DOUBLE MAP SUPPLEMENT: THE MEDITERRANEAN SEA

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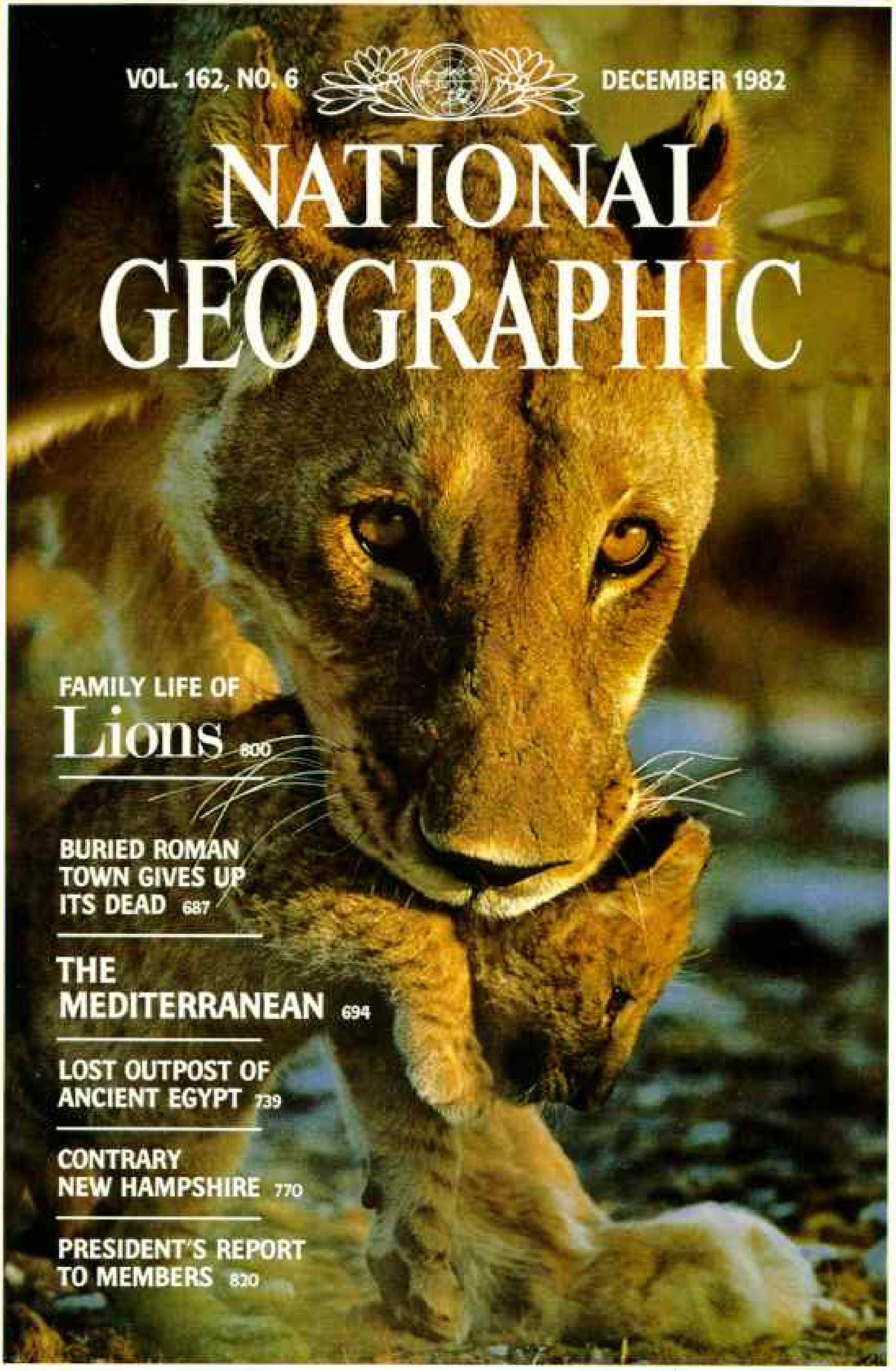
NATIONAL GEOGRAPHIC



OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

THE *Chicago Tribune* reports that high-school teacher Jerome Burgess for ten years opened his geography course by asking a student to come forward and point out the United States on a world map. Not once did the first student succeed—nor the second. But by semester's end most of his students had a basic geographic literacy.

Not true for most Americans. In an age—or perhaps at an age—when shocking statistics no longer shock me, I am still dismayed that in the United States, unlike most countries, a student can graduate from high school without a single course in geography.

Mark Twain, through that literary paragon of youthful illiteracy, Huck Finn, satirized the problem in *Tom Sawyer Abroad* when Huck assured Tom that their balloon had not yet reached Indiana because it was still green below. He had seen Indiana on a map, and it was pink.

A worldly-wise photographer assigned to cover the Jonestown mass suicide in Guyana prepared to leave for Africa. I'm from Missouri's second largest city, Kansas City, but many I meet think mistakenly I'm a Kansan.

Even though National Geographic Society headquarters has been in Washington, D. C., since 1888, a lot of mail to us each year is addressed to Washington State.

Such stories can be funny or, at worst, embarrassing, but ignorance of geography can result in business losses or failures and lead to tragic mistakes in international affairs. We fought a ten-year war in Southeast Asia. Yet many of us—like the students in Chicago—could not point out Laos, Cambodia, or Vietnam on a world map. It's conceivable a better understanding of Asia's historical and political geography might have helped win, shorten, or even prevent the war.

We can't promise that reading the GEOGRAPHIC will erase the problem, but this month's issue, more scholarly in approach than usual, includes an article and double map on the Mediterranean that offer more new geographic information than many a textbook—and a lot more interestingly.

To be fair, those students in Chicago may be no more geographically illiterate than previous generations, but that doesn't excuse the problem. Any generation that can master Pac-Man* can cope with continental drift.

Wilbur E. Garrett

EDITOR

NATIONAL GEOGRAPHIC

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COVER: *Gentle as any fireside tabby, a lioness moves a month-old cub in Namibia's Etosha National Park. Photograph by Des and Jen Bartlett.*

ON THE SLOPE OF VESUVIUS

A Buried Roman Town Gives Up Its Dead

By JOSEPH JUDGE
ASSOCIATE EDITOR

Photographs by JONATHAN BLAIR

THESE WERE SIGHTS not to be forgotten: An ancient Roman lady emerging from a tomb of volcanic rock, her hand glorified still, after 1,903 years, by the shine of gold rings set with gemstones (***left***).* A few feet away, an armed skeleton sprawling face down on the pumice-covered sand of a onetime beach. One end of a boat's hull breaking the surface and, beside it, perhaps the dead helmsman. In nearby chambers, a dozen, two dozen, maybe more, of the dead—skeletons in anguished poses, a truly pathetic scene.

And smaller things: bronze and silver coins, an ingenious combination-lock money box that still held two coins (***below right***). They speak of headlong flight for life, of grabbing the valuables on a dead run.

But the cruel end came swiftly for these citizens of the small seaside town. Herculaneum was blasted and buried under more than 60 feet of ash by the same stupendous eruption of Mount Vesuvius on August 24 and 25, A.D. 79, that destroyed and entombed its famous neighbor, Pompeii.

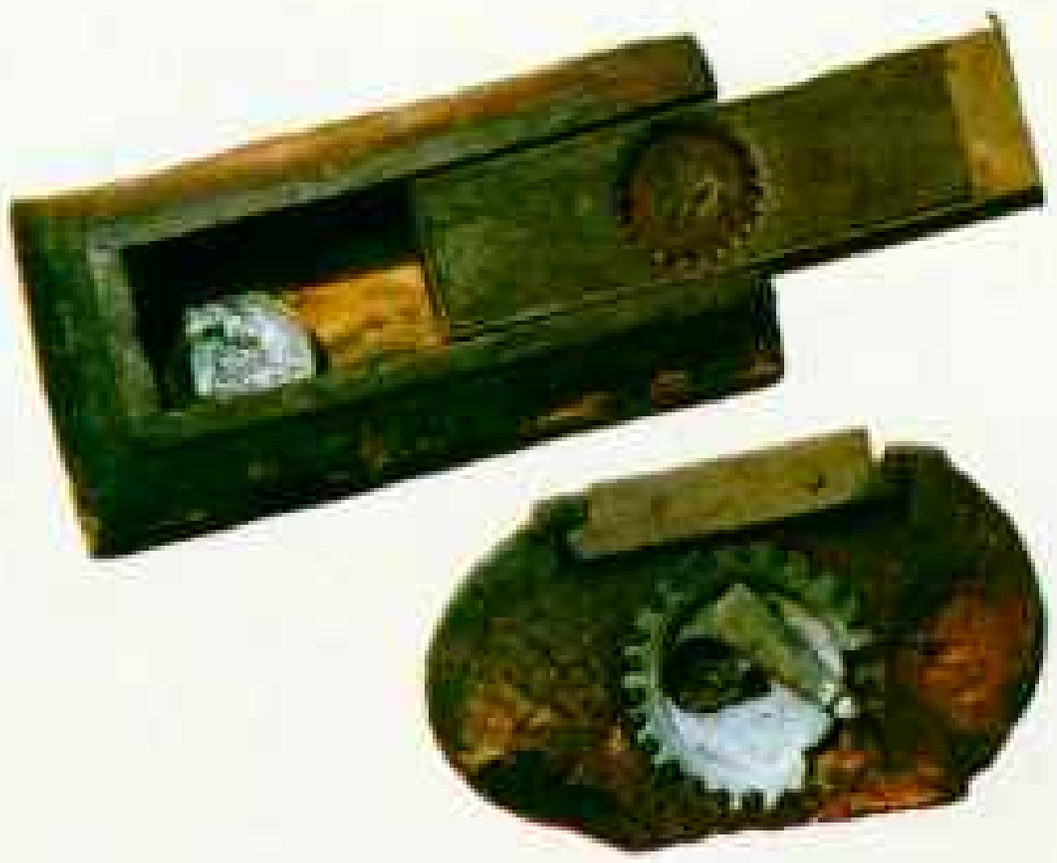
After 1709, when a well digger broke through to an underground theater, the buried town was quarried for art objects. Bronze and marble statues, wall paintings, mosaics, and furniture were hauled out through shaft and tunnel and carted away to museums and palaces, helping to foster two centuries of neoclassicism.

In the last century archaeologists began to remove the huge blanket of volcanic debris, revealing streets in a square pattern, spacious houses, and, most recently, the old beachfront. A Roman benefactor, probably a wealthy proconsul, had built out from the town wall a large public bath. A temple and another religious building are joined to it with two terraces that are supported at beach level by arches.

During excavation of the bath, groundwater seeping into the dig became a problem. Italy's Ministry of Public Works provided funds for trenching along the old beach, and there, under the arches, Herculaneum began to yield its hidden dead.

The discoveries are overwhelming; few other complete skeletons of ancient Romans survive. And the work is just beginning.

*Rings displayed on the second metacarpal were found where indicated above the knuckles.



LIKE PASSENGERS from a time capsule, the newly found dead of Herculaneum bring with them tales of everyday life during the Roman era. The low-sugar diet of the times helped keep teeth as sound as those in the skull displayed by Giuseppe Maggi, director of the excavations (***below***).

The modern town of Ercolano (***facing page***), a suburb of Naples, stands on top of the river of ash that buried the old town. Today greenhouses spread over the rich soil and surround the great pit where the Roman town lies revealed. While nearby Pompeii has received much of the tourist attention, Herculaneum also gives the visitor a genuine sense of daily life in a small town.

Built on the lower slopes of Mount Vesuvius, background, with a prospect of the Bay of Naples, it must have been a pleasant place to live for its 4,000 people. Although Herculaneum had known war and, in A.D. 62, a shattering earthquake, the homes of its wealthy were spacious, lighted by atria, and beautified by gardens.

Since not more than ten human skeletons had been found earlier in the years of digging, scholars assumed that most of the population had been able to escape to safety. Thus, when the remains in the chambers beneath the terraces and on the beach came to light, it was both a shock and a surprise.

The Roman beach level lies in the immediate foreground, hard against the wall of mud that marks the limit of excavation. The present shore of the bay is 500 yards away.

With their belongings from everyday life, the skeletons are an archaeological prize of incalculable value. But they were in danger of deterioration as the wet mud in which they were entombed shortly began to dry.

NATIONAL GEOGRAPHIC responded to a call for assistance. (See President's Report, page 820.) As a result, Sara Bisel, an expert in ancient bones, soon arrived at Herculaneum and began a five-week crash program in which she excavated, bone by bone, 26 skeletons (***below left***).

Washed, dried, and dipped in an acrylic-resin solution (***below right***), the bones harden, ensuring time for study and reconstruction. In a museum built beside the site in 1980, Dr. Bisel will re-create the drama of the final moments, but it is a drama whose last act is far from being played out.

"EVEN THE GODS wish they had not the power," cried the poet Martial after Mount Vesuvius exploded, sending its billowing tower of ash and pumice 12 miles into the Mediterranean sky. For 18 hours a drizzle of ash darkened the world, accumulating eight inches at Herculaneum and burying Pompeii under nine feet.

Many fled but others stayed on, awaiting rescue by ship, hoping the worst was over. But the worst, on the following morning, was an event of supreme horror. A blazing hot stew of pumice, ash, and gas, drawn down by gravity from the vast column in the sky, fell like a waterfall toward the town.

Just ahead of it at 60 miles an hour roared a black comet of ash, gas, and rock. It took no more than five minutes for this awesome angel of death to reach, blast, overwhelm, and obliterate Herculaneum.

Among the victims trapped on the beach (***above***) was an armed man, slammed to earth on a sword and scabbard that were buried with him (***above right***). A gold coin

National Geographic, December 1982

PAINTING BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BOND; SIRRI BRIMBERG (BELOW LEFT)

in his purse commemorated Emperor Nero, who died in A.D. 68 (***facing page***).

A woman, whose skeleton was badly shattered, appeared to have been blown onto the beach from the terrace. She was found near a third victim. The woman with the gold rings died in the archway.

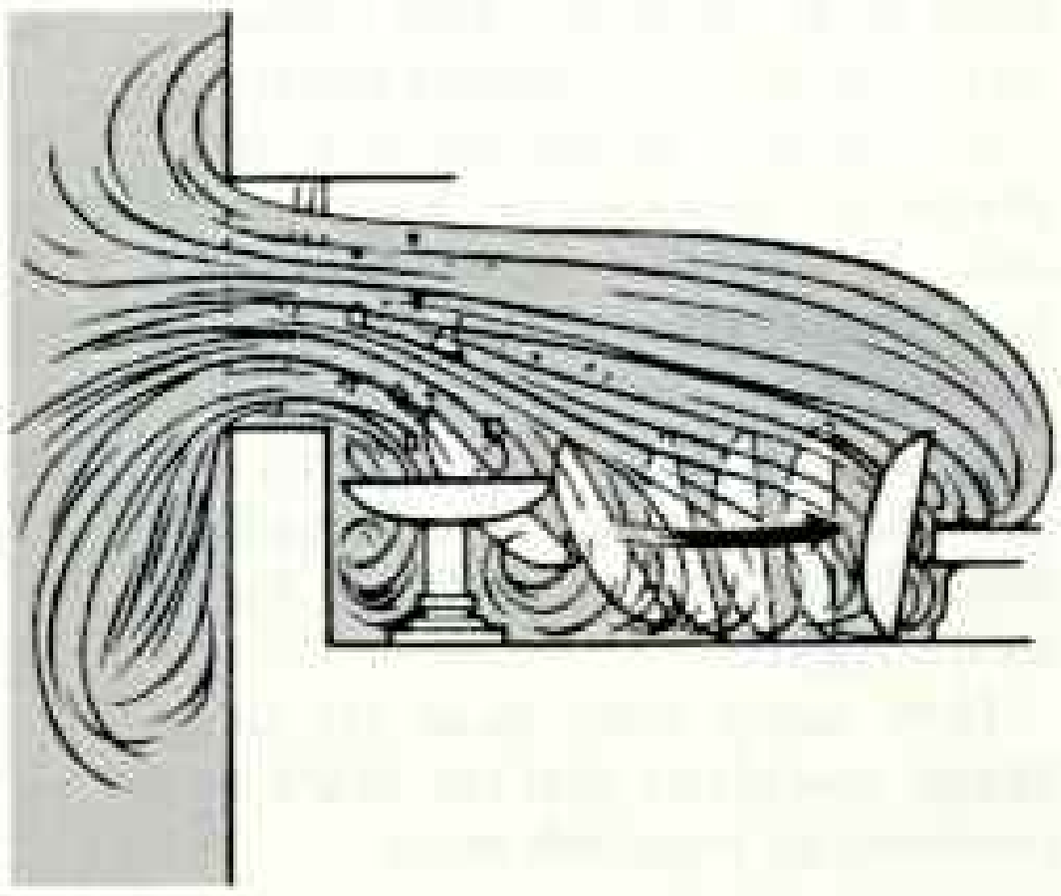
A boat was flipped keel up by a turbulent sea and dry-docked—an incredible find from Roman times, with its hull nearly intact (***right***).

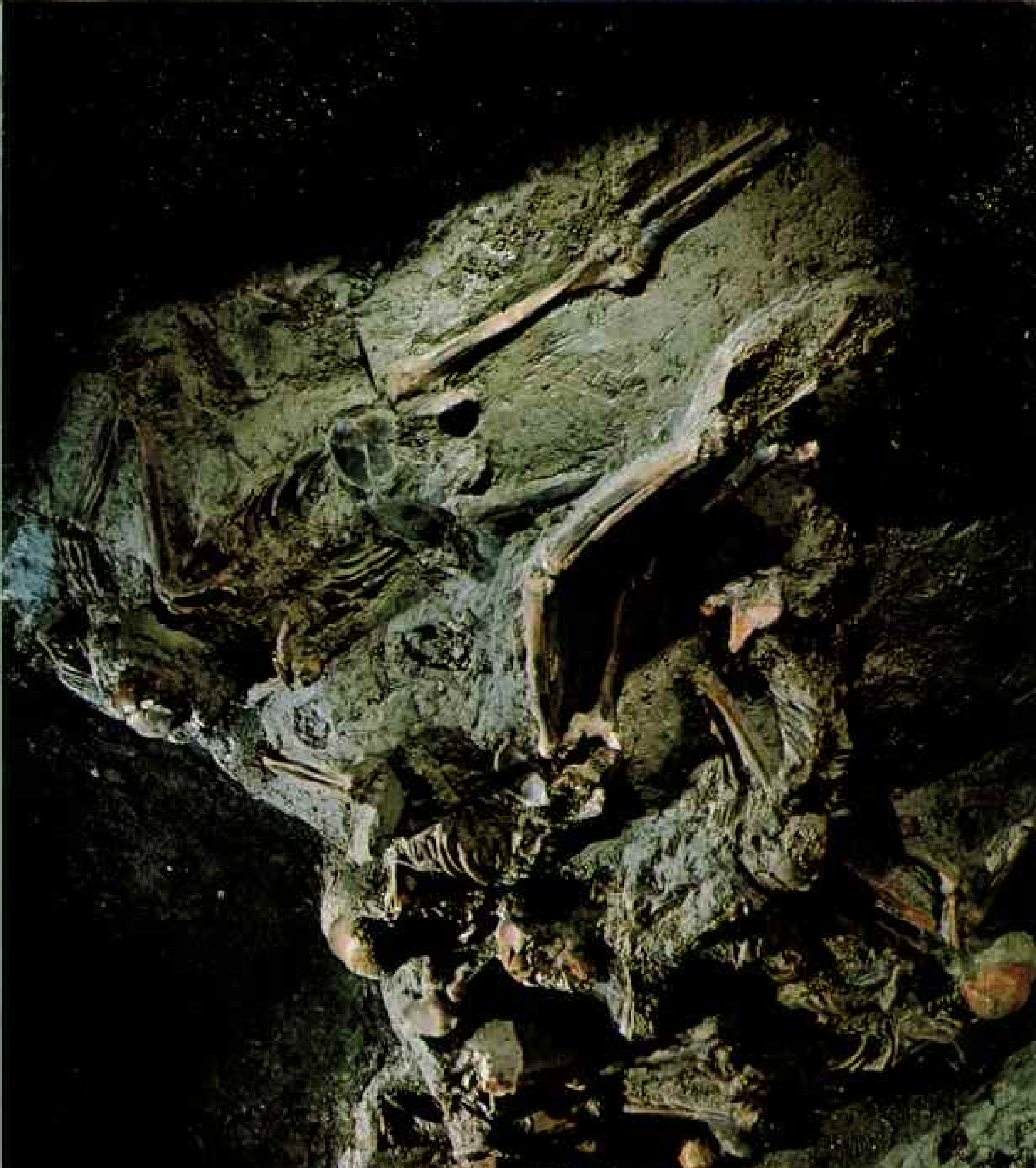
How many more dead are there? Dr. Maggi speculates that the beach may be a cemetery for hundreds more.

NATIONAL GEOGRAPHIC ART DIVISION (BELOW)

THE KILLER STILL STANDS in the door of a public bath (***above***)—part of the hot ashflow that inundated Herculaneum, left in place as testimony to the power of the event. The surge and wave of pyroclastic matter burst through the double-paned window that once looked out to sea (***right, top***), flung the heavy marble basin across the room (***bottom***), and peppered its bottom with broken glass (***center***). The view from the window today is of the lower part of the 80-foot mud wall that still blankets the old seashore.

Nearby and on a lower level (***opposite***), another chamber revealed what Dr. Maggi calls "a masterpiece of pathos"— the skeletons of six adults, four children, and two infants in embraces of protection, agony, and death. The urgent effort to preserve the skeletons for reconstruction is being funded by the Society. As digging proceeds, Herculaneum will surely yield other scenes from its last moments, an unforgettable tragedy in the life of Mediterranean man. □

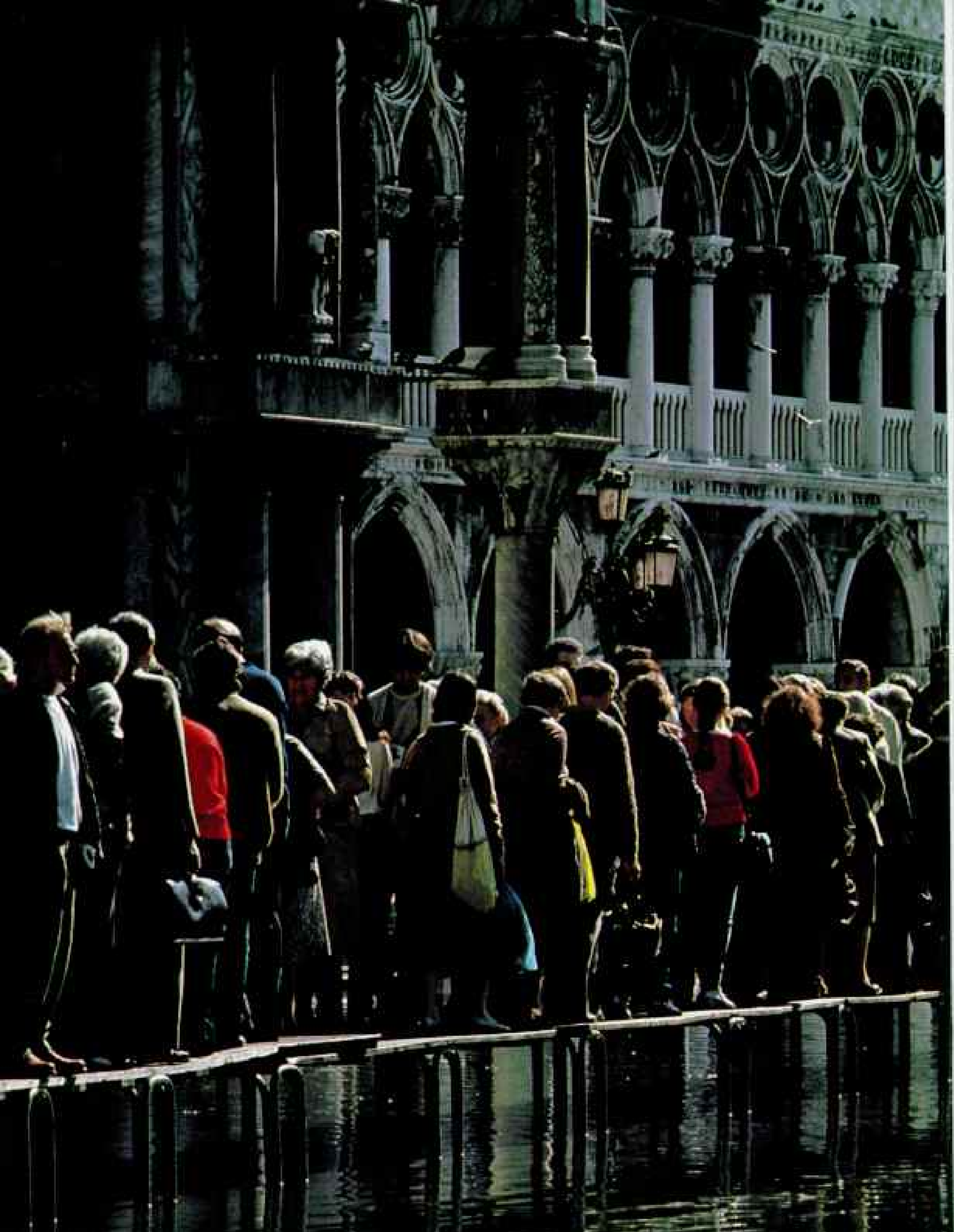




THE MEDITERRANEAN
Sea of Man's Fate

By RICK GORE NATIONAL GEOGRAPHIC SENIOR WRITER Photographs by JONATHAN BLAIR

No sea of tranquillity, as the volcanic sputtering of Stromboli attests, the Mediterranean keeps earth scientists busy trying to fathom its volatile evolution, even as its nations confront the problems of pollution and exploding populations.



They came, they saw, but the sea conquered *St. Mark's Square in Venice, where visitors teeter across a temporary bridge before the Doges' Palace. Venice suffers several major floods a year, with sea level rising and the city sinking*

along with the Adriatic basin, depressed by accumulating sediments. Venetians also blame a canal dredged for supertankers in the waterfront lagoon. Meanwhile a plan to jack up buildings and install emergency tidal gates languishes.


FOGUERES
DE

Tourism burns *in effigy. During the century-old festival of the Bonfires of St. John (Joan in the Catalán tongue) at Alicante, Spain, a display satirizing that nation's popularity among visitors flares at the town hall. The plaster figure, on parade earlier* ***(above)****, portrays the tourist as a locust, drawn by the magnet of Spanish shores. The insect crushes a windmill of Majorca, most commercialized of Spain's Balearic Islands, as mice, representing ministers of tourism, stand helpless before the invading multitudes.*

Spain attracts 40 million visitors each year—and pays a price for success. Even tourism officials now regret high-rise resort developments—dubbed the "great wall of Spain"—that have sapped coastal resources.

"Civilization exists by geological consent, subject to change without notice."

—WILL DURANT

HALFWAY THROUGH our crossing I have come on deck to watch the Rock emerge from the mist. Inside, the lounge of this ferryboat from Morocco is pulsing with Mediterranean merriment. An off-key Spanish soprano sings of Gypsy matters, a guitarist strums, and the polyglot passengers clap, cheer, laugh, and toast one another. Impeccably dressed children get hugged, and picnic baskets are emptied of their cheeses and olives, their fruits and fragrant fresh breads.

On deck the massif of Gibraltar grows more distinct (above). If rocks could speak, this one could spellbind. It could recall, for instance, how the dinosaurs died and how the Alps were born. It could describe how Africa and Europe slowly collided to create

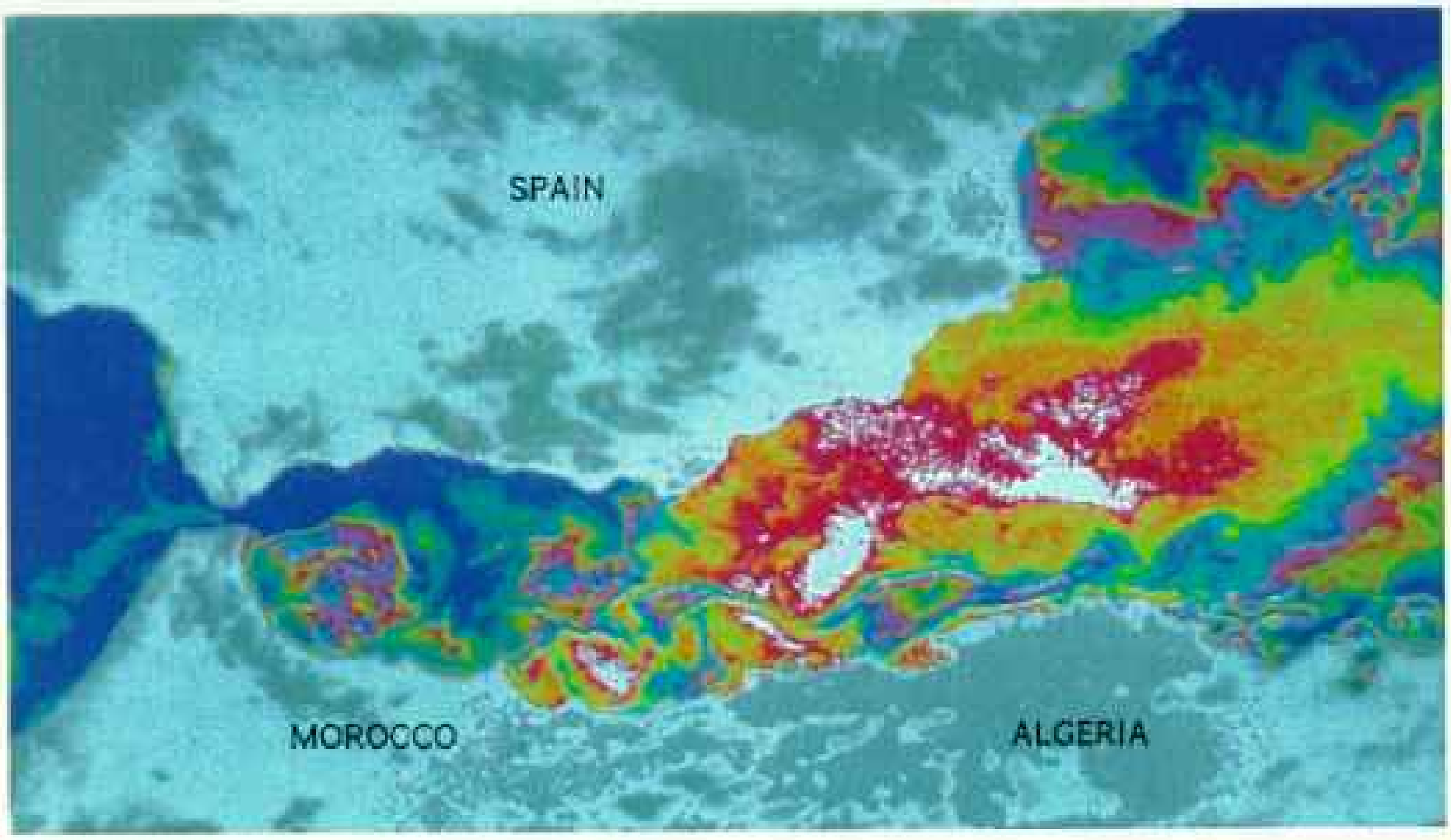
KEVIN FLEMING

this sea over which it still stands sentinel.

The Rock could speak also of man. The first remains of the Neanderthals were discovered in its recesses. During the Stone Age the Rock had watched its Neolithic inhabitants make fire and pottery, and farm and hunt on its terraces. In a 14th-century battle between Spaniards and Moors it saw in its bay perhaps the first use of cannon in Europe. Even though the tongue of water it guards is only 13 kilometers (8 miles) across, much of Western history has passed through this strait and much of Islam's across it.

Yet man's comings and goings are but an instant to the Rock. It was born in a primitive pre-Mediterranean sea some 160 million years ago. Many geologists think the Rock then became a wanderer, part of a slab that shifted from somewhere north of Algiers, wedging between the colliding continental masses of Africa and Spain some 55 million years ago.


FRANCE
ITALY
SPAIN
AFRICA


SPAIN
MOROCCO
ALGERIA

COPYRIGHT METEOSAT, SUPPLIED BY EUROPEAN SPACE AGENCY (ABOVE); CENTRE DE METÉOROLOGIE SPATIALE, LANNION, FRANCE; COLOR IMAGING BY LOCUS PHOENICS, INC.

Weather and water patterns *of the Mediterranean unfold through color-enhanced satellite images. Last March clouds spiraled around a winter nemesis called a Genoa low, or lee cyclone (**above**), lashing southern Italy with winds of more than 80 kilometers per hour. Such storms often begin when a cold front moves southeastward across Europe and slams into the Alps. The mountains help create a vortex that feeds on moisture from the Gulf of Genoa. Blustering east, it often drives storm surges up the Adriatic to flood Venice.*

Genoa lows sometimes pull behind them the mistral, a gale that can set teeth chattering for days in Marseille as it howls down the Rhône Valley. A frigid cousin, the bora wind gusts up to 180 kilometers per hour along the northern Adriatic coast. From Africa the oppressively hot sirocco rises from the Sahara and flows north to bake Italy.

Winter is sent packing by the Azores high, a pressure zone that dominates from late May through September, bringing northerly breezes.

While the moon and sun tug only slightly on the Mediterranean's small area, keeping tides gentle, weather drives its complex hydrology. Summer heat causes massive evaporation in the eastern basin. As the Mediterranean's saline water cools in winter, becoming denser, it sinks and flows westward out through the Strait of Gibraltar. Above this deep Mediterranean water, a less saline stream flows in from the Atlantic.

*Over the long run, these two currents go their separate ways. But an infrared image (**left**) reveals the clash of their differing temperatures at the surface south of Spain in a great swirl called a gyre. Around its edge, dark blue marks cold water that has welled up from the depths. Red and yellow toward the center show warmer surface water.*

One's first glimpse of the Rock is unforgettable. Something springs from our unconscious storehouse of myths. The Romans called the Rock and a similar peak, Jebel Musa, on the Moroccan side, the Pillars of Hercules. Here, at the ends of the classical world, it was said that Hercules had pushed the two continents apart. Intuitively the ancients grasped what modern geology is just now explaining—that continents can rise and fall and move about.

For instance, the ancient Greeks believed that the island of Delos, once the center of their civilization, had wandered through primordial seas awaiting the birth of Apollo and Artemis. Indeed, science now knows that Delos and many other Mediterranean islands have moved around, like the Rock. Corsica, Sardinia, and a part of Italy swung away from France and Spain. (See **The Mediterranean Sea**, a double map supplement to this issue.)

KEVIN FLEMING

Bones of mythical giants *to the Greeks, fossils like this seven-million-year-old rhinoceros lower jaw remain on what is now the island of Samos. Such mammals roamed ancient land areas of Asia and Europe before the Aegean Sea was formed.*

If rocks could speak, everywhere from Corfu to Sicily they would recall Ulysses and tell tales of Cyclopes and sorceresses. But they would speak in the language of the gods. This is the age of men. A sudden crash awakens me to that fact. A box of garbage has hurtled down and splattered on the sea. Modern reality. Man no longer mythicizes his mare nostrum. Today he muddies it.

MY ODYSSEY, which I am just beginning, is a scientific quest. I want to learn why there is a Mediterranean. How do its currents flow? Why do its famous winds blow? Why is it ravaged by earthquakes and volcanoes? How serious is man's pollution?

Yet it is so hard to stay on course. Everywhere in this sea, sirens lurk. They tempt me to linger on history and myth, on art and religion. I know I will not be able to ascend Mount Etna without feeling the presence of Vulcan. When the frigid mistral blows, I will suspect Aeolus. When I explore the caves of Crete, I will meet Minoan eyes. In the sewage-fouled waters off Alexandria, Cleopatra will still sail. Venetians and Turks, Saracens and crusaders, emperors from Claudius to Bonaparte will all beckon.

So be it. Journeys in the Mediterranean have always gotten sidetracked. And who could ask for better traveling companions.

For the time being, the rocks of the Mediterranean will guide my course. These rocks hold many surprises. Those of eastern Italy, for instance, were once part of Africa. So were the southern Alps. They were part of a chunk of land that broke loose from North Africa. Later, according to geologist Bernard Biju-Duval of the French Petroleum Institute, the chunk rammed into the underbelly of Europe as Africa moved northward (pages 710-11).

That same thrust from the south shoved up not only the Alps but also all the mountains that now ring the Mediterranean. Only in the southeast, where Sinai and the Sahara meet the sea, does the Mediterranean have a gentle coast. At times I think mountains may be more integral to the Mediterranean than water. For the Mediterranean, we now believe, dried out completely.

An evaporated Mediterranean? In 1970 the deep-sea drilling vessel *Glomar Challenger* discovered that a layer of salts, in places more than two kilometers thick, covers the seafloor. These evaporites indicate that around six million years ago the Mediterranean did indeed lose its water.

How did it happen? Until 70 million years

ago, the Mediterranean was an open seaway extending far to the east. But slowly Arabia swung northward into Turkey, making the young Mediterranean an Atlantic gulf. Then the rocks of Africa and Iberia finally closed in the west, creating a natural dam at Gibraltar.

"If that happened today, the Mediterranean would dry up again, because more water evaporates here than the rivers and rainfall replenish," says paleontologist Maria Bianca Cita, who was aboard the *Glomar Challenger*. "You would get a drop in sea level of one meter [three feet] a year," adds one of her colleagues, geologist Kenneth Hsü. "You'd get the Mediterranean dry in about 1,500 years."

The Mediterranean desert, a shimmering no-man's-land of brine lakes and playas 2,000 meters (6,500 feet) deep, existed intermittently for half a million years. Long, green freshwater oases radiated from the mouths of the rivers that feed the Mediterranean. Having to fall much more steeply, the Rhône incised a deep canyon as far upstream as Lyon. A still more spectacular Nile gorge began at Aswan and cut its course several hundred meters beneath where Cairo sits today.

If the desert formed in a geologic instant, it disappeared even more quickly. About 5.5 million years ago the fossil record shows a sudden return to marine fauna. Scientists debate just how water broke through at Gibraltar. Perhaps an earthquake burst the dam. Perhaps the sea level rose enough to send Atlantic water over the top.

"The Mediterranean had to refill in less than a hundred years," says Bill Ryan, a marine geologist on that voyage of the *Challenger*. He believes the breakthrough was a catastrophic cascade. "That would take the equivalent of 170 Victoria Falls. You'd need 15 Victoria Falls just to equal the water the sun would evaporate.

