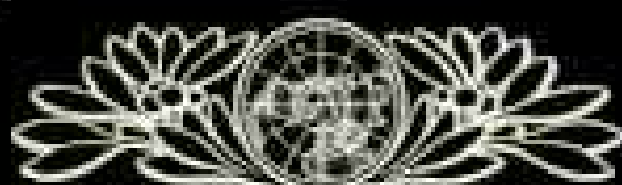


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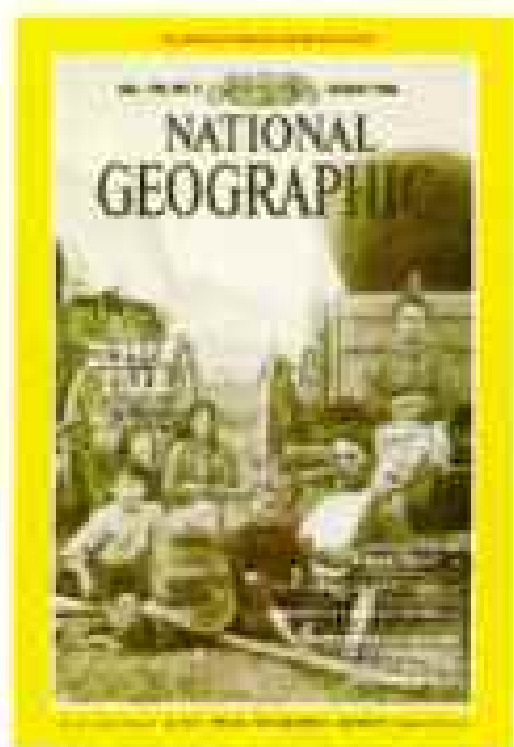
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THEY ARE INDIVIDUAL, yet somehow archetypal, those people resting by two covered wagons in our Oregon Trail article last August. They stare fixedly at the camera; we can imagine the photographer bent under his black cloth, focusing, fixing this moment forever. Because the image he made has such an enduring quality, it has become a favorite of historians of the western movement. We were very surprised, then, to find that no one knows who made the picture, or where, or who is in it. We asked our readers if any of you knew.

Answers came from as far away as Papua New Guinea. The family was variously identified as the Tiptons on their way to southern Oregon; that of Mads Steffenson, a Danish im-



migrant westbound; the Phelps family, who settled in Colorado; survivors of an Indian massacre from Minnesota; a family that later died in Death Valley; the family of William Loosley, an English immigrant on his way to Fort Klamath, Oregon; an unnamed group camped near

Colorado Springs; the Chiles family en route to Oregon; the Griggs family resting near Spearfish, South Dakota, 19 days out of Valentine, Nebraska; an unnamed Mormon family. . . .

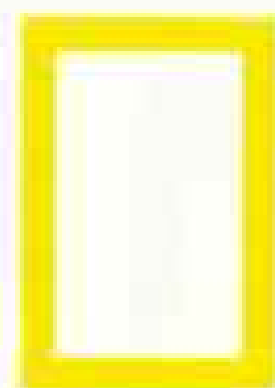
Rather than feel disappointed at lack of a clear and certain answer, I had a profound sense of how close to us the past really is—what a truly young country we are. For these replies spoke of family albums, grandparents, even parents. The correspondence was a microcosm of a vast tidal movement of people across the plains that is still a living part of our history.

It was another reminder of the power of pictures in the reporting of history. Our images of the Civil War and of Abraham Lincoln will be forever fixed by the stark photography of Mathew Brady. All of modern history lives on film. What we would not give for real images of the ancient world!

So perhaps it is best after all if we do not have a final answer on the pioneer family. They are stronger as symbols of twin powers—the human memory and the unblinking lens—that constantly keep our past alive.

*Wilbur E. Garrett*

EDITOR



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*On earth's fourth largest island, naturalist Alison Jolly and photographer Frans Lanting find the human fight for survival endangering unique and wondrous plants and animals.*

## Iceland: Life Under the Glaciers 184

*Turning a hostile environment to their advantage, Icelanders enjoy prosperity at home while resisting foreign influences. Louise E. Levathes and photographer Bob Krist report.*

## The Appalachian Trail 216

*From Georgia to Maine the footpath covers 2,100 miles of forest glades, valley views, and rocky heights. Noel Grove and photographer Sam Abell chronicle its gifts. A "Making of America" map supplement traces the historic contributions of New England.*

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*Biologist-photographer M. Philip Kahl travels to Australia for a close look at one of the most spectacular waterbirds anywhere.*

**COVER:** Viking descendant nine-year-old Ingibjörg Björnsdóttir takes the midnight sun in Iceland. Photograph by Bob Krist.

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# Madagascar:





# A World Apart

By ALISON JOLLY

Photographs by FRANS LANTING

**M**ay I announce to you that Madagascar is the naturalists' promised land? Nature seems to have retreated there into a private sanctuary, where she could work on different models from any she has used elsewhere. There, you meet bizarre and marvellous forms at every step. . . .

Philibert Commerson, 1771  
French naturalist

*A paradise much praised by early naturalists, the world's fourth largest island faces an ecological crisis of the first magnitude. Separated from eastern Africa 165 million years ago, the island became a living laboratory for evolution, spawning myriad plants and animals unlike any others. Many of its larger animals, such as Aepyornis, the world's largest known bird, disappeared in a wave of extinctions ending some 500 years ago. Today more extinctions are imminent as a rapidly growing human population is pitted against the environment in a struggle for survival. Eggs of the Aepyornis are still occasionally found along streambeds after heavy rains.*





*Only the most intrepid hunters and honey gatherers enter Bemaraha Tsingy National Reserve, where hundred-foot*



*limestone needles offer sanctuary from human incursion for some of western Madagascar's unique flora and fauna.*



**S**urvivors from the age of dinosaurs, chameleons abound in Madagascar, where half the world's species are found. Like other chameleons, this *Brookesia* (left), smallest of all, is scrupulously avoided by islanders, who consider the creatures to be ill omens. A *Brevicornis* captures prey a body length away with its tongue (above). Brilliant, mood-altered pigmentation distinguishes other species, such as the *Parson's* chameleon (right).







**P**rovident plants, a water-storing bottle tree (above) and a grove of octopus trees (right) can survive sparse rainfall in Madagascar's arid regions. Though it sports thorns to deter thirsty predators, the octopus tree is unrelated to any cactus plant.







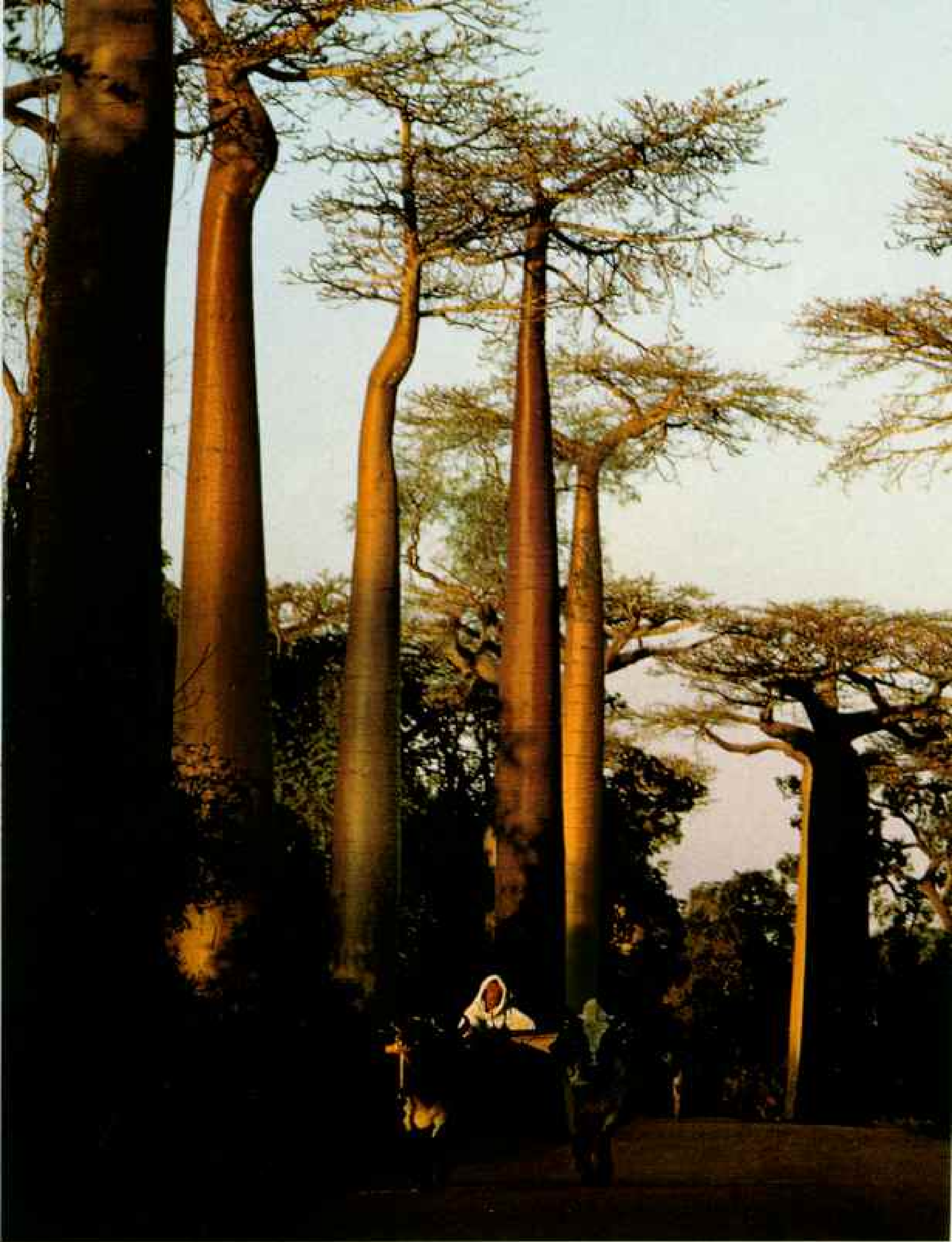




*Primitive primates displaced elsewhere in the world by monkeys, lemurs evolved in Madagascar unbothered by simian competitors. These ring-tailed lemurs and 25*

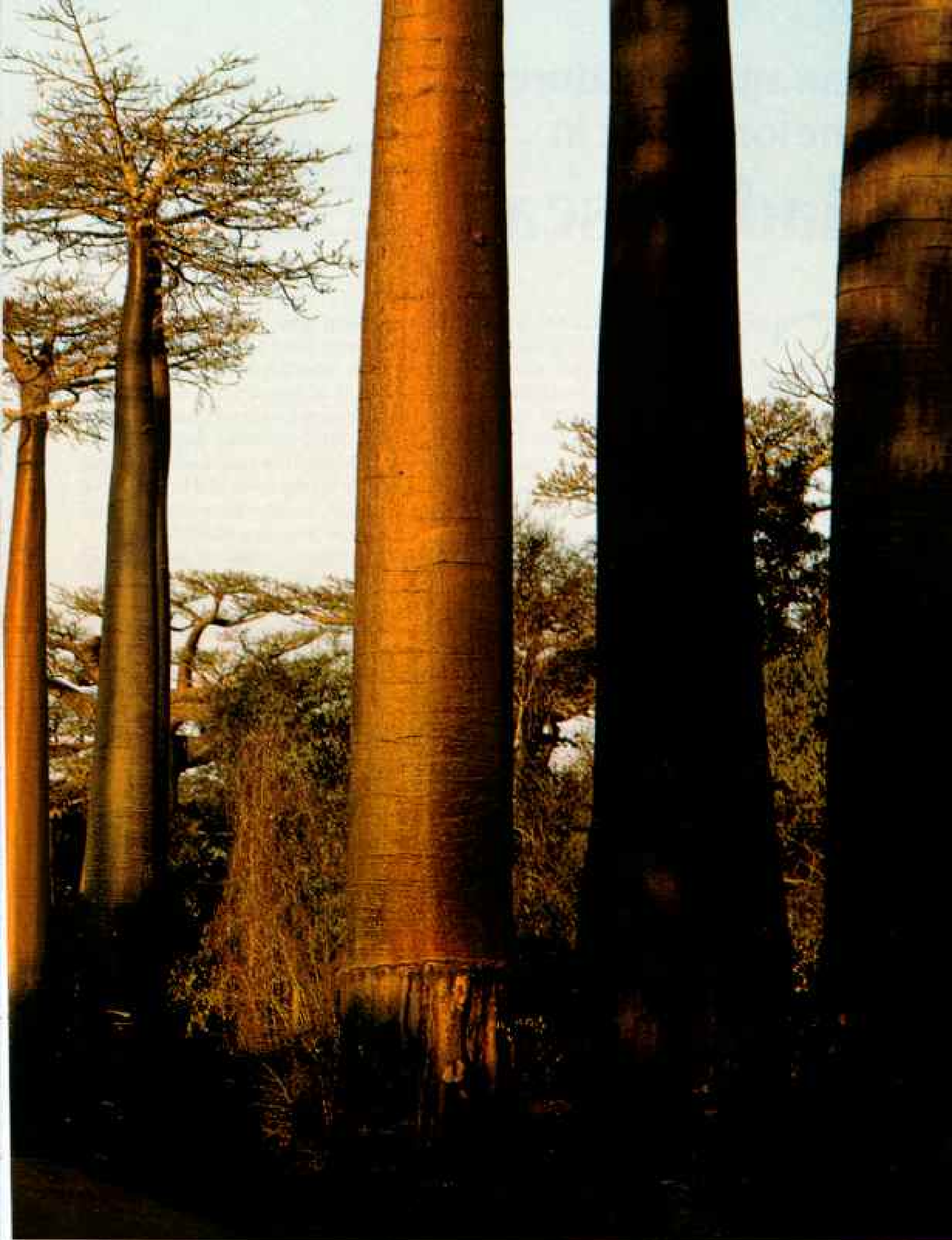


*other species cling precariously to the island's remaining forests. Giant bamboo lemurs were sighted by American researchers in 1986 for the first time in 15 years.*



*Bronzed by the setting sun, water-gorged baobab trees rise in vertical splendor near Morondava, where rain falls just four*





*months of the year. Though known as a mainland Africa tree, only one species grows there, whereas Madagascar boasts six.*

# Man against nature: time for a truce in Madagascar

*Poverty smiles in the rice fields of central Madagascar, where a girl scoops fish from a rain pool to augment the evening meal. Many islanders teeter on the edge of malnutrition.*

**G**EORGES Randrianasolo, Madagascar's leading naturalist, grabbed the doorframe of our descending helicopter and stared uneasily at the limestone pinnacles below us. From horizon to horizon, erosion had sculptured rock into spires a hundred feet tall, some whetted so thin at their peaks that the setting sun gleamed as if sinking behind an entire skyline of Empire State Buildings. Malagasy—the people of Madagascar—call these rocks *tsingy*, or spikes, and say that in the *tsingy* there is hardly enough flat land to plant your whole foot.

The helicopter veered, hovered, and set us down on a tabletop rock hedged by 60 square miles of stone needles. Georges unclenched his fingers. Once before he had tried to penetrate the *tsingy*, on foot, but turned back when its mineral blades sliced viciously at hands and arms and boots. Few Malagasy scientists ever reach this roadless western region of their nation, and for foreign zoologists like me, any trip to remote Madagascar—let alone to the bizarre precinct of the *tsingy*—is an excursion into a world that might have been.

Earth's fourth largest island, Madagascar is a thousand miles long, almost a continent unto itself. Tearing loose from eastern Africa 165 million years ago, it became an isolated world, an alternate arena for the evolution of animals, plants, and insects. Some are living fossils, little changed from their earliest ancestors. Others evolved into creatures found nowhere else.

---

Zoologist Alison Jolly first visited Madagascar in 1962 to study its unique lemurs. She has closely observed the island's environment ever since. Photojournalist Frans Lanting specializes in natural history and human ecology. A native of the Netherlands, he lives in California.

Any question you ask about nature's possibilities may have an answer in Madagascar. Must woodpeckers be birds? On Madagascar it is the aye-aye—a primate cousin of monkeys, apes, and humans—that probes trees for burrowing beetle grubs, detecting them with the ears of a bat, baring their tunnels with the teeth of a beaver, and worming the larvae out with specialized fingers, as thin and bony as a skeleton's.

With like climates, must all jungles and deserts contain the same forms of plants? Madagascar rain forest looks as green and tangled as that of Africa or the Amazon, but four-fifths of its plants grow only there. A southern desert bristles with thorny succulents at first sight like Mexican cactus, although unique and unrelated. Worldwide, plants and animals adapt in similar ways. In Madagascar, though, the ecological theater has a wholly different cast of players.

Madagascar shelters 10,000 kinds of flowering plants, most with no other refuge. Only a dozen of its 400 species of amphibians and reptiles exist elsewhere. Here live half the world's chameleons, the little lizards that change color and can swivel each eye independently. More than half the island's birds and virtually all its native mammals are solely Madagascar's.

More and more biologists see this distinctive island as the world's foremost conservation priority: the place with the greatest number of unique species in the greatest danger of extinction. Increasingly, too, the socialist government of Madagascar is growing alarmed—sufficiently so to modify economic policies that once put development ahead of conservation.

Better recognition of Madagascar's plight has come almost too late. The Malagasy are a frontier people, having come to Madagascar barely 1,500 years ago from the African





Continent and the Malay Archipelago. Tradition pits them against the wilderness; growing poverty spurs them to an increasingly ferocious assault. Four-fifths of Madagascar now stands barren, burned over by subsistence farmers and cattle herders. Whenever it rains, Madagascar's gullied hills bleed red clay into the sea.

**O**NLY in Madagascar's most inaccessible regions—such as the Tsingy National Reserve of Bemaraha, defended by its guardian rocks—do its peculiar native animals and plants still have a good chance of survival.

The odds would favor them even more if they were fully protected. Yet impoverished Madagascar can budget a scant \$1,000 annually to maintain 36 national parks and reserves. Most forestry schools closed in the 1970s, and an aging cadre of foresters steadily dwindles.

Until my visit the warden and sole watchman of the 600-square-mile Tsingy Reserve had only skirted the pinnacle fields at its heart. Dokobe, who like many Malagasy uses only one name, had been fenced out by lack of transport or roads. He lacked even hiking boots. Georges Randrianasolo invited him aboard our helicopter; I gave him my spare sneakers.

Light was fading when we pitched our tents in the tsingy's riven landscape, barren-looking but hardly lifeless. Gray vasa parrots screeched their evening call in advance of the first flights of bats as Georges lit a lantern. Moths quickly smothered it, luring a pocket-size scops owl to dine with us.

That night the darkness rang with noise. At 1:30 a.m. a string of barks exploded from a tree overhead. Shocked bolt upright in my sleeping bag, I fumbled to record an ear-splitting *yap-yap-yap-yap-yap!* The call was echoed, first from one point, then from another, in a furious chorus. Georges shot from his tent with a light; its beam picked out the saucer eyes of a rare Coquerel's dwarf lemur, gleaming like head lamps.

Lemurs are primates named for the ghosts of the Roman dead said to have roamed the night. They are the closest living descendants of the common ancestor of monkeys, apes, and humans—squirrel-size creatures that scuttled through subtropical forests 50

million years ago. Displaced by monkeys, some survivors of this early primate line became the pottos and bush babies of Africa and the lorises of Asia—solitary, nocturnal, and living largely on fruits and insects.

Yet on Madagascar, never reached by monkeys, lemurs developed monkey ways of life. Honey-colored, eight inches long (not including a ten-inch tail), the Coquerel's is monogamous. It forages alone, but late in the night male and female play together. For an hour that night the lemurs wrestled and tumbled and swung by their hind feet, sparring with their hands.

Other lemurs rove by day, in treetop troops, dropping leaves on your head or squishy, half-chewed fruit. Setting out the next morning for a distant clump of trees, I discovered our campsite was an island. Millennia of rainfall have splintered the tsingy into a labyrinth of shafts and crevasses, fluted with ribs keen enough to flay anyone who slips. In a few million years our relatively flat perch, too, would be etched to a spearpoint.

The first obstacle to reaching the trees was minor—a ten-foot-deep fissure. But other cracks gaped deeper and wider, and the tsingy grew sharper under my boots, ringing sometimes like a Japanese stone gong. I finally balked at a crack too large to jump across. Trees rose up from below, and I climbed over through the branches—into a sinkhole, it turned out, with many of the trees below the surface of the tsingy.

*Shifakh!* A two-foot-tall lemur stared at me from the branches, and then swore its alarm call again—*shifakh!* Slowly its lemon-colored eyes blinked. Its hands, with opposed thumbs and fingernails much like a human's, clung around a vertical limb. The fur of its legs and back and the round monk's cowl about its face were pure white.

Suddenly this Decken's sifaka doubled in length, stretching in a ballet leap to a trunk nearer to me. A companion followed, and the two hung over me, grumbling in mingled distrust and curiosity. Malagasy claim that sifakas attack, a misjudgment of these lemurs: In my experience the animals are placid except when cornered or during the frenzy of summer mating season.

Now the male merely flattened his throat against the trunk, marking it with scent



*Better for straw than hay, low-nutrient bozaha grass, which blankets much of central Madagascar, is carried home to make hats by a woman of the village of Andranomadio. Malagasy, as islanders are called, descend from Africans and Indonesian seafarers who arrived some 1,500 years ago.*

from an oozing gland. The female made a dubious noise, remarkably like a snore. For most of the year, sifakas care most about food, play, and territorial boundaries.

Laughing, I clambered back to tell the others about my snow-white sifakas, living in their open-skied grotto.

Dokobe, the reserve warden, was not laughing. He and Georges had lugged in an iron kettle and the shell of a freshwater terrapin. Somehow honey gatherers had invaded the tsingy with the terrapin as a living box lunch, then stowed their cook pot for the next foray. In Madagascar even the most impenetrable natural sanctuary is not safe from man.

**E**VEN LESS SO the wet, lush mountains of Madagascar's northeastern Masoala Peninsula. They drop almost vertically to a great, deep bay, roiled by whales and cyclones. On their slopes it took Martial Ridy only four days to hack down an entire acre of rain forest illegally. His luck ran out when I surprised him

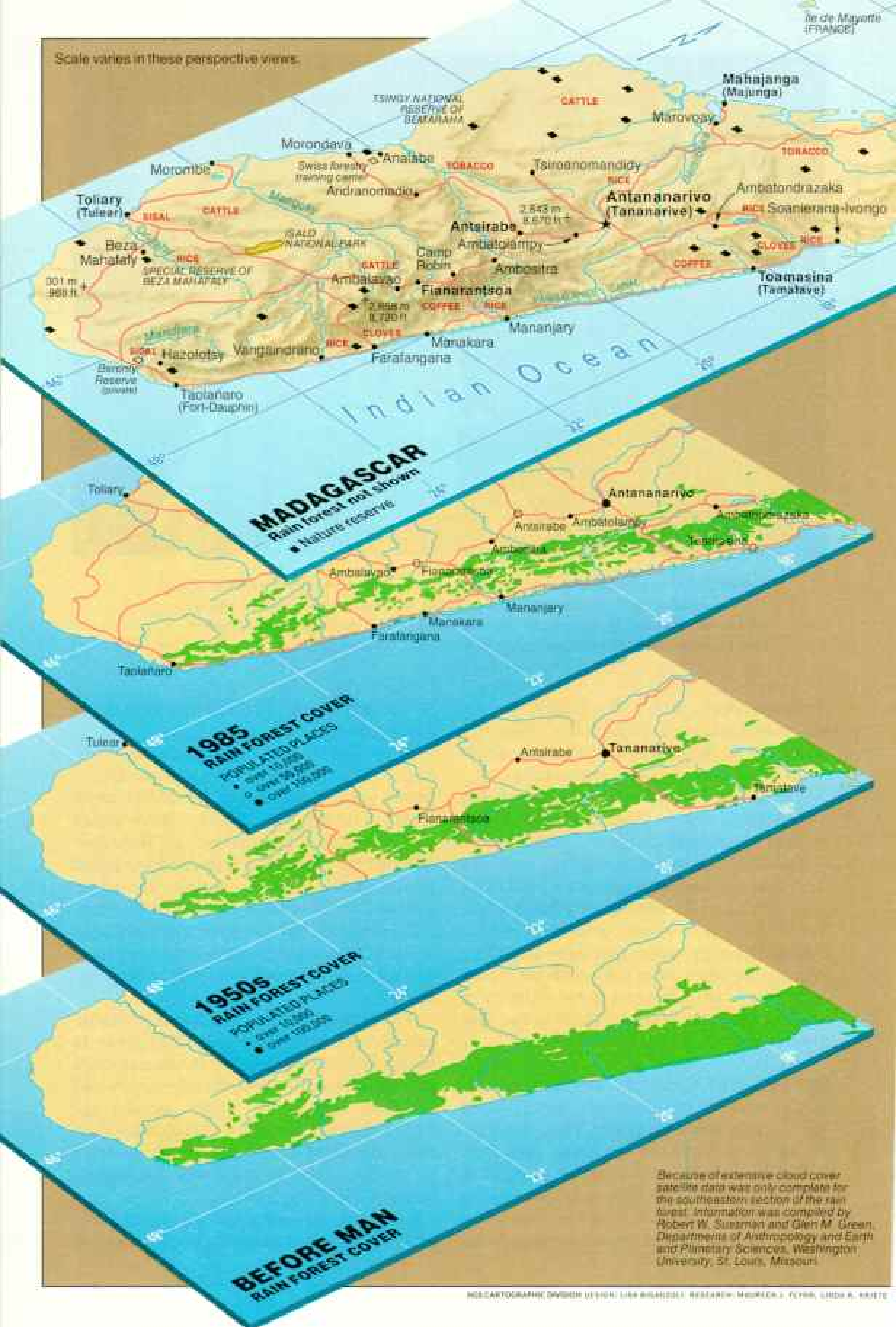
on the fifth day with his ax halfway through a hintsy tree.

A poor man, Martial had cleared a 70-degree slope, so steep that no one wealthier would want it but which the Madagascar forestry service would never have ceded to him. Now a forester named Ratiarson climbed up lianas that festooned the fallen trees and told him to continue chopping, so that I could witness the destruction myself, I suppose. Martial squirmed and raised his ax but desperately refused to swing, as if one more stroke would increase his inevitable fine.

Throughout the last woodlands of Madagascar, peasants slash and burn trees to plant rice or corn or manioc in clearings that lose their natural fertility in a few years and are then abandoned. Three decades ago 65,000 square miles of woodlands remained: rain forest in the humid east, deciduous trees in the west, and in the south, the thorny scrub of the spiny desert.

Miadana Faramalala, a Malagasy botanist, has prepared a satellite map of much of

Scale varies in these perspective views.



Île de Mayotte (FRANCE)

TSIMINGY NATIONAL RESERVE OF BEMARAHANA

Mahajanga (Majunga)

Morondava

Marovoay

Moronibe

Analabe

Tsiroanomandidy

Toliary (Tulear)

Beza Mahafaly

Andranomadio

Antananarivo (Tananarive)

Ambatondrazaka

Antsirabe

Ambatolampy

Soanierana-Ivongo

301 m (988 ft)

SPECIAL RESERVE OF BEZA MAHAFALY

Ambalavao

Camp Robin

Ambositra

CLOVES

RICE

Berenty Reserve (private)

Hazofotsy

Vangaindrano

Fianarantsoa

Mananjary

Manakara

Farafangana

Toamasina (Tamatave)

2,858 m (9,376 ft)

COFFEE

RICE

RICE

CLOVES

COFFEE

RICE

Indian Ocean

**MADAGASCAR**  
Rain forest not shown  
• Nature reserve

**1985**  
RAIN FOREST COVER  
POPULATED PLACES  
• over 10,000  
○ over 20,000  
● over 100,000

**1950s**  
RAIN FOREST COVER  
POPULATED PLACES  
• over 10,000  
○ over 20,000  
● over 100,000

**BEFORE MAN**  
RAIN FOREST COVER

Because of extensive cloud cover satellite data was only complete for the southeastern section of the rain forest. Information was compiled by Robert W. Sussman and Glen M. Green, Departments of Anthropology and Earth and Planetary Sciences, Washington University, St. Louis, Missouri.





## The changing face of Madagascar

*Legacy of misuse, wounded landscapes dominate Madagascar's central plateau (right), where grass fires are set each dry season to produce new shoots, known as a green bite, for livestock. Following heavy rains, rampant erosion of the once wooded hills turns the rivers into arteries that hemorrhage red clay for miles out to sea. Similar degradation is under way in the tropical rain forest zone on the eastern seaboard, once blanketed with jungle foliage (left, bottom). Based on recent satellite images and data from a 1950 survey, two maps (center) illustrate the rapid clearance of the rain forest for firewood and agriculture.*

*A thousand miles long and half again as large as California, the island (top) boasts the ecological diversity of a small continent. Despite the rapid growth of the capital, Antananarivo (population 700,000), and*



*several smaller cities, 80 percent of Madagascar's ten million people still live off the land. Eighteen major groups, of mixed African and Indonesian stock, speak Malagasy, an Austronesian language, while French is*

*widely spoken in the cities. After 65 years of French rule, the Malagasy won independence in 1960. The present government accepts aid from both East and West as it pursues its own brand of Malagasy socialism.*

More than any living scientist, botanist Armand Rakotozafy, seen with a *Pachypodium baronii* (below), knows his country's endangered flora. Scientists and other concerned Malagasy have helped steer the government onto a conservationist course. In the eastern mountains, where many new plant species are discovered every year, inhabitants survey a rain forest only 30 percent its original size.



Madagascar's rain forest today, showing it shrunk by half since the previous survey in 1950. Forest soils in Madagascar are mainly laterite, an iron-red clay that bakes to concrete hardness in the tropic sun. Given centuries, rain forest will regrow, but in practice second-growth scrub is cleared again, leaving soil that finally nourishes only brambles and bunchgrass. Madagascar has been called an island with the shape, color, and fertility of a brick.

Over the course of two millennia, more than 80 percent of Madagascar has been significantly degraded. Martial would protest that *his* clearing won't become barren ground in only a few years. He showed me long-lived coffeebush and clove-tree seedlings, bought from his village's agricultural extension officer.

Clove trees have golden green leaves, the young ones frosted pink at their tips. The pungent flowers are white; their spicy buds



are scarlet before drying. Oddly, Madagascar sells most of its cloves to Indonesia, their native home. But Indonesia wants to cut imports and encourages its own farmers to expand clove production. In seven years, when Martial's seedlings bear a first full crop, will it be worth picking?

Half the children in Martial's village, including his own three-year-old son, are potbellied with malnutrition. His neighbors grow vanilla, part of a crop that meets 80

percent of global demand. Cash income for the village and for many others in northeast Madagascar hinges on the developed world's craving for cola drinks, for which vanilla is an essential ingredient, and real vanilla ice cream.

Martial lives two days' sail down the coast from the forester Ratiarson, but the laws of global economics—even though they are formulated half a world away—rule his life more directly.





*By ax and by torch, Madagascar's woodlands fall prey to the inexorable pressures of human survival. Unable to afford kerosene for their rice pots, Malagasy, like this couple in the south (left), depend almost exclusively on firewood and charcoal. Adding to the problem, land-hungry farmers slash and burn the dwindling forest reserves to grow subsistence crops. In the eastern rain forest, on slopes that would be spurned by most farmers, a young Malagasy pokes holes in recently cleared soil for her rice plants (below). Within a few years the soil will be depleted of its nutrients, forcing the planters elsewhere.*



**M**ADAGASCAR was one of the first countries in the world to establish a national system of nature reserves, in 1927. In an effort to preserve their wilderness, many of the reserves officially admit only scientists. Paradoxically, this keeps most Malagasy from appreciating the richness—and the vulnerability—of their wildlands. Most think it idiotic to conserve wild habitats and their birds and animals. Malnourished peasants would as soon eat them; city dwellers disdain the bush.

Madagascar's remaining native forests lie at least a hundred miles from the capital and largest city, Antananarivo. For generations the plateau surrounding the city has been prairie and paddy land, where people cook rice over wood from introduced eucalyptus trees. The Australian trees have been planted in government programs since 1910, but cannot keep pace with the Malagasy tradition of firing the savanna to produce a "green bite" of tender second growth for cattle. Government campaigns against this burning only provoke more blazes, in political protest. If Antananarivo's residents ever see a lemur, a parrot, or a hintsy tree, it is in the local zoo and botanical garden, the only one in Madagascar.

In all their country the Malagasy have legal entry to only two national parks. One centers on an extinct volcano at Madagascar's northern tip.

The upper flanks of the Montagne d'Ambre, or Amber Mountain, often vanish in mist, as moisture from westerly winds and the monsoon collects into shredded clouds. A river tumbles from the peak, cuts across a dry, thorny plain, and sustains Antsirana (formerly Diégo-Suarez), a port beside the Indian Ocean's finest natural harbor. The clouds also water rain forest, cupped in multiple old craters. With Adany, the park warden, I hiked jungled depressions forming a mosaic of habitats for many distinctive species, uncomfortably including some 20 kinds of mosquitoes.

A cyclone had scythed through one crater two years before, and impatiens had run riot in the clearing. Wading among the four-foot-high wildflowers was like breasting a red-and-pink tide. Orchids—Madagascar holds nearly a thousand unique species—





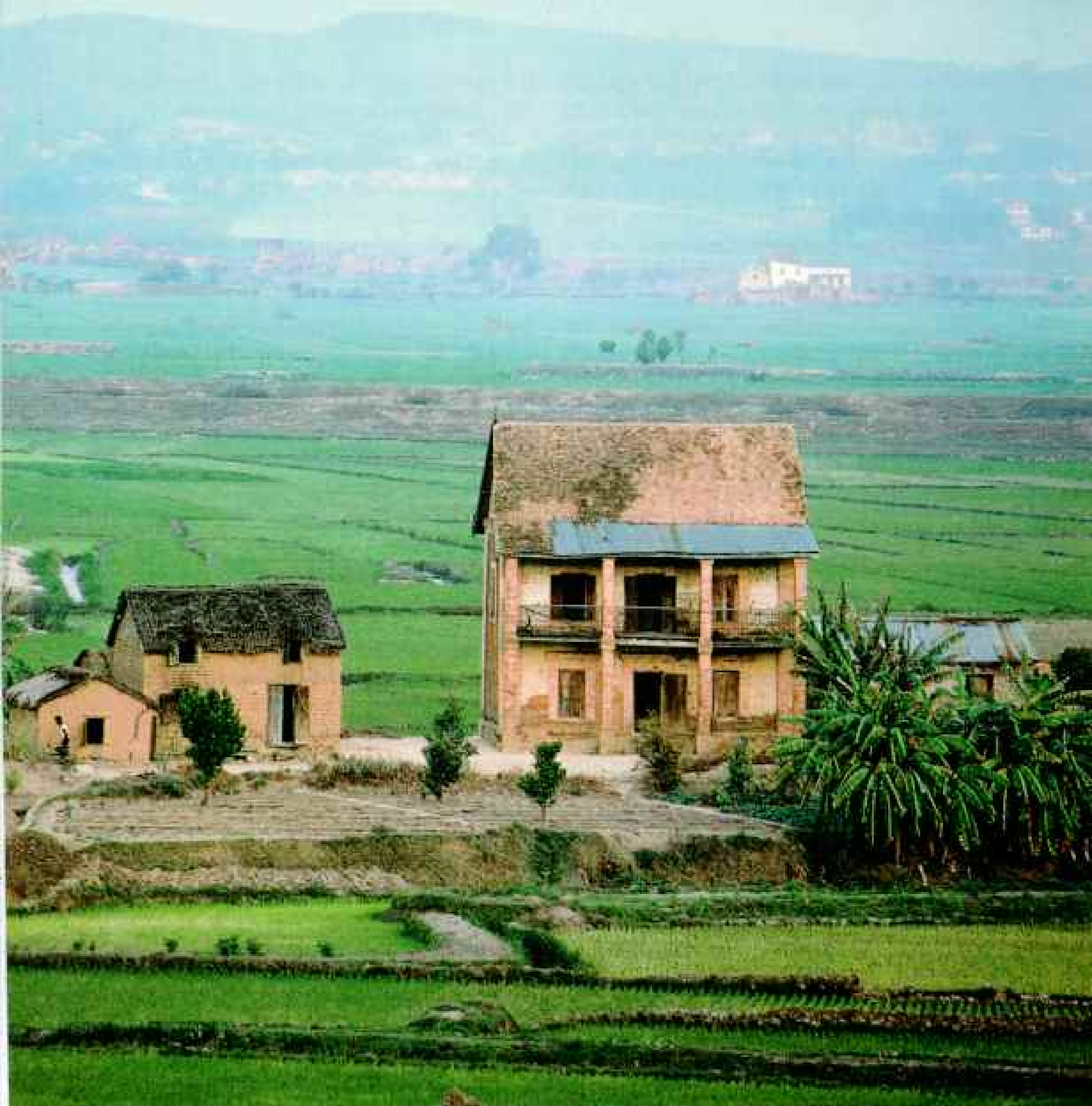
Free markets for basic needs were revived in 1984, following a failed government attempt to nationalize rice marketing. In the plateau town of Camp Robin (above), rice growers are again able to market their crop, while other vendors sell bananas from the coast and baked bread—a vestige of French colonial days. Eaten at each meal, rice is the national food staple. Privately owned paddies, like those around a typical house near Antananarivo (above right), produce the bulk of the crop.



rooted to a fallen tree, beside a surviving neighbor draped with ferns, club moss, succulents, and a climbing cactus. A cuckoo trilled the opening of Beethoven's Fifth Symphony, while the predatory *vorondreo* competed with its flight song. Some Malagasy take the gray-and-white male's *dreo, dreo, dreo* for a mating call and make love potions from its eyes and wing feathers.

