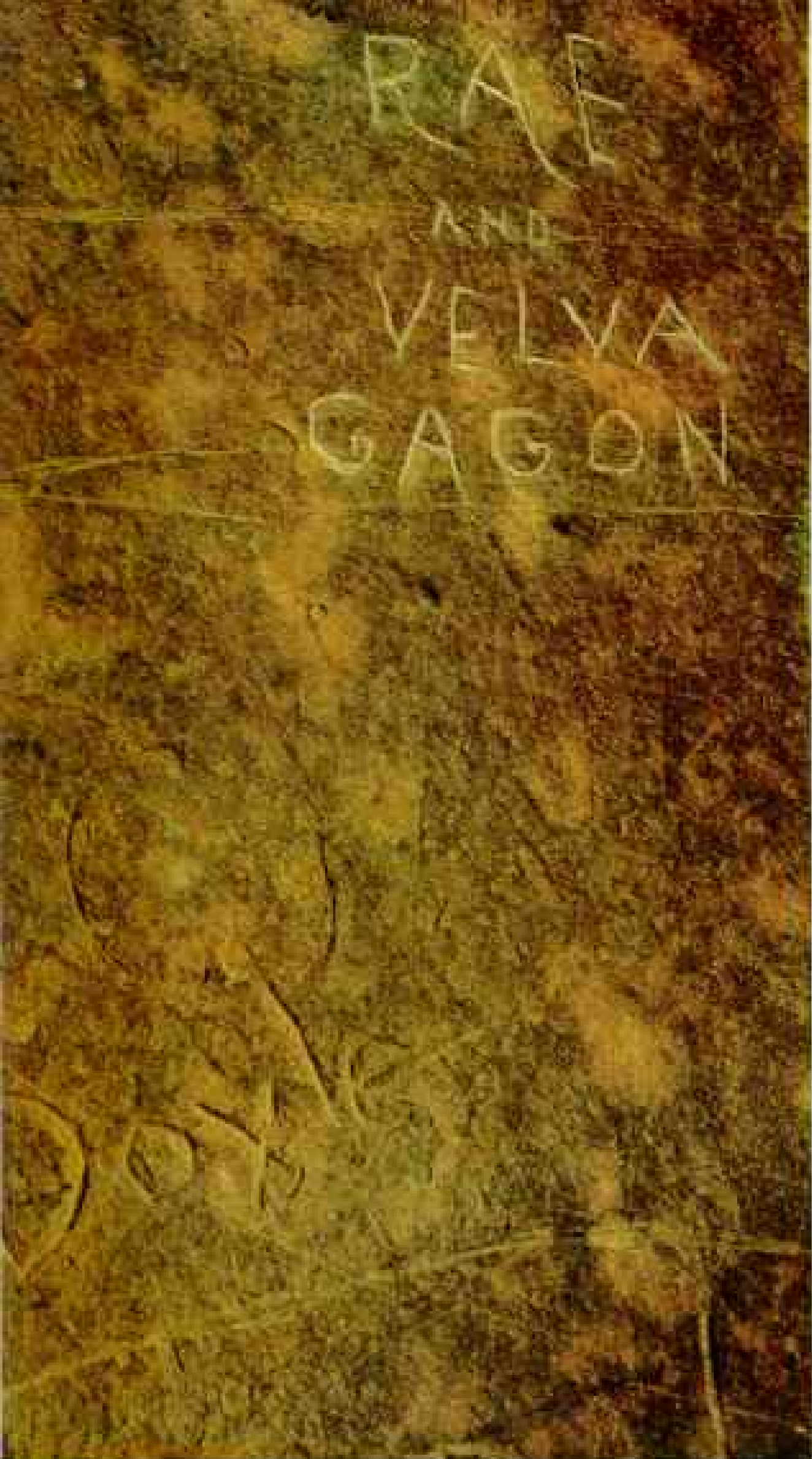
Mr. McLellan, in turn, disturbs cattle ranchers Melvin Brooks and his father Arlis (lower right), as well as Escalante businessmen Paul Steed and Dale Marsh (lower left). Mr. Marsh, also a county commissioner, reads from anticonservationist literature distributed by the local chamber of commerce.