"Maybe the dam's bursting is what caused man's ancestors to stand upright," he jokes. "To run the hell away."

I HAVE BEEN sidetracked. I am in the Aegean. I have taken this tiny ferryboat from Kuşadasi in Turkey to the Greek isle of Samos. The sea is limpid, the blue sky dazed with Aegean light, the mountains of Turkey spectacular, and my thoughts are of Amazons.

In the age of gods an army of Amazons made this same crossing pursued by Dionysus, who slew them. Their bones were left to parch on mountainous Samos.

I go into those mountains, where indeed since antiquity many large bones have been found. The bones intrigue me. Another myth says they belonged to terrifying beasts called Neades that once lived on Samos. The horrible loud cries of the Neades, the ancients said, could fracture the earth.

THE BONES I see at a museum in the town of Mytilinii are not those of Neades, but of creatures whose closest relatives, oddly enough, were native to China millions of years ago. Despina Platia, the museum's self-educated curator, points out the remnants of rhinoceroses, mastodons, hyenas, a one-meter-tall horse, and a *Samotherium*—a large short-necked giraffe discovered on Samos. "So many animals were found together," says Platia, "that this must have been a water hole."

Perhaps they died in a volcanic eruption, a fire, or a sudden flood. More likely it was drought that killed this strange assemblage of creatures some seven million years ago, according to Greek paleontologist John Melentis.

Then, on the Aegean's other side, the Mediterranean's rocks surprise me again. At the University of Athens paleontologist Constantin Doukas tells me that a similar assortment of bones was found nearby.

Thus, the two sites were connected. Mountainous Samos, and indeed the entire Aegean, was once rolling, heavily wooded terrain, says Samos expert Nikos Solounias.

How does such dry land become a sea filled with peaked and jagged islands? The answer that most scientists now accept is complex, yet it may explain the shape of the entire Mediterranean.

Think of the Aegean as a piece of western Turkey that is slowly extending southwestward toward Africa. Crete is the leading edge of this arc-shaped landmass. The Aegean is one of the few areas where Africa and Europe have not yet collided. Most scientists believe that dense oceanic crust in front of Africa is diving beneath the lighter

continental rocks of the Aegean. As it dives, the African crust creates a suction that tugs at the edges of the Aegean landmass. The Aegean is thus being stretched and pulled toward Africa. Eventually Crete and Libya will ram into each other, thrusting up a new coastal mountain chain.

As the Aegean crust stretches, it grows thin and, like the legendary continent of Atlantis, it sinks, explains French geophysicist Xavier Le Pichon of the University of Paris. Blocks of land drop and tilt, new mountains are sculpted, and the sea floods the now rugged terrain. Thus the bones of the Neades end up high on a mountainous island.

Not all Aegean islands, however, are remnants of a sunken continent.

Crete, for instance, is being thrust up rapidly. Sediments as thick as five kilometers cover the eastern Mediterranean seafloor, says Crete specialist Jacques Angelier, also of the University of Paris. "These sediments are too light to dive back into the earth with the dense African crust. Instead they crunch together beneath Crete and jack up the island. Parts of Crete have been uplifted nine meters since Roman times."

Volcanoes are still another class of Aegean island. They are fired as the diving African crust meets the heat of the earth. At about a hundred-kilometer depth, that heat begins to melt the rocks. Magma then creeps back toward the surface, eventually to erupt through weak spots in the crust. Active

BOTH BY KEVIN FLEMING

Victim of volcanic fury, *the Greek island of Santorini, ancient Thera, exploded around 1400 B.C. with a force rarely matched in recorded history. With it went an island culture shaped by the Minoans, master seafarers who built Europe's first great civilization 115 kilometers to the south on Crete. Today visitors sail into the caldera and ride mules to the cliffside town of Thera* ***(left)****. Mule power* ***(below)*** *carries a barley mower up steep fields, enriched by the ancient volcano's ash.*

volcanoes in the Aegean bubbled to life about 2.5 million years ago along an arc about 115 kilometers north of Crete.

One of those is Thera (Santorini), among the most violent volcanoes that civilization has known, where stout-backed mules carry boatloads of tourists up the steep cliffs, and white houses glisten like snowcaps atop the caldera walls (above).

"In 10,000 years or so they won't need those mules," says volcanologist Floyd McCoy as we cruise the caldera. "Those cliffs will have eroded." Working with a National Geographic Society research grant, McCoy of the Lamont-Doherty Geological Observatory and colleague Grant Heiken of Los Alamos National Laboratory have reconstructed what this deceptively peaceful but still active island looked like before its infamous eruption of around 1400 B.C.

That eruption may have been far greater than the one of Krakatoa in Indonesia in 1883. Krakatoa cracked windows 160 kilometers away and was heard as far off as Australia. It triggered huge tsunamis, seismic sea waves, as high as 40 meters.

Thera's tsunamis must have devastated Crete, home base of the ancient Minoan civilization. The vigorous, far-sailing Minoans mysteriously disappeared at the peak of their powers—about the same time that Thera erupted.

Why do Aegean volcanoes, diving plates, and stretching crusts fascinate scientists?

BOTH BY KEVIN FLEMING

Happy is the Greek cat *that haunts the docks of Samos (**above**), where fishermen share the rejects of their catch, damaged in nets. While the Greek love of the sea built the world's largest merchant fleet, hard times now send many sailors to jobs ashore. Near Piraeus, freighters rafted together (**left**) await the scrapper's torch or simply lie idle, marooned by a worldwide shipping depression.*

"We think what's happening right now near Crete already happened in the western Mediterranean," says Cambridge University geophysicist Dan McKenzie. "Just as Crete will one day jam up against Libya, similar islands have been plastered all across the western Mediterranean."

A landmass analogous to the Aegean was pulled and stretched away from Iberia. Part of this land stopped midway across the western Mediterranean to become Corsica and Sardinia. Part of it continued sweeping eastward to create Italy and the Apennine Mountains. Part of it rammed into a corner of Africa to form Sicily.

A similar crustal block crunched into the Algerian coast, raising the Kabylia mountains. Still another block was the wedge that carried the Rock to Gibraltar.

ISLAND ARCS of volcanoes like those of the Aegean also arose in the western Mediterranean. Most have died. But the African ocean crust has probably just finished diving beneath southern Italy. It takes time to turn a volcano off. And so north of Sicily lies a cluster of volcanoes—Lipari, Vulcano, Stromboli—often called the Aeolian Islands. (Myth says that Aeolus, god of the winds, lived here.)

Stromboli, the so-called Lighthouse of the Mediterranean, hurls out explosive blobs of fresh magma almost continuously (pages 694-5). Lipari has not erupted since about A.D. 525 but is not extinct. Vulcano clears its throat once or twice a century.

"The last eruption was in 1888. It lasted for two years," says Aeolian native Antonio Nicastro. "A Scot named Stevenson owned the crater then. One of his servants was mortally wounded when a boulder from the volcano blasted through the roof."

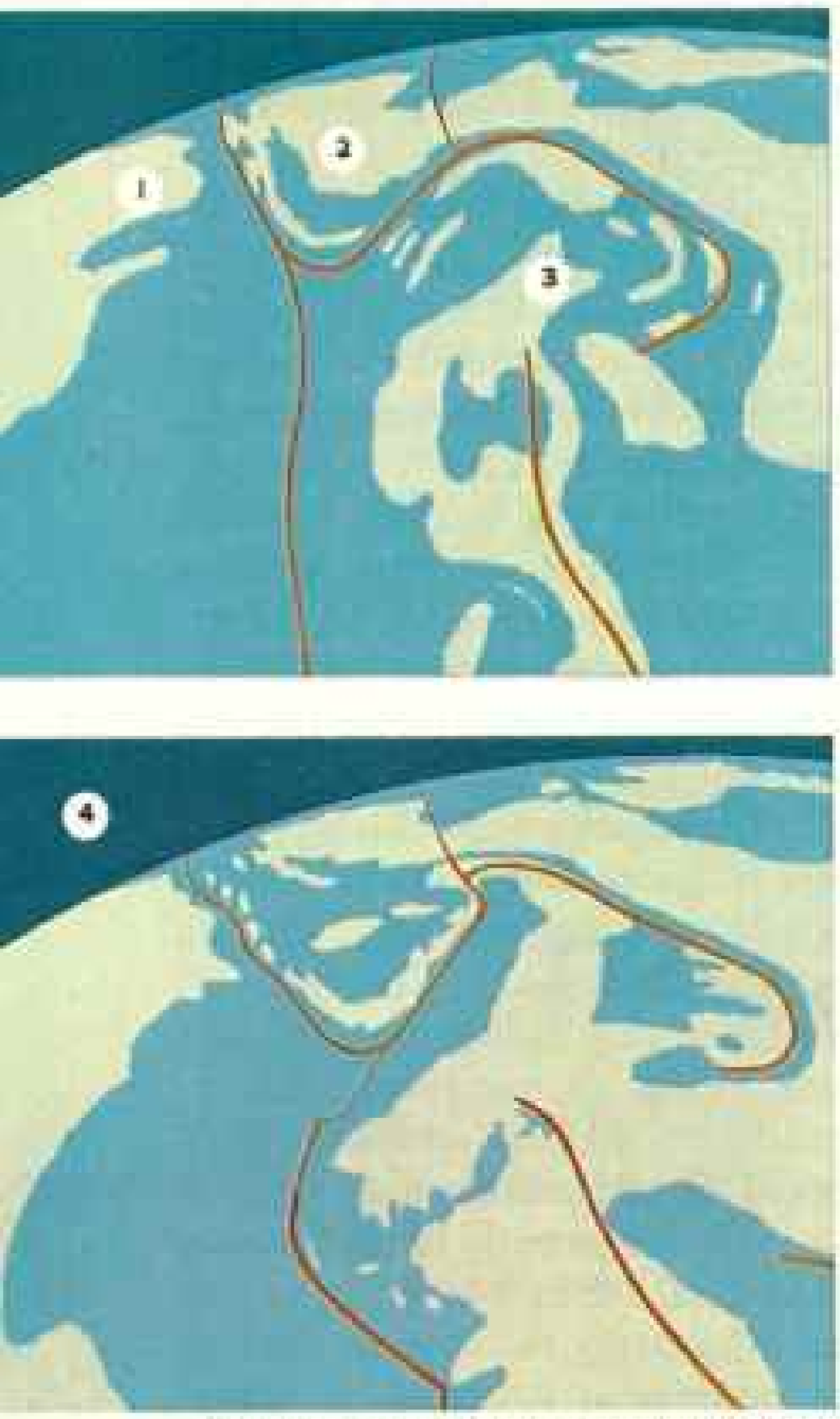
This stunning region, which locals say is "so beautiful you need four eyes to take it all in," pulses with geothermal energy. The sea off Vulcano actually bubbles, like a natural Jacuzzi, with many hot little fumaroles. Just onshore lies Vulcano's big tourist attraction—its mud bath. At dusk scores of nearly nude bodies of all ages and sizes soak in this murky pond that looks more like a place to put toxic chemicals than a tonic spa. Vulcano's mud supposedly restores the skin. It seems like hedonistic Rome or a Fellini

Continental pileup sculpts a sea

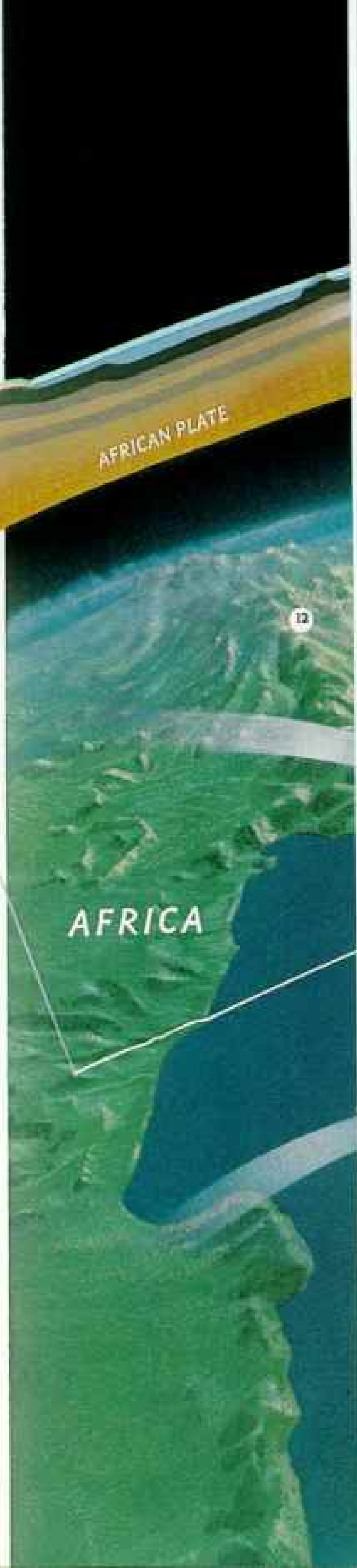
COLLIDING, buckling, and fracturing, continental plates that created the Mediterranean's complex topography resemble a geologic jigsaw puzzle, here viewed toward the west in three scenarios. About 44 million years ago ***(below)*** *Africa's plate (1) drove north into Iberia (2), separated by a fault from Europe. A chunk of northern Africa split off to form another plate called Apulia (3), abutting both Iberia and Europe. By nine million years ago (4) the multiplate pileup built most of today's features* ***(right)****, with some profiled in cross section at top.*

Part Africa, part Iberia, Sicily (5) rises as a widening Atlantic Ocean (6) shoves Iberia and Africa toward Apulia. The African plate, forced beneath Iberia, creates molten rock, tapped by volcanoes such as the Aeolian Islands (7). The Apennine Mountains of central Italy (8) mark the collision of the Apulian plate and Iberia, thus forming most of the Italian peninsula. Trailing fragments of Iberia are isolated to become Corsica (9) and Sardinia (10). Meanwhile, Apulia has also plowed north into Europe, thrusting up the great arc of the Alps (11).

To the south the Atlas Mountains (12) rear up along the coast of Africa as it collides with Iberia. A similar process continues today beneath the Aegean Sea, at lower right. Pushed north by Africa, ocean crust slides beneath Aegea (13), a partially drowned landmass dotted by protruding islands such as Crete (14). Africa's plunge stretches and thins Aegea and pulls it away from western Turkey (15), itself driven in the same direction by another plate, the Arabian. New mountains will rise when Aegea and Africa meet millions of years from now.



PAINTINGS BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BOND
BASED ON DATA FROM B. BIJU-DUVAL, J. DERCOURT, AND X. LE PICHON
COMPILED BY JOHN B. TREIBER, NATIONAL GEOGRAPHIC ART DIVISION



ALPS

APENNINES

MOUNT ETNA

AEOLIAN ISLANDS

EURASIAN PLATE

NORTH

APULIAN PLATE

IBERIAN PLATE

EUROPE

6

9

10

11

8

7

5

14

13

15

sound stage as the bathers spread gray muck on their faces and torsos and squat, heads bobbing, in Vulcano's stew (pages 718-19).

The fumaroles of Vulcano only hint at the power of the deep earth forces that move the continents about. But on a clear day from Vulcano you can see Sicily and the most monumental hunk of rock in the Mediterranean: Mount Etna. Now there's a volcano!

"Etna, that wicked witch . . . ," wrote D. H. Lawrence. "She seems rather low, under heaven. But as one knows her better, oh, awe and wizardry!"

Huge Etna differs radically from the Aegean volcanoes. Its magma comes from much deeper—from the very level on which the continents drift. No one really knows why Etna is there.

"Etna is one of the great puzzles of the Mediterranean," says volcanologist John Guest of London's University College, who has been studying Etna since 1969.

Mount Etna is remarkably young.

"At the present rate of eruption, you could build this thing in 60,000 years," says Guest. "There have been quiet periods, but I'd say much of it has been built up in the past 100,000 years."

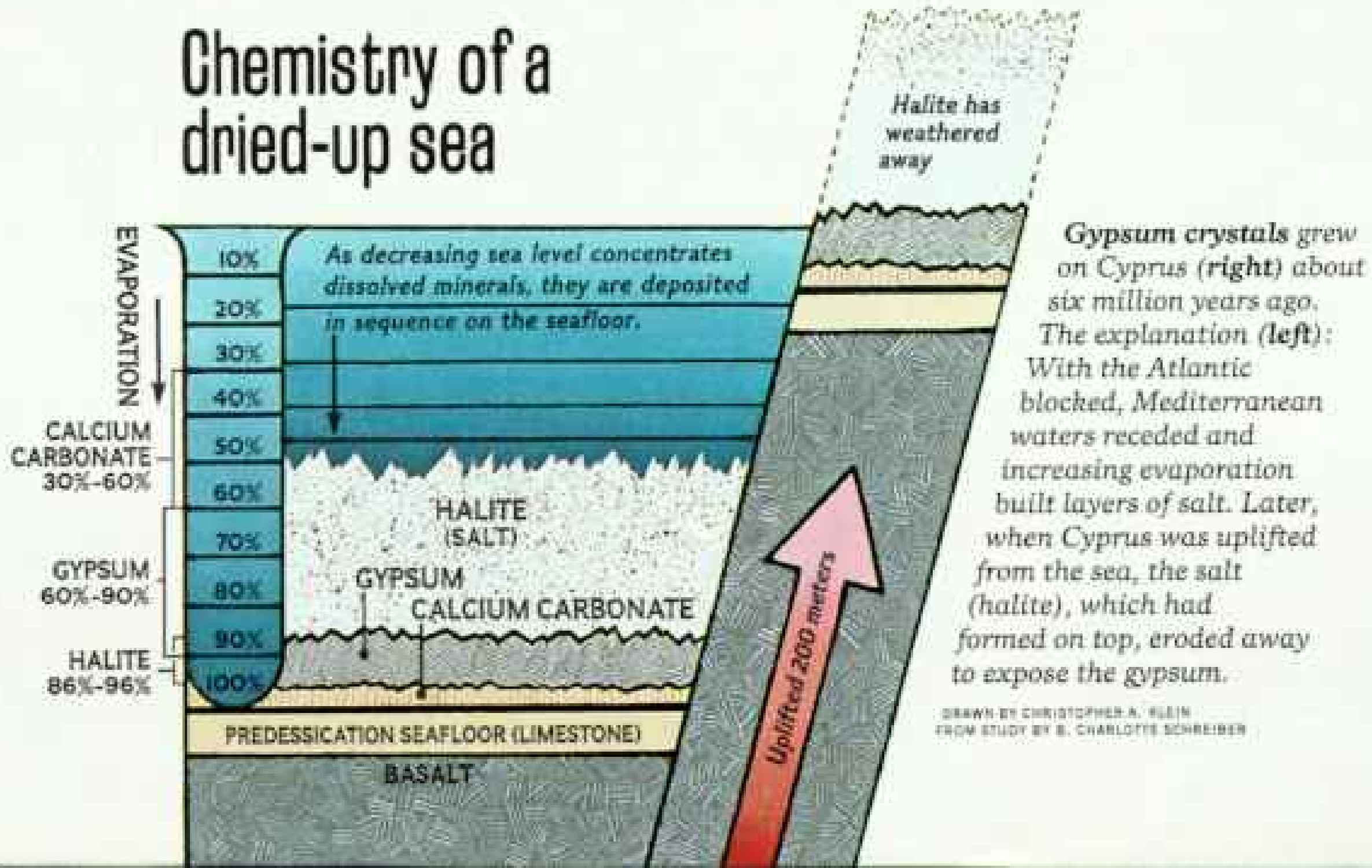
Guest takes me 3,300 meters to Etna's summit (pages 714-15). In 1979, he recalls, Etna killed nine tourists and injured dozens more when it unexpectedly burped out a barrage of boulders. We don hard hats. "It's really roaring," he says at the edge of its most active crater, Bocca Nuova. "I've never seen it so violent."

The vibrating ground makes my knees feel weak. The chasm thunders with the echo of gases exploding in the gray, crusted-over magma below. A piece of the wall collapses into the pit. A massive cloud of dark ash gushes out, and the volcano roars as if it had captured a monstrous cyclone within. Awe and wizardry! I feel I have a direct line to the bowels of the planet. On quiet, restless nights at home I will recall what goes on beneath my feet.

TRAVELERS and poets can rhapsodize about the Mediterranean's spectacularly capricious geology. But 230 million people live with it. On the afternoon of March 17, 1981, a bit of hell burst loose on Sicily. The world scarcely noted that Mount Etna had erupted again, as it does 10 or 20 times a century. But to the people of Randazzo, March 17 was the nightmare of a lifetime. The lava broke out from a chain of vents above the town. Flaming ash turned the sky red and the air sulfurous as the lava smothered the town's most fertile farmlands, as well as its economy.

More than five months later I walk briefly on the jagged black lava field that bisected the rail line and buried the main road into town. Its crust is still too hot to walk on

Chemistry of a dried-up sea



*Gypsum crystals grew on Cyprus (**right**) about six million years ago. The explanation (**left**): With the Atlantic blocked, Mediterranean waters receded and increasing evaporation built layers of salt. Later, when Cyprus was uplifted from the sea, the salt (halite), which had formed on top, eroded away to expose the gypsum.*

DRAWN BY CHRISTOPHER A. KLEIN
FROM STUDY BY B. CHARLOTTE SCHREIBER

comfortably. It will take years for the lava to cool completely.

"Etna is part of the mental geography of the people," says Antonio Grasso, a young Sicilian psychologist. "Nowhere else do people have dreams of being covered by lava. They are common here."

"The people say that farmers go to bed at night with one eye closed and one eye on Mount Etna," adds journalist Pietro Nicolosi. "However, they know that land born of a volcano is among the most fertile. They use lava to build their homes and pave roads. So even though they must beware, they know Etna is their friend."

Also, lava seldom kills. It moves too slowly. Nevertheless, on the evening of March 17, the lava moved frighteningly fast—two kilometers in 20 minutes. It just missed the town. The following day a new vent opened above the town.

"The fire and lava were so horrible," local sculptor Gaetano Arrigo tells me, "I promised Saint Joseph, patron of our town, that if he stopped the lava, I would make a statue of him out of lava for the town. Lava is very hard to work with, but I had to do something."

Other townspeople made a procession carrying the saint's picture in front of the lava. The next day, on the feast of St. Joseph, the lava stopped flowing, and a miracle was proclaimed. Arrigo began to sculpt his thanksgiving, which was recently raised in the town (following page).

NOWHERE in the Mediterranean does humanity seem as vulnerable to the whims of the earth as in the Bay of Naples. Mount Vesuvius, which catastrophically buried Pompeii and nearby Herculaneum in A.D. 79, dominates its eastern horizon. (See the preceding article.)

Despite Vesuvius's past, refugees from overcrowded Naples each year press ever farther up its broad and fertile flanks, oblivious of any danger. For the moment, that danger seems slight. "Vesuvius is asleep," says volcanologist Giuseppe Luongo. Its last eruption in 1944 ended a cycle. It may be two hundred years before it wakes up—or ten.

Not all the Bay of Naples is as quiet. Ask anyone in the town of Pozzuoli.

"Pozzuoli, she is like a ballerina. She is always going up and down," says fisherman Carmine Carante at the wharf along the Gulf of Pozzuoli. He points to a loading dock, which is today nearly 20 meters from the water's edge. "We used to drag our boats up there. But about 1970 the earth started to rise. That happened once before near here—in the 1500s—just before a new volcano erupted. So the people here were scared."

Recently scientists have realized that Pozzuoli is near the center of one of the most hazardous volcanic areas on earth—the Phlegraean Fields. A huge explosion there 36,000 years ago left a caldera some 12 kilometers across, creating an ancient gulf. Then 17,000 years ago another explosion filled in most of the gulf, putting down an ash layer upon which Naples is built.

The rise of Pozzuoli indicates magma is accumulating again. An eruption like the one 17,000 years ago could bury Naples under 100 meters of ash.

The same tectonic stresses that create Neapolitan volcanism also bring earthquakes. On November 23, 1980, eastern Italy jerked slightly toward Yugoslavia. For two terrifying minutes the ground was pulled out from under millions of Italians.

Seventeen southern hill towns were totally demolished. Some 5,000 people were killed and about 400,000 villagers left homeless. Many of those flocked to Naples.

"Heart of men." That is how the poet

Fitful monster, *Mount Etna on Sicily belches ash and gases around volcanologists making observations at one of its craters* ***(above right)****. The site was closed to nonscientists after a 1979 eruption killed nine tourists. On March 17, 1981, Etna unleashed lava flows toward the town of Randazzo. Molten rock buried rail lines* ***(right)*** *and farms—causing millions of dollars in damage—but spared the town itself. "When the lava stopped, I began work," says Gaetano Arrigo* ***(above)****, who sculpted a lava statue of Randazzo's patron, Saint Joseph, in thanks for a miraculous deliverance.*

Shelley described 19th-century Naples. Today that heart seems broken. Once one of the great cities of Europe, home of kings, resort of royalty, and architecturally a paragon of the Continent, Naples is now a city of scaffolds. Hundreds of buildings in the old part of town were so shaken by the quake of 1980 that they must be propped up to survive. Countless wood and metal scaffolds span the narrow streets (pages 724-5).

"After the earthquake more than 250 streets were closed," says architect Fulvio Tammaro. "Just the passing of cars could make buildings fall down. People were evicted from many buildings. There are 100,000 homeless now. We have emergency programs to build and restore housing, but in Italy big programs take a long time."

Some 80 streets in Naples remain closed. The resulting traffic jams add to the woes of this urban area of three million that has lost its economic role but not its population. At least 320,000 Neapolitans are unemployed. Many others live off banditry and organized crime. Street criminals and a cholera epidemic in 1973 have seriously affected the once vital tourist industry. Sewage-ridden water off poverty-stricken beaches makes hepatitis endemic. The educated are fleeing the city to find jobs.

GIANNI TORTOLI (BELOW LEFT)

Italian tragedy, then and now: *A young boy's final moments linger in a plaster cast made from the cavity left by his decayed form at Pompeii* ***(above)****. The "fearful black cloud" of Vesuvius's eruption, witnessed by Pliny the Younger in A.D. 79, entombed thousands of inhabitants. Modern Pompeii suffered again on November 23, 1980, when an earthquake rocked its famed excavations. Throughout southern Italy the disaster left about 400,000 villagers homeless and killed some 5,000, including this victim in the town of Sant' Angelo dei Lombardi* ***(left)****.*

Yet despite its crisis, on even the poorest back street Neapolitans evince an indomitable spirit. "We are full of life," Neapolitan Anna Gatta tells me. "We are good humored. We can be hardworking, despite the propaganda. We can also be violent. Unfortunately life has taught many people here to make their living day by day. More than anything, we are an enduring people."

Somehow, the "heart of men" beats on. Naples. They still make love and ice cream there as if they were art forms. It's the most Mediterranean city I know.

EVEN THOUGH the Mediterranean geology all too often ravages civilization, it has also made that very culture possible. Long before the Bronze Age, for instance, the little Aeolian island of Lipari flourished from its deposits of obsidian, the black razor-edged glass that flows from certain volcanoes. Such a fine cutting blade once made Lipari rich. In the centuries before man learned to work metals, the obsidian trade was one of his most important.

However, as the Bronze Age set in around 2300 B.C., the island of Cyprus far to the east began to exploit its own geologic gift—copper. Prodigious amounts of copper, the major component of bronze, were deposited on Cyprus by processes that make the island one of the world's great geologic field sites.

The Troodos Mountains of Cyprus were once oceanic crust. Such crust forms when magma from the earth's interior oozes out along rifts thousands of meters under the sea. Similar rifts created all the oceans.

The Troodos formed some 70 million years ago when a piece of old ocean crust was sliced off and later uplifted by the advancing African and Arabian plates.

I ascend the Troodos with Andreas Panayiotou of the Cyprus Geological Survey. On the way up he shows me rock complexes—pillow lavas and sheeted dikes—that represent the various levels of ocean-crust formation. Here on dry land lie rocks that scientists would otherwise have to dive or drill many miles below the sea to study.

The magma from which Cyprus formed was copper rich. Seawater leached that copper out and deposited it as compounds in the crust of the island-to-be.

At first the ancient Cypriots could simply pick copper nuggets off the ground. Later they developed mining techniques that helped give birth to Western technology.

"Mining is the essence of our civilization," says the geological survey's director, George Constantinou. "Without metals we'd still be like monkeys in the trees throwing stones at each other."

He shows me the Skouriotissa mine, where armies of slaves dug tunnels 550 meters deep to extract copper ore.

"Those people had an astonishing knowledge of geology," says Constantinou. "Even today there is not a single mine on Cyprus that was not exploited by the ancients."

We drive amid mountains of black slag. "This was the Ruhr Valley of antiquity," he adds. "Consider the labor force needed to dig, mine, smelt, and refine the copper, and the ships needed to transport it. Imagine the amount of wood the smelters consumed! Over a period of 3,000 years, some 200,000 tons of copper metal were produced on Cyprus. You'd need charcoal equivalent to 150,000 square kilometers [58,000 square miles] of forest. All Cyprus totals only 9,300 square kilometers. So the forests of Cyprus must have been destroyed at least 16 times! Clearly Cyprus went through frequent energy crises. Energy is not a new problem in the Mediterranean."

LIKE CYPRUS, most of the Mediterranean's once lush shores have been denuded. Cyprus was lucky, however. The Troodos Mountains create weather. Mountain snows feed rivers that bring down soils and water, allowing forests to regenerate rapidly.

Snow is surprisingly important in the Mediterranean. It means water during nearly rainless summers that epitomize the world-famous Mediterranean climate.

In the past, snow was actually big business. It was shipped by the boatload into Istanbul. Teams of fast horses carried it to Egypt from Syria. And without snow from nearby mountains, would the Neapolitans ever have perfected ice cream?

The Mediterranean's long, sunny summers are dominated by the same huge, dry high-pressure zone that creates the Sahara. In the summer this high pressure simply follows the sun north.

Mediterranean snows occur after the high pressure retreats south for the winter, leaving the region vulnerable to Atlantic storms.

"We've seen the classic Mediterranean

Volcanic mud *from a nearby deposit soothes the skin of a visitor to the Aeolian Island of Vulcano, just north of Sicily. He basks near a tiny steam vent on the mountain, which last erupted in 1888.*

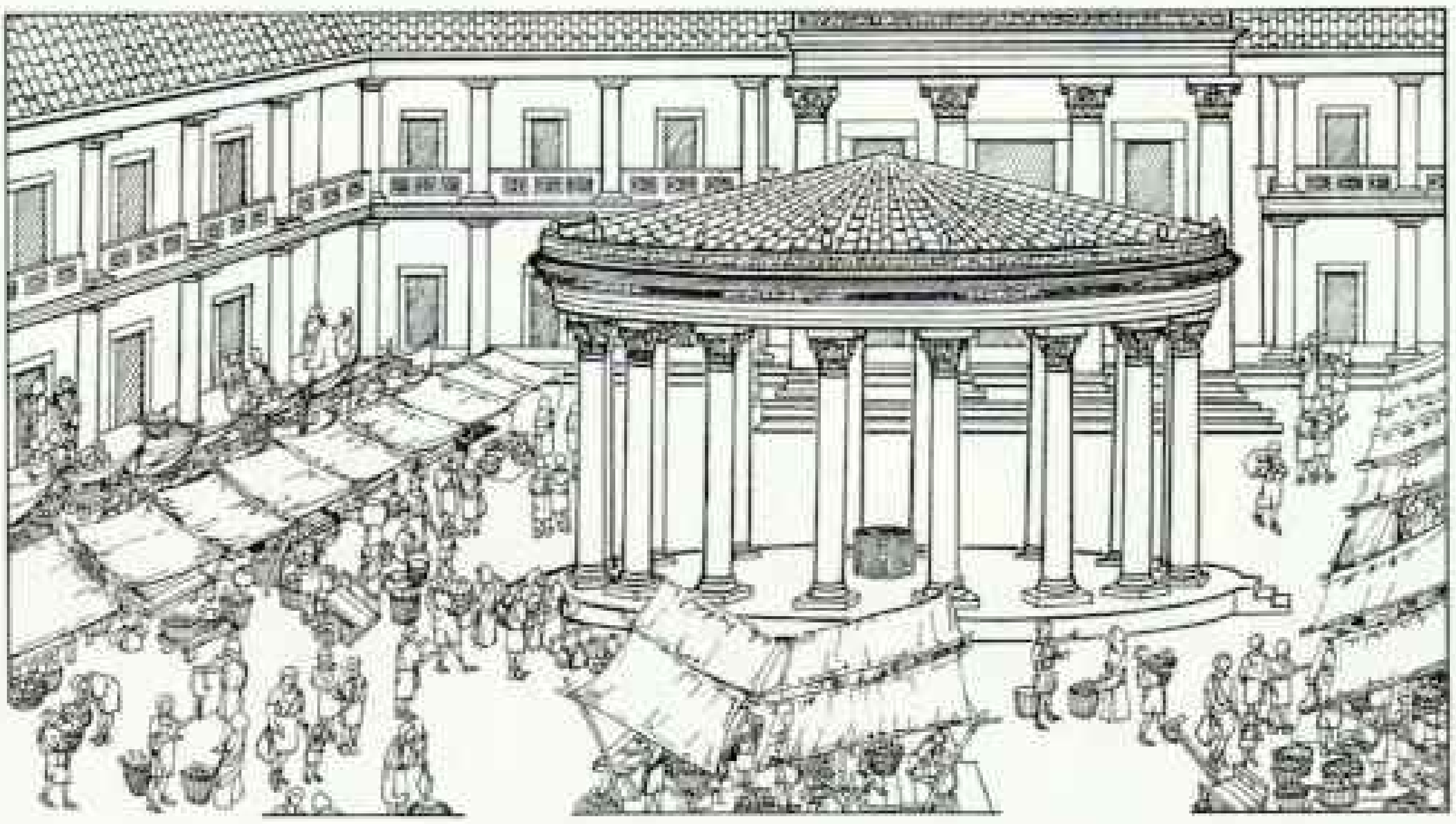
winter weather pattern this week," says Yale University meteorologist Ron Smith as we fly over the snow-mantled Alps in a hurricane-hunter airplane in early March. The flight is part of an international meteorologic program called ALPEX (Alpine Experiment) to study how the Alps help generate Mediterranean storms.

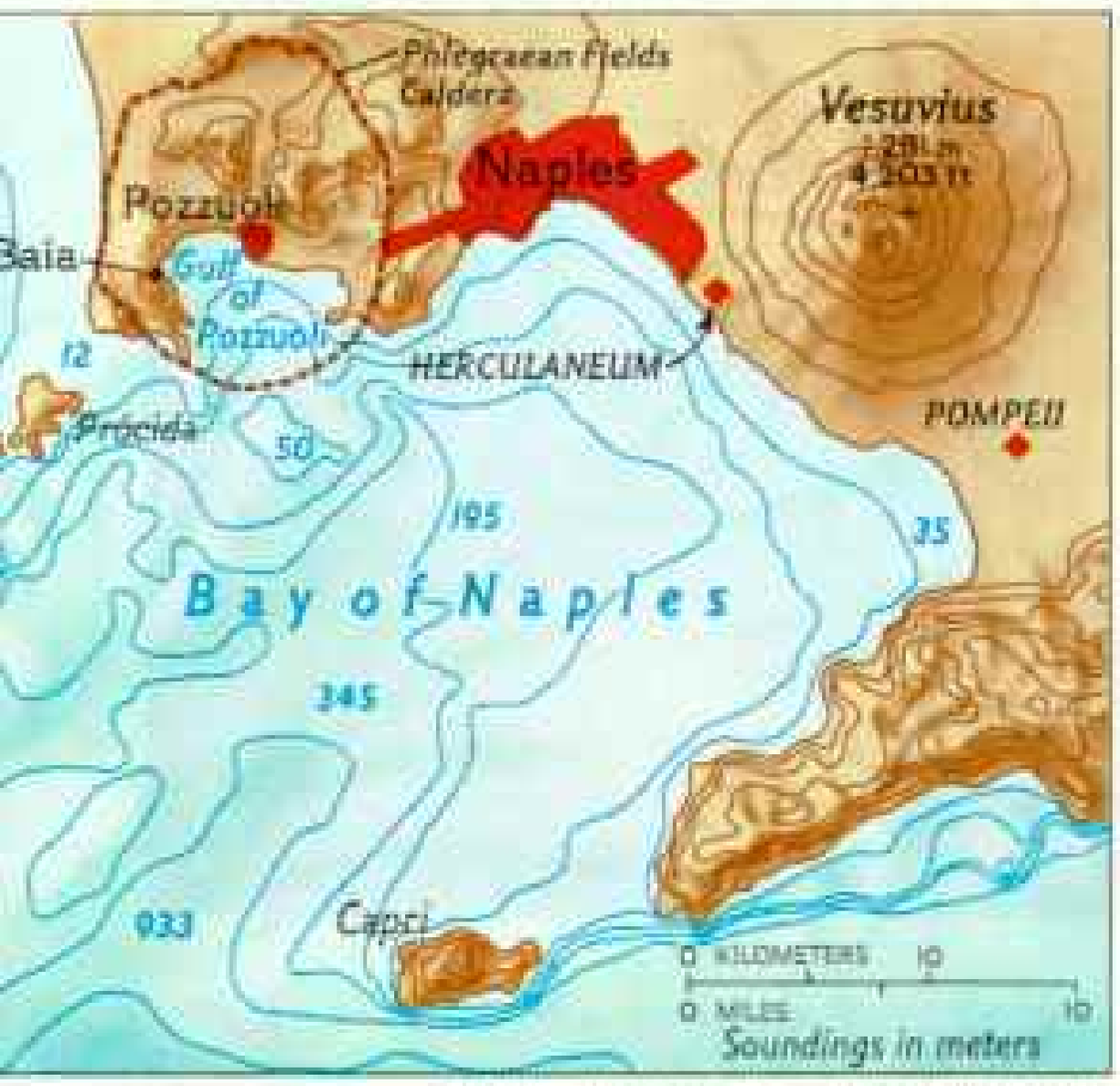
"An Atlantic cold front got blocked when it met the Alps," explains Smith. "Part of the front sneaked down the Rhône Valley, however. When its cold air met the warm sea off France, a cyclone formed and moved east.

"By the time the storm reached the Gulf of Genoa, cold high pressure had set in over Europe. So the Genoa cyclone's low pressure pulled that clear, frigid air into the Mediterranean behind it. Southern France had itself a good, strong mistral."

The cold, wicked mistral, which can suddenly turn Marseille into an icebox, is one of several famous local winds in the Mediterranean. Siroccos, or hot winds from the Sahara, often bring desert air and dust to Italy and the Alps.