At last we spotted what I most wanted to see on Amber Mountain—Malagasy enjoying nature. Over roads recently rebuilt with aid from the World Wildlife Fund, past a new rest house for visitors, a picnicking





family had come into the park from Antsir-anana. Husbands and sons good-humoredly shoved and tugged young wives in jeans and mothers in saris up a steep path to view a waterfall's sheer plunge to a lava rock basin, 260 feet below. The women's delighted laughter played soprano counterpoint to the Grande Cascade's steady bass.

Madagascar's reserves fascinate scientists; its parks rightly are for all Malagasy to enter and admire. Admiration stirs respect, and respect encourages understanding and protection. The Malagasy I saw may have sensed for the first time the indispensability

of the rain forest: Without the forest to trap moisture, the Amber Mountain would not be a water tower, and the Grande Cascade a pipeline, for their city of 50,000 on the thirsty plain below.

Not all reserves in Madagascar require a pragmatic justification. The conservation showplace of the island is Berenty, an extraordinary private preserve in southern Madagascar. Its owners, the de Heaulme family, set it aside nearly 50 years ago, motivated by sheer love of nature.

Henri de Heaulme, his brother Alain, and Henri's son Jean are sisal planters. For three

decades beginning in the 1930s they uprooted spiny scrub in Madagascar's southern desert and felled baobab forest in the west. But they halted at the woods of Berenty. Giant tamarind trees resembling northern white oaks lined the Mandrare River. From its banks spread grassy meadows, where ring-tailed lemurs promenaded, tails crooked in the air like black-and-white-striped question marks. Berenty was too beautiful to obliterate, its animals too marvelous to destroy.

Berenty also shelters huge fruit bats, so-called flying foxes with wings measuring four feet tip to tip. I clapped my hands under a great roosting tree. Hundreds of bats swept toward the sun, with an explosive slapping of beaten air. Their russet fur glistened, their large black eyes sparkled, and the sun outlined every finger bone in the translucent parchment of their wings. The Berenty colony numbers several thousand and may be the largest left near human habitation, in one of the few places in Madagascar where animals can trust humans.

The reserve at Berenty is too small to preserve entire species of animals, but the forest there has long been a magnet for naturalists and for film and television crews making documentaries about conservation. Increasingly its natural beauty also attracts tourists. Five years ago if someone said, "Your wildlife could draw tourists," most Malagasy would answer, "Why? We have no lions or elephants." Now they reply, "You mean like Berenty."

**P**RESERVING BERENTY was not a simple matter of the de Heaulme family appropriating a tract of empty wilderness. Passage through the reserve and watering rights on the Mandrare River had to be guaranteed for the cattle of the neighboring Antandroy—"the people of the thorns."

The Antandroy are pastoralists of African origin, as dark as bitter chocolate. Living in a semidesert, they graze their humpbacked zebu cattle among tall, thorny succulents. One is a didierea tree, cactus-like, but unique to Madagascar. It splays its upright limbs 30 feet into the air. Rows of spines twist along each branch, between coin-shaped leaves that grow vertically to escape

the scorching glare of the sun. The Antandroy inhabit a forest without shade.

Like the spiny bush around them, the Antandroy and their cattle have accommodated themselves to aridity. Before dawn women sponge dew from succulents. It is tedious work, but not nearly so tiring as walking 15 or 20 miles to fetch a pail of water. The women of the village of Hazofotsy are luckier than most—they live beside a perennial stream. One morning the headman's senior wife sent me a gourd of fresh milk. The fluid was thick, like evaporated skim milk, because the zebus of the Antandroy are adapted to conserve their scant body fat and water.

Until recently no young Antandroy male passed to manhood except by stealing cattle, emblems of wealth and prestige. A truly self-respecting man still cannot marry without his bride's price in cows. Nor should he die without bulls for slaughter at his funeral. The more zebus killed, the greater a man's glory, proclaimed forever by horned skulls displayed on the stone walls of his tomb.

Only at funerals or other ceremonial occasions do the Antandroy kill and eat their cattle. To save the zebus in times of drought, the villagers of Hazofotsy fell and split baobab trees, gorged with stored moisture, creating water troughs.

Many plants in Madagascar's desert defy dehydration with stems, trunks, or roots that serve as natural water bottles. Waxy leaves droop in the heat of the day, then rise again in the kinder rays of the setting sun, but they seldom drop. The succulents surrounding Hazofotsy are so grudging of their foliage that the desert floor lacks enough leaf litter to sustain wildfires.

A far greater threat comes from charcoal burners. In the central plateau each year prairie fires set to stimulate a green bite for cattle spread to the deciduous woods of the west. This recklessness reduces the chief renewable source of firewood. Meanwhile, a steady fall in per capita income has left most Malagasy too poor to buy kerosene, once the common cooking fuel. So they turn to charcoal, made by cutting and roasting more and more of the spiny southern forest. Ultimately, even the fire-resistant place of thorns becomes a burnt sacrifice to Madagascar's ten million cattle.

As the desert forest is razed, a potential pharmacopoeia of drugs goes up in smoke with it. Many desert plants in Madagascar defend themselves with poison against birds or browsing animals that might snap off leaves or branches and cause a withering hemorrhage of vital sap. Such poisons can sometimes be medicinal.

In every Antandroy village a healer has folk remedies for ailments from plague and malarial fevers to dandruff—cures based on the legendary restorative powers of desert plants. Yet scarcely any have been scientifically studied for their health benefits, and fewer still will be investigated in the future if botanists and biochemists lose in a race against Madagascar's poverty and the charcoal burners.

An inkling of what we may forfeit lies in Madagascar periwinkles. One species blooms on a single rocky outcrop in the central plateau; its medical value is unknown. A pink-petaled cousin found in the south, though, is the source of precious extracts that arrest childhood leukemia.

To buy time for the spiny desert, part of which forms a national reserve along with adjoining rain forest, the government of Madagascar hopes soon to reinforce warden Zigzag Randria, and even get him a motorbike. In the dry season Zigzag and his one guard now patrol the perimeter of the 300-square-mile reserve on foot. Marking boundaries, visiting villages, and setting early backfires to protect the forest from later pasture burning, they were on safari six weeks last year.

Zigzag's most potent ally is a generations-old curse laid upon a mountain in the reserve that cuts off the spiny desert from most rain. Set foot on the mountain without a white hair on your head, or be of the wrong clan, and the peak will kill you with its clouds and rain and hail. The storms are real enough, and though the curse is only legend, it does more than a hundred forest wardens to deter destruction of the reserve.

**A** DIFFERENT CURSE oppresses the Sakalava people. For eight months of the year, in the baobab forest near Morondava on Madagascar's west coast, Sakalava live without rain. In this dry and hungry season the Sakalava eat the last

of their stored grain and begin to trap lemurs and dig for wild roots. This is the time between harvests, when children die.

Six species of baobab grow only in Madagascar, five more than in all Africa. The Sakalava call the tallest of these trees *reniàla*, "mother of the forest." They rise huge and white above the other trees like creamy Doric columns. In the last weeks of the dry season I went to see how the Sakalava were using their forest. They were burying Monika, age three and a half.



*Rx for leukemia: Madagascar periwinkles are collected for export to pharmaceutical companies that produce drugs for childhood leukemia. Many of the island's unstudied plants, including other periwinkle species, may harbor more potential wonder drugs. Nearly 10,000 flowering species include perhaps 1,000 orchids, one of which yields a major Madagascar export: vanilla.*



To satisfy the demand from collectors around the world for native insects, André Peyriéras (right), entomologist at the University of Madagascar, breeds comet moths and studies other island species, such as stick insects and hissing cockroaches. Tenrecs, small endemic insectivores, are the special interest of Martin Nicoll (below), a National Geographic Society research grantee. One species (bottom) communicates by vibrating quills on its sides.





It was a Technicolor funeral. Monika's coffin had a peaked roof, as if it were a little house, and was swathed in bright red, green, and yellow cloth made for the 25th anniversary, in 1985, of Madagascar's independence from France. Women knelt around the coffin chanting songs, or danced, their perspiring skin gleaming very black under the strong sun. The whole forest was skeletal and white against the cloudless blue sky, waiting for the rains to bring new leaf and clean water.

Monika had died of dehydration from severe diarrhea, like four million other children around the world last year. Drinking

from a well gone nearly dry, she had been unable to withstand the microbes teeming in the fetid water and had dehydrated past recovery within 24 hours.

One by one the mourning women tossed a handful of yellow sand over her shoulder and into the open grave, then ran away so that death might not follow. But death pursued, pitiless: Two more children died that night in Monika's village; seven more that week. One man lost three grandchildren in four days.

There is a simple treatment for dehydration. If you prepare a mixture of sugar, salt, and water no saltier than tears and spoon

this into a child as quickly as it loses fluids, the child can recover dramatically. This life-saving recipe stemmed the epidemic in Monika's village within two weeks, although many Sakalava parents believe that they finally banished death as much by wailing and drumming as by feeding their children the simple sugar-and-salt potion.

**T**HE MOST VALUABLE tree in the baobab forest is the termite-resistant *hazomalany*. Decades after a *hazomalany* topples in the forest, you can find its trunk almost intact. Madagascar's Ministry of Scientific Research and Technological Development wants to unravel the biochemistry of the *hazomalany*, which might have immense commercial value. But it may already be too late to log the tree on a meaningful economic scale, or even to save the species, because the baobab forest is steadily shrinking beneath the axes of peasant farmers.

For this the government itself bears some blame. The agriculture department has long encouraged peasants to fell and burn the forest, clearing it to raise corn and other cash crops for export. Now that the forestry department urges restraint, peasants feel that forest conservation takes food out of their mouths and money out of their pockets.

Two experiments in and near the baobab forest aim to revise that judgment. At a Swiss-sponsored forestry training center a sawmill whines through logs and provides much of Morondava's housing lumber. For eight years foresters have been selectively cutting the largest trees and cultivating their remaining seedlings.

Reforesting the baobab woods poses formidable challenges. Trees there often have natural life spans measured in centuries, and many do not fruit every year. Even in a good fruiting year, a freak dry spell during the rainy season can kill the year's entire crop of new sprouts. Perhaps once in every five or ten years do the seedlings of a given species survive for more than a few months.

Animals are another hazard. Many seedlings at the training center become salad for a conspicuously large rodent. When I congratulated the chief forester, Jean-Pierre Sorg, on growing fodder for a rare endangered mammal, he looked exceedingly sour.

The baobab forest is home to Madagascar's giant jumping rat.

Brown, long-eared, and poised upright for leaping, the giant jumping rat bears but one offspring a year, much like the African springhare. It lives exclusively in the basin of one seasonal river, with an equally unique tortoise. The known range of both animals lies between the Swiss training center and the neighboring sisal plantation of Analabe. Now abandoned, the plantation is owned, like Berenty, by the de Heaulme family.

"I find it inconceivable," Jean de Heaulme admitted to me one day, "that any one family should hold virtually the entire range of creatures existing nowhere else. So to preserve them we're forming a foundation we hope will become self-sustaining. With donations from foreign conservation groups we'll be able to set aside 16 square miles of virgin baobab forest as a reserve. I think tourists would pay to see it, and the money will finance a project to aid people as well as to save the environment. We're uprooting the sisal stumps at our old plantation and helping villagers from Analabe work the land as permanent farms.

"This is much harder than burning the forest and moving on every few years," Jean continued. "It calls for fertilizer and plows and investment that the villagers alone could never afford. But they are a hundred percent for the scheme. They can see that the forest won't last forever."

**I**F THE MALAGASY depended on money alone for their food and shelter, most of them would have perished long ago, for their cash income is very meager. They survive because 85 percent work in agriculture and an even larger percentage grow their own food and build their own houses from materials at hand. Their government is socialist but economically unorthodox. One of its most daring propositions, newly embraced, is that conservation itself can help promote a poor nation's economic development.

The President of Madagascar, Didier Ratsiraka, came to power in 1975. From the start he declared his development policy as one of "all compass points." In other words, mainland Chinese engineers recently reconstructed a road connecting Antananarivo



with Madagascar's main eastern seaport of Toamasina. West Germany is rebuilding a major road to the southern half of the island. The United States underwrites irrigation and small hydropower projects.

Accepting foreign aid from any and all donors has helped Madagascar, but other policies of the socialist government haven't solved a decade-long economic crisis or eased the conflict between slash-and-burn agriculture and conservation.

One major socialist reform failed spectacularly: the nationalization of rice marketing in 1976. In good times the Malagasy are great consumers of rice; they like to eat a *ka-pòaka*—the standard measure, enough to fill a condensed milk tin—three times a day. But production of rice fell until marketing controls were lifted in 1984, and its cost has remained high since. Market rice for a year would cost the average Malagasy three-fourths of his \$250 annual income.

In recent years Madagascar's economy has been deeply depressed by decreased demand for its exported vanilla, cloves, sisal, and coffee. Simultaneously the cost of most

imports has climbed, along with interest due on Madagascar's sizable foreign debt.

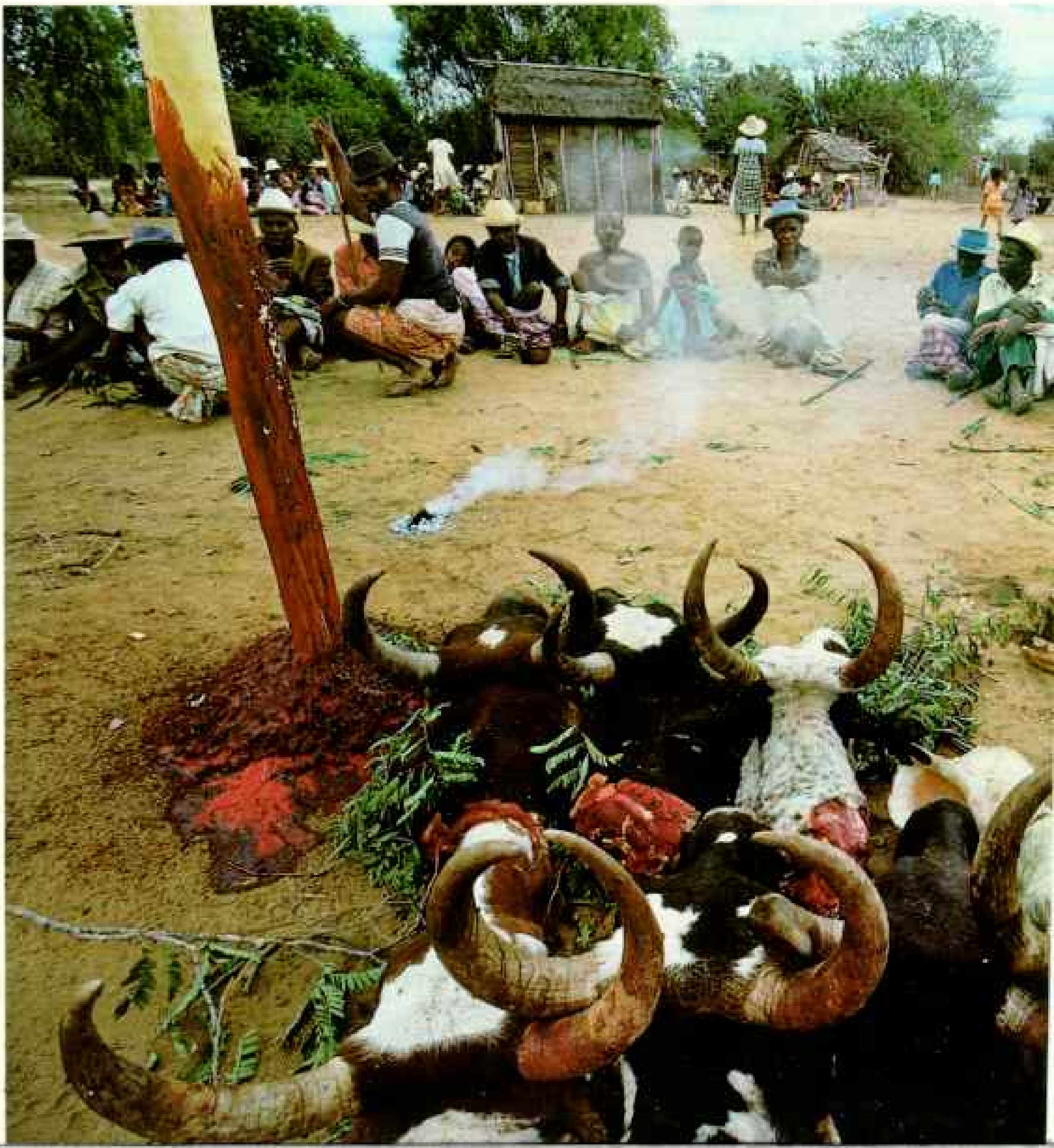
One result was a 24 percent drop in per capita income between 1979 and 1983. Another is that Madagascar's transport system has decayed, despite foreign assistance. Roads, especially from agricultural areas to the towns, have regressed from paved lanes to oxcart tracks, while cars and trucks fall to pieces for lack of replacement parts. It is nothing extraordinary for Malagasy traveling abroad to return home with crankcases in their luggage.

Gradually Madagascar's government is beginning to link the country's economic decline with its environmental degradation. Late in 1985, realizing that a halt to the assault on nature could be an important step toward economic revival, Madagascar was host to the International Conference on Conservation for Development, the first such gathering there in 15 years. Joseph Randrianasolo, Minister of Livestock, Fisheries, and Forests, explained the purpose of the meeting.

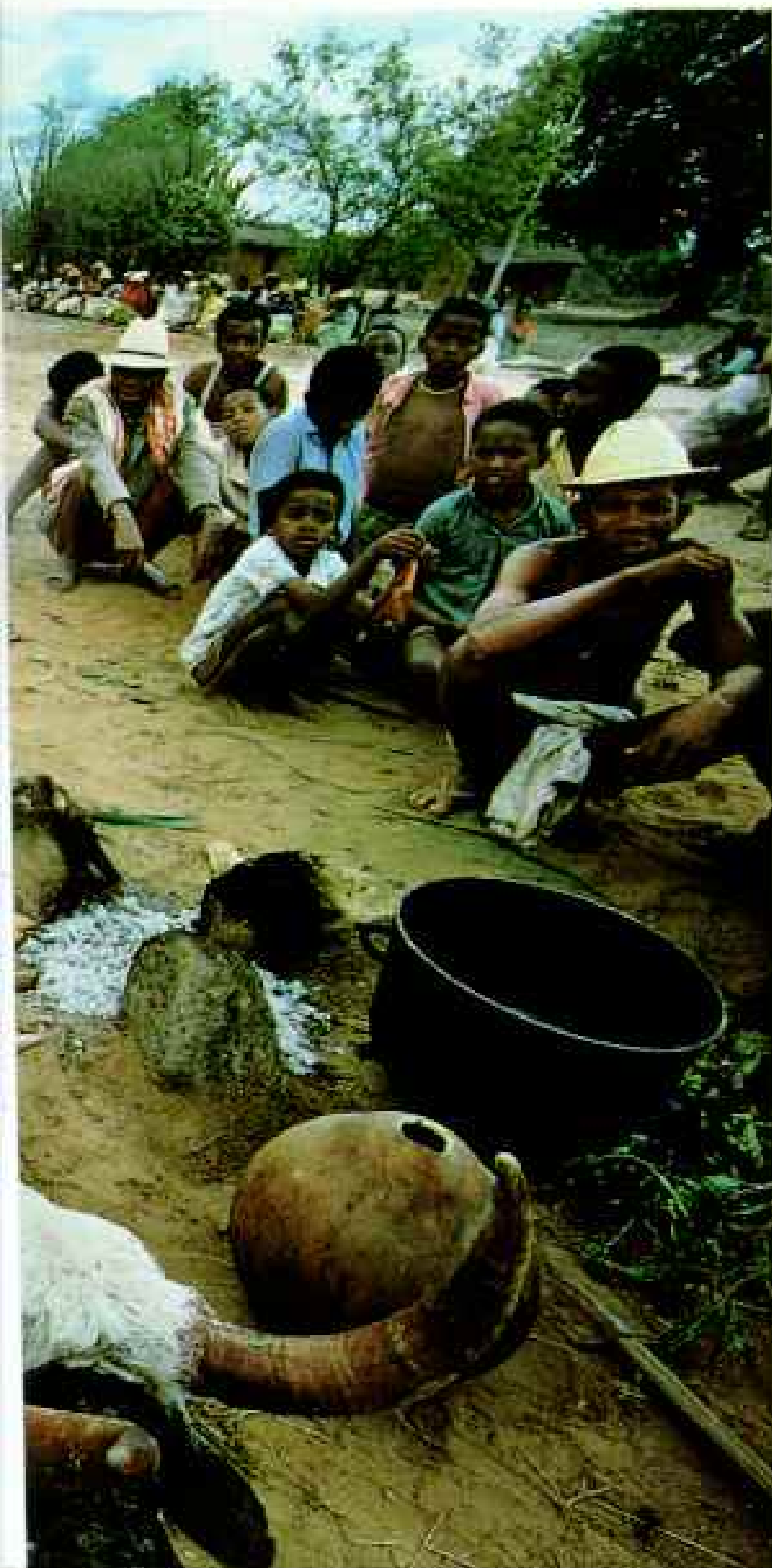
"This conference is very different from



*Human hunger stalks many of Madagascar's threatened species, like the radiated tortoise—one of four terrestrial species found only on the island. A sister species, the plowshare tortoise, faces imminent extinction. Only a handful of the island's 267 species of reptiles exist elsewhere. None of its snakes are poisonous, and a dwindling number of crocodiles pose little danger to man.*



*Ceremonial slaughter of zebu cattle, about equal in number to Madagascar's human population and a major source of pressure on the island's environment, offers sporadic supplements of beef to an otherwise low-protein diet. At the initiation of a new headman in the southwest, Mahafaly gather around a pole smeared with zebu blood, signifying clan solidarity (below). Symbols of Malagasy wealth and prestige, the humpbacked cattle are sacrificed in even larger numbers for funerals. At another Mahafaly village, dozens of zebu horns adorn the tomb (left) of a wealthy man, along with elaborately carved depictions of his cattle.*



the last, in 1970," Randrianasolo told the delegates. "Then people just praised the beauty and scientific interest of our flora and fauna. Now we want to manage our resources so that Madagascar can be self-sufficient in food and fuelwood." Another official was blunt about the alternative: "We have before us the specter of Ethiopia."

**A**T THE START of the conference I had before me the spectacle of Antananarivo. Its buildings—mostly old, mostly clay red—climbed up hills and down valleys, recalling a north-Italian hill town. In the streets the color scheme was exuberant, with red strawberries, orange mangoes, green apples, and crimson litchi fruit heaped at stalls shaded by white umbrellas. Beneath them Malagasy women shopped in traditional white cotton stoles draped across their left shoulders like togas. There is something classical about Malagasy taste, and the Roman dignity of white tempered the lavender swash of jacaranda trees against the city's ochre walls.

The conservation conference in Antananarivo might have become only a pompous diversion or an excuse to tickle more money out of foreign donors. But two field trips anchored the meeting in reality by first cheering, and then shocking, Malagasy officials.

The first outing had its slapstick aspect, in southwest Madagascar, on what passed for a road to the nation's newest reserve, near the village of Beza Mahafaly. While Minister Randrianasolo frowned and looked on, his fellow passengers hauled like oxen at a sisal rope tethered to a rickety bus mired up to its hubcaps in sand.

We had all been in worse fixes, including the minister himself, but a tug-of-war between a decrepit bus and a mob of giggling students, diplomats, World Wildlife Fund officers, and leading Malagasy conservation officials seemed an undignified prelude to dedication ceremonies for the new reserve.

In 1978 the villagers of Beza Mahafaly gave up grazing rights to a parcel of forest. In return the World Wildlife Fund provided money for fencing the woodland to keep out cattle and goats and for posting guards against charcoal burners. The University of Madagascar, Yale University, and Washington University in St. Louis all support

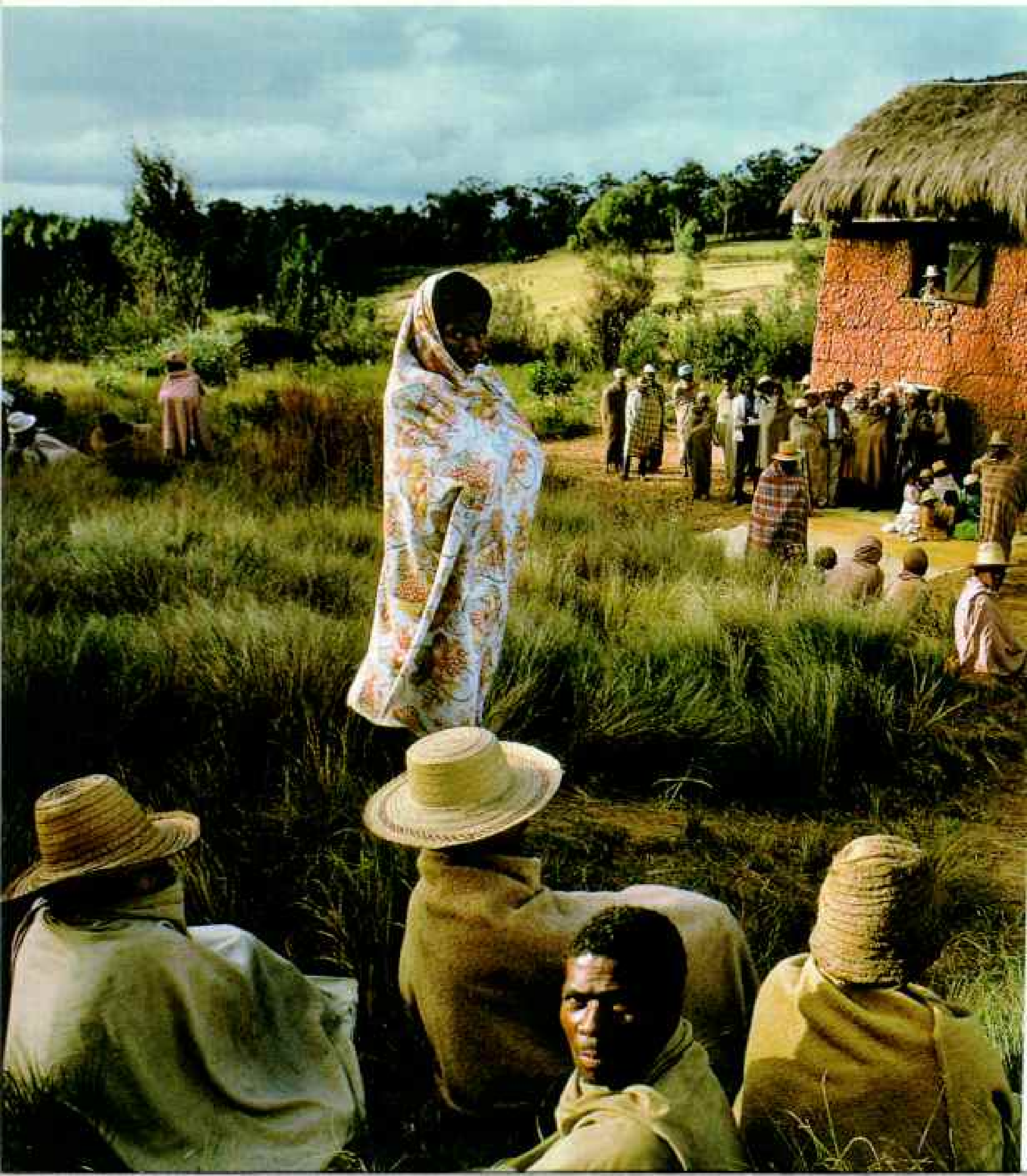


*Remembrance after death, aspired to by all Malagasy, will be accorded a recently deceased man by his neighbors in a central plateau town. Among plateau peoples, corpses are periodically disinterred for ritual honors. With the Malagasy, whose average life expectancy is only 50 years, reverence for the dead surpasses even that which they hold for the aged.*

forestry and conservation training there and sponsor Malagasy and foreign researchers studying the reserve's wildlife.

The reserve has also begun to benefit local people with construction of a new village hall and water reservoir and restoration of an old irrigation canal to the village's paddy fields. Another project will improve the bus-swallowing road, so that the farmers of Beza Mahafaly can get their rice to market.

All this inspired much high-flown oratory



in the dedicatory speeches. In his floweriest style the district president extolled the new reserve and its benefactors with stock phrases and universally known proverbs. Who better merits such good fortune than the Mahafaly people, he demanded to know, acclaimed because they respect all God's creation, and who eat neither tortoise nor lemur?

Joseph Randrianasolo, the minister, spoke more concretely about the virtues of

conservation. "*Tsy misy ala, tsy misy rano, tsy misy vary!* If there is no more forest, then no more water, and no more rice!"

Finally the minister declared the Special Reserve of Beza Mahafaly officially open, the first inaugurated in Madagascar since 1970. We clapped and whistled and cheered, drummers drummed, and dancers somersaulted. And one Malagasy official confessed that he had tears in his eyes to know that after 15 years conservation was again a national priority in Madagascar.

A few days later Madagascar's leaders received a salutary reminder of reality. Eager to show off successes like that at Beza Mahafaly, the government flew Prince Philip, Duke of Edinburgh and president of World Wildlife Fund-International, to the baobab forest of the west. With luck the de Heaulmes would shepherd him through colonnades of virgin baobabs without encountering any unpleasantness.

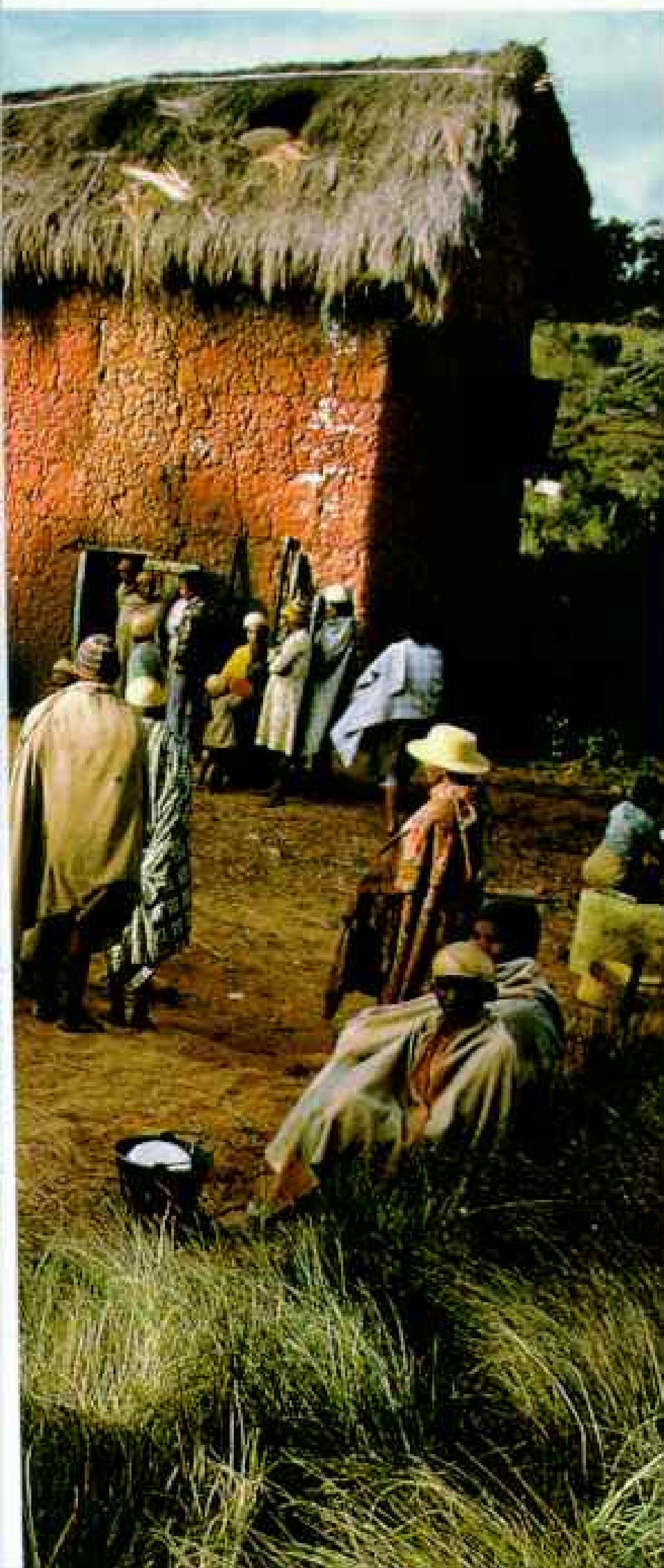
Just before the official party reached its goal, some farmer set the woods on fire. He was opening a clearing to plant corn.

Prince Philip watched the flames scorch baobabs 40 feet up their trunks. Later, he said to Rémi Tiandraza, a member of Madagascar's governing elite, the Supreme Council of the Revolution: "Your country is committing suicide."

**F**OR 25 YEARS I have been visiting Madagascar, long enough to grow cynical about conservation on an island whose population has nearly doubled in that time, from 5.4 to 10.3 million, and whose woodlands have meanwhile been decimated, together with their wild creatures.

Yet lately I feel hopeful that Madagascar can be rescued before its environment is ravaged entirely. Recently national needs have grown urgent enough to shock Madagascar's leaders into an acute awareness that little time remains to save their island and its people. A strategy of conservation with development now has the government's declared support.

True, Madagascar still burns, but desperation, not desire, fuels its self-immolation. Hard-pressed peasants seldom see any alternative to razing the forest or firing the prairie for a green bite. But given a way out, the





*A stark beauty belies the ill health of the southern plateau, where only bunchgrass and fire-resistant palms survive yearly prairie fires. Though not without fertile land, the Malagasy face major changes in agricultural practices if they are to safeguard their unique environment and assure their own survival.*

Malagasy would attempt to seize it. And a rescue is possible, if clear-sighted leaders act and foreign donors support their conservation plans.

Madagascar has more than enough fertile land left to feed its people, if the land is farmed for high yield. And with proper management, enough forest still stands to make Madagascar self-sufficient in fuel as



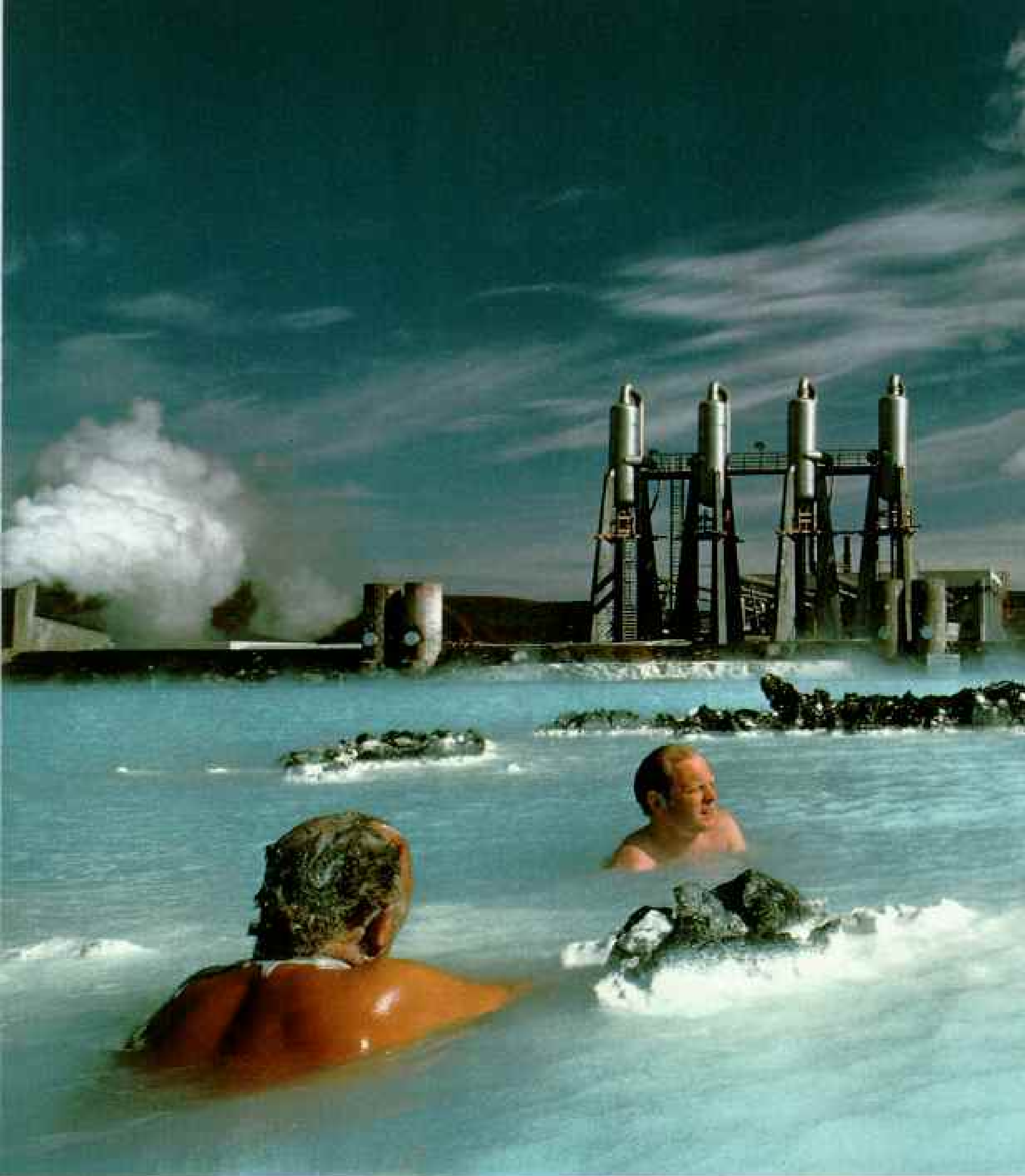


well as to preserve most of its unique plants and animals.

