NATIONAL GEOGRAPHIC

From the Editor

"WHY DON'T YOU CALL your magazine *International Geographic*?"

We get letters asking that question all the time, and while it's probably best that we stick with the name that has served us so well for 110 years, there's no question that the global scope of our readership is light-years beyond that of our first issue, when of 217 Society members only 31 lived outside the District of Columbia.

Today the English-language edition of NATIONAL GEOGRAPHIC is read in nearly every country. And to make the magazine we are so proud of accessible to even more people, we have begun publishing local-language editions as well.

Since its launch in 1995 the GEOGRAPHIC's Japanese-language edition has been followed by editions in Spain, Latin America, and Italy. Now two more local-language versions of the magazine are appearing, in Greece and Israel.

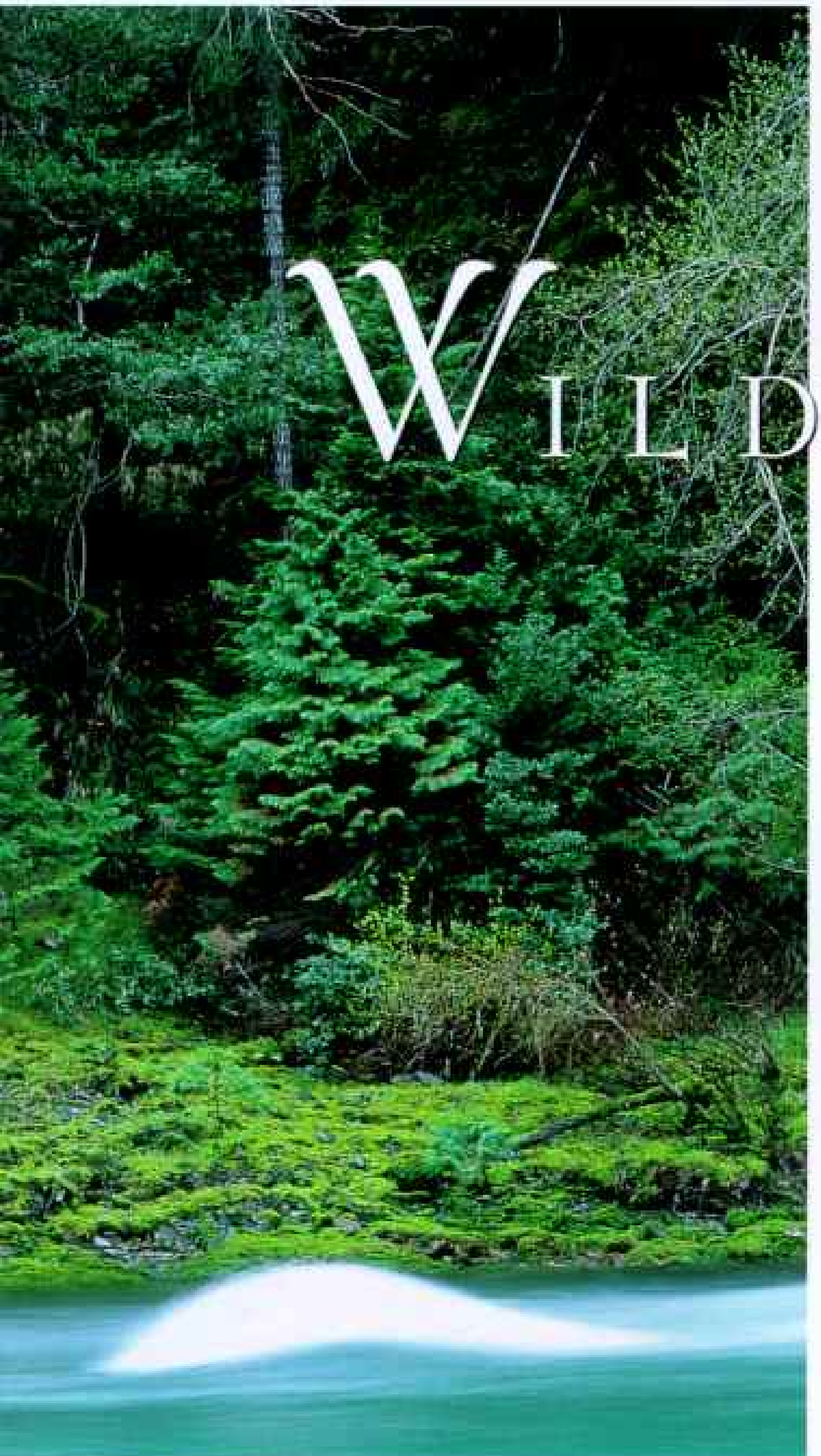
Greeks are already well acquainted with us through Greek-language National Geographic videos. In fact, Greeks began taking out Society memberships months ago in anticipation of the Greek edition's October launch.

For Israelis, the June arrival of our Hebrew edition was perhaps a footnote in the month that marked their nation's 50th anniversary. Still, it was warmly embraced by readers. Our first pressrun of 25,000 copies sold out in less than a week, and more than 15,000 Israelis have joined the Society.

Translating a magazine into another language involves more than just pouring type onto a page. The Hebrew edition, for example, reads "backward," with the issue beginning on what Americans would consider the back page. Each two-page layout has to be reviewed by the Israeli staff, with final approval for any changes coming from our Washington, D.C., headquarters—as is so for changes in all our international editions.

As our family of international editions grows, it's exciting to think of people around the world, with vastly different cultures and languages, sharing this magazine every month. So what if it doesn't say *International Geographic* on the cover?

Bill Allen



WILDERNESS

America's Lands Apart

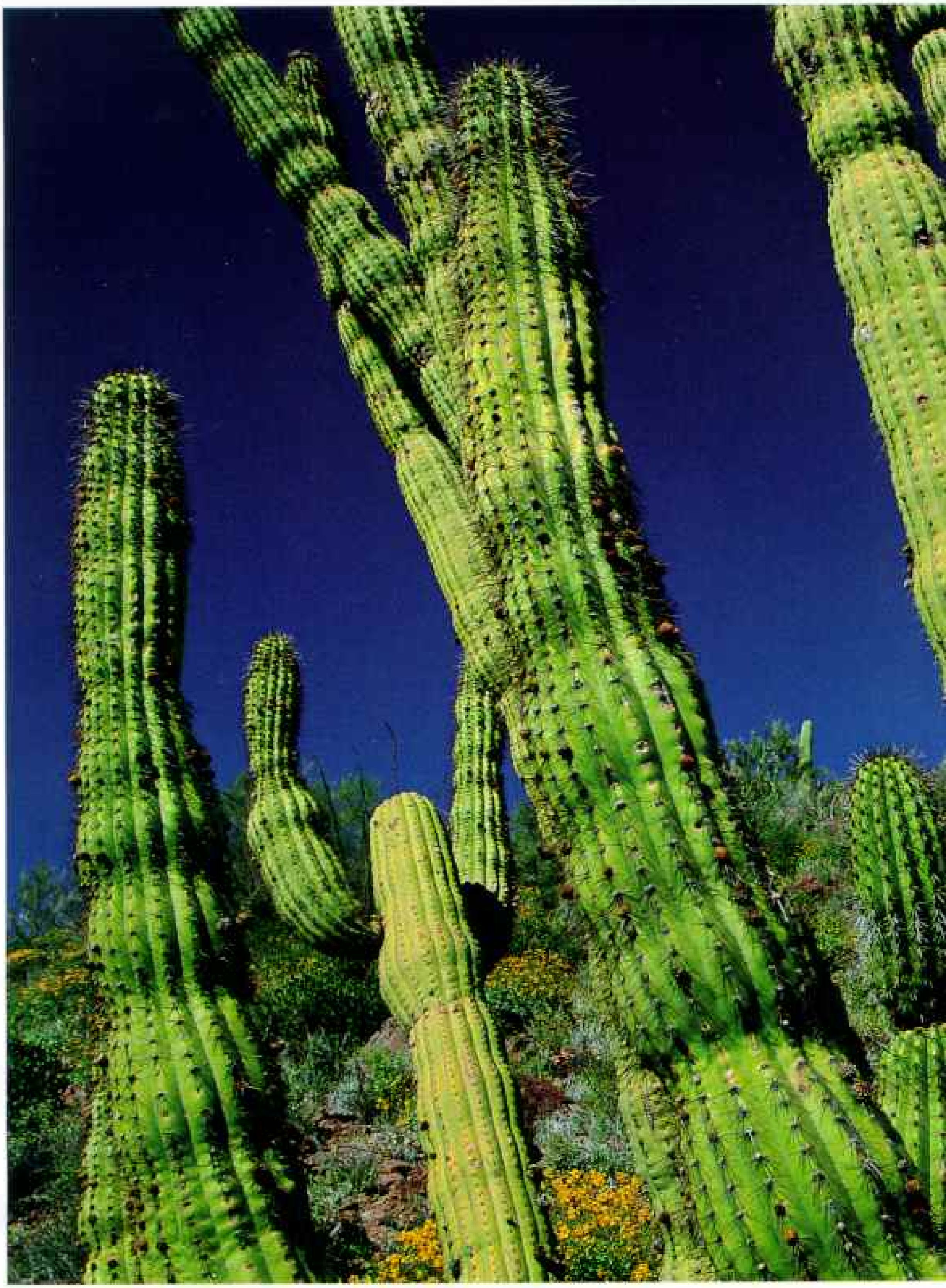
Wilderness held little allure for early settlers. Deep and dark, full of beasts and demons, it was good for one thing: taming. But as America's vast blanket of wildlands was reduced to swatches, wilderness became a refuge—for both wildlife and people. In 1964 the United States began designating roadless areas as wilderness. These lands haven't necessarily escaped the hand of man, but they have been given the chance to survive it. Wolves and grizzlies no longer roam Oregon's Kalmiopsis Wilderness (left), yet it remains one of the wildest and most botanically diverse areas in the lower 48.

Thousands of tired, nerve-shaken, overcivilized people are beginning to find out

SEQUOIA-KINGS CANYON WILDERNESS, SEQUOIA AND KINGS CANYON NATIONAL PARK, CALIFORNIA

that going to the mountains is going home; that wilderness is a necessity. . . .

—JOHN MUIR

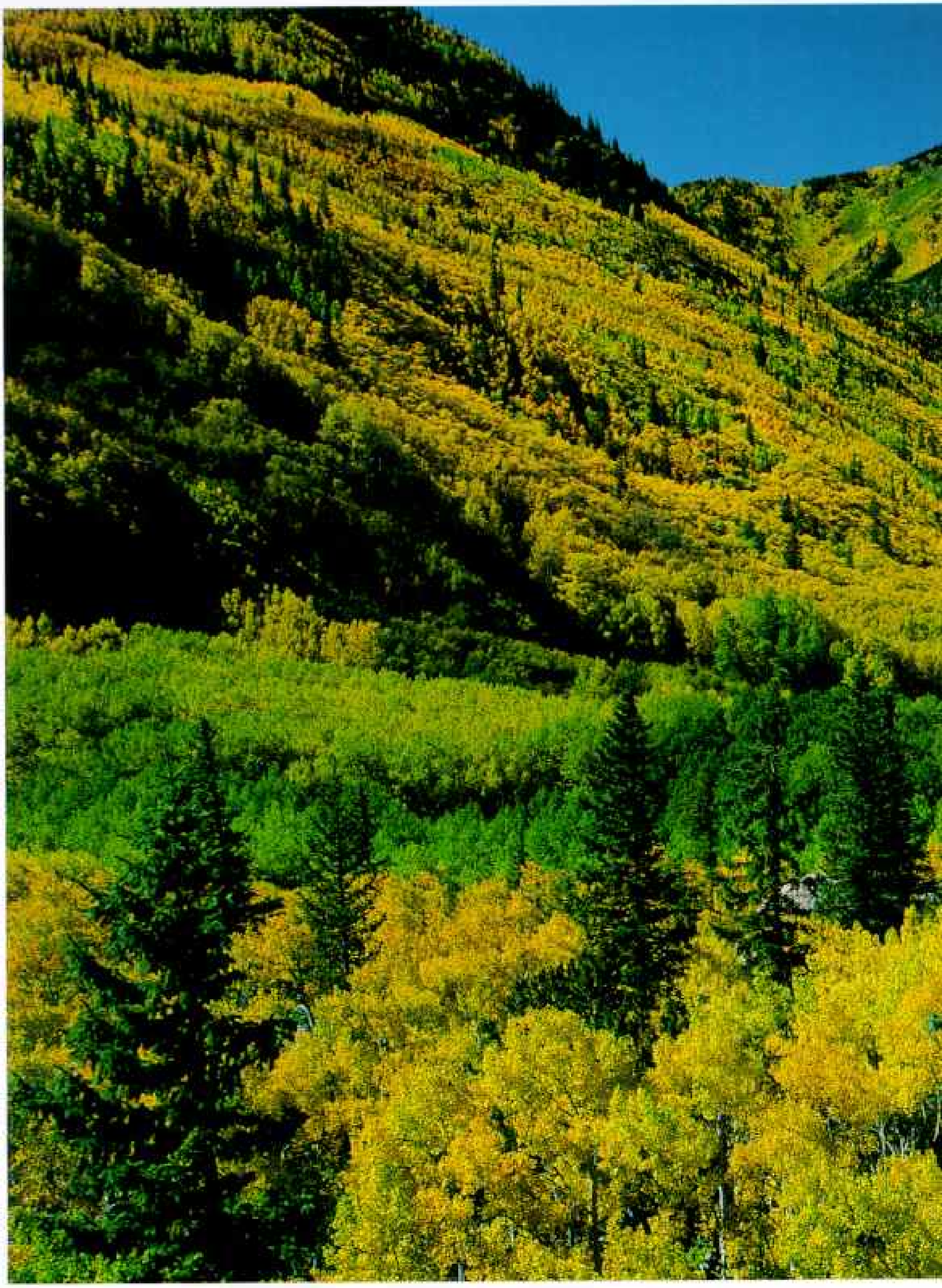


You can't see *anything* from a car. . . . You've got to . . . walk, better yet crawl,

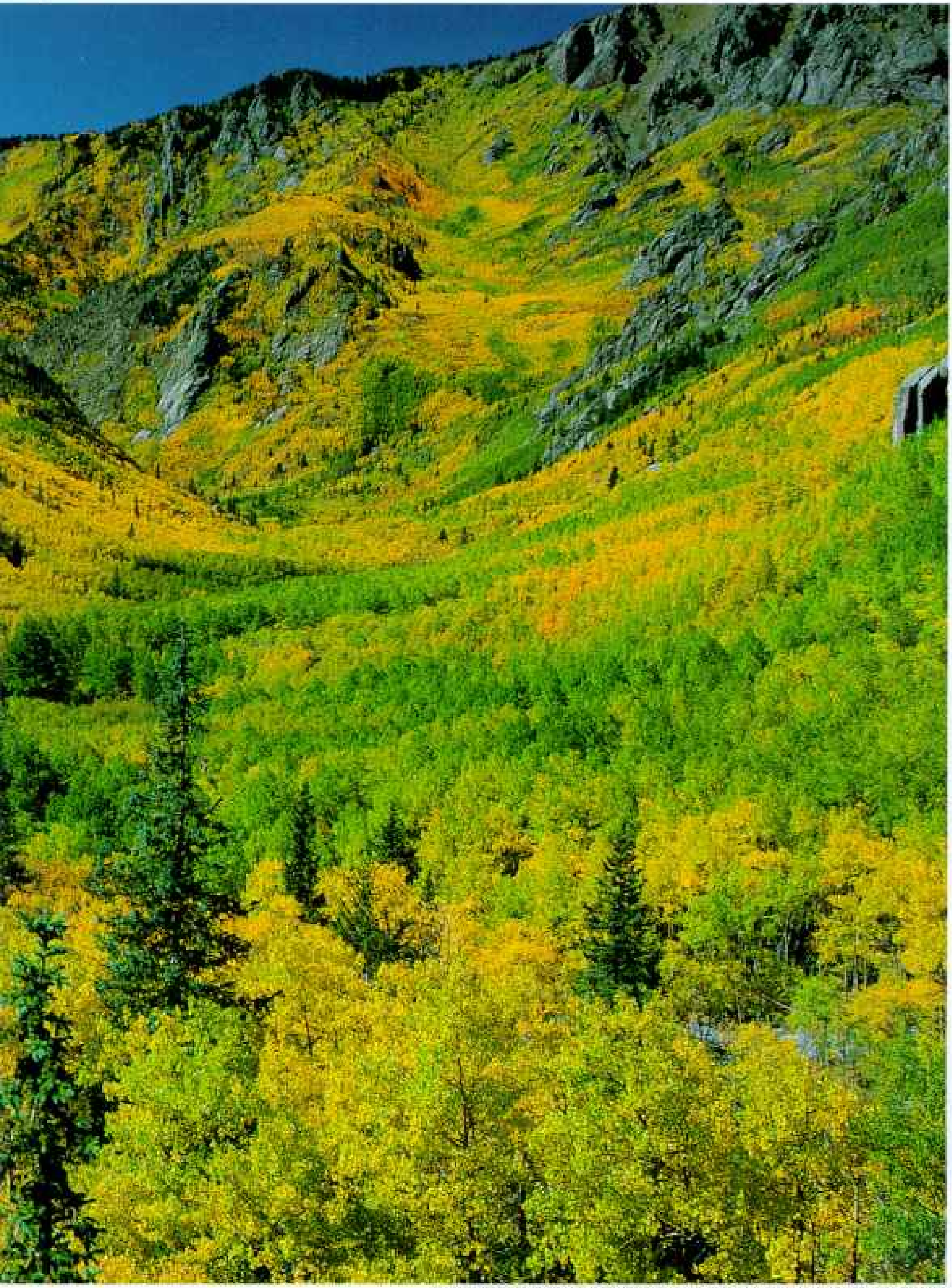
ORGAN PIPE CACTUS WILDERNESS, ORGAN PIPE CACTUS NATIONAL MONUMENT, ARIZONA

on hands and knees, over the sandstone and through the thornbush and cactus.

—EDWARD ABBEY



I am glad I shall never be young without wild country to be young in.



SANGRE DE CRISTO WILDERNESS, RIO GRANDE NATIONAL FOREST, COLORADO

Of what avail are forty freedoms without a blank spot on the map?

—ALDO LEOPOLD

IT IS HARD TO RESIST a place that is known as Kootznoowoo, Fortress of the Bears. That's what the resident Tlingit call it, rejecting the square-rigged English name, Admiralty Island, and the antique fur trader's Russian, Ostrov Kutsnoi, Fear Island. One wonders which the fur men feared more—the Tlingit or the bears. Or the wilderness.

And wilderness it remains, most of this island in the rain forest archipelago of southeast Alaska—nearly a million acres of statutory uppercase-W Wilderness set aside by the U.S. Congress out of the country's largest national forest, the Tongass. There are 18 other designated wilderness areas in the Tongass and 624 throughout the federal lands of the United States. A lot to choose from. But because of my lack of resistance to bears, I have chosen Kootznoowoo to help me gather my thoughts about wilderness and share what I've seen and heard of it elsewhere over the years.

A floatplane has brought me to this pebbled beach at the edge of Windfall Harbor, a notch in Kootznoowoo northeast of the Tlingit village of Angoon. About 600 people live in that village. The island's bears are said to outnumber them two to one.

Coming in, we saw a couple of bears from the air, big brown grizzlies grazing on spawned-out salmon in the estuaries of Windfall's graveled streams. My companion, David Cline, an Anchorage conservationist and chairman of the nonprofit Kodiak Brown Bear Trust, instructed the pilot to put us down at a beach where there aren't any salmon streams. Though Cline had once been charged by a grizz and successfully outbluffed it, he assured me that coastal bruins prefer salmon to people almost every time. *Almost?* I wondered. And I forgot to bring pepper spray.

It is a fortress all right, this Kootznoowoo Wilderness. Beyond the beach the forest begins in a tangle of saltwater sedge and alder, then reaches for the sky in jagged battlements of Sitka spruce and western hemlock. Inland the forest floor yields a labyrinth of giant moss-covered snags and nettlesome clumps of devil's club. West, above the misted moat of Windfall Harbor, the mountains rise steeply through layered clouds to elevations of 4,000 feet. It is the kind of terrain that frowns on a casual stroll. The place for walking is the beach, at low tide. In the morning Cline and I will catch that tide and walk up the beach to the head of the harbor, looking for bears at a respectful distance.

So what thoughts do I have to gather, standing alone at the edge of the water while Cline scouts the fortress for a good place to camp? Only that one can never know enough about wilderness even if one has been scratching the territory and the idea for half a lifetime. And *that* is something to gather right off the bat, for wilderness is not just a place, or a congeries of places, or a management system—the National Wilderness Preservation System—that was put in place by an act of Congress. Wilderness is an idea. It is an idea at once personal and worldly—as personal as risk and freedom and solitude and

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Although PETER ESSICK's photographic assignments have taken him around the world, peering into the past and documenting diverse cultures, his most recent work delves into environmental issues in the United States.

RAINBOW LAKE WILDERNESS, CHEQUAMEGON NATIONAL FOREST, WISCONSIN

spiritual refreshment, as worldly as the living earth and waters that define it.

More than a century and a half ago the Concord eccentric Henry David Thoreau begged in writing to be shown "a wildness whose glance no civilization can endure." If he ever came close to experiencing such a thing, it was likely near the top of Maine's Mount Katahdin in September 1846. He would write of feeling "the presence of a force not bound to be kind to man." It was a presence I had clearly felt myself, often in mountain country, once or twice in places where I imagined no other human might ever have stood. I had felt it too just moments ago, after our pilot waved good-bye, kicked on the engine of his plane, and taxied into the harbor for his takeoff toward Juneau.

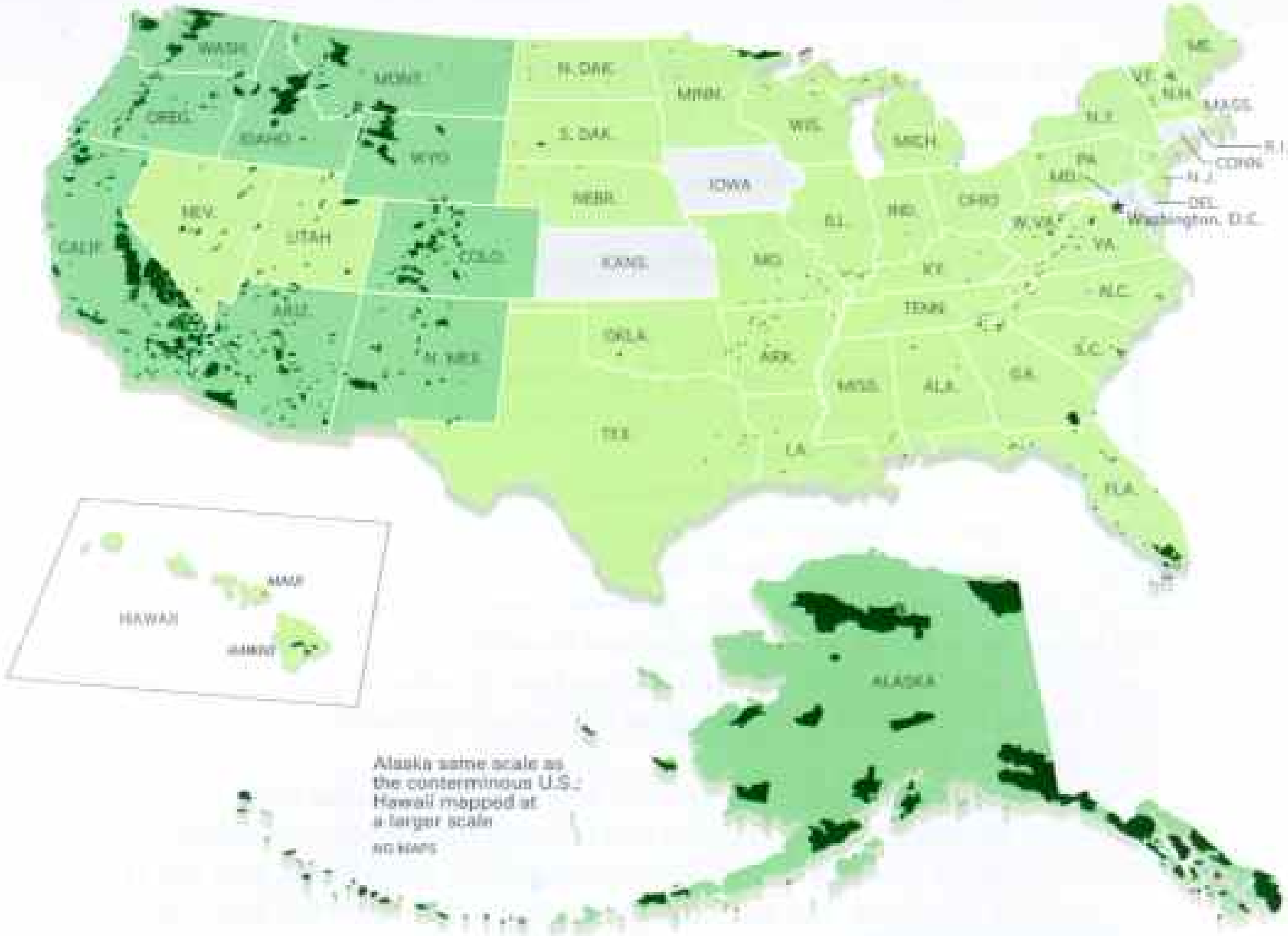
"Talk of mysteries!" Thoreau had written of those other woods a wild continent away. "Think of our life in nature,—daily to be shown matter, to come in contact with it,—rocks, trees, wind on our cheeks! the *solid* earth! the *actual* world!" I watched the floatplane lift off the water into the clouds. Then even the sound of it was gone. "*Contact!*" Thoreau had written, and for a second I thought I might have said the word myself. "*Contact!*"

ON SEPTEMBER 3, 1964, after eight years of deliberation and 66 drafts, an act creating the National Wilderness Preservation System passed under the pen of President Lyndon B. Johnson. The measure established 54 wilderness areas in national forests in 13 states and decreed that the 9.1 million acres within them were to be protected in their natural condition. Wilderness, the act declared, was to be recognized "as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." And the law further stipulated that such areas were to be forever free of "permanent improvements" such as roads and man-made structures.