This day, however, our hurricane hunter





NATIONAL GEOGRAPHIC ART DIVISION (ABOVE AND LEFT)

Naples: an unsettling bay

*"FIERY FIELDS," ancients called the coastal region west of Naples, where nature herself provided hot spas. But that volcanic instability later drowned works such as the first-century A.D. Temple of Serapis at Pozzuoli (**left**). Evidence of inundation, borings of marine mollusks pit the exposed marble columns of the temple, once the centerpiece of a macellum, or marketplace (**left, below**), when the city boomed as a Roman port. Pozzuolians still live uneasily atop a bizarre volcanic trampoline that keeps the earth rising and falling. As magma is injected from the depths into the earth's crust, first stage of a volcano, the ground goes up. If the magma stops and solidifies—as it has in the past—the ground subsides. Between 1969 and 1972 Pozzuoli rose nearly two meters. Is a new volcano about to be born, as occurred during the 1500s? Possibly, say scientists, who locate the town near the center of a caldera (**map**) that formed some 36,000 years ago. Ancient craters, hot springs, sulfurous fumes, and earthquakes are trademarks of the bay area, dominated by the smoky brow of Vesuvius. Agent of doom for Pompeii and Herculaneum, the mountain's last blast came in 1944.*

While Italians can do little about the forces of nature that govern the bay, they are struggling with their own pollution that sullies its waters, with industrial wastes and raw sewage accumulating heavily in some spots. Shocked by an outbreak of cholera in 1973, Naples began planning an ambitious system to collect and treat its sewage, which could cost two billion dollars before completion. To combat pollution throughout the Mediterranean, 17 nations reached an agreement in 1980, vowing to clean up their acts.

is tracking the bora, another cold wind, which afflicts Trieste and the Yugoslav coast with gusts as high as 180 kilometers an hour. This bora was triggered when cold high-pressure air on the Continent was sucked across the coastal range by the Genoa cyclone. As we approach the coast near Senj, we can watch clouds roll over the mountaintops. They evaporate quickly as the cold air descends, warms, and accelerates into invisible gusts that pummel the coast and churn the Adriatic. The boras are formidable breezes. They deform what few trees can grow where they blow. Villagers sometimes put rocks on their roofs to keep the shingles on. Special walls along steep and curving roads keep cars from being blown into ravines by boras.

"People on the coast say that a bora blowing is the devil's wedding," says Yugoslav meteorologist Berislav Makjanic. "The whistling and shattering of shutters outside make it seem like a noisy, windy hell."

Besides helping generate mistrals and boras, the Genoa cyclones often drive surges of water up the shallow Adriatic toward Venice. In the past, Venice withstood these storm surges well.

But in the 20th century, geology, man, and the sea have been collaborating to bring about the death of Venice. The accumulating weight of sediments washed down from the Alps is gradually depressing the Adriatic basin, causing the city to sink slowly. That subsidence was, until recently, made much worse by local industries, which pumped groundwater out from under the region. A canal dredged to permit supertankers to dock in the lagoon of Venice intensifies the effects of storm surges. Also, parts of the lagoon have been filled, leaving less area to receive those floods. Most important, the world's sea levels have been rising slightly.

"We have lost 22 centimeters in respect to sea level since 1900," explains Venetian hydrogeologist Paolo Gatto.

"When the wind blows, the lagoon is more like the sea now. It becomes wild," says mussel fisherman Ghezzo Attilio, who has worked the lagoon for the past 53 years.

VENICE HAS several serious floods a year. High water forced merchants along St. Mark's Square, a low part of the city (pages 696-7), to close their shops some 200 times in 1979.

"It keeps getting worse," complains Elsa Masprone, the wife of the owner of the Cavalletto Hotel just off St. Mark's on slightly higher ground. A flood has been forecast overnight, and a bellhop rolls up an Oriental rug and carries it off the regularly inundated ground floor. "It seems now that a *bambino* wetting can cause a flood."

"We are always on the alarm," says Vita Magistris, whose ground-floor apartment is flooded twice a month in a bad year. "A siren goes off when a serious flood threatens."

"Then we have two hours to put our furniture on blocks," adds her husband, Aldo. "In 1979 the alarm went off at 4:30 a.m. We didn't hear it. We woke up with water in our bed and big rats in our room."

Hydrologists have developed a plan to save Venice. They propose building many small dikes and jacking up structures that are sinking. The scientists have long urged that huge inflatable gates be installed at the three points where Adriatic water can enter the lagoon. These 500-million-dollar gates would be inflated only when extreme storm surges threatened the city. Financial problems and political infighting, however, have delayed any action on the plan over the past ten years.

"They are thinking about doing something," I overhear a Venetian tour guide tell her American sightseers as they watch water from the lagoon splash over the seawall and inundate the waterfront near St. Mark's. "That's our problem in Italy. They are always *thinking*, never doing! Our governments last only six months. So each one passes the problem of saving Venice on to the next."

The high waters that flood Venice are generated by wind. The Mediterranean is too small a body of water for the moon's and sun's gravity, which creates ocean tides, to pull significantly. Only in a few regions, such as the northern Adriatic and the waters

Fit for an emperor, *marble appointments sank with a palatial summer villa—probably owned by Claudius (10 B.C. to A.D. 54)—as land submerged around the Bay of Naples. Archaeologists recently recovered the back of a "cline" (**left**), a couch on which people reclined while dining (**above**). A statue pocked by mollusks (**right**) bears a wineskin. The philosopher Cicero praised this Roman resort area near Baia. But, like some modern visitors, he complained of crowding that "almost makes one want to flee."*

Spiderweb of scaffolding *forestalls the collapse of shaky buildings by propping them up in the old Spanish quarter of Naples (**above**). The city still reels from the 1980 earthquake. Eighty streets remain closed, and about 100,000 people, many evicted from condemned apartments, still seek housing. Though rebuilding will take years, Neapolitans hang out the wash and grin through the turmoil (**above right**).*

east of Tunisia, where waves move from deep basins onto shallow shelves, do noticeable tides occur.

Were it not for the Strait of Gibraltar, the Mediterranean would behave like a big lake. Evaporation in the hot eastern regions is as great as 1.5 meters a year. That actually lowers the sea level enough to draw in the Atlantic through the strait. The less saline Atlantic water rushes in on top of an outflow

of denser and saltier Mediterranean water.

Once through the strait, Atlantic water swirls in gyres around the western basin of the Mediterranean. Much of it then continues to stream eastward, along the coast of North Africa.

During the summer months in both the eastern and western Mediterranean, the difference between the solar-heated surface water and the cooler, denser water below helps prevent the two layers from mixing. That keeps many nutrients trapped in the depths. Moreover, the Mediterranean's famed intense light actually inhibits productivity in the upper levels. So, despite its reputation as a cornucopia of sea life, the Mediterranean is a relatively infertile sea. Its remarkably clear water indicates a paucity of life.

In winter the northern Mediterranean

winds change the oceanographic regime dramatically. Wherever the cold, dry mistral and bora blow, they chill the surface water and evaporate even more of it than the summer sun. This evaporation makes the surface waters saltier, explains oceanographer Henri Lacombe of France's National Museum of Natural History. Now cold and dense, these surface waters start to sink, and the layers of water mix, creating a characteristic Mediterranean water that is saltier than the Atlantic. This water feeds the strong, deep current that streams out past Gibraltar. Mediterranean water can be identified by its temperature and salinity all the way to the Bahamas.

Despite this outflow, the sea takes perhaps eighty years to turn over all its water. The Mediterranean is thus easy to pollute. Whatever gets dumped in the Mediterranean stays there a long time.

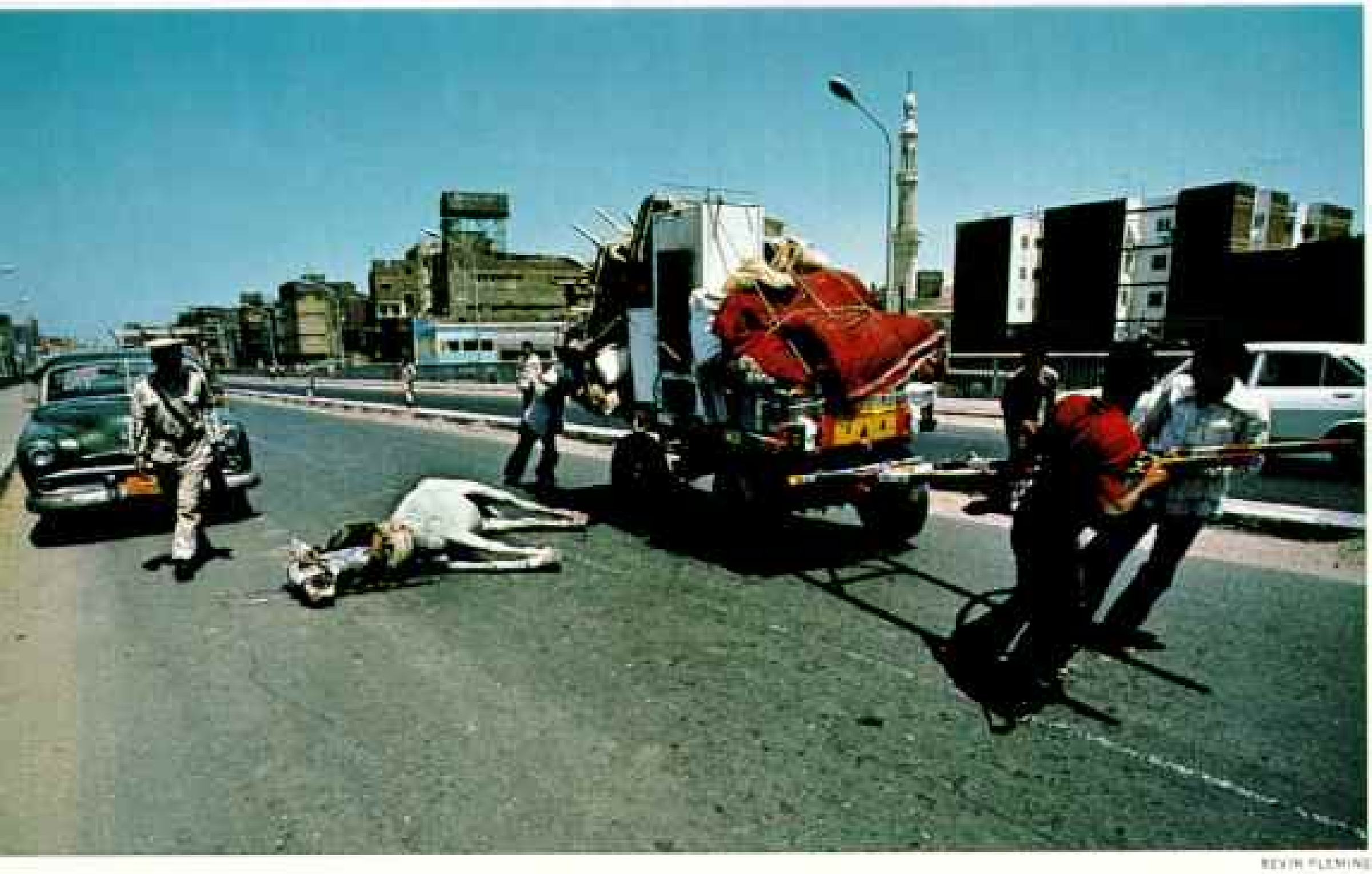
Oil, from industrial waste and from tankers and pleasure boats, especially worries environmentalists.

"Oil floats," says oceanographer Oton Oren of Israel's Institute of Oceanography. "The water that leaves the Mediterranean at Gibraltar is deep water. So we lose our cleaner water and keep the oil. It accumulates in the sea."

"The food chain of the Mediterranean is now marked by oil pollution," adds his institute's director, Colette Serruya. "It is part of the tissue of our fish and mollusks in polluted areas." Whoever eats that tissue is eating oil pollution.

Even more alarming are the pesticides, detergents, heavy metals, and other hazardous wastes that also pour into the sea. No one knows just how these chemical pollutants affect human health or, perhaps more important, the food chain. But increasingly, scientists realize that the equilibrium of the marine food chain is governed by subtle chemical messages among species. If it does not poison outright, pollution can easily interfere with those signals.

"The Mediterranean cannot renew itself



KEVIN FLEMING

Egypt's pitiless sun *stuns a workhorse on a bridge over the Nile at Dumyat. Here on the river's troubled delta, a once prolific fishery has waned with freshwater nutrients now reduced by the Aswan High Dam. The dam has also decreased the river's flow, so sediments clog the delta, forcing frequent dredging.*

forever," explains Greek marine biologist Constantin Vamvakas. "If pollution is unchecked, one after another the organisms will die, and we'll have a community with ever fewer species."

YOU CANNOT GET AWAY from pollution in the Mediterranean today. On the remote Tunisian island of Jerba, I take a pleasant stroll along a beach filled with topless sunbathers—and then must scrub my feet with gasoline to remove the tar. I find an isolated grotto on the isle of Capri clogged with bobbing plastic bags and other flotsam of civilization.

In tourism-sensitive Nice an official tells me how a plane makes daily flights in summer to spot garbage floating over from Italy. This spotter directs boats called Pelicans, because their prows open to swallow floating garbage, to the scene. "You wouldn't believe what we intercept," he says. "Casks, bottles, even dead cows."

Like many cities, Alexandria still dumps its sewage raw along its beachfront. In summer, when half a million visitors flock to the beaches, the sewage is supposedly detoured to a nearby lake. A health official tells me, however, that the diversion does not always work. "Thank goodness the people don't know what goes into the water," she says.

In Israel, environmental official Uri Marinov tells me that before recent treatment plants were built, swimming off parts of Tel Aviv was equivalent to taking a bath with a cup of raw sewage added to the tub.

Sewage does add needed nutrients, and the sea can oxidize and purify human waste rather quickly. But this depletes the water's oxygen supply. Then, too, fresh sewage breeds infectious diseases.

In addition, sediments from Marseille's industrial wastes are creating a rapidly expanding dead sea. The sediments darken the water and have smothered the seafloor organisms with a lifeless ooze meters deep and a kilometer square.

Pollution fills the air as well as the water. Acid smog eats the marble at Athens' Acropolis. Black fumes besmirch the enchanting vistas of Istanbul, once the queen of the eastern Mediterranean.

"In the early 20th century," says University of Istanbul architecture professor Doğan Kuban, "one of our best poets wrote that Istanbul is a widow of 1,000 husbands, but still fresh like a virgin. That was before the automobile and before people coming from the countryside swelled our population in the past two decades from one and a half million to about five million."

Such population growth, which infects many Mediterranean cities with endless traffic jams, blaring horns, and choking smog, is the chief driver behind the Mediterranean's pollution crisis. By the year 2030 some 400 million people will live along the Mediterranean coast. But despite the relentless population pressures, the pollution prospects are improving.

Recently the United Nations' Mediterranean Action Plan has galvanized 17 nations to develop strict antipollution regulations. Naples, Marseille, Athens, and many other communities are planning major new sewage systems. Fos, a sprawling industrial port in southern France, has dramatically reduced its pollutants. One question in the cleanup campaign is whether the less developed nations will be able to afford the expensive antipollution measures.

MAN HAS BEEN tampering with the Mediterranean ecosystem for more than 8,000 years. Civilization has usually been the loser. Where trees have been cut down, desertification has set in or erosion has greatly speeded up.

Ancient Troy, for instance, was strategically located on a natural harbor at the mouth of the Dardanelles. Today its ruins overlook a landlocked plain. In only about a thousand years sediments from the deforested Küçük Menderes River region filled in access to its harbor.

"The Greeks didn't finish off Troy," says Turkish expert Oğuz Erol. "The city lost its function when its harbor filled in."

Rapid sedimentation also ruined Ephesus, a world-class city as late as A.D. 600, when its engineers finally gave up trying to keep its harbor open. I go to the former docks of Ephesus and look out over a sea of bramblebushes. The Aegean is now 11 kilometers away.

Man's most recent major tampering with the Mediterranean was the construction of the Aswan High Dam to harness the Nile in

upper Egypt in the 1960s. The Nile's reduced flow has brought trouble downriver along Egypt's coastline. Sardines used to swarm off the Nile Delta to feed on the river's nutrients. Now they have lost interest in Egypt. Fish production, one expert tells me, is one-fifth what it was before the high dam.

Moreover, the Nile no longer brings down sediments from central Africa. These sediments built the delta, Egypt's breadbasket, as well as a shelf extending far into the sea.

"Sediments no longer replenish the delta," says geologist Farouk El-Baz, formerly Egypt's science adviser, as we walk along a disappearing beach at Ras el Bar. "Therefore, the coastline retreats. In some places a kilometer has been lost."

The shells of several Ras el Bar homes have nearly tumbled into the advancing sea. Nearby, at the mouth of the Nile, the flow is

High tide *of tourism floods Rimini, Italy* ***(left)****, in mid-August, when 250,000 sunseekers, mostly Italians, triple the population of the Adriatic Sea resort.*

Less dress prevails on the French coast, launchpad for the modern bikini, where a windsurfer ***(above)*** *sails in its abbreviated descendant, the monokini.*

so diminished that the sea is actually filling in the river channel with its own sediments. Twenty-five years ago the river averaged ten meters deep. Now it is pocked with islands. Children play on one in the middle of the river. Were it not for a channel dredged frequently to let fishing boats pass, I could wade across the Nile.

Some fear that the sea may begin breaking through Egypt's coastal barrier beaches and flooding precious agricultural lands. As Samilia Abdulla of Egypt's Institute of Oceanography and Fisheries puts it: "We are afraid the Mediterranean will start to reclaim the delta."

Modern man's most striking environmental impacts, however, are the monuments of tourism. Never has anyone conquered the Mediterranean so quickly and so completely as the tourist. If the fortunes of past rulers

were spent building great coastal fortresses to repel invaders, today's landlords spend as much to encourage invasion.

At times the Côte d'Azur of France seems like one continuous overcrowded marina. Much of Spain's splendid coast has been visually devastated by cheaply built beachfront high rises. Even Spanish tourism officials admit that permitting this "great wall of Spain" was a mistake.

"We are losing our personality," says a tourism officer in Palma de Majorca, which now welcomes some four million hotel visitors a year. In 1952 a mere 134,000 came.

Yet tourism brings in big income. Spain, a country of 37.5 million people, welcomes 40 million visitors a year. They contribute 6.5 billion dollars to the Spanish economy.

"We are selling the Mediterranean," says Tunisian tourism official Taoufik Kastalli. "Tourism is now our second largest industry. It could soon be our first."

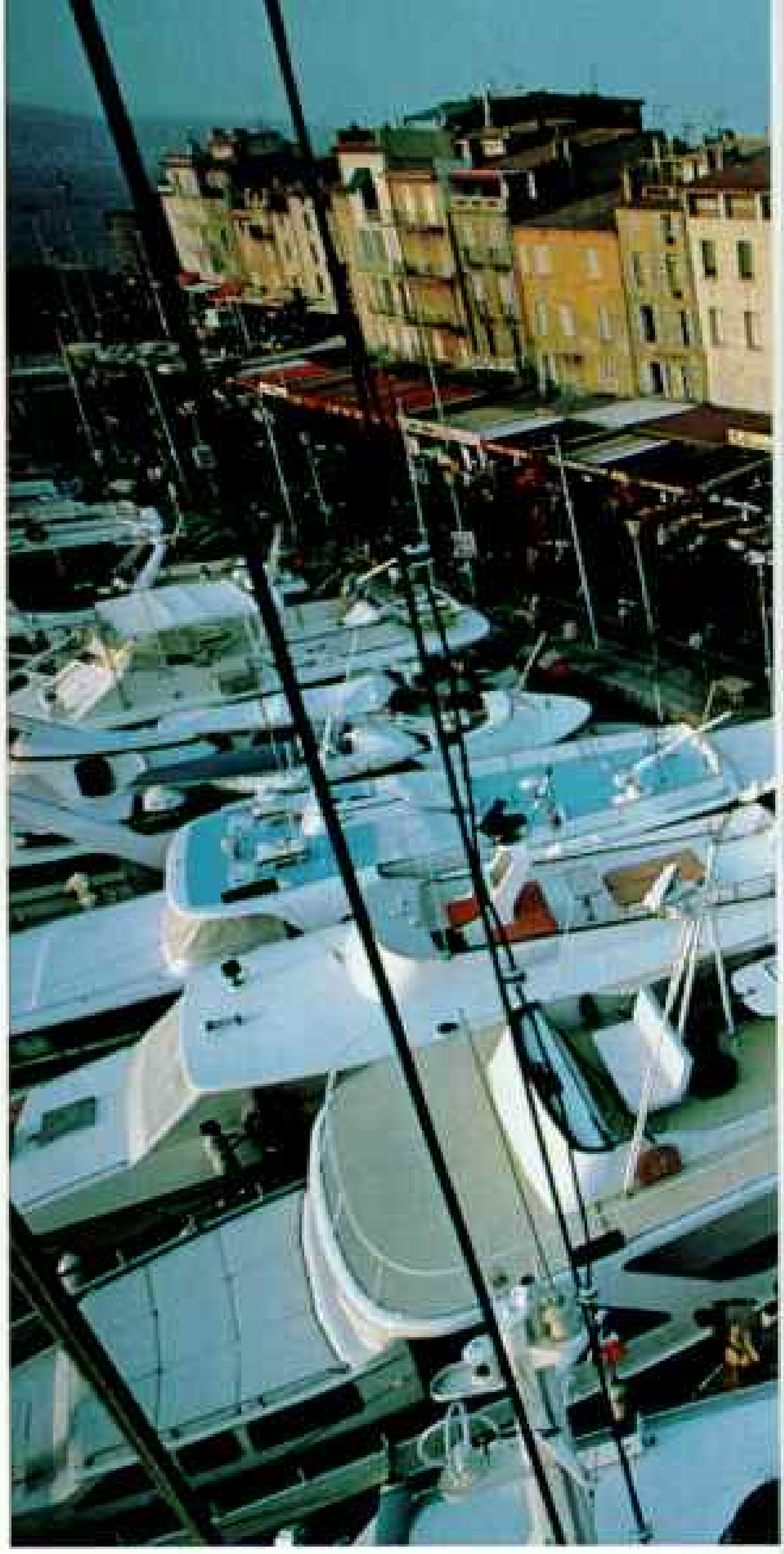
Kastalli boasts of deluxe hotels, golf courses, and marinas more than he does of Carthage or of the country's intriguing Islamic and Roman heritage. This attitude is common. In Corfu, I hire a driver to show me that Greek island's most interesting sites. Here, in the country that created many of the ancient wonders of the world, I am taken on a tour of fancy tourist hotels.

THE MEDITERRANEAN has new wonders in the offing, however—wonders that will challenge the best technology civilization has developed.

Israel, for instance, hopes to build a conduit stretching from the Mediterranean to the Dead Sea, despite Jordanian protests.

"The Dead Sea is turning into a mud flat," says the project's chief engineer, Avner Arzi, as we stand on a high cliff looking down on it. "Water from the Jordan River is being diverted for agriculture. So the sea is receding half a meter a year."

To restore the sea to its natural level, the billion-dollar, 113-kilometer Med-Dead conduit may start becoming a reality as soon as next year. Seventy percent of its length will be bored through mountainous terrain to this spot where we stand. Then Mediterranean water will tumble down through turbines that will generate some 20 percent of Israel's peak electricity demand.



You can't see the water *for the yachts in Saint-Tropez* ***(above)****, one of the most famous of French Riviera resorts. There a boat that risks a day sail can easily lose its expensive slip* ***(right)****. Half a million visitors each summer jockey to be the watchers and the watched in the harbor, streets, and cafés of this fishing village—inspiration for such painters as Signac and Matisse at the turn of the century.*

Brigitte Bardot and other celebrities put Saint-Tropez on the jet-set map 25 years ago. But as the crowds flocked in, most trendsetters left for more exclusive sands on the Riviera, also known as the Côte d'Azur.

A feast of illusion, *Mediterranean specialties sculpted in ice cream (**facing page**) capture Sicily's passion for frosty "gelati." Saracen invaders introduced ices in the ninth century, and Sicilians, using snow from Mount Etna, raised the dessert to an art form. Only the lemon slices are genuine in these dishes of creator Francesco Amoroso.*

*Olives—the soul of Mediterranean cooking—stock an Italian market (**top**) along with peppers, brought from the New World by Columbus. Most olives come from the Mediterranean, where the fruit was first cultivated.*

*Ancient gourmets paid handsomely for delicacies such as walnuts and pomegranates (**above**), still accorded artful treatment by an Istanbul vendor.*

IN CAIRO I learn about an even more audacious Mediterranean waterworks. The Egyptians want to fill up their huge Qattara Depression, a quicksand-pocked pit nearly the size of Israel, with Mediterranean water. Their canal could require rock excavation equal to building 270 Great Pyramids. The Qattara project would generate a relatively modest amount of Egypt's future power needs. But energy seems almost a secondary concern to Egypt's minister of electricity, Mohamed Maher Abaza.

"We can put in a chemical industry on the shores of this new Lake Qattara," he says. "We can extract many minerals, perhaps even silver and gold, from the seawater. We suspect there is oil beneath Qattara's quicksand, but now we can't get the heavy drilling equipment into the marshy depression. When Qattara becomes a lake, we can use offshore-drilling techniques.

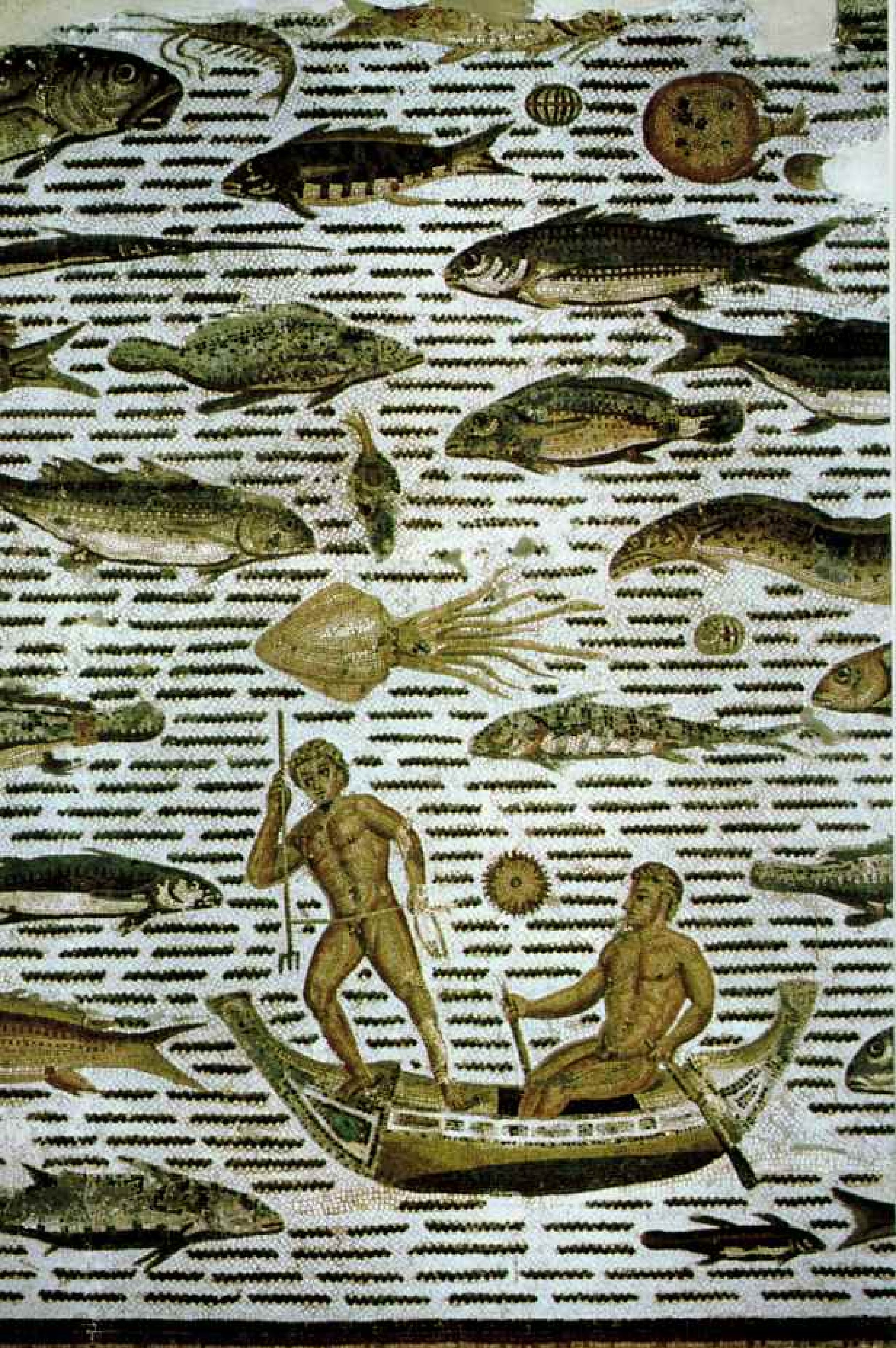
"The tourism potential is enormous. This will be a huge lake. Also, humidity from this lake could increase rainfall enough to permit grazing as well as certain types of desert agriculture. Cities will sprout and attract people from our overcrowded Nile Valley. It will be a new Egypt!"

If feasibility studies bear out Abaza's optimism, and if Egypt can manage to find financing, Lake Qattara could begin filling in the early 1990s.

The most appealing—and potentially the most important—Mediterranean megaproject, however, is a grand scheme of Morocco's King Hassan. He wants to build a bridge across the Strait of Gibraltar.

King Juan Carlos of Spain has endorsed the Moroccan monarch's dream, and in both Rabat and Madrid, I find engineers plotting to make it a reality. At this point Spanish officials prefer building a tunnel instead of the elegant cables of a 25-kilometer-long suspension bridge.

A tunnel, the Spaniards believe, is technologically possible today, whereas no one has ever dared build a bridge over waters as deep and treacherous as those between the Rock and Tangier. Among other challenges, a bridge would require supports hundreds of meters high. These towers would pose navigation hazards for ships in the busy, often foggy strait. In case of war, while a tunnel is by no means immune from possible



Fighting for their share *of the sea, Sicilians go hand to hand with bluefin tuna in a "mattanza" held in May on the island of Favignana* ***(below)****. Led through a series of nets into a final death chamber, only a few hundred of the giant tuna have been caught in recent years—compared with 10,000 in 1850—as commercial fleets as well as water and noise pollution take their toll. Tunisia's ancient marine heritage echoes in a mosaic in a museum at Sousse* ***(left)****, while its modern fishermen bring sea bass to a Tunis market* ***(right)****. Though its seafood tradition runs deep, the Mediterranean yields a limited bounty because nutrients are scarce.*

MUSEUM OF ANTIQUE ART, SOUSSE (FACING PAGE)

attack, such a strategic bridge would be a bomber's delight.

Still, King Hassan is pushing for a bridge. "It would remind the world that Morocco has always been a vector of culture," says Mohamed Kabbaj, former royal aide and now minister of public works. "Islamic civilization spread from Fez across the strait to Spain, and from there to Italy to help inspire the Renaissance."

A bridge, the king believes, would renew Morocco's former prominence. It would funnel the growing trade between Europe and the developing nations of Africa through Morocco.

STREET HUSTLERS are like flies in Tangier. Once they descend on you, they persist. But this one is affable. "Mostaffa Bakkali, artisan" reads his identity card. He can hustle in six languages, and his face is a mélange of North African and European features. So I don't mind that he tags along after me as I roam the streets of this faded, seedy former gateway to the Mediterranean.

I ask Mostaffa about the bridge, and he grins, as if in anticipation of the ten million visitors a year that would probably drive across the span. His words are less lofty than the king's aide's: "If it comes, we'll all be rich. Tangier will be a great city again!"

Mostaffa does not understand why I have come to Tangier, which caters to many fleshly pursuits. "You can get many new ideas in Tangier," he suggests as we part.

I doubt that there are any new ideas of the kind Mostaffa has in mind, and certainly not in Tangier. But new ideas—I have found no shortage of those.

After more than a year of travels I am returning to the Rock to close a circle. Mist clouds the strait once again. The Rock emerges, like an old friend. This time I disembark at Gibraltar and ascend to the peak. From this vantage point of Hercules the squabbles below—such as whether Britain should cede its 269-year-old sovereignty over the Rock to Spain—seem minor.

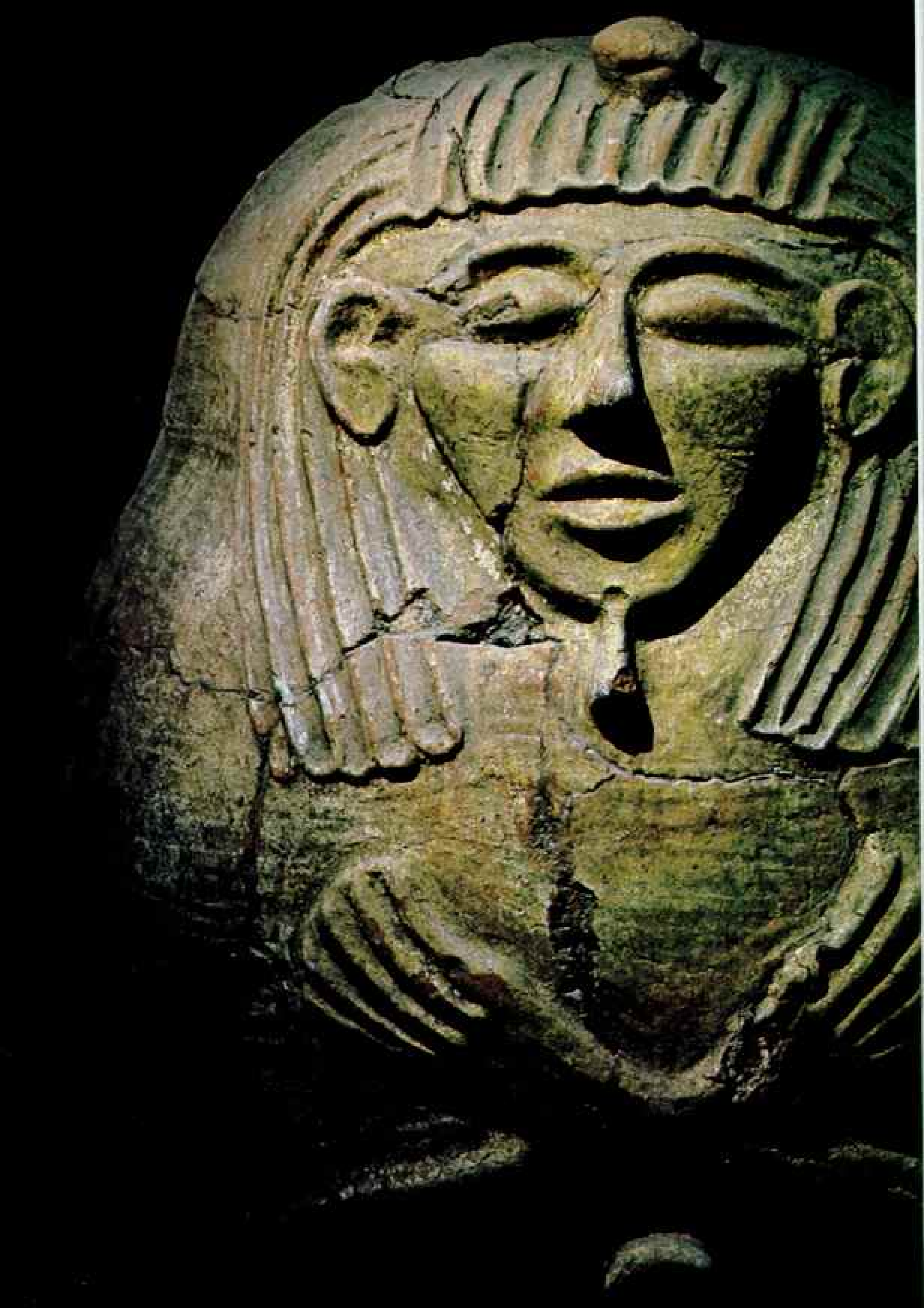
More apropos is a news report I read en route across the strait. A volcanic hazard alert has been issued for the Mammoth Lakes region in California. That volcano erupted 700,000 years ago far more explosively than the one that created the Phlegraean Fields. Such an eruption, some

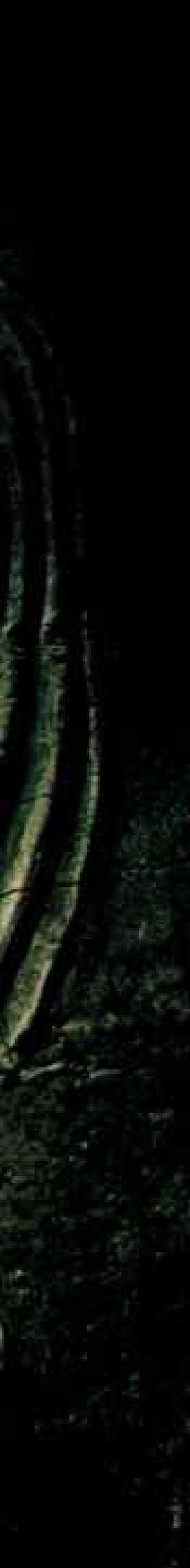
Teeming Istanbul *ends a day on the Bosporus, a passage between the Black Sea and the Mediterranean. Above the ancient crossroads, a bridge links Asia, left, and the European city whose population has tripled in 20 years.*

scientists suspect, could trigger another ice age. What a benign geologic period civilization has enjoyed!

I enter St. Michael's Cave, a vast chamber in the heart of the Rock. A stage has been built, and the stalagmites are bathed in multicolored lights. The music of Schubert resounds in the grand cave. "This is where we hold all our big events," a guide tells me. "Concerts, ballet, the Miss Gibraltar contest." The Rock indeed knows civilization.

If rocks could speak, I wonder what this one I'm standing in will say about us after Europe and Africa have closed the strait. Will it remember *Homo sapiens* as a master of dreams and a builder of bridges? Or will it recall him as a creature, like the dinosaur, not quite adept enough to live with his environment? Will it recount how civilization died out when geology one day suddenly revoked its consent? Or will it once again shelter a few of us, as it did our ancestors in the past ice age, and thus continue to stand sentinel over man's fate? □





GAZA SANDS YIELD

Lost Outpost of the Egyptian Empire

By TRUDE DOTHAN
Photographs by SISSE BRIMBERG
Paintings by LLOYD K. TOWNSEND

AUSTERE VISAGE of a coffin-lid mask gazes across 3,300 years from a cemetery long lost to history. Finds by modern grave robbers alerted Israeli archaeologist Trude Dothan to its existence. Her search led to a dune near Deir el-Balah in the Gaza Strip, where a cemetery yielded Egyptian-style "anthropoid" coffins with molded faces on the lids. Artifacts from the late Bronze Age outpost attest to the part it played on the highroad to Egypt. In that era, called "the first international age," new contacts blossomed between the Nile and the world beyond. The Egyptian presence on the coast in Moses' time may explain the route of the Exodus through the Sinai desert.