The Malagasy know that what they have already lost, they have lost forever. A dozen kinds of giant lemur, along with pygmy hippos, tortoises as large as those in the Galapagos, and the "elephant bird"—*Aepyornis*—have all vanished from Madagascar within the past thousand years. *Aepyornis* lives on,

but only in legend, as Sindbad's giant roc.

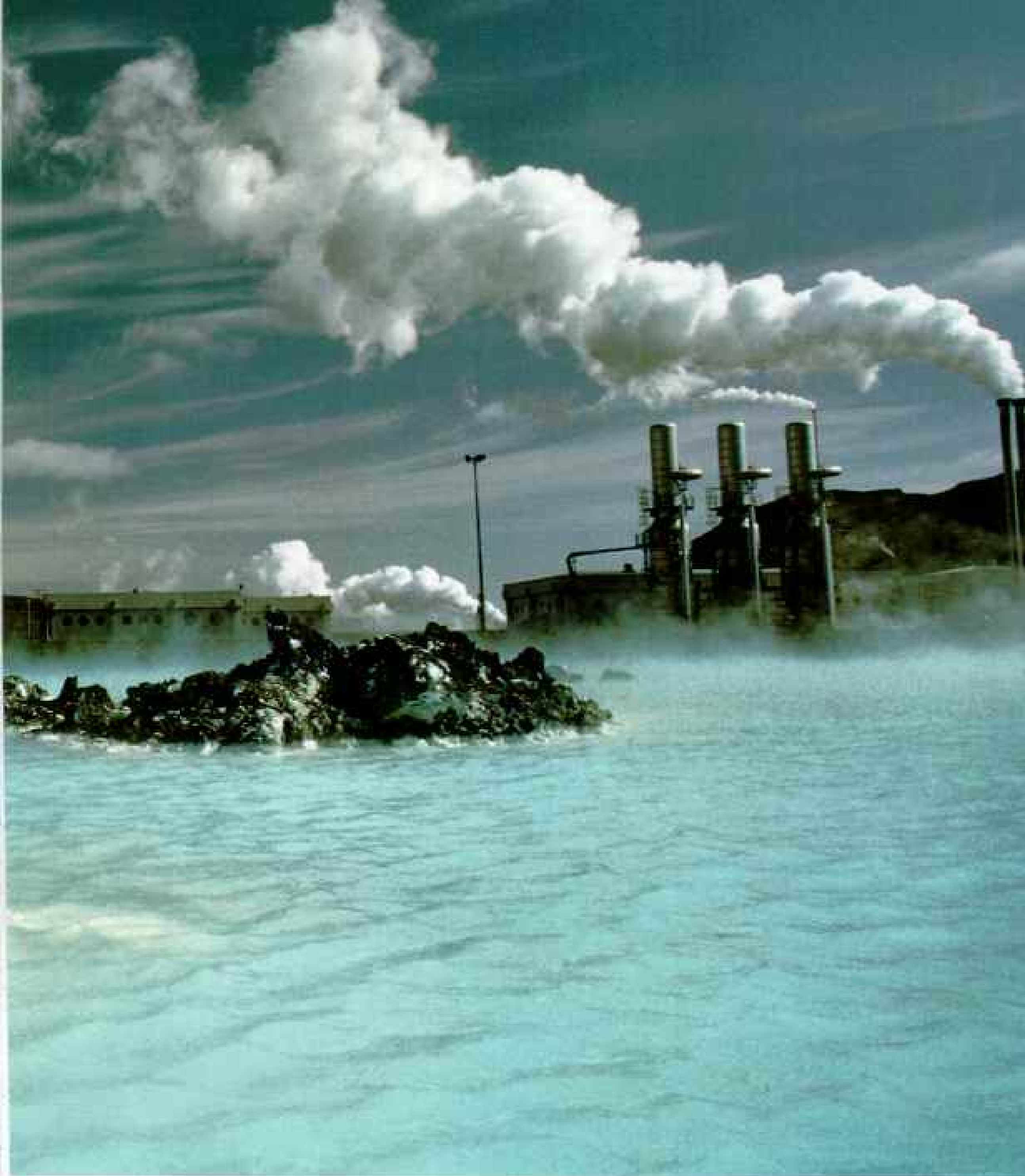
Madagascar's first wave of extinction eliminated a relative handful of species. Today's extinctions are far more drastic, undercutting the survival of the Malagasy themselves. For their own sake, they now must heed their own proverbial advice: "Be like the chameleon—keep one eye on the past and one eye on the future." □



# Iceland

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Life Under the Glaciers

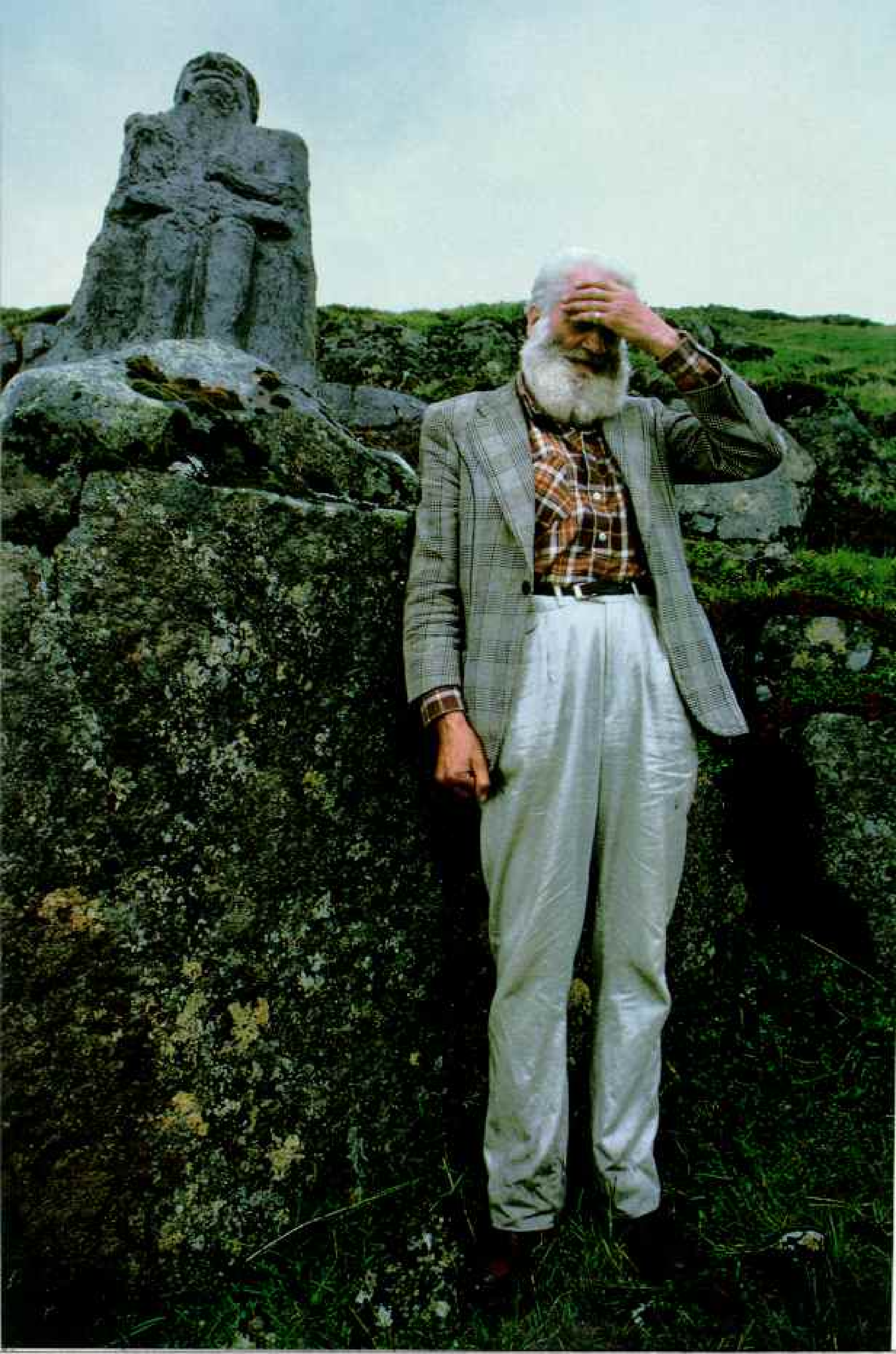


*In a harsh land of volcanoes, earthquakes, and glaciers, Icelanders have learned both to survive and to prosper at the edge of the Arctic. The Svartsengi geothermal plant harnesses the earth's energy to help heat Iceland's homes, while healing waters in a runoff pond warm bathers.*

By LOUISE E. LEVATHES  
NATIONAL GEOGRAPHIC STAFF

Photographs by BOB KRIST





**O**n a clear day in Reykjavík, you can see the glacier-capped Snæfellsnes volcano across wide Faxa Bay. The giant pyramid of ice, too perfect to be quite real, seems suspended between sea and sky. Novelist Jules Verne imagined that the glacier was the entrance to the center of the earth, and mystics still make pilgrimages there to contact the forces of the universe.

This particular August day, however, the glacier was veiled in low-hanging clouds, which also shrouded the city and the nearby NATO base. A light rain was falling as a small group of Icelanders gathered outside the base to protest the presence of foreign troops on their soil.

A pagan priest with a flowing beard stood before the crowd holding a pole with a life-like horse's head on it. The priest of the ancient Ásatrú religion, a reclusive farmer named Sveinbjörn Beinteinsson, at first said nothing. Then he planted the pole in a pile of rocks and, turning the frightening, wild-eyed head toward the NATO base, chanted a curse as his Norse ancestors did against their enemies a thousand years ago:

"I raise this *nið* [insult] against nuclear weapons and all warfare. . . . I raise this *nið* against the destruction of life and the land, so help me Freyr and Njörður. . . ."

It has been scarcely two generations since Iceland emerged from six centuries of domination by foreign powers, and the presence of nearly 6,000 Americans on the NATO base has been a bitterly divisive issue for the 242,000 proud Icelanders. The Icelandic Parliament's decision to join NATO in 1949 led to the only riots Reykjavík has ever seen. Isolated for so long from the world's squabbings, the island nation at the edge of the Arctic unhappily finds itself in the middle of the East-West conflict because of its strategic location (map, page 193). Not exactly the center of the earth, but certainly a vital base in the North Atlantic.

When it was suddenly announced last October that President Reagan and Soviet leader Mikhail Gorbachev would meet for talks in Reykjavík, Icelanders were surprised. "At first we couldn't believe it," Styrmir Gunnarsson, editor of *Morgunblaðið*, the nation's largest newspaper, told me when I returned for the summit. "We're a

small country, and we doubted we could handle it."

Rural rescue squads were called in to assist Reykjavík's tiny, unarmed police force. To reserve limited facilities for the use of visiting diplomats and journalists, TV spots implored those living outside the capital not to visit it during the summit and urged local residents not to patronize restaurants, hire cabs, or use overseas telephone lines. Icelanders, I noticed, dutifully obeyed.

Peace groups held a quiet vigil, but their



MARR GODFREY

*Farmer, poet, and priest, Sveinbjörn Beinteinsson (facing page) recalls an ancient chant before a modern statue of the Norse god Thor. A recluse with some 60 followers, he combines efforts to revive interest in pagan religions with well-publicized protests against NATO's presence in Iceland. On the eve of the recent Reagan-Gorbachev summit, Icelanders braved torrential rains to attend a candlelight peace vigil (above).*







hopes—and the hopes of many—for a breakthrough on disarmament were not fulfilled. After the last limousine, the last journalist had left, Icelanders were pleased that their country had received such world attention, but worried that their unspoiled homeland might now be inundated by tourists.

"We are an insular people," editor Styrmir explained to me. "We don't like too many foreigners in our country."

Except for some angry exchanges with the British over fishing rights in the 1950s and '70s (dubbed the "cod wars"), Iceland has never fought a war. It has never had an army. It even achieved its independence from Denmark in 1944 without shedding a drop of blood. But, since Viking refugees landed on its shores in 874, Icelanders have been involved in another kind of warfare. Their history is the history of an unceasing battle with the elements—ice, fire, wind, sea—in one of the world's most inhospitable lands. They have had to struggle against nature's excesses—which is, perhaps, why they have so little patience with man's.

The land, lying along the Mid-Atlantic Ridge, is literally being torn apart by the gradual spreading of the oceanic plates. A wide zone of volcanic activity through the center of the country has created a pock-marked wasteland of craters, black lava deserts, and jagged mountains covered with glaciers. The east and west coasts are dominated by steep fjords, and only here and there do narrow, fertile valleys open on to the generous sea—which makes life possible on the Arctic island at all.

Geography has forged a strong-willed people who have managed not only to endure their environment but even to prosper. Since the turn of the century, when Iceland finally began to shake loose the yoke of the Danes, it has revolutionized its life-style from a near-medieval existence to a modern society with a high standard of living.

But as the Soviets and the Americans play

*Symbol of survival, the Icelandic horse served as the only transport for a thousand years. Purebred descendants of stock brought by ninth-century Viking settlers, the much loved, five-gaited horses are now ridden for pleasure and in farmers' annual sheep roundups.*



war games off their shores, Icelanders worry about a more imminent danger, the video invasion that daily assaults their ancient language and culture. Icelanders speak virtually the same tongue as their Viking forefathers, in which some of the finest literature of the Middle Ages was written and which helped them shape their identity as a nation and an independent people. Discotheques, European fashions, and American music are rapidly changing life under the glaciers.

**S**lowly we made our way up the 150-meter (500-foot) wall of the crater on Surtsey. Near the top, footing grew treacherous in the brittle new lava, and steam poured from open vents in the side of the dying volcano.

Suddenly a strong gust of wind pushed me backward, and my foot caught in a crevice. In the next moment I was falling . . . tumbling down the side of the crater. I could hear the fragile lava boulders shattering beneath me like broken glass, cutting my hands. Then the sky went black. Everything was still.

"Are you OK?"

"Yes . . . OK."

Photographer Bob Krist helped me to my feet. I have taken some bad falls, but I've never been in a place that so *invited* a fall.

Aptly named for the giant Surtur, who, according to Norse myth, set fire to the earth on the gods' day of doom, the island belched and spewed itself into existence 23 years ago off Iceland's southern coast. In the first days of the eruption the submerged volcano sent forth a menacing black column of ash 9,000 meters high that could be seen 105 kilometers (65 miles) away in Reykjavik.

Geologists speculate that Iceland itself was a series of volcanic islands like Surtsey that eventually became joined together at least 15 million years ago. Iceland is above one of the world's so-called hot spots, anomalies in the earth's mantle that permit the escape of large amounts of energy and material from deep within the earth.

When the fires finally died and the ash settled in 1967, nearly three square kilometers of Surtsey had emerged from the sea. Since then, savage southwesterly winds and powerful ocean breakers have eroded a third of the island. There is little danger, however,



*Tropical fruits and hothouse flowers thrive along with staple vegetables in geothermally heated greenhouses. Gardar Arnason (above) shows off the "banana plantation" where he works in Hveragerði. A pipeline crossing a geologic fault in Bjarnarflug (facing page) carries steam tapped from the earth to a diatomite plant at Mývatn. Nearby, Helga Finnsdóttir (below) bakes pumpernickel-like hverabraud in the hot ground.*





that Surtsey will be swallowed by the sea again, because ash and pumice around the island's warm core have already formed hard rock.

"This is the first time we've been able to study the formation of a submarine island, and we thought it took thousands of years for the volcanic ash to harden into rock, called palagonite tuff," said Sveinn Jakobsen, a geologist with Iceland's Natural History Museum. "But with temperatures of more than 100°C [212°F] around Surtsey's crater, new minerals quickly fused the particles of ash, hardening and forming rock within just a few years."

Surtsey also provided scientists with a unique opportunity to study how life colonizes a completely sterile new environment. Biologists expected that lichens would be the first plants on the island, followed by the mosses and then the higher plants. In fact, just the opposite happened. In 1965, Surtsey's second summer of existence, a sea rocket was found, apparently having sprouted from a seaborne seed.

Birds ventured onto Surtsey while it was still erupting, warming their feet on the hot rocks. Cliff-dwelling fulmars and guillemots were the first to nest on the island in 1970, soon followed by kittiwakes and black-backed and herring gulls. Seals come up on the rocky shore each spring, but otherwise Surtsey is devoid of mammals.

"Life has come to the island much more slowly than we expected," said biologist Sturla Fridriksson, who has been studying Surtsey for 20 years.

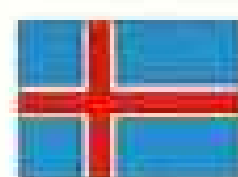
We had joined Sturla on an international research expedition to Surtsey last year. He led us from the base camp to a sheltered spot on the east side of the crater. Here black lava sands slope gently to the sea, and lyme grass has taken root in clusters of sea sandworts, forming a small dune.

A pair of black-backed gulls took flight when we approached, and by their nest in the dune we spotted the frail body of a young gull lying motionless in the black sand. It had died not long before.

"These fledgling plant communities attract gulls seeking shelter for their young, and the gulls, in turn, fertilize the place with their excrement," said Sturla. "Not all breeding is successful. But, life begins. . . ."

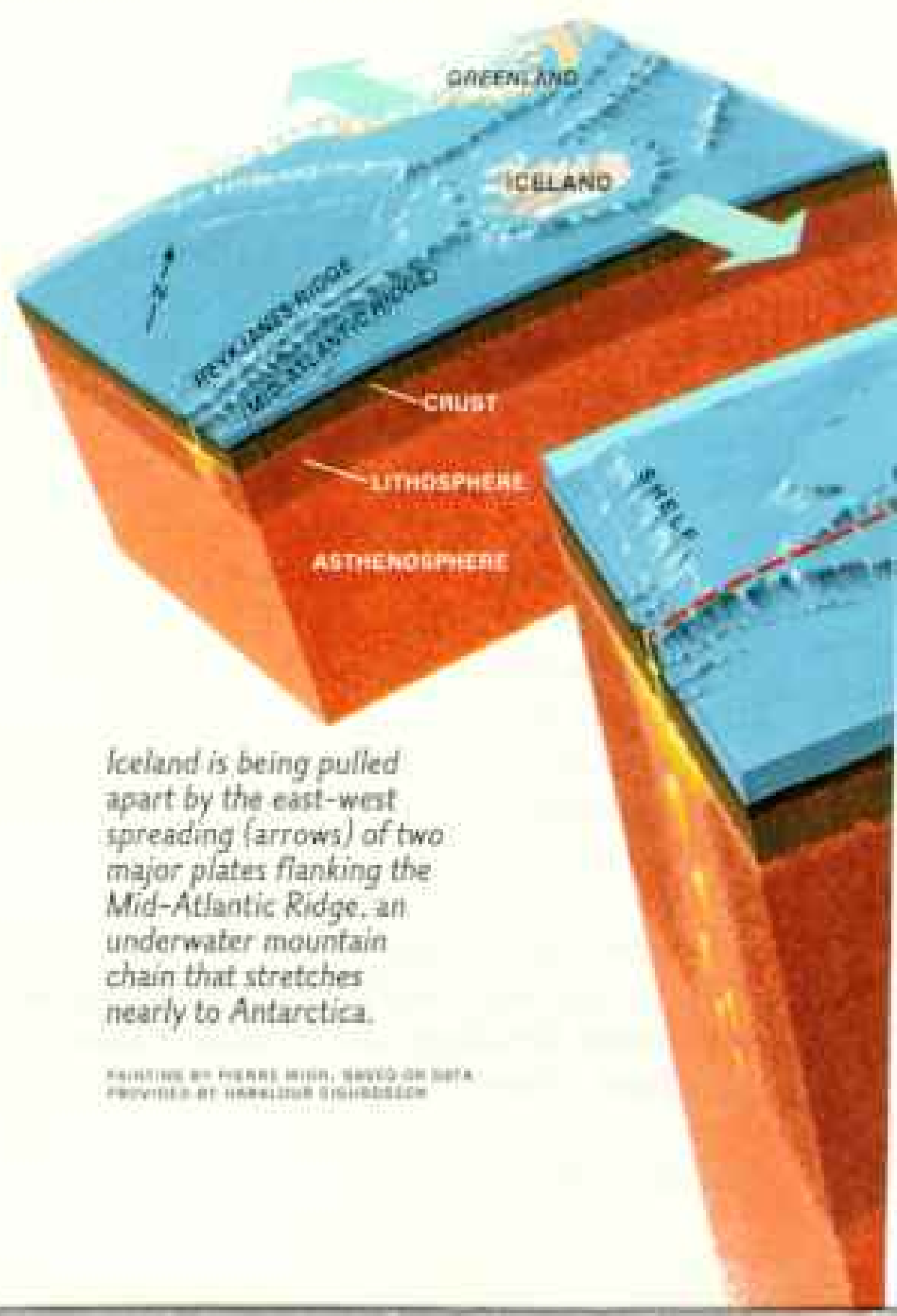
## Hot spot at the edge of the Arctic

*Christian Irish hermits—probably Iceland's first inhabitants—fled the island after pagan Vikings arrived from Norway. The first permanent settler, Ingólfur Arnarson, set up camp in 874 at the present site of Reykjavík. In 930 the Althing, the world's oldest surviving parliament, first met at Thingvellir, where chieftains ironed out disputes in an open-air assembly. Iceland submitted in 1262 to Norwegian rule and in 1380 to more than five centuries of Danish domination. Overcoming poverty, famine, and natural disasters, Iceland severed ties with Denmark in 1944.*



AREA: 103,000 sq km (39,768 sq mi). POPULATION: 242,000. CAPITAL: Reykjavík, pop. 90,000. RELIGION: 97%

Evangelical Lutheran. LANGUAGE: Icelandic. LITERACY: 100%. LIFE EXPECTANCY: 73.9 years for males, 79.5 for females. GOVERNMENT: Constitutional republic. ECONOMY: Mostly fishing. EXPORTS: Fish, woolen goods, aluminum. CLIMATE: Cool temperate oceanic; highly changeable, influenced by both the warm Gulf Stream and Arctic currents.



*Iceland is being pulled apart by the east-west spreading (arrows) of two major plates flanking the Mid-Atlantic Ridge, an underwater mountain chain that stretches nearly to Antarctica.*

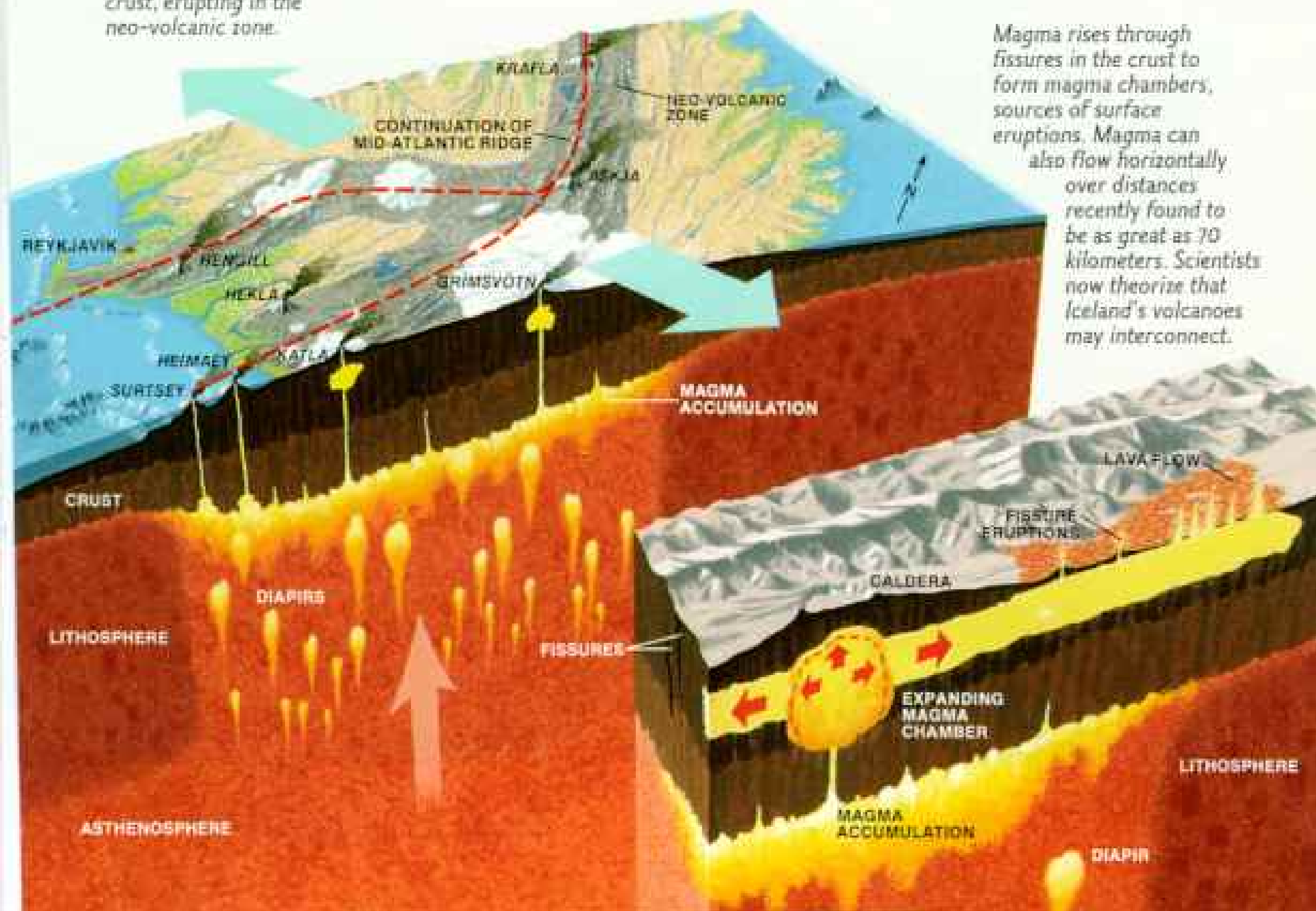
ILLUSTRATION BY PIERRE WILM, BASED ON DATA PROVIDED BY HANSLUUR SIGURSSON



NO. 1247 GEOGRAPHIC DIVISION  
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 PRODUCTION: SAMSEY MURRAY, ISAMUND SAGRY

*A cutaway close-up reveals a gap in the rigid lithosphere beneath Iceland. Balloon-like diapirs of magma thus rise unimpeded to form a layer beneath earth's crust, erupting in the neo-volcanic zone.*

- HYDROELECTRIC PLANT
  - GEOTHERMAL ELECTRIC PLANT
  - GEOTHERMAL HEATING PLANT
- fjörður ..... fjord  
 floi ..... bay  
 foss ..... falls  
 hraun ..... lava field  
 jökull ..... glacier  
 nes ..... peninsula  
 vatn ..... lake



*Magma rises through fissures in the crust to form magma chambers, sources of surface eruptions. Magma can also flow horizontally over distances recently found to be as great as 70 kilometers. Scientists now theorize that Iceland's volcanoes may interconnect.*





*Fiercely protective of a language hardly changed in a thousand years, Icelanders of all ages still read with ease and enthusiasm the adventure-filled sagas penned by their ancestors from the 12th to 14th centuries. Among the some 40 stories relating ancient myths and traditions, Njál's Saga takes the prize for length—this edition (left), known as the Grayskin for its sealskin binding, contains more than 400 pages. Now reverently held in an atmospherically controlled vault behind two-ton steel doors at Reykjavík's Árni Magnússon Institute, the original copies of the sagas lay for many years in Danish hands. On April 21, 1971, when a ship arrived from Copenhagen to return the first two manuscripts, thousands of Icelanders turned out to celebrate.*

*A living part of the literary tradition, 84-year-old writer and Nobel Prize winner Halldór Laxness (above right) pays frequent tribute to the sagas' authors, believing that without their legacy Iceland would*

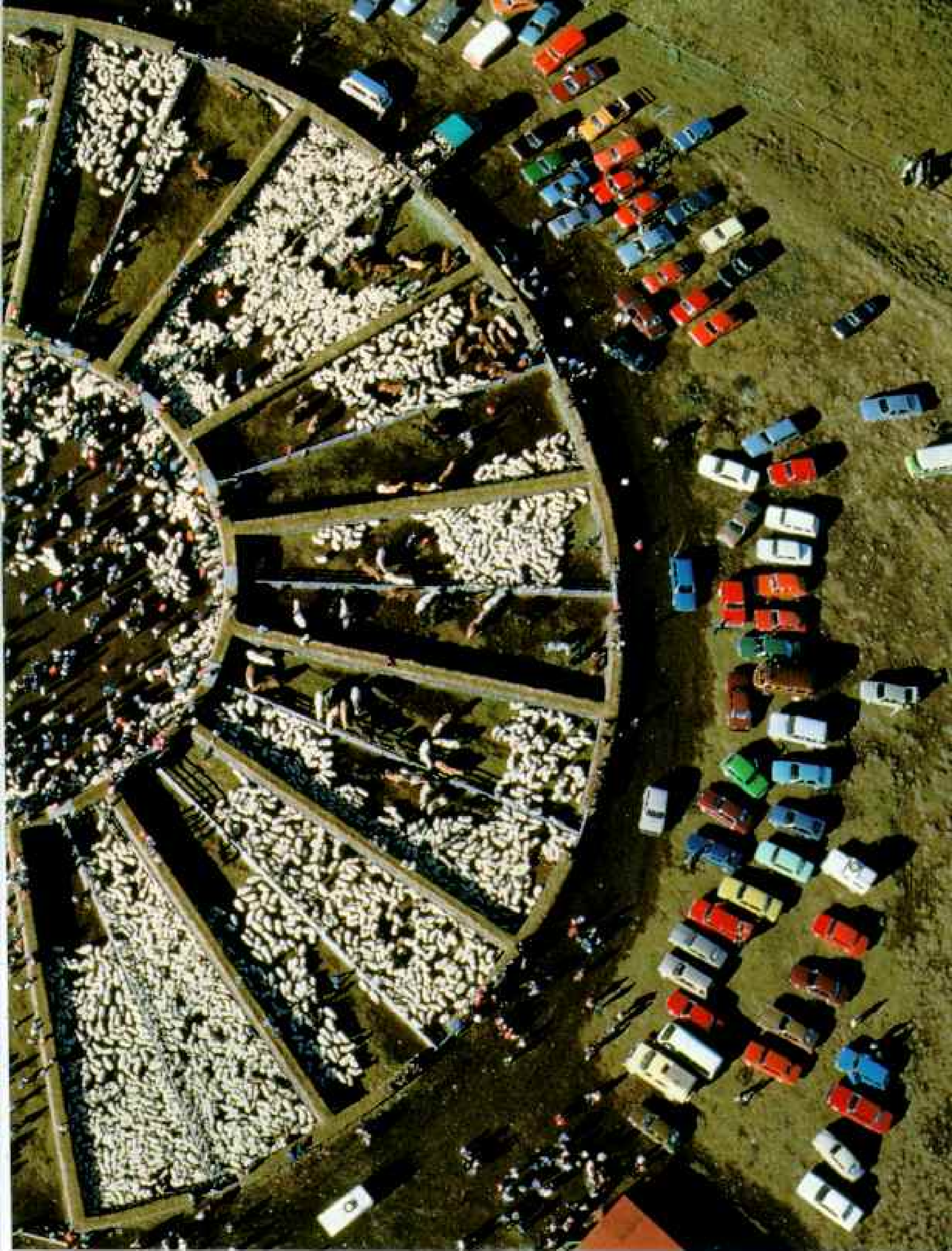
*have remained "just another Danish island." Universally literate since the 18th century, Icelanders publish more books per capita than the people of any other nation. Other pursuits that help while away long winter nights include chess (below), enjoyed from a young age.*





*Farewell to freedom comes at summer's end for Iceland's one million sheep, as farmers join forces to drive flocks from common hillside.*





*grazing into wheel-shaped sorting pens. Known as a réttir, the staggered event lasts several weeks, accompanied by much festivity.*



*The spring was an extremely cold one. Flóki climbed a certain high mountain, and north across the mountain range he could see a fjord full of drift ice. That's why they called the country Iceland. . . .*

THE BOOK OF SETTLEMENTS, circa 1175

**T**en million years ago Iceland's climate was comparable to Florida's and able to support sequoia and redwood trees. As recently as 5,000 years ago Iceland had expansive forests, and even those Norsemen who ignored Flóki Vilgerðarson's unfavorable report about his "iceland" found lush meadowlands dotted with stands of birch and mountain ash.

Man and sheep have managed in little

over a thousand years to destroy virtually all of Iceland's forests. And when the trees disappeared, so too did most of the well-drained soil, carried off by the incessant wind. Farming is largely limited to the production of hay for fodder on 1,500 square kilometers (less than 2 percent of the country).

Although the mean daily temperature in Iceland is about 4°C—nine degrees higher than might be expected at this latitude—farmers may get warm, summery days in February or hailstorms and snows in July. The relatively temperate climate is brought by a branch of the Gulf Stream that hits the southwest coast. Seasons are defined rather by the amount of daylight. Summer is three months of almost perpetual sun, when the pace of life quickens; winter is the season of



*Fingers and needles fly as Sigríður Vilhjálmsdóttir whips up yet another Icelandic sweater with help from her husband, Gísli Skaptason, in their apartment in Reykjavík. An important cottage industry, woolen goods for export generate an annual revenue of 30 million dollars. Sigríður produces four to five sweaters a week and claims she could, if necessary, knit them in the dark.*

darkness, when farms and villages are isolated for months and life retreats indoors.

The fertile triangle around the Thjórsá River, which attracted Iceland's first settlers, is still the country's most productive agricultural region. Life has changed here more rapidly in the past 35 years than in the previous 850 years.

"When I married and came to the farm in 1950, I cooked on a coal stove, and we had no electricity," said Dora, wife of Guðni Kristinsson, whose land at Skarð was first farmed in 1100. "Guðni brought in the hay with horses, and all the milking was done by hand. Now we have tractors and automatic milking machines and a silo."

One Saturday afternoon Dora gave me a tour of the farm. The modern split-level farmhouse, barn, stables, and corrugated-iron church were clustered around a stream. By the family cemetery, where sand and wind have erased the names on the oldest tombs, were a shrub-covered hill and the ruins of an earlier farmhouse.

"I want this old house torn down," said Dora anxiously.

"Why?" I asked.

"The hill may be a *bæli* [shelter] for the *huldufolk* [hidden people]. It shouldn't be disturbed," she said.

Huldufolk are descendants of the unwashed children of Eve, and a study conducted by the University of Iceland found that 55 percent of the Icelanders believe they may exist. According to Icelandic folklore, God visited Eve in the Garden of Eden while she was washing her children. She presented just the bathed children, pretending they were all she had. This angered the Lord, who said, "That which is hidden from me shall be hidden from men."

Skarð, a few kilometers from the volcano Hekla, is one of the last farms on the route to the interior, and it has always opened its door to strangers. Guðni's father would lead people across the lava deserts, a four- or five-day ride, and rescue lost travelers.

Late in the afternoon a steady stream of people began arriving at the farm. Dora and her daughter-in-law, Fjöla, worked in the kitchen, carving a leg of smoked lamb, the national delicacy. I asked Dora how many she was expecting for dinner. "The last time I counted, there were 29," she said vaguely.

The platters of lamb and boiled salmon and potatoes were emptied and refilled many times. After dinner the men lit cigars, and the conversation turned to the legendary Torfi in Klofi, a 15th-century farmer and an ancestor of Dora. They talked about Torfi as if they knew him and spun stories of his life well past midnight.

Through the long Icelandic winters, families used to gather for *kvöldvaka*, or evening wake. While the men made horsehair ropes and the women spun or knit, a member of the family would read one of the Icelandic sagas, dramatic historical novels written in the 12th to 14th centuries, or recite *rímur*, rhymed verse narratives. The traditional *kvöldvaka* has disappeared, but the sagas are still widely read and *rímur* written.