The cattlemen fear, despite denials, that save-the-Escalante schemes by "outsiders" like Mr. McLellan include plans to revoke grazing privileges on the surrounding public land, making ranching impossible in this remote section of Utah. Cowboys grow grim at the thought of lost livelihoods, and traditional Western hospitality gives way to talk of frontier "justice."

"You a conservationist?" one of Escalante's 640 townfolk asks a visitor. "If I thought that was true, there'd be a horse comin' back to town with no rider. And blood on the saddle."

Businessman Steed, proponent of a tourist-funneling wilderness road and a new reservoir, is more tactful. "We all believe in conservation. But preservation for embalming something? To put it away and never use it? We don't believe in that!"





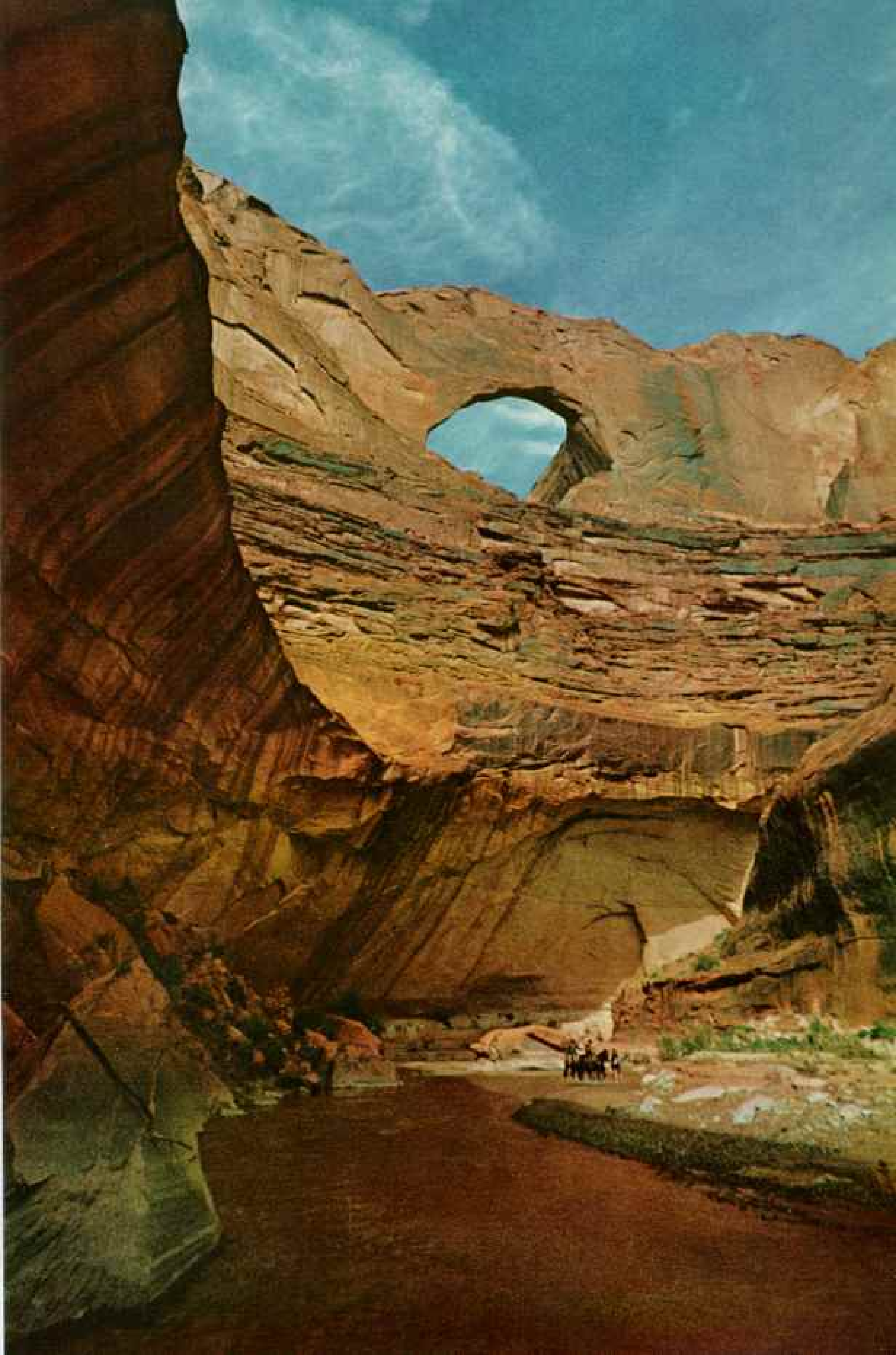
INDIANS tamed the canyon once, but nature took revenge. The Anasazi—the “Old Ones”—made their homes on high ledges in the canyon walls and cultivated crops on the river-watered floor. But, archeologists theorize, changing weather patterns brought crop failures and forced these probable progenitors of the Hopi and Zuni tribes south for survival in the 12th century.