FROM THE DAYAN COLLECTION, GIFT OF L. TISCH TO THE ISRAEL MUSEUM

I HAD the uncomfortable sensation of going on a blind date—and for that matter a dangerous one. As we left the military checkpoint on the border of the Gaza Strip, two armored cars of soldiers convoyed our party. Through the desert heat of that July morning in 1968 I could feel a tense silence and hostility. It had been less than two years since the Six Day War, and an Israeli archaeologist was not the most welcome of visitors in this tiny stretch of the Mediterranean coast.

Aside from the element of danger, I felt a strong sense of uncertainty. After many obstacles and months of waiting, was I finally going to find the ancient burial ground that I knew grave robbers had been systematically plundering?

As we pushed past orange groves and palm trees, through the somnolent town square of Deir el-Balah, and into a barren landscape dotted with concrete houses and Bedouin tents, I could not guess how rich our discoveries would really be.

FROM THE T. KELLER COLLECTION, JERUSALEM

Untold treasure *was looted before scientific excavation began in 1972. A golden amulet bearing the face of Hathor, Egyptian goddess of love and fertility, will eventually go to the Israel Museum in Jerusalem. But many other artifacts are scattered around the world, in museums as well as private collections.*

Eventually we were to uncover not only a cemetery full of archaeological treasures, but also a hidden city, a fortress, and a reservoir—all more than 3,000 years old. And we were to find a clue to a biblical mystery concerning the Exodus: Why, in their flight from Egypt, did Moses take the children of Israel inland to the wilderness instead of pursuing a far easier path along the coast?

This modern detective story had begun a few months earlier when I visited an out-of-the-way antiquities shop in the Old City of Jerusalem. There I saw something that interested me enormously—a clay coffin lid propped up against

the wall. A huge face modeled in the clay stared at me with an uncomfortable intensity.

The lid was part of an anthropoid, or human-shaped, coffin, a pottery imitation of Egyptian mummy cases. Such coffins have been found in Egypt and at a few sites in Israel. Slipper-shaped and slightly larger than life-size, they are notable for a great variety of stylized sculptured features, some naturalistic and others so grotesque as to be caricatures.

The Jerusalem antiquities market had recently been flooded with Egyptian scarabs, jewelry, and alabaster and bronze vessels, and with exquisite painted pottery from Mycenaean Greece—all typical grave offerings from the 13th century B.C. I suspected that these objects had been looted from tombs. Now the appearance of an anthropoid coffin confirmed my hunch. Modern tomb robbers had apparently stumbled upon a late Bronze Age cemetery of unprecedented richness, complete with Egyptian-style burials.

The antiquities dealers told me that the coffin lid and burial gifts came from near Hebron. This hilly area south of Jerusalem is notoriously rich in plundered tombs. But I knew this could not be true, for the artifacts bore traces of yellow sea sand, typical of Gaza and the Sinai coast.

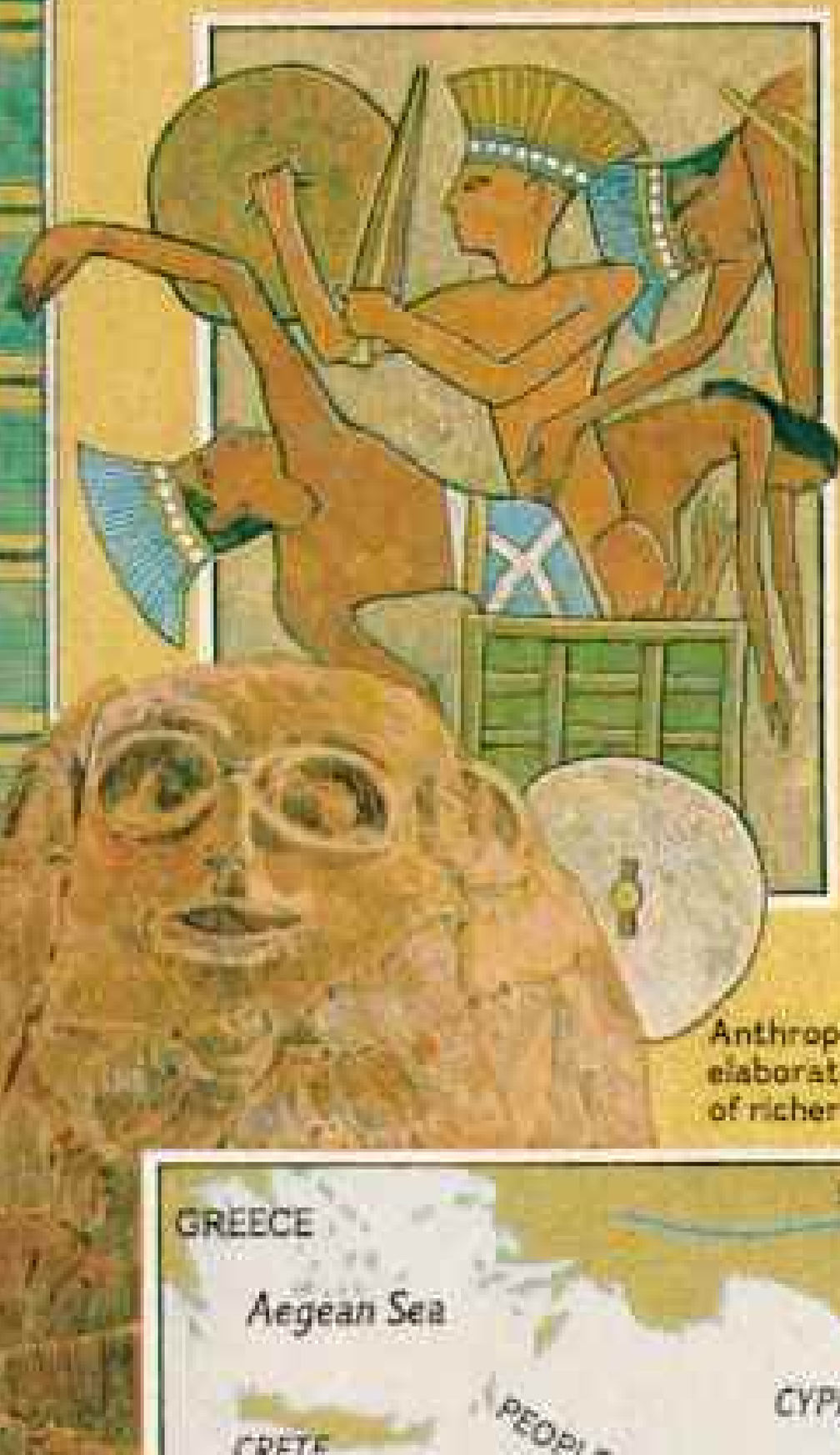
Through the good offices of the minister of defense, the late Moshe Dayan, I tracked down the source: The looted materials came from the Gaza Strip. Through Dayan, also, I secured permission to visit the site on that July morning in 1968.

With my husband, Moshe, professor of archaeology at Haifa University, and Dov Meron, archaeological staff officer of the area, I arrived at eight o'clock sharp at the checkpoint on the border. After picking up our military escort, we made our way south through Gaza and Deir el-Balah. My anticipation grew more feverish as we reached our destination: an unassuming tilled field in the midst of sand dunes, about a mile from the sea.

The owner, a Gaza *(Continued on page 746)*

Deir el-Balah—way station of empires

*TUMULT was the hallmark of the end of the Bronze Age. It culminated in Ramses III's final defeat of the Peoples of the Sea, who had threatened Egypt over decades (**inset map**). Among them were the Philistines, seen defending their families on a relief from Medinet Habu (**below**). The pharaoh placed the conquered Philistines in Canaan as mercenaries. Egypt's influence, seen in the coffin lids, waned in the following centuries.*



Anthropoid clay coffins copy elaborate Egyptian originals of richer materials.

Known to Egyptians as the Ways of Horus, the coastal artery from the Nile Delta to Canaan was called "the way of the land of the Philistines" in the Bible. Six fortresses along the route have been identified.

LOWER EGYPT

THE EXODUS
Israelites' 13th-century B.C. flight from Egypt may have been through southern Sinai to avoid Egyptian coastal strongholds.

Cairo
Giza

Western Desert

Nile

Eastern Desert

Gulf of Suez

Akhetaten (Tell el-Amarna) RUIN

NEW KINGDOM
16TH TO 11TH CENTURIES B.C.
Conquering pharaohs pushed Egypt's border northeast as far as Syria; great temples, tombs, and palaces rose on the Nile.

UPPER EGYPT

Nile

Medinet Habu
TEMPLE OF RAMSES III

Thebes (Karnak)

0 KILOMETERS 100
0 MILES 100

HITTITE EMPIRE

GREECE

Aegean Sea

CYPRUS

CRETE

PEOPLES OF THE SEA c. 1200 B.C.

SYRIA

Mediterranean Sea

CANAAN

EGYPT

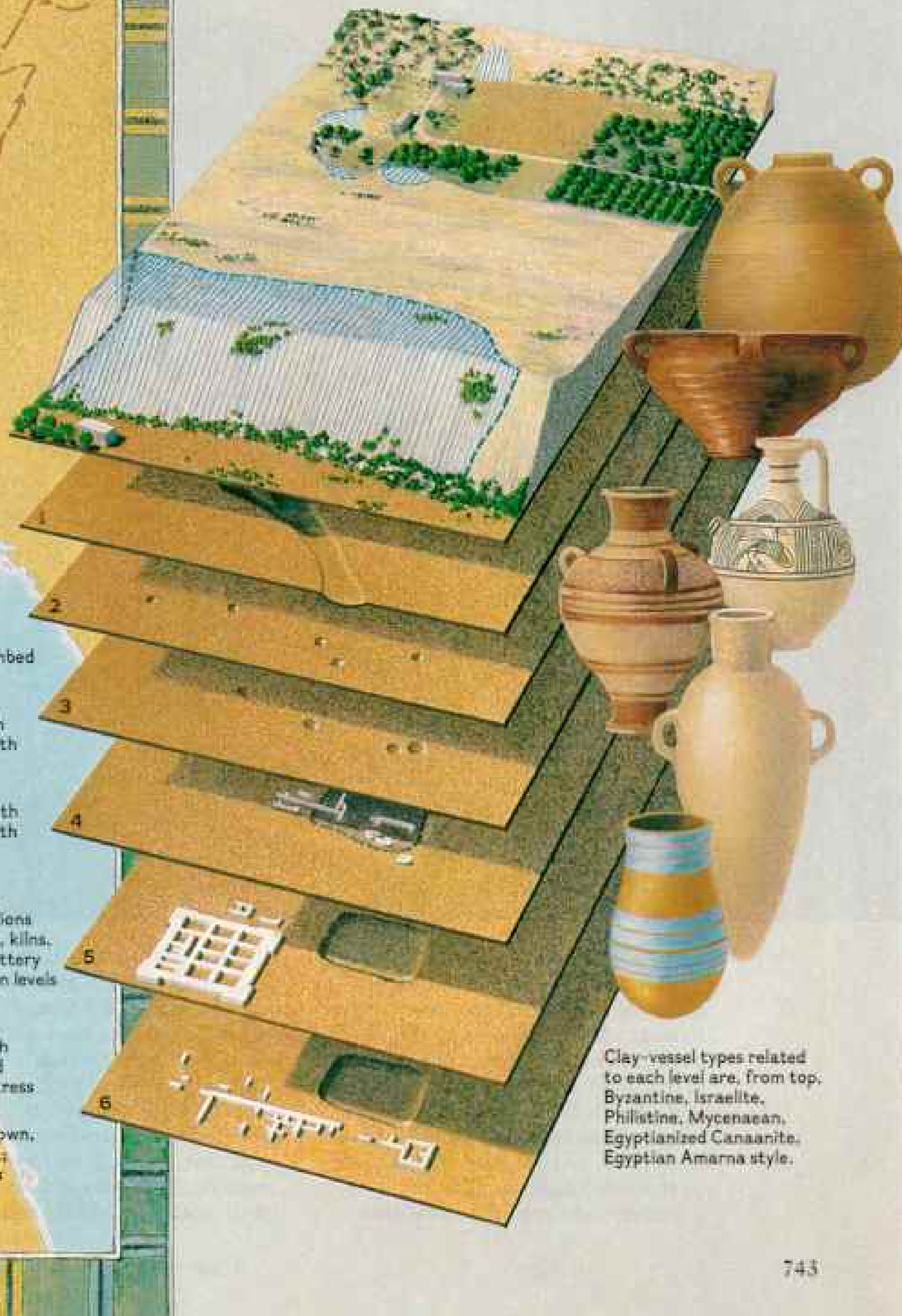
AREAS OF EGYPTIAN INFLUENCE ca. 1300 B.C. (BOTH MAPS)

0 KM 300
0 MILES 300

MAP AND PAINTINGS BY LLOYD K. TOWNSEND

A cloak of sand *formed above the site after* A.D. *700, piling as deep as 13 meters. Excavations uncovered part of the settlement, foreground, in addition to the cemetery at the back of the dune. Potsherds on the upper three levels signaled occupancy by Byzantines, Israelites, and Philistines. Deeper lay building foundations, a filled-in pool, and artifacts from the time of strongest Egyptian influence in Canaan.*

AREA OF SCIENTIFIC EXCAVATION



LEVEL 1: Byzantine remains, 4th to 7th centuries A.D.; streambed with pottery.

LEVEL 2: Israelite campsite, 10th to 9th centuries B.C.; pits with pottery sherds.

LEVEL 3: Philistine settlement, 12th to 11th centuries B.C.; pits with sherds.

LEVEL 4: Egyptian settlement, late 13th century B.C.; foundations of artisans' quarters, kilns, and multinational pottery of types found also on levels 5 and 6.

LEVEL 5: Egyptian stronghold, early 13th century B.C.; pool and foundations of a fortress and buildings.

LEVEL 6: Egyptian town, mid-14th century B.C.; pool and foundations of a palace from the Amarna period.

Clay-vessel types related to each level are, from top, Byzantine, Israelite, Philistine, Mycenaean, Egyptianized Canaanite, Egyptian Amarna style.

A TANTALIZING PORTION *of the dune's secrets has come to light* ***(above)****. Bulldozers have removed some 175,000 metric tons of sand; the dune once reached to the orange grove at left. But much of the ancient settlement undoubtedly lies untouched below the sand between the newly excavated area, foreground, and the cemetery uncovered on the dune's opposite side.*

Flanking the open dig, fields once covered with sand have already been excavated and refilled with soil by agreement with the landowner. The present open area must similarly be reinterred by this month.

Working against time, Dr. Dothan and her team of scientists, student volunteers, and local workmen reached what may be the lowest level during their most recent dig last summer. In the floor level of mid-14th-century B.C.

buildings, a fragmented flail similar to one found in Tutankhamun's tomb supports other evidence that the site may have been an important satellite of Egypt's New Kingdom.

*On the last day of digging, a sharp-eyed student sorting pottery spied a fragment of a bowl with ancient script (**right**). Such bowls have been found associated with Egyptian administrative centers of that period.*

Lost Outpost of the Egyptian Empire

lawyer, was expecting us. Nearby waited several Bedouin—tenants and custodians of the land. As I stepped toward the plowed field, I knew immediately that this was the source of the coffins.

Hundreds of late Bronze Age pottery sherds and almost complete vessels were scattered among the furrows. Most striking were broken pieces of coffins. I rushed around collecting every significant sherd I could find. My excitement was so infectious that even the skeptical soldiers joined in.

Because of the security situation in the Gaza Strip, our visit had to be very brief. Indeed, despite my enthusiasm, I had to wait several more years for permission to excavate. Meanwhile, with the help of Joseph Aviram, director of the Hebrew University's Institute of Archaeology, I began to organize a multidisciplinary team from among my colleagues there.

Finally, in March of 1972, permission was granted, and we were joined by a group from Tel Aviv University for the start of our first field season. At Deir el-Balah we were housed in the garrison, and soldiers accompanied us at all times. We agreed to work only in daylight hours.

Honor Among Suspected Thieves

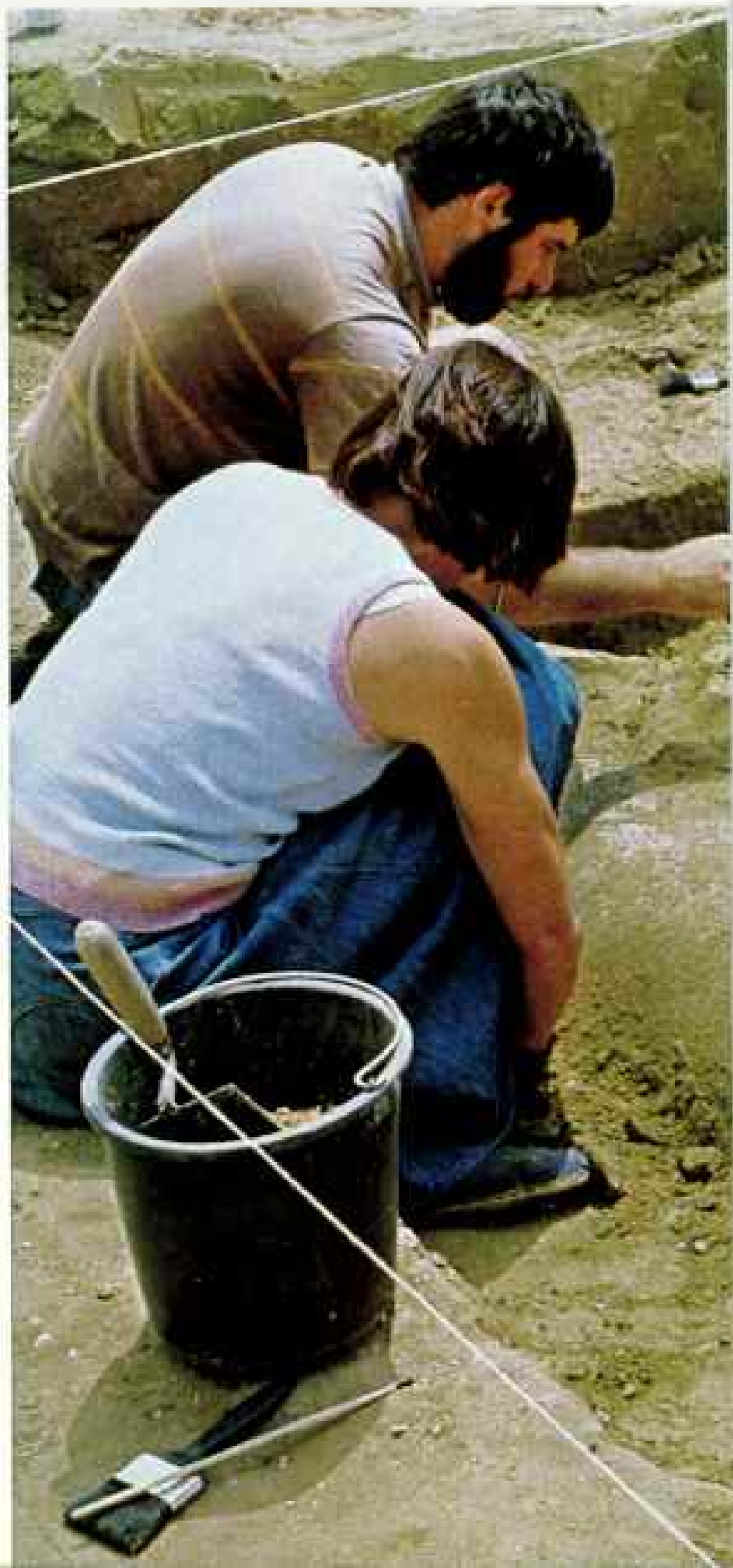
Finding the actual burial ground proved frustratingly difficult. We were faced with agricultural fields of plowed sand enclosed by high, shifting dunes on every side. The local Bedouin whom we hired to help in our search kept leading us to sites that had already been robbed.

Finally we turned to the apparent leader of the Bedouin, Hamad, a dignified and deeply religious man. Although we wondered if he had been one of the tomb robbers, we needed his expertise, and we believed he would not betray us.

Hamad would lead us over new areas, holding an enormously long screwdriver before him like a divining rod. Every so often he would probe the earth with it. When asked about his technique, he replied enigmatically with an Arabic proverb: "*Yaum asal, yaum basal*—Some days it's honey, some days onions." Then, after one particularly uneventful day, he announced that our next day would probably be honey.

In the morning Hamad's prediction came

*FIRST GLIMPSE of the cemetery site was a field (**right**) that had been hastily plowed to hide evidence of clandestine digging. But a quick hunt among the furrows turned up a crop of late Bronze Age sherds and fragments of clay coffins. Subsequent digs unearthed four anthropoid coffins undisturbed since ancient times. Seeming nearly intact when uncovered (**below**), all were in fact badly cracked, their forms kept by sand within. Coffins probably held Egyptian officials and others of high rank, though Canaanites may also have been so interred.*



BOTH BY ZEEV RADOVAN

true. At the edge of the plowed ground below the high dunes, we found our first clue—a storage jar buried upright in the sand. That was what he had been probing for—an ancient grave marker.

Beneath the jar lay a patch of dark soil about a meter and a half wide and two meters long, readily distinguishable from the surrounding sand. Clearing it away, we caught a glimpse of our first undisturbed coffin—with two modeled-clay hands folded peacefully on the lid.

Slowly and gently we worked our way along with brushes and dental instruments. The lid, when completely exposed, proved to be an unusually fine example of the naturalistic type, with a delicately molded face surmounted by an Egyptian-style wig.

We had intended to transport the coffin to Jerusalem, where it could be opened under laboratory conditions. We had even brought ambulance stretchers for this purpose. But the coffin was cracked into dozens of pieces, held in place by the sand that had seeped into it over thousands of years. We had no alternative but to open it immediately.

To our surprise this coffin contained four skeletons—two adults and two children, all buried at the same time. No traces of mummification were discernible. How was this multiple burial to be explained?

At our ten o'clock break, as we sipped cups of the cloyingly sweet tea Hamad's son brought for us, we speculated about the matter. "Perhaps an entire family died in an epidemic," suggested Professor Baruch Arensburg, one of our anthropologists. "Or, a more gruesome possibility is that a deceased's wife and family were entombed to accompany him to the next world."

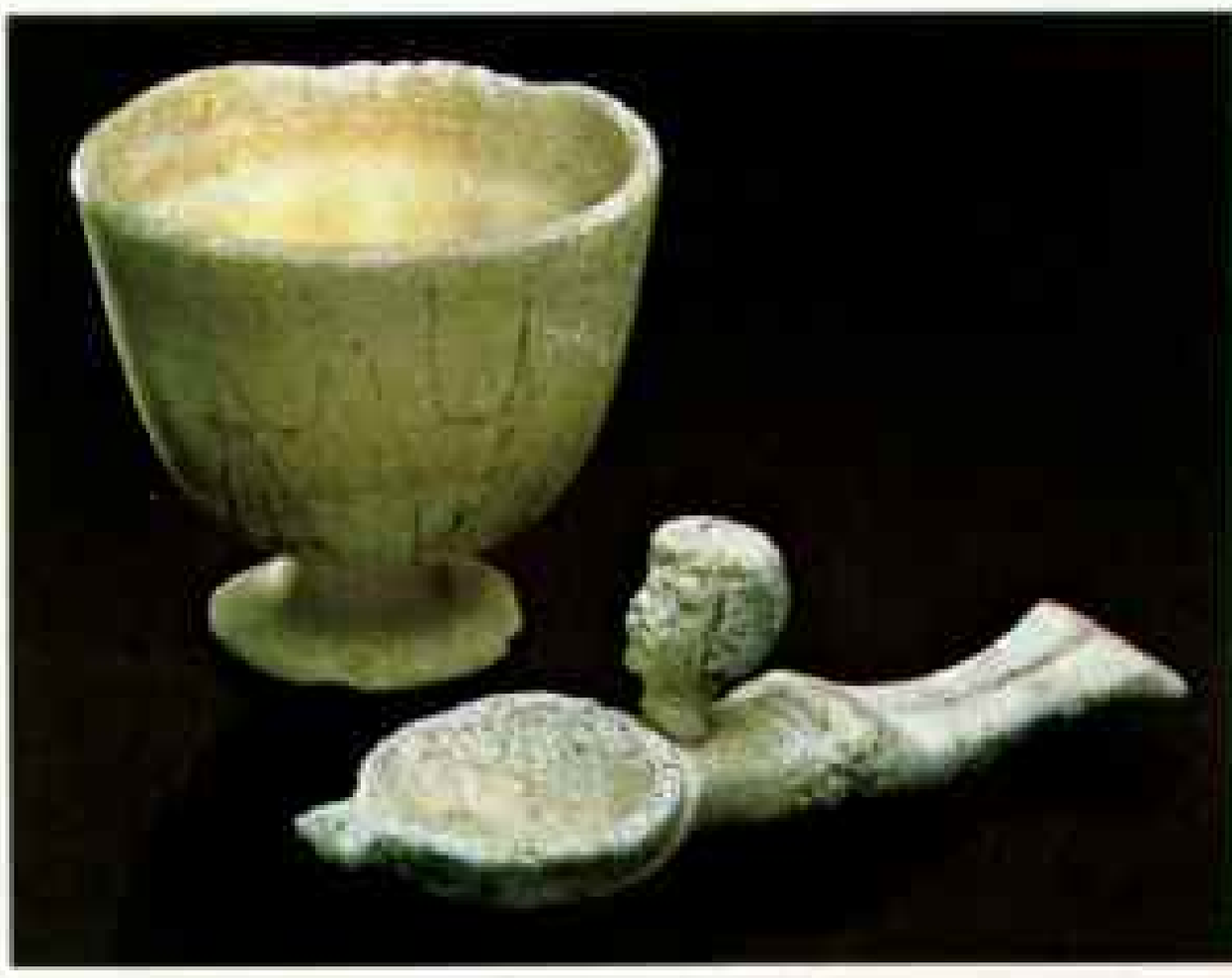
Aside from the skeletons, the coffin yielded handsome treasures—scarabs, gold and carnelian beads, and gaming pieces. The burial gifts also included a bronze mirror and knives, one with a handle in the shape of a cloven hoof, and a set of bronze vessels that I recognized as a wine set of the type depicted on Egyptian reliefs.

This was our first glimpse of an anthropoid coffin in situ. In the ten years since, we have been fortunate to find three more.

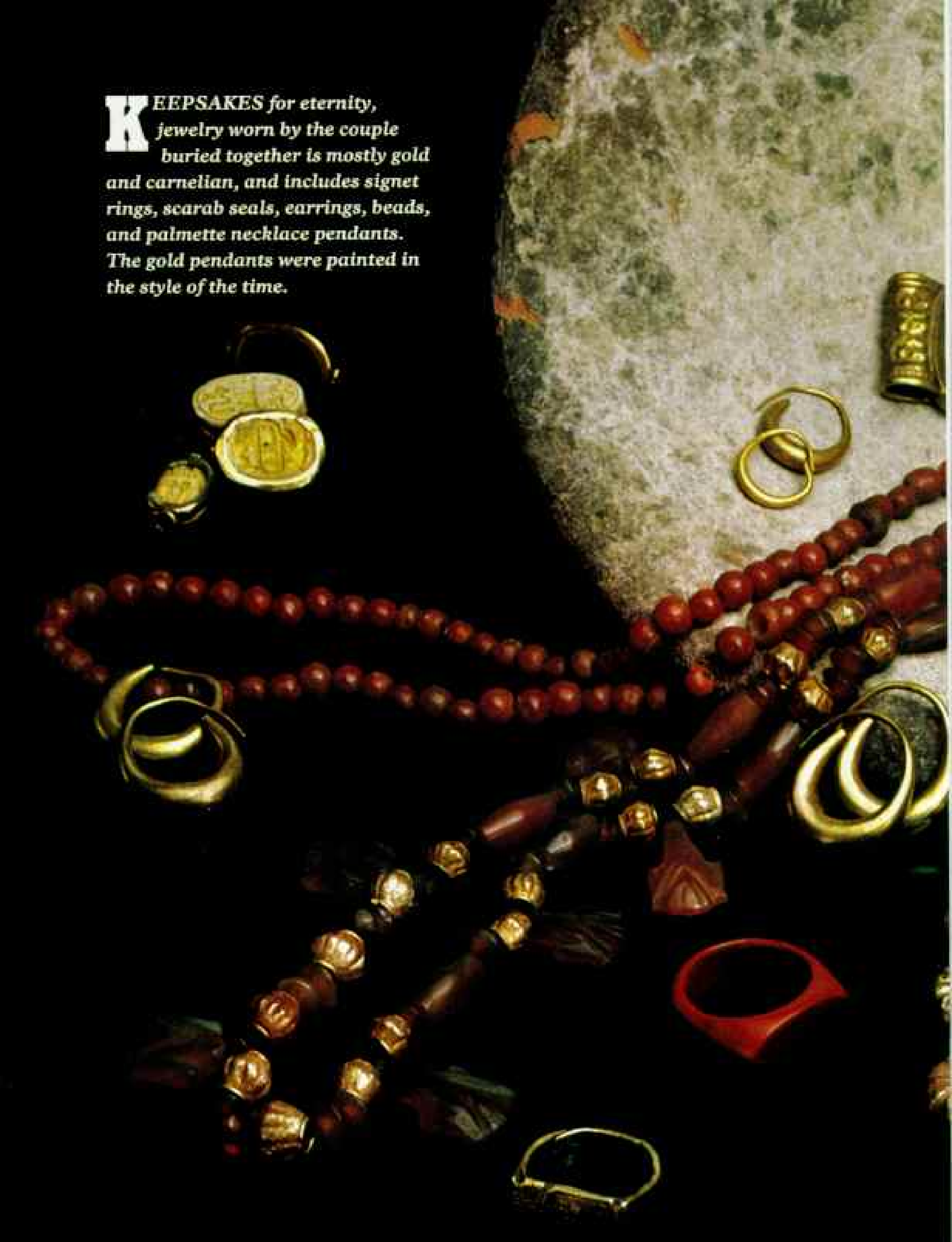
One of the most memorable bore an unusually small lid, with features and design details we had never seen before. A tiny face

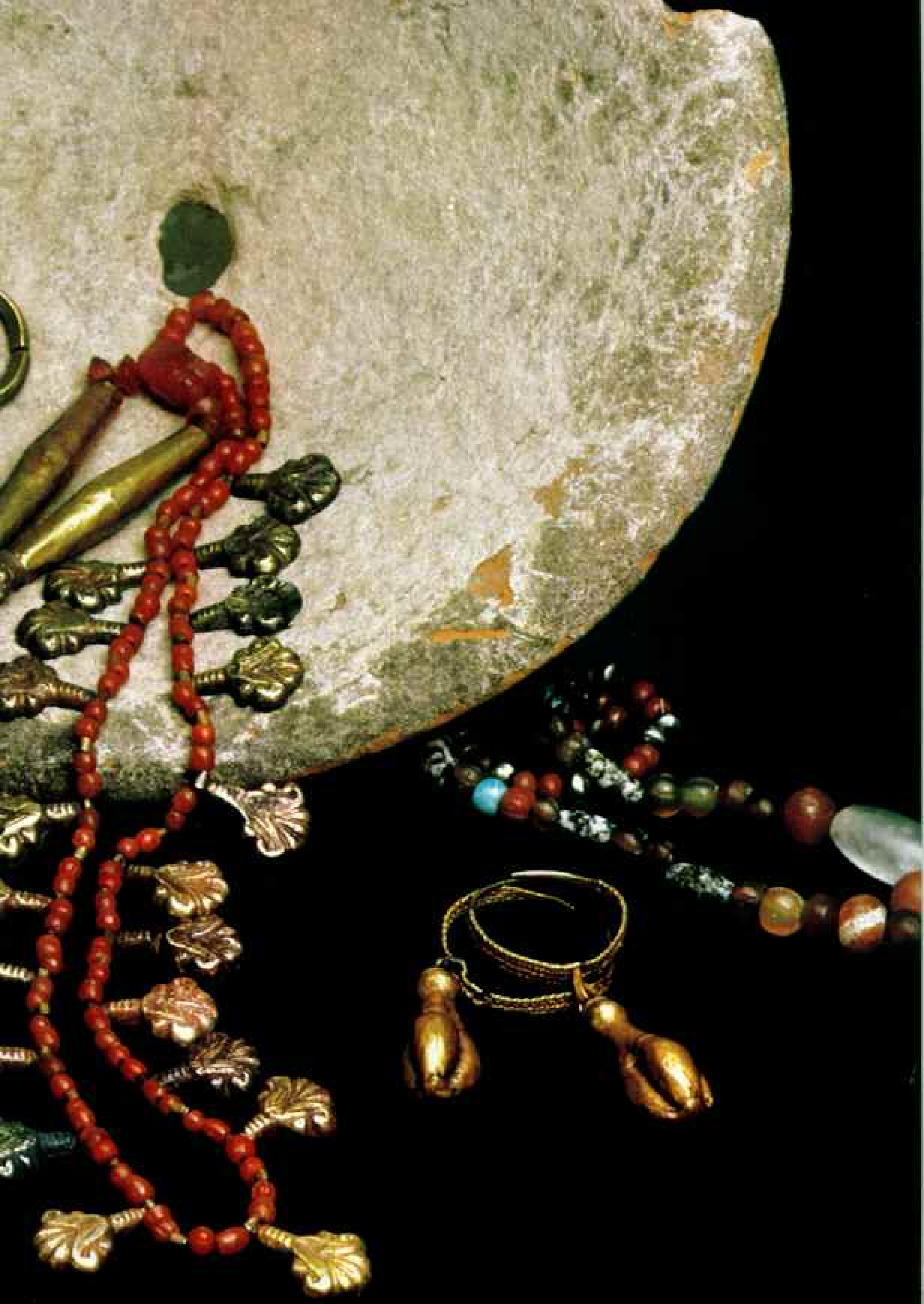
ZEEV RADOVAN (ABOVE AND RIGHT)

*IN DEATH'S EMBRACE, skeletons of a man (**right,** at left) and woman buried at the same time lie together with articles for the afterlife: alabaster goblet and a cosmetic spoon shaped like a nude swimming girl (**below**), clay vessels, and bronze platter, jug, and mirror. A large funeral jar above the 13th-century coffin (**above**) served as a grave marker—and aided in its recent relocation.*



KEEPSAKES for eternity, jewelry worn by the couple buried together is mostly gold and carnelian, and includes signet rings, scarab seals, earrings, beads, and palmette necklace pendants. The gold pendants were painted in the style of the time.





smiled up at us, framed by a heavy wig and surmounted by a stylized lotus-flower garland. Rows of indentations in the clay wig apparently signified curly hair.

When we removed the lid, we met a truly dazzling sight. Inside lay the skeletons of a man and a woman, touching each other in a pose so romantic that we nicknamed them Romeo and Juliet. Glistening in the sand beside the skulls were 20 palmette gold pendants along with gold and carnelian beads. Five pairs of earrings lay nearby—some solid gold crescents, others braided gold loops with fruit-shaped drops. One hand still bore a seal ring of gold and another of carnelian. And beside the skeletons lay bronze and alabaster vessels, among them a lotus-shaped goblet with petals painted in red and black.

Another fascinating gift was an alabaster cosmetic spoon carved in the shape of a nude swimming girl. Examples just like it have been found in tombs in Egypt.

As we made these spectacular finds, our Bedouin helpers sat dejectedly, notebooks in hand, privately figuring the price each artifact would have brought on the antiquities market. But their grave-robbing days were over; they would follow Hamad, and Hamad was a committed member of our team.

These coffins could be dated by the nature of the objects inside them. The burials apparently took place during the reign of Pharaoh Ramses II in the 13th century B.C.

Fundamental questions remained. Who were the people buried in the cemetery? Where had they lived? Were they Canaanites steeped in Egyptian culture or Egyptian officials serving abroad? No ancient settlements were known to us in the immediate vicinity, and the closest known sites were too far away to have established their cemetery here. We had to find the settlement connected with the cemetery.

Humble Homes Concealed Wealth

Because of the Yom Kippur War, digging at Deir el-Balah was interrupted until 1977. Then I returned to the site with our team from the Institute of Archaeology, supported from that time on mainly by the Dorot Foundation of New York. While part of our team continued searching for more burials, another group sought traces of the elusive settlement. Considering the opulence of the grave gifts we had found thus far, we hoped to find an extensive and wealthy site.

We spotted our first clue in an orange grove at the foot of one of the high dunes. Scattered on the surface were broken fragments of 13th-century pottery similar to that in the coffins. Excavation uncovered an earthenware oven with cooking pots beside a mud-brick wall. Additional remains of brick structures contained pottery vessels, grinding stones, pestles and mortars, and flint knives.

Could such humble dwellings be the homes of the wealthy men and women buried in the cemetery? Hamad, who keenly followed our progress, assured us that they could. "My own house is made of mud bricks like these," he reminded us. Yet there was no doubt that he was a wealthy man.

DAINTY cloven-hoofed animal's leg forms the handle of a bronze knife from the first coffin uncovered by Dr. Dothan. Like many Deir el-Balah artifacts, the knife matches others from both Egypt and Canaan. A Mycenaean jar found near it indicates contacts between Canaan and the Aegean at the time of burial, believed to be the 13th century B.C. A bronze wine-serving set, also in the coffin, resembles one depicted in a 14th-century tomb at Amarna in Egypt, Pharaoh Akhenaten's capital.

Rich or poor, the ancient settlement could not be excavated right away. The continuation of the buildings ran under a sand dune that towered 13 meters—about 43 feet—above us. From the trickle of sand already beginning to drift down, we realized that further digging could be dangerous. We called in construction and sand-removal experts for advice; heavy earth-moving equipment was the only practical answer. But the cost of such a massive undertaking was far beyond our budget.

Fortunately, in the course of discussions with the landowner and the local authorities, an ingenious idea was born. Clean sand for construction purposes was a valuable commodity, and there were apparently few sites as accessible as ours. The landowner enthusiastically agreed to the clearance, no doubt pleased with the prospect of enlarged arable fields. So when we finished our small excavation, the site was declared an official sand quarry for local construction firms.