**I**nside the small gabled chapel at Thingvellir, a young unmarried woman stood at the altar holding her three-month-old son.

"And what is the child to be called?" asked the priest.

"*Steinn* [Stone]," she said softly.

The priest dipped his hand in a silver basin of water and touched the boy's forehead saying, "In the name of the Father, the Son, and the Holy Ghost, I christen you Steinn."

In a few moments the baptism was over, and the mother stood outside the chapel overlooking the historic plain where the pagan Norse chiefs had gathered in 930 to establish a commonwealth and where, not long afterward, they debated whether or not to accept Christianity. She smiled contentedly, surrounded by her sister and her parents, who would be the child's godparents. It was clear, though the father was absent, that this boy would be loved and cared for. Illegitimacy, in fact, carries little stigma in Iceland, where 60 percent of all first-born children are born out of wedlock.

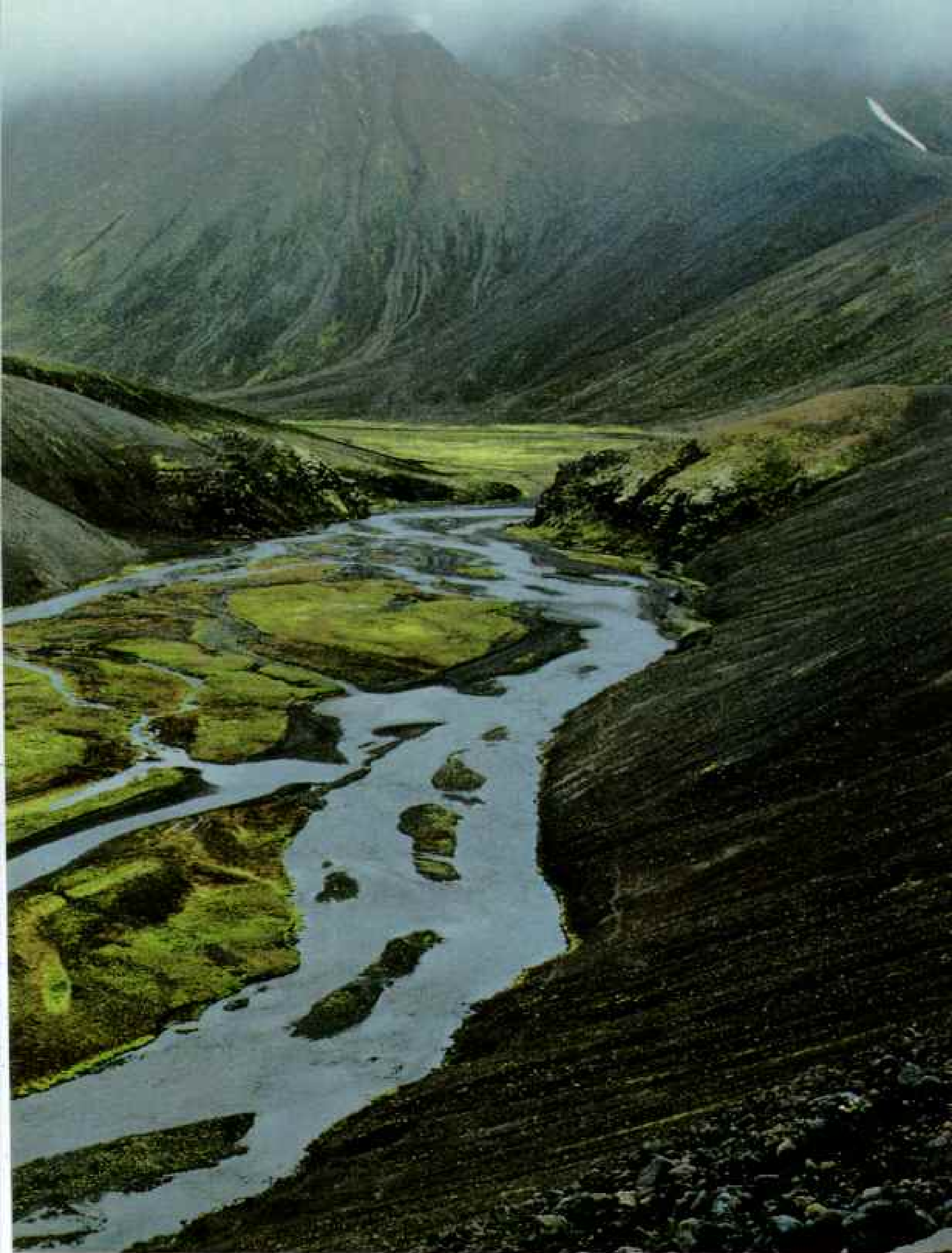
"Christianity has always been . . . *different* here," said the priest, Heimir Steinsson. "From the beginning there was no internal questioning of faith and little moralizing. Even the priests kept concubines."

In the late tenth century, missionaries had failed to bring Christianity to Iceland, and yet, curiously, enough Christians were already there to threaten the union of the young commonwealth. In the year 1000,



*Riverbeds make roads in Iceland's forbidding interior. Forging a path through the volcanic landscape, a bus keeps to schedule in a glacial valley. This "road*





*behind the mountains" will be crucial when the next, long-overdue eruption of the subglacial volcano Katla causes flooding on Iceland's coastal ring road.*



Christian and pagan chiefs gathered at Thingvellir. The men were close to fighting, and Thorgeir, the Law Speaker and leader of the Althing (or general assembly), was asked to render a judgment. It is a famous story of compromise told in one of the sagas, *The Book of the Icelanders*.

Thorgeir, the saga tells us, retreated to his shelter and spent an entire day resting, his cloak drawn about him. Finally he emerged with his decision. He decreed that all men should officially become Christians so that there could be one law in the land for all people. Those who wished to make sacrifices to the pagan gods privately, however, could continue to do so.

Iceland's conversion to Christianity has resulted in considerable speculation on just how great the Irish-Celtic influence was in

early Icelandic history. It has long been known that the Norsemen took Irish wives and slaves on their way to Iceland, but it is now thought possible that as many as half of the early settlers may have been Christian Irish Celts. Some scholars attribute the flowering of Icelandic literature in the 12th to 14th centuries to this unique blending of cultures.

"The Irish brought to Iceland their literature and their learning—of which the Scandinavians had nothing," said Halldór Laxness, 84, Iceland's Nobel Prize-winning author. "The sagas are our cultural foundation. Without them we would be just another Danish island."

In 1965 the Apollo astronauts trained for their moon flight at Askja, a huge lake-filled caldera in the center of Iceland. This fortress



of stone lies in the forbidding Ódáðahraun, the largest lava field in the world, covering 4,500 square kilometers.

"Askja is a very primitive place," said volcanologist Guðmundur E. Sigvaldason, who accompanied the astronauts. "It is the beginning of everything—or the end."

**M**ore than 200 volcanoes along Iceland's backbone have poured forth a third of the world's output of lava in the past 500 years. Eruptions occur on the average of once every five years, and heat energy is constantly making its way to the surface in geysers, hot springs, and boiling mud pots.

Iceland's fiery interior is identified with the bleakest period in its history, the 14th to 18th centuries. Famine and outbreaks of

*Pursuer of puffins for 60 years, retired businessman Hlödver Johnsen (above) works the cliffs on the uninhabited island of Bjarnarey in the remote Westmann Islands. The average daily catch of 600 birds, taken in July and August, will end up in gourmet guise on dinner tables. On nearby Heimaey, hardy islanders light bonfires (above left) in an annual festival commemorating the day in 1874 when bad weather prevented them from joining their mainland brothers to celebrate the granting of Iceland's constitution.*





BAKINAR ABELESON, NORÐURBLAÐIÐ



*Two presidents meet as Vigdís Finnbogadóttir greets Ronald Reagan (above) before Soviet leader Mikhail Gorbachev's arrival in Reykjavík for the October 1986 summit. Formerly director of the Reykjavík Theater, Iceland's popular president stayed home for a day in 1985 to celebrate the tenth anniversary of a women's strike that brought the country to a near standstill.*

*In a land that is 70 percent uninhabitable, the almost pollution-free capital (above right) houses more than half the population.*

smallpox and Black Death coupled with disastrous volcanic eruptions decimated the population. After one catastrophic eruption in 1783 along the Laki crater row in the south, Denmark, which had taken control of Iceland in 1380, considered evacuating the population to Jutland.

In the past 50 years, however, Icelanders have learned to tap the power of the volcano. The curse has become a blessing. Most of the country's homes use geothermal heat, and, in addition, power harnessed from Iceland's mighty inland rivers provides 96 percent of its electrical needs.



Water from these untamed rivers, which are fed by melting glaciers and heavy rains, usually runs through the porous lava soils. But where it is trapped, life blooms in the inland deserts. Mývatn, a glacial lake partially dammed by lava, attracts one of the world's largest concentrations of breeding ducks. In the summer 14 species—more than 15,000 breeding pairs—flock to the shallow lake in northern Iceland.

"There! You see? *There* are my birds!"

It had been two weeks since Arni Einarsson, an ornithologist, left his fieldwork at Mývatn, and he was glad to be back. For

five years he has been studying the Barrow's goldeneye, a North American duck that has mysteriously made its way to Iceland but is found nowhere else in Europe.

As we motored across the lake, we could see the Barrow's goldeneye females swooping down over the small crater-islands, then veering skyward again.

"They're checking the nests," said Arni, "to see which breeding pairs were successful and where they should nest next year."

Life is at critical limits on Mývatn. Slight variations in temperature, sunlight, and wind affect microorganisms on the lake

bottom, and they, in turn, can cause wild fluctuations in the bird population.

The struggle of the ducks is not the only drama for survival being played here. A diatomite plant on the north side of the lake has pitted businessmen against residents. The plant has been dredging the lake since 1967 for diatomaceous earth, used as a filtering agent, and this has launched a conservation battle in a country unaccustomed to worrying about its vacant land. Some think that the dredging may be affecting local fish-and-game stocks.

"My father made half his living from fishing," one farmer told me. "Now I can barely get enough fish for my family."

Lest man should ever feel in control of his environment at Mývatn, there is nearby the volcano Krafla, which awoke in 1975 from nearly three centuries of slumber. During the next ten years potatoes baked in the fields, and a geothermal drill hole at the diatomite plant exploded, spewing red pumice. The earth rumbled, heaved, and eventually split open along an eight-kilometer fissure.

Scientists had believed the spreading of the Mid-Atlantic Ridge was always a slow process, with the plates moving apart only a

few centimeters a year. After the Krafla fires they realized the movement could occur in sudden bursts and then cease for hundreds of years. At Krafla they also witnessed the interaction of volcanic events 70 kilometers from each other.

"Now we're beginning to think in larger units and to ask ourselves if all the volcanoes in Iceland are not connected in some way," said Páll Einarsson, a geophysicist with the Science Institute in Reykjavik. "Our studies indicate that the lithosphere, the top layer of earth's mantle, is missing under Iceland. About ten kilometers under the surface, then, we have a spongelike, semimolten material that could produce a pressure connection between all the volcanoes."

**W**e were driving up the narrow, winding road between Ísafjörður, the main fishing center in the western fjords, and the village of Flateyri. Although I had gotten used to seeing orange emergency huts for travelers in this frontier country where few roads are paved, I asked my companion Páll Guðmundsson why there were two huts only a few kilometers apart on this pass.





"They're needed here," he said dryly.

Once over the mountains, we gazed down the beautiful valley where Flateyri lay. Outside the fjord's mirror-calm waters, the Gulf Stream mingles with the East Greenland Current, creating an excellent feeding ground for cod. More than 60 percent of Iceland's trawler catch comes from the ocean here. The cold weather, strong winds, and treacherous currents, however, make these seas the worst in the North Atlantic.

We stopped to visit the local priest. He told us that Alcoholics Anonymous meets here religiously every Sunday morning—more often than church services are held.

"For almost four months in the winter we don't see the sun at all in this fjord," he said, "but people don't drink so heavily then. Rather, we tend to have problems in the summer—in people's eagerness to begin life again. Drinking is a release. Release from the hardship, the danger, the loneliness."

When we left the priest, it was snowing heavily in the mountains. This was July. As we made our way through 15 centimeters of new snow, large hailstones hit the car. Suddenly we stalled and slid backward to the edge of the road. Just beyond was a sheer

drop of about a hundred meters. I thought about the rescue huts and a story the priest had just told us about an avalanche burying his car on this road last winter. He spent the night crawling on his hands and knees in a blinding snowstorm back to Ísafjörður.

We made it back safely, just as the Ísafjörður police were closing the pass. The snow continued for three days, and the fells around the town turned white. One by one the fishing boats returned to the safety of the fjord. The fishermen spent their days restocking the boats, and their nights in the discotheque, where local girls defied the weather in paper-thin dresses of Italian cotton. Release came on the dance floor, in the steamy, smoke-filled room. Release finally, for the tired fishermen, at the bottom of an empty vodka bottle.

**T**he snow had stopped, but the winds were still strong when Guðni Einarson, 30-year-old captain of the *Sigurvön* steered his 33-meter boat out to sea.

"I don't think the fishing will be very good," he said, "but we always try."

Before he left Súgandafjörður's calm

*A mock funeral was staged in Reykjavík in September 1985, when townspeople gathered in mourning to protest a new law banning the custom of spiking Iceland's extremely weak beer in the barrel with vodka or other hard liquor. Onlookers sang dirges as the last of the pepped-up brew was symbolically collected in a cask (left) for later disposal.*

*Facing the more serious side of their drinking habits, pajama-clad patients (right) receive counseling at one of four treatment centers for alcohol and drug abuse run by the S. Á. Á., the Laymen's Council on Alcoholism.*





waters, he radioed the National Lifesaving Association. All boats are required to check with the association at least once a day while they are out at sea. Still, there is a loss of life almost every year in the major fishing villages and hundreds of accidents.

"This system started about 15 years ago when a boat went down off the north coast," said Guðni. "The men were in the lifeboats for ten days before they were found. No one knew they were in trouble."

When we hit the open ocean, we were greeted with ten-meter ocean swells and a 25-knot wind. The *Sigurvonn* suddenly felt like a toy boat in a bathtub. The bow pointed toward the sky as it climbed the gray mountain of water, then plunged downward on the other side, sending a shower of spray

across the deck. I struggled to keep my balance and steady my uneasy stomach.

We headed toward the northernmost finger of land in the western fjords, where, on the lee side of a mountain called Grænahlíð, we found some protection from the punishing northeasterly. This part of Iceland was abandoned after World War II. People just found life too difficult here.

"Maybe the fish will seek calmer water during bad weather—just like us," Guðni said. Using sonar equipment, he began to explore the ocean depths for schools of fish.

"There!" he announced before too long. "I think I'll go for that one."

It was past midnight when he released the dragnet. The sun had just set behind a bank of thick clouds. Guðni's father, who



*Golden light of a winter's afternoon warms fishing boats in Heimaey's harbor. In 1973 islanders saved much of their home from the might of a volcano, pumping six million tons of seawater to halt the all-engulfing deluge of lava.*

skipped the *Sigurvon* before him, had fished with only a compass and his knowledge of the current, and Guðni's grandfather had braved the seas in an open rowboat.

Slowly, slowly Guðni pulled his net in. A computer plotted the exact location of the throw for future reference. His eyes were fixed on the sea in back of the boat. Finally the net, full of fish, bobbed to the surface, and the gulls hovered hungrily around it. Guðni smiled.

Quickly the crew of four hauled the fish below, where they slit the throats of the squirming cod, cut out their livers and stomachs, and packed them in ice. The smell on that blood-spattered lower deck was sickening. Burned diesel fuel and cod-liver oil mixed with the stale odor of

pipe tobacco and yesterday's lamb stew.

They fished until 4 a.m., when Guðni gave his men a rest. But before 8 a.m. the crew was on deck again. Guðni usually stays at sea for two or three days at a time and fishes, he said, "whenever the fishing is good." Sleep is a luxury few fishermen can afford.

In recent years the cod catch has fallen off dramatically. Quotas have been imposed on all Icelandic fishing boats to conserve the stock. To keep profits up, captains like Guðni have had to cut crews and expenses.

Few nations in the world are as dependent on fishing as Iceland, where it accounts for 17 percent of the gross national product and 70 percent of export earnings. When stocks of cod (Iceland's most lucrative fish) plummeted in 1982, the economy was badly shaken. Inflation peaked in May 1983 at more than 130 percent.

Prime Minister Steingrímur Hermannsson, whose Progressive Party formed a coalition government that spring, ended automatic wage-price indexing and cut the value of the Icelandic króna 15 percent. Inflation was halted, but the subsequent drop in the standard of living led to a series of crippling strikes in the fall of 1984.

In the past year, however, the economy and the mood of the country have turned sharply upward. Lower world interest rates have reduced Iceland's large foreign debt, and suppressed oil prices and good catches have meant profits for the fishing industry.

**O**n a nice day, almost everywhere in Reykjavík, you hear hammers. Children determinedly hammering together play huts of broken shipping crates. Their parents, with less confidence, work on their houses.

The lure of better jobs attracts 1,400 Icelanders to the capital each year, and the city is exploding. Neat rows of painted concrete houses and an occasional high rise climb the hills around the picturesque bay where



Ingólfur Arnarson, honored as Iceland's first permanent settler, built his farm in 874.

The development of Reykjavík—and the urbanization of Iceland—has been fairly recent. Reykjavík wasn't even officially a town until 1786, when the Danish king granted the community of 167 merchants rights as a trading center. In 1900 only three villages, including Reykjavík, had populations of more than a thousand. Since World War II, Reykjavík has grown from a town of 47,000 to 90,000, and over half of Iceland's entire population lives in the capital and its burgeoning suburbs.

Still, Reykjavík maintains a small-town

atmosphere. Iceland's entire Foreign Ministry consists of 33 people, with headquarters on the fifth floor of the Reykjavík police station. And, every Wednesday, Mayor David Oddsson opens his door to anyone who wants to see him.

The city is the center of Iceland's cultural life, and, especially in the winter, people from the country flock to the city. Reykjavík has two theater companies, an opera, a symphony orchestra, a chamber-music orchestra, and a ballet company—almost all of which were started in the past 40 years. The visual arts too have taken off in this century, producing such artists as Jóhannes Kjarval,



*"Like different vintages of the same fine wine,"* claims connoisseur chemist Baldur Hjaltason (above) of the batches of cod-liver oil that he regularly tastes for the Lysi Company in Reykjavík. Icelanders enthusiastically consume more cod-liver oil than does any other nationality, believing that it contributes to longevity and arterial health. They also produce more than a third of the world's supply—including a new mint flavor. At the Hjalmur fish processing plant in the remote western fjords, light tables help workers spot bones while filleting fish (right). Crucial to the economy, fish and fish products account for 70 percent of Iceland's export earnings.



Iceland's best loved painter, and sculptor Ásmundur Sveinsson.

Iceland's president, Vigdís Finnbogadóttir, former director of the Reykjavík Theater, is a strong supporter of the arts.

"We were so poor and materials so scarce that Icelanders expressed themselves with the only thing that was free—words," she told me in her Reykjavík office.

The 56-year-old president was elected in 1980 to her position as spokesperson for the nation and reelected without opposition in 1984. She believes that a national women's strike in 1975 planted the seed for her nomination and also for the founding of the

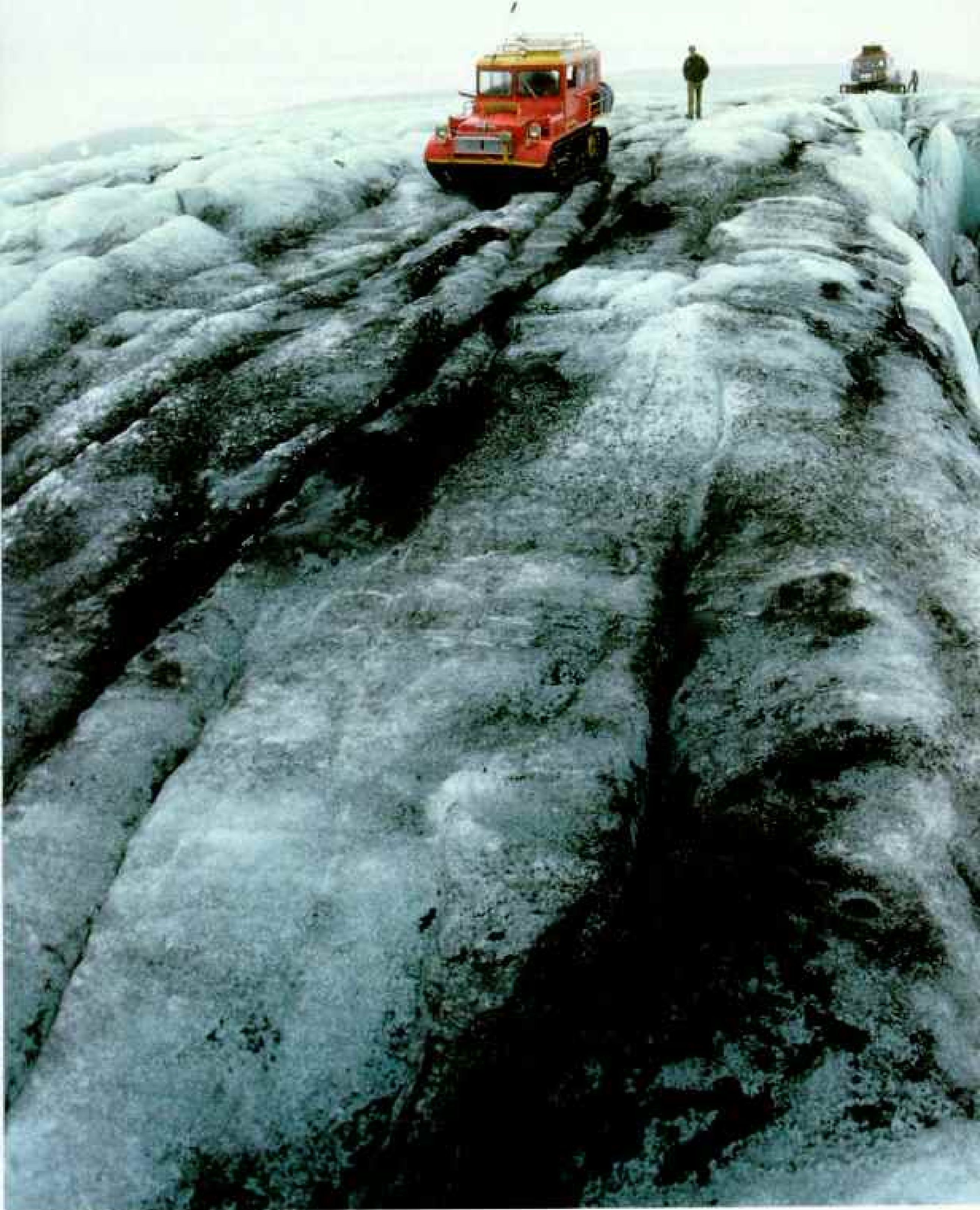
Women's Alliance, which holds three seats in the Iceland Parliament.

"The idea of the 1975 strike was to demonstrate how valuable women are to our society," said President Vigdís. "It was a marvelous day. Men cooked for their children for the first time and ran day-care centers in their offices."

Some banks closed during the strike for lack of tellers, and telephone communications became hopelessly snarled because switchboard operators left their posts.

In October 1985 the women staged an anniversary strike, and this time the President of Iceland herself didn't show up for work.





*In a wasteland of ice, Gísli Hjálmarsson surveys Skálafellsjökull, a tongue of southeast Iceland's vast Vatnajökull. He has established a ski area on the glacier, using snow tractors to transport the intrepid across treacherous terrain to a site that provides an exhilarating 3,000-meter downhill run. Vatnajökull covers 8,300 square kilometers to a maximum*





*thickness of 900 meters. Underneath lies Grímsvötn caldera, a collapsed volcano whose heat melts ice to form a blue lake in the middle of the glacier. Such subglacial volcanoes periodically produce havoc-wreaking "glacial bursts." Carrying sand, boulders, and floods of water, they destroy everything in their path.*



**W**hite. White from horizon to horizon. Ominous and formless. A sea of ice obliterating all that is beneath it.

We had been flying over Vatnajökull for an hour, and there was no end in sight to this great glacier. Covering 8,300 square kilometers, it is one of the largest ice caps in the world and reaches a formidable thickness of 900 meters. Suddenly our single engine plane shook violently.

"These *jökull*s [glaciers] create their own weather," said our pilot, Omar Ragnarsson. "We'll have to stay clear of that. . . ."

He pointed to a storm brewing at the southern end of the glacier. There a ridge of coastal mountains including the Hvannadalshnúkur, at 2,119 meters Iceland's tallest peak, traps the prevailing winds and generates blizzards summer and winter, adding six meters of snow a year to the glacier.

We soon passed over a large blue lake in the middle of the ice. A *lake*? What in the world, I wondered, could have melted a hole in a kilometer of ice?

"That's Grímsvötn volcano—the largest geothermal area in Iceland," said Guðmundur Sigvaldason, head of the Nordic Volcanological Institute, who was with us. "Every five years or so the volcano melts enough water to actually *lift* the glacier, sending a huge flood of water and broken pieces of ice onto the plains below. By measuring the amount of water unleashed during these *jökulhlaups*, or glacial bursts, we were able to calculate the power of a volcano for the first time. Grímsvötn is steadily generating the equivalent of 5,000 megawatts."

Such violent subglacial eruptions have created large, barren expanses of black sands along Iceland's southern coast. Many ships have been wrecked on the shoals and shifting sandbars, and stranded sailors have died after wandering for days on the desolate beaches. The farmers of Öraefi, or Wasteland, as the area is called, have been the most isolated in Iceland. Even mice couldn't make it to Öraefi until 1974, when

the road was completed under the glaciers.

Skaftafell, one of Öraefi's farms, has become a national park. On a visit there with my friend Thóra Thórhallsdóttir, we decided to explore one of the stubby fingers of Vatnajökull. To get to the glacier, we would have to wade through four branches of the Morsá, a swift-moving glacial river.

"*Ekkert mal!* [No problem!]" said Thóra. Stepping into the first icy river, my pants rolled high above my knees, I knew this was going to be a problem for me at least. The ugly gray water hit my legs like a thousand steel daggers. I lost all feeling in my feet. Slowly we inched our way across the river, our knees facing into the strong current so it wouldn't push us down. Every year several tourists underestimate the power of these frigid streams and drown.

Once across the rivers, we hiked to the sinister black edge of the glacier, where soot and sand accumulate. A cold wind blew off the ice. The force of the water coming from underneath the glacier was so strong that it created an eerie fountain three meters high.

Beyond the sooty edge the ice turned blue-white. Suddenly we could hear running water and came upon eddies, whirlpools, and rivers in the ice. We heard water falling, falling from an unseen interior river to a pool underneath the glacier. And, in the distance, there was thundering. Somewhere—we couldn't see where—ice and snow were crashing down in a great avalanche. Always the ice is moving, shifting. This landscape feels alive. It is frightening. Like walking on some gigantic animal.

A few kilometers into the glacier we came upon steep crevasses 12 meters deep and couldn't continue without climbing equipment. I was afraid to continue—yet disappointed to be turning back.

Exploring Iceland had been, for me, a process of stripping down pretensions, of confronting my smallness in nature. And, under the glaciers, in this land like no other, there is a compass that will steer those who let it on a truer course. □

*Thundering waters of Skógafoss, at 60 meters one of Iceland's highest waterfalls, are said to conceal a chest of gold salted away a thousand years ago by one of the first settlers. Legends and folktales abound in this elemental land, where most of the population believes that huldúfolk, or hidden people, may inhabit the landscape.*

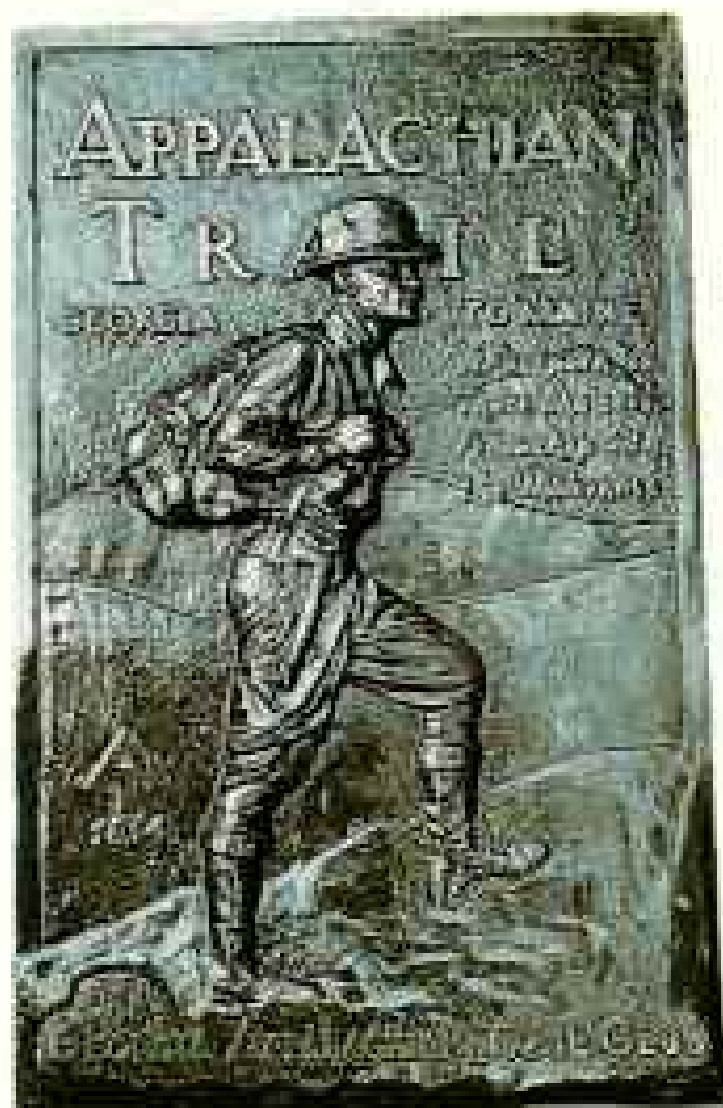


# A Tunnel Through Time

## THE APPALACHIAN TRAIL

By NOEL GROVE Photographs by SAM ABELL

NATIONAL GEOGRAPHIC SENIOR WRITER



**H**AUNTED by a sense of misdirection as a real estate salesman, Steve Nuckolls dropped everything to walk the Appalachian Trail. From Springer Mountain, Georgia, he headed north in April, strode across the "balds" in North Carolina and Tennessee, and labored through the Smokies. Long, long Virginia took a month, and rocky Pennsylvania took a toll on his shoes.

From a New York State hilltop he could glimpse Manhattan before ducking back into woodlands of the populous Northeast. Vermont was bucolic in August and New Hampshire's high mountains were inspiring. He knew solitude in Maine, but when he reached the end of the trail atop Katahdin in September he still didn't know himself. So he turned around and headed back to Georgia.

Back across streams now fringed with ice and over Mount Washington to be lanced by cold. Three times he lost his way in snow and twice he nearly froze. On March 11 he was back on Springer Mountain, but who was he? He still wasn't sure. Maybe if he walked back to Maine. . . .

Yo-Yo Nuckolls they call him, pulled up and down the East Coast by the thread of self-discovery and now part of the trail's growing lore. A legend along with Grandma Gatewood who roamed it into her late 70s; snow-haired Ed Garvey whose book about the trail became its bible; Warren Doyle who has traveled its length more than anyone else—seven times—sometimes walking at night while wearing a headlamp.

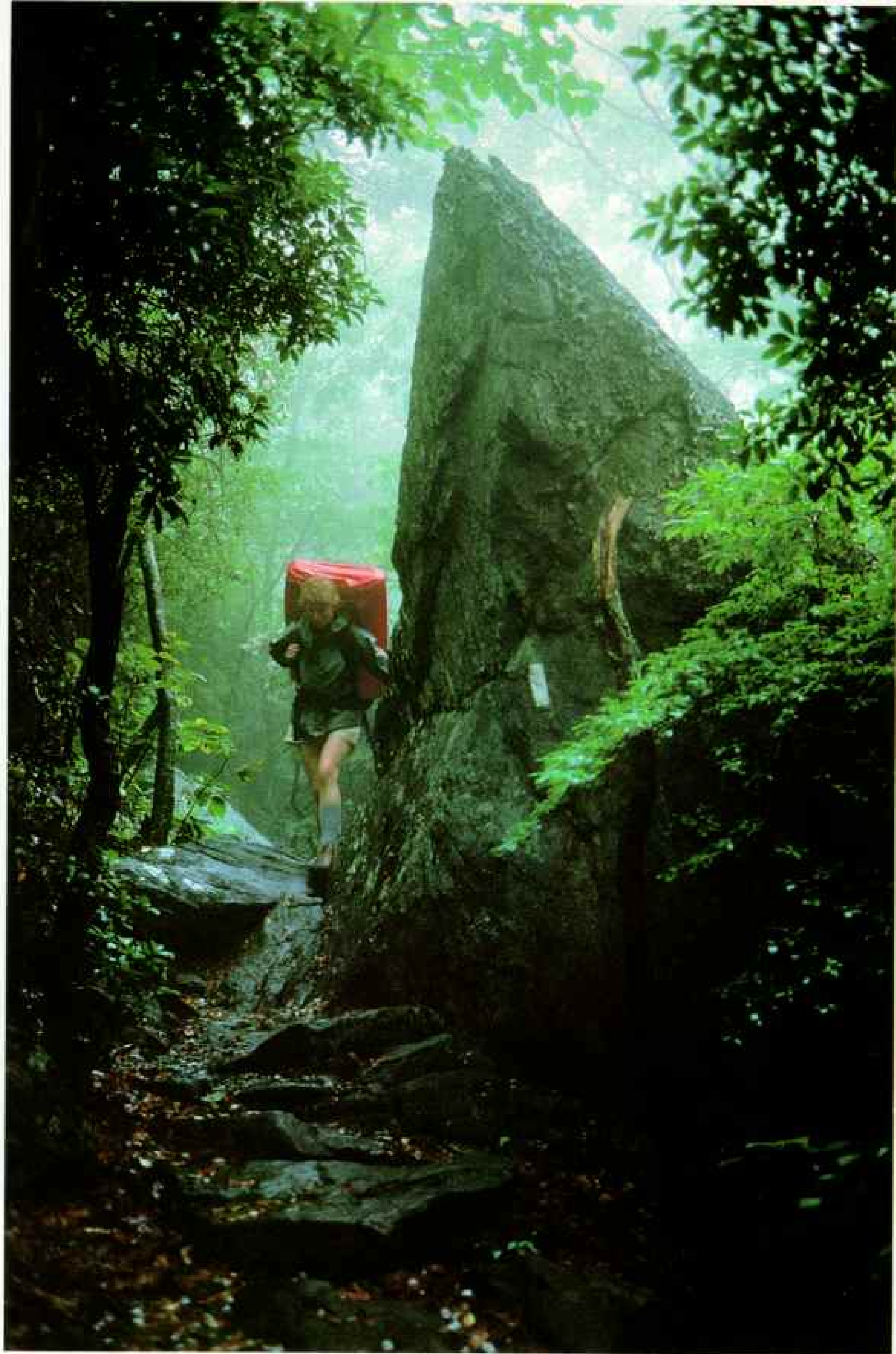
Most hikers have never heard of them. Three to four million people annually tread the well-marked path, but their passage is usually brief—a few hours to reach a broad-view promontory, or a weekend of camping, or a two-week vacation in the woods.