Additional measures were later enacted to include more wildlands in the eastern U.S. and expand protection beyond national forests to selected backcountry areas of the National Park System, the National Wildlife Refuge System, and the public domain of the Bureau of Land Management. In 1980 the Alaska National Interest Lands Conservation Act more than doubled the system's existing acreage while allowing established practices, such as the use of motorboats and floatplanes, prohibited in most wilderness areas in the lower forty-eight. Today the nation's 624 wilderness areas embrace more than a hundred million acres, or about 4.5 percent of the U.S. landmass.

Even before a wilderness system was officially in place, exuberance and a fondness for mountain scenery posted me along the edges of a few of its future sites. I recall a scramble on the Great Western Divide of the Sierra Nevada above Mineral King, where the trail cairns made contact with a high, craggy country destined to become the Sequoia–Kings Canyon Wilderness. At 736,980 acres it is California's second largest, after the Death Valley Wilderness. And once there was a wind-chapped prowl on a spiny, porphyritic ridgetop in New Hampshire's White Mountains, above the green gulf of the once and future Pemigewasset Wilderness.

Since those early days, my sorties into this diverse assemblage of wildlands have ranged from a tundra hike in the most remote of them all, the Mollie Beattie Wilderness (eight million acres in the Arctic National Wildlife Refuge on Alaska's North Slope), to a binocular visit to one of the system's smallest units, Three Arch Rocks (a 15-acre seabird sanctuary off the Oregon coast—and off-limits to humans). But I've missed so much of it too—the Delirium and the Menagerie, Apache Kid and Cache la Poudre, the Washakie, the Popo



Total acreage per state

■	58,182,216	Alaska
	13,957,083	California
	4,529,061	Arizona
	4,324,182	Washington
	4,015,061	Idaho
	3,442,416	Montana
	3,253,945	Colorado
	3,111,132	Wyoming
	2,096,403	Oregon
	1,648,475	New Mexico

■ State with fewer than 1.5 million acres

States with no wilderness areas shown in gray

The U.S. Wilderness System

Though most Americans live within an easy day's drive of one of the nation's 624 wilderness areas, more than half the system's 104 million acres are in Alaska, and most of the rest are in western states. In the East, where barely a tree escaped the ax, requirements were adjusted in 1975 to allow wilderness designation for lands recovering from human use.

Agie, the Irish, the Scapegoat and the Superstition, Bisti, Bear Wallow, Blood Mountain, and Hell Hole Bay, among many others.

Still, I have seen and heard enough, in the places that I didn't miss, to report that the National Wilderness Preservation System is holding up reasonably well after nearly 35 years. Not that its stewards are wanting for problems. Like the national forests, parks, and refuges that contain it, Wilderness U.S.A. is peppered with problems of heavy use, abuse, and underfunding, eroded trails, invasive species, squabbling constituencies, and local interests hostile to government regulation. Yet so far, for the most part, the resource prevails.

Of all the problems, visitor impact on trails and campsites consumes the largest segment of the backcountry managers' time and charges. Almost everyone in the U.S. today lives within an easy day's drive of a wilderness area, and each year more people are making the trip. Though absolute numbers are hard to come by, the agencies report that recreational use of wilderness has increased sevenfold over the past three decades. The most heavily used areas remain those closest to large metropolitan areas, such as Denver, Los Angeles, and Seattle. Near Seattle the Alpine Lakes and Mount Baker Wilderness Areas are about as hard hit by hikers and backpackers—and erosive rainstorms—as

any in the system. "Just trying to keep these mountain trails open is a major challenge," says Gary Paull of the Forest Service. "And it doesn't help to be operating with a trails budget two-thirds of what it was three years ago."

Such problems seem remote here at the misty edge of Kootznoowoo, where there are no visitors but us and no greater immediate challenge than the prospect of starting a cook fire with wet wood.

IT IS DONE. From hemlock shavings come wisps of white smoke, a puff of orange, glowing, growing, curling around the kindling. Done. David Cline is a good scout.

Sitting now with our boots to the woodsmoke, Cline and I agree that while those little gas-fed backpacker stoves may be ecologically correct—if not obligatory in wood-scarce or combustible backcountry—they cannot begin to match the crackling ambience of a good old-fashioned campfire. What is it that bonds us so tightly to woodsmoke and pyrolysis? The spark of some primordial memory, the gene that reminds us how dreadful it must have been when the dark was never light enough at the back of the cave? Cline isn't sure, and neither am I.

Nor can we be sure of absolute answers when the fireside chat turns to contemporary questions, such as the pros and cons of manipulating wilderness in order to preserve or restore some degree of primeval naturalness. Fire sits at the center of that issue too, not our tidy Kootznoowoo campfire but rather the big burns ignited by nature's lightning and the smaller burns prescribed by human managers to compensate for decades of fire suppression.*

In a few wilderness areas natural wildfires are no longer suppressed where they pose no threat of serious smoke pollution or damage to neighboring properties. But in many regions natural fires may not occur often enough to restore wild land to what some scientist thinks might have been its pristine, pre-Smokey Bear condition. In which case the managers may intervene by orchestrating a prescribed burn.

"In designated wilderness," Cline says, "I'd have a problem with that, just as I would with suppression of fire."

So would a lot of other people. I tell Cline of my visit to a wilderness conference at the University of Montana in Missoula a few months earlier and of the dichotomy there between defenders of intervention management and those who believe wilderness is managed best when it is managed least or not at all. "We can't just let these areas 'go,' or we'll end up with something we never anticipated," said one scientist who advocates intervention. But on the other side of the issue, Tom Power, a writer and economics professor at the University of Montana, told me: "The wilderness agencies have no humility, just this sweeping idea that landscape managers can do better than nature can."

More troublesome than fire for some managers is the prospect of exotic species invading wilderness to usurp native habitats. In Montana years ago horses or cows introduced the seeds of two unwelcome plants, leafy spurge and spotted knapweed. The exotics have since spread over hundreds of thousands of acres, transforming wilderness grasslands into weedy barrens.

Meanwhile, in dozens of wilderness areas across the country, lakes and streams were stocked with non-native fish to enhance the visitor's recreational opportunities. But all too often there was an unexpected catch: The alien species ate up or starved out the indigenous ones and altered the ecosystem.

*See "The Essential Element of Fire," by Michael Parfit, in the September 1996 issue.

So what's the solution? Do managers, as some would argue, refrain from further meddling and hope that nature will set things right in the long run? Or, for the sake of restoring a lost naturalness, do they intervene—sometimes with chemicals—to purge the spurge and the alien trout?

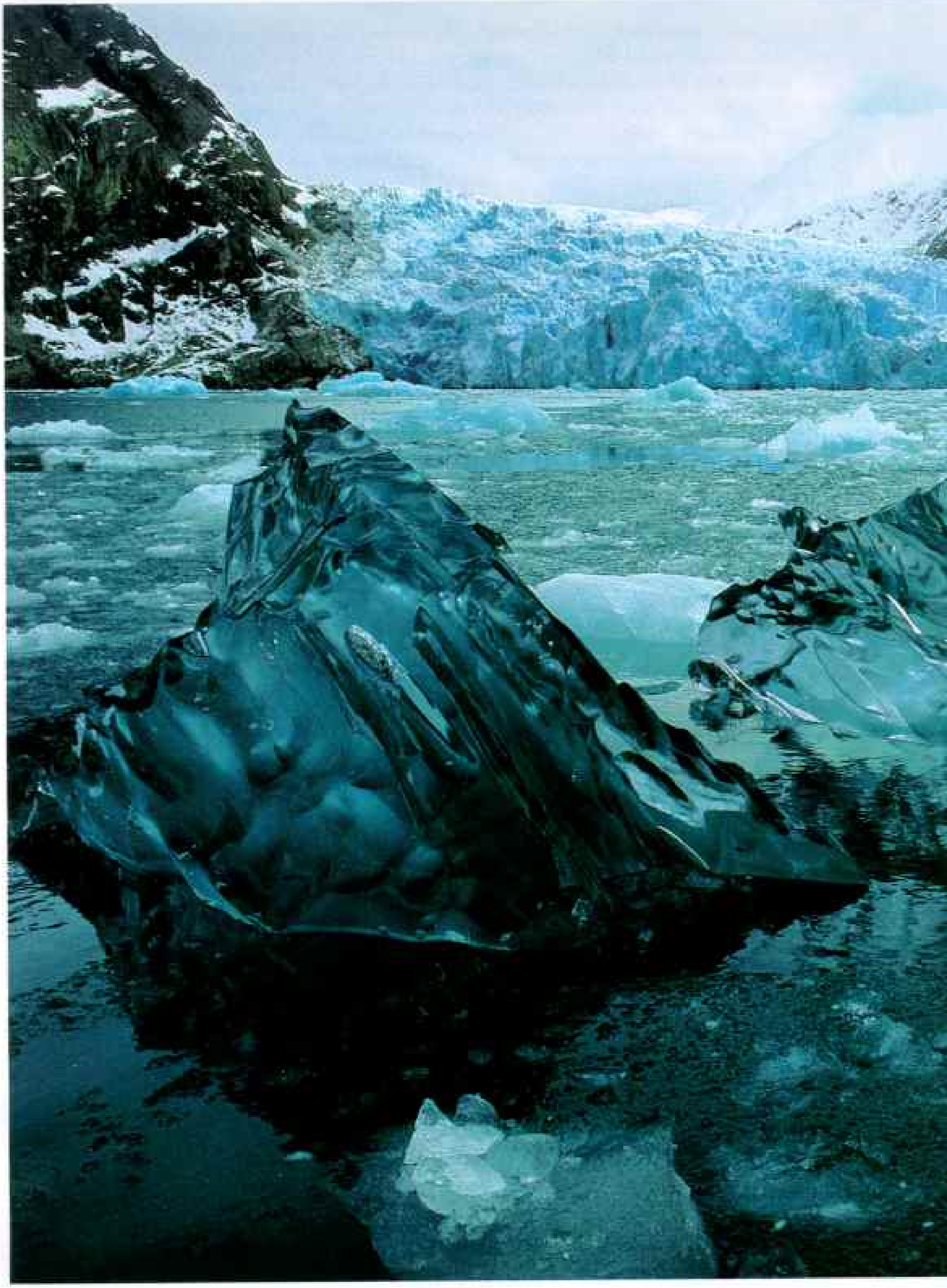
Cline, who once served a hitch as a wilderness biologist with the U.S. Fish and Wildlife Service here in Alaska, is squinting at me through the woodsmoke. We agree there is no easy answer. What might succeed on a wilderness island off the coast of Alaska might not work at all off the coast of Georgia.

CUMBERLAND ISLAND is the southernmost of Georgia's barrier islands and its largest, with 17 miles of white-sand beach and a maritime forest of moss-draped live oaks and towering loblolly pines. It is not connected to the mainland by bridge or causeway. For that reason, among others, much of Cumberland was acquired by the National Park Service in 1972 and declared a national seashore. Ten years later, at the behest of conservationists who feared the Park Service might develop the seashore for intensive recreation, Congress designated nearly 9,000 of its 36,400 acres as statutory wilderness. In so doing, however, Congress recognized that certain nonconforming uses and structures, such as the narrow unpaved road that runs the length of the island, could not soon be abandoned. They would have to be phased out over the years. Cumberland, in effect, would be a kind of evolving wilderness. Thus, even now, motor vehicles belonging to the Park Service and private landowners have access to this road and to the wide-open avenue of the beach. Backpackers complain that the vehicles disrupt their wilderness experience.

DECADES OF FIRE SUPPRESSION HAVE TURNED MANY FORESTS INTO TINDERBOXES. CONTROLLED BURNS—LIKE THIS ONE IN SEQUOIA-KINGS CANYON WILDERNESS—ARE INCREASINGLY USED TO PREVENT INFERNOS AND RESTORE NATURAL CONDITIONS.

But some advocates of a wild Cumberland are more concerned that the island's ecological stability has been put at risk by feral hogs and horses. The hogs, introduced as provender in antebellum days, compete with native wildlife for the island's slim pickings, including sea turtle eggs. Park Service trappers and marksmen have had scant success controlling the porcine population. The free-ranging horses, some descended from Arizona mustangs imported early in this century to entertain wealthy landowners, now number nearly 200 and are decidedly competitive for browse with white-tailed deer. The sight of mares and stallions trotting along the beach has proved so entertaining to visitors that the Park Service is loath to have the horses removed.

One day on Cumberland I called on Carol Ruckdeschel, a biologist who lives at the island's north end, beyond the wilderness area, collecting and autopsying the carcasses of sea turtles washed up on the beach. Ruckdeschel, like many of the island's two dozen residents whose tenure predates the seashore designation, retains the right to live out her *(Continued on page 21)*

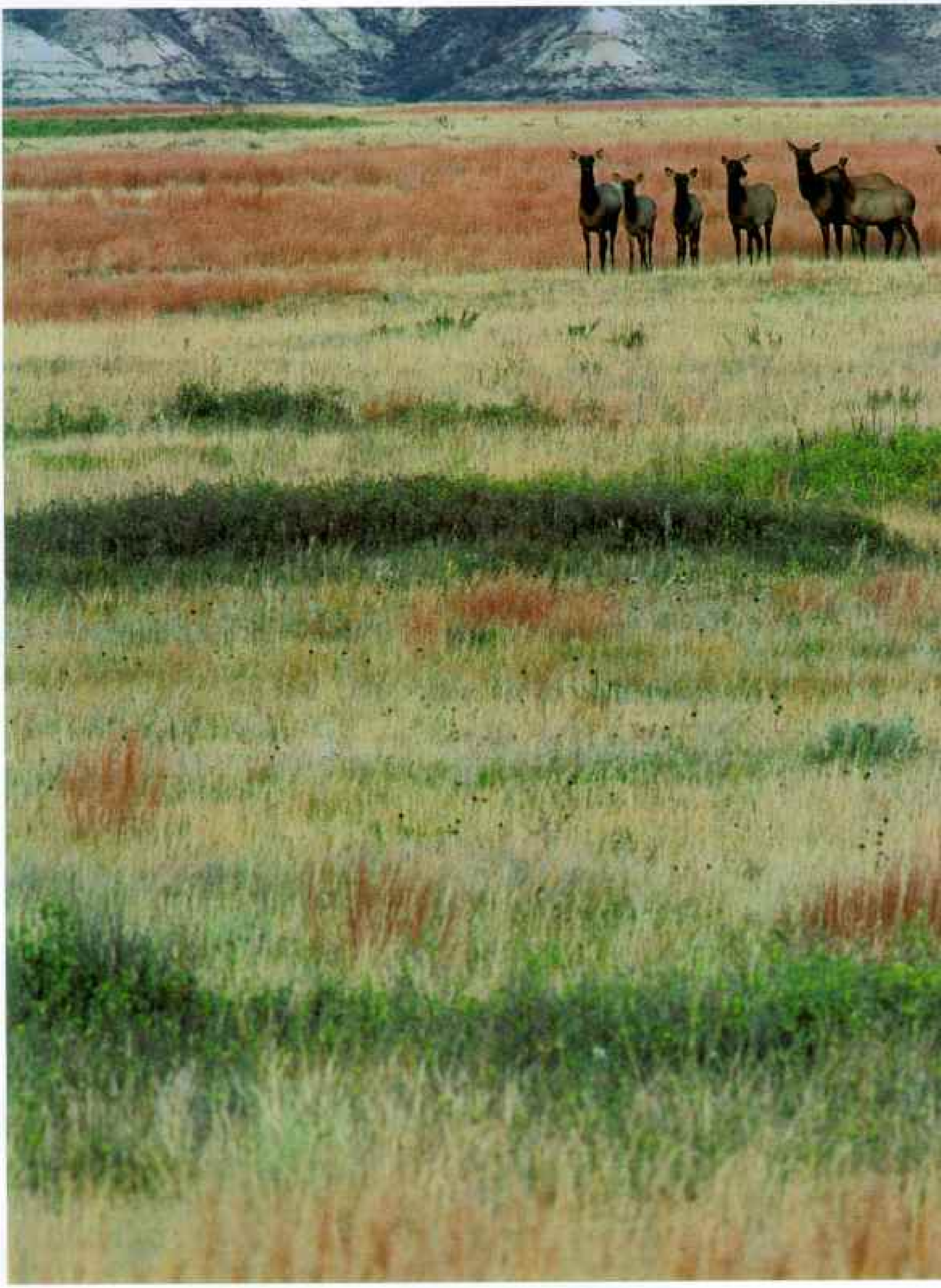


If you know wilderness in the way that you know love, you would be unwilling to let

TRACY ARM-FORDS TERROR WILDERNESS, TONGASS NATIONAL FOREST, ALASKA PETER KISSICK, BUNDNA & OLIANTA PRODUCTIONS

it go. We are talking about the body of the beloved, not real estate.

—TERRY TEMPEST WILLIAMS



We did not think of the great open plains, the beautiful rolling hills, and winding

THEODORE ROOSEVELT WILDERNESS, THEODORE ROOSEVELT NATIONAL PARK, NORTH DAKOTA

streams . . . as "wild." Only to the white man was nature a "wilderness."

—LUTHER STANDING BEAR, OGLALA CHIEF

life here and to drive on the beach and the road. An ardent wilderness booster, she tries to keep her transportation profile low to the ground, the preferred ride being a one-cylinder all-terrain vehicle.

"If you just look ahead a hundred years or so," Ruckdeschel said, "there'll be something special here. We'll all be dead and gone—no more people living out here. And no vehicles. Hell, right now the hogs and the horses cause more damage than the vehicles do."

Now, on Kootznoowoo, Cline and I have polished our dinner plates, poured a nightcap, and are silently roasting our separate thoughts over glowing coals. For my own part, I'm wondering how accessible wilderness can be, and still be Wilderness.

Sure, cracking Kootznoowoo was easy with a floatplane. But if this were a wilderness constrained by the rules of the lower forty-eight, to reach Windfall Harbor we'd have been obliged to endure either a two-day paddle by sea kayak or an arduous 25-mile trek from Angoon. Which leaves me in a somewhat vulnerable position as I declare that I cannot understand why some critics of statutory wilderness regard restriction of motorized access as an act of discrimination against the old, the infirm, and the vehicularly pampered. Thus, these scoffers argue, access to wilderness is enjoyed only by the physically elite.

As one who assuredly is not among that elite, I affirm that neither age nor infirmity barred me last year from paddling a canoe into Florida's Juniper Prairie and Everglades Wilderness Areas, riding a horse into New Mexico's Gila, or poking afoot into the Otter Creek wilds of West Virginia far enough to absorb a short measure of solitude.

But, of course, there are many wildernesses where canoes, kayaks, or horses don't work, steep mountain places accessible only to the hardiest hikers. Last year I stood at the edge of a few of those places, looked in—or, rather, *up*—and, without too much regret, tipped my hat to the lost opportunity. It was like that with the Enchantments, in the Alpine Lakes Wilderness of Washington State.

I had heard about the Enchantments from a mountaineering friend in Seattle; about stark clusters of granite spires and glacial lakes and waterfalls and heather meadows and gnarled larches with needles that glowed like gold splinters in October; about the area's Lost World Plateau and the Knitting Needles and Dragontail Peak and Witches Tower. "The way is long, steep and grueling," one guidebook warns. "A strong hiker needs at least 12 hours to reach the high lakes. The average hiker takes 2 days. The rest never make it."

I knew where that left me. So early one morning in June I dropped by the Wenatchee National Forest ranger station in Leavenworth, Washington, to see if I could find a strong or average hiker waiting there to pick up a permit to camp overnight in the Enchantments. Because of lingering snow at elevations over 6,000 feet—the Cascade summits here top 8,000—June is not the most popular month for backpacking the Enchantments. But I was in luck. Mark Simon and his friend Heather Wolfe, permits in hand, were getting ready to head out. They both looked strong enough, in their early 20s, traveling light with 30-pound packs, food for three days. They'd take it slow, Simon said, because of his bad knee. "Blew out a ligament skiing last winter," he explained.

How did he feel about the Forest Service restricting overnight use with

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STURGEON RIVER GORGE WILDERNESS, OTTAWA NATIONAL FOREST, MICHIGAN

permits issued by advance reservation or daily lottery? Did he feel that was an infringement of his liberty to use public land? "It's an inconvenience, that's all," he said. "The permits are a good thing. Without them, I don't think the Enchantments could withstand all the use they'd otherwise get."

I wished Simon and Wolfe happy hiking, paid my respects to the Leavenworth district ranger and her wilderness manager, and then drove out along the Icicle Creek Road to the Enchantments trailhead at Snow Creek. There was scattered dead timber on the slope that the trail ascended in switchbacks. I was hoping to catch a last glimpse of the couple working their way up the mountain, but already they were out of sight over the first ridge. Forget that blown-out ligament. Those two were better than average. And I was happy for them, because I knew they were going to make it to the high country.

TENTS DO NOT AGREE with me. Flat on my back in a sleeping bag, I much prefer the starlit sky to a nylon roof, except when the bugs are biting or the clouds are spitting—and that's what the clouds are doing to our tent tonight in the Kootznoowoo rain forest. A steady drizzle it is, just enough patter to muffle the imagined footfalls of insomniac bears. I try to think of other nights untented—no biting bugs, no spitting clouds, no grizzlies. I think of a night flat on my back beside the Middle Fork Gila River, with the rimrock framing a wedge of sky flecked with a million stars.

CONGRESS CALLED WILDERNESS A PLACE "WHERE MAN HIMSELF IS A VISITOR WHO DOES NOT REMAIN." MAN'S TRASH IS ANOTHER STORY. PULL TABS LIKE THIS ONE IN ARIZONA'S HUMMINGBIRD SPRINGS WILDERNESS HAVE BEEN OUT OF USE HERE SINCE 1983.

It was a pilgrimage, that horseback trip into the mountain backcountry of southwestern New Mexico. If I was going to celebrate the idea of federal wilderness, I had to go to the place where it began—sort of like celebrating the Fourth of July beside the Liberty Bell at Philadelphia's Independence Hall.

The Gila—pronounced HEE-lah—is both river and wilderness tucked into a national forest of the same name. Elevations run from 5,000 feet on the floor of some canyons to nearly 11,000 on top of Whitewater Baldy in the Mogollon Mountains. Cool forests, sparkling trout streams, elk and bighorns and javelinas, black bears and mountain lions, solitude for those who seek it and scenery enough to knock your specs off. I went out of Gila Hot Springs with outfitter Becky Campbell, her husband, David Snow, and Charles Little, an old friend and writer with much savvy about matters of the land and why land counts in the human scheme of things. And I wanted Little's company in the Gila because he is savvy about Aldo Leopold.

We rode in through piñon and juniper country, down the twisty Little Bear Canyon to the Middle Fork, and then upstream between towering red rock cliffs and riverine sycamores to a parklike spot with plenty of dead Gambel oak for the cook fire and deep ponderosa shade for hobbling the stock. I thanked my horse, Tater, for the ride, staked out a stargazer's spot for my bedroll, and

perched on the riverbank, watching for signs of insects and trout. Little sat down beside me, pointed at a big pool upstream, and said, "I'll bet you anything Aldo Leopold wet a fly line right there about 80 years ago."

Why 80?

"Because," said Little, "that's about the time Aldo Leopold got into this country first time around."

Leopold's is such a runaway story, we'd best pull back on the reins. He hailed from Iowa, long after the sodbusters had tamed the prairie. Maybe he got a taste of the wild during boyhood summers in the Les Cheneaux Islands, topside of Lake Huron; every time he looked north from there, he imagined boreal mysteries beyond the horizon. By and by he went to Yale, joined the Forest Service, was posted to Albuquerque, rode into the Gila on survey patrol.