Towering Dunes Pushed Back

A year later, the small area we had previously excavated was planted with cucumbers, and the huge sand dunes that had loomed over it were gone. In our considerably enlarged area we began to find remains of a different nature from those mud-brick buildings we had found before. Previously, the archaeological layers were shallow. Here in our new area we found layer upon layer of ashes, rubbish, and animal skeletons, packed with enormous amounts of crude pottery fragments. The accumulation—apparently the fill of a huge depression—was six meters deep in some places.

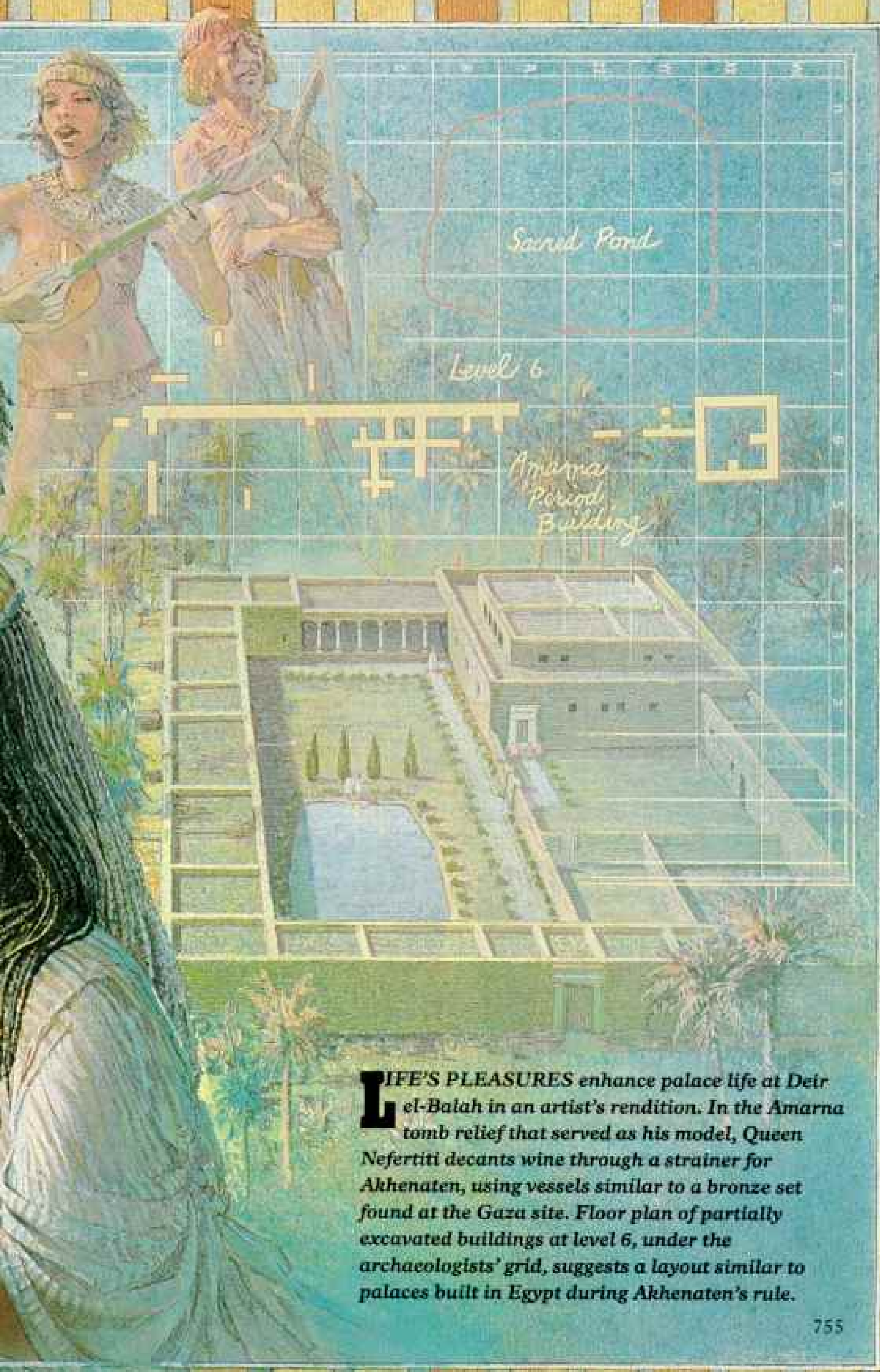
As we continued to enlarge the excavation, we gradually distinguished the semicircular outline of a brick structure built on the crater fill. Its collapsed domed roof and vitrified walls indicated a pottery kiln, one of several we were to find.

Large fragments of coffins began to appear, and we came upon a flat, perforated disk of clay, the size and thickness of a coffin base. It was similar to coffin bases we had discovered in the cemetery, thus establishing a possible link. And then we discovered a lid fragment with the distinctively shaped mouth and nose of a well-known coffin type.

The links between the cemetery and the

*WORTH ITS WEIGHT in gold to 20th-century archaeologists, a carnelian seal was cast aside by ancient grave robbers interested only in precious metal. On one face stand three Egyptian gods (**above**, from left): the sun god Amon-Re; Horus, the falcon god; and Min, the god of fertility. Hieroglyphs represent the names of Ramses II—pharaoh of the Exodus—and Amon-Re. The warrior king, who ruled from about 1304 to 1237 B.C., crossed Canaan in his drive against the Hittites, reaching what is today Syria. The burial almost certainly dates from his reign.*

*On the other face (**below**) the Egyptian king in a chariot holds reins, scepter, and whip. An attendant holds the horse's bridle.*



***LIFE'S PLEASURES** enhance palace life at Deir el-Balah in an artist's rendition. In the Amarna tomb relief that served as his model, Queen Nefertiti decants wine through a strainer for Akhenaten, using vessels similar to a bronze set found at the Gaza site. Floor plan of partially excavated buildings at level 6, under the archaeologists' grid, suggests a layout similar to palaces built in Egypt during Akhenaten's rule.*

*UNLIKELY COLLEAGUES worked together at the site. A local Bedouin, Hamad (**left**), located the first coffin excavated by the author. Catching on to the excitement and painstaking care of scientific work, he became an invaluable foreman, guardian, and adviser.*

*One of three guards assigned to protect the team last summer, an Israeli soldier helps carry tools (**right**). A military escort accompanied Dr. Dothan on her first survey in 1968. Unrest in the Gaza Strip made work impossible until 1972. The 1973 Yom Kippur War interrupted excavation, not fully resumed until 1977.*

*Last summer's efforts ended at the Amarna level (**above**). Further work will provide clearer knowledge of Deir el-Balah's ancient inhabitants.*

settlement were getting stronger, and it became evident that the settlement included an artisans' village. We uncovered hoards of bronze nails and scraps, and spinning bowls used in the production of textiles. In fact, eventually we found traces of nearly every craft connected with the burial gifts.

Poor Coffin Becomes Modern Treasure

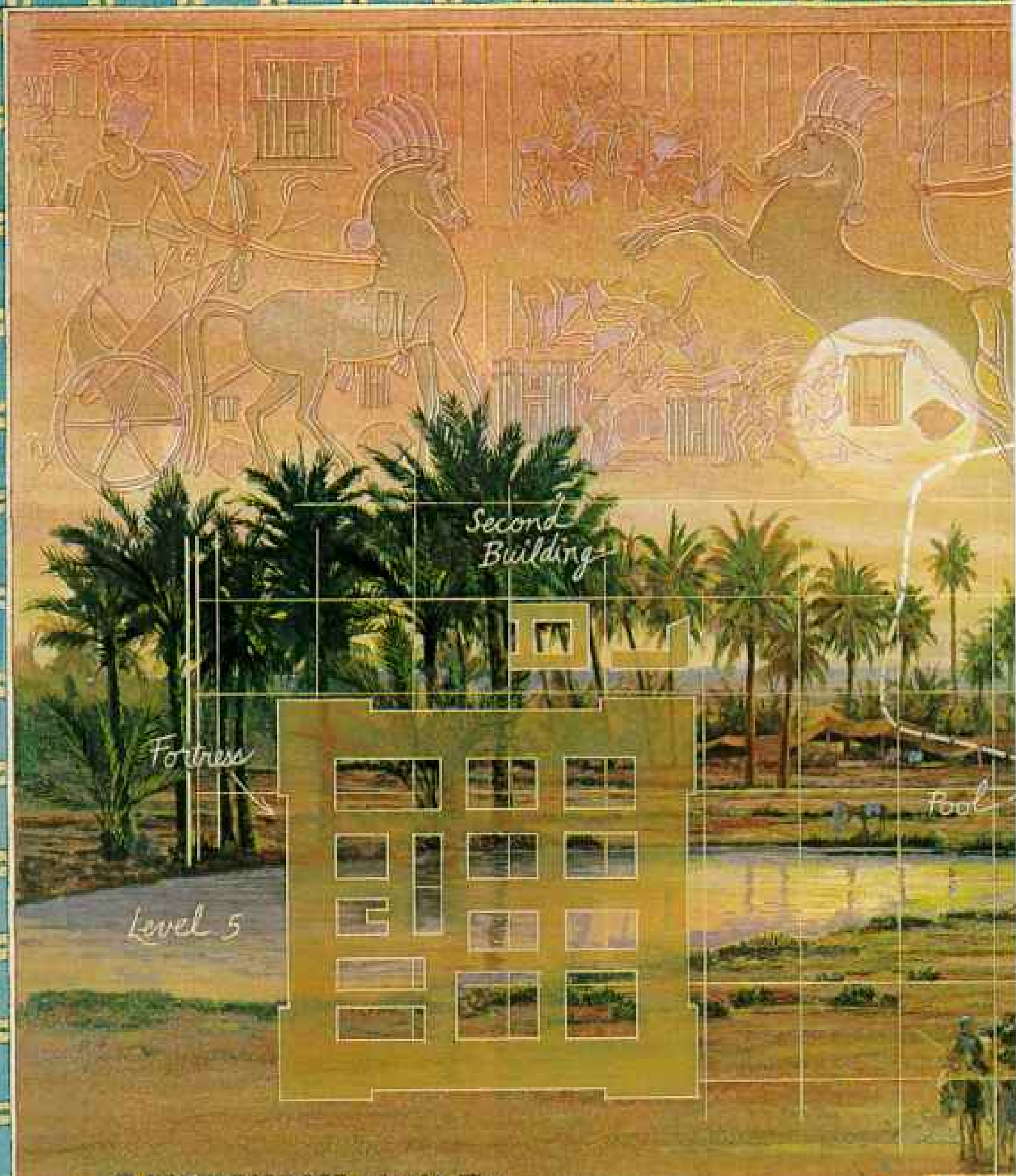
It often happened that the natural amphitheater of the remaining dunes was filled with onlookers. One day during our 1980 season, an Israeli TV film crew had joined them, and they were to see the uncovering of a mystery. Inside a coffin, tangled together, lay the skeletons of two men and a woman, 30 to 40 years old, rather elderly by the standards of the time. The skulls of the men were undamaged, but the woman's forehead had a huge hole in it. Was it the result of an amorous triangle ending in murder? Or the fatal aftereffect of trepanation—the ancient form of brain surgery?

To our surprise, this coffin held no burial gifts. Only later, when its fragments had been reconstructed in the laboratory, did we understand why. The coffin lid, which bore a delicately beautiful face, did not fit the coffin. It was clearly a reused lid, apparently sufficient for the burial of less affluent people whose survivors could not afford gifts.

Despite its stark simplicity, however, this coffin proved to be the conclusive link between the cemetery and the artisans' village. Its base was a flat, perforated disk identical to the fragment we had discovered inside one of the kilns.

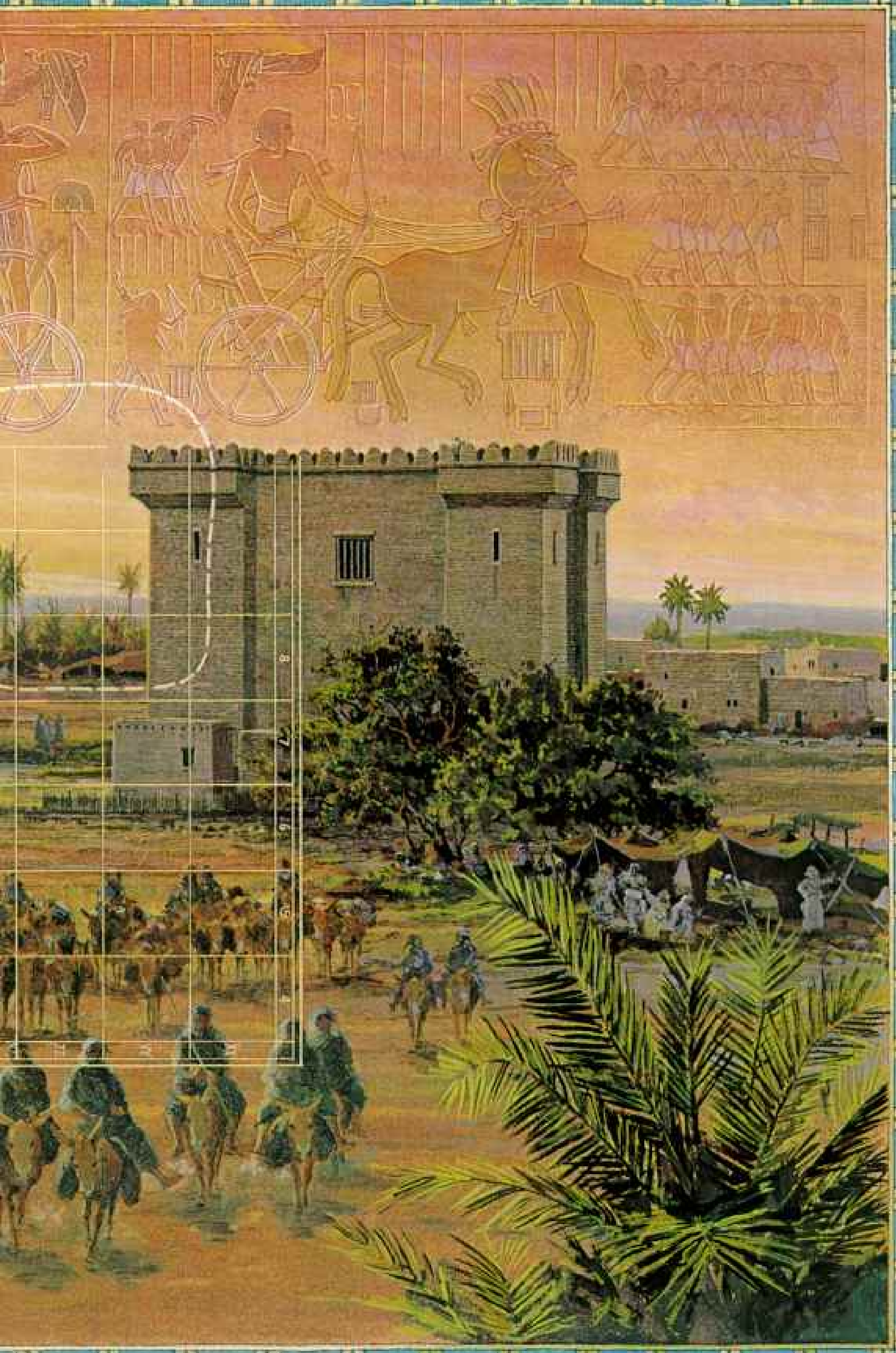
Returning later in the season, this time with additional support from the National Geographic Society, we hoped to find the main part of the settlement where the people buried in the cemetery had lived. So far we had uncovered remains of the workshops and courtyards, but domestic structures were yet elusive.

Because unbaked mud bricks, the main building material at the site, are so similar to the surrounding soil, they are very difficult to discern. Our workmen, whose houses are still made from local clay, developed great skill in distinguishing them. When Gary Lipton, our surveyor-draftsman, plotted these remains on our ground plans, they led to an understanding of the plan of the site.



■ FORTRESS ROSE at level 5. The

***A** FORTRESS ROSE at level 5. The bastion may have resembled those shown on a relief depicting Seti I campaigning in Canaan about 1300 B.C. Like a map, the tableau shows a series of citadels with pools, strung from the Nile Delta to Gaza. Although it is impossible to say which, one is probably Deir el-Balah.*



To the east of the great crater, we finally found the apparent dwelling place of the people interred in the cemetery—two monumental brick structures, one superimposed on the other. From the thickness of their outer walls and the floor plans, we recognized that we had found no mere civilian settlement. One was a royal palace, the other a fortress, built in the imperial Egyptian style of the New Kingdom.

The earlier structure, not yet completely excavated, is a palace measuring at least 55 meters long. It contains more than 15 rooms with outer walls more than a meter thick. Led by Ann Killebrew, the American archaeologist who is my right hand, we found on the floors local and imported pottery vessels, a steatite seal, pestles, mortars, flint sickle blades, and, most important, molds for manufacturing nude female figurines. When we later returned to Jerusalem, we found to our great surprise that one of our previously excavated figurines fitted the mold exactly.

Our best evidence for dating this palace was a clay bulla, or seal impression, that had once been attached to a papyrus scroll. Its hieroglyphics were very similar to those on a seal discovered at Egypt's Tell el-Amarna, the town built by King Akhenaten. Thus the artifact, the architecture, and the crater (which we later found to be a pool) could be dated to the second half of the 14th century B.C.

The fortress, constructed partially above the ruins of the palace, was of even more massive construction. Its walls, more than two meters thick, apparently supported two stories. Corner bastions indicated that this fortress, too, was built in the royal Egyptian style, and in a manner strikingly like fortresses shown on the relief recorded by Pharaoh Seti I on the walls of the Amon Temple at Karnak, far up the Nile (previous pages).

This relief, from about 1300 B.C., depicts the ancient route from Egypt to Canaan, a well-traveled road known to the Egyptians as the Ways of Horus. There is more than simply a resemblance between our fortress and the details of the map—the relief provides an almost exact blueprint of the kind of structure we were uncovering. In fact, it was another element of that ancient relief that enabled us to understand the enigmatic crater that had puzzled us for so long.

My chief assistant and stratigrapher, archaeologist and Egyptologist Baruch Brandl, had never been satisfied with the geologists' explanation that the huge depression was a natural feature caused by erosion. Baruch felt that its outlines were too regular—there had to be something more to it than that. Finally we recognized the most important clue: Most of the fortresses depicted on Seti's Karnak relief are connected with large water reservoirs of varying shapes.

The crater at Deir el-Balah, we now realized, was actually a reservoir, about 20 by 20 meters, with very steep sides. Thus our ground plan of the fortress and its adjacent

PHOTOGRAPHED COURTESY ISRAEL MUSEUM

*MILLENNIA-OLD IMAGE in sand mirrors a broken figurine mold, just lifted from its resting-place (**right,** at left). It and a twin, from the same master mold, were found on the Amarna-floor level. A carved stone nude reclining on a bed (**above**) came from the cemetery. A familiar figure in Egyptian tombs, she was buried as a "divine concubine" to accompany the dead.*

pool fit exactly the depiction in Seti's relief.

The clay removed in construction of the reservoir apparently provided material for the bricks of other structures. As the central feature of a roadside fortress, it served many uses besides providing drinking water. A large volume of water would have been needed to prepare potter's clay. The reservoir may also have served as a sacred lake, a feature well known in Egypt. At some time after its construction the reservoir slowly choked with debris. Later an industrial area including the kilns was built on the fill.

We have not yet been able to identify the Deir el-Balah fortress with a particular representation on the Karnak relief. Two of the fortresses shown along the Ways of Horus are designated as towns "which His Majesty built newly." Considering the close connections between Egypt and Canaan during the XIX Dynasty, it is possible that our fortress, with the thick walls and corner towers, was built during the reign of Seti I, who ruled New Kingdom Egypt and its empire in Canaan from about 1318 to 1304 B.C.

On the basis of the pottery found in the fortress, we believe that it flourished during the reign of Seti's son, Ramses II (about 1304-1237 B.C.), to whose reign we date the anthropoid burials as well. Our fortress, reservoir, and cemetery provide a vivid demonstration of Egypt's power and prosperity in this period, a time of close Egyptian control over the coastal route. Moreover, ceramic analyst Bonnie Gould has determined that 80 percent of the locally made vessels were Egyptian in both shape and ware.

An Exodus Riddle Solved

The Ways of Horus holds much interest for scholars. As long ago as 1920 the noted Egyptologist Alan Gardiner optimistically predicted that future excavations along its route "would reveal many of the fortresses depicted in the Karnak sculptures." Our evidence, together with excavations by the Ben-Gurion University, has made his prophecy come true.

Once we discerned the meaning and function of the settlement at Deir el-Balah, we were able to understand a passage in the Bible that has long puzzled scholars. It is

*BORROWINGS FROM EGYPT encompassed articles of daily life as well as the trappings of death for residents of Deir el-Balah. Fragments of pots with handle-like loops inside them (**right**) are remnants of Egyptian-style spinning bowls of a type that gained wide use in Canaan.*

*The fiber spun at Deir el-Balah was probably flax; traces of linen cling to bronze objects found in the coffins. Rough fibers were twisted into loose thread, which was then wound into balls. In an artist's interpretation (**left**), based on a wall painting from a 14th-century Egyptian tomb, the thread is pulled through spinning-bowl loops that both hold the balls in place and provide tension for the spinner to pull against. As he rotates the spindle in his hands, the length of the strand that has passed through the ring above the bowl twists into a tighter, stronger, and more workable thread for weaving into fabric.*

believed that during the reign of Ramses II the Israelite Exodus from Egypt took place. But the route chosen by the Israelites is rather cryptically described:

> *And it came to pass, when Pharaoh had let the people go, that God led them not through the way of the land of the Philistines, although that was near; for God said, Lest peradventure the people repent when they see war, and they return to Egypt. (Exodus 13:17)*

The problem with the passage is chronological; the Philistines had not yet arrived to settle along the coast. The solution to its meaning lies in an anachronism—though the Bible speaks of "the way of the land of the Philistines," it is describing the very same road that the Egyptians called the Ways of Horus.

As the Bible observes, this route to the Promised Land was far shorter than the route the Israelites eventually took. But our excavations at Deir el-Balah revealed the wisdom of this choice, for by escaping into the desert, the Israelites avoided the powerful fortresses of the very pharaoh from whom they had fled.

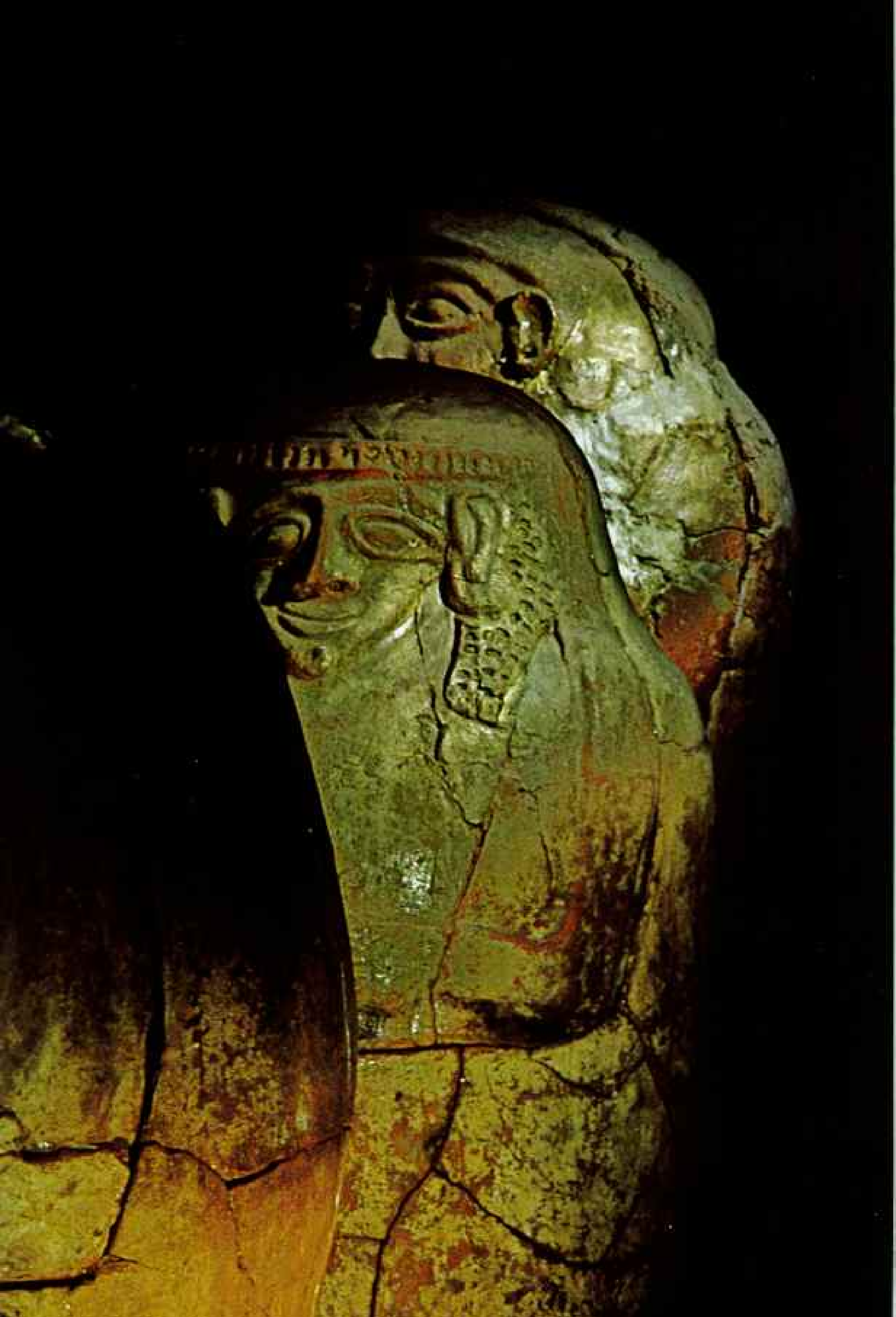
The crucial question of the identity of the people of ancient Deir el-Balah, so steeped in Egyptian culture and religion, remains unanswered. The period in which they lived was one of intensive international trade and of great ethnic changes and political upheaval. It was the time of the last flowering of the Egyptian New Kingdom before its decline to the point where the Bible scorned it as a "bruised reed" (II Kings 18:21).

We are still unsure whether the cemetery served as the private resting-place for Egyptian officers and officials or as a regional cemetery for people of Egyptian religious background. Its value to us, in either case, is its reflection of the cosmopolitan culture of the late Bronze Age, a period in which influences from Egypt, Canaan, Cyprus, and the Aegean freely mixed.

At levels above the remains of the late Bronze Age fortress, we eventually discovered the Philistine settlement that I had originally hoped to find. This unfortified settlement, *(Continued on page 768)*

CONGREGATION from the other world, coffin effigies from Deir el-Balah now stand in Jerusalem's Israel Museum. They were collected by the late Moshe Dayan, who purchased them on the antiquities market in fragments and personally reconstructed many. As minister of defense, he was instrumental in helping the author locate their source.

FROM THE DAYAN COLLECTION, GIFT OF L. TISCH TO THE ISRAEL MUSEUM



PREPARATIONS FOR DEATH *keep a busy tempo in the artisans' quarter at level 4. A customer advises a craftsman shaping a coffin lid. Other workers move a completed coffin, build another with coils of clay, and fire a lid. In a mural re-created from a tomb at Thebes, professional mourners approach a classic Egyptian coffin of the sort roughly copied in clay at Deir el-Balah.*

Artisan Quarters

Ponds filled with black earth

Kiln

Kiln

Level 4

*FEET OF CLAY were added to some coffins (**below**) and holes drilled in the back to allow body fluids to drain (**above**). Whoever they may have been, those buried at Deir el-Balah sometimes retained ushabti, or servant figurines (**facing page**), to wait upon them in the afterlife.*

ALL FROM THE DAYAN COLLECTION, GIFT OF L. TISCH TO THE ISRAEL MUSEUM

consisting mainly of pits filled with typical Philistine pottery, unmistakably demonstrated the beginning of the end of Egyptian domination in the 12th century B.C. After defeating the invading northern Peoples of the Sea (among whom the Philistines played a dominant role), Pharaoh Ramses III of the XX Dynasty settled them as mercenaries in his own strongholds.

Defeated in war, the Philistines borrowed from the culture of their conquerors, including their burial customs. We see this in two places—at Tell el-Far'ah in the Negev, and at the Egyptian garrison of Beth-shan in the Jordan Valley. In the latter, coffins have been found with the "feather crown" headgear that links them with the Sea Peoples, as depicted on the walls of the mortuary temple of Ramses III at Medinet Habu in Thebes.

These coffins, which I had studied years before, had brought me to Deir el-Balah, and the excavations had answered some of the questions I had raised. The Deir el-Balah coffins are among the earliest ones ever found outside Egypt, and they represent the apparent prototypes for the coffins used by the Philistines at other sites.

Beyond the archaeological achievements of the excavations at Deir el-Balah, I look back fondly on the human side as well. The work, often long and frustrating, began before the sun rose and did not end until dusk. But I still have many pleasant memories, like those of our open-air breakfasts with the fragrance of the nearby orange grove pervading the site. Every evening, though exhausted, we could still find time for an active social life—dancing, singing, and enjoying visits to the homes of our local workmen and friends.

As the dig continues and our team constantly improves its techniques, we anticipate more discoveries at this uniquely cosmopolitan site. At Deir el-Balah, more than 3,000 years ago, the civilizations of East and West met to produce an eclectic culture all its own. Our excavations have succeeded in revealing this culture, buried deep under the shifting sand dunes. And with the new hope for peace along the Sinai border between Israel and Egypt, we look forward to even greater cooperation among the peoples of the region in a continued search for our mutual past. □

Contrary

By ROBERT BOOTH
NATIONAL GEOGRAPHIC SENIOR STAFF

Photographs by
SANDY FELSENTHAL

LIVE FREE OR DIE. It's the state motto. You see it on road signs just above the message Welcome to New Hampshire. You see it on every license plate. And, without having to look too hard, you see it woven through the fabric of life.

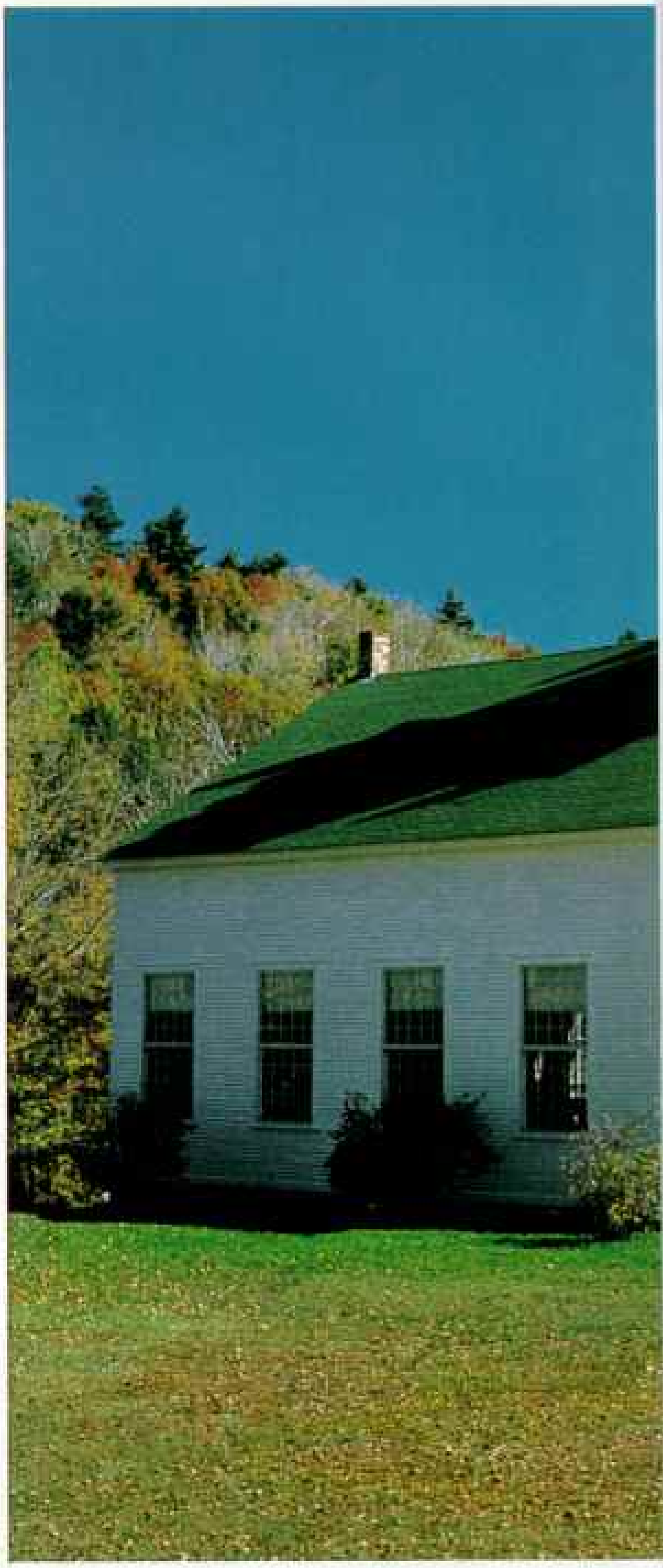
When Revolutionary War hero John Stark coined the phrase, it was an expression of the fierce sense of Yankee independence, an idea grown clichéd through the years, though no less true for that. Even today New England forms as distinct a region as can be found in this country.

New Hampshire in some ways is a microcosm. It shares mountains with Vermont, forests and seacoast with Maine, a manufacturing heritage with Massachusetts. But in other ways New Hampshire stands alone. Consider these anomalies:

• It has the largest legislature of any state (400 men and women in the lower house, each with only 2,300 constituents). For the nation to be so thoroughly represented in Washington, Congress would need another 100,000 members.

• In case the government gets out of line, the constitution defiantly maintains the people's Right of Revolution: ". . . nonresistance against arbitrary power and oppression is absurd, slavish, and destructive of the good and happiness of mankind."

• It is the fastest growing state north of Florida and east of the Mississippi River. In the past dozen years newcomers raised its population by some 20 percent. At the same time more than 600 new businesses moved in, keeping unemployment the lowest in the region (about 5 percent last year).



Pillars of continuity, *the town hall, at far right, schoolhouse, and Congregational Church have served many generations in Washington. In 1776 the township became first in the new nation to incorporate under that name.*

New Hampshire

Representation without taxation *distinguishes New Hampshire state politics. The 400-member House of Representatives (**above**)—by far the largest state body in the U. S.—has steadfastly refused to impose broad-based taxes on sales or income. Instead, the budget relies heavily on tourist dollars and "sin taxes" on alcohol, tobacco, racetrack betting, and sweepstakes. Critics find the system, with its limited services—especially aid to education—inadequate for the Northeast's fastest growing state.*

*Democracy in its purest form flourishes at town meetings. Once a year voters represent themselves (**left**) in deciding on township business and a budget that will determine their local property tax.*

• Alone among the 50 states, New Hampshire has never levied broad-based sales or income taxes, and overall collects the fewest tax dollars per capita.

The last two points are intertwined. Much of the movement into the state has been from what is gleefully referred to as "Taxachusetts." Nevertheless, taxes or the lack of them are the single most debated topic. A growing number of people believe that New Hampshire is in a dangerous financial squeeze and can no longer afford the luxury of past policy. Others feel equally strongly that broad-based taxes are anathema.

"Live free or die." The words echo with a certain irony.

SO WHERE DOES the state get its tax revenue? From sin. Along with a tax on business profits, so-called sin taxes help keep New Hampshire afloat. The state collects on its lottery (first in the nation this century), on horse and dog racing, and especially on the sale of cut-rate cigarettes and liquor, largely bought by Massachusetts bargain hunters.

"Not only from sin, but from somebody else's sin," said Nackey Loeb, publisher of the Manchester *Union Leader*, New Hampshire's major newspaper. "To those sanctimonious people who are dreadfully shocked by this, my response is, 'Do you want to have the honest people pay taxes and let the crooks go free?' "

A dynamic woman in her middle years, she is as feisty as was her late husband, William Loeb, archconservative and longtime publisher of the paper. Many people credit him (or debit him) with safeguarding the state's fiscal policy almost single-handedly. His hand could be heavy. "He knew how politicians think," said Mrs. Loeb, "and was able to react to them, either for or against, either gently or strongly."

The paper will continue to speak out, she says, against additional taxes and for local autonomy, but preserving the "character of the state" is becoming more difficult:

"People move up here, away from high taxes and unnecessary services, and ask, 'Where's the garbage collector?' 'Where's the school bus?' We should have a six-month induction period to educate people before we release them into New Hampshire."

QUEBEC

Franco-Americans
About one-fourth of all Granite Staters trace French-Canadian roots, largely from migration to mill jobs in the state's south.

CANADA
UNITED STATES

The Rural North
Isolated by the White Mountains, an economy of scattered small towns reliant on forest products and tourism has not shared the growth in the south. The rugged northern fifth of the state holds less than 4 percent of its people.

Connecticut Lakes
Colebrook
Dixville Notch
Connecticut River
Androscoggin
Groveton
WHITE MOUNTAIN NATIONAL FOREST
Lancaster
Berlin
St. Johnsbury
Jefferson
Gorham
Whitefield
Presidential Range
Mount Washington 1,917m 6,288 ft
Observatory and cog railway
Bretton Woods
Littleton
Wildcat Mountain
Pinkham Notch
Tuckerman Ravine
Mount Pierce (Mount Clinton)
Lisbon
Franconia Notch
Cannon Mountain
Old Man of the Mountain
The Flume
WHITE MOUNTAIN NATIONAL FOREST
Crawford Notch
Jackson
Loon Mountain
Lincoln
North Conway
Conway
Saco
KANCAMAGUS HIGHWAY
Warren
Plymouth
Squam Lake
Ashland
Ossipee
Meredith
Lake Winnipesaukee
Wolfeboro
Hanover
Dartmouth College
Enfield
Lebanon
Laconia
Franklin
Farmington
Sunapee
New London
Newport
Canterbury
Rochester
Claremont
Pittsfield
Somersworth
Dover
Charlestown
Concord
Washington
Suncook
Merrimack River
Newmarket
Portsmouth
Epping
Goffstown
Exeter
Rye Beach
Isles of Shoals
Star Island
Crotched Mountain Rehabilitation Center
Manchester
Seabrook Station
Hampton Beach
Seabrook
Seabrook Beach
Bedford
Keene
Derry
Peterborough
Merrimack
Londonderry
Monadnock Mountain
965m 3,165ft
Milford
Salem
Nashua
Hudson
Pelham
Durham
Gloucester
Connecticut
Merrimack

VERMONT
NEW HAMPSHIRE
MAINE
MASSACHUSETTS
Atlantic Ocean

The Populous South
Boom times in the past decades brought burgeoning growth to the region that contains five-sixths of the state's population. Long-established Merrimack River cities—once textile centers, now hives of high-tech activity—cap the eastern seaboard megalopolis.