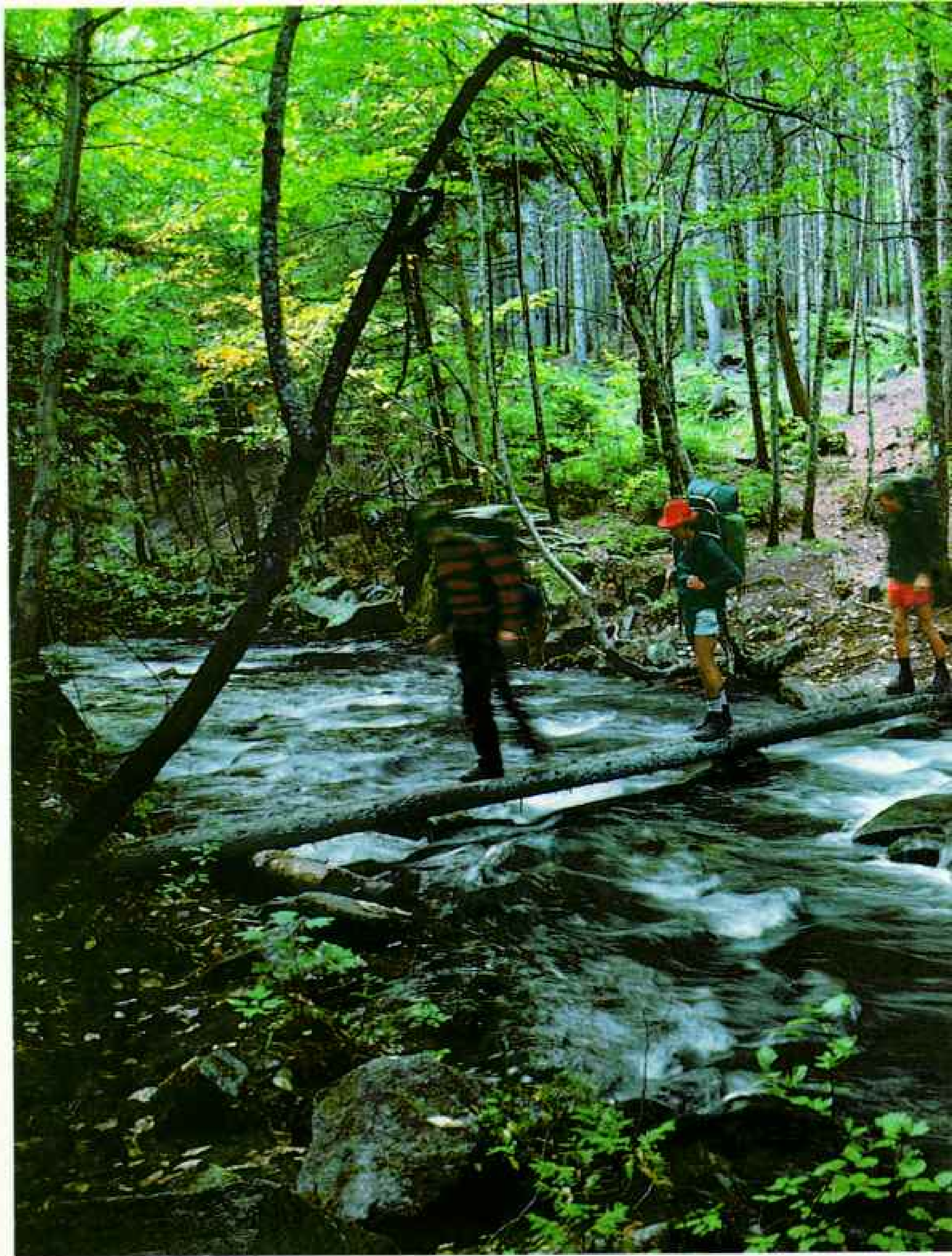
But the Nuckollses, Gatewoods, Garveys, and Doyles are well known to "thru-hikers," who have traveled its 2,100 miles in one 12-month period. They are known as well to "2,000-milers," who realize over several years their dream of walking the entire length of the track they call simply the A. T.

As recently as a decade ago the

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**B**ronze hiker sets forth on a plaque in Georgia marking the southern terminus of the 2,100-mile Appalachian Trail. One of the three to four million people who enjoy the trail each year heads north from nearby Blood Mountain (facing page).





*Careful footwork carries hikers over Maine's Rainbow Stream, 29 miles from the trail's northern end. Campers linger at a shelter, one of a series of refuges usually spaced a day's hike apart—about*



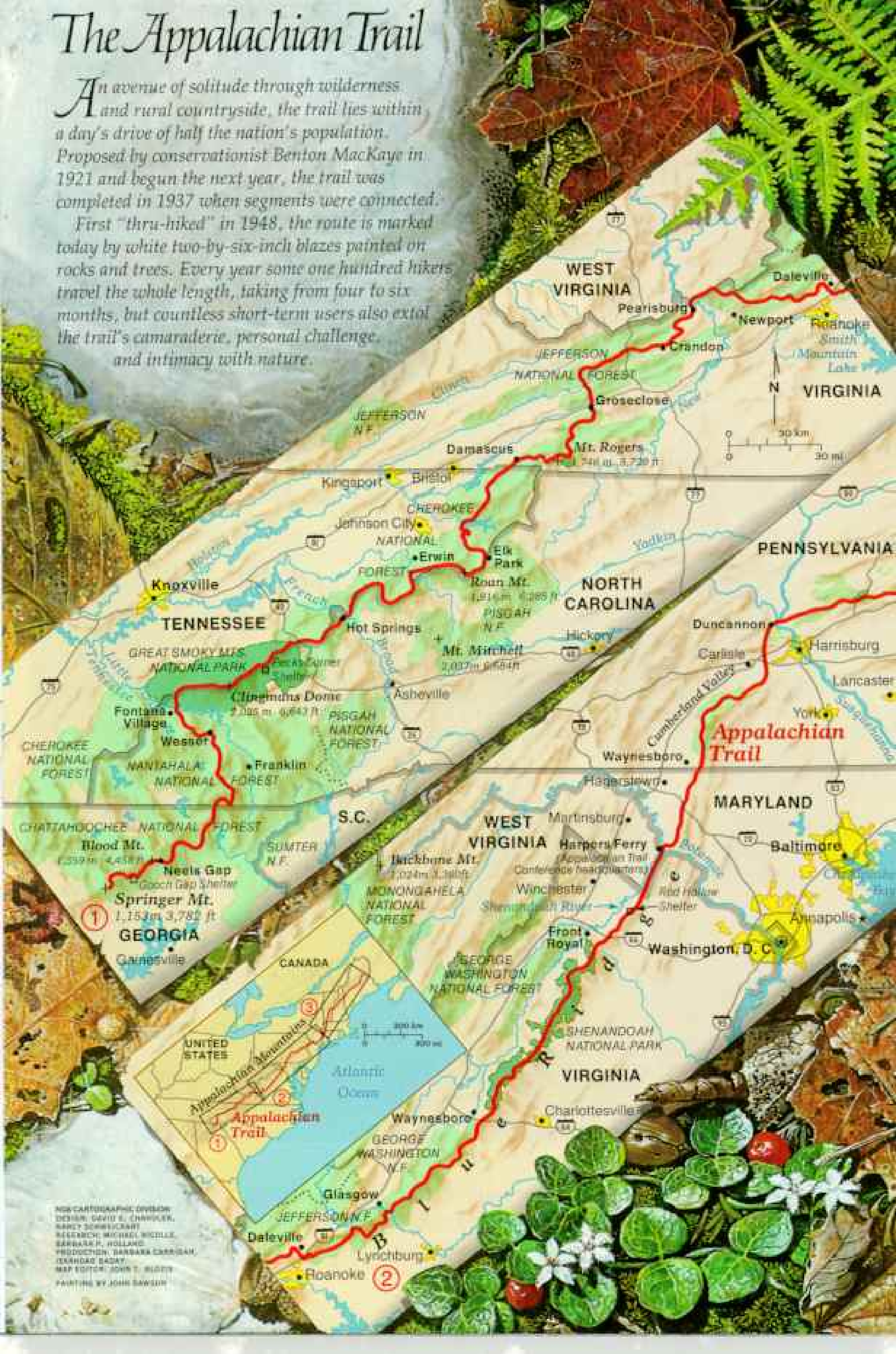


*nine miles—along the length of the trail. The three-walled design wards off the elements, and fencing protects some southern shelters from bears, although reports of injury are rare.*

# The Appalachian Trail

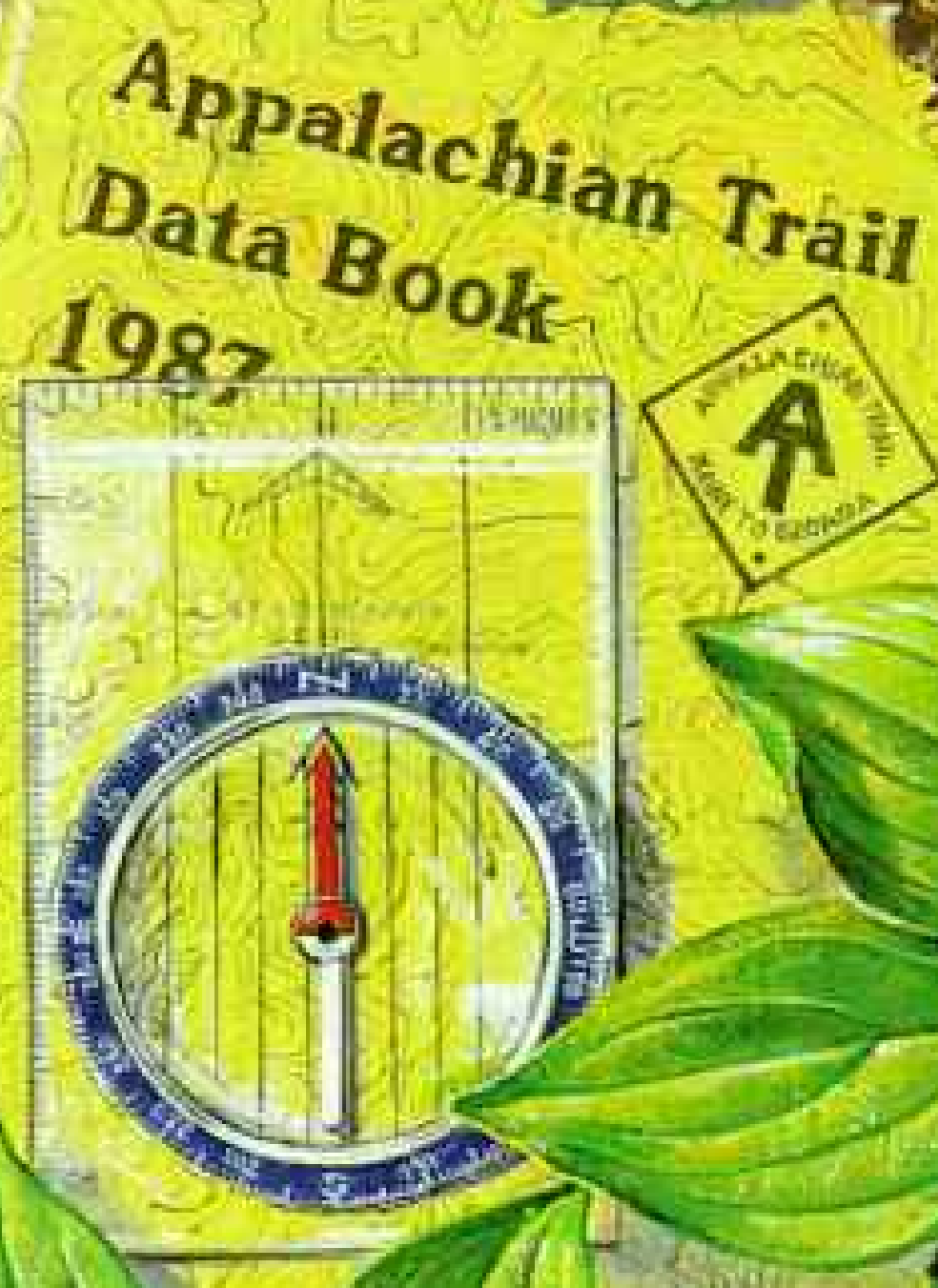
An avenue of solitude through wilderness and rural countryside, the trail lies within a day's drive of half the nation's population. Proposed by conservationist Benton MacKaye in 1921 and begun the next year, the trail was completed in 1937 when segments were connected.

First "thru-hiked" in 1948, the route is marked today by white two-by-six-inch blazes painted on rocks and trees. Every year some one hundred hikers travel the whole length, taking from four to six months, but countless short-term users also extol the trail's camaraderie, personal challenge, and intimacy with nature.



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dream almost faded. In the mid-seventies nearly half the trail crossed private land, and development plans threatened to sever it into separate chunks. The route changed frequently to circumvent tract housing and public roads, and the margins of escape were growing thin.

"Back then I was told, 'Better hike the trail now, because in ten years it may be too late,'" said Dave Sherman, a trail enthusiast and 2,000-miler. He works for the National Park Service, which today holds title to much of the trail property.

In 1978 President Jimmy Carter signed a bill authorizing 90 million dollars to buy an A. T. corridor averaging 1,000 feet in width, leaving less than 225 miles to be drawn under the protection of public land. Future hikers are virtually assured that they can pull on sneakers for a short jaunt, or throw kitchen and bedroom on their backs and follow the white blazes of the world's longest continuously marked footpath.

**O**DDLY Georgia's Springer Mountain is called the terminus (though more hikes begin than end there), perhaps because the trail's originator was a New Englander. When his idea of a lengthy eastern trail was published in an architectural journal in 1921, it is doubtful that Benton MacKaye expected anyone to walk it all. The author, forester, philosopher, and New Deal activist envisioned a path connecting a series of community camps for city dwellers to use for the study and appreciation of nature. The route was not even connected until 1937 and the camps never materialized, but a string of three-sided shelters offer marathon backpackers a dry haven in storms.

An agony of spring bugs in the North makes Georgia the logical starting point. A walk begun here as spring explodes with life can end when summer dies aflame in Maine.

Although the corridor falls within a variety of holdings both public and private, the trail is sometimes called a long, thin national park. If so, it is the only one managed mainly by private citizens.

In an unprecedented move, in 1984 the Department of the Interior signed over responsibility for managing part of the A. T.'s public land to a private organization—the

Appalachian Trail Conference, headquartered in Harpers Ferry, West Virginia. The conference serves as an umbrella organization for the 31 A. T. clubs. Working mostly on weekends and vacations, volunteers from these clubs swing picks, move dirt, muscle boulders around, and clear away blown-down trees to maintain a pleasant pathway for hikers they may never see. They may represent the largest volunteer effort in the world for operating a recreational facility.

"With federal budgets what they are these days, I'd like to see citizen participation like that in the whole park system," National Park Service Director William Penn Mott, Jr., said to me.

Though the pathway is usually clear, vegetation alongside is at times dense. You can see weeds and brush if you wish. Or, as the student of nature that MacKaye intended, you can learn to recognize pipsissewa, toothwort, Michaux's saxifrage, and mountain laurel. Some vegetation is nearly impossible to forget, such as Indian pipe, which pokes through rotting leaves and curls into a little alabaster peace pipe. Jack-in-the-pulpit preaches so solemnly that every sighting brings a smile, as do Dutchman's-breeches, tiny puffed pants hanging out to dry.

In North Carolina and Tennessee one has both flowers and panoramic views on mountains called balds. A heaven conceived by hikers might look like this. The lofty path cuts through grasses and sedges that ripple in the wind and are quilted with color from hawkweed, buttercups, wild strawberry, and flame azalea. To either side are views of farmlands and toy houses, wooded valleys and hills and more mountains beyond. Farther north, acres of rhododendron drape Roan Mountain in a pink blanket, and a roadside grocer just off the trail remarked, "In June, some say, it's the most beautiful place on earth."

With a few notable exceptions grades of the far South are gentle compared with the steep pitches of New Hampshire and Maine, but a hill is a hill . . . is a hill. Days, even weeks of backpacking are required before the body adjusts to a burden that pulls at the shoulders, strains the back, and teaches the legs the true meaning of gravity.

If the Appalachian Trail is a school, a major test in vegetation and endurance is the

Great Smoky Mountains National Park, where the trail rides the border between North Carolina and Tennessee for 70 miles. Highest point on the A. T. is the Smokies' Clingmans Dome at 6,643 feet, and the trail stays above 5,000 feet for nearly half its distance through the park. More species of trees grow in the Smokies than in all of northern Europe, and you can see more different kinds of wildflowers in a mile here than in any other mile on the trail. And you may see *more* bears.

**S**HELTERS in the Smokies are zoos in reverse. At night you shut yourself in behind a fence of heavy wire so the bears can come look at you. Park officials admit to a black bear problem but hastily add that people cause it, and that nobody has been seriously injured.

"All it takes is one peanut butter sandwich and a bear thinks of people as a food source," said chief ranger Dick Moeller.

On the trail I prodded veterans for frightening tales, and the lack of drama was appalling. A copperhead seen well in advance, sunning beside the trail. A bellow near a shelter one night that turned out to be a browsing moose. The south end of a bear going north. Plenty of yapping domestic dogs, easily the most aggressive critters a hiker is likely to see.

"We worried about bears a little at first," said JoAnne Staskus, who thru-hiked the trail with her sister Sandy in 1985. "After months without seeing any, you begin to feel cheated. When one finally crossed the trail, I yelled 'Hey, a bear!' and scared it away."

I met the Staskus sisters in the Smokies and wished them better luck than I'd had. One small bruin came by as I brushed my teeth by a spring at Pecks Corner Shelter early one morning, and it skulked away at my shout. My overreaction embarrassed both of us.

My only lump from an animal on the trail came from a deer mouse. It ran across my scalp as I slept one night on a top bunk, causing me to sit up in surprise and bonk my head on a roof beam.

"The most dangerous animal on the trail is man," offered a leggy hiker one day, but the comment met a chorus of disapproval. "You're safer than in town," others responded, and trail history bears it out.

Perhaps two dozen deaths can be tied to the trail since the first mile was cut in New York at Palisades Interstate Park in 1922. Most were accidental—hikers who fell from rocky heights, succumbed to hypothermia, were struck by cars, hit by lightning, or drowned. Four were homicides, two the same night in Virginia resulting in conviction of an out-of-work high-school dropout.



*Helping hands raise roof beams as Potomac Appalachian Trail Club members build a new Virginia shelter at Rod Hollow after the trail was rerouted away from a highway and onto National Park Service land. Thirty-one volunteer clubs, coordinated by the Appalachian Trail Conference, maintain the trail.*







MIKE WARREN

*Wild gardens of earthly delights reward the unhurried hiker. Among the most celebrated flowers, pink rhododendrons (top left) paint the slopes of Roan Mountain on the North Carolina-Tennessee border (above), where sightseers throng in summer. A delicate stem offers up a pink lady's slipper (left), an orchid found at lower elevations. Slender blossom of the galax plant (far left) shoots up amid its leaves, admired for the handsome copper color they take on in winter. Hikers are discouraged from picking plants, some of which are rare or endangered species.*



*Traveler's aid awaits at a post office where long-distance hikers claim food and supplies they mailed themselves for pickup along the way (left). New footbridge on a railroad trestle (below, at left) brings the trail over the Potomac River at Harpers Ferry, West Virginia, home of the Appalachian Trail Conference.*



A recent study of crime over a ten-year period produced figures that would make a small town proud. This for an annual trail population of a Chicago with a couple of Denvers thrown in.

Instead hikers regaled me with tales of generosity up and down the trail that seemed out of step with today's headlines. A North Carolina farmer who provides lodging in exchange for a fence painted or a garden weeded. The "ice-cream lady," housewife Bonnie Shipe in Pennsylvania, who has handed out more than a thousand free cones and never hiked a lick. A liquor store in Connecticut that gives a free beer or soda to anyone going end to end.

The act may be as elaborate as a church hosting weekly potluck suppers for hikers or as simple as a friendly wave. In Vermont one hot August day, photographer Sam Abell and I called out to a woman reading on her terrace: Could we rest on her stone wall by the road? Yes, she answered, and would we like a drink? Our canteens were tepid and tiresome and cool fresh water sounded mighty fine. She brought iced lemonade.

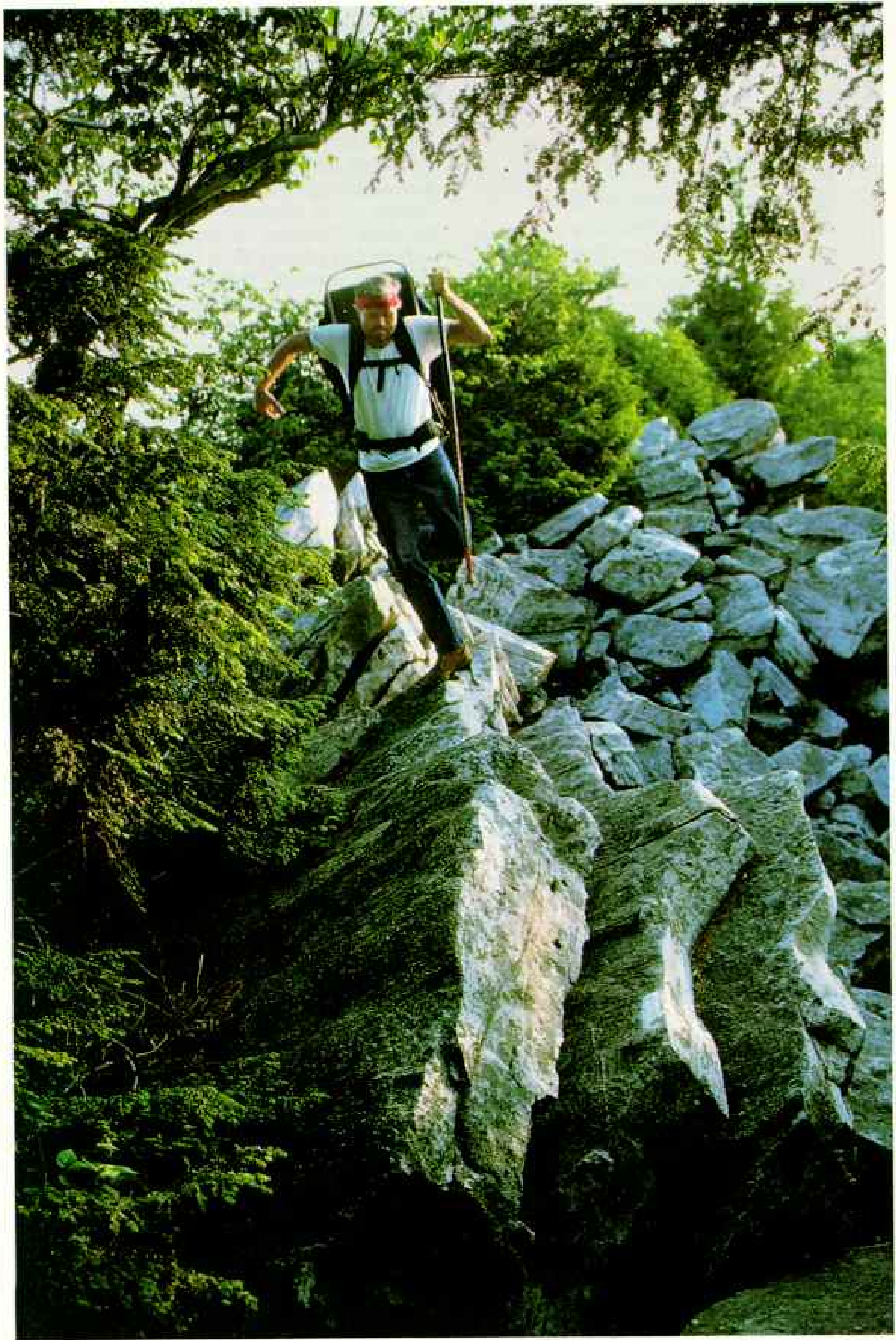
**A** FOURTH OF the Appalachian Trail resides in Virginia. Because I also reside there, I can attest to the use of the A. T. in all seasons. Spring and summer are most familiar to hikers, the first a time of renewal and the other a balm from the heat. I have hiked the Blue Ridge in autumn when the tang of drying leaves quickens the blood and the sight of whole mountains ablaze can tighten your throat.

Even winter has merit. I climbed Mount Rogers, Virginia's highest peak, in late December and found visibility at its best and solitude virtually assured. Although wind knifed at me on open stretches, the woods were calm and silent, frost wafting off dark firs like falls of bridal veil.

Virginia ends near the Shenandoah River and a bridge to Harpers Ferry, West Virginia. Thru-hikers usually look in at the modest headquarters of the Appalachian Trail Conference, parent of trail activities. Familial it must seem when they are welcomed like long-lost nieces and nephews by a silver-haired "trail mother" named Jean Cashin.

"Many start out on the trail as cynics," she





said, smiling. Would she know one, I wondered, if it sneered in her face? "But that's changed by the time they reach us because of the people they've met along the way."

States acquire personalities among hikers as well: Georgia a woods walk, Virginia long, and Maryland short. Pennsylvania is rocky, the path a purgatory of book-size shards. "The devil's golf course," muttered one backpacker. "Where boots go to die," added another.

The death of the glaciers that stopped here can be blamed, said Pennsylvania geologist and trail enthusiast Peter Wilshusen. "The numerous sharp rocks were caused by a periglacial climate," he told me north of Carlisle. "The coldness of the ice sheet to the north and the warm air from the south caused alternating freeze-thaw cycles, breaking stone outcrops into small fragments."

**T**HE TRAIL lies within a day's drive of half the nation's population, an oblique fact until one reaches the high-density states of New Jersey, New York, Connecticut, and Massachusetts. The route winds through woods that are spacious and sculptured with boulders, where deer accustomed to passersby play Bambi to your Hansel or Gretel. The number of hikers increases dramatically, many of them from urban areas and oddly out of sync with the trees.

I overtook an exhausted young couple lugging a cooler of provisions between them who asked me desperately if I knew where they could find water. As I topped a hill near a road a dozen miles farther, a convoy of limousines roared up. Out poured a wedding party, the bride a cloud of organdy, the men in top hats and tails, for a sylvan ceremony. Near the Hudson River I emerged from woods into a grassy park chockablock with lounging bodies and dueling transistor radios—the Bronx moves to Bear Mountain.

A few miles farther on I heard different music, the hum of men's voices singing evening prayers at Graymoor monastery, where I slept in a small, plain cell. Offering food and lodging to foot travelers dates from medieval times, a friar told me over a supper of shepherd's pie. Medieval it seemed when the electricity failed later, and I scribbled notes by candlelight.

In their search for a retreat, hikers and monastics have more in common than they realize. On the trail, hikers revert to lives of simplicity, denying themselves modern comfort, seeking purification in an uncorrupted world. Monkishly, a thru-hiker from Connecticut told me that he wished somehow he could walk it indefinitely—"for the simpler life-style."

Farther north I met Rebecca Cuming, her

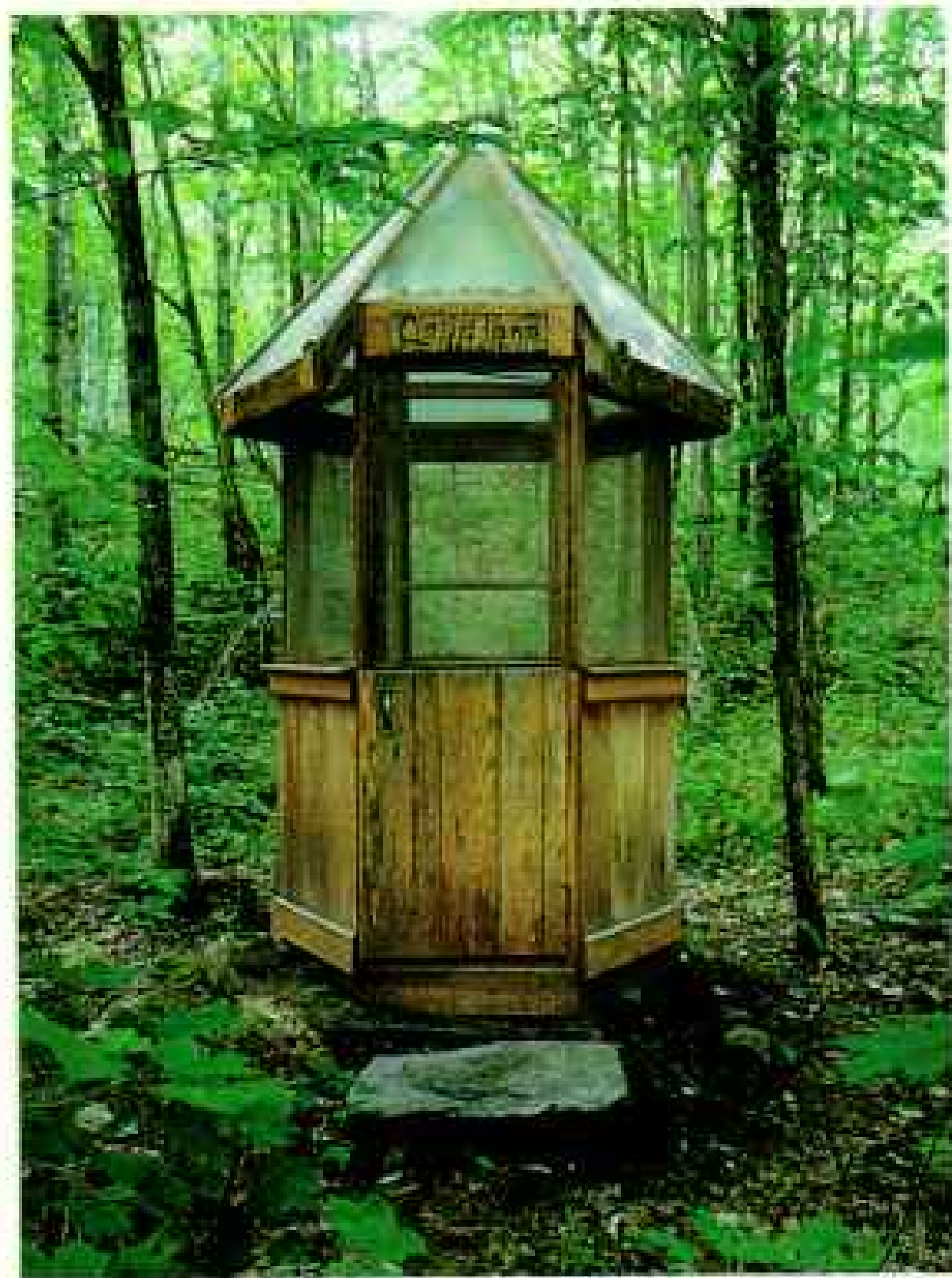


**R**ocky road inspires a lively step from veteran hiker Dave Sherman in Pennsylvania (facing page). In that state's Cumberland Valley near Carlisle (above), hikers must follow busy highways and country roads for 14 miles. Here and elsewhere, officials are attempting to acquire rights-of-way through less congested areas.

hair in the tossed blond waves seen more often on the streets of New York City, where she is a successful artist. "I find I need to hike the trail at least once a year for a sense of renewal," she said.

Vermont is a mix of woodland walks and pastoral scenes. The route skirts meadows, meanders past weathered barns, and once cuts directly through a farmyard. In the woods, beech and maple are joined by gleaming white birches, leaning languorously like fashion models among milkmaids.

Weeks of hiking had toughened me, but



*Providing privacy with panache, trail clubs build artfully designed outhouses such as the Dartmouth Outing Club's hexagonal structure at Vermont's Cloudland Shelter (above). Frequent trail hikers, Boy Scouts (facing page) also contribute their services for trail maintenance.*

the White Mountains in New Hampshire were both punishment and pleasure. Smarts Mountain was five and a half brutal miles uphill. Mount Moosilauke was higher and steeper and, for a northbounder, the first mountain above timberline. I lunched on the leeward side of a hump as the wind bent and bothered sedges on either side of me. But I didn't know wind until I reached Mount Washington.

A 70-knot blast sent me staggering like a drunk on a ridge walk from Washington to Madison in the mountains appropriately called the Presidentials. My wind suit popped like sheets on a clothesline and the string of the hood lashed at my face. Surrounded by fog, I vowed not to lose sight of the blaze behind me until I could see the one ahead. Aimless wandering and hypothermia could add one more to the list of 99 fatalities that have occurred here.

**H**IGH VANTAGE POINTS on the trail frequently draw crowds. Everyone, it seems, wants to take in the world at a visual gulp. The trail is a wine better sipped. Godlike views are far apart, and interest can wane if distance is the only goal.

A journalist half my life, I have lived too long with deadlines, and I carried them over to the trail. Early in the summer I would eye the maps in the morning and grimly plot my day. Gooch Gap Shelter by noon! Blood Mountain or bust!

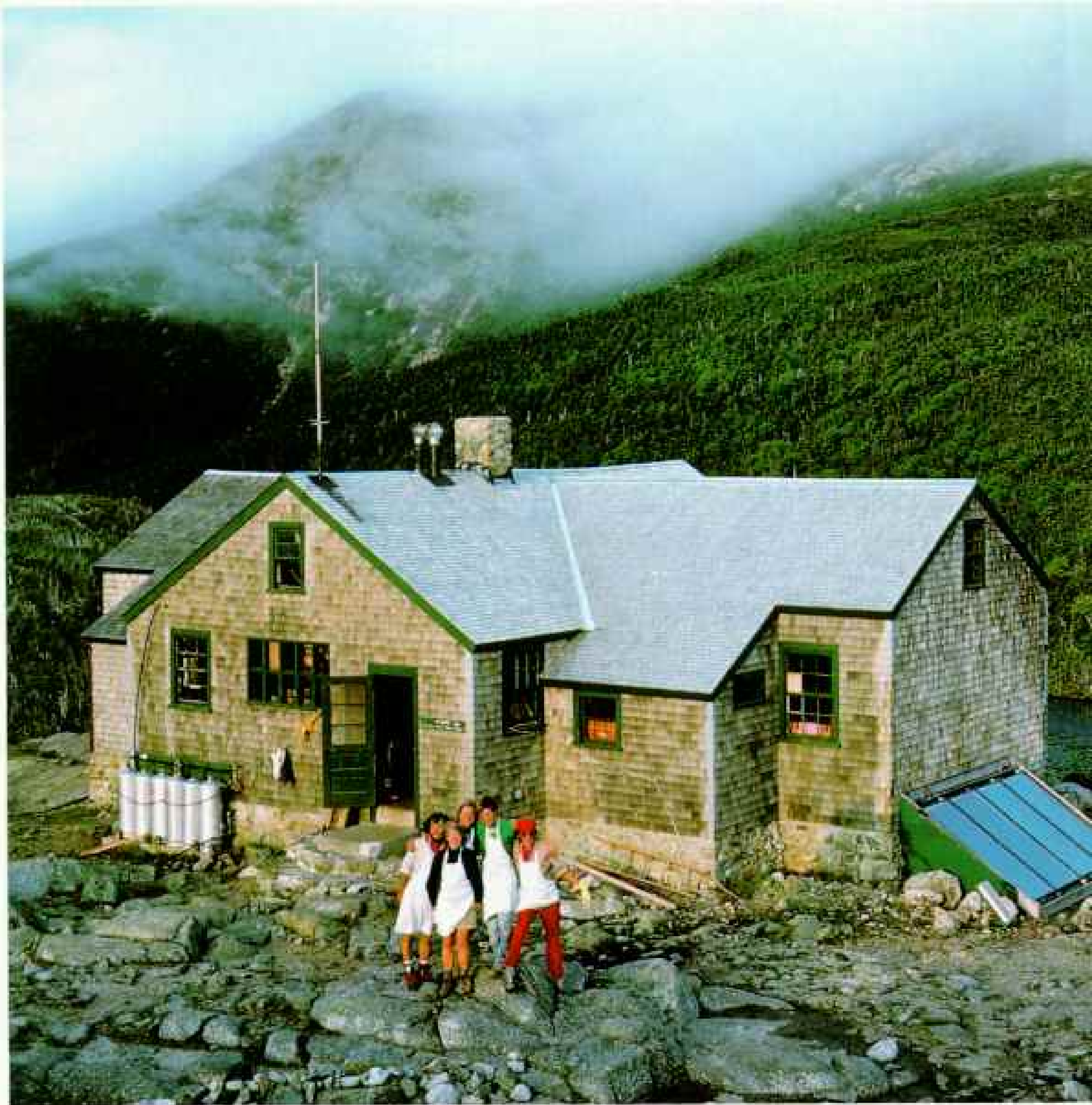
From wiser walkers I learned a different way. I once asked a three-time thru-hiker who joined me for a few days in Maine what common mistakes he observed in long-distance backpackers. Gentle of voice and slow to criticize, 30-year-old Albie Pokrob first demurred, saying people worked out their own methods according to their needs.

We strode in silence for a time, and finally he spoke again, unwittingly describing my trail habits perfectly: "I do feel most hikers anticipate too much—the top of a mountain, arriving at a shelter—a waste of energy and a detraction from the minute-to-minute enjoyment of the trail."

Sam Abell, possessed with patience and a lensman's eye for subtle beauty, was a frequent companion. Lagging appreciatively, he cut my daily mileage in half. We paused







to note the play of mottled sun on an island of ferns. We lunched like eagles at perches with a view, and we always napped afterward, Sam so soundly that I once had to wake him to point out that it was raining.

I bellied down in New England to watch an orange newt alligator its way past mountainous pebbles on valleys of moss. With a magnifying glass I spied on a striped snail grazing on fungus. An amazingly clear and seemingly comprehending eye stared back at me from the end of a long stalk, then rolled in on itself in a see-no-evil retreat.

I began to relax at sleeping alone in the woods and then actually grew to enjoy it.

The trail, already a classroom, began to be a home—the kind you can miss later after too much time on sidewalks.

**B**Y NORTHERN New Hampshire, however, I rarely camped alone. Leap-frogging sections of the trail, I had finally caught up with the season's contingent of thru-hikers, that elite corps undertaking the "five million steps" from Georgia to Maine.

They assume trail names, and eventually most of them know or have heard of one another through reading entries in the trail registers along the way. Hiking alone, they



*Welcome respite from the elements, a real bed and home-cooked meals are available for a fee at Greenleaf Hut (left), one of a chain of hostels operated by the Appalachian Mountain Club in New Hampshire's White Mountains. Between kitchen duties, Doug MacKenzie hugs fellow worker Joan Doyle (above).*

cluster at night at the log shelters in scenes that look a little like a Scout outing and a lot like a hobo jungle.