Wind-smoothed Anasazi dwellings and granaries still remain, and

hikers still find Anasazi-chopped footholds (**below**) leading to the ancient ruins.

What irony, that a region abandoned because of uncertain rainfall should fall prey to flood! Lake Powell’s waters, at their peak, may eventually reach into Escalante Canyon almost as far upstream as Stevens Arch (**right**), the area’s most spectacular landmark. Its opening, 580 feet above the river, measures 160 feet high and 225 feet wide at the base.







SOFTLY PAINTED by velvet moonlight, pack-trip wranglers harry their animals from mesa to canyon floor before dawn. Horses and mules have trouble traveling the canyon's length; jumbled slickrock, lurking quicksand, and fallen rocks and boulders impede their passage.

Area ranchers know the hazards. They've heard the plaintive bawl of cattle sunk chest-deep in the sucking sand; they've tuckered many a cow pony searching for stray steers in the labyrinthine canyon. A makeshift fence post apparently rigged by a cowhand (right) anchors barbed wire that keeps livestock away from a precipitous slope.

The Bureau of Land Management, a federal agency, administers 1,005,000 acres of Escalante country. It recently designated 136,000 acres stretching along both sides of the river for preservation as an "Outstanding Natural Area."

But conservationists advocate even greater protection and have urged that the entire region be set aside as a wilderness area. Already the Utah Highway Department proposes a paved road that would cut across some of the Escalante's most primitive points. From Bullfrog Basin, site of a Lake Powell marina, the scenic highway would thread southwestward for 37 miles, passing near Stevens Arch, to a junction with Hole-in-the-Rock Road from Escalante (map, pages 272-3).

The lure of tourism inspired the highway plan and keeps it alive. Escalante businessmen support the road, though it would pass 40 miles southeast of town. Surely, they hope, some travelers' dollars would be diverted to their community. In a town of dwindling

population, where per capita annual income averages under \$3,000, such hopes are not to be scorned.

Some conservation groups foresee this road through the Escalante heartland as a gateway for abuse. Scenes of defilement—names scratched on canyon walls, litter, earth-churning dune buggies, and roaring snowmobiles—parade nightmarishly before their eyes. Jack McLellan and his letter-writing, speech-making band of protectionists back a different route—a Canyon Country Parkway System that would utilize existing roads between population centers while discreetly skirting the wilder areas.

The U.S. Congress now has pending before it several bills affecting the future of the Escalante. One of them calls for a study to determine whether all or part of it should be designated as a wilderness area. Such a study, conservationists hope, would kill, or substantially modify, the Highway Department's proposal.



IT DOESN'T LOOK like much, this silty sun-bouncing waterway called Escalante, where hikers wade at the entrance to the narrowing canyon. But few places are as unspoiled. In a state that vies with Nevada and Arizona as the Nation's driest, the Escalante River remains undammed and unpolluted by man.