Appalachian Trail

Montreal
CANADA
UNITED STATES
MAINE
VT.
Estimated population 931,698; each dot represents 7,500 persons.
NEW YORK
MASS.
Boston
CONN.
R.I.
Atlantic Ocean
New York
N.J.
72° 30'
0 KM 100
0 MILES 100
10°
42° 30'

0 KILOMETERS 50
0 MILES 30
Ski area

DRAWN BY VIRGINIA STEPHENS
COMPILED BY DONALD GARRICK
NATIONAL GEOGRAPHIC ART DIVISION

Betwixt hikers and skiers, *leaf lovers take to the White Mountains for autumn foliage, viewed in Franconia Notch by Korean tourists* ***(below)****. Most of the state's annual six million visitors come from the Northeast, escaping urban sprawl for a sampler of mountains, forests, lakes, streams, and ocean beaches.*

NEARLY ALL the astonishing growth has been in the southern half of the state, where five out of six people live; the mountainous north remains essentially rural. This north-south dichotomy is nothing new. Southern New Hampshire has been a manufacturing center since the early 1800s, when cotton mills first sprang up along the Merrimack River. At one time the mammoth Amoskeag complex in Manchester was the largest textile concern in the world.

Nowhere has the recent boom been felt more than in the city of Nashua, southern anchor of the industrial "golden triangle" that reaches north to Manchester and east to Portsmouth. In 20 years Nashua's population has soared from 39,000 to 68,000—a 75 percent increase. One of the biggest reasons was Sanders Associates, a firm specializing in defense electronics and computer graphics. In 1981 it had 436 million dollars in sales and employed 5,200 people here.

"We moved in after the textile industry moved south," said manager of public affairs Bob Mercer. "There was space available along with plenty of labor. The work ethic in this community and statewide is still very strong. And the location is ideal—an hour from Boston, an hour from the coast, an hour from the mountains."

Lately, partly as a result of the national recession, Nashua's growth has slowed considerably. But that's OK with Mayor Maurice Arel. "We need a chance to sit back, catch our breath, and see where we want to go from here," he told me.

"The big problem we're facing is lack of funding from the state; there's very little aid to education or to anything else. The state tries to balance its budget by passing along costs to the cities and towns. That has to be addressed, and I think the answer has to be a broad-based tax. We cannot continue to raise local property taxes, and we cannot continue to cut services. As it stands, we seem to have the ability to get money from everybody except those who have it."

Not all the recent refugees to southern New Hampshire were lured to the glitter of

Giant of the north country, *James River Corporation pulp and paper mills in Berlin spew steam and enough sulfides to coin the local adage, "Want to find Berlin? Just follow your nose." High stacks help disperse odors as part of a 40-million-dollar outlay for pollution abatement. Complaints are few: The mills*

directly and indirectly provide 2,300 jobs in the depressed north. Midstream in the Androscoggin River, man-made islets, foreground, channeled log drives in the flush days of virgin forests, when cutters denuded many of the state's mountainsides. Today, however, renewed forestlands cover a remarkable 86 percent of the state.

the golden triangle. West of Nashua lies the state's quiet corner, rolling hills and well-kept towns punctuated by church steeples straight out of Currier and Ives. The region is crowned by a peak the Indians named Monadnock—"mountain that stands alone." These days it at least doesn't lack for human companionship.

On a bright autumn Sunday I joined 5,000—yes, *5,000*—other hikers on a tromp to the 3,165-foot summit to view the glory of New England fall foliage. Monadnock, with 125,000 visitors annually, is one of the world's most climbed mountains. Said ranger Ben Haubrich, "It's not so much a wilderness experience as it is a social happening."

It was surely more of a wilderness experience a hundred years ago, when Emerson and Thoreau found inspiration on its slopes. But the region still beckons writers and artists, many of whom find their inspiration at the MacDowell Colony in nearby Peterborough. Established in 1907 by composer Edward MacDowell and his wife, Marian, the colony has welcomed to its secluded studios such giants as Leonard Bernstein, Willa Cather, and Thornton Wilder. Colonists stay only about six weeks; others have succumbed to Peterborough permanently.

"It's a marvelous community," said Gail Anthony. "It's got a mountain on either side, and it's not a suburb of anything. People who live here work here, mostly." Originally from Massachusetts, Gail and her husband bought Sandhill, Inc., a wood-stove enterprise, in 1976.

"We were sick of the suburbs," Gail explained, "though we left what many would consider the American dream—a large house in a good neighborhood. We found it stifling. We got the bug to move up here, and we love it.

"The business just took off. With the price of oil and the energy crisis in general, there are a lot of people in New Hampshire heating with wood."

Another response to the energy crunch has sprouted a few miles north of Peterborough on the top of Crotched Mountain: the world's first wind farm. A research project of U. S. Windpower, Inc., the 20 windmills in the array are rated at 30 kilowatts each. Collectively they can provide electricity for 150 homes.

The land on which the propellers turn belongs to the Crotched Mountain Rehabilitation Center for handicapped children. Its chief of special projects, Phil Waterman, helped get the program under way: "U. S. Windpower was looking for a site. We were a site looking for a wind-energy company. In August of 1980 we got together."

Strolling through the grove of 60-foot-high tripods, Phil spoke like a true believer. "The idea of a series of small wind machines rather than one large one makes a lot of sense," he said. "The technology is less costly, they don't dominate the skyline, they're quiet. If one of them breaks, you lose only part of your power. The future may hold arrays of a hundred or more machines.

"You can get a lot closer to these things than you can to a nuclear plant. Plus," he joked, "they don't glow in the dark."

IT'S A SAFE BET that no one less appreciates such glowing references to nuclear plants than officials of Public Service Company of New Hampshire, the state's prominent utility. They have a large interest in the town of Seabrook's nuclear namesake currently rising from the coastal marsh.

My first glimpse was from several miles distant. By chance it was the day that a giant crane gently placed the 214-ton cap atop the containment building of Unit I. Unit II, its twin, is not as far along. With both units operating, Seabrook Station could produce an awesome 2,300 megawatts of power.

A few weeks later, escorted by company representatives, I got a better look at the plant. When completed, they said, the massive concrete-and-steel containment buildings (enclosing the actual reactors and their radioactive fuel) will each be able to withstand the impact of a fighter-bomber crashing into it. The highlight of the tour was a journey nearly 300 feet underground to cavernous tunnels that will cycle cooling ocean water through the condensers.

All told, Seabrook Station is an impressive engineering feat. But is it a good idea? That question has been debated for a decade. It is being debated still:

"Seabrook is necessary," said Public Service president Robert Harrison, "because New England is at the end of the oil pipeline.

We all know the folly of dependence on unreliable sources for our fuel.

"There are risks associated with nuclear power, but there are risks associated with coal-fired plants, with getting on an airplane, with walking across the street. Society accepts certain risks.

"We have to have energy. How should we produce it? It's a matter of weighing choices and getting down to what I think is an inescapable answer."

To some, that answer is escapable.

"The solution to our energy problem is obvious, and it need not include nuclear," said Robert Backus, attorney for one of the groups opposing Seabrook. Backus favors converting oil-fired plants to coal, alternatives such as hydro, and conservation. "The demand for additional power in New England has died down," he said. "That should be good news; conservation is in the national interest. But it's not good news if you're building a nuclear plant."

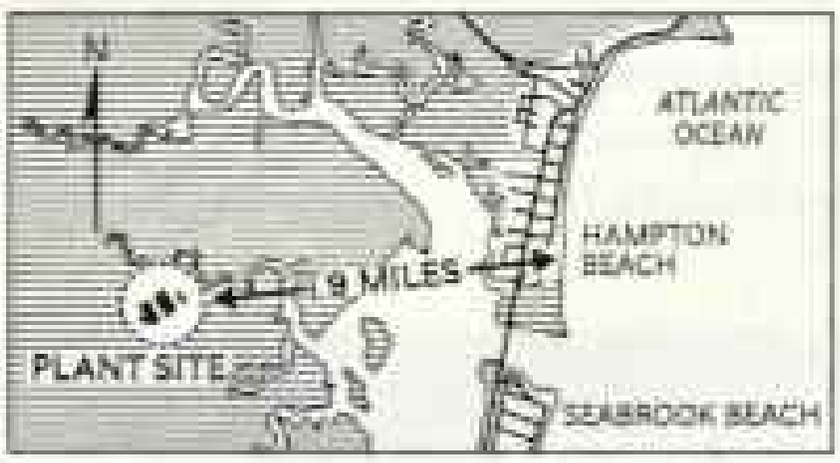
Before Seabrook can obtain an operating license, federal regulations require a plan to evacuate the area in case of a serious accident. Battle lines are being drawn along nearby ocean beaches.

"The beaches are the key," said Backus. "You have a potentially dense population without adequate shelter, not even the shelter of the clothing we wear most of the time. They are downwind from the reactor, and there's a marsh behind them."

Harrison responds: "Whatever has to be done—if we have to build roads—we'll do it.

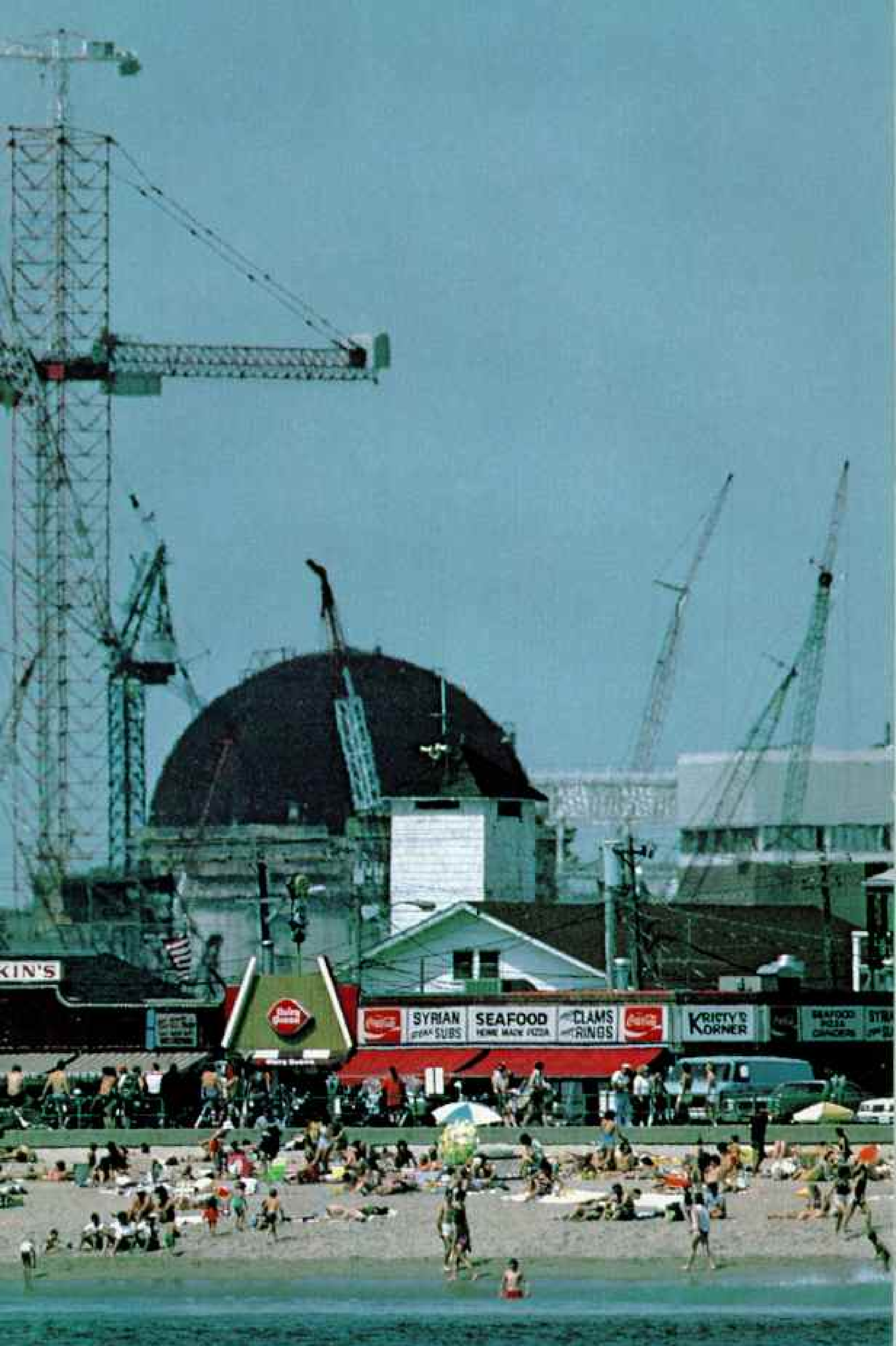
First word *on the presidential race comes from these voters—plus a few others—in the far northern hamlet of Dixville Notch only moments after midnight on the day New Hampshire inaugurates the primary-election season. Onetime country boy Neil Tillotson, foreground, established a factory and revitalized a resort hotel here, breathing new life into this community near land homesteaded by his great-grandfather. Says he of the north, "People here don't work for you. They work with you."*

Looming as large *as the national controversy over nuclear power, construction cranes at the Seabrook nuclear plant rise 1.9 miles beyond packed beaches, a distance sharply foreshortened by a telephoto lens. Economic considerations and highly publicized "anti-nuke" protests—twin factors that have killed or slowed dozens of U. S. nuclear projects since the 1979 Three Mile Island accident—*



have set back scheduled licensing of Seabrook's first reactor from 1979 to 1984.

A milder Seabrook protest—this one over Sunday dog racing—pits picket against police chief ***(below)****.*


KIN'S
SYRIAN SUBS
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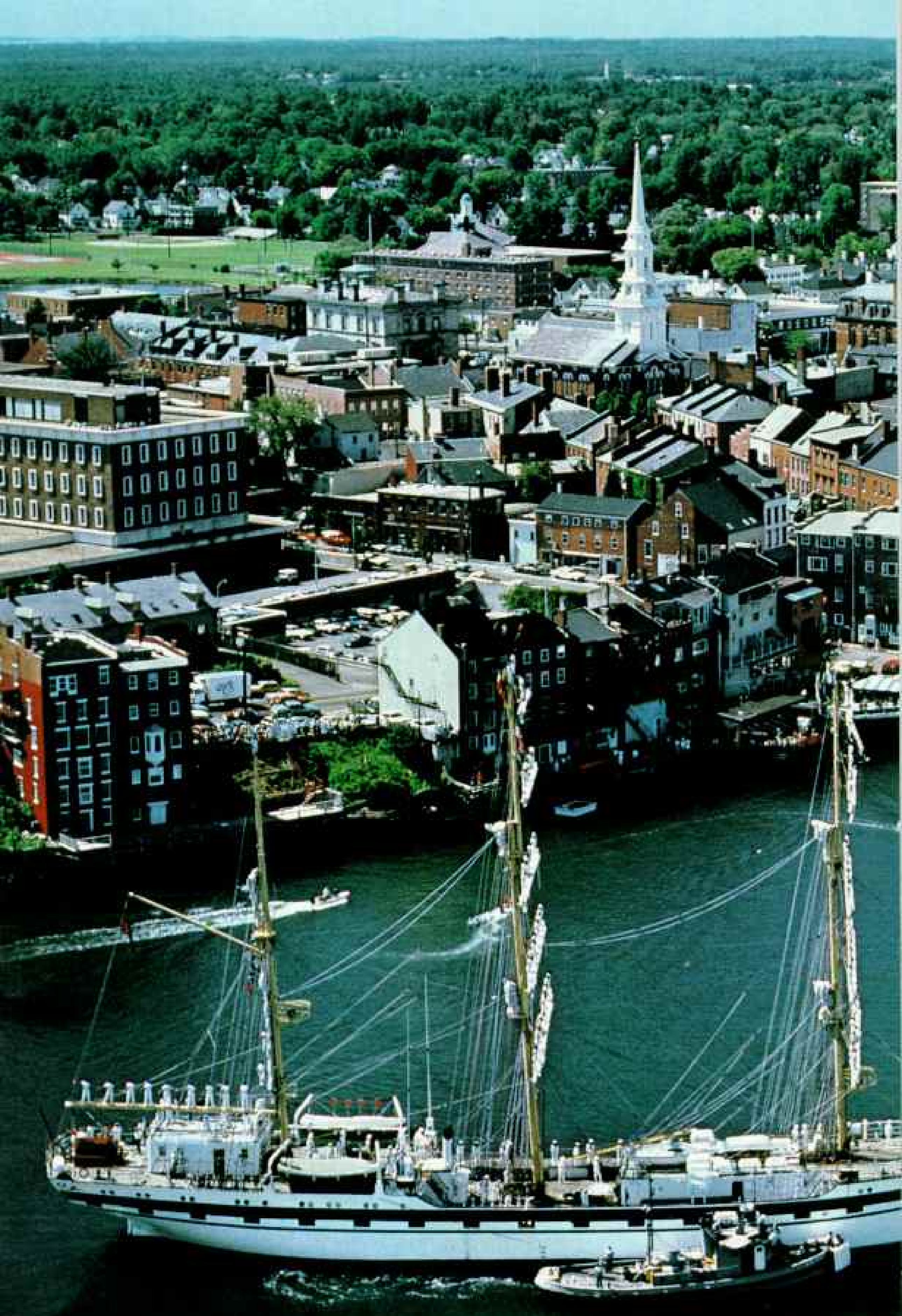


That's a 3.5-billion-dollar plant, and it's not going to sit idle while we figure out how to get the people off the beach."

SEABROOK lies at the southern end of New Hampshire's 18-mile-long coast, shortest in the nation. It was to the coast, just three years after Plymouth Rock, that the first settlers came. Unlike the Pilgrims they did not come seeking religious freedom. Instead, in grand New Hampshire tradition, they came to make money. They were fishermen.

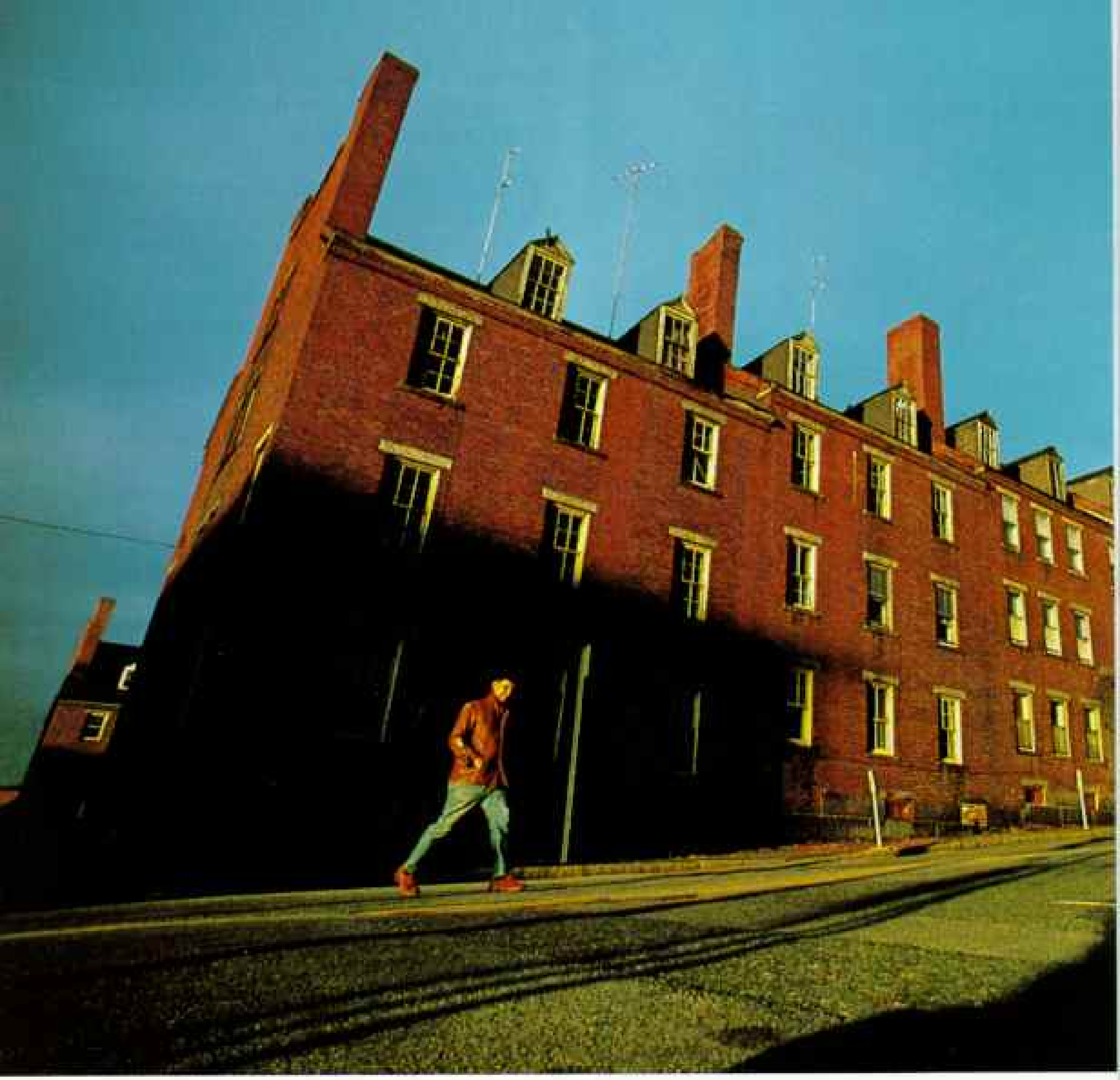
A decade earlier English explorer John Smith had come upon a group of offshore islands surrounded by what he termed "the strangest fishpond I ever saw." Smith tried to name the islands for himself, but they became known as the Isles of Shoals, for the vast schools, or shoals, of fish.

Today it is people that swarm to the islands. In summer 50-acre Star Island holds religious conferences in a wooden Victorian hotel. Conferees are ferried out from Portsmouth, New Hampshire's oldest and most attractive city.

Early on, Portsmouth showed signs of the independent streak that would characterize the state. In 1656, for instance, when witches were being hanged in Massachusetts, charges filed against an accused New Hampshire witch were dismissed in Portsmouth court. She sued for slander, and won. In 1774 Portsmouth patriots took part in one of the first armed skirmishes of the Revolution when they raided nearby Fort William and Mary for guns and powder used at Bunker Hill. Not long after the raid New Hampshire became the first of the 13 colonies to adopt a constitution independent of Britain, and later was the ninth and deciding state to ratify the U. S. Constitution.

For most of its history Portsmouth has been associated with ships and shipbuilding, first with the Royal Navy, for whose vessels New Hampshire's tallest pines were

Paying respects *to a birthplace of the U. S. Navy, Venezuela's tall ship Simon Bolivar heads for docking in Portsmouth, New Hampshire's oldest settlement and a showcase of renovated New England architecture.*



exclusively reserved. A cradle of the U. S. Navy, Portsmouth during the 1800s became a primary builder of clipper ships. Today the naval shipyard's mission is the care and feeding of submarines. Many residents not employed in that effort provide similar services for visitors to this historic city.

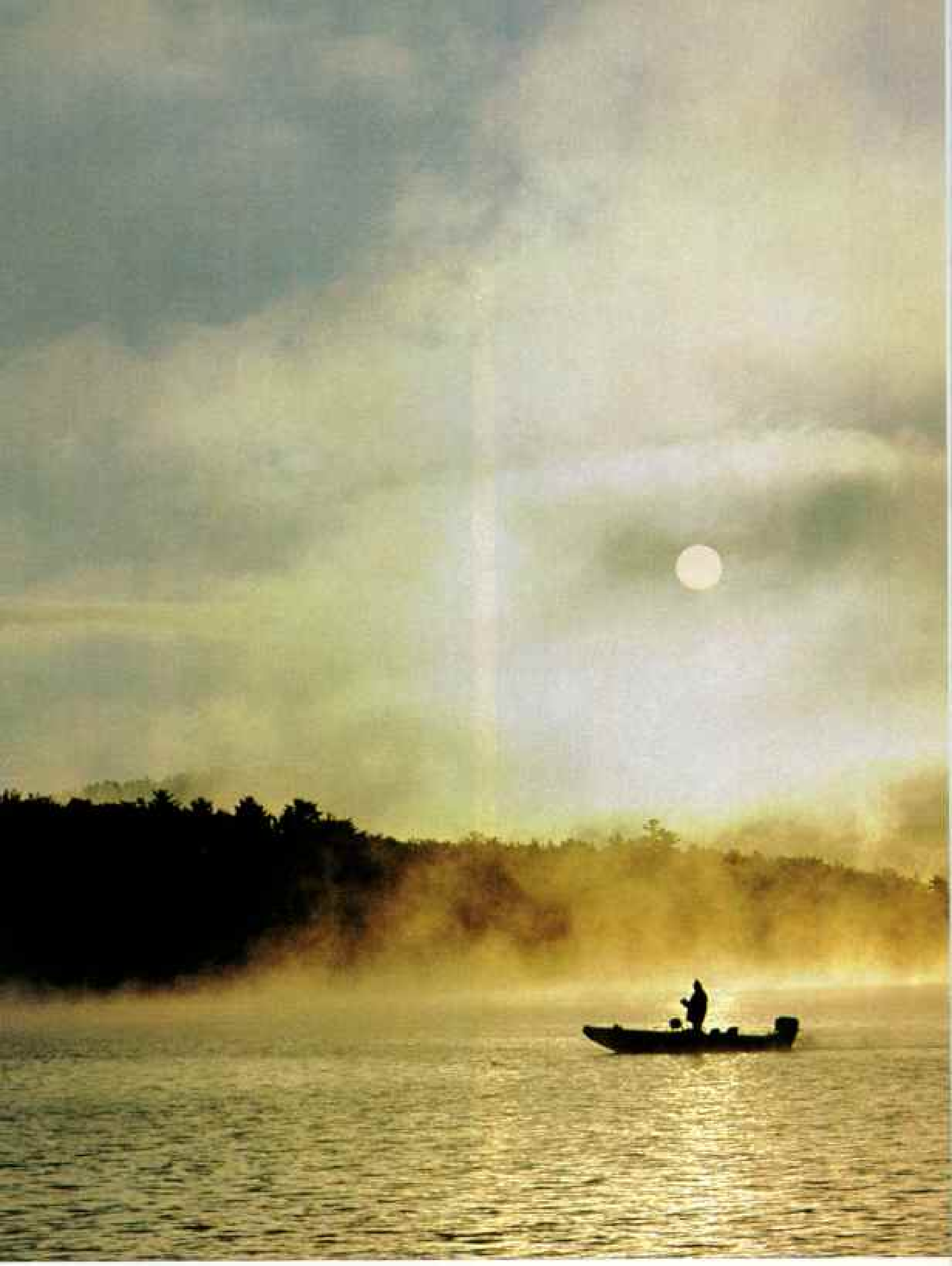
SIXTY MILLION people live within a day's drive of New Hampshire, and each year about 10 percent of them make the trip. They go home richer in spirit but poorer in the pocketbook by 850 million dollars, ranking tourism second in importance only to manufacturing. Six out of ten visitors come during summer, many heading for the lakes region north and inland from the coast.

New Hampshire has 1,300 lakes and ponds, born of the last great ice sheet. Some are privately held, and others are tightly controlled by a few wealthy landowners. One such crusty old gentleman on Squam Lake told me: "We have enough money to hang on to the land, and we intend to do so. There's very little house pollution. It's not like Winnipesaukee. I can't stand that damned place!"

It's not as bad as all that. Winnipesaukee, the state's most popular and populous lake, is also its largest. Rimmed by wooded hills, it is 27 miles long and 13 wide. Trophy lake

Changing times *closed Manchester's Amoskeag textile-mill complex, once the world's largest, in 1936. Former corporate housing (**left**) is now privately owned. New businesses helped boost the economy of the state's largest city. At Pandora Industries, Claire Jacques (**below**) recalls that her mother emigrated from Quebec to work in the mills, one of many who bequeathed the state a French-Canadian heritage.*

***Fast track** for the aging manufacturing tier of the south opened up with its discovery by space-age industries in the 1960s. At Digital Equipment Corporation's facility in Salem, a computer whizzes toward completion (**right**). The Massachusetts-based firm expanded into New Hampshire seven years ago and became a leading employer. The favorable tax structure, the availability of land and skilled labor, and proximity to Boston's bright lights and universities as well as to mountains and beaches for recreation sparked the electronic invasion. Equally important, says a spokesperson for Digital, "We were welcomed here."*



Dawn's solitude *can be fleeting on Lake Winnipesaukee, largest of the state's 1,300 lakes and ponds, where a population of 50,000 quadruples with summer*

visitors to one of the nation's oldest resorts. Glaciation that formed the many pools of the lakes region also bared the rocky domes of the White Mountains.

*"**People won't forget** that lesson!" says Dartmouth College professor of French John Rassias, wielding a chair while demonstrating the word for anger—"la colère" (**left**). The method in his madness combines classroom theatrics with intense student involvement and rapid-fire give-and-take to produce outstandingly quick learning and long-term retention of a foreign language.*

*Dim logic and a short memory might be better qualifications for playing in North Conway's annual charity Mud Bowl (**below**). This tourney featured Maine's Carrabassett Valley Rats and Free Street Pubbers, New York's Hamslammers, and local heroes, the Mount Washington Valley Hogs.*

trout—15-pounders—have been pulled from its nearly 200-foot depths.

The water is clean (though you're not supposed to drink it), and it is kept that way in part by Tom Hunter and his family. The Hunters operate a paddle-wheel work barge from which they install and repair lakefront septic systems. But it's seasonal work. Their farm, on the other hand, is a year-round business. They have been on the land for five generations, and their pride and joy is their maple orchard.

"Everybody helps out come sappin' time," said Tom. "Everybody" is a lot of Hunters: Six of his nine children have their own families and live close by. Tom is a big man with craggy features, and speaks in the rhythmic cadence of north-woods natives.

"The size of the trees doesn't matter," he said. "If they're healthy, they run good sap. People argue whether it runs up the tree or down. The old-timers had their theories. One would tap over a big root, another under a big limb. They both got sap.

"We're still using spouts and buckets instead of plastic tubing. And we boil with wood, not oil. I think you can taste the difference." I took a sip of the best maple syrup ever dribbled over a pancake, and took another half gallon with me.

ONLY a relative handful of New Hampshire's maples are tapped for syrup. Many of their brethren have dates with chain saws. Though it seems incredible, considering the recent economic growth, fully 86 percent of the state is covered with trees. But not with virgin forest. By 1840 half of the land had been cleared by settlers; by the early 1900s lumber barons had ravaged much of the rest.

Conservationists finally persuaded Congress to halt the uncontrolled cutting. In 1911 the Weeks Act authorized establishment of the White Mountain National Forest, which now includes 1,175 square miles, equal to an eighth of the state.

Today, between 50,000 and 70,000 acres of timber are harvested annually statewide. Much of the activity centers around the far northern city of Berlin (pronounced BER-lin since World War I), where the James River Corporation operates New Hampshire's largest pulp and paper complex.

Weather maker, widow maker, *Mount Washington thrusts 6,288 feet into the sky, squarely in the path of storm systems that bring the Northeast's highest peak some of the most horrendous weather known. A cog railway and a road carry visitors to the top in summer. Even then, plummeting temperatures, sudden winds, snow, hail, and freezing*

rain can catch the unwary on miles of hiking trails, and may add to the list of more than a hundred victims claimed by these heights since 1849. Only weather observers and a TV-transmitter crew man the summit in winter. The highest surface wind ever measured peaked here at 231 miles per hour on April 12, 1934.

The road north from Berlin parallels the swift and lovely Androscoggin River, once the thundering scene of spring log drives. Many consider this stretch to be among the most beautiful of the state's 40,000 miles of rivers and streams.

On the opposite side of the road, a hundred yards into a stand of balsam fir, I found Fernand Fortin and his three sons having lunch amid the trees they had felled that morning. Fernand's and my conversation was limited: I can't speak French.

About a fourth of the state's population shares some French-Canadian heritage. The migration swelled after the Civil War, as desperately poor Quebec farmers left for New Hampshire's booming postwar economy. Most headed to the textile mills, but a significant number settled in the north.

The Fortins moved down in 1970. Harold, the youngest son, was ten years old then and speaks with no trace of French accent. "The family couldn't get steady work in Canada," he said. "And here the government doesn't take as much of your check."

The 25 cords of wood that the Fortins produce each day join the 430,000 others that feed the voracious James River plant each year. The plant's holdings at one time totaled 600,000 acres, but have now shrunk to fewer than 200,000. John Bork, 61, suntanned and silver-haired, is vice president for the woodlands division.

"We do no planting of trees," he told me. "In this part of the world natural regeneration is a problem—it's too prolific. We have to thin stands so they don't stagnate.

"We're careful with our clear-cuts, both with their size and their location. Why look for trouble? We have good rapport with the forestry people and with our own private little mini-Sierra Club, the Society for the Protection of New Hampshire Forests."

The SPNHF, founded in 1901, was the driving force behind establishment of the White Mountain National Forest. Director Paul Bofinger's office occupies a corner of the organization's solar-heated headquarters in the state capital of Concord. "John Bork," said Bofinger, "is an intelligent, sincere, thoughtful guy. He also happens to be a good company man.

"The forest industry tends to see us as wild-eyed environmentalists. The Sierra Club thinks we're too close to the industry. The truth is we believe in preservation of some areas and multiple use of others. We have to be particularly careful now because of the population influx. If everyone doesn't make a special effort, New Hampshire runs the risk of becoming a *southern* New England state by osmosis.

"The society often finds itself keeping peace in the family. For example, we favor more wilderness in the White Mountains, but not as much as the Sierra Club. We helped devise a proposal that all parties can live with. The society is responsible along with the Appalachian Mountain Club for the wilderness areas already set aside."

THE APPALACHIAN Mountain Club (AMC) has been dedicated to conservation and recreation since 1876. It maintains a 1,000-mile network of hiking trails from Maine to Pennsylvania, 350 miles of which wind through the White Mountains.

"The only fault I find with old New Hampshire," wrote poet Robert Frost, "is that her mountains aren't quite high enough." Perhaps. But not high enough for what? I'd like to ask him. They are high enough to provide sensational panoramas of northern New England. They are high enough to challenge climbers and hikers, a few of whom, nearly every year, find them high enough to die on.

In fact the White Mountains, topped off by Mount Washington at 6,288 feet, are the highest east of the Dakotas and north of the Carolinas. And they were certainly high enough for me to appreciate the hot supper and soft bunk of the AMC's Mizpah Spring Hut near the summit of Mount Clinton in the Presidential Range.

(Never heard of President Clinton? In the election of 1812, DeWitt Clinton lost to James Madison. A century later the legislature decided to change the name to Mount Pierce in honor of Franklin Pierce, the state's only presidential son. It is a testament to Pierce's place in history that no one paid the slightest attention.)

In summer the AMC operates a series of huts, a day's hike apart, high in the Presidentials. The "huts" are actually sturdy lodges accommodating as many as 90 guests

a night. Staples, propane tanks, and other heavy equipment are helicoptered up in spring. Most food, however, is packed up on the backs of the college-age staff. Mizpah, the newest hut, was opened in 1965.

After a supper of oxtail soup, deep-dish pizza, applesauce, and fresh-baked cookies, I talked with that day's chef, veteran hut-person Ellen Hartwell. Twice a week she hikes the steep two and a half miles down the mountain, picks up 60 pounds of food, and hikes back up. She weighs 110.

"Packing has a lot to do with the pride of this job," she said. "Without packing we'd just be in the restaurant business.

"I had never seriously challenged myself physically before, and it was interesting to learn how *mental* physical exercise can be. The only thing getting you up that mountain is your mind saying, 'You have to do it,' because your body is saying, 'No way.' It makes every meal a little more special."

In winter the huts are closed or staffed with a caretaker. Winter visitors to the mountains aren't generally interested in walking up them but rather in sliding down them as fast as possible.

Skiing is big in New Hampshire. It is so big that a few years ago when the bumper-sticker command to Think Snow proved ineffective the state asked for and received federal disaster relief.

More than 30 downhill ski areas feed the habits of the gravity addicts. I strapped on the boards for the first time in my life at Wildcat Mountain, about 25 years too late. I drew that conclusion looking up from a supine position at the six-year-olds flying past. For those who want a break from the crowds (or the humiliation), the Jackson Ski Touring Foundation offers an alternative.

A few miles north of North Conway, heart of the winter tourism trade, one of New Hampshire's 54 covered bridges marks the entrance to the village of Jackson, population 650. At the ski-touring center the

A sinking feeling *came over driver Dave Shepardson crossing frozen Lake Winnipesaukee for ice fishing. "I looked out the window and noticed the lake had come up a foot or two," he recounts. He and four passengers escaped through windows before the truck sank beneath the ice. It was recovered by a diver and tow truck.*

novice learns that it is indeed possible to stand up on skis and even to move around, with caution. The center rents and sells cross-country equipment, gives lessons, and manicures 80 miles of trails. Last winter it had about 35,000 skier days.

"With good snow, in two years we'll have 50,000," said director Thom Perkins. "We've had a surge of people who are only mildly active but who try it because it's not too difficult to learn. They find out you don't have to dress up like a marshmallow to enjoy being outdoors. We're also getting downhill skiers who find it attractive economically."

But for die-hard downhill skiers the ultimate attraction is Mount Washington's infamous Tuckerman Ravine, where a heart-stopping 55-degree pitch awaits the expert and the fool. There are no lifts. You walk up the mountain.

P. T. Barnum, it is said, once called the view from Washington's summit, "the second greatest show on earth." Nearly 250,000 people saw that show last summer. Most drove up the old carriage road, inaugurated in 1861. At the top along with the view are a visitor center, a TV transmitter, and the Mount Washington Observatory.

IN FEBRUARY the tourists are long gone, but it's the height of the season for the men who work in the observatory. They watch and record some of the most ferocious weather in the world.