I walked one day with a hiker named Tabasco, who burned with a curiosity to match his nickname. What did I think about Nicaragua, he wanted to know, and could I name this plant at trailside? We stopped for lunch on a flat boulder and during the afternoon sprawled twice more for rest, backs against trees and feet uphill.

By late afternoon, our packs now a punishment and with wind-stirred leaves muttering rumors of rain, the three-sided shelter looked like a four-star hotel. We crossed

Eliza Brook, shrugged out of the straps, and unrolled our sleeping bags to claim space. Walking downstream, we found a deep pool that we entered gasping to splash away the day's grime.

As we returned to the shelter, several more humpbacked figures appeared out of the woods, murmured greetings, and set down their loads with a sigh. Tall, slim Linwood Gill, so aware of his heavy pack that he gave it a name and traveled as "Linwood and Henry." Karen Peil, a trim Detroitter with hair the color of ripe wheat. Two quiet men who called themselves the Drifters. A towering figure in a red rain suit





*P*athway in the sky leads hikers past one of the cairns that mark the trail along a treeless stretch of Mount Lafayette in New Hampshire, where the weather can quickly turn dangerous. Blazes are carefully spaced to ensure that, in most cases, a hiker will have a marker in view.

strode up and cries of "Santa!" rang out.

The shelter filled with hikers. Most were headed north, but two southbounders appeared just before dark and camped on the ground. Trail talk mingled with the hiss of propane stoves.

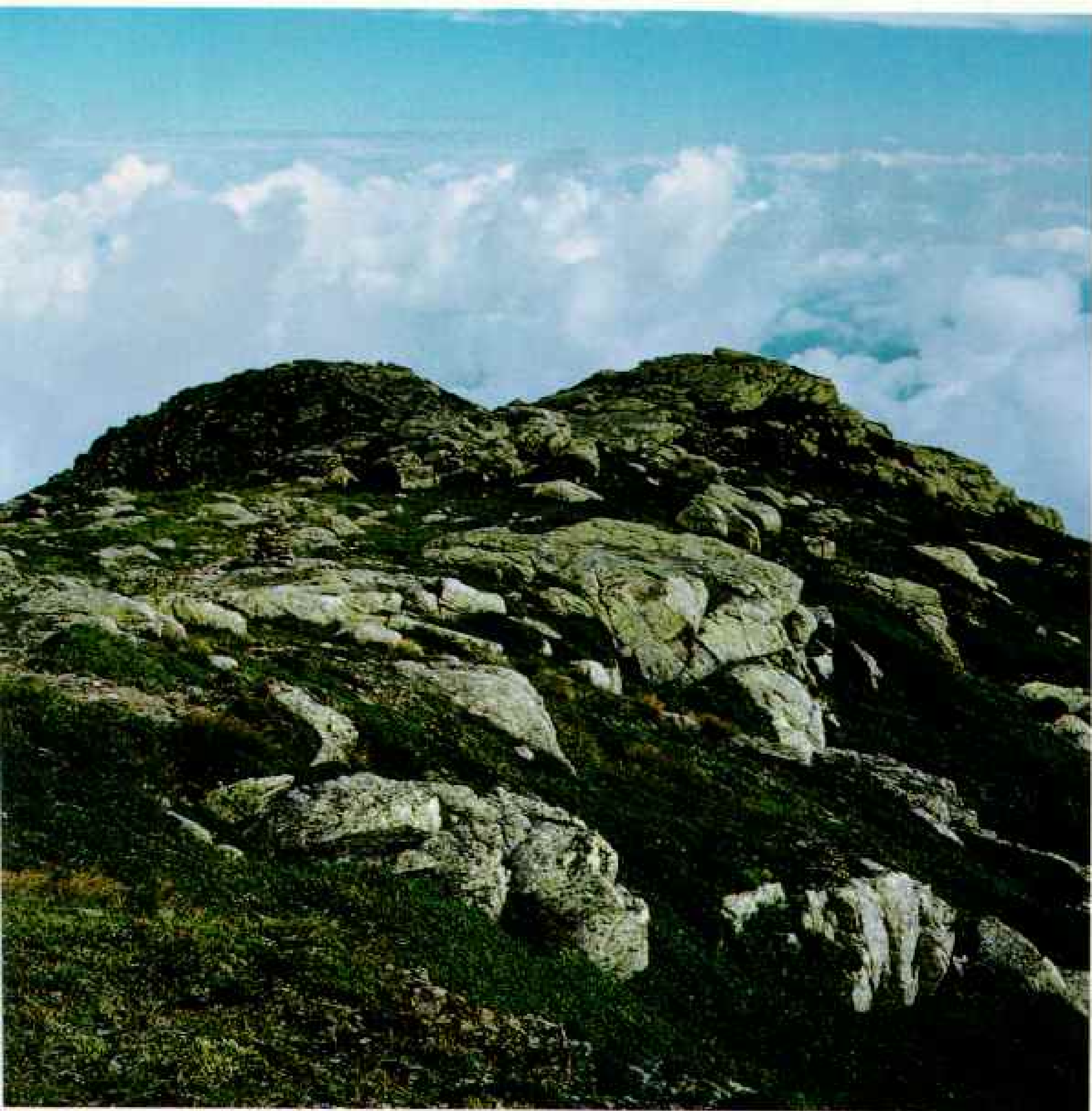
"How's the water up on Kinsman?"

"Cloudy. Take a bunch with you."

"Stew, anyone? I fixed too much."

One by one the stoves went quiet, and night herded us into sleeping bags. Talk became whispers, then faded. Santa snored.

Except for the propane, cameras, and Gore-tex fabrics, the scene could have been cut from this nation's infancy. Foot travelers



meeting, sharing shelter, exchanging food, information, and nicknames. In an era of office high rises they had walked back in time through a tunnel of green.

A sense of timelessness, in fact, had a lot to do with their presence.

"Most are people at some transitional point in their lives—divorce, job change, or just self-discovery," I had been told by Elmer Hall, former chaplain at Duke University who now lives within yards of the trail in North Carolina and offers shelter to long-distance hikers.

"It's a pilgrimage not unlike those made in the Middle Ages. Thru-hikers emphasize

self-reliance and simplicity—basic pioneer virtues rarely practiced in this country any more. If you are going to open your house to strangers, there isn't a finer group."

**T**RAIL BUMS? Hippies? Thru-hiker Harry Train was a Navy admiral. Iowan Dean Barber is a retired truck driver who for a summer became a camping chum with kids half his age. Santa is Jack Springston, a retired construction engineer. He spoke vaguely about hiking the trail in order to enjoy the outdoors and strengthen his heart, then finally he grinned and admitted, "Aw, I guess I just wanted to







*H*igh-wire act takes veteran hiker Albie Pokrob over Maine's Baker Stream on crossing cables (above), an off-trail detour necessary in times of flood. Pokrob fords the Kennebec River (left) in dangerously high waters, a means of crossing discouraged by officials, who plan to begin free ferry service this year.

prove I wasn't ready for the rocking chair."

Karen Peil, a college grad heading for a career in advertising, said many of her classmates went to Europe before going to work. "I wanted to see more of America, and I have. People have been terrific."

Thru-hikers I met were responsible slices cut from America's working class. No quitters make a walk like this.

**T**HE WAR against a hiker's resolve is waged in guerrilla style. It is fought on terrain steeper than you imagined and lonelier than you dreamed. You are harassed by a pack too heavy and a determination suddenly too light.

Domesticated, we sleep behind four walls and locked doors. Thrust into the outdoors, we find the enemy prowls in the dark to mount sneak attacks on the imagination. Alone one moonless night I turned in my sleeping bag and heard the *rip, rip, rip* of a bear tearing into my supplies. Yet next morning the pack was undamaged, still suspended from a branch. My rustling in the night had startled several deer, whose raspy snorts of alarm I had heard as tearing fabric.

There's either too much water or not enough. Hiking dehydrated to a dried-up spring is a significant taste of despair. Pulling on wet socks after five days of rain and inserting them into damp boots is all one need know of loathing.

Many urban hikers yearn for the woods and then grow bored by its silence. Crowded in cities, they crave solitude only to find it can be overdone. "I dreamed," announced thru-hiker Linwood Gill one morning, "that I was coming into a town."

"I wanted to quit a few weeks after I started," said Chuck Wood, a long-legged hiker from Pennsylvania with fire-red hair and beard. "I missed my friends and family, but how could I stop? There had been a big party sending me off, and I had dedicated the trip to my dad."

Trail friendships kept him going all the way to Katahdin. The network of thru-hikers becomes a magnet pulling itself to Maine. It turns campsites into social gatherings and town visits into reunions. The notes to one another in the shelter registers weld the bond tighter, as do the trail names they give themselves and each other.



*N*ot lacking in dramatic horizons, the trail also leads to curious sights along the forest floor. On a fallen branch in the White Mountains, a fungus called a birch polypore forms a bulbous shape (left). Light and shadow play over maple leaves on a mossy boulder to create a multihued mosaic (below left) on Mount Washington. Lacking chlorophyll



of its own to produce food, Indian pipe (above), found from Maine to Georgia, draws nourishment from other plants with the help of a root fungus.

A hard rain peppers the water like buckshot in a Vermont trailside pond frequented by a flotilla of unconcerned ducks (right).





Chuck Wood turned his name around to Woodchuck. And I met Ramblin' Rose, Sourdough Bob, Wingfoot, and Hobbit. I never caught Virginia Slim, the Pennsylvania Mountain Boys, or the Colorado Golden Girls. The Poetry Man brightened registers with his verse (recently published as *The Appalachian Tale*), including this comment on an uneven section of trail:

*These ups and downs  
tore my feet apart  
this pathmaker had  
a sadist's heart.*

Two women who knitted became Knit One, Purl One. An enamored couple called themselves the Thing With Two Heads.

A completed thru-hike is a profound experience. "It changes your life," said writer Ed Garvey, who walked the trail at 55 and plans to repeat in 1990 at 75.

"MAINE IS WHERE it's at," I was told by a hiker familiar with the northern sections of the trail. "Lots of animals—moose, bear, fishers, coyotes—and no people."

To the hiker heading north, it is the perfect final leg. Suddenly, beyond the often thin corridor of wilderness lies even more wilderness. The trail is less manicured, with fewer frills. A high-water crossing over Baker Stream is a bridge of two cables—one for your hands and one for your feet—a yin-yang balancing act.

You can schedule a ferry by motorboat to carry you across the hundred-yard Kennebec River, but many hikers wade it to save the ten-dollar fee. In the early morning, before an upstream dam releases more water, it is still thigh-deep on a six-footer. The rocks on the river bottom are rounded and greased with algae, and the powerful current sucks at your knees and battles your balance. Two weeks before my crossing, it toppled a petite woman in her early 60s, thru-hiking with her husband. Swept along, held down by the heavy pack, spunky Alice Ference drowned within 150 miles of completing the trail.

The toughest mile of the A. T. is in Maine, in a narrow valley littered with slabs of granite that peeled from cliffs on either side.

Jumbled with these 50-ton dominoes, overgrown with moss and gnarled scrub trees, Mahoosuc Notch creates a landscape more suitable to fables and gnomes. Fog swirled on the day I passed through, and occasional chill breezes from subterranean springs blew on me like dragon's breath.

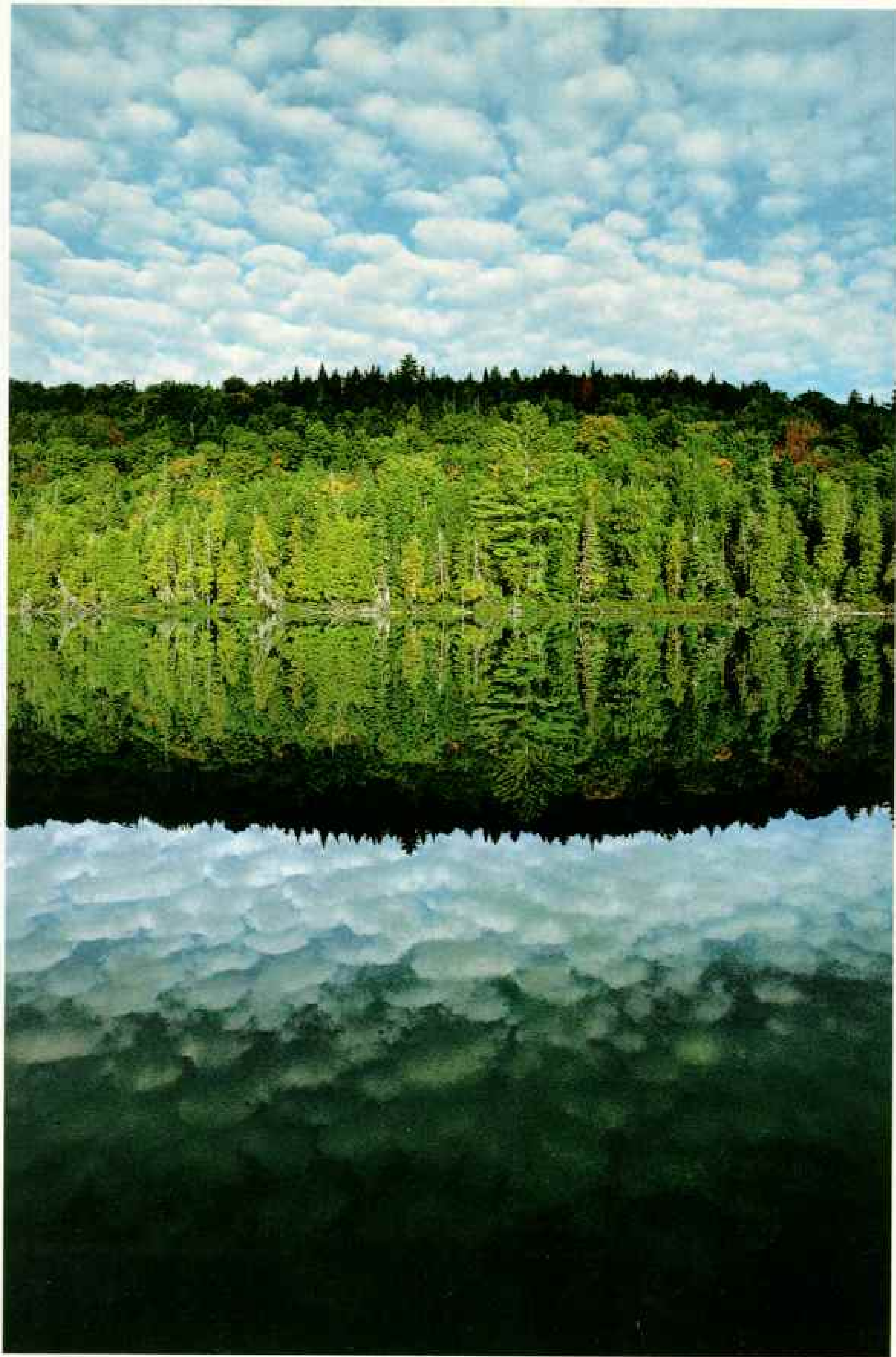
You lever up chimneys and duck walk through dark tunnels. Caves abound beneath the stacked rocks, and I followed one until time and claustrophobia won out. After two hours of gymnastics I wistfully climbed out of the notch.

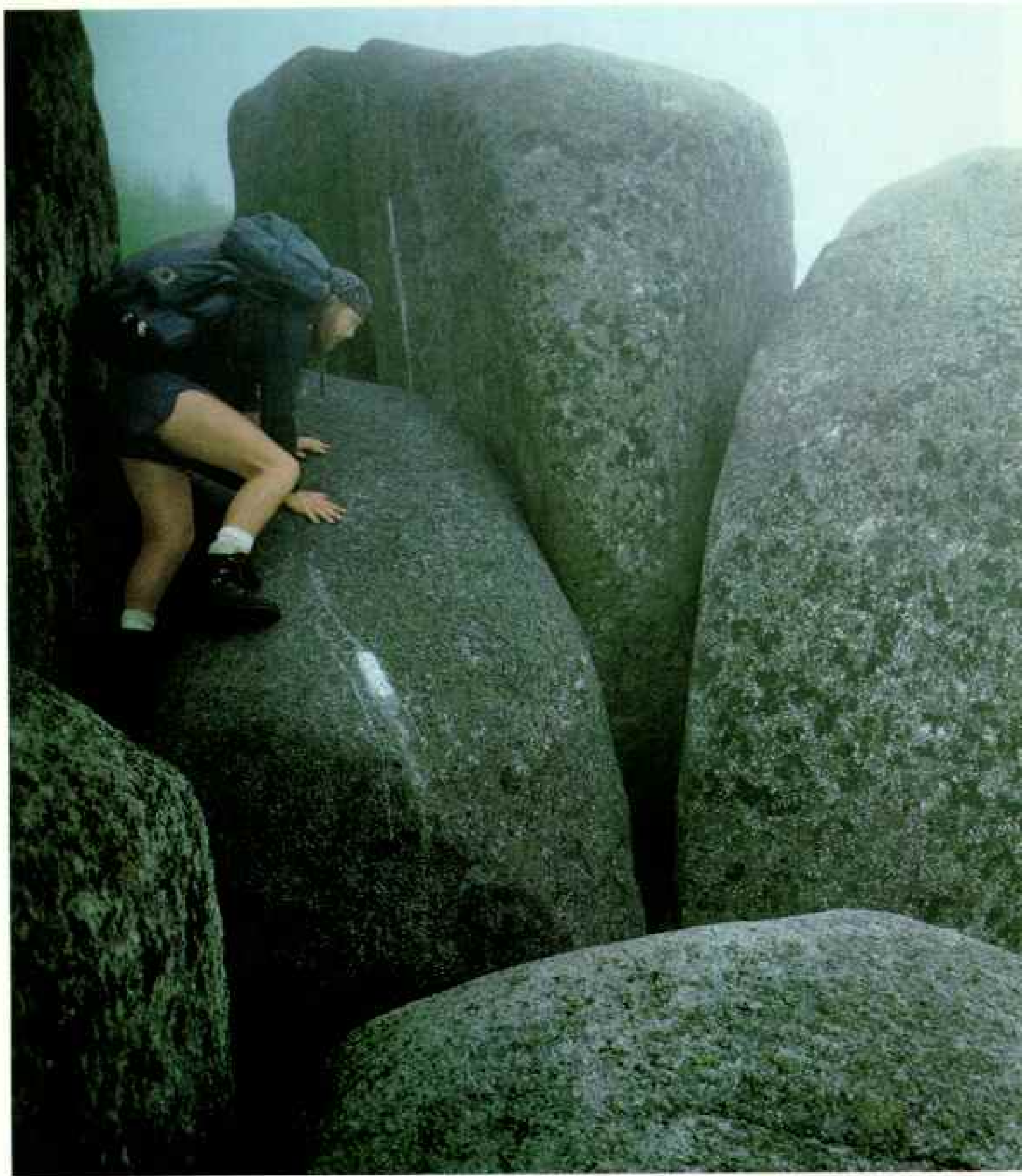
There are no towns for more than a hundred miles before Baxter State Park and Katahdin. Visible days in advance, the mountain becomes a bittersweet goal to hikers who have accepted the trail as home. "I looked forward to finishing," said Albie Pokrob, "but the closer I got, the more reluctant I was to end the experience."

It is difficult to imagine a more fitting climax to a long, exhausting journey than this rocky monolith. After a steep woodland trek the trail rises above the timberline and becomes a difficult but seldom dangerous rock climb. About a mile from the peak the mountain flattens, a chance for contemplation before the final slope up to the hiker's holy grail.

Within sight of the marker on the peak, Mark Miller, a 20-year-old thru-hiker from Connecticut, stopped, put a hand on each side of his head and shouted, "My God, this is incredible!" Then he rushed forward to embrace the wooden crosspiece. Ben Brantley, a geology student from Memphis, Tennessee, touched the sign that marked the end

*Nature doubles her autumn beauty in the placid waters of Maine's Rainbow Lake. So numerous are the scenic attractions of the trail's northernmost state, says photographer Sam Abell, that he overheard many a hiker exclaim: "I'm hurrying up here so I can slow down in Maine."*



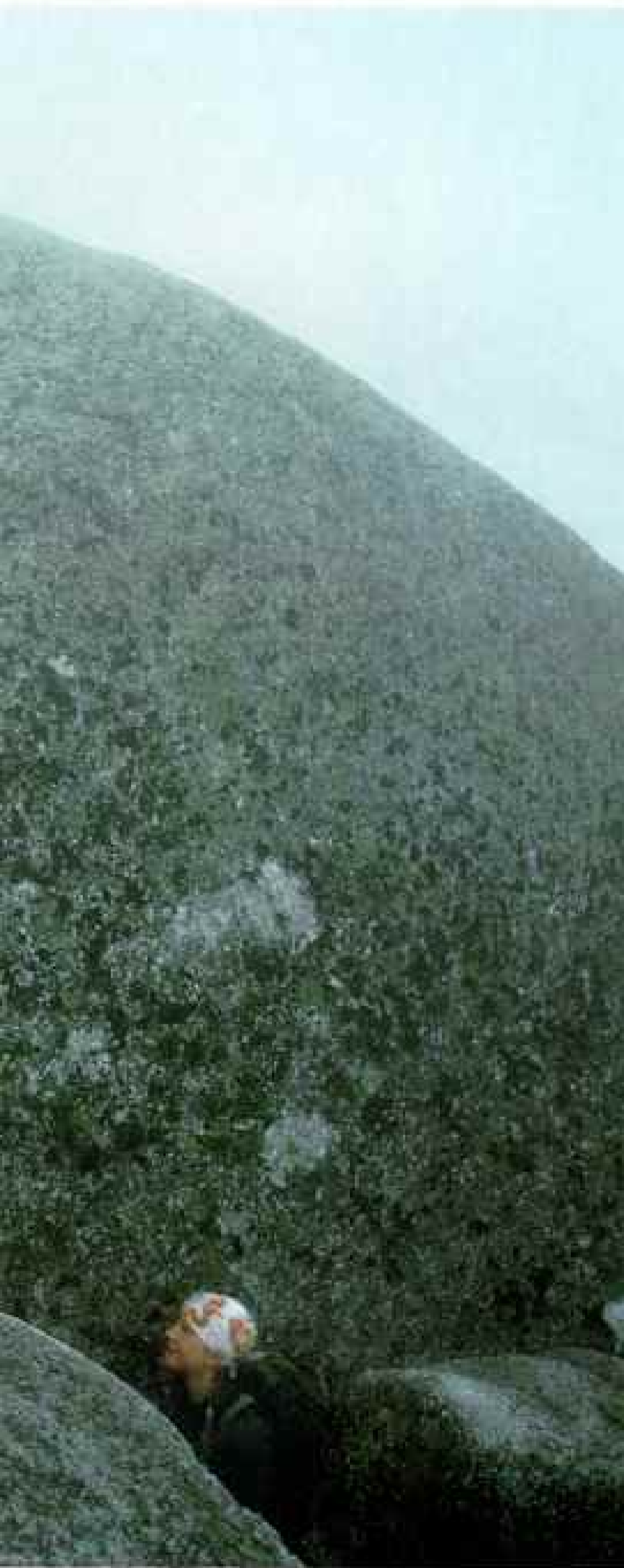


of a six-month journey, looked at it for a moment, then walked away to sit quietly alone.

"The A. T. changed my perspective about people and about my country," he told me when sufficient time had passed. "I felt like a stranger in a foreign land going into some northern towns, but never for long. And I talked to New Englanders who felt that way about the South. The trail has a way of bringing people together."

**I** REMEMBER a morning on a rocky outcrop above the Pennsylvania town of Duncannon beside the Susquehanna River. The A. T. passes through its heart, as I had early that morning when the town was beginning to stir. I had peered at a gingerbread-trimmed house under restoration, with ladders all around it, and admired another with endless gables that could have been drawn by Norman Rockwell.





*T*rail's end marks a new beginning for Dawson and Sugar Wheeler, scrambling up Maine's Katahdin mountain (left). The Chattanooga, Tennessee, couple embrace at the top (above) after a six-month honeymoon hike of the entire trail. Said Sugar: "I think we're stuck together for life now."

When my gawking led me off route, a dark-bearded young man gave directions and walked with me until I found the white blazes. Ten minutes later a car passed, and a young woman honked and waved. Next to her sat the dark beard, and I waved in reply.

I had struggled up a rock-toothed slope to reach the outcrop for my look back at the town, one that might have rated a glance had I whooshed by in a car. Via the trail I

had impressions of a community where people rescue handsome, aging homes from the wrecker. I had friends there, however brief the encounter. The geology around the town was programmed in my sinews; its rocks held my sweat.

I know something of a place called Duncannon. Just as all long-distance travelers on the Appalachian Trail know something of America. □



## *Shakespeare Lives* AT THE FOLGER

By MERLE SEVERY

ASSISTANT EDITOR

Photographs by NATHAN BENN



LONE FIGURE moves slowly onstage, wrapped in a winding-sheet of thought. Hamlet, Prince of Denmark, begins his famous soliloquy: "To be, or not to be, that is the question. . . ." Words that speak not only to the turmoil in Hamlet's heart but also to the distress of those who fear this theater itself might die—the Elizabethan theater in the Folger Shakespeare Library in Washington, D. C.

In 1970 this stage became a living theater—like Shakespeare's own lusty Globe Theatre come to life. Productions, impressively mounted, lost money, leading to a somber scene the winter before last in a New York City boardroom. There, 18 trustees of Amherst College in Massachusetts, who oversee the Folger Library under founder Henry Clay Folger's will, assessed rising deficits and ruled: The Folger's professional resident acting company—distinguished for its commitment to the classics—was "not to be."

No more would regular productions, in the warm embrace of this "wooden O" with its carved galleries, portray the rage of Lear, playfulness of Puck, scheming of Iago, or the passion of Juliet.

The news struck like a bombshell. Protests came from across the

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*Shrine to the Bard of Avon, the Folger Shakespeare Library in Washington, D. C., preserves the world's greatest collection of Shakespeareana. Opening in 1932, the library, its Elizabethan theater, and exhibition hall provide a vibrant center of Renaissance studies.*

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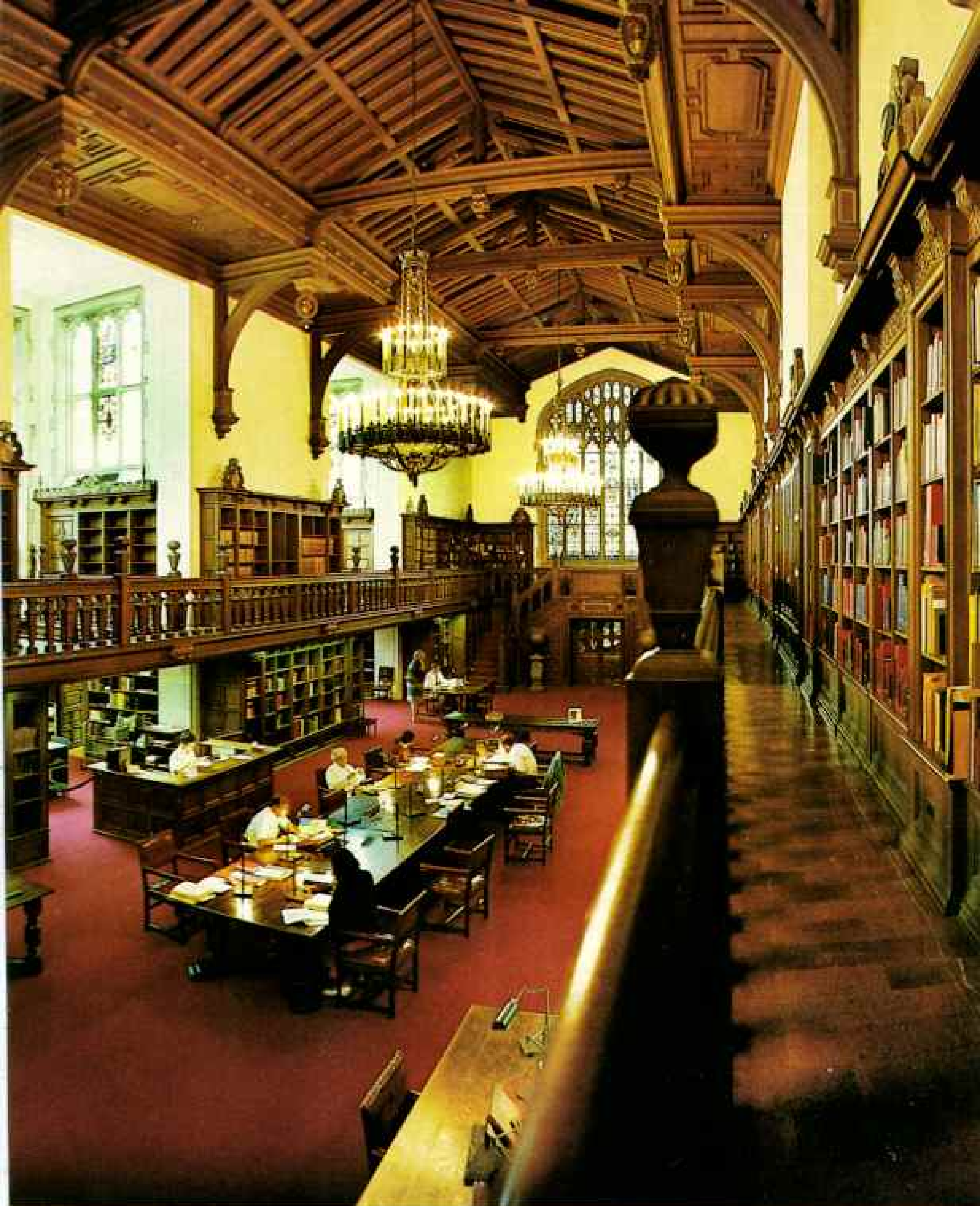


*Silence rules in the main reading room of the Folger Library, where accredited scholars have at their fingertips some 250,000 volumes, nearly a third of them rare, as well as a superb collection of manuscripts, playbills, and other memorabilia spanning the last five centuries.*



*Gazing out over this quiet domain is a portrait of Henry Clay Folger (far left), the American philanthropist who left his fortune — and priceless collection of rare books — in trust to his alma mater, Amherst College, to found the library dedicated to William Shakespeare in the nation's capital.*





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*Beyond the reading room with its Tudor-Jacobean decor lies the greater world of today's Folger, where the dignified hush of scholarship is sweetened by the sounds of actors rehearsing, poets reciting, musicians playing, and children laughing — keeping alive the Shakespeare legacy.*

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nation: "Tragic!" "The Bard belongs not just on library shelves but on a living stage." "A study of Shakespeare's world without a passion to see his plays is like a study of agriculture by persons who have renounced food." Other letters voiced fear that theater involvements impaired the Folger's research library role.



**T**HUS DID CONTROVERSY draw our nation's attention to one of America's most remarkable—and least known—national treasures. The Folger Library, dedicated to the most universal dramatist mankind has produced, not only possesses the greatest collection of Shakespeareana on earth, it also preserves the heritage of the Renaissance and the age of reason: the turbulent age of Raleigh, Drake, and Elizabeth I; of Bacon, Milton, and Newton. An age that formed the colonial foundation of our American nation, that expanded our geographic horizons, shaped the philosophical and scientific concepts of our modern world, enriched our language with the rhythms and sonorities of William Shakespeare and the King James Bible.

As a Folger devotee for 30 years—reader, lecturer, symposium panelist, relishing its concerts, festivities, and theater—I followed the crisis closely. Congressional reaction included a proposal for federal support. Citizens groups formed; donations came in. The City Council urged Amherst's board to reconsider.

Graciously, it did, and granted a stay of execution for the acting company, provided the theater incorporate itself, raise its own funds, and take charge of its own deficits.

A prominent Washington attorney and community activist rose to that challenge. "I'd have been an English professor if World War II hadn't diverted me," R. Robert Linowes told me. Now he undertook an even greater service to literature.

In July 1985 the theater, newly established as the Shakespeare Theatre at the Folger, became independent. Linowes opened its first board of trustees meeting with "Now the theater sets its own course, responsible for its own destiny." Top priorities: funding and restructuring.

Its financial base broadened by corporate fund-raising, wide academic ties, and upcoming performances in New York and South Carolina as well as in Washington, the theater launched its 1986-87 season with a "rich and riveting" *Romeo and Juliet* under a new artistic director, Michael Kahn, whose work on Broadway and in regional theater has won awards.

"This theater," Linowes told a benefit audience, "was designed to bring to life, to a far wider audience, the magnificent Shakespearean folios housed next door in the library. Our goal is to make it *the* preeminent classical stage in the country, a beacon for theater audiences from around the world."

The challenge is great. Folger subsidies—\$330,000 this year—end with the current season. A matter of money, of course, as in the beginning. Except then it was 25 cents.

Twenty-five cents. The cost of a lecture ticket that in 1879 put Amherst student Henry Clay Folger under the spell of Ralph



FOLGER SHAKESPEARE LIBRARY





WILLIAM DURAY

*Love for Shakespeare* drove Henry Folger (left), a self-made millionaire and chairman of Standard Oil, to unobtrusively acquire the world's largest collection of rare Shakespearean editions. Crossing the Atlantic many times in their quest, Folger and his wife, Emily (herself a literary scholar), quietly filled their Brooklyn home—and later fireproof warehouses—with books, manuscripts, and other Shakespeareana. Then, following Folger's death at 72 in 1930, came the stunning revelation of his lifetime collection, fulfilling his plan to endow a "dwelling place for the spirit of Shakespeare" in

the District of Columbia.

Today the Folger preserves treasures ranging from the only known quarto of *Titus Andronicus* to the enamel medallion (right) given by fellow players to David Garrick, foremost Shakespearean actor of the 18th century.

The library also sponsors annual Shakespeare festivals, inviting students to the Folger (above) to enact scenes from Shakespeare's plays, echoing the poet's words in *Julius Caesar*:

"How many ages hence  
Shall this our lofty scene  
be acted over  
In states unborn and  
accents yet unknown!"





Stitching new life into old volumes, the Folger's conservation department uses age-old bookbinding skills and state-of-the-art equipment to preserve the library's collection. Here an expert restores a book by stitching linen-fiber thread to strips of alum-tawed goatskin—a binding technique older than the 16th-century text he is working on.



Waldo Emerson, whose admiration for the "orbit and sum of Shakespeare's wit" changed Folger's life. Marrying Emily Jordan (whose Vassar master's thesis, "The True Text of Shakespeare," the library owns), the future chairman of Standard Oil began collecting everything relating to the poet they both loved.

**S**TARTING with a \$1.25 copy of Shakespeare's works, Folger bought his first rare book in installments, for a total of \$107.50. Purchases escalated with his success—yet often left him in debt despite the fortune he made fueling the new automotive age. Competing for Shakespeareana with California railroad magnate Henry Huntington and other moguls, the shy, shrewd oil tycoon, checklist at his elbow, cabled agents to settle on the spot with cash, forestalling offers topping his ten to one.

Once, at golf, his boss questioned his business sense: "What's this about \$100,000 for a book?" You know how the press can



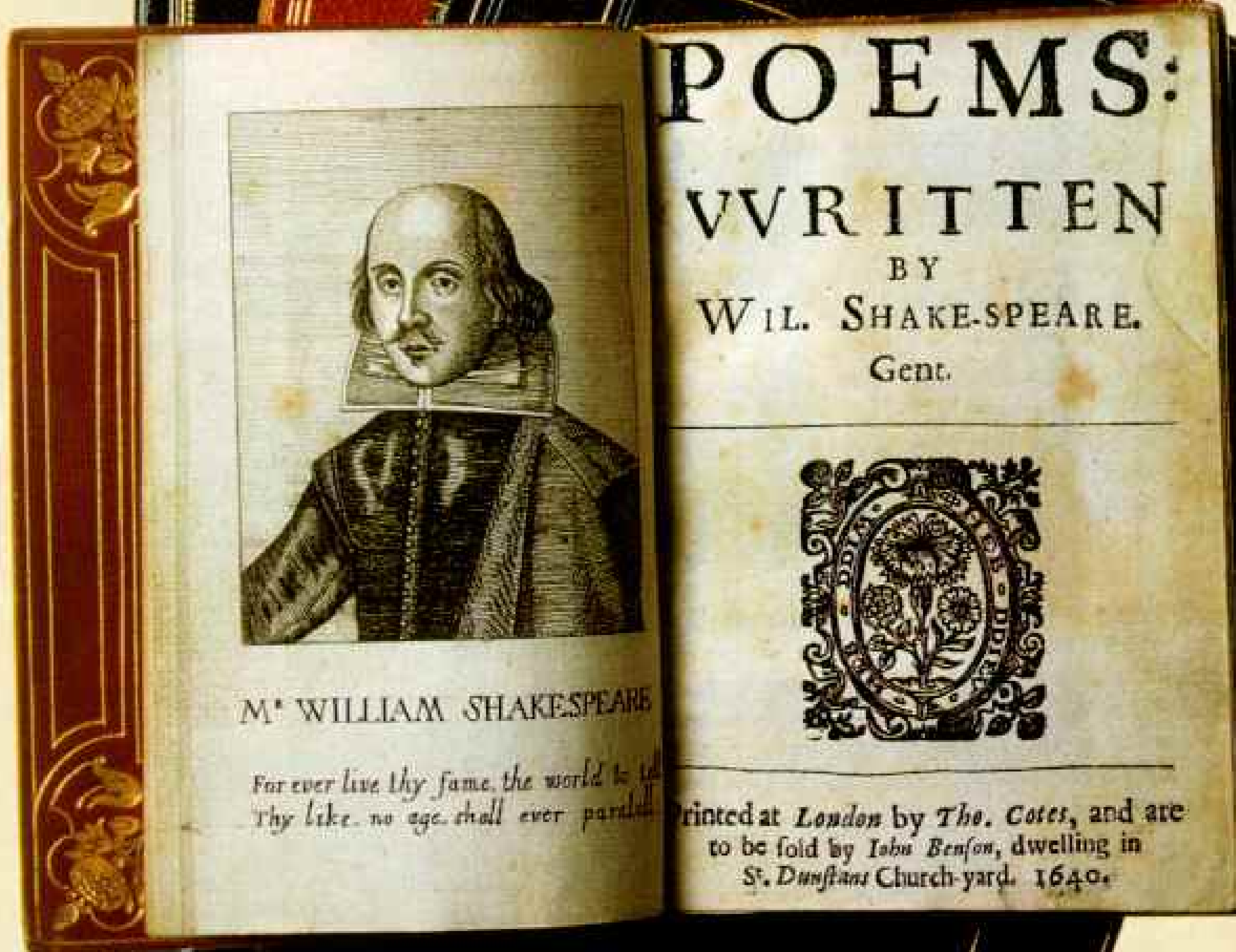


exaggerate, Folger dissembled; buy something for \$10,000, and the papers make it \$100,000. John D. Rockefeller expressed relief. No Standard Oil president would be fool enough to pay \$100,000 for a book!