Escalante ranchers want more water, though, and power companies say that Utah needs more electricity to forestall a predicted power shortage by 1976. Exploitation of the Escalante River would help both situations. Thus a proposal that the river be dammed for impoundment of 23,000 acre-feet of water. Most of the water would be fed to steam turbines that would generate power; coal mined from fields in the area would heat the water. Surplus water could go to local ranchers to irrigate feed crops.

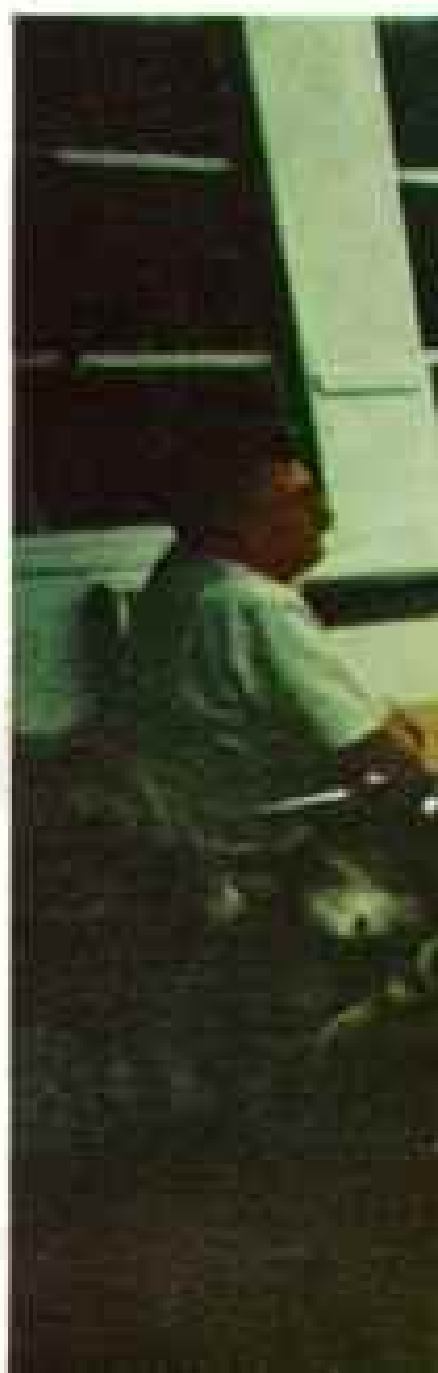
A new power plant would create many jobs and add millions of dollars to Escalante's tax base, a boon to tax-supported schools, road-improvement programs, and other public services. Irrigation would increase production of feed for cattle, which, though relatively few in number, are the area's chief economic resource. Cattlemen could approach schoolhouse meetings with Bureau of Land Management officials (**lower right**) somewhat less concerned about rising fees for grazing privileges on public lands.

An enticing prospect. Especially since, as Escalante businessman Steed puts it, "We're trying to move toward a change in attitude for this place. We want to make it attractive to our young people. Give them a chance to stay here or come back here to make a living."



Conservationists feel the cost is too high. The power plant, they say, will not only bring air pollution, access roads, and power transmission lines, but also coal mining and its attendant damage. They seek wilderness status for the Escalante to save its primitive grandeur for generations to come.

Thus, once more, a dilemma is posed—a difficult choice that must balance practical values of the moment against the diffuse, though very real, interests of tomorrow. The decision will affect not just a few Americans and a remote canyon, but all Americans and the future of their land. □





Amateur Gardener Creates a New Rose



Photographs by
FARRELL GREHAN

Text by
ELIZABETH A. MOIZE
NATIONAL GEOGRAPHIC STAFF

THE FRAGRANCE of a thousand blossoms stirs with the evening breeze as a tall spare man strolls down the rows of roses, scanning each bush with a practiced eye. Tag, the German shepherd, pads along behind, and the strident voice of Boop, the goose, shatters the quiet.

"I never really thought about the money end of the thing," muses Carl Meyer (left). "I just wanted to make me a good rose and say I made it."