One day in 1919 Leopold had a talk with another young forester named Arthur Carhart. A landscape architect by training, Carhart had this crazy idea that the shorefront of Trappers Lake, up in the White River National Forest of Colorado, ought to be preserved for its scenic value rather than developed with roads and summer cabins. It was an encounter of kindred spirits. On behalf of scenery, Carhart would prevail in preserving Trappers Lake against the incipient roadbuilding mentality of the Forest Service, while Leopold within a few years would be advocating an even larger heresy—the setting aside of wilderness areas in national forests for public recreation. And what sort of area did he have in mind? An area "big enough to absorb a two weeks' pack trip," he wrote; a place "devoid of roads . . . or other works of man." Such as? Such as "the headwaters of the Gila River," a half million acres that could absorb a hundred pack trips a year "without overcrowding." In 1924, by administrative decree, the Forest Service designated a portion of the Gila as its first wilderness. (Today the Gila and the adjoining Aldo Leopold Wilderness embrace nearly 1,200 square miles.)

From Leopold's earliest writings—and from the Gila—the wilderness movement gained momentum, inducing the Forest Service to honor roadless areas as much as commercial clear-cuts and enrolling such influential leaders as Bob Marshall, a co-founder with Leopold of the Wilderness Society, and Howard Zahniser, who as that society's executive director would spearhead the legislative effort resulting in the Wilderness Act of 1964.

"And now," Charles Little was saying beside the Gila River, "we have a wilderness system, but I'm not sure we yet understand Leopold's wilderness idea. It's not just a matter of protecting land because it's scenic or because we can pack in for three days to catch trout. 'Land is a community,' Leopold wrote. Its waters, soils, plants, animals all fit together not for our sake but for their own."

"Trouble is," I said, "that's what's driving some people right up the wall."

IN RECENT YEARS I have encountered more than a few individuals who feel uneasy, if not threatened, when bureaucrats or new-wave biologists speak of preserving wilderness ecosystems at the expense of human use. That evening with Little beside the Gila River, we listened to the complaints of our outfitter, who was deeply concerned that officials in faraway places were making decisions—about livestock grazing in the Gila, for example—better left for the local folks to sort out. And one month later, in the northern Cascades of Washington State, I heard similar tales about government regulation from another outfitter, at a hideaway place called Stehekin.

For a perfect little community at the edge of wilderness, you'd be hard put to find one more remote than Stehekin. It sits up there at the top of that

landlocked fjord, Lake Chelan, tucked into one big North Cascades National Park wilderness—the Mather—and bracketed by two other areas administered by the Forest Service—Glacier Peak and Lake Chelan–Sawtooth. Wilderness Village, some people call it, though not the handful who live there year-round served only by boat and floatplane, the lake so deep and windy it rarely freezes.

Cliff Courtney is the proprietor of the Stehekin Valley Ranch a few miles beyond the village, a hop and a skip from the Mather Wilderness. Courtney runs white-water raft trips on the Stehekin River and, with his brother Cragg, horse trips into the mountains. Some of the trips are called Hike & Like It, the idea being that you hike while a horse totes your gear.

One morning I sat with Cliff out behind the ranch's main lodge, looking across a stock corral and a field of new rye and over the spruce tops to mountain snowfields almost blinding in their whiteness. He was telling me about government regulations.

"They're talking about cutting us down to 12 sets of eyes," he said. "That means six horses and six people per trip. Not much for earnings when we used to be able to take 20 to 30 people a trip." Courtney took a deep breath and said, "You keep making it harder for people to be a part of wilderness, and you'll lose them. Okay, I may be grinding my own ax, but it seems to me the best thing you can do for wilderness is to show it to people and share it with people and let them see how great it is."

Courtney's father, Ray, who died in a trail accident some years back when a loose packhorse knocked him off a 200-foot cliff, helped form the North Cascades Conservation Council and led Sierra Club trips to promote wilderness designation. But later, Courtney said, his father felt betrayed when conservationists pushed for tighter controls on wilderness access.

"In a lot of people's minds," Courtney went on, "there's a real question whether all this overlayering of regulation is really to protect wilderness or part of some greater plan to keep people out. I find fewer and fewer everyday Joe and Sally Sixpacks who can relate to the wilderness. They haven't been there. For a lot of them, wilderness is just a word that means No."

IT IS MORNING in Kootznoowoo. The rain has stopped, the tide has ebbed. David Cline and I are walking up the beach toward the head of Windfall Harbor, toward that wide gravel estuary where we spotted one of those grazing grizzlies from the air. A harbor seal, goggle-eyed, watches us from the water. An eagle, suspicious of our approach, flees its roost at the top of a Sitka spruce. A mile away, on the other side of the harbor, a small dark spot moves slowly along the water's edge. Cline measures the spot with his eye and identifies it as a young grizzly.

Suddenly I am feeling exposed and alone on this wide-open strip of tidal cobble and glacial grit. Possibly it's that old Thoreauvian imagining again—the presence of a force not bound to be kind to me, or to Cline. Whatever it is, I like it. What I don't like are the forces not bound to be kind to wilderness.

As I follow Cline to the head of Windfall Harbor, I am thinking that the rule books by now ought to be pretty clear regarding motors and wilderness, but what about all these newfangled high-tech electronic devices that weren't even around when the Wilderness Act's language was drafted more than a generation ago? I mean what about cell phones, global positioning systems, and laptop computers? How wired can the wilderness be, and still be Wilderness?

Put that question to federal agencies, and you'll hear variations on a theme

expressed by Jeff Jarvis, the Bureau of Land Management's wilderness leader. "Sure, these items will detract from the wilderness experience, but it's the individual's choice. We have no intention of regulating these devices any more than we would regulate the use of cameras."

Wes Henry, Jarvis's counterpart over at the National Park Service, agrees, but he responds to the question a bit more critically. "People are using these things as crutches," he says. "A woman called once on a cell phone from the middle of the wilderness. She said she had blisters and was tired and wanted us to take her out in a helicopter."

Cyberspace invasion of wilderness worries some purists more than cell phones do. The way they tell it, it won't be long before our backcountry trails are obstructed by hackers hunkered over their laptops, checking their e-mail. Richard Bangs, a West Coast expeditionary entrepreneur and advocate of online adventure travel, has carried the information age even deeper into the wilds. Defending the use of computers, digital cameras, and satellite communications to link a wilderness expedition to a website, Bangs wrote: "The Internet is not the death of wilderness. It may be its savior. . . . For the first time, we can showcase the beauty and magic of a wild place to a global audience, and millions can participate in a journey through it without ever breaking a branch or stepping on [fragile] soil." Bangs's cybersorties have ranged from Africa to the Antarctic.

TAKE ONLY MEMORIES, LEAVE ONLY FOOTPRINTS? SOMETIMES THAT'S LEAVING TOO MUCH. WITH WILDERNESS LANDS BEARING SEVEN TIMES THE TRAFFIC THEY DID 30 YEARS AGO, FRAGILE SPOTS LIKE THIS IDAHO ALPINE MEADOW CAN BE EASILY DAMAGED

Virtual wilderness. It may be with us sooner than we think. In Minnesota the Boundary Waters Canoe Area in Superior National Forest now has a website designed to help the prospective visitor plan a wilderness trip. Not everyone is ecstatic. Alan Watson, a social scientist at the Aldo Leopold Wilderness Research Center in Missoula, Montana, says: "They're approaching a level of information that makes me wonder why one would want to go to that wilderness. The sense of discovery is why people go there, but discovery's gone. Risk and adventure—gone. I felt like they'd just taken the Boundary Waters away from me."

At the head of Windfall Harbor a braided stream rushes out of the rain forest through a wide and open valley edged with alder and spruce. This is where, from the floatplane, we saw the big grizzly. This morning no bear is in sight. "I'll bet you it's up there," Cline says. "Taking a nap in those alders. Bloated with salmon."

I can believe it, because this stream is bloated with salmon—thousands of them, mostly pinks, dead or dying in the shallow riffles, the last of the spawners fighting the flow with flapping tails, humpbacks atilt. What a movable feast for the seagulls, the eagles, and the bears. And what a gift to the sea as the

uneaten carcasses rot and post their nutrients down this stream to nourish invertebrates—the food supply for next year's salmon. Contact. This is how wilderness works.

But where is the bear?

"We *could* stroll upstream a way," Cline says.

"*You* could. I'll watch."

Cline splashes across a channel and takes a direction that looks discreetly sideways to upstream. Be wary of poetic justice, Cline. You don't want to deprive the Kodiak Brown Bear Trust in Anchorage of its chairman.

My friend's passage across the gravel bars puts the squabbling gulls to flight, and suddenly I find myself wrapped in a circle of silence that is punctured only by the stream that runs through it and by the struggle of the dying fish. I close my eyes and try to imagine the measure of this million acres of Kootznoowoo Wilderness, this one percent of all our designated wilderness between the Arctic and the Everglades. The devil in me asks, Do we really need it all? Isn't a hundred million acres more than enough for scenery and solitude and risk and self-discovery and genetic diversity and, as a wise woman once remarked, for securing answers to questions we have not yet learned how to ask?

Or is a hundred million acres *not* enough?

There are those—on the right hand of Congress and in the western countryside—who say we have too much wilderness already and should forthwith unhinge it from the federal estate. But others, citing the pressures and stresses on existing wildlands, argue that we could double the size of the system and still be deficient. Advocates cheer a recent Clinton Administration temporary moratorium on roadbuilding in millions of acres of national forest, thereby suspending logging and converting those lands into de facto, though impermanent, wilderness areas. They demand additional wilderness in the forests of the Northwest, the Rockies, and the Appalachians. They call on the National Park Service to complete or update its review of wilderness study areas in 27 parks, including Grand Canyon, Glen Canyon, and Big Cypress. They want the Bureau of Land Management to recommend to a divided Congress the designation of 8.5 million acres of red rock mesas and canyons in southern Utah. Some even say that 58 million acres of wilderness in Alaska is not enough; 125 million acres more should be designated.

"We have only a fraction of the wilderness we're going to need," says Gaylord Nelson, the former senator from Wisconsin, father of Earth Day, and longtime counselor to the Wilderness Society. "Our public lands are being overwhelmed by population pressures. There'll be half a billion people in this country by 2075. The rarest thing you'll find by that time will be a natural area undisturbed by the hand of man. It will be a real tragedy if we don't start now doubling or even tripling the extent of our designated wilderness."

Cline has come back from his reconnoiter with a sad sort of smile on his face. "Gets pretty narrow up there," he says, hooking his thumb at the alder-edged valley behind him. "Not a good place to spook a sleeping bear."

We head back toward camp. About a hundred yards down the beach, Cline stops and turns to look one more time at the gravel flats and the long green valley tapering into the rain forest. If I know Cline—and what wilderness does to people like him—I know exactly what he's feeling. He doesn't want to leave the uncertain presence in the alders. He wants to go back up that valley, into the real world.

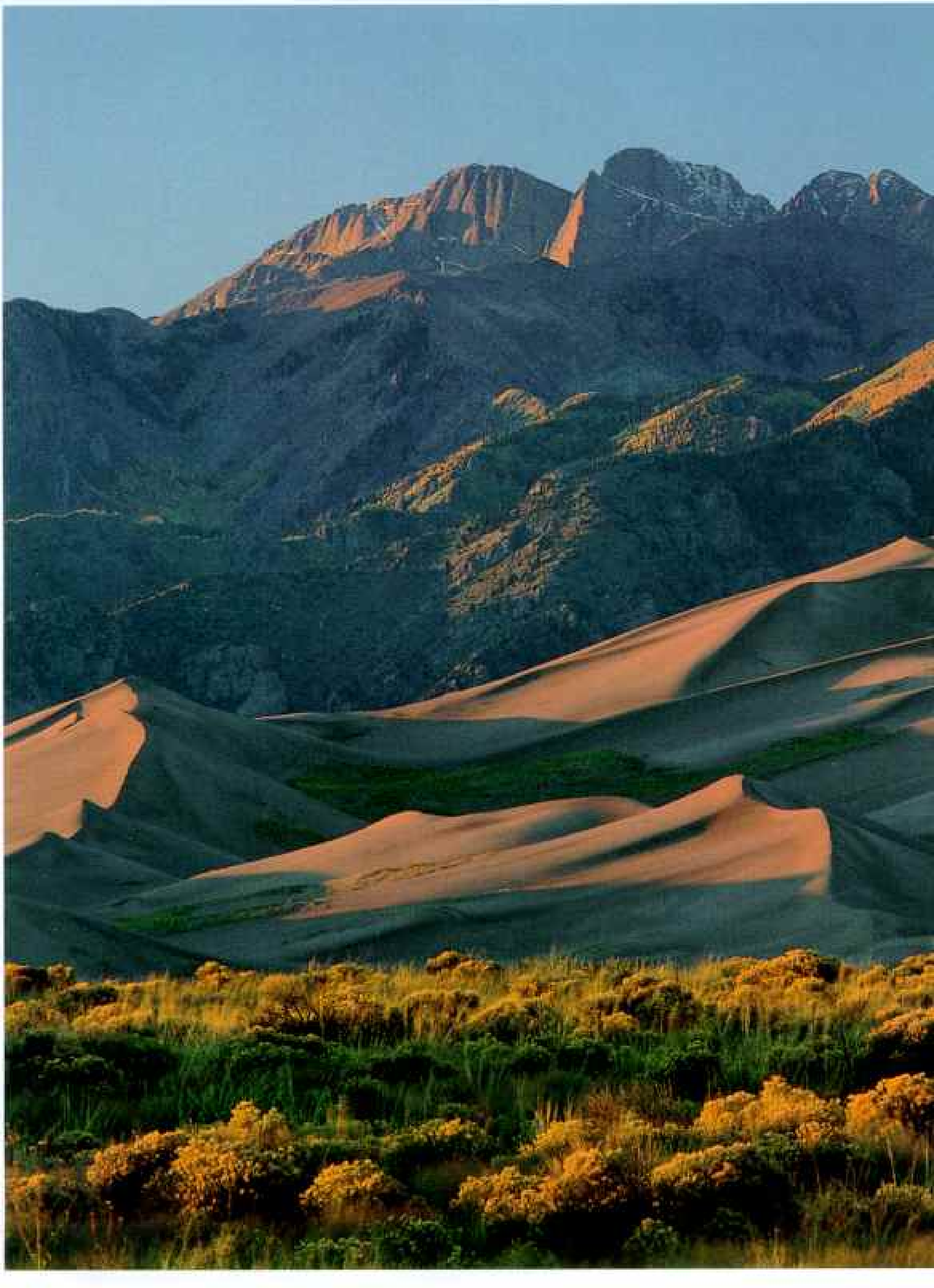
GREAT GULF WILDERNESS, WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE

At the gates of the forest, the surprised man of the world is forced to leave his city

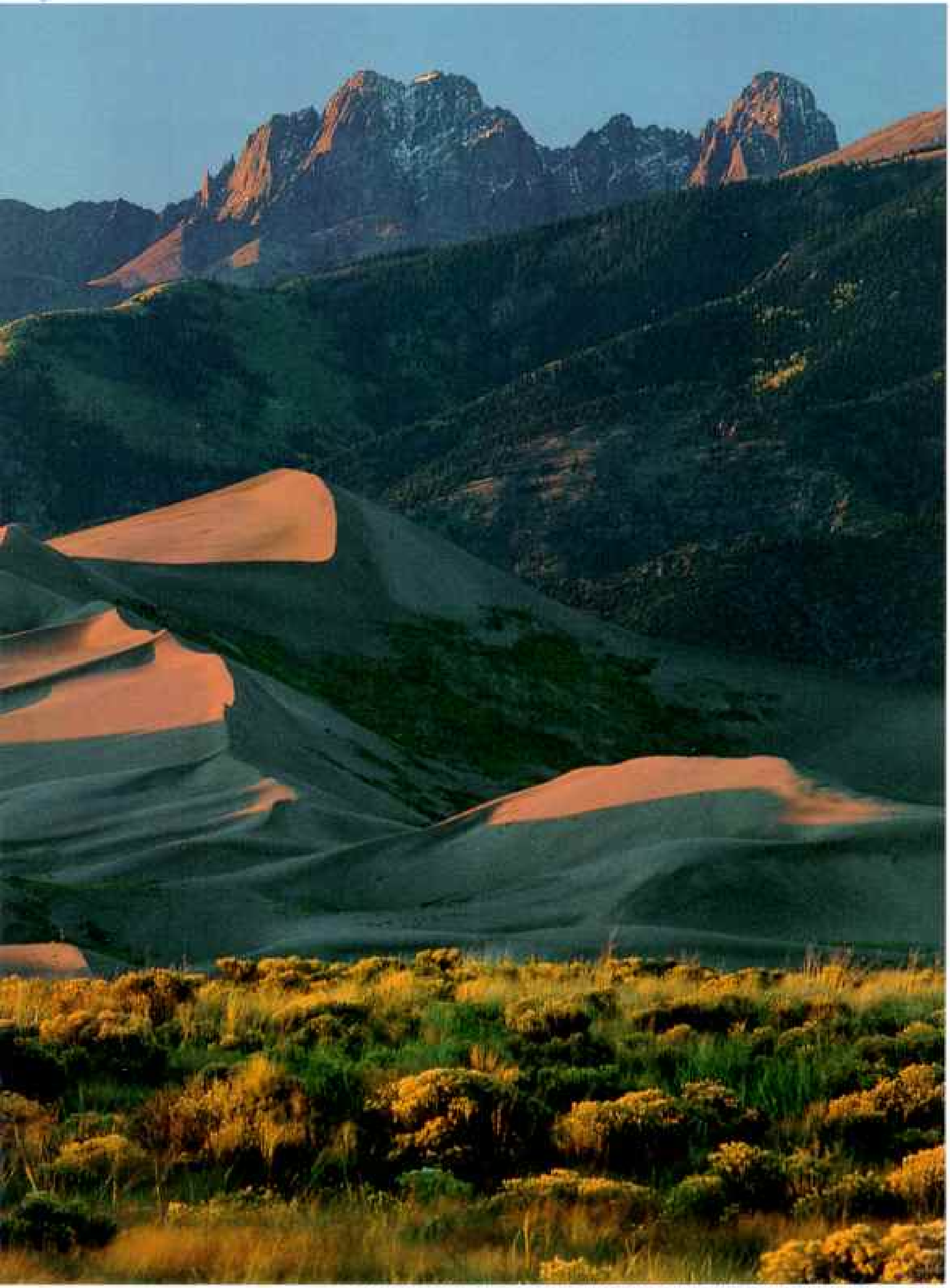
CUMMINS CREEK WILDERNESS, SIUSLAW NATIONAL FOREST, OREGON

estimates of great and small. . . . The knapsack of custom falls off his back.

—RALPH WALDO EMERSON



We simply need that wild country available to us, even if we never do more than drive



GREAT SAND DUNES WILDERNESS, GREAT SAND DUNES NATIONAL MONUMENT, COLORADO

to its edge and look in. For it can be a means of reassuring ourselves of our sanity. . . .

—WALLACE STEGNER

HUMMINGBIRD SPRINGS WILDERNESS, BUREAU OF LAND MANAGEMENT, ARIZONA

Today's appreciation of wilderness represents one of the most remarkable intellectual revolutions in the history of human thought about the land. . . . Wilderness has evolved from an earthly hell to a peaceful sanctuary where happy visitors can join John Muir and John Denver in drawing near to divinity. Such a perspective would have been absolutely incomprehensible to, for example, a Puritan in New England in the 1650s.

—RODERICK NASH

JOYCE KILMER-SLICKROCK WILDERNESS, NANTAHALA NATIONAL FOREST, NORTH CAROLINA

A COMEBACK FOR THE COSSACKS

By MIKE EDWARDS
ASSISTANT EDITOR

Photographs by GERD LUDWIG

Ardent protectors of Mother Russia—and sometimes her rebellious sons—Cossacks strike a prideful pose as they celebrate the founding of Stavropol as a Cossack fortress. One of the largest subgroups of this warrior caste, the Don Cossacks, who received an official seal (above) from Tsar Peter the Great, originated as a band of mercenaries along the Don River. Repressed in Soviet times, Cossacks battle today for power to shape their destiny.

PLAYFULLY RAMPANT, HORSE AND RIDER REAR AS ONE IN RUSSIA'S FABLED DON RIVER.

Eternally on horseback, eternally ready to fight, eternally on guard.

—ALEXANDER SERGEYEVICH PUSHKIN

They are of robust stock, handsome, lively, industrious, submissive to

PICNICKERS LEAVEN THEIR LUNCH WITH REVELRY ON THE BANKS OF THE DON.

On the cobbled square in front of the cathedral of Novocherkassk, in the sprawling steppe of southern Russia, 3,000 men stand at attention. Some are in army fatigues, but most wear the traditional uniform of the Don River Cossacks, an olive tunic and blue trousers with red stripes down the legs.

Their flags are emblazoned with crosses, sabers, and the double-headed Russian eagle. "Wounded But Not Conquered" is the motto on one, which bears an old Cossack symbol of defiance, a stag still standing though an arrow has pierced its back.

A band strikes up, and the Cossacks pass before a bearded fellow who is their *ataman*, or leader. Their ranks waver as they try to execute a turn while marching ten abreast. "We're not in the village entertaining ourselves!" shouts the parade marshal. "March straight! Don't swing your arms like you're throwing something away!"

As I watch from the cathedral steps, it seems that nearly six centuries of history are passing before me. Cossacks trace their origins at least to the 1400s, when their traditional homeland, the steppe of Russia and Ukraine, was virginal grassland that belonged to no government—"an ocean of green and gold, sprinkled with millions of different flowers," as Nikolay Gogol wrote in "Taras Bulba," the story of a Cossack chief.

They were not an ethnic group but an agglomeration of brigands and soldiers for hire; a possible meaning of "Cossack" is "free warrior." From a few bands of horsemen and pirates they swelled into a warrior caste that numbered nearly five million by the beginning of the 20th century. At times Cossacks fought against imperial Russia, but mostly they served alongside the tsars' soldiers. Cossacks were in the vanguard of the legions that colonized Siberia, hurled back Turkish invaders, and captured the Caucasus and Central Asia. In Russia's war with Napoleon in 1812-14, Cossacks not only helped chase the French army from Russian soil but triumphantly rode all the way to Paris.

Chests swell across the square as a speaker extols these exploits, and even the threadbare World War II uniforms worn by a few pensioners seem splendid. "Cossacks *created* Russia," an officer boasts to me. And many yearn to create Russia anew, strong and righteous, with law prevailing against the near anarchy that afflicts Russia today.

From St. Petersburg on the Gulf of Finland to Vladivostok on the Sea of Japan, these warriors are marching again. More than 400 Cossack groups have sprung up, some enlisting only a few dozen "sabers," as Cossacks call themselves, and others attracting thousands. The ceremony at Novocherkassk, once capital of the huge Don *voisko*—meaning host, or community—marked the enrollment of that legion as a sort of home guard, government sponsored. Many other units are independent, not wanting to swear fealty to a government they blame for Russia's lawlessness and chaos.

Some Cossacks have taken up arms again. In the war against Chechnya, 800 were hired to fight with the Russian Army when that Caucasus state tried to wrest its independence in 1994-96. Some aided the Serbs in the former Yugoslavia. At home a few have verged into vigilantism, attempting to enforce public order with an old Cossack weapon, the whip.

Although Cossacks were savagely repressed after communists seized power in 1917, an estimated five million Russians claim Cossack ancestry. Tens of thousands of other descendants live in Ukraine and ex-Soviet Central Asia, but few of those are organized.