Sisters in faith, *Gertrude Soule, left, and Bertha Lindsay, Shaker eldresses, have shared a simple existence at the Canterbury Shaker community. They now share the Shaker past with visitors to the preserved village. "We don't believe in being apart from the world," says Eldress Bertha, "just not a part." Three sisters live here and five in Maine—the last of their sect.*

A private nonprofit corporation, the observatory has been in continuous operation for 50 years. Two three-man crews work alternate week-long shifts. Every three hours, 24 hours a day, they record the temperature and dew point, cloud cover, precipitation, and wind speed and direction. To get some readings and to de-ice instruments when necessary, the men must go outside. That can be a formidable task.

The wind reaches hurricane force about every third day. On April 12, 1934, it hit a screaming 231 miles per hour, the highest ever measured. Winter temperatures can plunge to minus 40°F, and the windchill may reach minus 115°F.

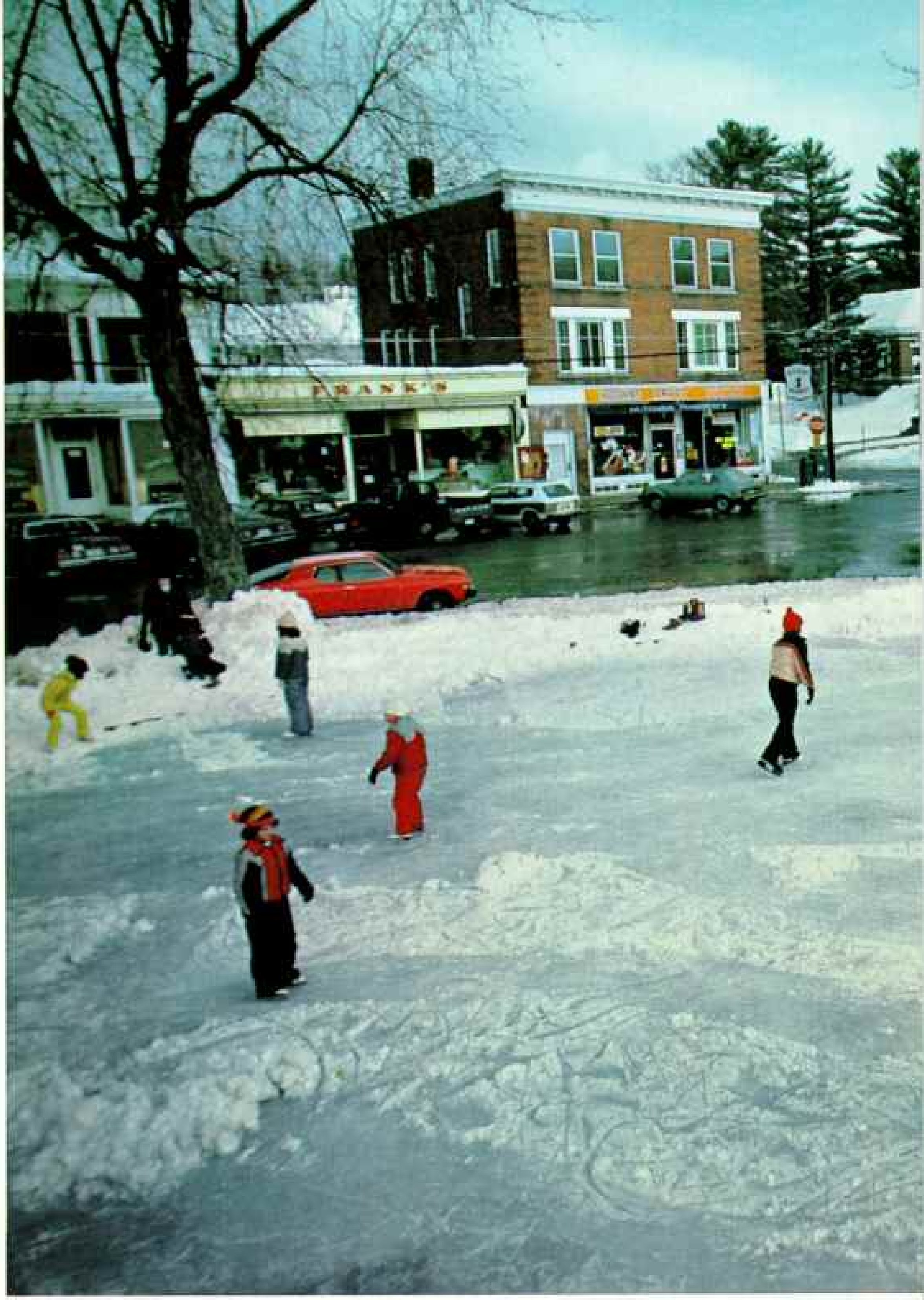
I went up with the crew shift in the observatory's snow cat on a clear sub-zero day. A snow cat is like a pickup truck on treads. The cab is heated. Unfortunately the cab only holds two people, and though I was dressed for the North Pole, the ride out back got chilly.

At the summit, with the wind blowing a paltry 50 miles per hour, we unloaded groceries and gear and headed inside to the perpetually full coffeepot. Why, I asked staff meteorologist Ken Rancourt, is the weather so severe?

"The Presidential Range is oriented north-south," he said. "The prevailing wind is west-northwest, so it has to go up and over these mountains. What you get is a speed-up effect, similar to putting your thumb over the end of a water hose." Perhaps most important: "Mount Washington is located at the intersection of three storm tracks. I see more weather pass me in a week than most meteorologists see in a long time."

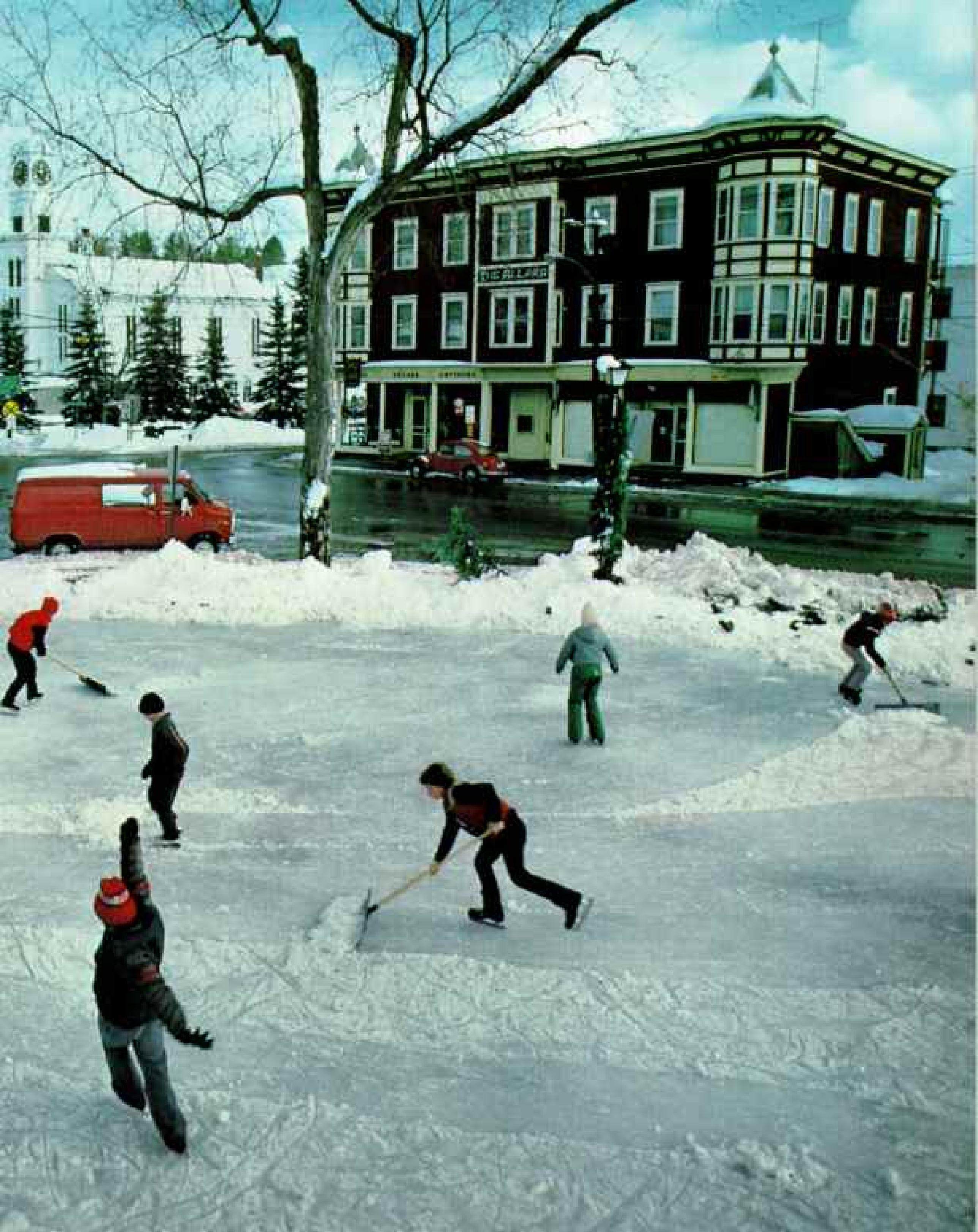
WHEN NOT WATCHING the weather or tending to other chores, Ken and his colleagues relax in their comfortably furnished quarters 30 feet below the summit. Diesel generators heat and power the abode, which includes a TV and stereo. Adding to the homey atmosphere is Inga, a calico cat. A couple of years ago she learned to fly. Radio technician Al Oxton explains: "Inga got used to going out into a west wind. She would lean into it as she went out the door. One day she went out and the wind was from the east. Blew her away. She touched down 20 feet later in a snowbank."

Inga's humans have trouble as well. To retrieve the precipitation canister, it can be prudent, Al says, "to strap crampons to your kneecaps, grab an ice pick in each hand, and drag the can with your teeth."



Work glides along *on a sunny Christmas Eve in Whitefield, as children clear a night's snowfall from the town common, flooded to make a skating rink. In a land where winter can arrive "any time after Labor Day," in one northerner's*

National Geographic, December 1982



words, cold-weather sports are a major pastime. But full-time employment in the youngsters' futures is another matter: Like many northern towns, Whitefield hopes to attract new industry, but has few jobs at present to hold its young people.

That night and all the next day the wind increased in violence. At one point, when I went out with observer Albie Pokrob, it was blowing 120 miles per hour. You could not draw a breath facing into it because it compressed your chest. It was overwhelming and unforgettable.

The men relish the excitement, but they also appreciate the mountain's gentler gifts. "You'll wake up at dawn," said Albie, "and see a whole valleyful of clouds with the sun rising above them. You feel awed and humbled. As John Muir wrote, you feel nature's peace flowing into you."

THE SUMMIT BUILDING that houses the observatory is named for former governor Sherman Adams, who has spent most of his life in the White Mountains. Some may remember him as President Dwight D. Eisenhower's chief of staff. Born in Vermont, he came to New Hampshire in 1916 as a freshman entering Dartmouth College, the preeminent educational institution in the state.

I found him in his office at the base of Loon Mountain, a ski resort he developed in the 1960s. His trim build, firm handshake, and lively speech belied his age. He is 83. "You wouldn't have guessed that," he told me, accurately, as he reminisced.

"At Dartmouth," he began, "I lived outdoors all the time I could. My first year I climbed Mount Washington in winter with no experience. The outdoors, the woods, affected me deeply.

"I chose the hardest way to earn a living you could find: I drove river. Up at 4:30 each morning, work the logs until 7:30 at night, roll into bed wet or dry, up the next morning and at it again. That work I enjoyed.

"I was misfortunate enough to get elected to the legislature. That really was no fault of mine; I was asked to do it by my boss. I beat the incumbent by about three to two. The next time, I got all the votes, which is about as good as you can do."

It was during his second term as governor that Adams organized Eisenhower's 1952 primary campaign. Later, controlling access to the new President as his chief assistant, he became known as the Abominable No Man. Leaving Washington and politics behind, he returned to New Hampshire.

And what of the state of his state today?

"Just last night someone asked me my opinion of the state's troubles," he replied. "I said that we were in a rather singular position because we had no troubles, and moreover we were opposed to them."

But he doesn't quite believe that.

"The tax structure is fundamentally wrong," he said. "New Hampshire should be ashamed of itself. Having to depend for its income on the present sources is simply ridiculous. And it's uncharacteristic of the people. We're not gamblers.

"New Hampshire is a traditionalist state despite its adopted sins of recent years; it tends to do things because they have always been done that way. There must be a willingness of people to assume responsibility—social responsibility and environmental responsibility."

I LEFT this old man and his mountain and drove north a few miles to visit another. In Franconia Notch, 1,400 feet up the side of Cannon Mountain, is the remarkable 40-foot-high granite profile of a human face. It is a resolute face, the jaw firmly set. It is the state's famous emblem, the Old Man of the Mountain.

He is looking south, toward the new New Hampshire, and perhaps he does not approve of all he sees. But he himself embodies a spirit that can still be felt today as it was in words attributed to 19th-century orator, statesman, and native son Daniel Webster:

"Men hang out their signs indicative of their respective trades: Shoemakers hang out a gigantic shoe; jewelers, a monster watch; and the dentist hangs out a gold tooth; but up in the mountains of New Hampshire, God Almighty has hung out a sign to show that there He makes men." □

Epitome of the Granite State, *the Old Man of the Mountain juts from a sheer cliff high in Franconia Notch. The figure's caretaker, Niels Nielsen, on his 50th trip over the edge, hangs below son David. Says Niels of the venerable Yankee, "I've seen some wonders of the world, but nothing like that Old Man."*

The king of beasts balks at a snarling queen of Etosha

Family Life

– an intimate view of lion life in one of Africa's largest animal reserves.

# of Lions

By DES and
JEN BARTLETT

IN THE PREDAWN STILLNESS the lions roar. Those roars have echoed through millennia. But more and more the sound diminishes. The wild lions of Europe, the Mideast, and Africa north of the Sahara now prowl only on canvas, as statuary, and across the fields of heraldry. Only about 200 wild lions survive in India. The rest—their numbers unknown—live in circumscribed kingdoms in Africa below the Sahara. We have come to desertlike northern Namibia to observe them.

It is just after 4 a.m. We dress and climb into our van, a mobile photographic vantage point now so familiar to the lions that we can drive among them as we like. We came to this arid place around Namibia's Etosha Pan—a dry, salty lake bed that becomes a lake only about every ten years—expecting to stay four months. But the lions held us. We have spent 1,600 hours over four and a half years observing them.

Bright moonlight flecks the surface of a water hole, one of dozens in the region that sustain some 500 lions and their prey: springboks, kudus, wildebeests, zebras, giraffes—even porcupines.

We scan the bush around the water hole. When the lions roar again in voices we now recognize as the greetings of old friends, we head off in their direction, hoping to find them by dawn's first light and again resume our watch.

We have seen the ritual of courtship, the rearing of the young, the explosive violence of the chase and the kill. The kill is the exclamation point in the day-to-day existence of the lion, since these great beasts spend most of their time, about 20 hours a day, sleeping and resting.

Lions are social cats, and during these times of leisure they love to rub against each other. After drinking at a water hole, a lioness rests her chin on another's back (***below***). When walking past lazing members of their pride, young lions often touch faces with the adults, an act of bonding among members of the group. The gamboling cubs make contact with all.

We have about 200 lions in our recognition files. Each sheet (***below right***) contains a drawing and items of identification: face and body scars, nicks on ears or tongue,

missing or broken teeth, color and shape of the eyes, and size and condition of the tail. Sometimes a tail tip will be missing, possibly from a fight. For unscarred cubs, whisker patterns, like human fingerprints, are the most important feature.

Not long before our arrival, an entire pride of 17 lions had been shot after straying into a farmer's territory. As other lions took their places, we were able to witness the formation of a new pride.

First, two handsome males took up residence. More than a dozen females passed through, with six remaining permanently. Nearly 18 months later, with the addition of 11 cubs, the pride totaled 19 animals.

Then, unfortunately, six members of the pride wandered onto a farm and were shot, one of the big males included. But two other males have now joined, and this pride is holding its own. One of the original male cubs, now four years old and sexually mature, will probably soon be driven from the pride by the older males. This exile prevents him from mating with his mother and sisters.

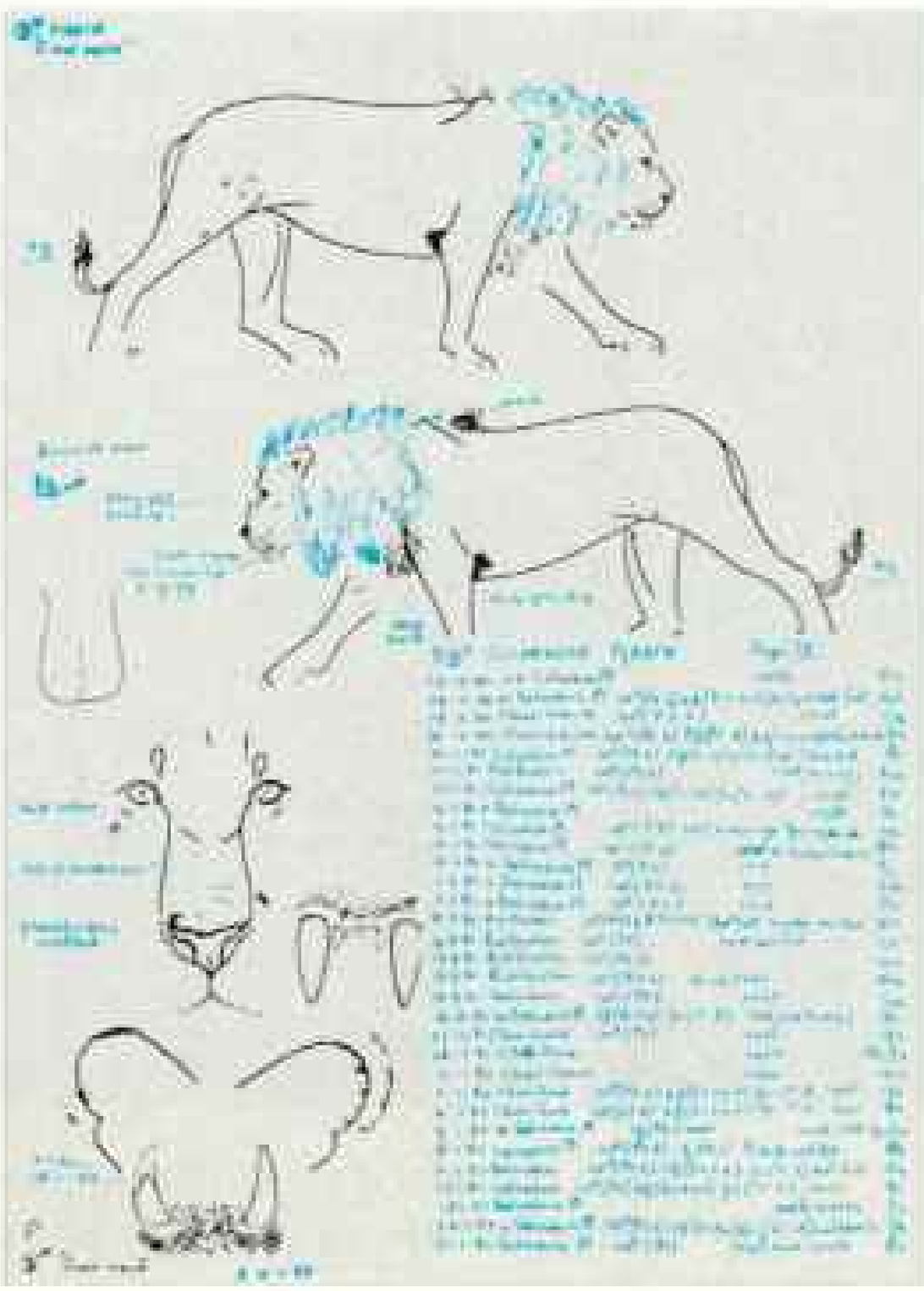
A young male outcast usually joins up with others of his ilk, leading a nomadic existence until he is older and stronger and can evict other, ruling males from a pride.

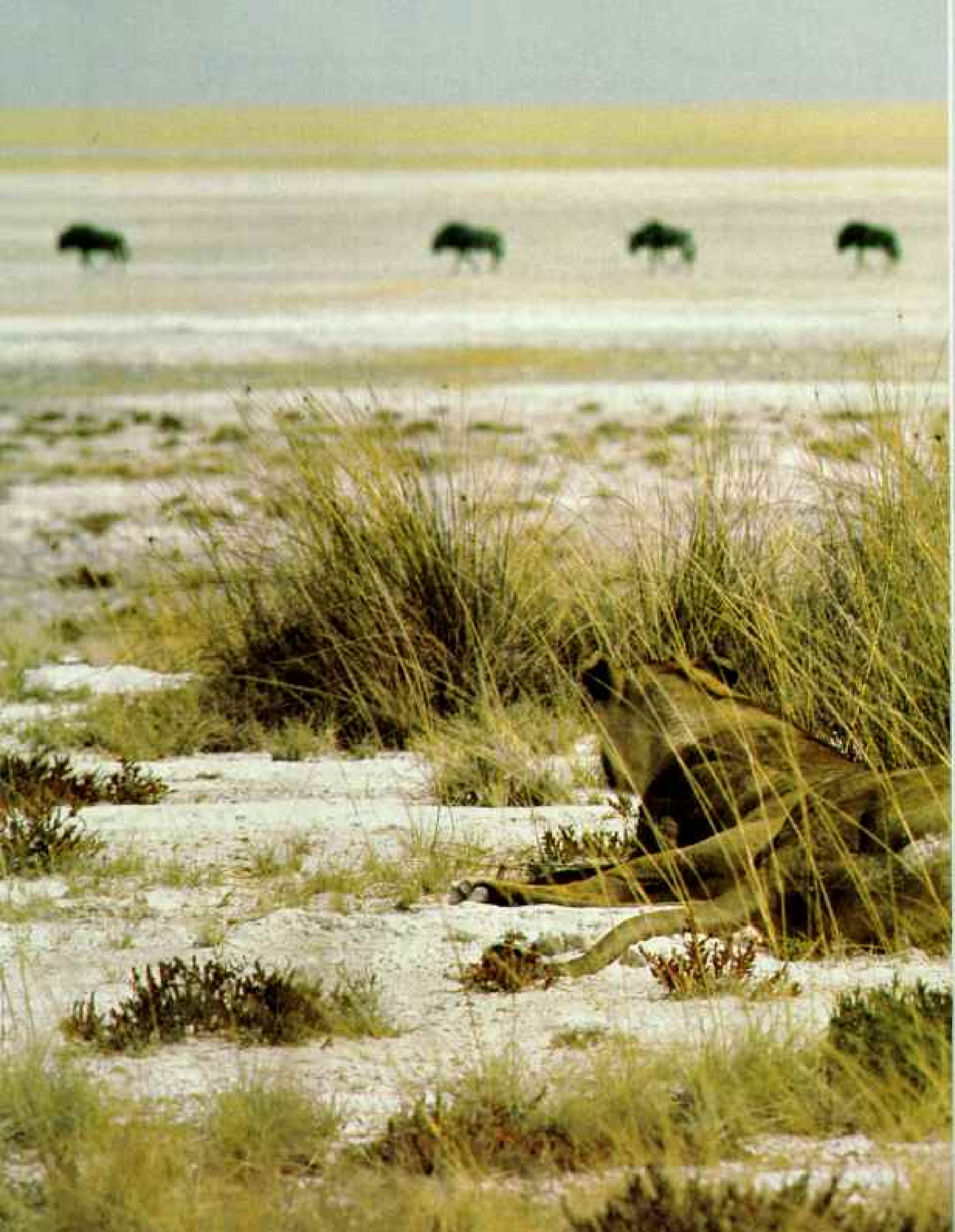
We witnessed an unusual example of this with eight powerful males who hunted and ate together in a band, going virtually anywhere they wanted. We called them the Pirates. They later separated, and members merged with two neighboring prides.

Though most young males are driven from a pride after the age of three, we know of one situation where three males, now four years old, are still on good terms with their pride's dominant males. This led to an unfortunate occurrence. During a drought when game was scarce in their area, three lionesses and three cubs died of starvation, unable to compete with so many males.

Knowing the resilience of lions, we are sure the drought-plagued pride will build itself up again. But we will always be haunted by the sight of those lionesses, whom we had known for four years, deteriorating while we were powerless to help. As naturalists, it is incumbent upon us here to keep human intervention at an absolute minimum.

Australian naturalists **Des** and **Jen Bartlett**, counted among the world's preeminent wildlife photographers and filmmakers, have previously reported for the GEOGRAPHIC on subjects ranging from kangaroos to whales to snow geese.





TABLETOP OPENNESS of the vast pan ensures a safe passage for wildebeests walking in line toward a watering spot. A pair of resting lions watches from behind

clumps of sedge. Since both hunter and prey recognize the barrier of distance, the wildebeests are unhurried, and the lions rest unharried by temptation.

LIKE A ROCKET, a lioness springs from ambush (***top left***) toward unsuspecting zebras and a lone wildebeest at a water hole. Accelerating, she closes to within

a few yards of the wildebeest (***above***). At this point we thought she was assured of a kill, but three successive pictures (***left,*** second from top to bottom) record a slip, a fall, and a miss. Even in the act of falling, she kept her eyes riveted on her quarry.

After returning—with an obvious limp—to her ambush site, the lioness waited while more zebras gathered to drink. She charged, but missed again. Afterward her cub licked her face as if in commiseration with her failure.

JULIE BARTLETT

IN THE MATING GAME, the lioness calls the signals. One time we observed a pair (***above***) mating 23 times in 5 hours and 40 minutes, and only once did the lion initiate it. The lioness circles the male—giving him her scent—flicks her tail in his face, and walks away growling. He follows and they mate for several seconds. Then there's a brief spat. They snarl and she may cuff him. After ten or fifteen minutes she initiates mating again.

The cubs, one to three in the litters we've seen, are born three and a half months later. Their chances for survival are enhanced if more than one lioness in a pride has a litter and can share nursing duties. A two-month-old lion (***right***) joins younger cubs for a meal at the teats of a mother.

EVER SO CAREFULLY, a lioness slides her enormous canine teeth around her five-week-old cub's head before picking up the youngster. She carries it 15

feet, then puts it down and moves on ahead, calling all the while with soft, moaning grunts. Finally the cub responds to her coaxing and trots after her.

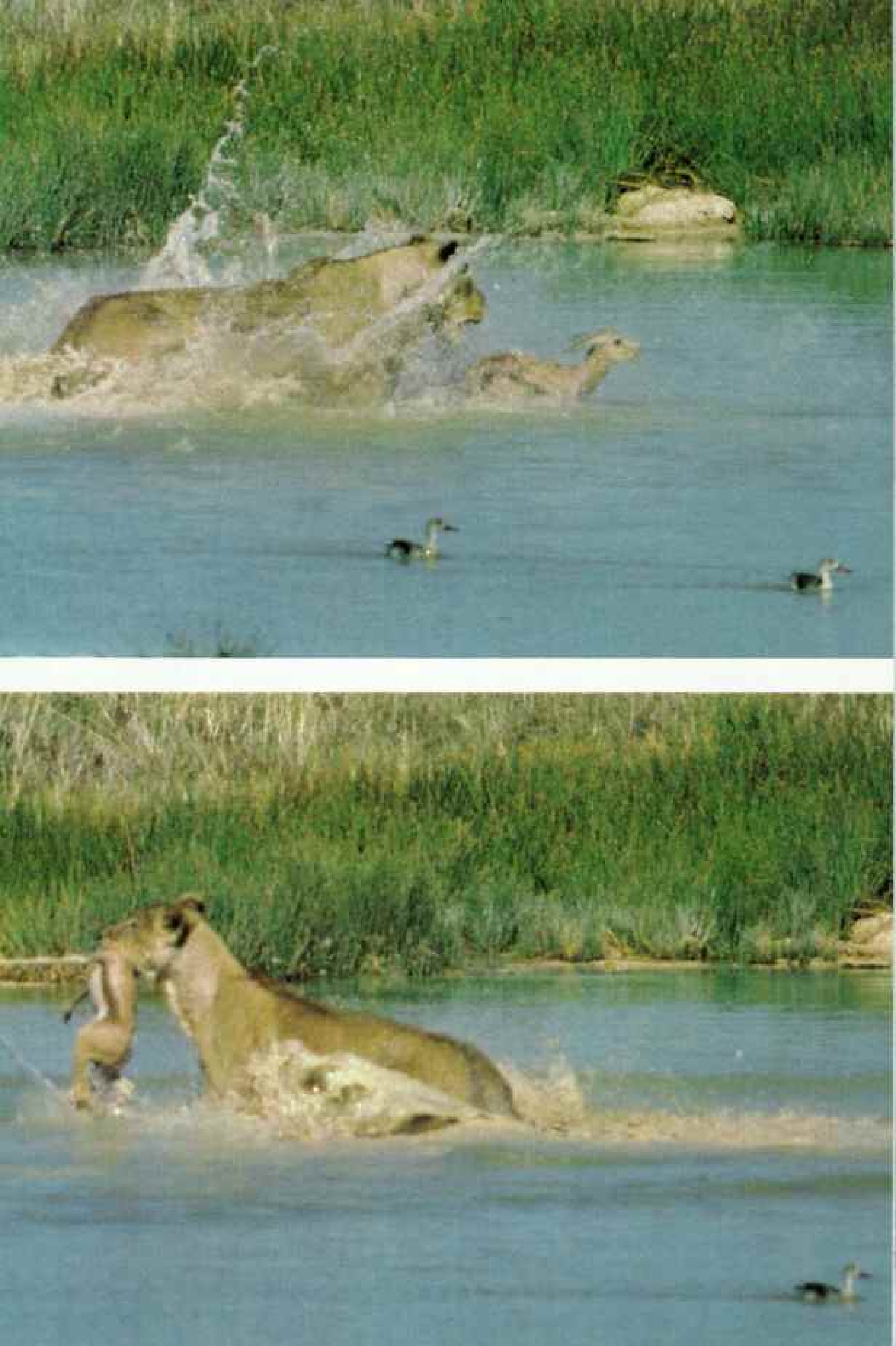
DEATH COMES SWIFTLY for a young springbok that panics at a lioness's charge and flees into a water hole. After pausing momentarily at the edge of the water, perhaps at the thought of getting wet, the lioness plunges in (***right***) and quickly overtakes and snatches up her prey (***bottom***).

Lions are opportunists; they prefer to eat without having to do too much work. When resting in the shade, they are also watching the sky, and if they see vultures swooping down, it is off and away. Even in the heat of the day they will suddenly rouse themselves and run a mile across the plains to find out what is going on. If another animal has made a kill, they will drive it off and take the kill for themselves. A grown lion can easily consume 60 pounds of meat at a single feeding. Often they eat until it seems painful for them to lie down.

The lionesses, being leaner and swifter, are better hunters than the males, who look a bit like moving haystacks during the day. The males don't mind; after the kill they move in and take the best share.

Most kills are made at night or just before dawn. In four years at Etosha we have witnessed many, many daylight attempts but only ten kills. We estimate the daytime ratio at around twenty attempts for one kill.

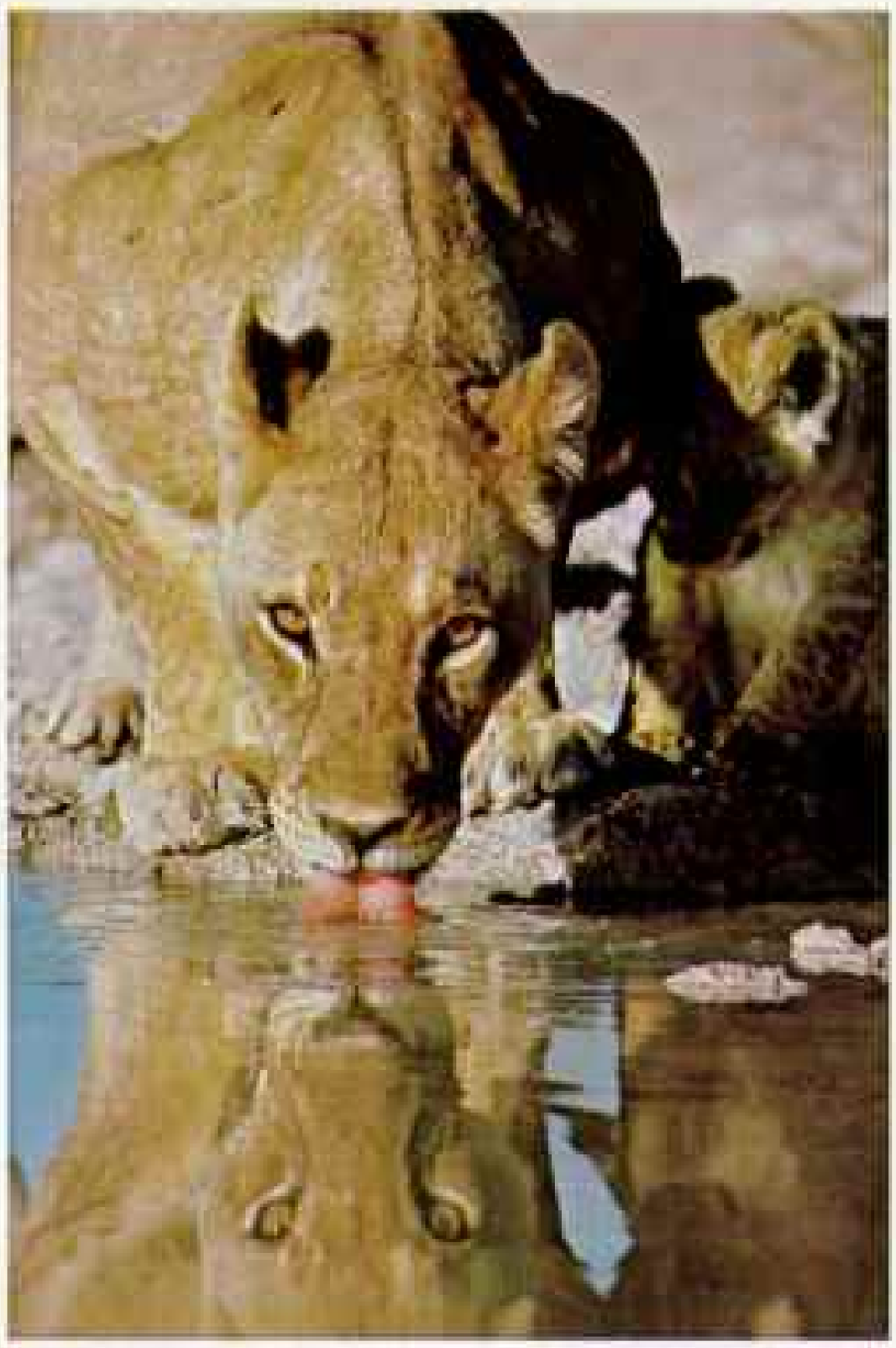
When lions are lying in ambush around a water hole, the atmosphere is electric. They flatten. Their haunches bunch up. They can charge at any second, so we keep ready with our cameras. Meanwhile, the wind is dry and our eyes tire from the sun's glare. Two days in a row we waited at such a water hole with plenty of prey and lions crouching 20 yards away. Yet they didn't make a single charge. It can be very frustrating. But that only adds to the exhilaration we feel when we do get dramatic pictures.



PORCUPINE—handle with care. Gingerly a worn-looking lion pulls out mouthfuls of quills at a time (***left***). According to folklore, only an old or injured lion will eat a porcupine, with the ingested quills his final meal. But it was evident that this lion had eaten them before. He knew exactly what he was doing. When we saw him months later, he looked fresher and stronger, supporting a recent study that found that healthy lions in the Kalahari Desert include porcupines in their diet.

One day we trailed a lioness stalking a baby giraffe following its mother. For five hours she zigzagged through thick acacias so thorny we, tracking her, feared punctured tires. Suddenly there was a cloud of dust ahead. Apparently the giraffes had blundered into other lions of the pride. When we arrived a few moments later, they were all preparing for a meal (***below***).

A drinking lion can flick up only a few drops of water at a time. It takes about ten minutes to fill up (***right***).



TALE OF THE TAILS. Cub play begins around dawn with the little ones climbing all over the sleeping male, pummeling him with their paws, chewing his tail, and tugging at his mane so hard that they extract bits of hair. Finally he rouses and walks over to a sleeping lioness while a cub clings valiantly to his tail (***above***).

Lions are very tolerant about this, but they can get fed up—the cubs' teeth are needle sharp. A lion will growl and even cuff the cubs gently, and they back off. But soon they're at it again.

Taking it easy on a troublemaker, a lioness mouths a cub's tail (***left***). Earlier he had been horsing around with another lioness—his mother—until she stopped the play by licking him roughly. After he switched his attention to this lioness, the two first licked each other's faces. When she opened her mouth, he put his head in and licked the inside. We had never observed that before.

The lions are so accustomed to our vehicle that mothers will leave their cubs by it when they go to hunt. We're just part of the landscape. One day we saw a pride approaching that we hadn't seen for a long time. We parked right in the lions' path so we could identify them as they passed. What did they do? When they reached the vehicle, they all flopped down and rested.

DESPERATE KICK its last defense, a whinnying zebra—all four feet off the ground—cocks its hind legs at a pursuing lioness (***left***). We've seen zebras do this many times, even very young animals; it must be an instinctive reaction. They seem to know how close the lion is, and when it's now or never. As the predator leaps, the hooves lash out—bang—higher even than the zebra's rump.

This lioness did not get kicked, but the hooves made her falter. She missed the kill and was left standing in a cloud of dust.

Another lioness (***above***) was not so fortunate. Kicked while the pride chased and killed a zebra, the left side of her jaw flops askew, broken. Standing over the kill, she is unable to eat. We never saw her again.

On an earlier occasion we photographed another lioness with a broken jaw, presumably from a zebra's kick. One of the park rangers found her dead at a water hole ten days later.

Many people think that lions have it their own way all the time, that they can kill without fear of retaliation. But they can't. In these instances, the awesome predators became the victims.

In the years ahead we plan to return often to this endlessly fascinating land—and the equally fascinating lions we have come to know so well. □

REPORT TO MEMBERS

An Exciting

By GILBERT M. GROSVENOR

GILBERT M. GROSVENOR AND DR. SARA BISEL BY JONATHAN BLAIR

THE EXCAVATION at Herculaneum had reached the level of the old beach, some 80 feet below the present surface, when I arrived there on an emergency mission last summer. Archaeologists were digging carefully with trowels, knives, and small brushes. A skull was uncovered; next, the bones of a human hand, adorned by rings of wealth (page 686). In a chamber, a dozen more skeletons had been found.

Here, I was told, lay the first human remains from the Roman era that would be subjected to modern scientific study. The bones would tell us new stories—not just about human tragedies (was this a family huddled together in a final moment of terror?) but also about the appearance, occupations, diseases, nutrition, a hundred details, of the ancient Romans.