There are about fifty recognized rose hybridizers in the world—those who develop new varieties by cross-pollinating one rose with another. Each of these professionals makes thousands of crosses a year in the hope of developing a plant worthy of acclaim as an All-America Rose Selection. This award is given to the best new roses as judged by 23 experts throughout the United States. Carl Meyer, an amateur hybridizer, won the award for his Portrait (facing page), a rich pink flower on a hardy bush. He is a pipe fitter for a meat-packing plant in Cincinnati.

"Anything Carl does, he does with all his energy," comments Sidney B. Hutton, Jr., President of the Conard-Pyle Company of West Grove, Pennsylvania. The company markets Portrait under its brand name, Star Roses. "That goes particularly for his hobbies. Carl played semiprofessional baseball until he was 42 and maintained a .340 batting average. Now he has become the first amateur rose hybridizer ever to win the coveted All-America award.

"Behind his determination lies talent. Other people may have made the same cross that produced Portrait, but only Carl Meyer recognized that he had something worth developing."

Carl continually bends to pluck faded petals from bush or ground. "He doesn't like all those dead petals," says Mrs. Meyer, his wife of 38 years. "He cleans up everything," she adds, "and I used to help him, but no

more. One time I snapped off one of his crosses."

Carl began experimenting in the summer of 1953 after seeing rose seedlings created by a local nurseryman. "I thought if he could make them, I could make them too," he says between sips of soda pop. "And I did."

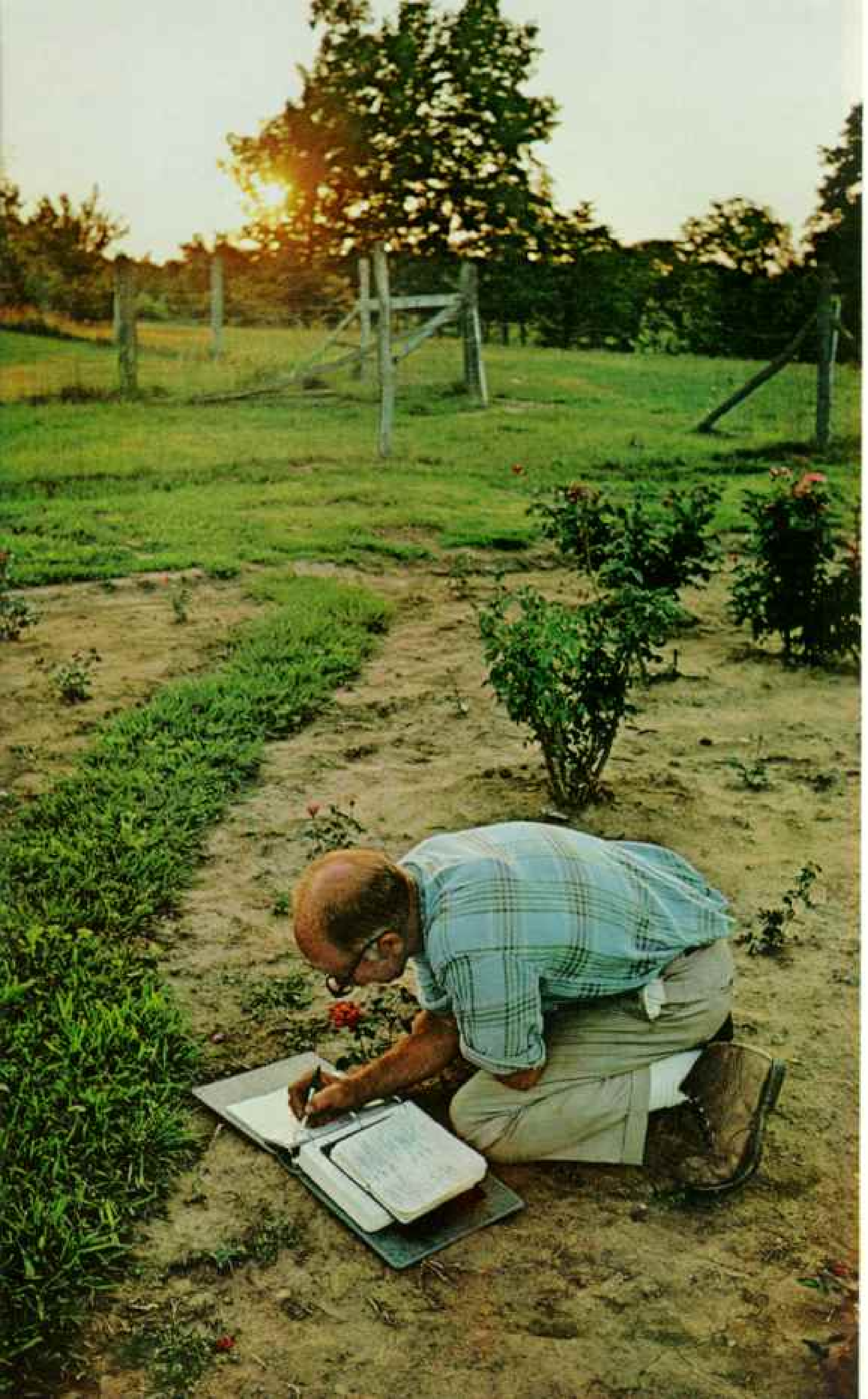
In 1961 he crossed well-formed Pink Parfait with many-petaled Pink Peace. Three years later he sent the most promising offspring to Conard-Pyle, where it became number 975 in their test garden.