Many of the Cossacks I met in Moscow and across the wide steppe gazed nostalgically back to a time they believe was better than the present—say, to the 19th century, when

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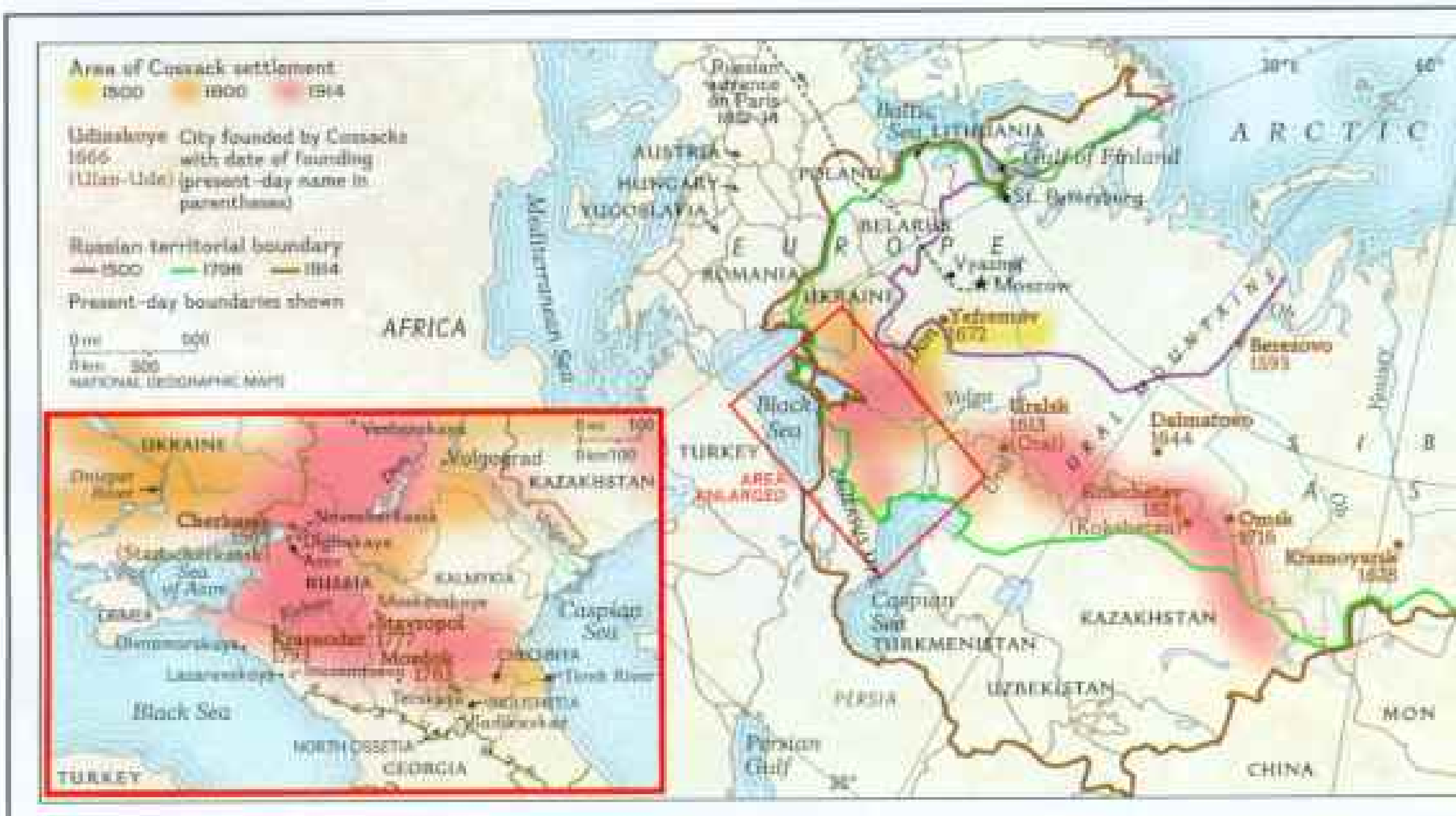
Photographer GERD LUDWIG has worked with MIKE EDWARDS on several NATIONAL GEOGRAPHIC articles about the former Soviet Union, including "A Broken Empire" in the March 1993 issue.

authority, brave, good-natured, hospitable . . . indefatigable, and intelligent.

—AUGUST VON HAXTHAUSEN

Wooden domes top Resurrection Cathedral in Starocherkassk, early capital of the Don Cossacks, one of ten government-sponsored Cossack groups today. Perhaps offshoots of Mongol invaders, Cossack bands swelled with brigands and runaway serfs from tsarist Russia. The crown later used Cossacks to guard borders and lead Russian expansion across the steppe, where their outposts grew into settlements (map).



Cossacks possessed land and enjoyed a measure of freedom in managing their affairs. "A Cossack house was always clean," a fellow named Ivan Zolotaryov told me. "It might have a clay floor, but there were herbs on the floor for aroma. We want to revive the Cossack spirit and have communities governed by the oldest person again, with children staying home and learning to farm." But sons also would be expected to serve in the military, as virtually all Cossack sons once did.

To be ready to fight was the essence of Cossack identity from earliest times. But who the earliest warriors were is still debated in the steppe. "It seems they were not Russians," Nikolai Manchenkov offered. "They may have been Scythians or other warrior nomads." Nikolai is ataman of Olginskaya, a village close to the Don. Like most Russian villages, it is grooved by unpaved, rutted streets. We sat under a walnut tree beside his small brick house. Chickens wandered and clucked.

Many Cossacks like to claim descent from the fierce Scythians, who migrated from Central Asia in the seventh century B.C.

But historians generally believe that Cossacks appeared in the 1400s A.D., and it's likely they were Tatars—Tatar being the Russian name for the Mongols who had invaded the steppe and for the tribes dwelling there. With Mongol rule collapsing, Tatar warriors roamed at will. Records mention Tatar Cossacks hired by the princes of Muscovy to guard their lands against raids by other Tatars.

Even today Cossack speech is sprinkled with Tatar words, such as "ataman." Olginskaya is a *stanitsa*, not a village. *Kazak*—Cossack—was a Tatar word too. (Scholars still debate whether the Central Asian nation of Kazakhstan got its name from this word's root or an unrelated source.)

Slavs drifted into the steppe no-man's-land, for game and fish were abundant and booty could be seized from caravans and from boats plying the Don and Volga. The Zaporozhians, a famous Cossack host in Ukraine, preyed on Turkish ships in the Black Sea. Don Cossacks voyaged with the Zaporozhians, and Tatars rode beside Slavs.

Many Slavs who swelled these bands in the 1500s and 1600s were fleeing serfdom in Russia and Ukraine, which was falling prey to feudal Polish nobles. Others were Old Believers, schismatics ousted from the Russian Orthodox Church, and even Germans and Scandinavians. Hence, Nikolai and many other Cossacks see themselves as a people apart culturally and genetically, mostly Russian but not quite.

Nikolai added in support of that view: "One of my great-grandfathers had a Turkish wife. He brought her back from a raid." This may explain why Nikolai's eyes are brown, not the more common green or blue. "There were a lot of men on the Don," he explained, "but there was a deficit of women." Cossack raiders bore off women from Persia too.

There are stories of Cossack women fighting beside their men, but mainly their role was passive. They bore children and tended the farm while their men were away, sometimes for years. The role of women still is a passive one, although a few uniformed women have marched in parades recently, and some have joined choirs that sing old

Rifles at the ready, Cossack vigilantes in North Ossetia defy a Russian ban against possessing military firearms as they guard the border with Ingushetia. The two regions clash over territory in Russia's Caucasus region. Honors to Cossack troops who fell in World War II came in 1997, when newly discovered remains of some 300 soldiers were gathered for reburial (right) at Vyazma, west of Moscow.

Cossack ballads. As Nikolai and I sat in his yard, his wife emerged to bring us cool drinks but did not join us.

Nikolai spoke of the days of his ancestors as if he'd lived then. "We had our own land. At the annual *krug* [meeting] important decisions were made. Land was distributed. Stealing was punished; the thief was whipped in the *maidan* [square]. All we demand now is the freedom to revive our old way of living."

Some Cossacks have joined the revival in hope of regaining land. Olginskaya's Cossacks have been granted 114 acres, a fraction of what they once possessed. It is parceled to families who want to farm commercially. So far the land has produced more woe than wealth. Agriculture is a shambles in Russia; everything a farmer needs—tractor, fertilizer, pesticide—is dauntingly expensive.

In the fields Nikolai snapped off a cucumber for me. It was sweet but small, and the vines were anemic. Nearby, however, was a six-acre patch of robust cabbage. "But nobody buys it," Nikolai moaned. He had expected government agencies to purchase the crops; Cossacks had been told they could compete with other farmers to supply the army, for example. But government agents didn't come.

"Why don't you truck your vegetables to Moscow?" I asked.

"We tried that last year," Nikolai answered. "We sent two trucks loaded with eggplant. They were stopped on the highway by men with guns. They said, 'You'd better turn around and go home.' They had their own trucks there." The armed men paid for the cargo but not as much as the Cossacks could have earned selling it themselves. "The Moscow market is controlled by some mafia gang," Nikolai concludes, probably correctly.

His face clouded. "A Don Cossack used to defend his house, the river, and Russia," he said. "What should I defend? My house is built of bricks stolen from a collective farm. The Don River doesn't belong to me—I need a license even to fish. And Russia. . . ."

He didn't finish. But I know Nikolai loves Russia, in spite of all. When Boris Yeltsin barricaded himself in the Russian White House in August 1991, defying hard-line communists who were trying to seize the Soviet government, Nikolai flew to Moscow unbidden to join the throng defending the building.

A few miles from Nikolai's stanitsa a bouquet of nine green domes rises over the Don. They crown the cathedral of Cherkassk, capital of the Don voisko from 1644 until the early 1800s, when Novocherkassk (New Cossack Place) was built and the original capital renamed Starocherkassk.

What, I wonder, did the unruly citizens of Cherkassk feel when in 1709 a ship bore the gangly figure of Peter the Great into their midst? Foreboding, surely, for some of these men had sided with a firebrand named Kondrati Bulavin, who had just led thousands of Cossacks in a *(Continued on page 50)*

Looking sharp as his saber, a fresh-faced soldier witnesses a ceremony marking Russia's recognition of

Forging the next generation

the Don Cossacks. During the Soviet era millions of Cossacks were slaughtered in Stalin's purges.

Tradition and discipline

Conducting his lecture, Anatoliy Kuznetsov (left) tells cadets at the School for Cossacks and the Caucasus Nations in Inozemtsevo how Cossack territory shifted through the ages. Photos of young trainees draw laughs at a Moscow gathering (right); an earring signals that Mikhail Chernikov, at right, is the only male supporting his family, excusing him from hazardous duty.

Budding soldiers muster at 7 a.m. for push-ups and a run at a summer camp in Divnomorskoye on the Black Sea. Long days are filled with close-order marching drills, target practice with air rifles, and policing the campground's perimeter. In some Cossack groups the military mind-set traditionally was instilled in the cradle: On a boy's 40th day of life, a tiny saber was hitched to his side.

From tenderfeet to warriors

Chin up, shoulders back, a child is fitted at the Royal Cossack Cadet Academy in Novocherkassk (above), where full-time tailors tend 260 fast-growing boys. Rising at dawn (above right), cadets are Cossack 24 hours a day. Established by Tsar Alexander III in 1883, the academy was closed by Stalin in 1933, then reopened under Yeltsin in 1991. At the Cossack school in Inozemtsevo, marching instructor Aleksandr Salamakhin teaches cadets to put snap in their step.

Sometimes seen in public places attempting to maintain order with whips, Cossacks reassure many crime-weary Russians but intimidate others, who recall that pogroms against Jews in Ukraine are among the dark chapters of Cossack history.

Twice-taken vows unite Eduard and Svetlana Yadykin, a Cossack couple married in a civil ceremony, then again by an Orthodox priest. This sanctified wedding was necessary for Eduard to heed his calling and become a priest himself.

(Continued from page 42) bloody campaign against imperial encroachment.

The relationship between Cossacks and Russia had long been uneasy, with terrible violence in the 1660s. Though the tsars embraced Cossacks in time of peril, exhorting them to hurl back invading Turkish armies, they also schemed to reduce them to vassalage. Peter urged his nobles, already enraged by the loss of thousands of serfs who had fled to Cossack territory, to claim Cossack lands.

When troops came to round up the fugitive serfs, Bulavin fought them. Tsar Peter retaliated by sending more troops, who burned villages and hanged the inhabitants. Defeated in battle, Bulavin shot himself.

"A few months later, when Peter came to Cherkassk, he brought the head of Bulavin, pickled in alcohol, and put it on a pole in the square," historian Mikhail Astapenko told me. While the Cossacks contemplated the gruesome visage of their leader, Peter washed his hands and, in a gesture of solidarity, laid a few bricks for the cathedral whose domes float over Starocherkassk today. The Don Cossacks could keep their lands and some of their freedoms, Peter decreed, but henceforth they would soldier for Russia.

The Cossacks of Ukraine also resisted domination, twice defeating Polish armies in 1648. Then the victors, joined by serfs and peasants, rampaged across the land, slaughtering not only the hated Polish landlords but thousands of other people, particularly Jews, who were also seen as oppressors. The Cossack chieftain Bohdan Khmelnytsky briefly led an autonomous state. But in 1654 he made an alliance with Russia—a fateful move, for Russia would gobble up his territory and obliterate Cossack rule from Ukrainian soil.

Russian Cossacks served the tsars loyally until disillusion set in after four years of carnage in World War I. Some applauded the communist takeover in 1917 and joined the

Reds in the fierce civil war that erupted afterward. Most Cossacks, however, threw in with the White Russians, who fought the Reds.

And some warred on both sides. In his great novel, *Quiet Flows the Don*, Mikhail Sholokhov's Cossack hero, Grigory Melekhov, turns communist, then changes sides and fights the Red Guards terrorizing stanitsas. Such events took place in Sholokhov's homeland, the middle reaches of the Don, where the steppe rises, Iowa-like, in easy waves.

"Cossacks changed sides constantly in the civil war," Aleksandr Sholokhov, the author's grandson, told me. "Some were White first, then Red, then pink. Everything was in chaos, and they couldn't understand what was going on in the country."

Though not a Cossack, Sholokhov peopled his novel with Cossack friends. Grigory is modeled on an officer who joined the Reds, then fought them—and was executed as the communists set out to eradicate Cossacks forever. In the 1920s and 1930s two million Cossacks—about half their total—were killed, jailed, or shipped off to Siberia.

Parts of Sholokhov's book had to be reviewed by Josef Stalin himself before they could be published, for the author had committed the blasphemy of characterizing the Red Guards as murderers and rapists. Some passages appeared only after the Soviet Union collapsed. Sholokhov nevertheless won a Nobel Prize in 1965.

Today in the stanitsa of Veshenskaya his two-story home—a virtual mansion in rural Russia—is a museum, and a nine-mile-long strip of land on both sides of the river is preserved in his honor. It is indeed a quiet Don there, flowing dreamily at sunup under a diaphanous mist. Rowboats move upon the surface like water spiders, as geese waddle down to the edge, honking joyously.

I found the people of Sholokhov's region still divided. "My grandfathers were White," said Alexei Turilin, Veshenskaya's former ataman. Turilin is a vigorous man who shakes hands as if intending to crush bones. "I am White in my soul, and I hate Reds," he added.

In World War II Cossacks generally leaped to defend the motherland, even if it meant fighting under the Soviet banner—though several thousand fought on the German side, as did other Soviets embittered by repression.

Vasily Ovcharov was just 16 when he was drafted in 1943. I met him in a bungalow beside a quiet Veshenskaya street. He is portly now, but his wartime photos show a trim soldier with hat worn Cossack style, on the back of his head.

Vasily was assigned to a cavalry unit. But there was a shortage of mounts. "We had to send men to Mongolia for horses," he said. "Those horses were strong—they could break any rope." He named his first one Mongolka, to honor her origins. "She was a great horse. She saved my life several times because she didn't run away when I fell from the saddle."

An enduring legend says saber-wielding Cossacks attacked German tanks. "Propaganda!" Vasily snorted. "Our main role was reconnaissance, ahead of the army. Sometimes we rode as much as 70 miles in seven hours."

Mongolka bore Vasily for more than a year, until she was shot in a skirmish. Gunfire from a plane killed his second horse. Then Vasily fell wounded as he tried to prevent the Germans from blowing up a bridge. He recovered and kept on riding, through Romania, Hungary, and into Austria. When the war ended in 1945, he rode back to the Don on his sixth mount, having survived a classic Cossack experience, making war on horseback.

Today the Russian Army has begun to re-create all-Cossack units but has little need of horsemen; the only cavalry units are ceremonial. Still, I met several Cossacks who carried a *nagaika*, a cavalry whip like those their grandfathers used.

Igor Zvinyatskovsky had one tucked into his boot. In the courtyard of Moscow's Danilov Monastery, his uniform stood out among the bearded monks and shawled women making pilgrimages to this seven-century-old shrine.

"The police don't do anything to protect the monastery," Igor said, echoing the popular view of law enforcement as lax to nonexistent. But, as Igor explained, ardent devotion

Catching the spirit, an onlooker tries the Cossacks' tendon-stretching, squat-and-kick Kazachok dance at a festival in Moskovskoye, part of the Azov–Mozdok defense line manned by Cossacks in the 18th century to guard the Caucasus.

to the Russian Orthodox Church was once a tradition among most Cossacks. So, as Cossack bands revived, volunteers began to patrol within the monastery's walls to safeguard its priceless icons and prevent rowdiness. Today the church pays its Cossack guards.

Igor drew his four-foot-long nagaika from his boot. "It helps a lot when we catch a thief," he said. I asked if he had actually used it against a thief. He answered obliquely but knowingly: "He won't come back."

Cossacks with whips are sometimes seen in the throngs that attend Easter services; they believe their presence assures appropriate reverence. They assist the police at highway checkpoints or augment the border patrol. A police official told me Cossacks have occasionally lashed food vendors for price gouging.

Some Russians laugh contemptuously at these "play soldiers," as I heard one man call them. Others are uneasy. "We don't like to see them going about with their whips," a Muslim said. "It's threatening." Since the slaughter of thousands of Jews in Ukraine in 1648, Jewish families have handed down stories of Cossacks throwing infants into wells and ripping open pregnant women with swords. Cossacks also participated in pogroms in the 19th and early 20th centuries. Today Cossacks claim they are not anti-Semitic; still, things are said in passing. One leader, for instance, told me that Jews should not have positions of power in the government or the press beyond their small percentage of the population.

Many Russians applaud Cossack vigilantism, hoping it will stanch the lawlessness that has flourished since the Soviet Union collapsed in 1991. At least a few Cossacks, along with other Russians, believe that their nation's manifold problems—economic disorder as well as lawlessness—could be solved if Russia was ruled again by a strong tsar. Could that happen? "God will bring a new tsar to us," one Cossack assured me.

A strong tsarina, Catherine the Great, sent large numbers of Cossacks south to the Kuban River in the late 1700s.* As she expanded Russia into the Caucasus region, Cossacks manned forts on the river's banks and homesteaded land belonging to Caucasus peoples. War was inevitable.

One day by the river I viewed a small shrine, fashioned like a steeple with a cross atop. A plaque named 17 Cossacks slain in an attack on their settlement in 1829.

The shrine is new; Soviet bosses destroyed the original monument about 65 years ago and replaced it with a dance pavilion. When Cossacks were free to reorganize after the Soviet collapse, the pavilion was demolished and the monument rebuilt. Surely there are no people in Russia more stubborn.

The Kuban region's capital is Krasnodar, or "gift of the Reds." In pre-Soviet days it was Ekaterinodar, "Catherine's gift." I walked among buildings with turrets and other trappings of the era that Russians call *Victorinsky*—Victorian—for this was a thriving trade crossroads in the 19th century.

Vladimir Gromov, a former history professor, presides there as ataman of a voisko that claims 140,000 members. It may be the strongest in Russia and has become a force in local politics; Gromov and seven other Cossacks sit in the elected Kuban legislature. It has founded a cadet school and businesses.

"And every year we send more than a thousand men to the army and the border patrol," he added. (Cossacks do not seem to yearn for their sons to have careers in such fields as medicine or computers. "They know they are a warrior people," as one woman told me.)

I spent a couple of days with Kuban Cossacks in the small city of Lazarevskoye, beside the Black Sea. They run a huge market that yields $85,000 a year from rentals to vendors of vegetables, clothes, and sundries.

The profit has helped create a new stanitsa. "The city gave us this land," Ataman Valery Gololobov said as we walked on a hill above the sun-speckled sea. He wore army fatigues and a chain with a crucifix. Several houses were under construction; 43 are planned. The Cossacks who will live here, he emphasized, must promise to abide by strict rules.

"Why?" I asked. Stupid question.

"Order!" Valery boomed. "Order has to come back to our lives! It used to be you could walk at night and nobody would bother you. Now you'll be stripped of everything. Kids are taking drugs, abusing alcohol. We don't want this—the Russian Army needs strong men."

Order means no arguments with the neighbors, Valery added. Violators will be punished with the whip—five strokes for public drunkenness or wife beating, for example. In a nearby stanitsa a Cossack lieutenant received ten lashes for stealing Cossack funds.

"After being whipped, the man is supposed to bow and thank the elders for the 'knowledge' he has received," one ataman said.

Among Lazarevskoye Cossacks, fealty to the Russian Orthodox Church is fundamental. When I asked if I could become a Cossack, one responded, "How do you cross yourself?" On purpose, I crossed myself the Russian way, right to left. "That's good!" he exclaimed. But when I confessed that in my church the accepted way is left to right, it became clear that no Episcopalians need apply here.

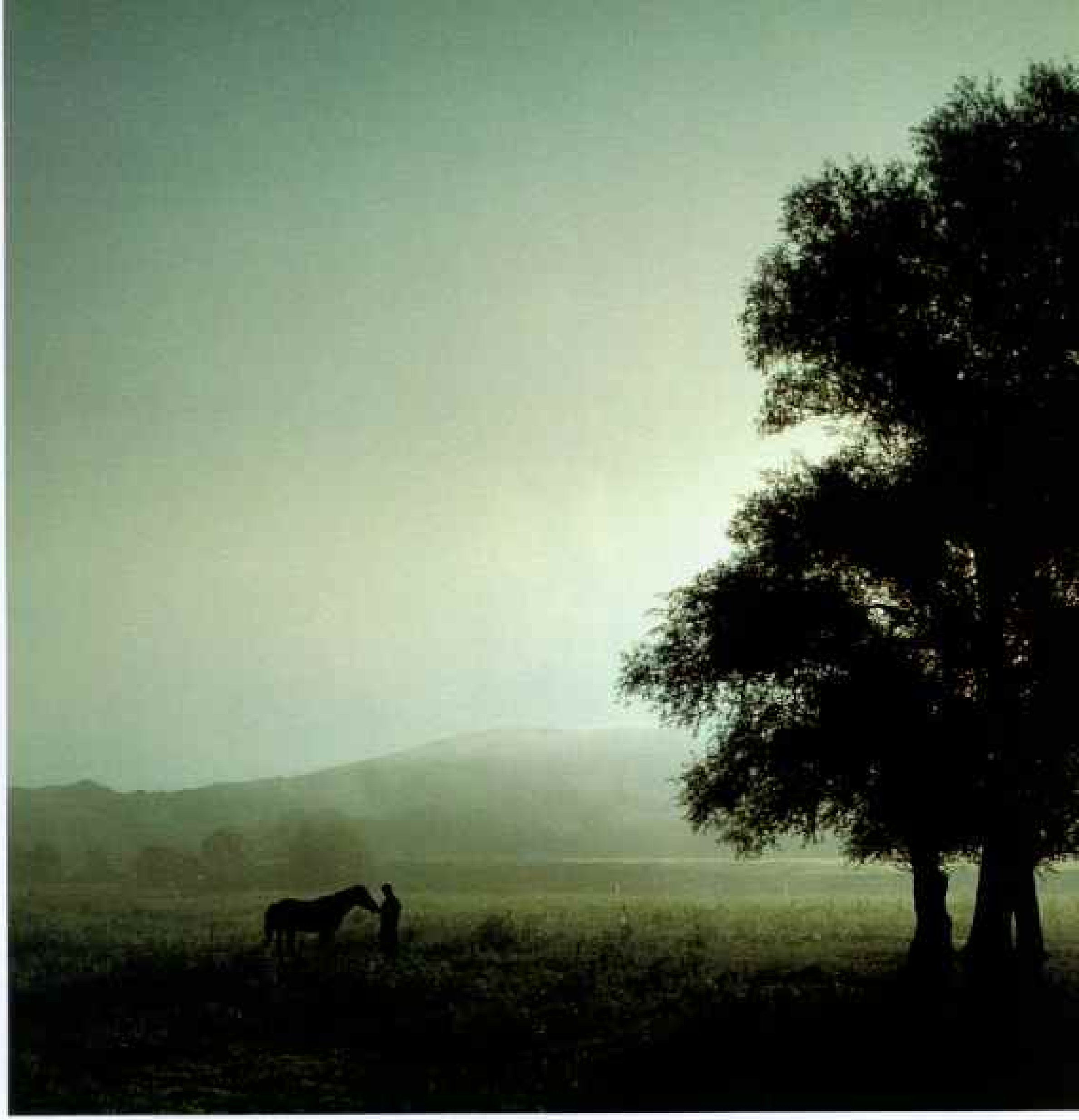
These Cossacks don't know their history. There were, and are, Cossacks of other faiths. A few Muslim Cossacks live in south-central Russia. There are even Buddhist Cossacks west of the Caspian Sea—the Kalmyks, who migrated from Mongolia in the 1500s. They, too, rode to Paris in the war with Napoleon, some bringing back French women.

An overnight train took me to Vladikavkaz, capital of the state of North Ossetia. When we pulled in, the sun was torching snow-mantled Caucasus peaks in the distance. Built in 1783, as Russia continued to expand southward, Vladikavkaz, literally "ruler of the Caucasus," was one of a line of forts along the Terek River, which loops through North Ossetia and neighboring Chechnya. "To rule the Caucasus" also meant to die. Chechens and other Caucasus peoples fought

*See "Catherine the Great," by Erla Zwingle, NATIONAL GEOGRAPHIC, September 1998.