Yet there was a horrifying catch. The past was perishing before my eyes. At nearby Pompeii hot volcanic ash had encased the trapped inhabitants, forming molds of their bodies, but most of the skeletons had vanished with heat and time. The dead on the beach at Herculaneum had lain for 1,900 years in wet mud, and now their bones, reacting to the light and air, were disintegrating quickly. Unless something was done—at once—an irreplaceable discovery would flake away and be lost for all time.

That was the problem that had brought

A sampling of the 150 research projects supported by your Society this year

ASTRONOMY: *A new survey of the northern sky to be made at Palomar Observatory in California will record objects twice as far away as those seen in the Society-funded Sky Survey of the 1950s.*

BOTANY: *Deep within a tropical forest in Bolivia scheduled for commercial logging, Dr. James C. Solomon is taking inventory of rare species that may soon be lost through deforestation.*

PALEOANTHROPOLOGY: *In East Africa, such scholars as Mary and Richard Leakey and Donald C. Johanson are tracking man's earliest ancestors.*

MARINE ARCHAEOLOGY: *Off Turkey, a team led by Dr. George F. Bass has been excavating a 16th-century Ottoman shipwreck.*

Year of Discovery

PRESIDENT, NATIONAL GEOGRAPHIC SOCIETY

me to Herculaneum. Dr. Giuseppe Maggi, director of the dig, had urgently appealed for help through Walter John Silva, U. S. Consul General in Naples. Mr. Silva had contacted the National Geographic Society.

There had been no time to convene a meeting of our Committee for Research and Exploration, so we made emergency funds available. We located Dr. Sara Bisel, a noted classical archaeologist and physical anthropologist already working in Greece. She had flown to southern Italy at once to begin the laborious and difficult task of preserving each bone (left). And when the Research Committee later met in Washington, its members acted instantly to continue the work. The preliminary report on Herculaneum leads this issue.

Gaza Yields Clues to the Exodus

Israeli archaeologist Trude Dothan tells on page 739 of another fascinating Society-supported project, that one in the troubled Gaza Strip. It has unearthed an ancient Egyptian outpost that may have influenced the route Moses chose for the Exodus.

You can take pride in the fact your membership helps make such studies possible. Each discovery fits in one more piece of a puzzle, and may cut across many disciplines of scholarship. Perhaps Herculaneum, for example, will tell us not only about health and history but also something new about volcanology, geology, even oceanography.

Two years ago I made a test dive in the research submersible *Alvin* off St. Croix in the Caribbean. Testing a new electronic imaging system that the Society helped develop, we plunged some 3,000 feet to the ocean floor. It was a journey from the known to the unknown world, in barely half a mile. I felt no sensation of dropping or of pressure, but looking out our portholes, I saw a kind of reverse snowfall of illuminated sea life. When we reached the ocean floor, everything was unearthly silent, strange and new.

It's a scientific irony that the largest geologic feature of our planet, the world-girding Mid-Ocean Ridge, was not seen by oceanographers until the 1970s. Even now, men in submersibles have viewed scarcely one-tenth of one percent of that 46,000-mile-long mountain range. Fortunately, soundings and seismic readings have recently given us a dramatic harvest of facts. And here again your Society is using new resources to make this research widely available.

A set of charts just completed this year by the Canadian Hydrographic Service, under auspices of the International Hydrographic Organization and UNESCO, brings together bathymetric data from ships of many nations in the most comprehensive seafloor mapping yet achieved. Using these charts,

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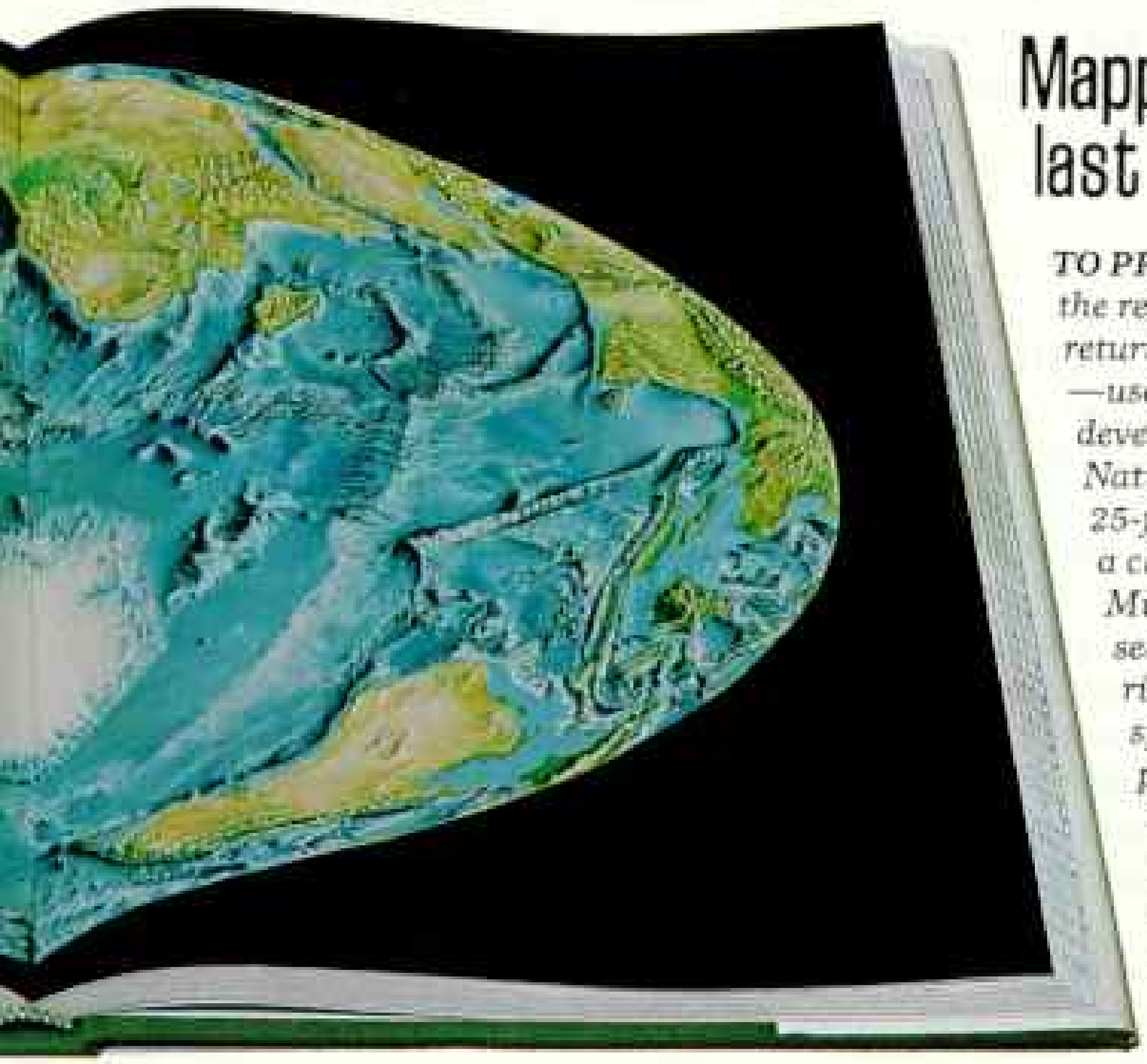
ANIMAL BEHAVIOR: *In the West Africa nation of Gabon, Dr. Carl D. Hopkins has been studying the fish of small forest creeks that communicate through electric signals.*

VERTEBRATE PALEONTOLOGY: *A team led by Dr. Farish A. Jenkins, Jr., continues to search the Arizona desert for new clues about a previously unknown branch of the mammal family. A tiny jawbone found in 1981 belonged to a mouse-size creature that lived 180 million years ago, one of the earliest mammals yet discovered in the New World.*

GEOCHEMISTRY: *In Hawaii Volcanoes National Park, Dr. Dale P. Cruikshank and Dr. Jay M. Pasachoff hope to unlock the secrets of volcanic gases through spectral analysis. The research may lead to prediction of potentially catastrophic eruptions.*

ARCHAEOLOGY: *To test the existence of legendary King Naymlap, Dr. Christopher B. Donnan has been excavating two sites in northern Peru. Said to have founded a powerful dynasty in the central Andes about A.D. 1000, Naymlap would be the earliest known historical figure in the Western Hemisphere.*

NATIONAL GEOGRAPHIC PHOTOGRAPHER EMORY KRISTOF



Mapping earth's last frontier

TO PROBE THE SHROUDED DEPTHS, *the research submersible Alvin—here returning to mother ship Lulu* ***(above)*** *—uses a low-light video imaging system developed with assistance from the National Geographic Society. The 25-foot-long vessel gives scientists a closeup look at earth's awesome Mid-Ocean Ridge, a globe-encircling seam of submarine mountains that rise where the seabed is physically splitting apart. In an exciting new painting prepared for the upcoming book "Exploring Our Living Planet"* ***(left)****, Society cartographers portray dramatically different terrain in the Atlantic and Pacific, caused by faster spreading of the Pacific floor.*

Society cartographers have produced a breathtaking new relief view of the world's seabed, including the Mid-Ocean Ridge.

This map will be published soon in an exciting new Society book, *Exploring Our Living Planet*, by marine geologist Robert D. Ballard. In understandable language, Dr. Ballard explains the theory of plate tectonics and continental drift. Photographs and paintings complement the text.

The book graphically reports new methods of earthquake prediction. New data lead volcanologists to believe that Yellowstone National Park someday could blow up in an eruption far greater than that of Mount St. Helens. And Landsat photographs from space suggest that India's long-ago collision with Asia not only raised the Himalayas but is even today breaking up much of eastern Asia, causing many of China's greater earthquakes, and possibly opening the rift that holds Siberia's Lake Baykal.

1983 Lineup of TV Specials

For the first time your Society has coordinated a multimedia treatment of these complicated subjects. Next April 6 Dr. Ballard will take television viewers to some of the most tectonically active spots in the world, in "Born of Fire," one of four National Geographic TV Specials for 1983.

As in the past seven years of close association with the Society, the Gulf Oil Corporation has underwritten this award-winning series on Public Television. The documentaries are coproduced by the Society and WQED/Pittsburgh.

The series begins January 12 with "Rain Forest." Filmed entirely in Costa Rica by cinematographers David and Carol Hughes, the program shows the workings of the rain forest's intricate ecosystem with its richly varied species of life—like the extraordinary lizard known as the basilisk that literally runs across the surface of water.

On February 9 we shall see "Australia's Animal Mysteries," showing the lives of such improbable creatures as the platypus, the koala, and the baffling gastric-brooding frog, whose young actually move up from the mother's stomach to emerge from her mouth at birth.

"Save the Panda" will be the title of our March 9 telecast. It portrays a joint research program of the World Wildlife Fund and Chinese government, in which Dr. George Schaller of the New York Zoological Society studies pandas in the wild as well as problems of breeding them in captivity.

New Atlas Portrays Ancient World

One of our most dramatic projects for 1983 will be the publication of a National Geographic illustrated cultural atlas of the ancient world, *Peoples and Places of the Past*. As a companion to our popular geographic *Atlas of the World*, this new publication will contain more than 100 new maps and 1,000 illustrations.

Nothing like this volume has ever before been published. Nearly 20 artists were commissioned for this great graphic history, stretching from the migrations of early man to about A. D. 1500. Here are the tides of history—the Indus Valley, China, Egypt, the classical world, the early Americas. I venture that one painting alone—a cross section of life in a castle—could occupy an interested reader for hours. When the editors learned of new Viking discoveries, they called Norway to secure photographs of the important artifacts. The latest Aztec and Greek finds also appear here; museums throughout the world have helped us update the distant past. *Peoples and Places of the Past*, I predict, will rank with the most informative, beautiful, and popular publications we have ever offered.

In each Society endeavor, technology plays its part, not only in our educational role but also in making the most of Society resources. Without new electronic techniques, our dues would have to be much higher, or we would be unable to fund 2.5 million dollars annually for research and exploration. Our accounting systems have been completely modernized. A new headquarters building—financed entirely by reserves set aside for this purpose during the past 15 years—will bring all headquarters employees efficiently together again.

We are planning the use of laser videodiscs for storage and retrieval of information. We are also studying the uses of cable television and satellite broadcasting. For in our continuing quest for geographic knowledge and in its dissemination, not even the sky will be our limit. □

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D. C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization. Since 1890 the Society has supported more than 2,200 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; its books, globes, atlases, filmstrips, and educational films; *National Geographic WORLD*, a magazine for children age 8 and older; information services; technical reports; exhibits in Explorers Hall; and television.

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** Remember: Compare this estimate to the EPA "Estimated MPG" of other gasoline-powered cars with manual transmission. You may get different mileage depending on how fast you drive, weather conditions and trip length. Actual highway mileage will probably be less than the "Highway Estimate."
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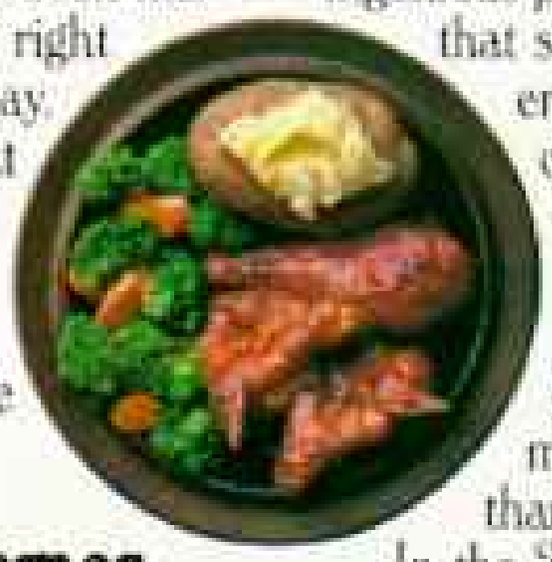

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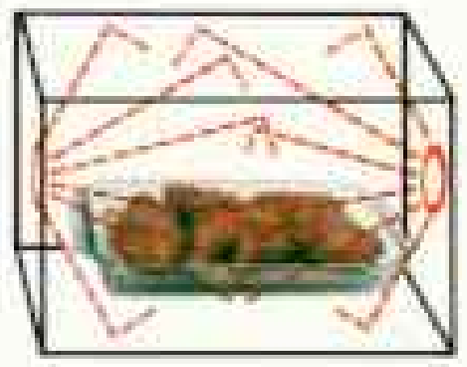

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Members Forum

OUR NATIONAL FORESTS

Mr. Findley wrote an article (September 1982) that obviously comes from a lover of wilderness, yet still with an understanding of the reasonableness of the opposition's arguments.

Diana Oliver
Flagstaff, Arizona

The fact that millions and millions of acres are now under federal control is not due to the federal government's not having tried, in most cases, its utmost to unleash the lands to private occupancy and use. Now that private lands have been overexploited, however, many are turning to the little that is left in public ownership, marginal though it is, for one last round of exploitation. This trend must be resisted, and use of the public lands must be in a controlled, sustained-yield manner.

Edward C. Sargent III, M.D.
Shedd, Oregon

You describe as "reduced to rubble" the logged areas. You should be honest and point out the foreground (photograph, page 320) is second growth timber 25 years or older. The hilltop in far background is old growth, and in front of that is an area at least 15 years old. Timber is a crop. Like apples, it should be harvested before it rots.

Harold Granatt
Quinault, Washington

Any extensive clear-cut will include areas logged in more than one season and hence will contain several stages of regrowth. But the immediate effect of a clear-cut is to leave a wasteland subject to erosion.

U. S. FEDERAL LANDS MAP

Your map (September 1982) showing the extent of federal government ownership of the western United States is nothing short of breathtaking. It is about time that the picture can be shown to the world, including the "preservationists." Perhaps it will give a shot in the arm to the "sagebrush rebellion," timed, as it was, to coincide with Secretary Watt's announcement of the sale of some federal government lands.

Jay W. Preston
Los Angeles, California

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B. PAID CIRCULATION		
1. Single Copy Sales	4,891	4,509
2. Mail Subscription	10,662,717	10,469,521
C. TOTAL PAID CIRCULATION	10,667,608	10,474,030
D. FREE DISTRIBUTION (incl. samples) BY MAIL, or OTHER MEANS. (No News Agents)	101,825	105,484
E. TOTAL DISTRIBUTION (Sum of C and D)	10,768,433	10,579,514
F. OFFICE USE, LEFTOVER, ETC.	137,403	104,381
G. TOTAL (Sum of E & F)	10,905,836	10,683,895

T.R.'s WILDERNESS LEGACY

Hooray for your story on T.R. (September 1982)! Now, there's one politician I can say I admire. If only he could help us now.

Janet O'Donnell
Clifton, New Jersey

President Roosevelt in my opinion is certainly one of the greatest Presidents this country has ever had. To him we owe the Great White Fleet, the FDA, and, his greatest contribution, the setting aside of free land for the future that Mr. Watt should keep his hands off of.

Thomas B. Gilbert
South Burlington, Vermont

PARAGUAY

In the August 1982 issue you describe Paraguay's President Stroessner as a "dictator." This is oddly biased terminology. In your articles on Russia and China you have never referred to these countries as "dictatorships" nor even to their rulers as "dictators." Please keep your political myopia to yourself and keep the GEOGRAPHIC objective and politically neutral.

Walter B. Larew
Falls Church, Virginia

A dictator is a person wielding absolute power—one-man rule. The authoritarian governments of the U.S.S.R. and China are ruled by one-party committee.

As a former Peace Corps volunteer to Paraguay, I read your article with a critical eye. It was with great delight I found no errors or misrepresentations. Of course, the emphasis on aspects of political life might have been different from my point of view, but what your writer, Gordon Young, had to say was true from my experience.

Leona Manke
Claremont, California

MELVILLE BELL GROSVENOR

I felt compelled to thank you not only for sharing your love and respect for the "Skipper" (August 1982), but also for giving me an insight into a person who was probably responsible for the fact that I read every issue of the GEOGRAPHIC from cover to cover! A friend of mine once wrote to me, "We are not ships on an ocean of wind and sail, free to drift where our hearts would cast." I would say MBG's life not only disproves that theory but encourages one to "set sail immediately!"

Nancy L. Willmon
Aurora, Colorado

Mrs. Willmon writes eloquently for the many members who expressed similar sentiments.

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PAPUA NEW GUINEA

In early 1973 before independence, I toured PNG (August 1982) extensively as a diplomatic officer based in Canberra. At that time great misgivings were raised about impending nationhood. Various centrifugal forces were thought to be going to disintegrate the nation once the unifying elements of colonial administration were withdrawn. The credit that they didn't goes to the leaders and administrators of this young nation for their successful operation despite the odds.

Mahmood-i-Elahi
Geneva, Switzerland

As an English teacher, I am outraged to see names shortened by abbreviation—especially names of countries. Papua New Guinea reduced to "PNG" will make my students think of it not as a nation but as an industry, medicine, or disease.

Joan C. Ludington
Rushville, Indiana

No stigma seems attached to the use of U.S.A. or UN, and PNG is a term commonly used by the Papua New Guineans themselves.

Papua New Guinea is described in your magazine as "egalitarian in spirit and instinct." Yet in the following pages we read that PNG is a country where women are "subservient," that village spirit houses are "strictly men's territory," that village clubhouses don't allow women, and that polygamy is legal. How then can any country in which half the population is routinely discriminated against by the other half, socially, religiously, and legally, be called egalitarian?

Barbara Kilgore
North Hollywood, California

FLORIDA

There were times 20 years ago when I would forsake the luxury of the school bus and walk the few miles home through Ybor City (August 1982). I could spoil my supper on nickel deviled crabs or guava pastry. Or feast on the subtropical plumpness of avocados, mangoes, and Japanese plums. Those credited with the development of Florida exemplify only that there is a time to be born and a time to die, but there is no time for reckoning.

Jim Farina
Thonotosassa, Florida

The caption for the picture on page 211 indicated that frozen juice concentrate uses a process pioneered at the University of Florida in Gainesville in 1942. Actually the process was developed by Dr. L. G. MacDowell, Dr. E. L. Moore, and Mr. C. D. Atkins, the first three scientists to be employed by the Florida Department of Citrus. All three scientists are still living, and Dr. Moore is still employed by the Department of Citrus.

John A. Attaway
Florida Department of Citrus, Lakeland

The University of Florida developed an early process, but it was not commercially viable. Besides the scientists Dr. Attaway cites, E. E. Wiederhold and, from the U. S. Department of Agriculture, M. K. Veldhuis, R. Patrick, and A. L. Curl helped develop the process now in use.

As a U. S. citizen originally from Cuba, I would hope that instead of "the last American" leaving Miami and taking the flag, some will stay and absorb the influx of Cubans and other Latin American immigrants, as has happened in the course of American history with European and Asian ones. Remember, we can all learn something from each other.

Sonia Vasquez
Glendale, California

As a longtime Sun Coast resident raised in Tarpon Springs, I decided the old stomping grounds were getting too crowded, too overdeveloped (I don't even own a golf club), and too impersonal for my tastes. So I packed up and headed inland to horse and cowboy country. Found a lovely little place where people I don't even know wave from their pickup trucks and a fellow comes round to the office every Friday selling fresh eggs. Only, already the old-time residents tell me how bad things are nowadays with all those strangers moving up from Tampa, endless lines of rock-hauling trucks, and fast-food places cluttering up the south end of town. I love it.

Lynne M. Bolton
Brooksville, Florida

BLUEFIN TUNA

In the picture displaying different ways of serving raw fish, or sashimi (August 1982), there are eight pieces of sushi, a term to describe rice combined with a variety of ingredients in various shapes. Sushi is the generic term; tekamaki is one species. Sushi is a subject that can be studied in depth by itself. May we invite your caption writer to a generous study at his nearest sushi bar?

Christella K. Urago
Honolulu, Hawaii

Please. If anything, he and the rest of our staff need restraint, not encouragement.

Letters should be addressed to ***Members Forum****, National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.*

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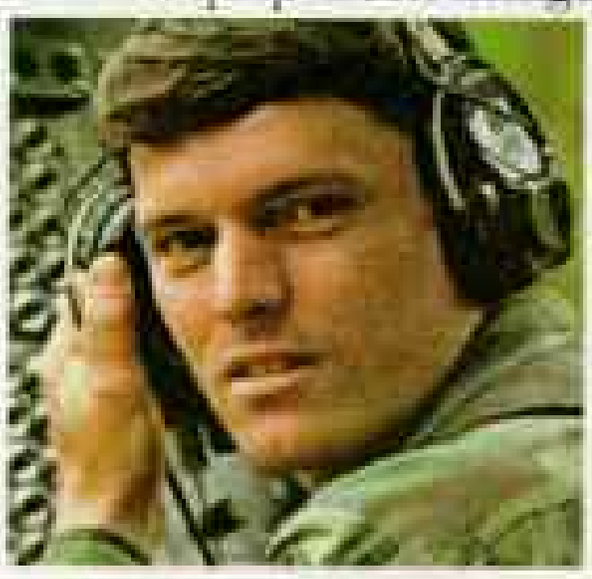

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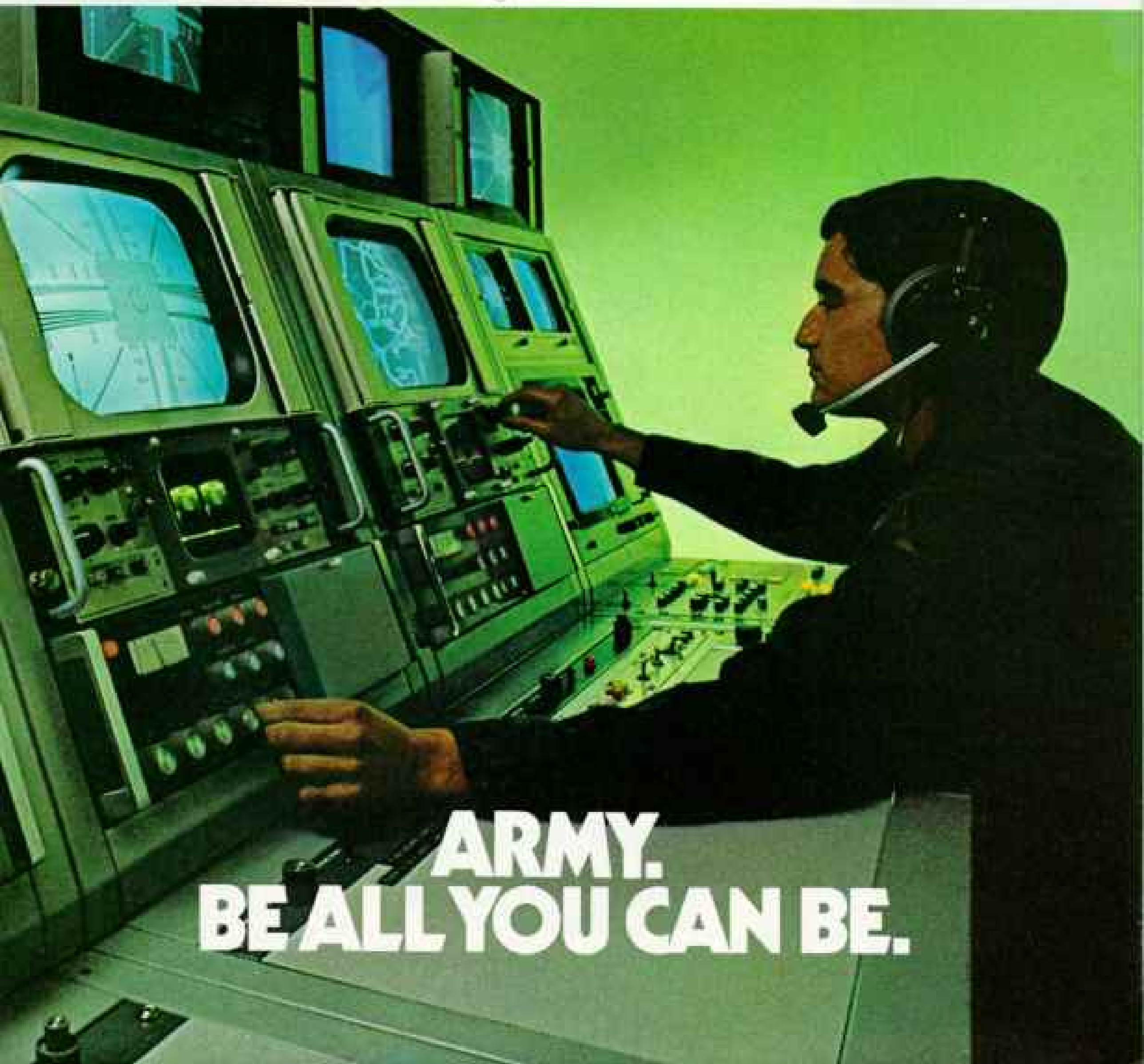

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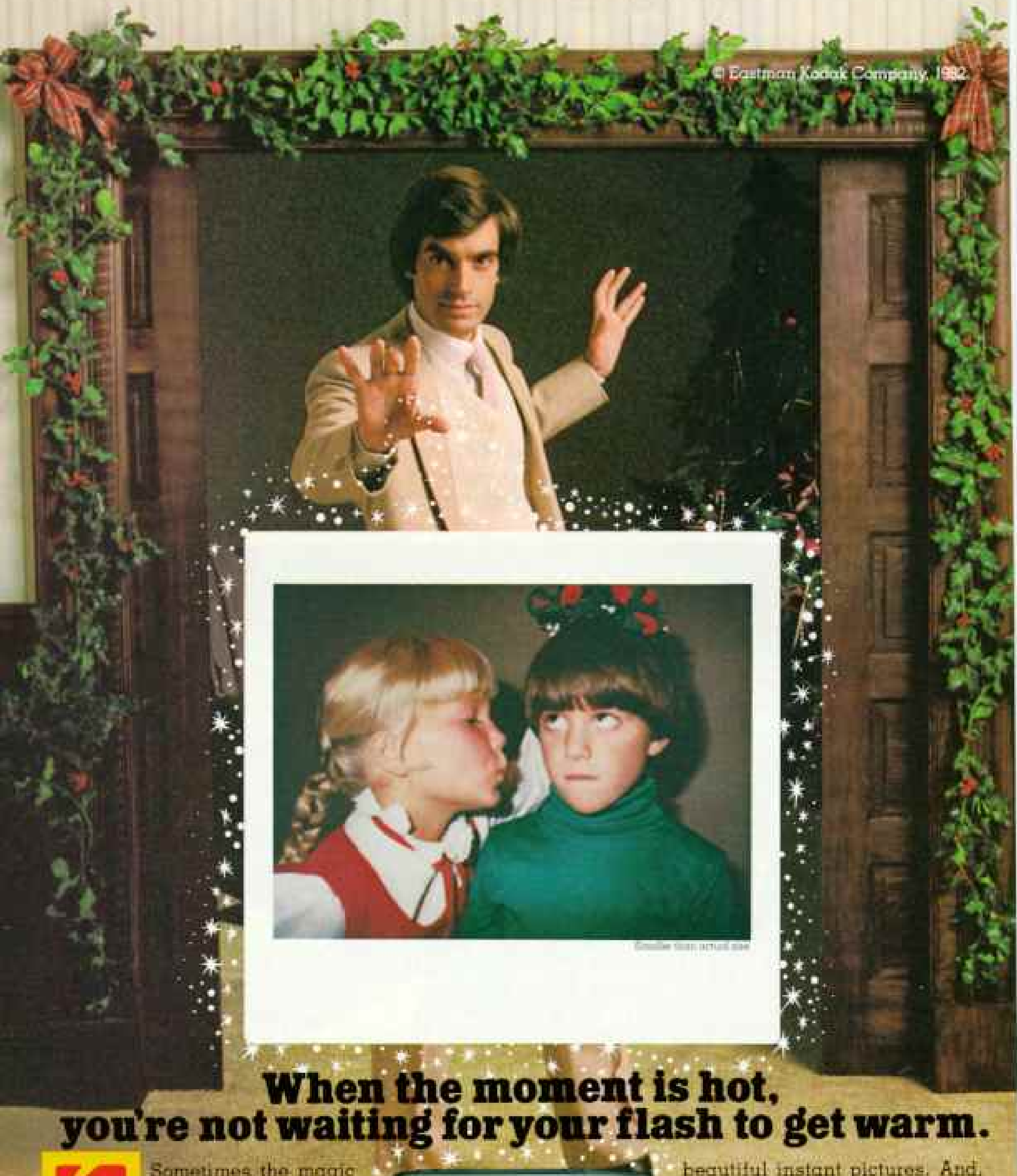

When the moment is hot, you're not waiting for your flash to get warm.

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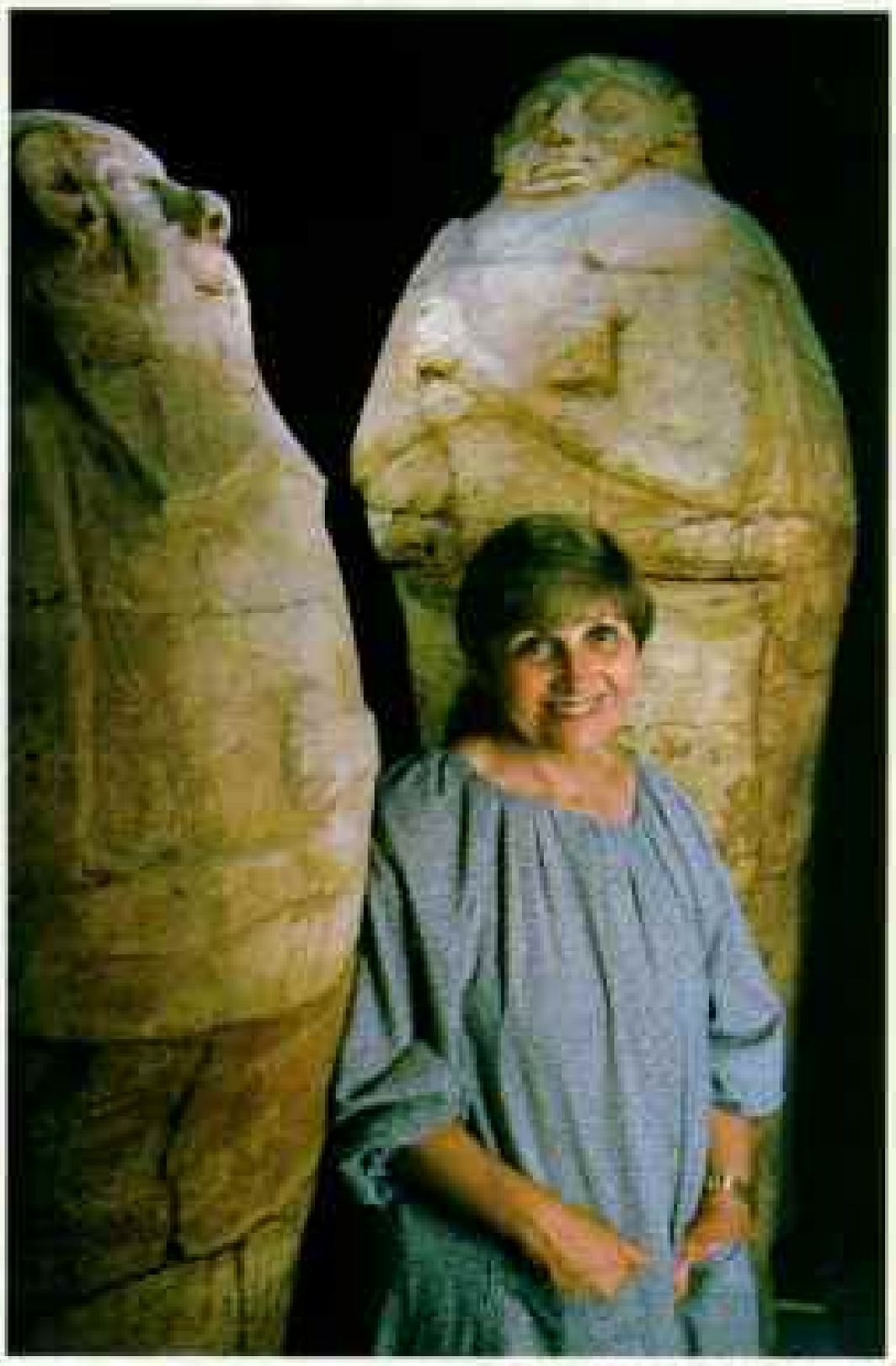
On Assignment

"DEALING WITH THE UNKNOWN and suddenly seeing a pattern in it" is archaeology's allure for ***Trude Dothan,*** here visiting "my friends"—human-faced clay coffins (right). Once taken by grave robbers from the site of her dig at Deir el-Balah in the Gaza Strip, they are now safe in the Israel Museum. Dothan, a Jerusalem native, is a professor at the Institute of Archaeology of Jerusalem's Hebrew University. As a student there she began delving into the pasts of the Philistines, Canaanites, and Israelites in search of links



TRUDE DOTHAN BY SISSE BRIMBERG

between ancient Mediterranean peoples. "They've followed me ever since," she says.

Getting together in the field (from left), staff photographer ***Jodi Cobb,*** Senior Assistant Editor ***Mary G. Smith,*** and photographer ***Sisse Brimberg*** met at Jerusalem's Damascus Gate. For a month Brimberg and her cameras spent most nights with Trude Dothan's coffins in the museum basement. "They're a little spooky at first, but they grow on you," she says. Smith studied thousands of slides taken during the Deir el-Balah dig and consulted with Brimberg and Dothan in a role she has played many times as photographic coordinator for those Society research grant projects that become magazine articles. Working for future magazine coverage of Jerusalem, Cobb found it "both a magical and a tragic place. It stirs your every sense. People have come and gone and fought over it, but somehow you think the city will endure."

COBB, SMITH, AND BRIMBERG BY JOEL COBB

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2. GREATEST STANDARD RANGE (hwy./city) (Mini Ram Wagon)	550/418* 906/684*	414/264*	506/374*
3. GREATEST CHOICE OF MODELS	7	5	5
4. GREATEST CHOICE OF DOORS	4	3	2
5. GALVANIZED STEEL	410 sq. ft.	81 sq. ft.	192 sq. ft.
6. TIGHTEST TURNING CIRCLE for handling ease	40.5 ft.	42.4 ft.	42.4 ft.
7. REAR WINDOW DEFOGGER AVAILABLE	YES	NO	NO
8. WRAPAROUND REAR WINDOWS for better visibility in longest model	YES	NO	NO
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Let's talk.

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AMERICAN LUNG ASSOCIATION
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Space contributed by the publisher as a public service.

Photographed by Peter G. Veit. ***Mountain Gorilla:*** *Genus: Gorilla Species: gorilla Subspecies: beringei Adult size: 152—182cm Adult weight: Approximately 182kg, male; and 114kg, female* ***Habitat:*** *Mountain rain forests in central Africa* ***Surviving number:*** *Less than 750*

Wildlife as Canon sees it: A photographic heritage for all generations.

The mountain gorilla is one of nature's most intriguing animals. Living in small, closely knit groups and exhibiting an intense devotion to its family, it is strikingly similar to man. And although it weighs as much as 400 lbs and possesses incredible strength, it is in reality a shy and gentle giant, much more likely to run and hide than face a human. Today, this largest of the great apes is fighting a battle to survive.

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Photography is an indispensable research tool for studying the intricate behavioral patterns, family relationships and social structure of the mountain gorilla. At the same time, photography speaks a language that is at once easy to grasp and expressive. Confined to a small area in Africa, the imperiled mountain gorilla can be brought to the attention of countless people with just one photograph, nurturing a sympathetic understanding of nature.

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1983 FORD LTD

Introducing the New 1983 Ford LTD Wagon.

From the smooth ride, to the new driver-designed seating position, the quiet new LTD Wagon is a uniquely comfortable driving experience.

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A new sloping hood adds aerodynamic smoothness to the exterior. And inside, there's plenty of room for passengers and cargo. In fact, there's more cargo space than any American-built wagon in its class. Of course, that's based on EPA Cargo Volume Index and does not include other Ford Motor Company products.

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A rare blend of function and convenience creates total driving comfort for you. You'll find luxurious reclining front seats, thick carpeting, and a new electronic station seeking radio option. But best of all, this impressive interior creates a quiet atmosphere that'll make you feel like you belong.

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The new 1983 LTD Wagon has more state-of-the-art technology than ever before. Gas-filled shocks for a smooth, stable ride. Optional 3.8 liter V-6 with automatic overdrive. And there's a convenient two-way liftgate option that lets you open the window separately for quick and easy small package loading and unloading.

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