"We studied about 600 new roses that year," says Richard Hutton, treasurer of the company. "Probably 95 percent of them came from professional hybridizers, such as the Meilands of France, who developed the fabulous Peace rose in the 1930's. After a year we thinned the ranks to 30, and by the third year we had a dozen that we were still testing. We finally chose six we felt were worthy of sending to the All-America Rose Selection trials. One of those was Carl's number 975, now christened Portrait."

The rose survived another two years of careful scrutiny by the AARS judges before being chosen one of two winners out of 43 competitors for 1972.

Eleven years between birth and the public debut of his offspring has not stilled the amateur breeder's desire to produce other superior roses. Each year Carl makes 250 to 500 crosses, using parents whose lineage he knows and respects for the qualities he is seeking: vigor, disease resistance, and good form—especially in the bud. Portrait is amazingly disease free, particularly from black spot, a fungus that is the bane of rose growers. His ultimate aim: "To make a rose called 'Beautiful.' I think it is going to be red, have yellow in the throat, and look just like velvet. When you see it, the only thing that will come to your mind is simply, 'Beautiful.'"





MY VACATION? Why, I spend it with my roses," says Carl. "I always take the first three weeks of June to make my crosses."

Throughout the year, in fact, he spends every possible moment with his flowers, and fortunately his wife understands. "He works Sunday morning, in the afternoon after the ball game, or whenever he has time. He goes into the garden and stands and stands. He evaluates things I don't see. He goes over the roses—petal by petal."

One trait a rose hybridizer needs is attention to detail. Carl keeps records of lineage, performance, and the outcome of particular crosses (facing page). He works with parents he can count on to produce healthy, attractive roses. "I guess it just boils down to this: If something works for me, I just keep working at it," he says. "If I'm getting results, why change?"

The anatomy of a rose became Carl's first lesson in hybridizing. A single flower can pollinate itself, because it contains both sexes—the male stamens that produce the pollen and the female pistils that contain the ovaries. In order to make a cross, Carl must first perform surgery.

Choosing the male parents, he picks the buds early in the morning with the dew still spangling the petals. He carefully cuts away the interior petals; removes the female parts, and places the flowers in pop bottles



while the pollen develops (top).

The female parents must be left on the bush for the seed to mature. "I like 'em high up on the plant, so that I get all the vigor possible," says Carl. Once again removing the petals, he emasculates the buds (center, left). When the ends of the pistils become sticky and ready to receive the pollen, he takes the male blossoms from the bottles and gently brushes the golden dust on the females (center, right). Finally, a plastic bag placed over the bud protects against cross-pollination by insects; a coded tag tells the parentage of each cross.