A PRETTY PATCH OF BLUE stands out against military drab as Cossacks parade in Novocherkassk.

Girls inherit a passive role in this macho world: cooking, keeping house, minding the children.



A new day finds Alexei Kompaneytesev pasturing his horse on the edge of the Caucasus, where he and his wife, Maria, raise vegetables, chickens, and turkeys on a small plot. At 69 he's content to let his son Dmitri and other young men join tomorrow's battles—fighting on for Cossack pride.

against Russian encroachment for 30 years in the mid-19th century, mowing down Cossacks and tsarist troops by the thousands.

Death waited, too, in 1996 for 27 men in an all-Cossack battalion that was hired to help subdue Chechens fighting again for independence. Another 260 were wounded. The battalion commander, Aleksandr Voloshin, said the men, all army veterans, felt that fighting Chechens was their duty. "We hated to see inexperienced draftees go die there," he said. "Besides, the independence that Chechnya was demanding was not right." (While Cossacks seek independence for themselves within Russia, it's another matter when a republic seeks independence *from* Russia.)

Though a cease-fire is in place, tension still grips North Ossetia. Militia posts are occasionally attacked by bands of Chechens as well as by Ingush, a neighboring people who claim part of North Ossetia's territory. Both have kidnapped journalists, aid workers, and even farmhands to collect ransom—tens of thousands of dollars have been paid—or to accumulate bargaining chips for negotiations.

When I wanted to go to Mozdok, another

Cossack post, just a few miles from Chechnya, I didn't protest when a North Ossetian official arranged travel in a police car for my interpreter, Ludmila Mekertycheva, and me. We sped off with two rifle-equipped officers.

Mozdok proved to be a dusty little city. Though it seemed peaceful, a militia post was attacked that night. "Nobody was hit," a defender told me. "I think they were just trying to see how fast we can get reinforcements."

I went to Terskaya, on the border, where Chechen raiders had stolen tractors and kidnapped a tractor driver. Farmworkers still go to the fields, but with armed militiamen.

Despite the tensions, Cossacks and other Russians had long lived among the Chechens. Now the Cossacks stream into Terskaya with stories of being harassed by bandit gangs. Tatyana, who had lived alone there, told me: "They came with rifles in the middle of the night. I cried and begged them not to kill me. I had some carpets that looked nice and a nice table. They took them. They even took my old broken cups." Terrified, she set out walking to North Ossetian territory. Tatyana is 72.

Not surprisingly, Cossacks fulminate when they hear such stories. I expected the ataman of the Mozdok district to say his men should be armed; many Cossacks elsewhere want weapons. But Aleksandr Sibilyov counsels that the government, not Cossacks, must restore order. "If we demand weapons and a Cossack gets a machine gun, his neighbor will demand a machine gun too. Then what do you think will happen? We have to be wiser. We have to find ways to live in peace."

Around Mozdok, domes soar over the plain. Up close to these churches I see holes in the walls and tar paper where once there were windows. The Cossacks who built them are long dead, buried in cemeteries now overgrown. Wading into brush, Aleksandr Sibilyov almost caresses the moldering tombstones. "This is our memory," he says reverently.

All over Russia, Cossacks are reaching for memories, looking back in the certainty that the old life was good and that, somewhere in it, salvation waits for them and for the motherland. In truth the old life was hard. Tsarist rule was autocratic. Soldiers were separated from their families for years.

As for Russia, the need for stability is huge, and stability is hugely elusive. Cossacks who would rescue the motherland with whips and guns may learn that vigilantism does not succeed as well as electing able leaders and demanding excellence from them.

But memory, or more correctly, *imagined memory*, is a powerful force among these men who were long denied their heritage. It's about all they've got—that and their pride and stubbornness. Not much to build a future on. But in modern Russia, humbled and troubled, it's no surprise that they're trying. □

Watch for Return of the Cossacks on National Geographic EXPLORER in December.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JET SET

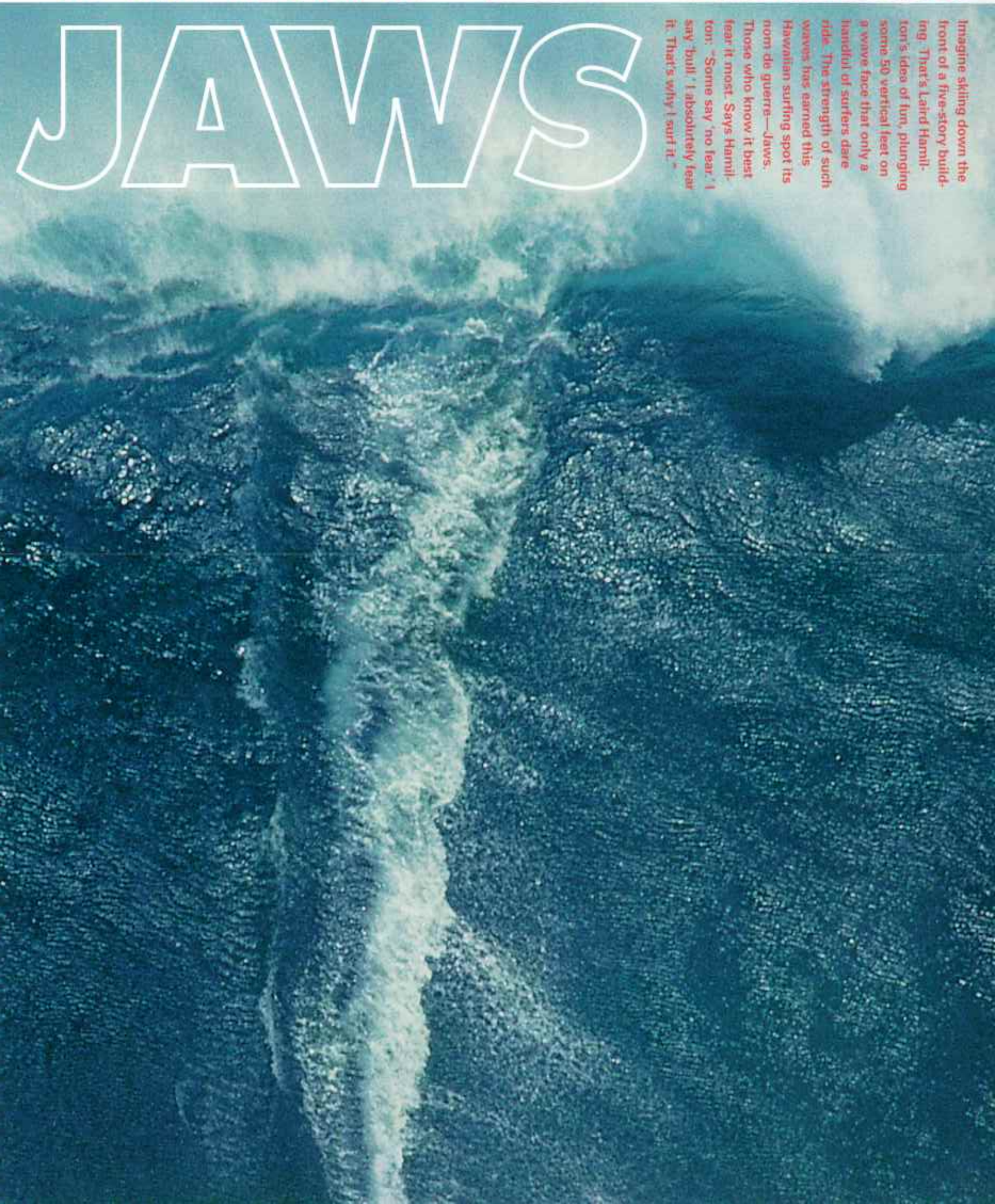
"When you fly down the face of one of these waves, it's not a wave anymore," says Luke Hargreaves, "it's a mountain." This mountain can move at 25 miles an hour and give a windsurfer the ride of his life, or leave him fighting for it. On a big-wave day—Jaws kicks up about 12 times a year—Hargreaves sails by as a wave flips Robby Seeger upside down. Seeger dove deep until the mountain barreled past, then he struggled through four more waves. "So far no one's died at Jaws," says Hargreaves. "I think that's because we always look out for each other."

IN THE TEETH OF

By JOEL ACHENBACH Photographs by PATRICK McFEELEY

JAWS

Imagine skiing down the front of a five-story building. That's Laird Hamilton's idea of fun, plunging some 50 vertical feet on a wave face that only a handful of surfers dare ride. The strength of such waves has earned this Hawaiian surfing spot its nom de guerre—Jaws. Those who know it best fear it most. Says Hamilton: "Some say 'no fear.' I say 'bull.' I absolutely fear it. That's why I surf it."



Normal waves are, by comparison, mere ripples. The waves at Jaws are so large as to be almost exaggeration-proof. In fact "large" doesn't quite carry the load here. Mountainous? Too inert a word to describe a heaving fluid. Voluminous? You could say the same thing about a duck pond. Titanic? No, too much cultural baggage. Let's just say these are "very big" waves.

The surfers have their own vocabulary, needless to say. They describe these waves as "heavy" or "gnarly" or "radical," all of which means they are . . . well, very big.

Surfers are still talking about January 28, 1998, Big Wednesday, when storm-spawned swells created waves so large that Honolulu's Ocean Safety Administrator declared Waimea Bay on Oahu legally off-limits. There was no safe place to surf. But Jaws is the creation of a peculiar reef, a spur that sticks out from Maui into the ocean with a deepwater channel along one side, allowing surfers to ride waves as intimidating as tsunamis.

Estimates vary, but a small wave at Jaws has a 20-foot face, and surfers talk about 60- and 70-foot faces. They talk about waves with barrels so huge you could park a Winnebago in them. They talk about the violence of a wave's lip as it crashes into the impact zone. They say, "That lip could snap your neck like a chicken bone." In other words, they respect Jaws.

"Jaws is one of the heaviest, if not the heaviest, wave around," says surfer Pete Cabrinha. "What makes Jaws different is that when the wind's not on it, it's a perfect wave because of the way it breaks. It's a long, peeling wave, which is unusual for a big-wave spot. It breaks at one point and keeps breaking uniformly as it goes down the line."

Not that Cabrinha ponders such things in the rush of the moment. No surfer at Jaws spends a lot of time intellectualizing the situation. (What do you think they are, crazy?) The main thought is: Make it. Make the wave. Don't get gobbled.

Everything happens at a furious pace. A wave this big doesn't have a singular, smooth face. The face is sculpted by surface chops that can bounce a surfer into the air. There are waves upon waves. "It's like you're skiing on a mountain that changes every second as you're going down—moguls pop up in front of you and disappear," says surfer Laird Hamilton.

Of course they have to show some moves—bottom turns, cutbacks, aerials. They put on a show for their buddies and for the omnipresent cameras. (Often photographers buzz just overhead in a helicopter.) Surfers say there's a moment of pure existence on the wave—no past or future, just the pulse-pounding present. "There are no opinions in big waves," says Hamilton. "You either make it or you don't make it."

Hamilton remembers the time he barely avoided getting smashed by the curling lip of Jaws. The initial impact missed him, but the secondary explosion of white water wiped him out. "It just vaporized me. I felt like my body went into little particles."

Dave Kalama also knows the sensation of being "rag dolled" in the water. "It's like four Arnold Schwarzeneggers,

Joel Achenbach is a reporter for the *Washington Post* and the author of *Why Things Are*. First-time contributor Patrick McFeeley specializes in aerial and action photography. His book *Jaws Maui* features images of some of the largest waves ever surfed.

one on each appendage, are shaking you. You're doing cartwheels and flips and somersaults all at the same time."

When people refer to Jaws, they are sometimes talking about geography, distinguishing the site from other big-wave locations in Hawaii. But they also use the word to refer to the waves themselves. Jaws isn't just a location, it's a theoretical wave that manifests itself in real life. It's almost a spiritual entity, a sleeping giant that sometimes awakens and beckons surfers.

What's astonishing is that on a typical day there's no sign of Jaws. You drive through a pineapple plantation and come to the cliff overlooking Jaws and see . . . nothing. There's just blue water. A fisherman anchored on the spot one night, unaware that there was a reef below capable of generating a ravenous wave. His boat got eaten up. Or so the story goes.

A ride on Jaws lasts less than half a minute, but the whole process leading up to it takes close to 24 hours. Pete Cabrinha begins by surfing the Internet. Cabrinha and his wife, Lisa, live about three miles from the ocean, and he keeps a speedy computer alongside his surfing magazines and drum kit.

Cabrinha starts by looking at images of the northern Pacific posted on a University of Hawaii website. He wants to see storms drifting from the coast of Japan toward the Aleutian Islands. Winds from these storms generate swells that break days later at Jaws.

Cabrinha pays close attention to what's called the fetch of the wind—the distance the wind blows in a consistent direction. The longer the fetch, the bigger the swells. (In 1933 a vast weather disturbance off Russia's Kamchatka Peninsula stirred up winds with a fetch several thousand miles long. A wave estimated at 112 feet nearly swamped the Navy tanker U.S.S. *Ramapo*.)

Another website details the measurements of waves passing a National Weather Service buoy 390 miles northwest of Maui. Cabrinha wants to see double-digit numbers: 10-foot waves are interesting; 15- or 20-foot waves are compelling. He also looks at the wave period—the interval between crests hitting the buoy. Waves far apart have deeper "roots" of energy and are more likely to break at Jaws' deep reef. It takes about 12 hours for waves at the buoy to reach Maui—plenty of time to check equipment, re-check equipment, pace, anticipate, obsess, and fail to get enough sleep.

The biggest danger for surfers isn't being crushed or snapped in two—it's drowning. They have to train themselves not to panic underwater, even when they can't tell which way is up. A wave like Jaws has such a thick foam layer in the impact zone that for paralyzing seconds it's impossible to swim to the surface. The foam also blocks out the sun, so tumbling surfers are disoriented and nearly blind.

When they finally get their heads above water after a wipeout, surfers look for one of their buddies to charge to the rescue on a Wave Runner. Another giant wave will come crashing down in seconds. If the rescuer doesn't make it in time, they have to go through the foamy violence all over again. The only losses so far: one Wave Runner, a couple of boards, and some windsurfing rigs.

When surfers make it to the calm channel, they get towed back out to sea. They don't stop until they run out of gas. Then everyone goes to a joint called Charley's to eat breakfast and replay the highlights.

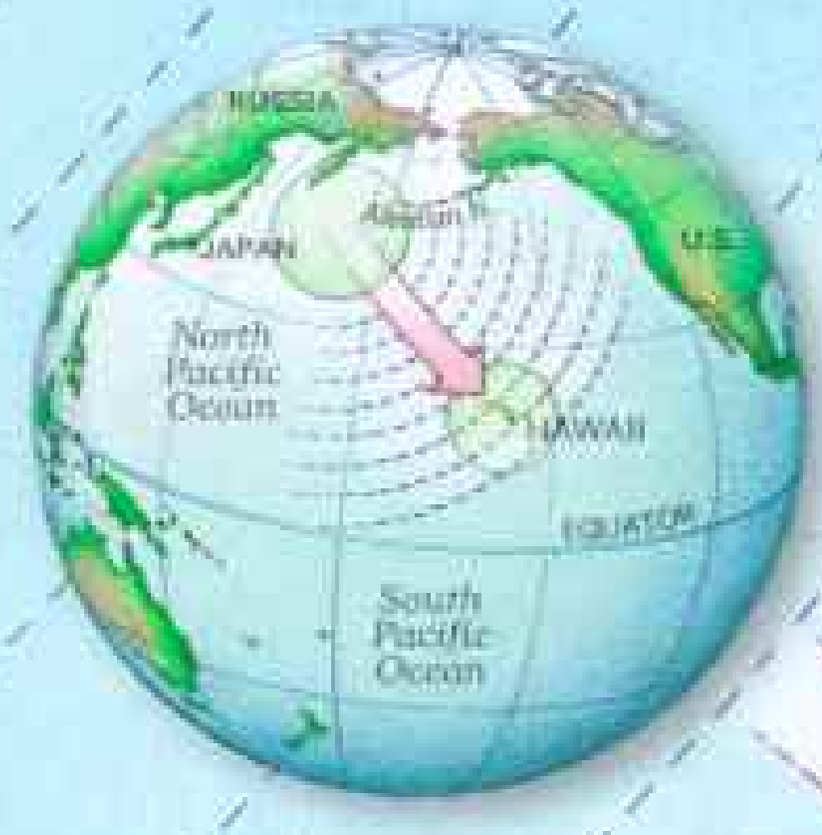
"You're shell-shocked," says surfer Mark Angulo.

"It's like being a gladiator," says Hamilton.

"We're walking on the moon," says Cabrinha.

Then, like astronauts, they have to resume their terrestrial lives. And wait for Jaws to roar again.

Cutting his losses, Robby Naish (above) launches himself from the curling lip of Jaws' cavernous maw and the deadly force of his nearly 30-pound board and sail. Another wave swallows Lyon Hamilton whole, spitting his board (right) at a photographer's hovering helicopter and leaving roughly 20 seconds for him to be rescued before the next wave sweeps in.



Spawning a monster: 48 hours

Day one, 8 a.m.
Near Aleutian Islands
1,900 miles northwest of Maui
Winter storm stalls; winds build, driving swells.

Day two, 8 p.m.
Buoy 51001
390 miles northwest of Maui
Storm-generated swells reach buoy; data posted on Internet.

Day three, 8 a.m.
Jaws reef
One-half mile offshore
Entering shallow water, swells transform to breakers.

As swells roll by, buoy 51001 measures wave height and period—the length of time between crests. The longer the period, the faster the wave. Using the buoy data, scientists and surfers can calculate how quickly the waves might reach Jaws, and how big they'll be when they do.

When Jaws roars

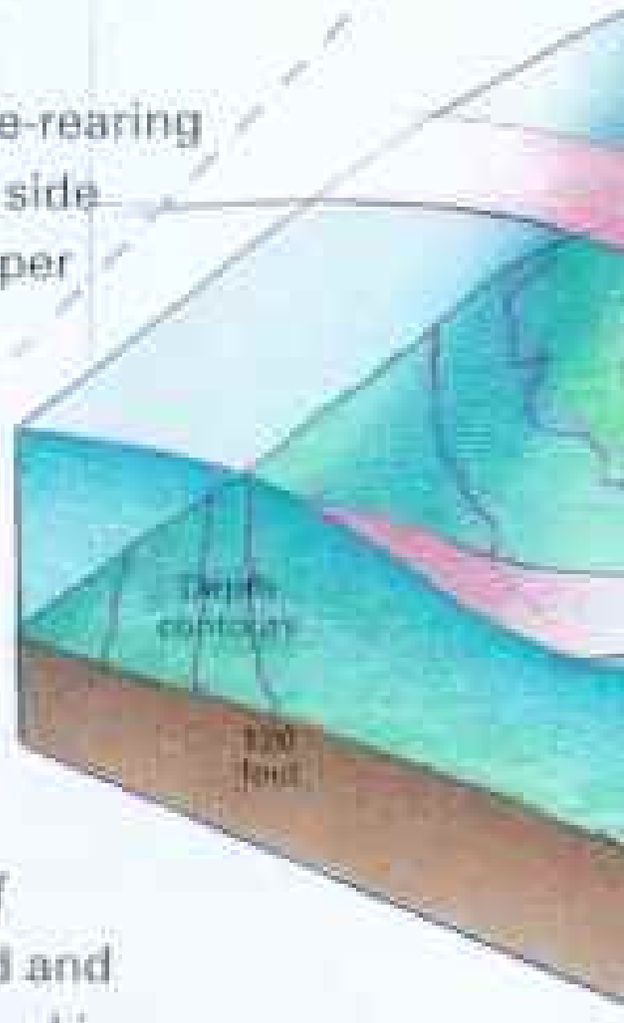
Local surfers also call Jaws by its native name, *Peahi,* Hawaiian for "beckon." And that's just what it does. "You can hear it from miles away," says Laird Hamilton of the spot's siren song—the thunder of giant waves pummeling a normally placid shoreline.

Jaws generates a breaking wave only when ocean swells reach a certain size. From the north shore of Maui a massive underwater ridge—the remnant of an old lava flow—juts straight out to sea. "It's impressive in its size and its steepness. It's huge," says former champion surfer Rick Grigg, now a professor of oceanography at the University of Hawaii.

A little over half a mile from shore the reef drops abruptly away into the sea. An average swell of 10 to 12 feet passes over the nub of the reef without incident. But larger swells, storm spawned, suddenly mound upward as they strike the reef, a process called shoaling.

Jaws has a second wave-rearing trick. The swells on either side of the reef, moving in deeper water, bend inward, focusing much of their energy on the center of the wave crest. This refraction of wave energy is like a magnifying glass gathering light into a hot, focused beam. In essence, the reef squeezes the wave inward and upward. Surfers call it a peaking wave. It's a pyramid of water worthy of a pharaoh.

The deepwater channel next to the underwater ridge also ensures that there is a safe zone where the wave won't break. That's where surfers are headed when they're flying down the face of Jaws.



To tow each other into the big waves at Jaws, surfers use Wave Runners. To keep from getting knocked off their boards, they use windsurfers' foot straps. Purists howl, claiming that the only right way to surf is to paddle into a wave and stay on your board using just your own strength.

MAP AND ART BY C. BRUCE MORSER, BATHYMETRIC DATA BY SEA ENGINEERING

Mike Waltze can hear Jaws' thunderous roar as it chases him toward the shore. With the collapsing wave at his back, he forces himself to focus on what lies ahead—relative safety in the channel that hugs Maui's reef. "It's the avalanche theory," Waltze says. "Keep going until you're out of its path." Then ride it again? "Every chance." □

For more on surfing join our forum at *www.nationalgeographic.com/media/ngm/9811*.

Zanzibar's Endangered Red Colobus Monkeys

Article and photographs
by TOM STRUHSAKER

A mother with a child clutching her tightly dashes between groves near the Jozani Forest Reserve, home to most of the world's remaining 2,000 Zanzibar red colobus monkeys. Tree dwellers by nature, the animals have lost much of their habitat and natural sources of food to deforestation.

Clinging to childhood, male *Procolobus kirkii* nurse far longer than do infants of most other species of red colobus, which live on the African mainland. Some males (below) suckle until they are three or four years old and ready to breed. Female infants nurse for up to a year and a half.

RESEARCH PROJECT

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A two-week-old baby (opposite) clings to its mother for protection. The long nursing period may cause hormonal changes in the mothers that delay future pregnancies. Zanzibar red colobus mothers average about three and a half years between births, nearly twice the interval for mainland species. This low reproductive rate is one factor in the monkeys' clouded future.

Duke University biologist TOM STRUHSAKER has studied red colobus monkeys since 1969.

Zanzibar encompasses just 640 square miles, and its human population will double, at current rates, within the next 20 years. The red colobus are, quite literally, being crowded out. At one time Zanzibar was covered with extensive forest, a perfect habitat. But as humans cut down trees for farming, construction, and fuel, the forest has not been able to recover. Now the monkeys, which once roamed most of the island, are concentrated in the vicinity of Jozani Forest Reserve. There they survive in forest, mangrove swamps, and private gardens with mango, coconut, and other fruit trees. Forced by habitat loss to spend more time on the ground, the monkeys fall victim to careless drivers.

The animals live in groups of about 30, with up to six males in each group. Often groups will split up, then reunite at a later time, a social system uncommon among primates.

A routine treetop-to-treetop leap of 25 feet with bonded baby would be the equivalent of a human athlete making a 50-foot standing broad jump while carrying 25 pounds of extra weight.

In addition to having feet that are half the length of their legs, the monkeys are superbly adapted to life in trees by virtue of a feature they don't have: usable thumbs. Little more than a pair of nubs, the thumbs stay out of the way as the monkey curls its four elongated fingers into hooks that neatly wrap around a branch. Like a circus acrobat, the monkey swings upward and lands, feet first, on another branch.

Chowing down on charcoal (opposite), a red colobus partakes of the species' most unusual dietary supplement, one that may allow the monkeys to eat potentially harmful foods. With their four-chambered stomachs they can easily digest the cellulose in leaves, as well as the fruit of Mkwamba shrubs (above).

In some areas of the island they also eat the leaves of mango and Indian almond, two tree species introduced by humans. Both types of leaves contain generous amounts of protein—but also high levels of phenolics, which can be toxic or interfere with digestion. The charcoal apparently eliminates the damaging chemicals from their system while leaving the protein for absorption.

Groups of the monkeys gnaw charcoal from charred stumps (below) and collect it from charcoal kilns.

Two on one, juvenile red colobus gang up on an older monkey. As in most primate societies, play is key in developing physical and social skills. A play group may be as large as a dozen, and often several of the youngsters will wrestle with and play-bite more mature companions. All that makes a show for the 12,000 tourists who yearly visit Zanzibar's red colobus. Yet unless the monkeys' dwindling habitat is properly managed, the curtain may come down forever.