For 40 years Henry and Emily collected and cached, filling box after box with books, manuscripts, actors' promptbooks, playbills, paintings, costumes, mementos. Living simply, with little space in their New York home, regretfully they sent the literary adoptions of their childless marriage to bank vaults and warehouses until they could provide a home fit for them. Finally, in the late 1920s, they planned a splendid library—not in Shakespeare's Stratford-upon-Avon, not in the Folgers' New York City, but in Washington, D. C.—on Capitol Hill, near the U. S. Capitol and the Supreme Court, and next door to that supreme repository of printed knowledge, the Library of Congress. A gift to the American people, it would also include a retreat—today called the Founders' Room—where the couple could live amid their books.

Two weeks after laying the cornerstone, Henry died. Emily

*Washing machine for rare art on paper, the Folger's ultrasonic humidifier (above) gently deep-cleans by pulling purified water vapor down through the paper's fibers with a vacuum device. Manning the plastic dome, Folger head conservator J. Franklin Mowery uses beams of light to bleach stains without damaging paper or ink.*



**Shakespeare plus:**

A London printer issued this volume containing many poems not written by the Bard. For scholarly comparison, the Folger preserves various versions of Shakespeare's plays, which show the vagaries of Elizabethan publishing.

survived to see the classic white marble building completed, the long-hidden collections installed, and the library dedicated in 1932 on April 23, Shakespeare's birthday. Today their ashes rest in an alcove there, under a bust of Shakespeare.

While the Folgers garnered Shakespeareana, Sir Leicester Harmsworth, an English newspaper magnate, was collecting 11,000 works printed in England from 1475 to 1640 on everything else. Corraling this collection in 1938, after Sir Leicester died, Folger director Joseph Quincy Adams transformed the Folgers' literary shrine into America's foremost historical library on 16th- and 17th-century English civilization.

In his two decades as director, South Carolina historian Louis B. Wright, who came from California's Huntington Library in 1948, added more than 40,000 English and continental rare books and expanded Folger publications and fellowships.

It was Wright's successor, O. B. Hardison, Jr., a lanky Renaissance scholar and essayist, who breathed life into the Folger theater. He rejected long-held notions that it was only an exhibit, not intended for performances.

"Then why have dressing rooms and stage lighting?" he asked as we discussed his 14 years as the library's director. "And why did Mr. Folger make his library the only one in the world with an Elizabethan theater—'to be used,' in his architect's words, 'for the presentation of Shakespeare's plays in their original staging.'"

Within months of arriving from the University of North Carolina in 1969, Hardison had the theater operational, later establishing an acting conservatory and Shakespeare festivals for schoolchildren. In 1970, with four universities, he founded the Folger Institute, a center for advanced study of the Renaissance and the 18th century. Twenty-two universities now participate—throughout the eastern United States—as well as the Newberry Library in Chicago, with its cluster of midwestern universities. He drew international scholars for conferences and jubilees honoring Petrarch, Luther, and other giants. The prestigious *Shakespeare Quarterly* became the library's journal. The Folger Consort, a fine early music ensemble, took up residence. Meanwhile, Hardison masterminded an 8.5-million-dollar modernization and enlargement of the library.

Today more than 200,000 visitors a year come from all over the world to study changing exhibits of rare books, costumes, and mementos, to buy Shakespeare greeting cards, to attend concerts, lectures, and poetry readings.

The Folger outreach even puts the Bard behind bars. In a prison near Pittsburgh, correctional institution teacher Dr. Robert Fowler, a black champion of the underdog fresh from a Folger "Teaching Shakespeare" summer institute, tells teenage inmates, "Shakespeare talks about real stuff—sex, friends dying, things you want but can't have." His street-smart listeners understand.

*Back-to-back Psalms and New Testament fill this embroidered English dos-à-dos volume, shown here three-fourths size. Its French-style binding was fashionable in 1610, when the book was published.*

*To protect its treasures, the Folger operates an elaborate environment-control system that keeps temperature and humidity constant throughout the building. Even slight fluctuations can cause chemical changes and abrasive movements of paper and binding.*







A tragic hero is portrayed by Elmore James (left) in a recent Folger production of *Othello*—the story of a man who “loved not wisely, but too well” and is thus undone by jealousy.

To emphasize the timeless meaning of the play, director Mikel Lambert (below, center) dressed her company in modern military costume (right). “Modern dress helps the audience tune in,” she says. “I don’t think Shakespeare would mind.”

Belt-tightening by the Folger’s trustees recently threatened theater subsidies. Spurred by public support, the playhouse reorganized as the Shakespeare Theatre at the Folger—an independent company responsible for its own finances.



At the Bard’s birthday bash in April the Folger opens wide—even its sacrosanct reading rooms—to several thousand citizens who flock there, many in costume.

“You’d never see this in Europe, where the research library is an ivory tower,” the present director, Werner Gundersheimer, told me. He had arrived in his “bardmobile”—a Honda with BARD on its license plates. Gundersheimer, a historian of Renaissance Italy and France who taught at the University of Pennsylvania, continued: “Imagine the director in a T-shirt!” His was lavender, emblazoned: Folger Shakespeare Library.

“Your aims for the Folger, Werner?”

“To make this the greatest Renaissance research library



in America." Among its varied programs are seminars and workshops that draw top scholars from many nations.

I attend a seminar on England's early years in America, which explains much about our nation's roots. This also leads me to such Folger treasures as Capt. John Smith's *Generall Historie of Virginia* (with its engraving of his rescue by Pocahontas) and to *Joyfull Newes Out of the Newe Founde Worlde*, extolling the medicinal virtues of "certaine Hearbes . . . and Drugges of the West Indies" such as tobacco—against which King James I directed his *Counterblaste to Tobacco*. A colloquium on Renaissance women draws me back evenings. Moralists of the time arraigned them as "Lewde, idle, froward, and unconstant"; yet

Shakespeare ennobled them in all their range—from intelligently commanding Portia to fragile Ophelia, fiery Beatrice.

From the 250,000 books, the most valuable kept in vaults and stacks deep underground, reference librarian Nati Krivatsy pulls out Chaucer's *Canterbury Tales*, printed by William Caxton in 1478; the sumptuous *Nuremberg Chronicle* of 1493 with its 2,000 woodcuts (but no mention of the discovery of America); the unique 1594 copy of Shakespeare's *Titus Andronicus*.

Laetitia Yeandle, curator of the 50,000 manuscripts, shows me the warrant releasing Sir Walter Raleigh from the Tower of London, then unrolls a 30-foot scroll listing New Year's gifts of gold, jewels, and finery to Elizabeth I from her nobles.

We were joined at table by a cluster of colleagues for the three o'clock tea, a charming custom that daily brings scholars and some of the eighty or so staff for a cordial exchange of ideas.



HE DEAN of early readers in the Folger reading room, George Winchester Stone, Jr., reminisces on the 1930s—days of “the curious many and the serious few,” when guards clocked visitors by the hundreds to the exhibition gallery while reading-room “day books” averaged only four scholars. Working on a biography of Shakespearean actor David Garrick, Stone agreed to catalog the Folger's 3,000 Garrick items. Then, using playbills, Drury Lane Theatre account books, diaries, a wide range of Folger materials, he began to compile “coffins” of file cards recording day-to-day London stage happenings from 1660 (when the Restoration reopened theaters, those dens of “lascivious mirth and levity” the Puritans had closed 18 years earlier) to 1800. Thirty-five years and many thousands of cards later the task was done; 44 years after Stone began, the 12th and final volume of his monumental, collaborative *London Stage* appeared.

Through the years more scholars have come to pursue an ever widening variety of subjects. Professor J. Leeds Barroll of the University of Maryland, working with Tudor and Stuart proclamations, state papers, correspondence, chronicles, broadsides, and bills of mortality in the Folger, is exploring the effect of the bubonic plague on Shakespeare's career. It carried off a quarter of Stratford's people in his birth year of 1564—but spared him. When plague closed London's theaters for 18 months in 1592 to 1594, his enforced leisure bore fruit in two long narrative poems, *Venus and Adonis* and *The Rape of Lucrece*. During later years when plague raged around the empty theaters, his company performed in royal halls before James I and peers of the realm—plays for an aristocratic taste, *Othello*, *King Lear*, *Antony and Cleopatra*, *The Tempest*, *Macbeth* (a Scottish play including witches for a Scottish king whose treatise on witchcraft the Folger conserves).

A discreet chuckle in the reading room's silence drew my eye to Peter Blayney. “Look.” He pointed to an inverted ornament. “They don't care.” Peter refers to Elizabethan printers in the present tense, he knows some 60 so well. A motley crew. “We







*Imagination works overtime as *A Midsummer Night's Dream* transforms the Folger's stage into the magical realm conjured by the poet about 1595. The theater is modeled on the innyard playhouse common in Shakespeare's time.*



Literary treasures such as Thomas à Kempis's *Opera* (Latin for "works"), published in 1494, are kept locked away in the Folger's climate-controlled vaults. Relic of an age when the art of printing was new and books costly, the volume's chain tethered it to a shelf for safekeeping.

The library seeks to acquire, in some form, every book printed in England before 1641. It now has two-thirds of these in original editions.

printers," lamented one, are called upon to publish so much news of everything that "marvayle it is, how that our wittes can last." Even so, this 1591 printing by John Wolfe of Bertrand de Loque's *Discourses of Warre and Single Combat* was a bit much. Of 22 ornaments in its 76 pages, three were upside down—including Wolfe's own trademark!

At Cambridge University Peter began a minute analysis of the first edition of one play, *King Lear*. His new research, which may take ten years, includes the printers of 18 Shakespeare plays. "All but one of the quartos were first printed between 1593 and 1609," he told me. "I'm examining 8,000 books, nearly half of them in the Folger. When I finish, scholars will be better equipped to learn what Shakespeare intended."

Shakespeare *intended*? Weren't his sacred words cast in concrete? Actually, he published none of his plays. Playwrights wrote for the ear, not the eye; the occasion rather than eternity. During Shakespeare's life 18 of his plays appeared singly in quarto editions, probably pirated. Seven years after his death two longtime colleagues, John Heminge and Henry Condell, gathered and "cured" his works in the famous First Folio of 1623. Half his plays appeared here in print for the first time.

"Unfortunately the precious First Folio is one of the worst printed books ever issued," went one 19th-century opinion; 20,000 errors, clucked another. So a Shakespeare industry was born—including collating copies of the First Folio edition. The Folger possesses 79, one-third of the world's known total.

From his day to ours, Shakespeare's text has traveled a rocky road. Those upset at the "bowdlerized" *Family Shakespeare* of 1818, in which the Reverend Thomas Bowdler cleans up expressions "of such a nature as to raise a blush on the cheek of modesty," will be outraged at the mayhem committed on Will's corpus by Restoration impresarios. One trotted "Shakespeare" onstage to testify how much his "rude Sketches" had been "improv'd." Another gave *Romeo and Juliet* a happy ending!



IN MAY yellow buses pass the U. S. Capitol and pull up before the Folger to disgorge swordsmen, kings, Romans in bed sheets, fairies, witches, kilted Scotsmen, ladies smashing in velvet gowns and tiaras—school groups here for the Children's Shakespeare Festival, some from as far away as New York and Connecticut.

A shrilling of recorders. In the Folger theater the chatter, giggles cease. Bells tinkle. Preceded by her jester, Her Gracious Majesty Queen Elizabeth sweeps in.

"I shower a welcome on you, welcome all. Your presence glads our days," declaims our Elizabeth, docent Kathryn C. Avery. "The play's the thing. Let the festivities begin!"



A fairy-tale wood outside Athens, the Roman Forum, a Renaissance mansion: scenes follow in 20-minute snatches. Girl Hamlets, Mark Antonys, and Falstaffs are a switch on Shakespeare, and ten-year-old Lady Macbeths wringing their hands, trying vainly to wash out that "damn'd spot."

Moon-shaped faces peer over railings festooned with school banners. Not a dry eye for the death scene in *Othello*; roaring, stomping at antics of Bottom and his fellow buffoons in *A Midsummer Night's Dream*.

Even when they break at midday, they're into their roles. A roughouser cries, "A hit, a very palpable hit!" Outside the library a docent eases down on the grass beside a boy in Renaissance apparel. "What's your name?"

"Petruccio."

After 30 schools, education coordinator Peggy O'Brien watches the last bus depart and slumps in her chair. The phone begins to ring. "You left your crown? A goblet? Does your sword have a gold handle?" Then come the letters. "Even though I was a meer stagehand," writes a girl with a flair for Elizabethan spelling, "I had immense fun and learned plenty. I saw plays I have heard of but never seen. The Folger is really neat."

Not a bad investment, Mr. Folger. That 25 cents. □



An ongoing Renaissance is the Folger's goal, says Director Werner Gundersheimer (top), at ceremonies reopening the Elizabethan-style Great Hall. A recent remodeling and facelift revealed floor designs (above) obscured by 50 years of wax.





# HEROD THE GREAT'S CITY ON THE SEA



## CAESAREA MARITIMA

By ROBERT L. HOHLFELDER

Photographs by BILL CURTSINGER

Paintings by J. ROBERT TERINGO

ASSOCIATE ART DIRECTOR

**T**HE SEA crashing on the beach woke me at 4:30 a. m. During the night a storm had moved in from the Mediterranean. I looked out my window to see five-foot waves rolling onto the beach near our dormitory at Kibbutz Sedot Yam on the Israeli coast between Haifa and Tel Aviv. No diving today.

My real worry was our diving barge. Had the anchors held? Or would we find the platform of Scandinavian pine frames, plywood, and oil barrels scattered in pieces along the shore, putting us out of action for the rest of the summer's excavations?

We piled into a van for the short drive to the warehouse headquartering our expedition—archaeologist colleagues John Oleson of the University of Victoria in British Columbia, Lindley Vann of the University of Maryland, and I. Project director Avner Raban of the University of Haifa met us with the news: “The waves flipped the barge. It’s holding steady, but the two seaward anchors are gone.”

I saw barrels bobbing in the surf. No telling how much else was left. “Can we save it, Avner?”

*The harbor Herod built, outlined by underwater shadows, lies in shallows off the Israeli coast (left). Some 2,000 years ago, Caesarea Maritima welcomed ships like the one carved in carnelian (above) to its harbor, called Sebastos. Featuring innovative design and hydraulic concrete, this building feat by a king given to grand gestures set a standard for harbors to come.*



**A** monumental work, city and harbor were constructed on an unstable, storm-battered shore at a site lacking a protective cape or bay. Herod the Great, King of Judaea from 37 to 4 B.C., named the city Caesarea for his patron, Caesar Augustus, Emperor of Rome.

Freighters sailed up to but

not into the harbor, where they were met and towed in. Two towers topped by six colossal statues **A** marked the entrance. In the harbormaster's building **B** ship's taxes were collected; a chain gate may have controlled entry. Wood or oil fueled the fire of a lighthouse **C** that guided ships to the port by day or night. Storage vaults lined the 600-

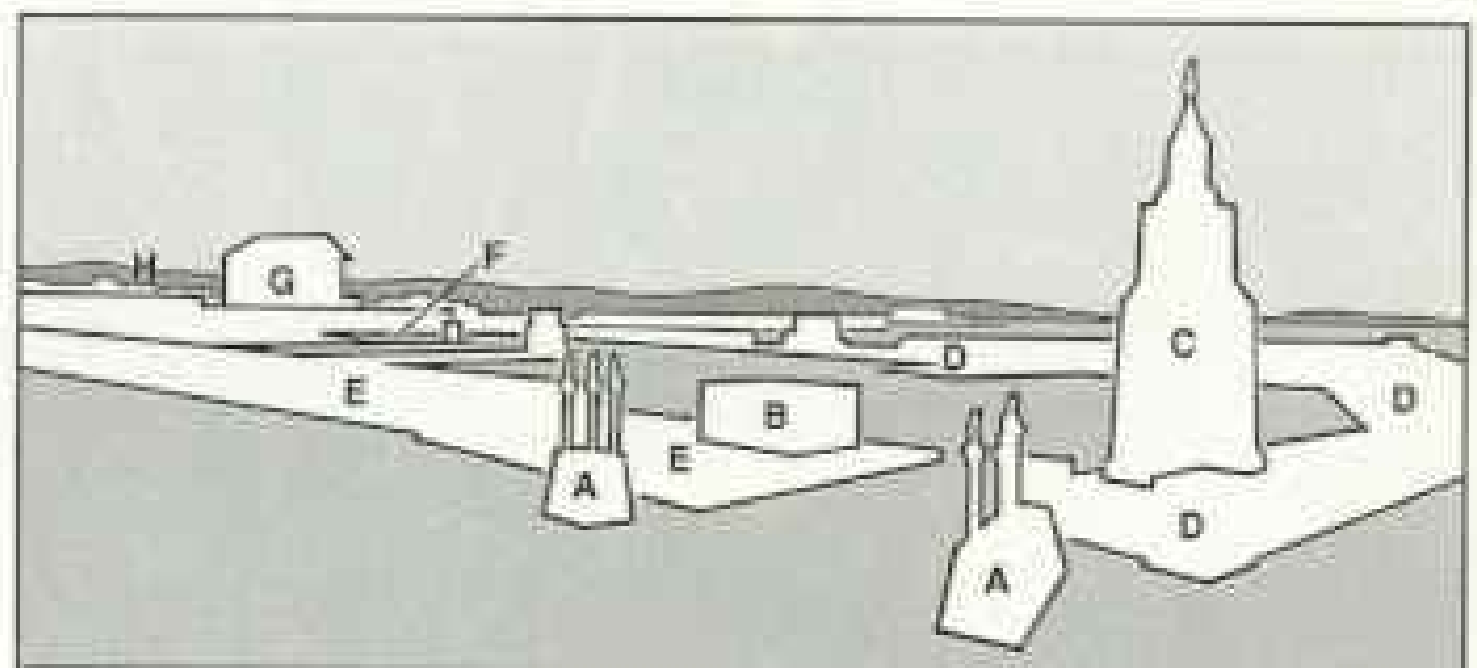
yard-long south breakwater **D** and the 300-yard-long north breakwater **E**. An inner harbor **F** enabled ships to anchor at the base of the temple to Augustus and Rome **G**.

The project challenged the ingenuity of Rome's most skilled engineers. Among innovations not depicted: a subsidiary breakwater that paralleled the





southern mole and helped dissipate the impact of waves. A sluice system periodically flushed the harbor to prevent silting, a problem exacerbated by a strong south-north current that carries massive quantities of sand from Sinai. Augustus' second-in-command, Marcus Agrippa, made a state visit to Caesarea H in 15 B.C.









**T**HE KING . . . overcame nature," wrote the Jewish historian Josephus.

Crucial to success was a corps of professional divers. Although capable of free diving 90 feet or more, they only worked in depths of nine to twelve feet at Caesarea. Ancient ships drew as little as six feet.

Concrete blocks, some weighing 50 tons, anchored the north breakwater. Double-walled wood forms constructed near shore were towed into

position over a foundation of boulders on the sandy bottom. Waterproof mortar packed between the double walls sank the form. Workers lowered concrete in baskets. When set, the foundation was paved with stone. A rubble barrier at the seawall barred undertrenching currents. Volcanic ash, key ingredient in hydraulic concrete, and wood for forms were imported, probably from Italy. "There was no room for mistakes," the author says.



He looked at the waves. I could see he was thinking of other rescues during his Israeli navy career. "Too risky; we'll have to wait."

For two days our staff and scores of volunteer divers from around the world stood by. As an explorer of submerged coastal settlements like Caesarea Maritima, you learn to expect days lost to storms.

As soon as the seas abated enough to let our Zodiacs—outboard-powered inflatable dinghies—out of the modern fishing harbor, we towed in our upside-down barge and, with lines to a tractor ashore, flipped it. Everything topside was gone. But the hard-to-replace timber frames were intact.

Steve Breitstein, our operations director, set search-and-repair teams to work. Two days of scouring the ocean floor recovered everything but the 12-volt battery that powered our radio and night-warning beacon. A week saw the barge once more in position, fully operational. This time the sea had

been easy on us. Next time...? The Mediterranean is a demanding partner.

SIX YEARS EARLIER, in 1978, when I first sailed to Israel from Greece, my mind was not on the frustrations of underwater archaeology. Filling it were the glories of an ancient city, my destination. Two decades before the birth of Christ, Herod the Great, King of Judaea, set out to create an international metropolis on the coast of Palestine where no major city had ever stood before. In a career marked by grandiose building projects—the Temple in Jerusalem, the winter palace in Jericho, the lofty Dead Sea citadel of Masada—this was to be his crowning achievement: Caesarea Maritima, rival to Alexandria in the eastern trade, a city in opulence and magnificence worthy to be named for Herod's patron, Caesar Augustus, master of the Roman world.

We don't know when the dream of Caesarea first came to Herod. It may have happened during his



## Caesarea links East with Rome

COINS of the realm include a bronze piece (top) struck at Caesarea in the second century A.D. It shows Tyche, goddess of fortune, who personifies the city. Another bronze coin (middle left) marks Caesarea's founding. Not



every city minted coins; that Caesarea did reflects its status. Coins, often a propaganda tool, portrayed an "official" version of events. An A.D. 70 bronze Roman coin (middle right) celebrates victory over the Jews while the war was still being fought. A silver coin of the same year (bottom) honored Emperor Vespasian. Caesarea was on a major east-west trade route (map); Byzantium and Rome lay 20 to 60 days away by sail. The harbor handled local products—wine, flax, and grain—and silk and spices via caravan from Asia. Herod hoped Caesarea would supplant Alexandria as the region's premier port. The gamble failed. His harbor, built on a fault, started to sink soon after completion. Following Herod's death, Rome was stuck with more harbor than needed and let it deteriorate. The Byzantines revived it. A diver (top right) examines part of a form used to cast a concrete block.



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meetings with Octavian, who in 27 B.C. would become Augustus, the first emperor of Rome. Herod had been a loyal follower of Mark Antony, Octavian's enemy in Rome's civil war, but switched his allegiance after Antony's defeat.

In a diplomatic stroke Herod not only saved his own life, persuading Rome's new master that he would be a dependable client king, but he also acquired new territory on the coast of Judaea and Samaria. It included this strip of sand where the ruins of a Phoenician settlement stood, together with an ancient roadstead. On this site Herod would establish a city majestic enough to impress even an emperor of Rome.

**C**AESAREA would become as rich in history as in monuments. From this capital Pontius Pilate, notorious in Scripture for condemning Christ, ruled Roman Judaea. The Apostles Peter and Paul preached here, and Paul languished two years in prison. Here Jews first revolted against Rome; Arabs besieged Byzantines; crusader armies fought Saracens. Until its destruction by the Mamluk sultan of Egypt in the late 13th century, the city stood center stage in a region always a world crossroads.

Parking beside tour buses that in their dozens bespoke the popularity of Caesarea as one of Israel's tourist magnets, I climbed a promontory successively crowned by a tower that preceded Caesarea, a crusader citadel, Turkish fortifications, and the Harbour Citadel Restaurant, which serves today's many visitors. From the observation platform atop it I looked out over rolling

dunes that cover chapters of the city's past.

Landward spread the massive crusader walls and moat cleared by Israeli archaeologists in the early 1960s. Within them lay vestiges of a medieval cathedral, ancient shops, mills, fountains, columns—even the mosque of a colony of Bosnian villagers who dwelt amid the ruins until 1948. Beyond them extended the far larger city of ancient and Byzantine times, still hidden by sand.

To the south, between the crusader walls and a restored Roman theater, I could see the row of vaults where archaeologist Robert Bull of Drew University in 1972 had discovered a sanctuary of the god Mithras. Northward, stacked like matchsticks, Roman columns jutted from shore. They probably were part of a crusader harbor, built in the 1250s when King Louis IX of France himself labored on the fortifications. Beyond ranks of walls that overhang waves threatening to devour them, I made

out distant lines of the city's aqueducts marching to their water supply.

Turning seaward, I discerned the outline of the two artificial breakwaters that formed the remarkable harbor of Herod's city. The southern one stretched west from the restaurant and turned north—about 600 yards in total length. The second one extended due west from the shore for about 300 yards. Both now lie beneath the sea, victims of a submerging coastline.

The size of the site amazed me, as well as how much of the harbor was still visible. Although 2,000 years had passed, I could conjure an image of Caesarea's construction.

Herod was an impatient man. He must



*Emblematic of a pagan past, a five-and-a-half-inch bronze Jupiter (right), recovered underwater, was a household ornament. Caesarea's Christian tradition is represented by a stone, once affixed to a temple, bearing the name Pilatus (above). This is the only archaeological evidence of Pontius Pilate, the Roman procurator who tried Jesus Christ.*







have directed much of the work himself. There could be no mistakes, no delays. Work proceeded at a feverish pace, thousands of conscripted laborers, speaking a babble of tongues, toiling in summer's oppressive heat and winter's biting winds.

He ordered his city to be laid out on the Roman grid plan: a forum, baths, government offices, temples, tenements within the walls, villas outside. Local quarries furnished some materials. Fine marble and statuary arrived on Roman merchantmen.

South of the city center Herod erected a

huge theater on a promontory with a spectacular view of the sun setting into the sea. In the eastern precincts he built a hippodrome, or circus. Here in 9 B.C. he staged elaborate games to dedicate his city. Later the hippodrome may have witnessed mass deaths of Jewish prisoners to mark the end of the first Jewish revolt, A.D. 70, which had begun four years earlier with the slaughter of 20,000 Caesarean Jews.

A Roman-style city required enormous amounts of water for its public baths, reflecting pools, and fountains. Unfortunately, the springs that would feed an aqueduct were nine miles distant, in the foothills of Mount Carmel. To reach them, thousands of laborers armed with picks, hammers, and

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National Geographic EXPLORER will telecast "Caesarea Maritima: Herod's Harbor" at 9 p.m. EST, Sunday, February 15, on SuperStation WTBS (check cable listings).



*Castaways, pottery pieces dumped in the harbor have been recovered by the ton. These amphora sherds and smaller vessels (left) are testaments to the volume of Caesarea's trade. To recover such artifacts, divers use a vacuum hose, here uncovering the mouth of a pot (below). Finished in less than a decade, the harbor encompassed a total area of 200,000 square yards, making Caesarea one of the four largest Mediterranean harbors of its time.*



chisels tunneled more than four miles through rock. Tunnel sections and entrance shafts today attest this extraordinary feat.

As the city grew on the shore, other engineers tackled the problems of building a harbor reflecting the imperial grandeur of Caesarea. The location Herod had selected proved a nightmare. The sandy, unstable coastline lacked coastal islands or bays that could be incorporated into an artificial harbor. No harbor had ever been built without starting off from such natural features.

A strong current and heavy seas hampered construction. Bad weather cost many days' work. Completed in less than a decade, the project displayed remarkably innovative technology: the use of hydraulic

concrete, which hardens underwater; unique wave-breaking structures and stepped revetments; ingenious sluice systems to reduce siltation. The largest anchorage constructed to that time, it could be called the world's first modern harbor.

According to the first-century historian Josephus, Herod's builders lowered huge stones, 50 by 18 by 9 feet, into the open sea to create twin breakwaters, each 200 feet wide. Atop each enclosing arm they erected a loading quay and a protective seawall, lined with storage vaults and surmounted with towers. Six colossal statues stood outside the harbor entrance, three on either side. On a podium dominating the harbor, Herod raised a temple to Augustus and





اللهم صل على محمد وآل محمد  
فانهم خير الامم  
والايمان محمد وكونوا  
فيهم كالمؤمنين  
الكاظمين

Rome. This landmark, identifying the city, could be seen from far at sea. When he had finished a harbor capable of becoming the leading transshipment port in the Mediterranean, Herod bestowed on it a regal name—Sebastos, the Greek equivalent of Augustus.

**T**O EXPLORE Sebastos was my goal in Israel. When Bob Bull asked if I would be interested in surveying the underwater remains at Caesarea, I jumped at the opportunity. For 16 years I had worked on other underwater harbor sites in Greece, Italy, and Spain. Here was the largest Greco-Roman harbor open to archaeological exploration—not buried under an airport like Rome's ancient Portus, silted up like Leptis Magna in Libya, or in commercial operation today like Egypt's Alexandria or Athens' Piraeus.

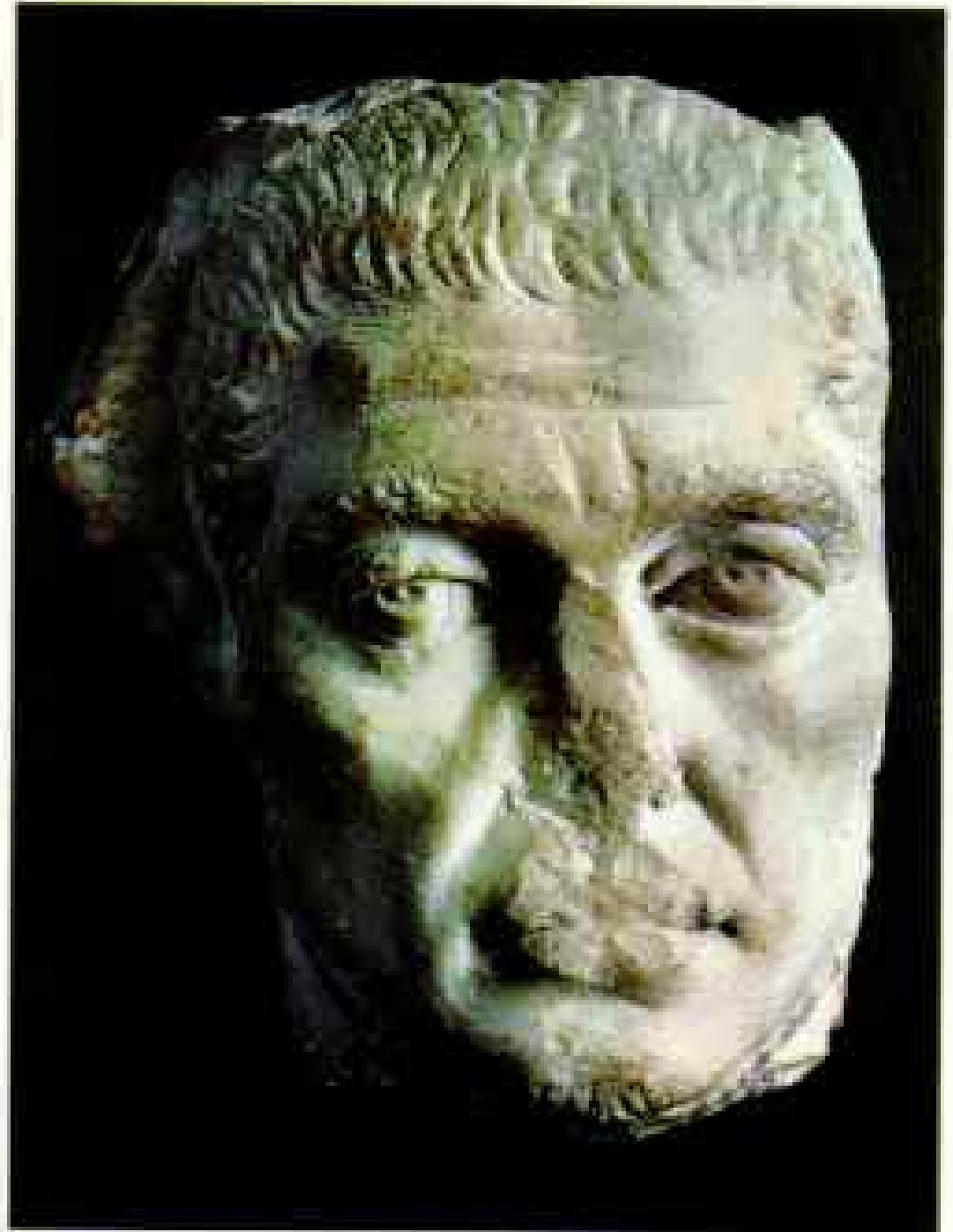
John Oleson came from British Columbia and underwater photographer Harry Wadsworth from Denver to join me. We had limited money and equipment that summer of 1978, but unlimited excitement. Since we had only six scuba tanks, which we filled at a nearby kibbutz, we could each make only two dives a day. To stretch our limited air supply, we swam out from shore on the surface with our survey equipment—often 200 yards in heavy surf—before making our descent. The major problem: to swim back after a dive when near exhaustion. I lost a lot of weight that summer. But despite limited visibility in the sand-filled waters, we managed to examine and photograph practically all the submerged ruins.

We found some of the large stone blocks mentioned by Josephus. To our surprise we also discovered huge concrete blocks on the seaward side of the south breakwater. They still carried the impressions of crossbeams from their construction forms. Josephus hadn't mentioned concrete at Caesarea, but then he wasn't an engineer.

Just outside the harbor entrance we found more concrete—remains of bases that had supported the colossal statues. At the end of the north breakwater we found more large cut stone blocks—once part of a massive tower—and remains of metal clamps that had held them in place.

More important encounters came on land: Avner Raban and Elisha Linder of the

University of Haifa, Israel's two leading underwater archaeologists, arrived to discuss a more ambitious joint effort. For years following their initial involvement with pioneer underwater explorer Edwin Link, who had surveyed here in 1960, Elisha and later Avner had been working at Caesarea, but on a frustratingly limited scale. John and I had reached the same conclusion: Only underwater exploration on an unprecedented scale could unravel the harbor's secrets and



*Found in an ancient vault, these treasures (facing page) probably were buried while Arabs, who occupied the city from the 7th to 12th centuries, braced for the Crusades. Captured by crusaders in 1101, it was finally razed by Mamluks in 1291 to prevent its use by other invaders. Marble immortalizes a resident of Roman Caesarea (above).*

produce significant scientific results. What if we pooled our efforts and dreams?

Those meetings marked the beginning of CAHEP—the Caesarea Ancient Harbour Excavation Project. A small season of exploration took place in 1980; the first truly international one followed the next year.

Living conditions were hardly grand—three crowded temporary structures on the beach. The ripstop nylon over rectangular

pipe frames offered some protection from sea breezes at night but none from mosquitoes or sand. Moisture condensed and collected on our ceiling, and you never knew when you'd experience a drenching rain while you slept. Our one lavatory, a public facility, was sometimes locked at night.

**W**ATER was always a problem. One time everyone got sick, and the story was that a dead dog had been dropped into Caesarea's water supply. For weeks we had to boil our local water and rely on Israeli colleagues to bring safe water from Haifa. A turn in our one hot shower became one of life's true luxuries.

But there were compensations: excellent restaurant food, natural extravaganzas of sunsets and sunrises on the beach, the

excitement of discovery. Camaraderie born of adverse conditions helped make CAHEP the extended family it has become today—one of the largest underwater archaeological teams in the world, with divers from many countries: men and women, ranging from corporate executive to carpenter, from student to soldier, aged from 15 to 69.

Many return year after year. They've seen accommodations improve—dormitory rooms that do not leak; soft, sand-free beds; safe water; hot showers; a spectacular sea-front terrace for social events and daily briefings; memorable season's-end parties. But the moans and groans when I get people up for the long workday that starts at 5 a.m. are the same now as during our first season.

Though suffering the intestinal distress of "Herod's revenge," enduring the pitching of





our small anchored raft—nicknamed the “vomit comet”—we could see that Josephus did not exaggerate in his description of Herod’s harbor. Diving in pairs, our early team of Canadians, Americans, and Israelis cleared the bases of the twin, or yoked, towers west of the channel with suction air-lifts. Other divers cut a trench across the harbor mouth.