1



2

From one seed, an infinity of roses

WHEN FALL crispness calls for sweater and cap, the rose hip swells with seed, and Carl begins his harvest (1). From the hundreds of crosses he will get some 2,000 fertile seeds. To find out which ones will grow, he drops them in a glass of water (2); the heavy fertile seeds sink. He then places these good seeds in a refrigerator until planting time in January.

When Carl first began hybridizing, he started his seedlings, including Portrait, in his basement. Now he has a small 120-square-foot greenhouse for germination. When all danger of frost is past, he sets the seedlings outdoors, once again marking them for identification (3).

"I plant every one that comes up," says Carl. "If it can't live over the following winter, it isn't worth having."

"In the past nine years I have developed a strain of parent roses that are my own creation. I've got at least six, and I use them in most of my crosses. They are good sturdy plants and seem to have real disease resistance. Anything that black-spots or drops its leaves, I get rid of in a hurry."

When Carl decides that he has a rosebush and flower worthy of further testing, he sends budwood—a section of stem with a bud on it (4)—to Conard-Pyle.

The miracle of exact reproduction of hybrid roses lies in the bud. Grafted to vigorous wild-rose rootstock, a bud always produces a plant that is identical to the one from which it was taken.

After Portrait was named an AARS winner, Conard-Pyle began mass-producing the rosebushes, including raising the

"nursemaid" wild rootstock that grows, say gardeners, "horse-high, hog-tight, and bull-strong." This stock is grown from seed, dug up and sorted for quality, and replanted with part of the root above ground.

In July and August, an expert budder pares off buds, or eyes, from the hybrid, making sure the rear of each bud is exposed (5), so that it can unite with the understock. After cutting a T-shaped incision in the root bark, he inserts the bud (6) and secures the graft with a piece of rubber tape (7).

If the graft takes, the bud will sprout the following spring (8), and the original stems of the wild rose will be pruned just above the new shoot. The bush develops at least three healthy canes, or stems, before being dug up in the fall and stored in a cool, moist warehouse until time for shipment to customers the following spring.



3



4



5



6



7



8



Two-listed pipe fitter, Carl tightens a flange in the lard room of the E. Kahn's Sons Company, a Cincinnati meat-packing firm where he has worked for 34 years. He plans to stay on, despite his success as a rose hybridizer and the money he will earn from the royalties.





HOURS of patient determination will pay off for Carl Meyer. To protect the people who develop new flowers, fruits, and trees, the United States Congress passed the Plant Patent Act in 1930. For 17 years all Portrait rosebushes sold will bring Carl a royalty, which he will share with Conard-Pyle for producing and marketing his rose. The company prepared Carl's patent application (right), listing Portrait's genealogy (next page) and the characteristics that make it different from any other rose. The patent also lists the color chart used to describe Portrait, so that anyone can check an identical chart for the exact hue of the rose.

Commercial rose growers throughout the country produce Portrait under a licensing agreement with Conard-Pyle, paying a royalty for every bush sold. "Our established competitors never cheat," says Richard Hutton, checking a portrait of Portrait for Conard-Pyle's 1972 spring catalogue (below right).

"Carl is one of the most unforgettable people I have ever met," Mr. Hutton continues. "I love to walk with him through our test fields [left]. He eyes his competitors' plants with more curiosity than envy, speculating on the ancestry of each new flower. More than anything, though, he loves to see his own roses growing."

This fall Carl will once more harvest his seeds, and—much to his delight—so will grandson Mark; the 14-year-old has begun to cross his own roses. The long winter months will again test Carl's patience. But with another spring, as the buds open, he may find he has another candidate for an All-America Rose.





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A scrap of wood—crude epitaph to South Pole struggle

1910. The date is clearly marked on the scarred piece of packing crate. Some mittened hand pried loose the board and flung it aside. And there it lay in the Antarctic until another hand, years later, picked it up and entrusted it to the Society to preserve, a memento of polar exploration's heroic age.

The heroes of that age bore the names of Robert E. Peary, Roald Amundsen, Ernest Shackleton, and Robert Falcon Scott. Struggling on foot through uncharted miles of ice and snow, they broke trail for future explorers, who would come in Sno-Cats, jet planes, and nuclear submarines.