THE ENDURANCE

In 1915 on a frozen sea Anglo-Irish explorer Ernest Shackleton (right) lost his ship and his dream of crossing Antarctica on foot. What began as a journey of exploration became a 20-month battle to stay alive, demanding ingenuity, courage, and leadership. All these Shackleton held in full measure.

EPIC OF SURVIVAL

SHACKLETON

BY CAROLINE ALEXANDER

PHOTOGRAPHS BY FRANK HURLEY

IT IS ONE of the very greatest survival stories in the annals of exploration. Sir Ernest Shackleton, his ship *Endurance* crushed by ice in Antarctica's Weddell Sea, led his men to safety through a series of impossible journeys over land and sea that, more than 80 years later, still leaves one gasping. When I was reading *South*, Shackleton's account of his adventure, I stood one evening in New York City, at a 79th Street bus stop, with the book tucked under my arm. Feeling an insistent tug on my sleeve, I turned to meet the gaze of a man who was staring at me with the burning eyes of a zealot.

"Shackleton," he said, in half-whispered complicity, knowing that if I had read even part of the book, I would be a convert.

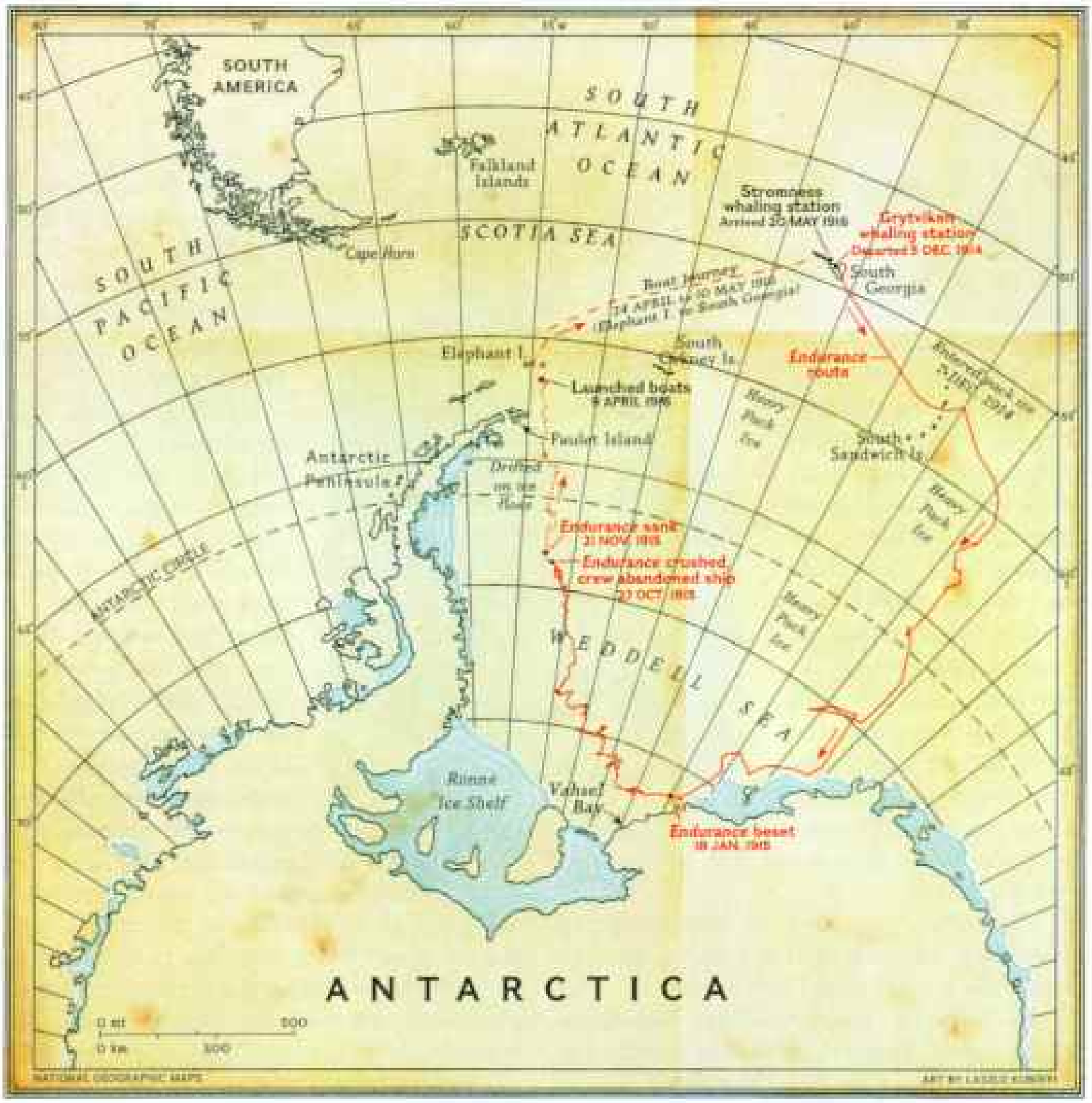
The Imperial Trans-Antarctic Expedition left Plymouth, England, on August 8, 1914, just at the outbreak of the First World War. Shackleton's ship was a three-masted wooden sailing vessel—a barkentine—specially designed to withstand ice. Called *Polaris*, the ship had been built by Norway's most renowned shipyard out of oak, Norwegian fir, and greenheart, a wood so dense that it has to be worked with special tools. Shackleton renamed her the *Endurance*, after his family motto, "*Fortitudine vincimus*—By endurance we conquer."

Heading south, the expedition's last port of call was the island of South Georgia, a wild subantarctic outpost of the British Empire inhabited by a small community of Norwegian whalers. From here the *Endurance* set sail for the Weddell Sea, the dangerous ice-infested ocean abutting the Antarctic continent. Battling her way through one thousand miles of pack ice over a six-week period, the *Endurance* was about a hundred miles from her destination—one day's sail away—when on January 18, 1915, the ice closed in around her. A drastic drop in temperature caused the seawater to freeze, effectively cementing the compressed ice. The *Endurance* was trapped, "frozen," as the ship's storekeeper wrote, "like an almond in a piece of toffee."

Shackleton was by this time already a famous polar explorer. He had first been south with Capt. Robert Falcon Scott in 1901, drawn to Antarctica by the ideal of heroic quest.

CAROLINE ALEXANDER has written two books about Shackleton's journey—*Endurance: Shackleton's Legendary Antarctic Expedition*, due out this month, and *Mrs. Chippy's Last Expedition*. Shackleton's photographer, FRANK HURLEY, kept his taste for adventure, shooting in Papua New Guinea and other exotic locales. He died in 1962.

"One might as well try to cross from
Ostend to Dover on water lily leaves as get over
the pack from where we are now."



After leaving South Georgia, the Endurance *became beset in pack ice a hundred miles from her destination, Vahsel Bay. For nine months the sea dragged her farther from the continent. In February the crew played soccer on the ice (right) with their ship still intact. But by November she had been crushed, and the men were forced to live on the drifting floes. Finally, by pulling their three lifeboats on sledges, they reached open water in April 1916 and sailed to Elephant Island. From this barren spot Shackleton and five men sailed on a desperate voyage back to South Georgia for help.*

ROYAL GEOGRAPHICAL SOCIETY, LONDON, U.K.

But the expedition ended in failure for Shackleton when he was invalided home with scurvy after the first winter. Five years later, at the head of his own expedition, he won renown for marching to within one hundred miles of the South Pole, the farthest south anyone had been. In December 1911 Roald Amundsen claimed the South Pole for Norway, leaving only one prize remaining in polar exploration—the crossing on foot of the Antarctic continent. It was on this Shackleton had set his sights.

NOW, WITH THE ENTRAPMENT in the ice, his most daring venture was thwarted. More important, he was responsible for the care of 27 men—as well as 60 sledging dogs, two pigs, and the ship's cat, Mrs. Chippy. For the next ten months the *Endurance* zigzagged more than a thousand miles with the northwest drift of the pack. As each day passed, Shackleton and his crew knew that the Antarctic continent was falling farther and farther away.

Some of the men were professional sailors from the Royal Navy; some were rough trawler hands who had worked in the brutal cold of the North Atlantic; some were recent graduates of Cambridge University who had come along as scientists. One, the youngest man on board, Perce Blackborow, had stowed away in Buenos Aires. All had come with different hopes, which had now evaporated.

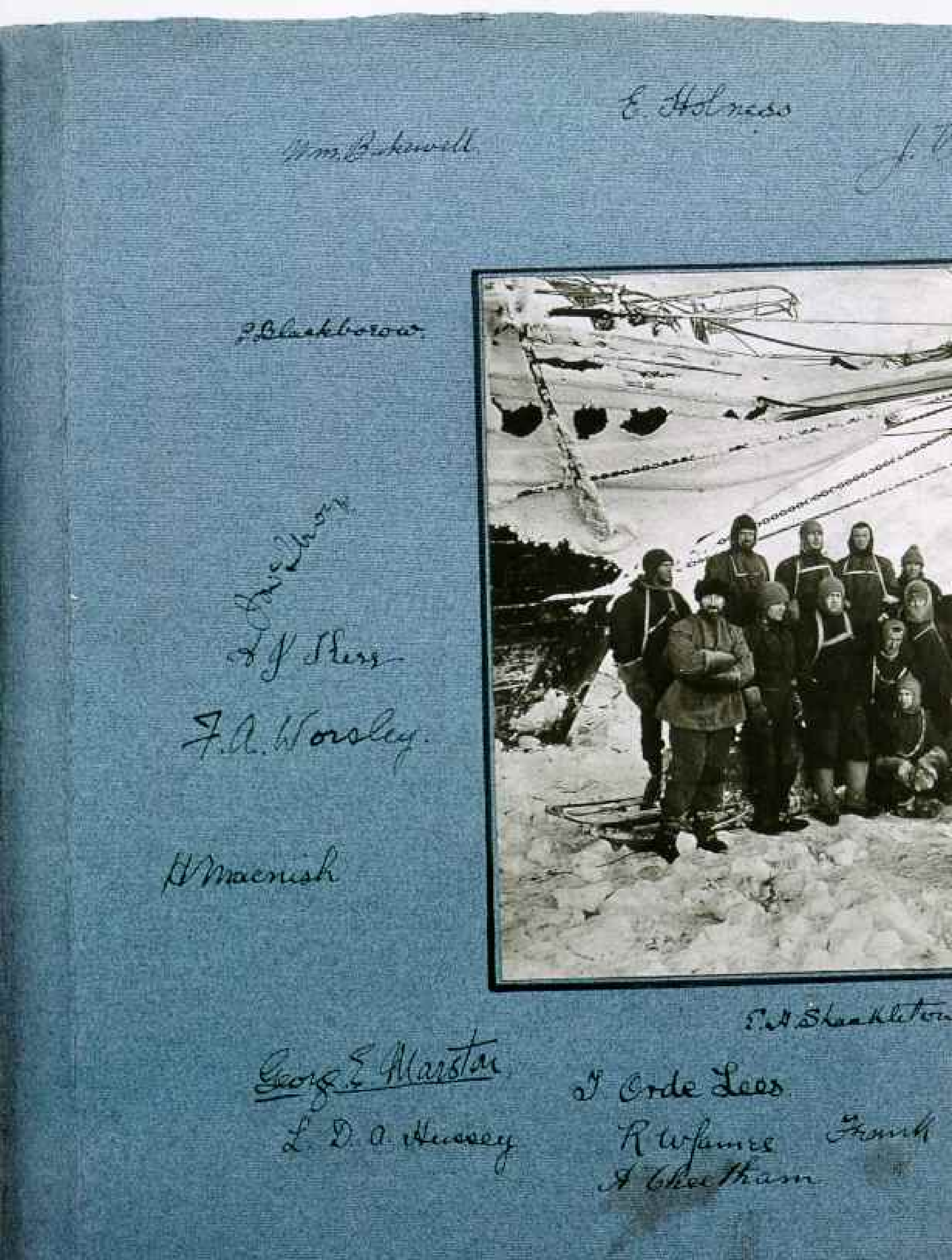
For Shackleton, the disappointment was particularly bitter. He was 40 years old, and the expedition had taken considerable energy to prepare. Europe was consumed by war, and he was unlikely to have this opportunity again. Nonetheless, he knew that his men would look to "the Boss," as they called him, for direction and morale. Disguising his emotions, Shackleton gave the appearance of being confident and relaxed, and the long months on the *Endurance* passed almost enjoyably.

All hands on board knew that one of two things would eventually happen: Come spring, the pack would thaw and disperse, freeing them. Or, the pressure exerted by the grinding floes would take hold of the little ship and crush her like an eggshell. In October 1915 the signs were ominous.

In his diary, now in the State Library of New South Wales, Australia, Frank Hurley, expedition photographer, wrote on October 26: "At 6 p.m., the pressure develops an irresistible energy. The ship groans and quivers, windows splinter, whilst the deck timbers gape and twist. Amid these profound and overwhelming forces, we are the absolute embodiment of helpless futility. This frightful strain is observed to bend the entire hull some 10 inches along its length."

On the following day, Shackleton gave the order to abandon ship. The men spent their first night on the ice in linen tents so thin the moon shone through them. The temperature was minus 16° Fahrenheit.

"A terrible night," wrote expedition physicist Reginald James in his diary, "with the ship sullen dark against the sky & the noise of the pressure against her . . . seeming like the cries of a living creature." *(Continued on page 90)*

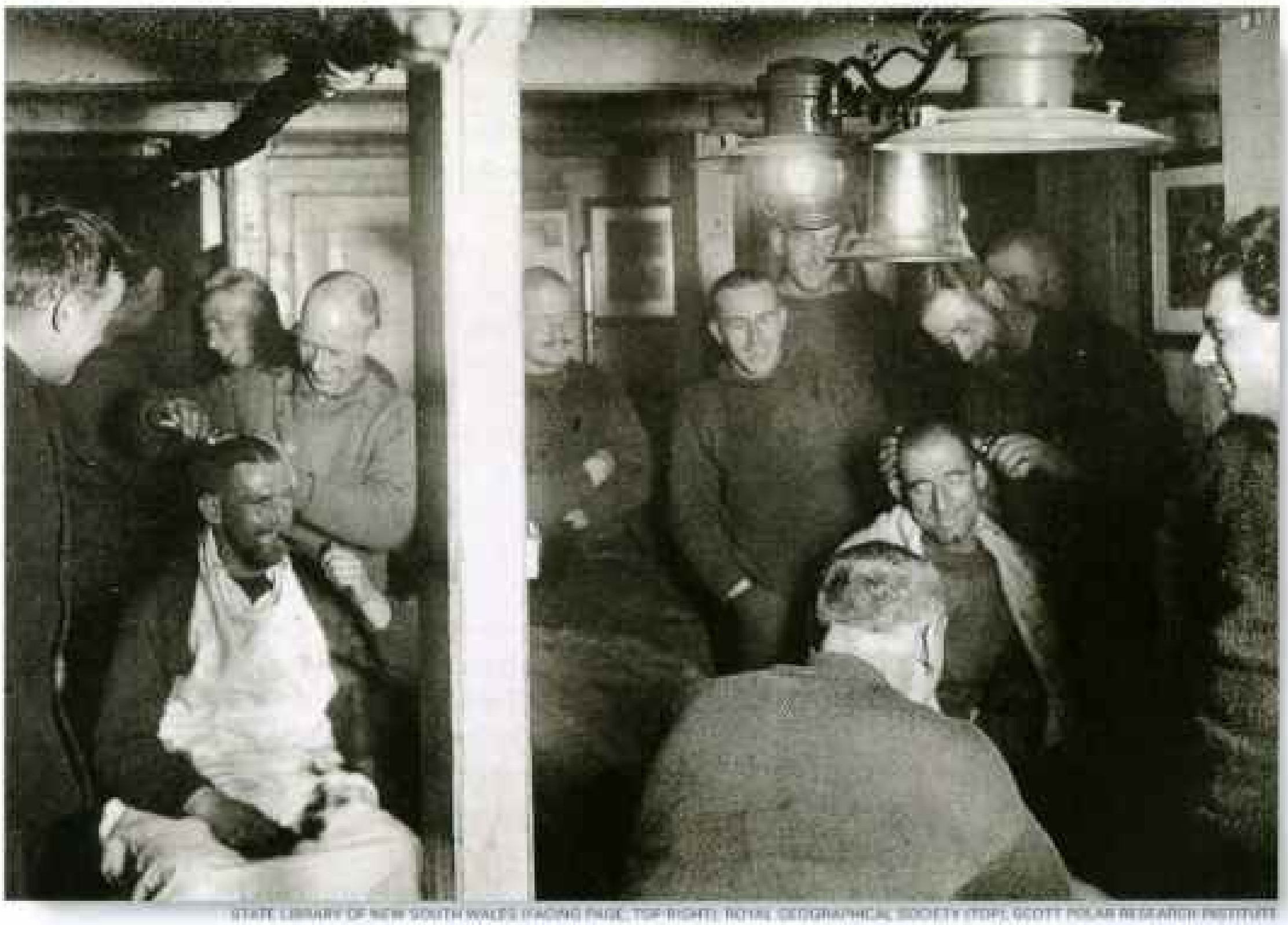


In September 1915 Frank Hurley photographed Shackleton, front row, third from left, with his crew, who signed their names in Hurley's album. Shackleton selected his team for the Antarctic expedition from some 5,000 applicants, including three women who were summarily rejected. Of the 27 men

on the Endurance, *Shackleton knew five from previous polar journeys, acquired one as a stowaway, and chose the rest on little more than hunches. But he chose well. He later wrote that his crew, even in "dark days and . . . continuous danger, kept up their spirits and carried out their work."*

In black and white and Paget, an early color process, Hurley chronicled the expedition's small stories before its epic disasters. Stowaway Perce Blackborow (above left) proved useful and brave. Boatswain John Vincent (above center) was demoted for bullying. Dog lover Frank

Wild (above) was Shackleton's loyal second-in-command. To vary their diet and ward off debilitating scurvy, the cook prepared nutritious penguin (below left). To break up the long polar night, Wild started a flurry of haircuts (below) in what Hurley called "mid-winter madness."



STATE LIBRARY OF NEW SOUTH WALES (FACING PAGE, TOP RIGHT); ROYAL GEOGRAPHICAL SOCIETY (TOP); SCOTT POLAR RESEARCH INSTITUTE

For two days in February 1915 the crew chopped a channel for the Endurance *in hopes of reaching open water. But they gave up 400 yards short of the lead, thwarted by layered ice up to 18 feet thick.*

Most of the expedition's food supplies were still trapped in the *Endurance*. Their warmest clothes were their long woolen underwear and Burberry windbreakers, about the weight of umbrella fabric. They had no radio communication, and no one in the world knew where they were. To get to safety once the ice broke up, they had only three salvaged lifeboats—and Shackleton to lead them.

"I can't remember the matter being discussed or argued in any way," James would recall. "We were in a mess, and the Boss was the man who could get us out."

In London's Royal Geographical Society, a venerable institution that has sponsored innumerable expeditions of discovery, the archivist brought me a Bible. I turned to the 38th chapter of the Book of Job—or, more accurately, to where the 38th chapter of Job once was. The page, as I already knew, was missing.

The day after the abandonment of the *Endurance*, Shackleton gathered his men and quietly told them they were going to try to march over the ice to Paulet Island, nearly 400 miles to the northwest. Only the barest essentials could be carried, and personal gear had to be sacrificed. By way of example, Shackleton took the ship's Bible and, ripping out a page from Job, deposited the book on the ice. The verses he saved read:

Out of whose womb came the ice?
And the hoary frost of Heaven,
who hath gendered it?
The waters are hid as with a stone,
And the face of the deep is frozen.

It was a dramatic gesture. What Shackleton never learned was that one of the sailors, a superstitious old salt named Tom McLeod, secretly carried the Bible away, believing that leaving it would invite bad luck.

The march to land was reluctantly abandoned: Dragging the loaded boats, each of which weighed at least a ton, over the colossal fragments of pressure ice and through deep snow proved impossible. The expedition now regrouped, and Shackleton determined there was nothing to do but pitch camp on the drifting ice and see where the current and winds would take them before conditions permitted the use of the boats.

Ocean Camp—the first of two camps pitched on the ice—was their new home. An eccentric supply of food was salvaged from the half sunk *Endurance*; the crates that first floated to the surface—soda carbonate, walnuts, onions—were not necessarily what the men would have chosen for starvation rations. Sledging rations originally intended for the transcontinental trek were put aside for use in the boats.

It was now summer in the Southern Hemisphere, and temperatures crept as high as 33° F.

SCOTT POLAR RESEARCH INSTITUTE (BOTH)

PREPARING TO ABANDON SHIP

Nine months later Shackleton, top right, watched as the massive ice floes tightened their grip. Endurance *lurched 30 degrees to port, causing an avalanche of stores, sledges, dogs, and men. The pressure eased but returned to squeeze and splinter the ship until ice alone held her afloat. After a ten-day battle Shackleton surrendered. "She's going, boys," he said. "I think it's time to get off."*

"A terrible night with the ship sullen dark against the sky & the noise of the pressure against her...seeming like the cries of a living creature."

The soft slush of snow made walking difficult, and the men's clothing was always wet; then the temperatures dropped each night, freezing the sodden tents and clothes. The principal diet was penguin and seal, and seal blubber provided the only fuel.

The men spent most of their time analyzing the direction of the ice drift. Their greatest hope was that the drift would continue north by northwest, carrying them within striking distance of Paulet Island, off the tip of the Antarctic Peninsula, where there was a hut with supplies from an earlier Swedish expedition. Shackleton's prime concern was not food or shelter but morale, and he feared the advent of depression as much as scurvy, the traditional bane of polar expeditions. The latter could be prevented by eating the organs of freshly killed animals, but the former required more complex management.

"Optimism is true moral courage," Shackleton often said. His particular concern was for the sailors, who more than the other men had been devastated by the loss of the *Endurance*. As Shackleton acknowledged, "To a sailor his ship is more than a floating home." From his earliest days as an explorer Shackleton had mixed easily with both the lower deck and the officers, and this now paid off. He was also well tuned to the temperaments of his men and catered to each. Hurley was somewhat vain, and Shackleton flattered him by making a pretense of consulting him privately on all matters of importance. A man found complaining that "he wished he were dead" was curtly assigned galley duties to distract him. Two of the more solitary and vulnerable men of the company were taken into Shackleton's own tent.

Other tactics were more controversial. The scientists and other educated personnel believed that the gravest danger facing the party was lack of food, and they wanted to kill and stockpile any wildlife that came their way. For the sailors who had been quartered in the fo'c'sle, on the other hand, the greatest imaginable hardship was remaining long months on the ice before being able to take to the boats. When Lionel Greenstreet, the first officer, urged Shackleton to put by more meat, Shackleton's response was instructive.

"Oh," he said. "You're a bloody pessimist. That would put the wind up the fo'c'sle crowd, they'd think we were never going to get out."

In mid-January four teams of sledging dogs were shot; the ice had become too treacherous for them to be safely used, and meat for their food was in increasingly short supply.

"This duty fell upon me & was the worst job I ever had in my life," reported Shackleton's loyal second-in-command, Frank Wild, in his memoir, also in the State Library of New South Wales. "I have known many men I would rather shoot than the worst of the dogs."

By March the northerly drift of the pack had carried them abreast of Paulet Island—but far to the east of it.

"One might as well try to cross from Ostend to Dover on water lily leaves as get over the pack from where we are now," wrote Thomas Orde Lees, the expedition's storekeeper. "What is going to happen remains to be seen."

March was bleak. The last of the dogs were shot—and this time eaten. The men lay in the tents, huddled in their bags that had frozen as stiff as sheet iron, too cold to read or play cards.

In April the ice cracked through their camp, and Shackleton knew that the long-awaited breakup was at hand. On April 9 he gave the order to launch the three boats, the *James Caird*, the *Dudley Docker*, and—barely seaworthy—the *Stancomb Wills*, all named after sponsors of the expedition. Twenty-eight men crammed aboard them with their basic camping gear and rations. The temperature dropped to minus 10°F, and high seas poured over the open boats and men, who had no waterproof clothing.

ROYAL GEOGRAPHICAL SOCIETY

On a final trip back to the Endurance, *Wild watched the ship in what surgeon Alexander Macklin called her "death agony." A week later she slipped under the ice, which quickly closed over her. One man wrote, "Without her our destitution seemed more emphasized, our desolation more complete."*

Day and night, through the minefield of grinding ice, then through the crashing waves of the open sea, the helmsman of each boat tried to hold his course, while his shipmates bailed. The boats were too small to maneuver in gale force winds, and after several changes of direction, Shackleton gave the order to run due north, with the wind behind them, for a splinter of land called Elephant Island.

This boat journey was made most vivid to me by a trip I took on a fine, calm winter day—not to the Antarctic but to East Anglia, England. The son of Huberht Hudson, navigator of the *Endurance*, had agreed to let me see the sextant his father had once steered by. Serene in its packing case, its brass somewhat faded, it was an evocative relic—but not as evocative as the single image Dr. Hudson recalled of his father.