We came to admire solutions of Herod’s engineers to challenges of the site; they have no known precedents. To bar undertrenching of breakwaters by currents and heavy seas, they first laid a foundation of rubble on the ocean floor wider than the breakwater that would rest on it. Where engineers now use concrete tetrapods for a breakwater, Herod’s builders used rocks and concrete blocks. As wave action shifted and settled

this material and marine growth intruded, the breakwater consolidated and solidified.

Siltation has always plagued harbor builders in the eastern Mediterranean. The offshore south-to-north current carries huge quantities of sand from Sinai. Any large structure like Herod’s harbor, built out into the sea, traps sand and spurs coastal erosion. Modifying a solution used by Phoenician harbor builders at Tyre and Sidon, Herod’s engineers cut sluice channels through the main breakwater to catch water from wave crests. The water, essentially sand free, was collected in the channels and periodically released into the enclosed basin. This artificially induced current scoured the basin, flushing flotsam and jetsam and silt out through the harbor mouth.

“We might be humble enough to learn



*Mass-produced ceramic lamps (left) that burned olive oil were so cheap they were discarded if broken. Bronze keys (above), including one worn as a ring, display the artistry accorded even common household objects. Excavations of the city revealed that Caesarea was built on a grid with such typical Roman amenities as a forum, theater, public baths, and a hippodrome. Because the city was sparsely inhabited after its 13th-century demise, it is a prime archaeological hunting ground. The harbor is also accessible to archaeologists—unlike Rome’s Portus, buried under an airport, or Athens’ Piraeus, which is still in use.*



from the ancients," Avner Raban suggests to modern harbor engineers.

We discovered another innovation. Where the south breakwater was most vulnerable to storm attack, Herod's engineers constructed a smaller, parallel, discontinuous breakwater some 15 to 30 yards seaward of it. This first line of defense broke the force of waves before they could smash directly against the main structure.

The most surprising discovery occurred near the harbor entrance on the north breakwater. A massive concrete block measuring 15 by 11 by 2 yards had been poured, in the open sea, into submerged wooden forms. Sections of sleeper beams that supported the caisson had survived 2,000 years. Tests conducted at the University of Tel Aviv confirmed that the concrete had hardened in the water. The first-century B.C. architect Vitruvius has written that the Romans knew about hydraulic concrete. But before our discovery, no examples of its use on such a massive scale had been found.

**H**OW DID HEROD'S engineers perform this feat more than 300 yards from shore? Consider the following scenario. It may have happened this way.

Divers trained to free dive carrying weights in their hands took turns descending to the ocean floor a dozen feet below. They had only a couple of minutes to smooth the bottom where the breakwater would go before they had to yank on the safety ropes around their waists and begin their ascent. Rocks too large to move by hand were lashed with ropes and hauled out of the way by cranes aboard a construction barge.

When these divers, descriptively called *urinatores*, reflecting a physiological response to prolonged submergence, had cleared about 250 square yards and laid a rubble foundation, sailors in small boats bent to the oars to tow a large form out from shore. Workers filled the space between its double walls with a mortar mixture to overcome the wood's buoyancy and seal the form. They used iron chains to guide and control its descent.

Again descending in relays, the *urinatores* checked the form's location and repaired any damage. Cranes shifted it slightly to ensure that its long side was perpendicular to

the shore. A dredge piled rocks and sand around the base to stabilize it.

Hydraulic concrete, including the critical ingredient tuff—a fused volcanic ash—probably from the Mount Vesuvius area in Italy, was lowered in baskets and dumped into the form. Engineers sent by Augustus to supervise the construction took no chances with local substitutes. They brought with them the ingredients for this new building



*Built to Herod's order to supply water to Caesarea, an aqueduct (facing page) from Mount Carmel nine miles away was subsequently enlarged. A separate aqueduct had to be added in the fourth century A.D. to meet the city's expanded needs.*

*Volunteers excavate the harbor's inner basin (above); the block between two pick wielders is a ship's mooring stone.*





## A sunken history: The search goes on

*SKELETAL TIMBERS* of a Roman merchant ship from the late first century B.C. were discovered in shallow water (*left*). The vessel hit offshore rocks and washed in. The 130-foot-long section of hull suggests the ship could carry 200 tons of cargo. Greek symbols for the number 1,750 (*below left*) scratched on the hull frame may have been the work of a stevedore taking inventory of the amphorae on board.

Subsequent expeditions instituted by the Caesarea Ancient Harbour Excavation Project, or CAHEP, will continue the search for other ships that never made it to port, focus on a systematic excavation of coastal buildings, and attempt to locate the eastern gate and the original Jewish quarter of Caesarea to better understand the city's layout.

Funds permitting, the author and his colleagues hope to build a working scale model of the harbor. "Then, we'll really see how it all worked," says Hohlfelder, professor of history at the University of Colorado.

What's highest on his wish list? "To find a shipyard," he says. "We're certain a harbor of this size had one. It would tell us a great deal about ancient shipbuilding."

CAHEP, a project organized in 1980 as an international consortium of universities, is headed by Avner Raban of the University of Haifa.



material, even for the wooden forms. After a wait of weeks for the block to set beneath the sea, the cranes recovered as much of the form as possible to be used again on the next foundation.

The south breakwater also had innovative features. Here Herod's engineers lowered huge blocks of concrete or stone onto a foundation course prepared by urinators. We found some blocks even larger than the ones Josephus described, positioned where wave attack from winter storms proved most violent. The outer face of the breakwater seems to have been revetted, with courses of blocks stepped from the ocean floor to the surface. This served to weaken the undertrenching wave action and direct wave energy back to sea to minimize the next incoming swell.

We also investigated the bay south of the main Herodian harbor. During fair weather it could be used by merchantmen for off-and-on-loading cargo from warehouses lining the 500-yard-long quay. Here we found our earliest artifact—dating from about 1200 B.C.—a stone anchor from some Bronze Age ship that had put in here long before any permanent settlement existed. Anchors from all periods of Caesarea's history dot the floor of this bay. As an adjunct facility, it doubled the port area of Sebastos. Josephus was correct, claiming that Caesarea's harbor rivaled Piraeus in size.

On land our excavations within the crusader fortifications in 1983 and 1984 uncovered an inner harbor connected to the outer one by a channel. This basin, not mentioned by Josephus, had a working area of about 10,000 square yards, one-twentieth the size of the outer harbor. Built earlier by a local tyrant named Zoilus, it ultimately would become a haven for Herod's fleet of warships—another reason to select this site for Caesarea.

Augustus himself never visited the city that honored him, but his second-in-command, Marcus Agrippa, did in 15 B.C. What a grand occasion! The Roman entering the harbor to meet Herod in the inner

basin at the foot of the temple to Augustus and Rome. The ceremonial greetings on the quay, then the pair going into the temple to pray to or for their mutual patron. A public relations event of the highest order. And, in the eyes of imperial Rome, cementing the image of Sebastos as a vast allied naval station for use in any crisis.

Many scholars have discounted Josephus' account of Sebastos, none more critical than W. M. Thomson. In 1861 he wrote of the "magniloquent Josephian hyperbole" that could not be read without a smile. We now view Josephus differently. We know how sophisticated and modern Herod's harbor actually was. Each season of fieldwork makes us more aware of its 20th-century, perhaps even its 21st-century, design.

From the tons of artifacts uncovered by our volunteer divers, we know that Sebastos was still operating in the mid-seventh century, when resupply by sea enabled the Byzantines to hold out for seven years before falling to the Arabs. Crusaders reopened a small harbor here after they took the coast in 1101. It was the last position in the ancient city to fall to Islamic counterattack in 1291.

I CONFESS I had hoped to recover one of the colossal statues Josephus mentioned, a long-held dream. The discovery in 1972 of two bronze statues off the southern Italian coast confirmed that the Mediterranean still yields such treasures (see the June 1983 *GEOGRAPHIC*). In 1981 we did find a lead statue of Aphrodite; the next year, a bronze Jupiter holding an eagle—alas, neither more than five and a half inches in size. "Have our colossi shrunk over the centuries?" I asked Avner. Probably Caesarea's colossi suffered the same fate as the Colossus of Rhodes—cut and melted down for reuse of the metal.

Summer of 1987 will give us another chance to find our Colossus of Caesarea. Volunteers from all over the world will again join our staff to continue exploring this international capital with its "modern" harbor. We will excavate a first-century B.C. Roman shipwreck, a victim of offshore rocks. Within the crusader fortifications we are going to search for the original Jewish quarter of Herod's city. The story of Caesarea on the sea is not yet complete. More surprises lie ahead. □

FOR COOPERATION IN PHOTOGRAPHING ARCHAEOLOGICAL OBJECTS IN THIS ARTICLE, THE GEOGRAPHIC THANKS THE FOLLOWING—CAESAREA MUSEUM, KIBBUTZ SEDOT YAM: PAGE 251; 254, COINS, TOP AND MIDDLE LEFT; 275, KEYS. MUSEUM OF ANCIENT ART, HAIFA: 264, COINS, MIDDLE RIGHT AND BOTTOM; 273; 274, LAMPS. ISRAEL DEPARTMENT OF ANTIQUITIES, JERUSALEM: 268; 272. CAHEP COLLECTION, UNIVERSITY OF HAIFA: 269; 270-271.





# The Royal Spoonbill

ARTICLE AND PHOTOGRAPHS BY M. PHILIP KAHL

In spring a royal spoonbill's fancy lightly turns to the question of love, and so September in southeastern Australia calls *Platalea regia* to gather at traditional breeding sites. With bushy crests of long, narrow feathers, the spoonbills are looking their regal best.

Spoonbills erect their bold head plumes into spectacular fans during courtship and other social displays, using them to both attract potential partners and repel rivals and predators. The "war bonnet" of an adult in full plumage may have a hundred feathers, some measuring six inches or longer. This bird (left) feels an itch somewhere in its plumage and flares its crest to scratch its head.

The spoonbill's dazzling colors reach their peak in breeding adults, which stand about three and a half feet tall. The bird's snow-white feathers contrast with the glossy black of its bill, legs, feet, and a face enlivened by yellow eyelids and a red patch on the forehead (center).

I came to Australia in order to study what is surely one of the world's most beautiful water birds. Aided by National Geographic research grants, I am



comparing breeding behavior of spoonbills around the world.

Earlier I had spent a year studying the African spoonbill in Kenya and South Africa. Next I plan to research the roseate spoonbill on the Texas coast and the two remaining species in Eurasia. This should deepen insights into evolutionary relationships within the group and

how ritualized behavior patterns develop and function in the lives of these birds.

Many regions of dry Australia have no water birds at all. But in the few well-watered areas of the continent, such as Lake Cowal in New South Wales, many hundreds of royal spoonbills—and their less showy cousins, the yellow-billed spoonbills (*Platalea flavipes*)—may be found feeding together or breeding in loose colonies.

Nestled amid rolling, partly wooded farmland, Lake Cowal, about 20 miles long and four to six miles wide when full, has large eucalyptus trees growing in its shallows, which often dry up during drought years.

To study the birds intensively for an entire five-month breeding season, my wife, Lindsay, and I parked our house trailer on the lakeshore. Each day a short motorboat ride brought me to one of the platforms I had constructed and topped with canvas blinds near spoonbill nests. After I entered the blind and Lindsay took away the boat, the birds forgot I was there, leaving me free to observe and photograph their uninhibited behavior.





**P**ush comes to shove in a fight among males for dominance. As other birds hold their places, a male with crest belligerently erect (*left, at center*) drives off a rival from the top of a tree.

In low stick nests built in lignum bushes in the shallows, parents take turns incubating three or four chalky white eggs. After about 25 days the eggs hatch helpless young, whose eyes, like kittens', are still closed (*bottom right*). Both parents brood, guard, and feed nestlings, relieving each other every four to five hours (*above*).

Bright yellow patches over the eyes serve for more than decoration. Against the shiny, bare black skin, they could fool a predator into thinking that a sleeping spoonbill is wide-eyed and awake. Voracious Australian ravens pose a major threat to spoonbill eggs and nestlings, while lace monitors—four-foot-long lizards as at home in the water as on land—can be equally dangerous. Even so, alert parents can

usually repel such predators.

From June through August, the coolest part of the nonbreeding season at Lake Cowal (*map*), royal spoonbills disperse to warmer climes, where they find food more available.

Major droughts in their principal Australian range force spoonbills to search afar for feeding areas. This may explain why satellite groups have become established on New Zealand's South Island, 1,500 miles distant, as well as in New Guinea and Indonesia.





**A**larmed by ravens, a spoonbill guarding a nest bristles its crest defensively (*right*).

When a parent returns to the breeding colony from feeding, it greets its mate with a display of crest raising and grunting, which helps in identification. Such displays often begin while birds are still in flight (*below*).

To catch its food—mainly small fish, crustaceans, and aquatic insects—the royal spoonbill jogs in the shallows, sweeping its partially open bill from side to side. When the bill contacts food, it snaps shut like a mousetrap, and the bird swallows the morsel with a backward toss of the head.

Appetites of nestlings exceed even those of their parents, and three or four young keep adults busy around the clock. Locating food chiefly by touch, parents can forage even at night, and one usually arrives at the nest with food soon after dawn.

Fed often, the nestlings grow quickly. Fully feathered in four to five weeks and already two-thirds the size of their parents, they are set to test their wings. The family groups that

I observed remained together several weeks more before they separated.

Though it is home to many water bird species, Lake Cowal is neither a national park nor a bird sanctuary. Collectors rob nests to supply zoos, and in late summer duck hunters converge on the lake. If duck shooting

disappoints, some “practice” on nongame species, even shooting birds on their nests.

Because of such threats, I would like to see parts of Lake Cowal declared a permanent bird sanctuary. It is the least we can do to protect this elegant symbol of a wetland ecosystem—the royal spoonbill. □

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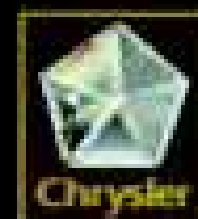
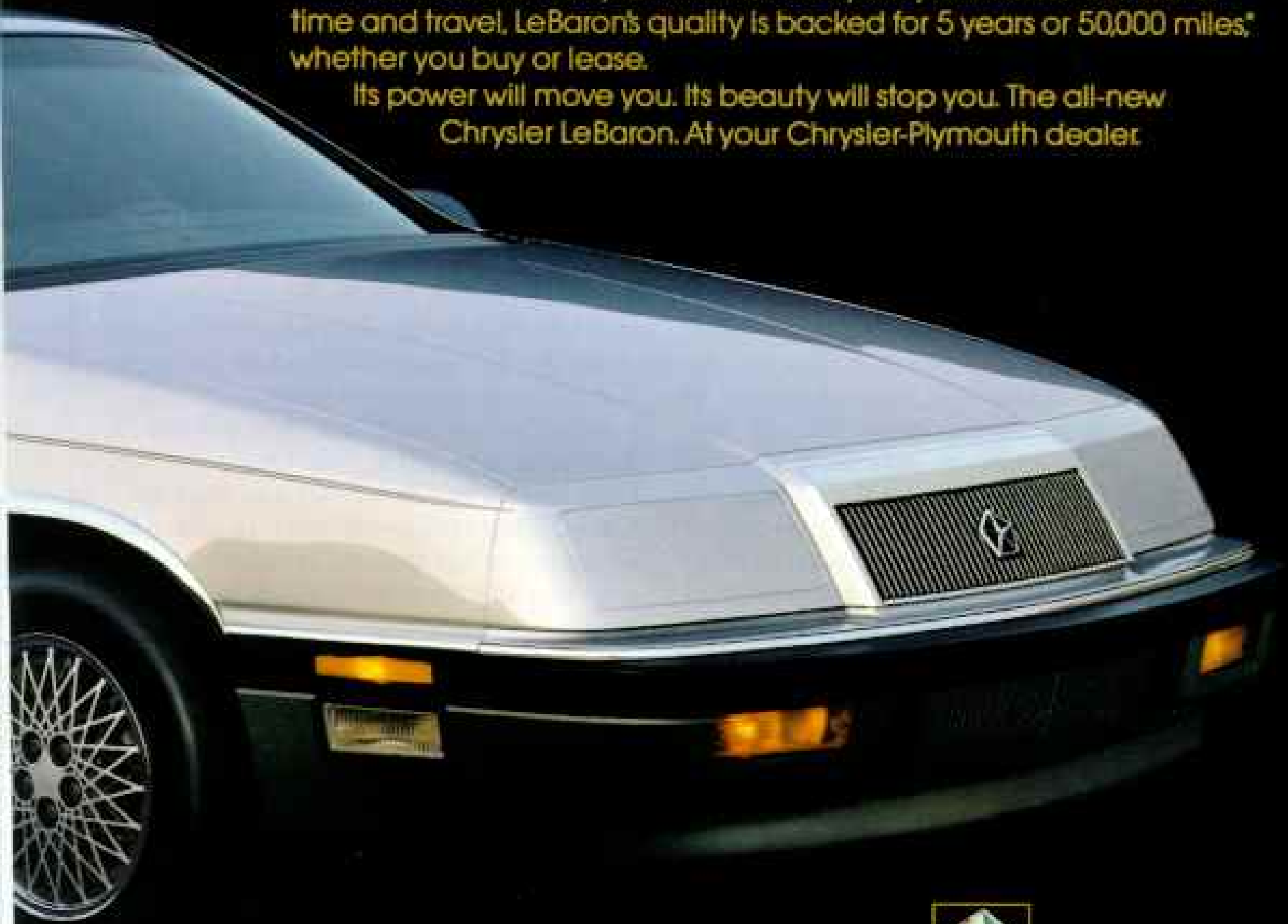
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## Batominiums: decent housing for deserving friends

I'VE NEVER HEARD A SONG called "The Bat of Happiness," yet if Merlin Tuttle has his way, the small flying mammal with the bum-rap reputation will soon rank with the bluebird in public esteem and affection. And so it should.

Society members may recall a story in the June 1977 issue of NATIONAL GEOGRAPHIC, "Song of Hope for the Bluebird," that included construction plans for bluebird nesting boxes. Now we are showing a bat house on this page, largely because Merlin Tuttle's curiosity and enthusiasm will not stop.

Already an accomplished professional mammalogist and avid amateur photographer, he was working several years ago with Bates Littlehales of our staff, an exceptional photographer of birds, in making bat photographs for our *Wild Animals of North America*. In six hard weeks, Tuttle learned new techniques of recording bats in flight and in natural attitudes.

(One reason for the reputation of bats as surly and nasty is that they often have been badly photographed in captivity. If you were cooped up, then poked awake to have your picture taken, you might snarl too.)

As his studies continued with the Society's support, Tuttle's science and photography contributed to each other, to basic knowledge, and to public understanding. Through Society books, magazine articles, and television programs, we have been able to help Tuttle share his vision of bats—as clean, intelligent, and useful animals.

Much still remains to be done to convince people. Bats have suffered a bad public image for a long time. (They don't get tangled in people's hair, and they seldom transmit rabies to humans.) In some parts of the world bats are hunted to the edge of extinction for food or because they are mistakenly thought to be a major cause of crop damage.

To spread the good word about bats and to recruit allies for their cause, Merlin Tuttle has organized a nonprofit group called Bat Conservation International (BCI), which now has members in 33 countries. As a source of funds to help support its work worldwide, BCI sells bat houses like the one shown here. Ready-

built of red cedar and including a booklet on bat basics, each house is offered at \$29.95, plus \$2.75 for shipping, from BCI, P.O. Box 162603, Austin, Texas 78716. You may join BCI for \$25 or send a contribution of any size and receive the booklet and plans for building a house yourself.

Why bother with bat houses? North American bats have, like bluebirds, suffered serious loss of habitat and need good homes. They are quiet tenants. In return for housing, one bat may eat as many as 600 of your neighborhood mosquitoes in one evening hour.

There is also the pure pleasure in having the animals around. When the sun is just down, there is a moment before full dark. Stars are coming out and shadows are darting to work in the evening sky. Who would want to lose that nightly show of aerobatics?



*Silvius H. Brown*

PRESIDENT, NATIONAL GEOGRAPHIC SOCIETY



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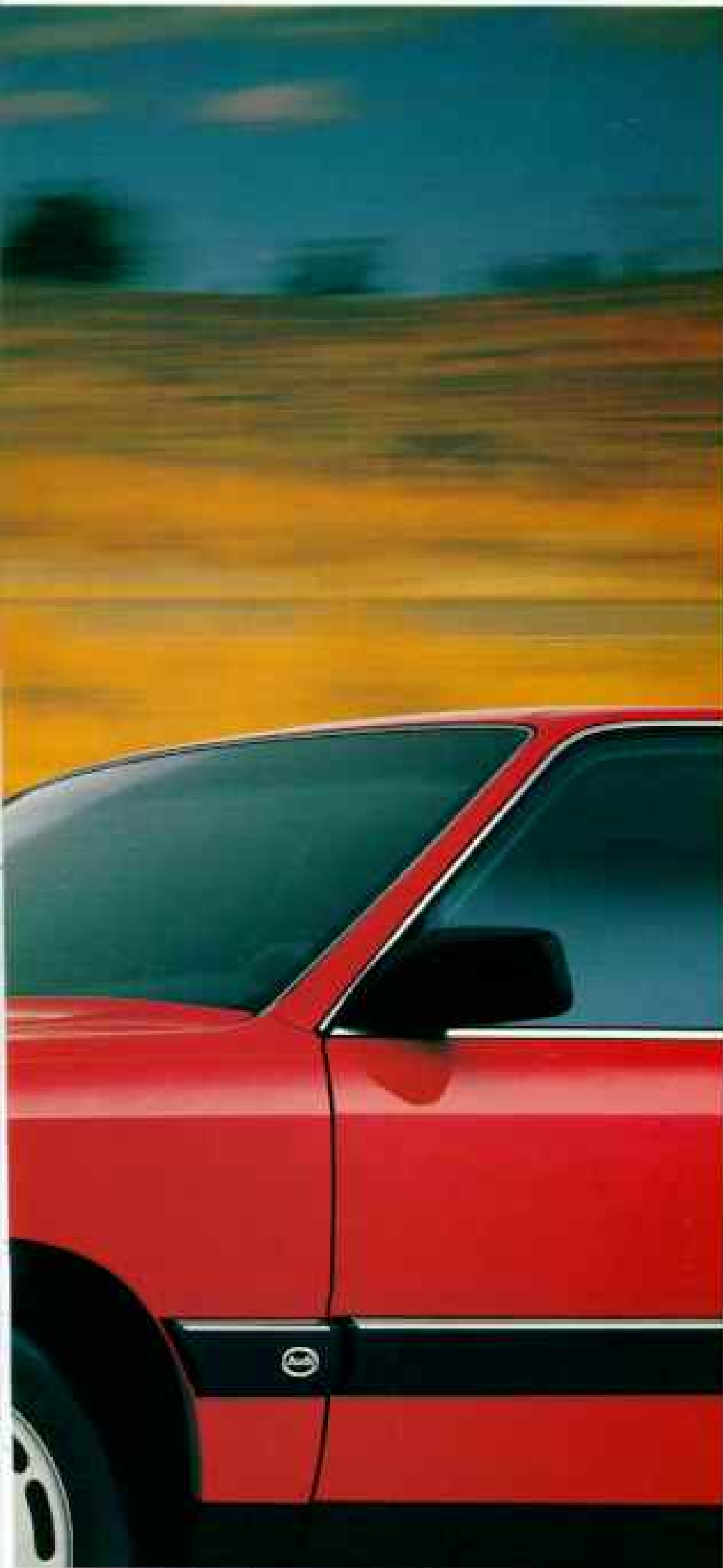
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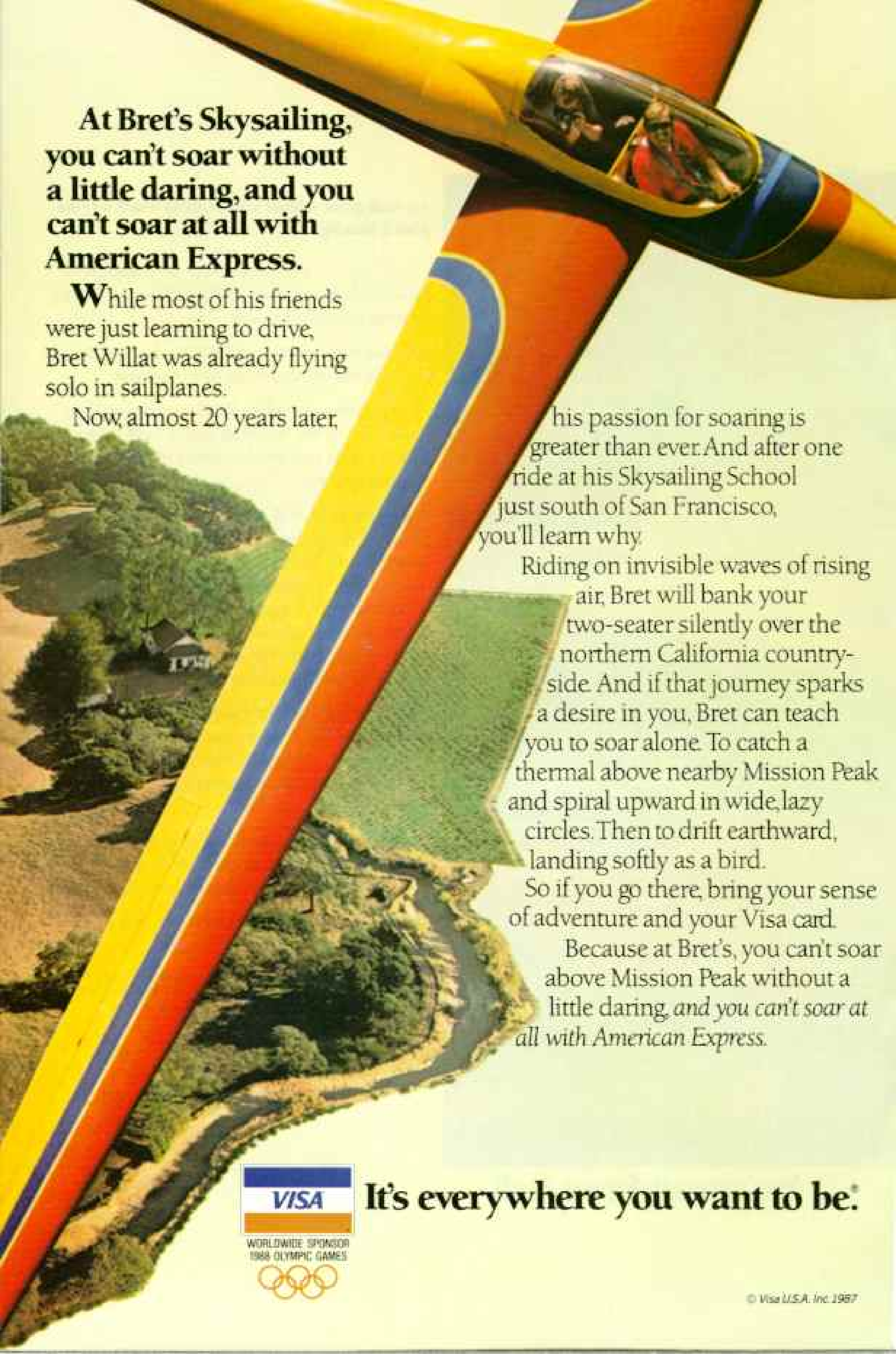
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# Members Forum

## Soviets in Space

Your readers have been given a unique look at the Soviet space program (October 1986). Mr. Canby did a superb job in capturing the Soviets' view of space and their national resolve to maximize its exploitation.

Gen. Robert T. Herres, USAF  
Commander in Chief, U. S. Space Command  
Colorado Springs, Colorado

You did a fine job of providing in one accessible article a valuable summary of interesting, detailed information that is normally widely scattered and hard to find.

Bevan M. French  
Office of Space Science and Applications, NASA  
Washington, D. C.

You refer to the Soviet space shuttle being "built partly from U. S. shuttle plans obtained by means of an immense Soviet apparatus for technology acquisition." Why not call it what it is? Espionage by foreign agents or traitors!

Ronald P. Neilson  
Pittsburg, California

*Most but not all technical information about the U. S. space shuttle is available legally from published material.*

On October 4 the Central Illinois Space Group held a space education event at a local shopping mall. Our theme was "International Cooperation and Peaceful Competition in Space," so we showcased the Soviets in areas in which they are winning. Almost everyone mentioned the GEOGRAPHIC article. Reactions ranged from fear to outrage. Several said, "We could be doing all that stuff and better—why don't we?"

David S. F. Portree  
Normal, Illinois

If Russia is getting more for the same cost, it's because their space program is not raped by fraud, cost overruns, and political connivance. Over half our scientists do not believe that the Strategic Defense Initiative can be made workable.

Regis C. Munio  
Rome, New York

The article made me understand why the Soviets are so adamantly opposed to the SDI: It could end up crippling their offensive capabilities. Even the prospect of shared technology is not enough payback to put themselves at such risk.

Elizabeth Houghton  
Cypress, California

Your excellent article was tainted by its counterproductive "competition with the U. S." perspective. This attitude prevents the open sharing of technology to benefit all. A more appropriate subtitle than "Are They Ahead?" would have been "Their Achievement."

Gary Simoneau  
Somerville, Massachusetts

## New Pacific Nations

Congratulations on another masterpiece: "In the Far Pacific, At the Birth of Nations" (October 1986). Why was no reference made to the rumor of Soviets pussyfooting around in the area? With our foe having Pacific flanks anchored in Kamchatka and Cam Ranh Bay, it would seem such activity would generate a few unquiet moments in Tokyo, Manila, and Washington.

Carter Weldon Clarke  
Brigadier General, U. S. Army (Ret.)  
Clearwater, Florida

As a civilian, I live with my family on Kwajalein and feel the impression of our life-style and purpose was not correctly conveyed. Life is comfortable, but I don't consider it similar to a "golfing condominium complex in Florida." The U. S. presence in the Marshalls is strategically essential to our defense systems worldwide. I deal with isolation and the inability to enjoy everyday freedoms that Americans back home experience. I seriously doubt that the average American would separate himself from family and friends to live in either a tin trailer or a concrete quadplex on an island only a half mile wide and three miles long, 4,500 miles from the U. S.

G. H. Moore  
Kwajalein, Marshall Islands

One thread runs through this story that the author keeps tripping over. All the world's problems cannot be solved by throwing money at them, though Uncle Sam keeps trying. Micronesia is a shining example.

H. W. Conner  
Palm Bay, Florida

Having lived on Yap and Ulithi Atoll as a Peace Corps volunteer, I was pleased to read your excellent article, but during the time I spent in the menstrual hut on Mogmog, women were not allowed to weave, and no man would have been allowed to take a photograph. Have things changed that much since 1983?

Sally Ehm  
Belmont, California

*On isolated outlying islands such restrictions are still strictly followed, while on Mogmog they are now less rigidly enforced.*





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**1987  
Golf GL**

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Your article was undermined by the full-page photograph of a bare-breasted pubescent female. Your exploitation of females, non-Caucasian in particular, is revolting.

James Yobs  
St. Thomas, Virgin Islands

Your picture of a dignified young lady displaying her necklaces may draw criticism from readers who misunderstand geography's proper scope. Despite the necklaces, I do not feel that she is overdressed.

Walter T. Wilson  
Clearwater, Florida

## Red Deer

Thank you for the well-balanced presentation of the predator-prey relationship between man and deer (October 1986). It was informative and non-hysterical. The successful conservation efforts of sportsmen have resulted in the survival of the red deer in the wild. They deserve a little praise.

Peter Vincello  
Boylston, Massachusetts

Times certainly have changed. For tens of thousands of years hunting was a most highly regarded occupation characterized by skill, endurance, and even bravery when facing dangerous big game. Hunting deer in Scotland is nothing but a lucrative proposition for the landowner. As the game is stalked, the rifle is carried and even loaded by a professional. It's but an ego trip for the participants, who are certainly not sportsmen.

Louis J. Mihalyi  
Forest Ranch, California

## Netherlands

In the October issue you showed both positive and negative aspects of Dutch society in a most balanced way. May I add that the Kingdom of the Netherlands consists not only of the Netherlands, or Holland, but also of Caribbean islands: Aruba—destined for independence in 1996—and the Netherlands Antilles (Curaçao, Bonaire, St. Maarten, St. Eustatius, and Saba).

Eric H. Grootmeijer  
Hattem, Netherlands

We Dutchmen know that the Netherlands is an ever so small country. But one can still get lost between broad rivers meandering through endless lowland. And if he tries to find Sint Jansklooster in Friesland, as the map on page 529 indicates, he has gone a few canals and polders too far. The town lies just north of Zwolle.

G. W. 'tHooft  
Eindhoven, Netherlands

The article failed to include even one photo of the southern provinces—Noord Brabant, Limburg, Zeeland. Being a native of N. Brabant, I can tell you that the south and its people are totally different from the north; we are dark haired, mainly Catholic, and much better cooks.

Maria Teeuwen Fallin  
Norfolk, Virginia

You didn't mention that the "sloe-eyed people of Indonesian ancestry" are also of Dutch stock on either the paternal or maternal side. In the former Dutch East Indies they were registered as Europeans, separate from the indigenous population. They came to Holland simply because they were and are Dutch.

Robert L. Beringer  
Hengelo, Netherlands

## President's Page

Your item on America's outdoors (October 1986) has been noted. Your words are heartening, but I wonder. Attempting to prevent damage to wildlife from rampant development in this area is difficult and sometimes discouraging. Last night I attended a local city council meeting. The issue was creation of a freeway right through some of the finest open space in the state. A large crowd expressed great opposition. The backers have in mind movement of traffic and people from place to place by auto. Another group, who never visit parkland, asserted if a freeway was built through the area, they could at least see it. I exhort you to bring the issues to the surface so "we the people" can attempt to develop adequate protections for our rapidly vanishing wetlands, open spaces, and wildlife.

A. B. McNabney  
Walnut Creek, California

## Members Forum

The letter writer from Albany, California, commenting (October 1986) on the Tolstoy article is under a great misapprehension as to the Soviet use of starvation as a weapon. The regime under Stalin engaged in a policy of mass starvation against millions of independent Ukrainian farmers in the early 1930s, at the same time flooding the international market with tons of wheat that these farmers had produced. The secret police kept the Ukraine borders sealed, allowing none of the organized relief to reach the starving, surely one of the greater acts of savagery of our time.

Tom Woodley  
Puyallup, Washington

.....  
*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.*

S M A L L



WHY SOME KIDS CAN'T STAND THE NEW SMALL WONDER.<sup>®</sup>

Bad news for camera-shy kids. The new Small Wonder VHS camcorder is so small, so simple, so fully automatic, it follows kids everywhere. Captures everything. Turns their life into an open book.

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**Amsterdam Albatross** Genus: *Diomedea* Species: *amsterdamensis*  
Adult size: Length, 110cm; wingspan, 3m Adult weight: 6.27kg Habitat: Central plateau of Amsterdam Island in the southern Indian Ocean Surviving number: Estimated at 50  
Photographed by André Fatras



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

An Amsterdam albatross chick, still covered in down, looks to its parent for food. Of the total population, there are only 15 breeding pairs, which nest on the peat bogs of a tiny remote island. Each pair raises only one chick every other year.

Discovered relatively recently, the Amsterdam albatross is considered one of the rarest seabirds in the world. Throughout the centuries, its fragile island ecosystem has been severely disrupted, causing the albatross population to decline to a precariously low number. An invaluable research tool, photography can assist in efforts to save the Amsterdam albatross by contributing to a better understanding of this bird and promoting a broader awareness of the urgent need to protect its remaining nesting site.

And understanding is perhaps the single most important factor in saving the Amsterdam albatross and all of wildlife.



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# On Assignment



**L**OVE OF THE OUTDOORS is shared by two men, raised an ocean apart, whose work appears this month. A native of the Netherlands now living in California, *Frans Lanting* was an economist and environmental planner before embarking on wildlife photography. In a Madagascar preserve (*above*) ring-tailed lemurs looking for a handout proved anything but camera shy. Lanting found an unexpected benefit from another subject: chameleons. “I put branches in my hotel room for 20 lizards in order to capture their changing colors,” said Lanting. “Considered evil omens, the chameleons proved to be like watchdogs, frightening the uninvited.”

While hiking the Appalachian Trail, senior writer *Noel Grove*, who grew up roaming the Iowa countryside around the family farm, walked some 500 miles. Moving ahead of photographer Sam Abell, Grove used bark that had sloughed off birch trees for leaving messages (*right*).

Vermont’s sylvan setting inspired these lines—with apologies to poet Joyce Kilmer: “I think that I shall never see a parchment tempting as a tree. A tree upon whose bark is writ a dash of literary wit. Snaps are made by folks like thee, but only scribes describe a tree.”

“I was an outdoorsman long before I was a writer,” says Grove. “When the assignment was complete, I began to miss the trail’s simplicity and solitude.” But Grove was soon back in his element, researching a forthcoming story on the Nature Conservancy for his 19th byline in the magazine.



FRANS LANTING (LEFT), SAM ABELL



The sound this magazine makes when  
you turn a page is louder than the Accord LXi  
moving at 55 miles per hour. **HONDA**