In 1910 Scott sailed for Antarctica. His objective: "to reach the South Pole, and to secure for the British Empire the honour of this achievement."

Shackleton had tried to win the honor the year before, but the bull-strong Irishman fell 112 miles short. That same year Peary had planted the Stars and Stripes at the North Pole. Would he now aim for a polar grand slam? Scott heard that

"the Americans are going."

Instead, it was the Norwegians who challenged him. Amundsen tersely cabled: "Am going south."

Amundsen! Scott underlined the name in his diary.

First to sail the icebound Northwest Passage, Amundsen had set his sights on the North Pole. Peary beat him to it. "This was a blow indeed!" the Norwegian wrote. "I resolved upon a coup." The race for the South Pole began.

Amundsen—like Peary—traveled on the ice with dogs, using them for dog food as well as for transport. "I figured out," Amundsen stated, "the precise day on which I planned to kill each dog..."

On December 14, 1911, eight weeks after leaving base camp at the Bay of Whales, he unfurled Norway's flag over the South Pole.

Scott also used dogs. But he relied mainly on unproven tractors and ponies to haul supplies over the ice. Both failed. Many of his dogs died. So men strapped on harnesses and pulled sledges up tortuous Beardmore Glacier.

On January 17, 1912, after a

strength-sapping march of 78 days, Scott and four companions reached the Pole. They saw sledge tracks and paw prints in the snow, the Norwegian flag flying.

"Great God!"

Scott's diary shouts his disappointment. "This is an awful place and terrible enough for us to have laboured to it without the reward of priority. . . . Now for the run home."

Run? It was a crawl—slow, painful, desperate. One man, "nearly broken down in brain," died. Another, frostbitten, disappeared in a blizzard. A blinding gale pinned down the others. Helpless, their food and fuel gone, they holed up in a tent and awaited the end.

Scott poured his remaining strength into letters and his diary.

His last words: "For God's sake, look after our people."

Inspired by the heroism of Scott, men continue to seek new heights of valor—in Antarctica, on Mount Everest, in space, undersea. Readers discover their deeds unforgettably chronicled in the pages of NATIONAL GEOGRAPHIC.



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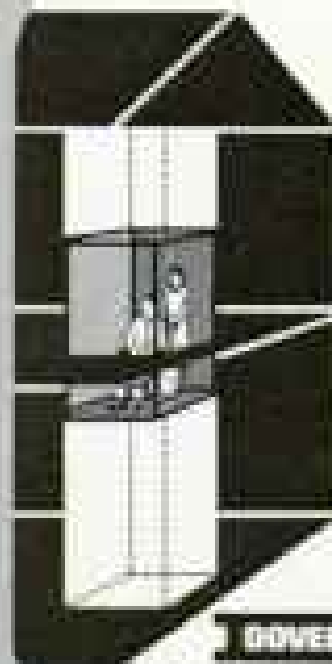
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THIAMINE (B ₁)	100%	104%
RIBOFLAVIN (B ₂)	100%	117%
IRON	100%	100%
CALCIUM	18%	29%
PHOSPHORUS	9%	21%
***VITAMIN B ₆	1.0 mg	1.05 mg
***VITAMIN B ₁₂	2.5 mcg	3.0 mcg
***MAGNESIUM	15.0 mg	30.0 mg

TYPICAL NUTRITIONAL COMPOSITION

	PRODUCT 19		PRODUCT 19 with 1/2 cup Whole Milk**
	% Total Weight	Amount 1 oz.	
Protein	8.5%	2.4 gm	5.7 gm
Fat	1.2%	0.3 gm	4.6 gm
Carbohydrates	81.0%	23.0 gm	29.0 gm
Calories		104 calories	188 calories

*Whole milk values derived from USDA Handbook No. 8 and USDA Report No. 36.

**Carnation D Sterilized Milk at 400 (16F) units/quart.

***Minimum daily adult requirements have not been established.

Kellogg's PRODUCT 19®