"My father's fingers were bent, you see," he said quietly, contorting his own hands. "From the frostbite."

For seven sleepless, nightmarish days and terrifying black nights, the men endured cold that froze their clothing into solid plates of icy armor. Out of the night-dark sea, with explosive, rhythmic exhalations, white-throated killer whales rose beside the boats, taking the measure of the men with their small, knowing eyes. Ernest Holness, who had braved the North Atlantic on trawlers, covered his face with his hands and wept. Blackborow, the popular young stowaway whom Shackleton had made ship's steward, quietly mentioned that his "feet felt funny." And Hudson, bent over the tiller with ungloved hands, finally collapsed. Shackleton's exhaustion was extreme.

"Practically ever since we had first started Sir Ernest had been standing erect day and night on the stern counter of the *Caird*," wrote Orde Lees. Shackleton knew it was important to his men that they see him in charge.

At last, on April 15, the boats hove under the forbidding cliffs of Elephant Island, and a landing was made.

"Many were suffering from temporary aberration," was Hurley's description of his shipmates' mental state. Many lay on the ground burying their faces in the stones or reeled down

Shackleton knew that the outside world would never come to Elephant Island. There was only one remotely feasible course of action. . . .

the small beach, laughing uproariously. It had been 497 days since they had last set foot on land, but, as they soon discovered, a more godforsaken, blizzard-raked part of the Earth could scarcely exist. Howling 80-mile-an-hour winds off the glacial peaks shredded their tents and swept away precious remaining possessions—blankets, ground sheets, cooking utensils. The sailors crawled into the boats to take cover; others lay with the cold wet tent canvas collapsed about them, draped over their faces.

Shackleton knew that the outside world would never come to Elephant Island. There was only one remotely feasible course of action, and it was terrifying. He would take the largest lifeboat, the *James Caird*, and with a small crew sail 800 miles across some of the most dangerous water on the planet, the South Atlantic, in winter, to the whaling stations of South Georgia. They could expect to encounter waves as high as 50 feet from tip to trough, the notorious Cape Horn rollers. They would navigate by sextant and a chronometer whose accuracy was unknown, depending on sightings of the sun—but they knew that in these latitudes weeks of overcast weather could prevent a single sighting.

It is possible to make a pilgrimage to the boat itself, now retired in Shackleton's old school, Dulwich College, and one day I went there on a day trip from London. To conjure the scale of the seas that this unremarkable-looking wooden craft had survived was beyond both my experience and imagination, and standing beside the *Caird*, I was struck by a more banal consideration—that six men had found room in so small a craft. Overcome by unexpected emotion, I wept.

The *James Caird* was a 22½-foot-long wooden lifeboat, whose gunwales had been raised by the skill of Henry "Chippy" McNish, Shackleton's gifted Scottish carpenter. Working outside with frost-nipped hands as the blizzards raged on Elephant Island, McNish salvaged what timber he could from packing cases and old sledge runners. The "decking" was made of canvas, painfully thawed over a blubber flame and stitched with brittle needles. The nails were secondhand, extracted from packing cases. In lieu of hemp and tar for caulking, Chippy used lamp wicks, seal blood, and the oil paints of the ship's artist. The ballast was two tons of rough Elephant Island beach stone.

Shackleton chose five men whose seamanship and fortitude he felt he could trust; two of the men—McNish and John Vincent, a bullying sailor who had worked on trawlers—were also known to be "difficult" characters, and he wanted them on board under his watchful eye. His navigator would be Frank Worsley, a high-spirited, somewhat rambunctious New Zealander, whose talent for navigation under impossible conditions had already helped bring them safely to Elephant Island. Tim McCarthy was a cheerful young Irish sailor, well liked by the whole company. The sixth man, Tom Crean, was a powerful, apparently indestructible Irishman who had sailed on both of Scott's expeditions; on the last he had been awarded the Albert Medal for bravery when he trekked 35 miles alone through snow, supplied only with three biscuits and two pieces of chocolate, to bring help to a stricken companion.

The *Caird* set out on April 24, 1916, on a rare afternoon of relative calm. "Bravo! Brave

CARY WOLINSKY (OPPOSITE); ROYAL GEOGRAPHICAL SOCIETY

After five months on ice and nine days on wind-ravaged Elephant Island, Shackleton and five crew set off in search of rescue, their boat caulked with lamp wicks, seal blood, and oil paints. Trusting in an unfamiliar sextant (left), Frank Worsley steered for South Georgia—800 miles away.

leader," Orde Lees exclaimed in his diary, now in the National Library of New Zealand, as they left. The men Shackleton left behind faced their own trials, surviving on penguins and seals and living in a makeshift shelter under the two remaining overturned boats. Frank Wild, Shackleton's lieutenant, was in charge of the demoralized and shaken men, some of whom—Blackborow, Hudson, and Rickinson, the engineer, who had suffered a heart attack—were in grave need of medical attention.

THE DAY AFTER departure the *Caird's* ordeal began in earnest. Of seventeen days sailing, there would be ten days of gales. Icy waves soused the men. Beneath the canvas decking, the off-duty watch lay for four hours on stone ballast in wet and putrefying reindeer-skin sleeping bags; the dark space beneath the thwarts was so narrow that it gave the men the sensation of being buried alive. One night they awoke to find the boat staggering in the water. Ice as much as 15 inches thick encased every sodden inch of wood and sail. Despite the dangerous pitching and rolling of the boat, the men had to crawl onto the glassy decking and hack the ice away. If Shackleton noticed that any one of the men seemed to be suffering more than usual, he ordered hot drinks prepared for all hands on their little Primus stove.

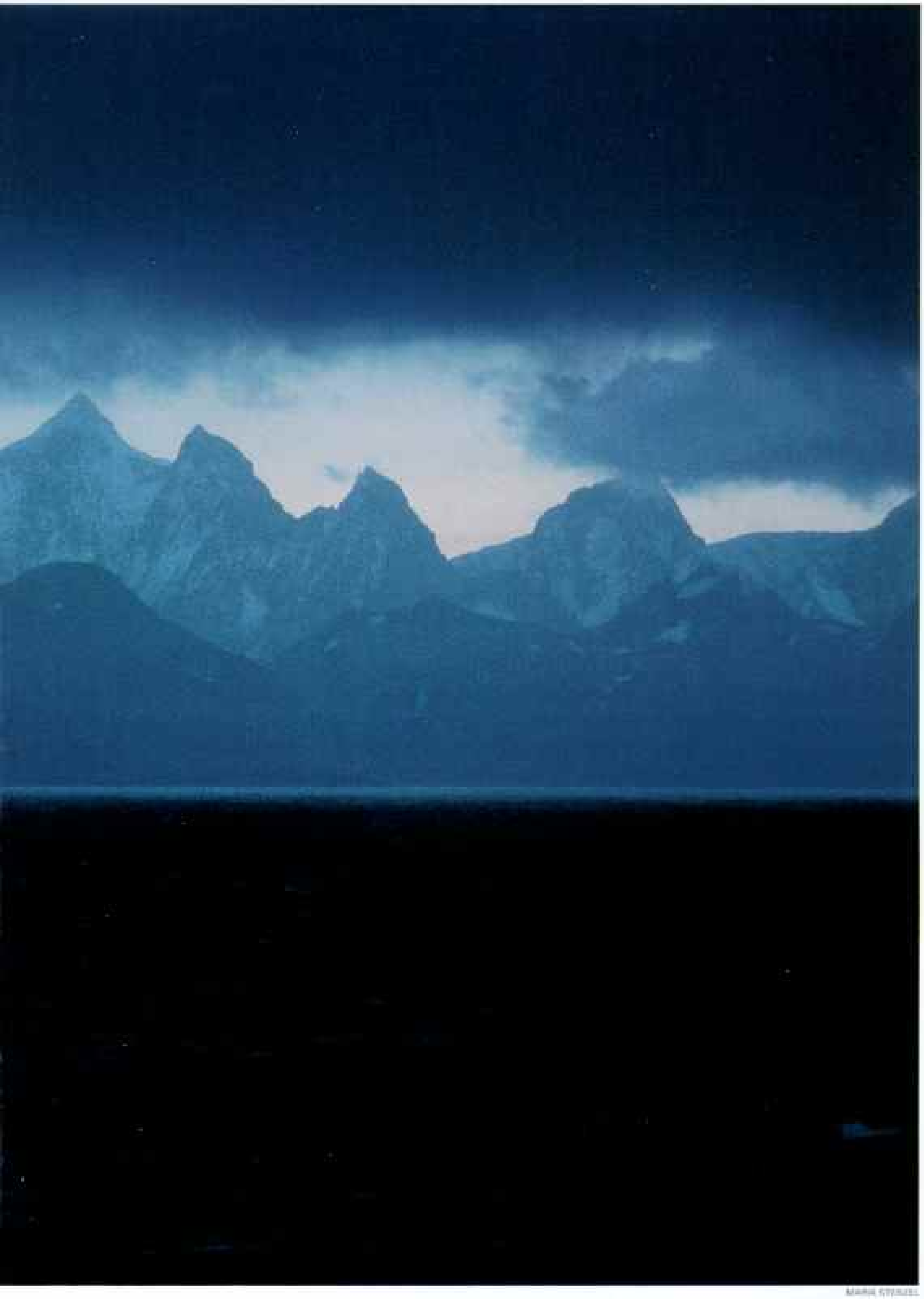
"He never let the man know that it was on his account," Worsley recorded, "lest he become nervous about himself." Despite Shackleton's care, Vincent collapsed after the first few days, and McNish was in a bad way, although still soldiering on. All six found that their feet, which were constantly wet, were white and swollen and had lost all surface feeling, while their bodies were cruelly chafed by their salt-ridden, icy clothes. Yet grimly, mechanically, through all the upheaval of wind and surf, they kept their watches, prepared their meals, took their turns at the makeshift pump, worked the sails, and held their course.

McCarthy shamed them all.

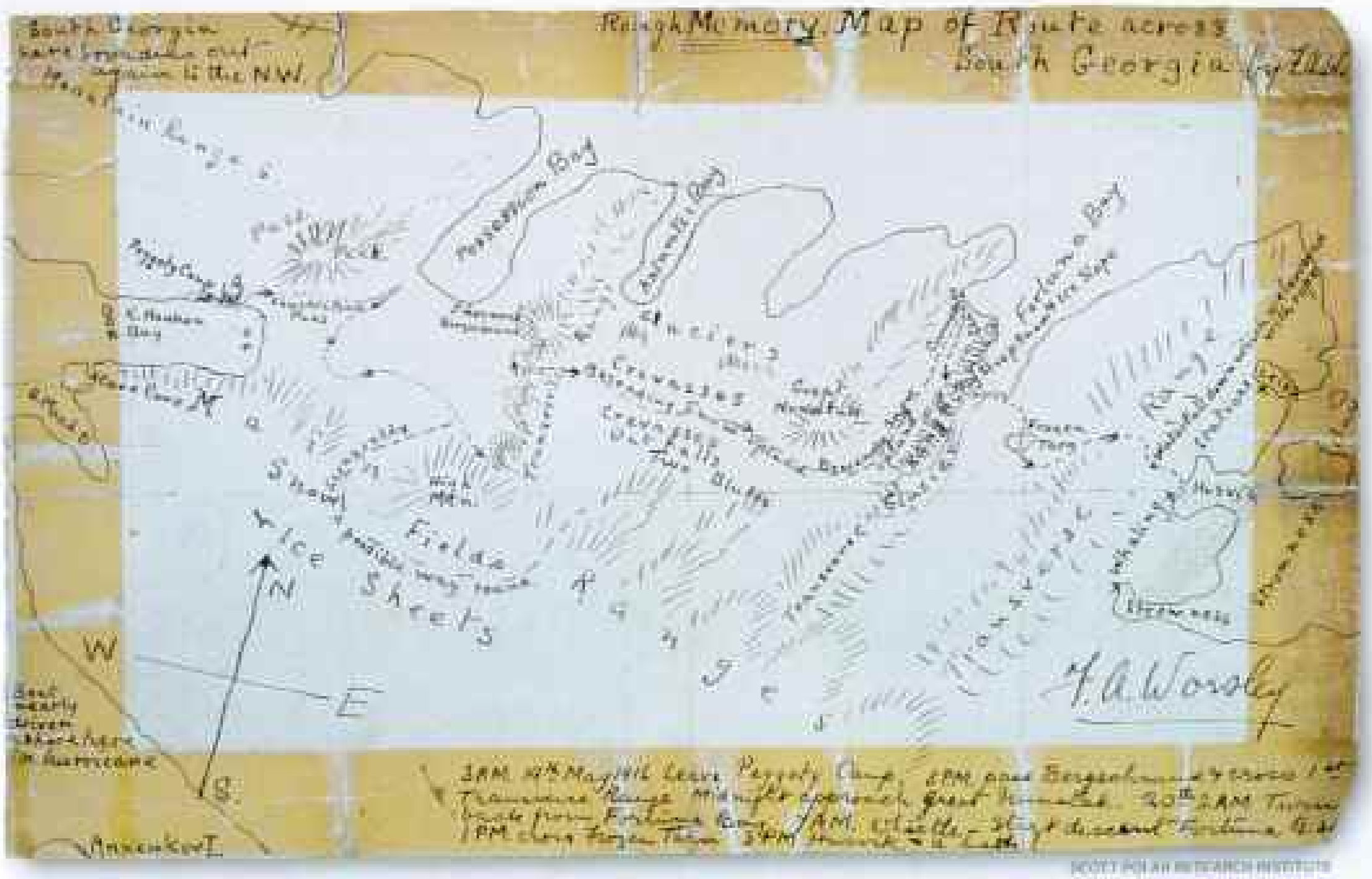
"[He] is the most irrepressable optimist I've ever met," Worsley scrawled in his navigating book. "When I relieve him at the helm, boat iced & seas pourg: down yr neck, he informs me with a happy grin 'It's a grand day, sir.'"

As feared, Worsley was able to take few sightings with the sextant he had borrowed from Hudson. Drawing on experience and an

Salvation. Shackleton and crew rejoiced at the sight of South Georgia's jagged coast, having sailed for 17 days through gale-force winds on the dark and heaving Scotia Sea. They had lost their anchor; their sodden clothes had frozen; their water had turned brackish. Had they missed the narrow



island, the next landfall was Africa, nearly 4,000 miles away. They put ashore 150 miles by sea from their goal, Stromness Bay, but they were alive. "Just when things looked their worst they changed for the best," wrote Shackleton, marveling at "the thin line that divides success from failure."



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Frank Worsley's sketch of South Georgia maps the route he, Thomas Crean, and Shackleton took from King Haakon Bay, left center, to Stromness, right, mistakenly marked Husvik. Leaving the others to rest, they trekked, bone weary, for 36 hours, crossing the island's unknown interior.

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uncanny instinct for assessing wind and tide, Worsley navigated mostly by dead reckoning, the sailor's calculation of courses and distance. Their proposed landfall, South Georgia, represented a mere speck in thousands of miles of ocean. Reluctantly the men decided to aim for the island's uninhabited southwest coast; if they overshot this landfall, prevailing winds would blow them east to other land. If they aimed for the inhabited northeast coast and missed—they would be blown into oblivion.

Near dusk on May 7, the 14th day, a piece of kelp floated by. With mounting excitement they sailed east-northeast through the night, and at dawn on the 15th day spotted seaweed. Land birds appeared in the thick fog, and when the fog cleared just after noon, McCarthy cried out that he saw land.

"There, right ahead, through a rift in the flying scud, our glad but salt-blurred eyes saw a towering black crag, with a lacework of snow around its flank," wrote Worsley. "One glimpse, and it was hidden again. We looked at each other with cheerful, foolish grins. The thoughts uppermost were: 'We've done it.'"

It was a triumph of navigation as much as seamanship and endurance; even the five sightings Worsley had been able to make had involved a degree of guesswork, as the boat had pitched too wildly for him to gain secure fixes of the sun. As if out of spite, a full-blown hurricane roared up to thwart any attempt at landing that day. On top of all else, the men had discovered that their remaining water supply was brackish, and they were tormented with thirst. But on the evening of May 10, with Shackleton and his men at their very limits, the *Caird* ground onto a gravelly beach on South Georgia.

THE NEAREST whaling stations lay about 150 miles distant by sea, too far for the battered boat and debilitated crew. Instead, Shackleton determined that he and two companions—Worsley and Crean—would cross overland to the stations at Stromness Bay. The distance was only 22 miles as the crow flies, but over a confusion of jagged rocky upthrusts and treacherous crevasses. While the coasts of the island had been charted, the interior had never been crossed, and their map depicted it as a blank.

As dawn was breaking, they passed over a ridge and saw below the distinctive, twisted rock formation that identified Stromness Bay.

Shackleton's main concern was the weather, as a blizzard in the mountains could finish them. But at 3 a.m. on May 19 the conditions were right, and—by a gift of providence—there was a full, guiding moon.

The highest mountains on the island were less than 10,000 feet, and by strict mountaineering standards the journey was not technically difficult. A modern professionally guided traverse requires that each climber take the following equipment: Sleeping bag (rated to +10°F), closed-cell foam sleeping pad, climbing boots (preferably double), waterproof gaiters, one set pile jacket and pants, one extra pile jacket, one waterproof jacket, one waterproof pants, two sets of mitts (one waterproof), spare gloves, lightweight balaclava, face mask, camp booties, vapor-barrier socks, long underwear, one large pack, crampons, one ice ax, two ice screws, sunglasses, goggles, water bottle, Swiss army knife, sunscreen, skis with climbing skins, ski poles, waterproof bags. Guides provide tents, stoves, radio, first aid kits, climbing ropes, snow shovel, food and fuel, and crevasse rescue equipment.

"We decided to . . . make the journey in very light marching order," wrote Shackleton. "We would take three days' provisions for each man in the form of sledging ration and biscuit. The food was to be packed in three socks, so that each member of the party could carry his own supply." They also carried matches, a cooking pot, two compasses, a pair of binoculars, 50 feet of rope, a Primus stove filled with enough fuel for six hot meals, and McNish's adze in lieu of an ice ax. They were dressed in threadbare long woolen underwear worn under ordinary clothing that had not been changed for seven months. For traction on the ice McNish had also put screws from the *James Caird* in their boot soles. Their frostbitten feet had not regained feeling in the nine days since their landing.

With moonlight glinting off the glaciers, Shackleton, Worsley, and Crean left their companions and set out from the head of King Haakon Bay into the mountains. Guided only by common sense, they made three failed attempts to pass through the rocky crags that lay athwart their path. The fourth pass took them over just as daylight was failing. After an initial precipitous drop, the land on the other side merged into a long, declining snow slope, the bottom of which lay hidden in mist.

"I don't like our position at all," Worsley quotes Shackleton as saying. With night coming, they were in danger of freezing at that elevation. Shackleton remained silent for some minutes. "We'll slide," he said at last. Coiling the length of rope beneath them, the three men sat down, one behind the other, each locking his arms around the man in front. With Shackleton in the lead and Crean bringing up the rear, they pushed off toward the pool of darkness below.

"We seemed to shoot into space," wrote Worsley. "For a moment my hair fairly stood on end. Then quite suddenly I felt a glow, and knew that I was grinning! I was actually enjoying it. I yelled with excitement, and found that Shackleton and Crean were yelling too."

Their speed slackened, and they came to a gentle halt in a snowbank. Rising to their feet, they solemnly shook hands all round. In only minutes they had descended 1,500 feet.

They tramped on through the night, half asleep. More blunders were made as they became too tired to calculate the lay of the land. But as dawn was breaking, they passed over a ridge and saw below the distinctive, twisted rock formation that identified Stromness Bay. They stood in silence, then for the second time turned and shook each other's hands.

At 6:30 a.m. Shackleton thought he heard the sound of a steam whistle. He knew that about this time the men at the whaling stations would be roused from bed. If he had heard correctly, another whistle should sound

> Shackleton and his men returned to a different world than they had left. Everything had changed, including ideals of heroism.

at seven o'clock, summoning the men to work. With intense excitement, Shackleton, Worsley, and Crean waited, watching as the hands moved round Worsley's chronometer. At seven o'clock to the minute, they heard the whistle again. Now they knew they had succeeded.

At three o'clock on the afternoon of May 20, after 36 hours without rest, they walked into the outskirts of Stromness station. Filthy, their faces black with blubber smoke, their matted, salt-clogged hair hanging almost to their shoulders, they presented a fearsome sight, and two small children—their first human contact—ran from them in fright.

Eventually they came upon the station foreman, and Shackleton asked to be taken to the manager. Tactfully unquestioning, the foreman led the trio to the home of Thoralf Sørlle, whom they had met when the *Endurance* came to South Georgia, nearly two years before.

"Mr. Sørlle came out to the door and said, 'Well?'" Shackleton recorded.

"'Don't you know me?' I said.

"'I know your voice,' he replied doubtfully. 'You're the mate of the *Daisy*.'

"'My name is Shackleton,' I said."

Aghast at their story, the Norwegian whalers received the castaways with admiration and open hearts. A ship was sent to collect the other three members of the *James Caird* crew—and the *James Caird* itself, which was carried into the station on the shoulders of the whalers like a sacred relic.

DAWN CAME CLEAR AND COLD on Elephant Island. It was August 30, 1916, nearly five months since the *Caird* had departed, and Frank Wild had privately begun preparations to mount his own rescue.

Food reserves had become alarmingly low. Perce Blackborow's badly frostbitten foot had been operated on by the expedition's two surgeons, but bone infection had set in, and his condition was grave. Since their arrival on the island, he had lain without complaint in his sodden sleeping bag.

At one in the afternoon, Wild was just serving a "hoosh," a stew of limpets scavenged from tidal pools, when George Marston, the expedition's artist, excitedly poked his head inside the shelter they had made under the two remaining boats.

"Wild, there's a ship," he said. "Shall we light a fire?"

"Before there was time for a reply there was a rush of members tumbling over one another," Orde Lees reported, "all mixed up with mugs of seal hoosh making a simultaneous dive for the door-hole which was immediately torn to shreds."

Outside, the mystery ship drew closer, and the men were puzzled to see it raise the Chilean ensign. Within 500 feet from shore the ship lowered a boat, and as she did so, the men recognized the sturdy, square-set figure of Shackleton, and then of Tom Crean.

"Then there was some real live cheers given," recalled William Bakewell, one of the sailors. This was Shackleton's fourth attempt to reach Elephant Island; pack ice around the island had thwarted three earlier efforts.

For the fourth journey the Chilean government had given Shackleton the use of the *Yelcho*, a small steel-hulled tug that had last served as a lighthouse tender, and her crew. In this eminently unsuitable vessel, he, Worsley, and Crean had set forth.

In one hour, the entire company of Elephant Island and their few possessions were aboard the *Yelcho*, Hurley bringing along his canisters of photographic plates and film that he had cached in the snow.

"2.10 All Well!" Worsley recorded in his log. He had been watching from the bridge. "At last! 2.15 full speed ahead."

Through all the long months of their terrible ordeal, Shackleton had lost—not a man.

ROYAL GEOGRAPHICAL SOCIETY

After three failed attempts spanning a hundred days, Shackleton rescued the crew on Elephant Island. "By self sacrifice and throwing his own life into the balance he saved every one of his men," wrote Worsley. In 1922 Shackleton died of a heart attack at the start of another Antarctic quest.

"TELL ME, when was the war over?" Shackleton had asked Sørlle, on arriving at Stromness station after crossing South Georgia.

"The war is not over," Sørlle replied. "Millions are being killed. Europe is mad. The world is mad."

Shackleton and his men returned to a different world than they had left. Everything had changed, including ideals of heroism. With millions of Europe's young men dead, England was not much interested in survival stories. Captain Scott, the Royal Navy officer who had brought honor to his country by dying in the Great White South, better fit the mourning nation's idea of heroism than did an entrepreneurial survivor like Shackleton.

Hard-pressed for money, at a loose end, his greatest dreams already thwarted, in 1921 Shackleton headed south again. An old school chum from Dulwich sympathetically financed this expedition in a somewhat shaky ship called the *Quest*. It was unclear exactly what the purpose of the expedition was; plans ranged from circumnavigating Antarctica to looking for Captain Kidd's treasure. It didn't matter. All that counted was to go south again.

On January 4, 1922, after a stormy passage, the *Quest* arrived at South Georgia, where Shackleton was warmly greeted by the Norwegian whalers. After an idyllic day ashore, he returned to his ship for dinner, bade his friends good night, retired to his cabin—and died. The cause was a massive heart attack; he was 47.

"Shackleton's popularity among those he led was due to the fact that he was not the sort of man who could do only big and spectacular things," Worsley wrote. "When occasion demanded, he would attend personally to the smallest details, and he had unending patience and persistence, which he would apply to all matters concerning the well-fare of his men." Shackleton believed that quite ordinary men were capable of heroic feats if the circumstances required; for him, the weak and the strong *must* survive together.

On hearing of her husband's death, Shackleton's wife, Emily, requested that he be buried on South Georgia. His body still rests in the island's small cemetery, lying among the sea-hardened whalers who perhaps best appreciated his achievements. Mountain and sea surround him, and the wild beauty of the harsh landscape that forged his greatness. □

Abusir

By ZAHI HAWASS

The serene face of Iufaa, an Egyptian priest, greets the mortal world for the first time in 2,500 years. Deep below the desert sands, archaeologists from the Czech Republic's Charles University uncovered the rarest of finds, an unlooted tomb with hundreds of artifacts. From beneath the lid of a colossal stone sarcophagus workers removed mud bricks and plaster (far right), exposing an inner sarcophagus carved in Iufaa's image and decorated with a scarab, symbol of eternal rebirth, and protective hieroglyphs. The next day the inner sarcophagus was opened, disturbing Iufaa's peaceful afterlife but revealing much about his world.

Tomb

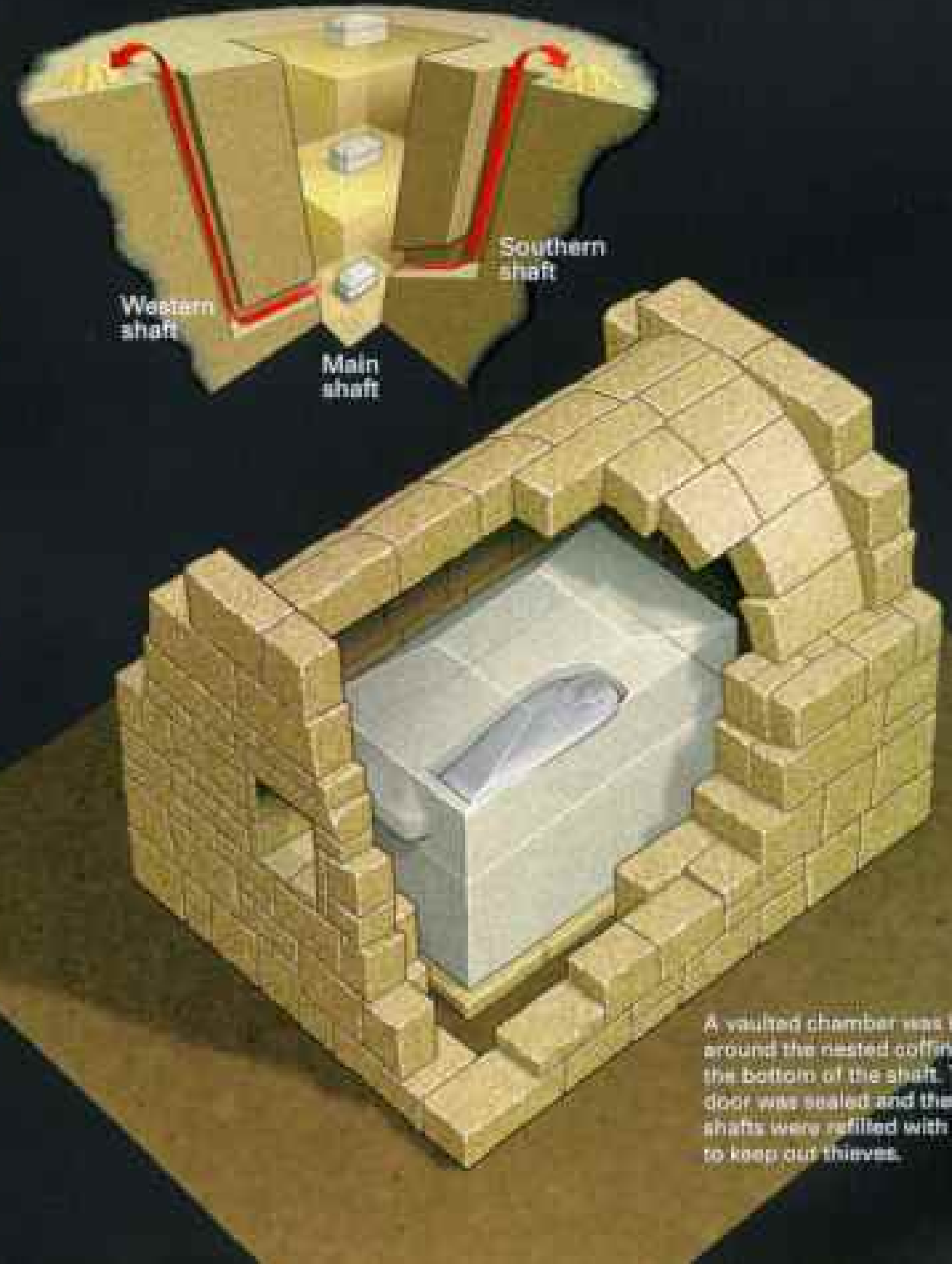
Photographs by KENNETH GARRETT

Engineering ancient and modern

"Stop! It's finished!" shouts team architect Michael Baldz (above, in plaid shirt). The dangerous task of shifting the 24-ton lid of the limestone outer sarcophagus is complete. For nine days the workers chanted, drowning out the sound of ratcheting gears as they cranked a series of jacks, lifting the lid, then pushed it aside inch by inch. Any slip could have damaged the burial chamber's walls or sent the slab onto the crew.

Quiet anticipation replaces noise and sweat as the lid of the basalt inner sarcophagus is hoisted (left). "We're anxious about what we'll see next," says chief archaeologist Ladislav Bareš.

Iufaa's nested coffins lay at the bottom of an 82-foot shaft. How did the ancients lower up to 55 tons of stone? They likely used narrow side shafts that joined the main shaft near its base. All three shafts were filled with sand, and the sarcophagi were placed atop the main shaft. Like a toy boat in a draining bathtub, the load descended as workers removed sand from the side shafts.



A vaulted chamber was built around the nested coffins at the bottom of the shaft. The door was sealed and the shafts were refilled with sand to keep out thieves.

ART BY STEVE COPPS

We never know what secrets lie hidden below the ancient sands of Egypt. In February 1998 a team of Czech archaeologists made a rare discovery—an undisturbed burial. Since Howard Carter marveled at the gold, jewels, and other wonders in Tutankhamun's burial chamber 76 years ago, such finds have been both scarce and significant. The newly opened tomb of the priest Iufaa, an administrator of palaces who lived around 500 B.C., holds treasures that promise to shed light on a little-known period of history.

This extraordinary discovery came about under the leadership of Miroslav Verner, a Czech archaeologist who has dedicated much of his career to excavating the ancient burial site of Abusir. Located several miles south of the Pyramids at Giza, Abusir's smaller pyramids (top right) mark the burials of forgotten kings and queens of the 5th dynasty (2470-2350 B.C.). Here also is a cemetery of shaft tombs from the sixth century B.C., when the Persians invaded Egypt.

Iufaa's grave lies at the bottom of one of the shafts. Verner and his Czech team began excavating in 1995, assisted by Egyptian workmen. Their dangerous labor took nearly three years to complete. The dry clay walls kept crumbling, which may have discouraged thieves in the past. Almost 70 feet down, workmen reached the vaulted limestone roof of a burial chamber. A small doorway in the side of the chamber was sealed with stones, which they removed.

The workmen had tears in their eyes and were all saying, *"Allah akbar, Allah akbar*—God is great," Verner told me later.

A box-shaped sarcophagus of white limestone filled most of the burial chamber, which is about 16 feet long and 11 feet wide. Along the sides of the chamber lay the original

tomb furnishings. Four canopic jars holding Iufaa's internal organs show the dead man's face (right).

The Czech team planned to open the sarcophagus in the autumn of 1996, but nature intervened when part of the shaft collapsed during an earthquake in September. Workmen cleared the shaft and encased the tomb in a reinforced-concrete shell. Most of the burial chamber escaped major damage.

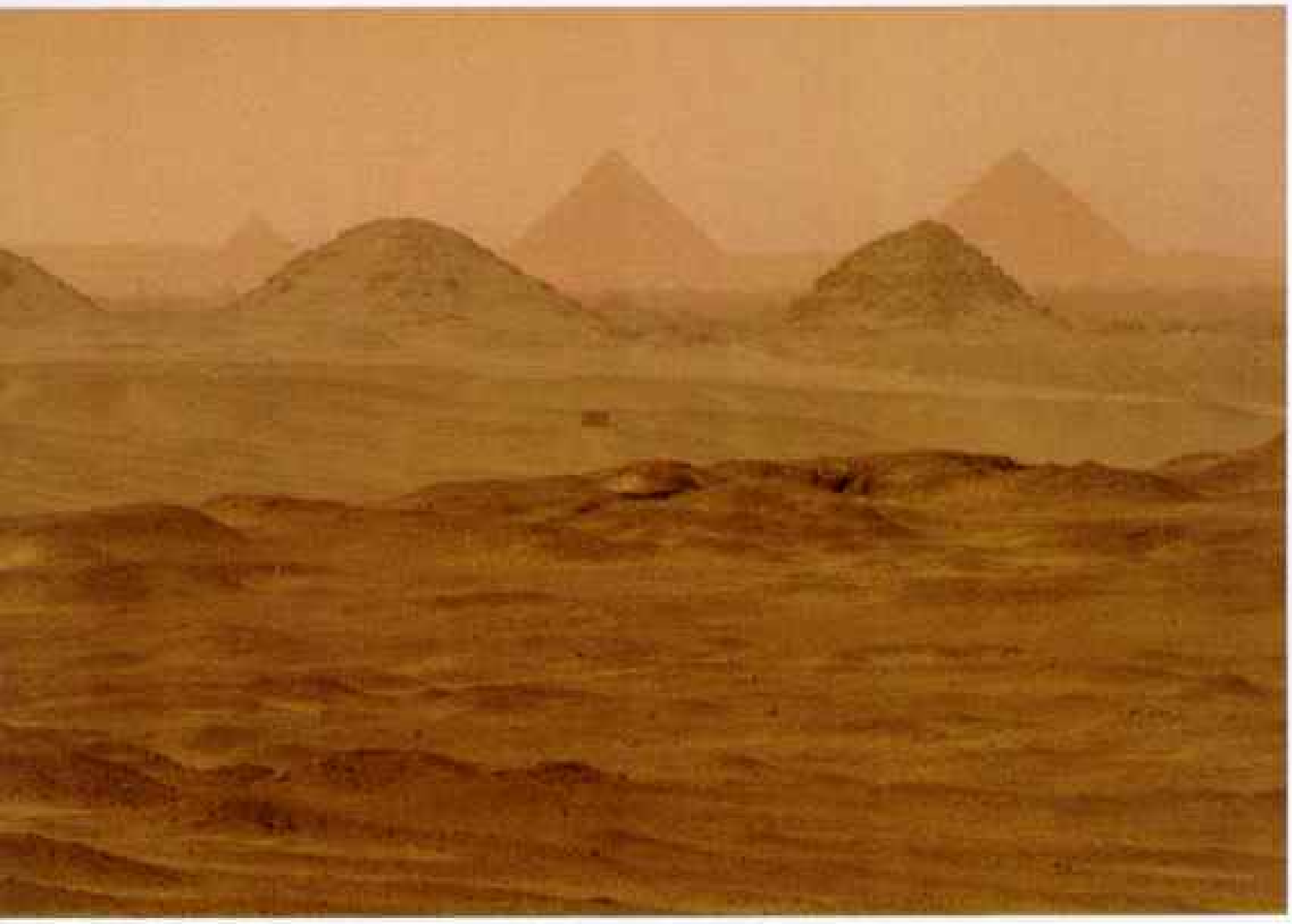
Not until February 17, 1998, did workmen begin to raise the outermost sarcophagus lid, using massive wooden beams and jacks. Working to the rhythm of traditional

chants, they strained to move the 24-ton lid inch by exhausting inch. At last it slid off. Beneath layers of mud bricks and plaster was a mummy-shaped sarcophagus of deep gray basalt covered with fine carvings and hieroglyphs.

Ten days later dignitaries and journalists crowded into the tomb to watch the inner sarcophagus being opened. Everyone was on edge as workmen wrapped the lid in chains and hoisted it off.

A hush fell as we gazed on the wooden coffin inside. Beneath the rotten lid, which turned to powder at the mere touch of a finger, we could see the mummy covered with a magnificent shroud of glazed ceramic beads depicting gods of the afterlife. It was a moment of awe—and triumph.

Zahi Hawass, Director General of the Pyramids, was a principal consultant on *Mysteries of Egypt*, National Geographic's first film produced using Imax technology. Kenneth Garrett has photographed archaeological subjects worldwide for the Geographic.



For Miroslav Verner it was a once-in-a-lifetime experience—after 38 years of study he had found an intact mummy whose name and station in life he could determine. "It was a big surprise," he said. "I could not sleep at all the night before opening the sarcophagus."

Iufaa's grave promises a wealth of new knowledge about ancient Egyptian religion. Hundreds of artifacts have been found intact and in place, just as they were left when the tomb was sealed. Exquisitely preserved inscriptions and reliefs cover the burial chamber walls. These discoveries represent a priceless record of the period when ancient Egypt's centuries of military might and cultural glory were drawing slowly to a close.

The bead-shrouded mummy

Like Russian dolls, each coffin yields another. A decayed wooden coffin, its carved face barely visible (above), lies inside the basalt sarcophagus. Rotted wood means that moisture has penetrated the seal of the sarcophagus. Even the most skillfully embalmed mummy must be kept dry—difficult in a humid shaft only a few feet above the water table. Tufaa may have been decomposing for centuries.

Piece by piece, workers remove the wood. What they uncover stuns the team: a delicate network of glazed beads (opposite)—the remnants of a shroud. Below a banded collar appear the winged goddess Nut and the sons of Horus, protectors of the dead. "Fantastic," says Czech anthropologist Eugen Strouhal. "I've never seen one so remarkably intact." The find forces an agonizing decision. Should the team take days to preserve the fragile shroud and risk losing the chance to study the rotting mummy? Decay isn't the only threat. The site may be a target for looters. Egypt's Supreme Council of Antiquities chooses a compromise. Tufaa will be moved to a lab for analysis. The shroud is photographed and the beads collected. "We hope to reconstruct it in the future," says a resigned Miroslav Verner, the team's leader.

Who was Iufaa?

After a prayer four trusted workers bear Iufaa's crude new coffin from his tomb. A truck waits nearly a mile away to take his remains to a radiography lab at Giza. Eugen Strouhal eagerly follows. In decades of research he has never had a chance to study a mummy from an undisturbed burial.

At the lab Strouhal (bottom) plucks a few remaining

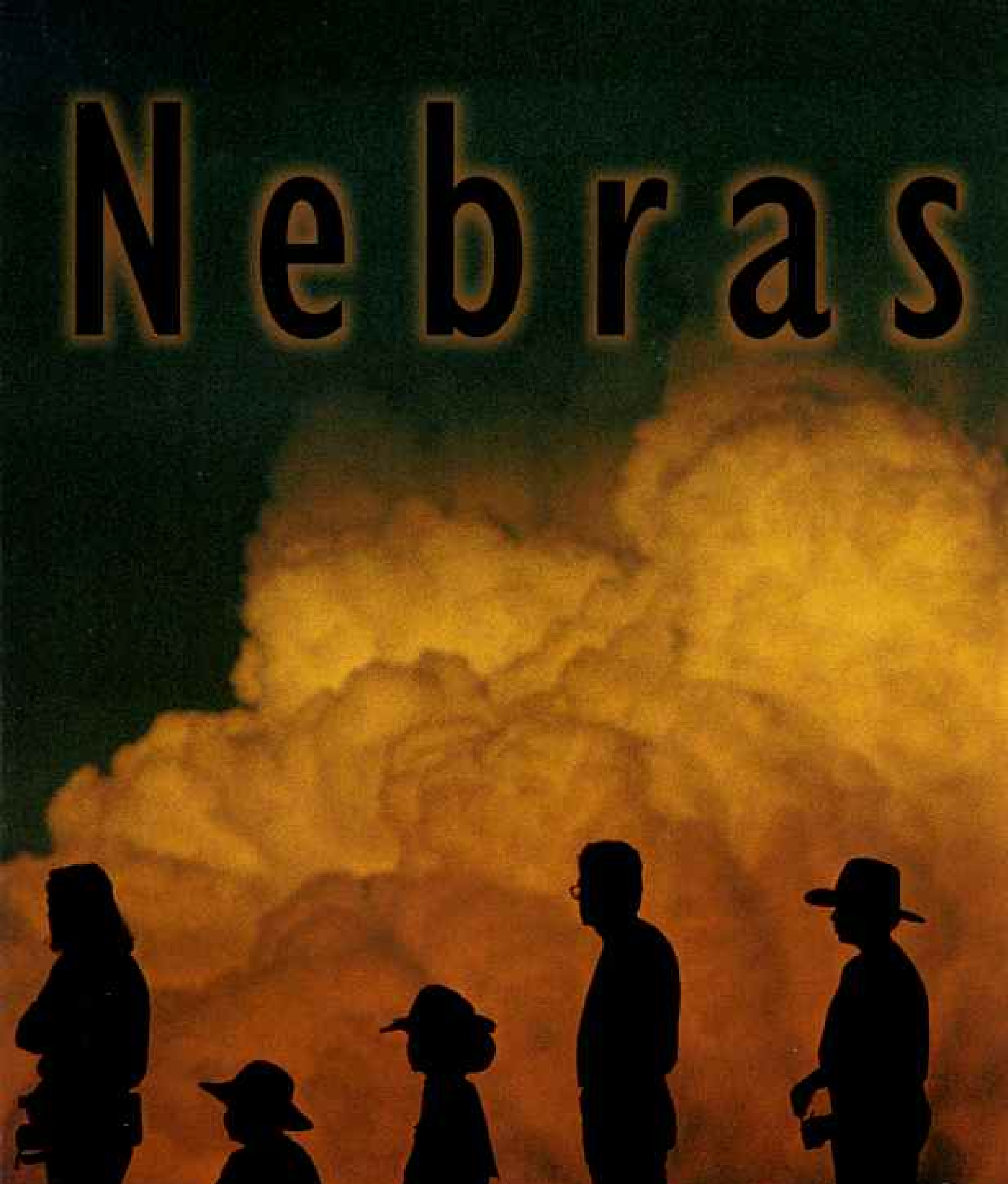
beads as he prepares Iufaa for the x-ray machine. Ancient embalmers didn't give the corpse first-class treatment: Its wrappings weren't all saturated with moisture-resistant resin. The mummy, already broken at the pelvis, crumbles with each touch. Soon it breaks at the neck. A gilded fingertip cover (left)

falls from the gap. All of Iufaa's digits are sheathed in gold. His fingers, held over the throat in an arms-crossed pose, glow white in the x-ray.

Though eight of Iufaa's molars are missing, he probably wasn't more than 30 years old when he died. Strouhal detects no signs of violence. Hieroglyphs identify Iufaa as a lector priest and an administrator of palaces. His titles and his grand tomb imply a life of privilege and prosperity. Lector priests belonged to an elite class, serving gods and king by reading spells and rites.

Iufaa lived centuries after Egypt's greatest glory had faded. Pottery from the tomb suggests that he came of age during the 26th dynasty, a time of cultural renaissance, but died in the 27th under the rule of Persian conquerors. What did Egyptians believe about death and the afterlife in this transitional time? What can the tomb tell us about relations between native priests and the foreign regime? The mummy is mute, but study of the tomb's artifacts and inscriptions may provide answers. □

Nebras



After weathering an economic slump that hit hard as a hailstorm in the 1980s, Nebraska has

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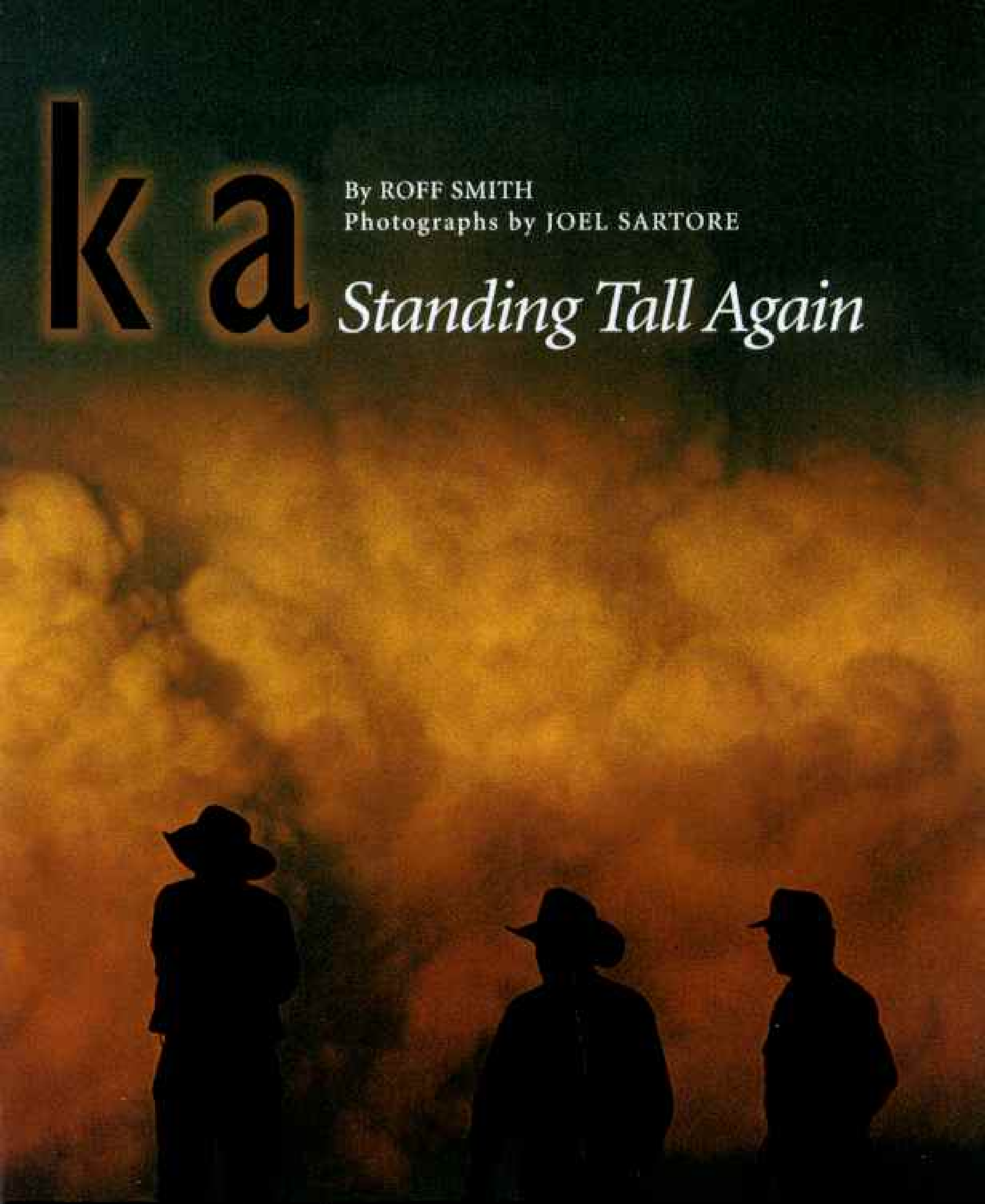
Standing Tall Again

By ROFF SMITH
Photographs by JOEL SARTORE



rebounded, reinventing itself while still looking out for traditions like the Big Rodeo at Burwell.

To fuel up, Chris and Nick Holste chow down at the Mule Skinner Saloon in Oxford. Hired farmhands, the twins keep almost identical

schedules. Up at 6 a.m., they'll sip a soda pop for breakfast, then fix tractors, balers, and gearboxes till lunch. Afterward they're back sweltering in the fields. Dinner is usually steak and potatoes and then, in the summer, a few more hours of work. Says Nick, "I must enjoy it if I keep doing it."

Designed to be invisible to enemy radar, a B-2 stealth bomber slices across southwestern Nebraska. The state's main military installation—Offutt Air Force Base, in Bellevue—managed to evade Washington's political guns during a spate of recent base closings. This area, the top brass successfully argued, provides the Air Force with a central location relatively free of commercial air traffic.

THERE ARE TWO THINGS Nebraskans want you to know about their state's geography. The first is that when the University of Nebraska Cornhuskers are playing a home game, Memorial Stadium in Lincoln becomes the third largest city in the state. There hasn't been an empty seat there since a game against Missouri on November 3, 1962—a string of 220 consecutive full houses. The second is that Nebraska ain't flat.

"Any time I hear somebody say Nebraska's like a pool table, I know they've zipped across on I-80 and haven't seen a thing," says Don Hutchens, executive director of the Nebraska Corn Board. Certainly they haven't tried to put a car into first on the surprisingly hilly streets of Omaha. Or stopped to admire the view of the North Platte River Valley from the top of Windlass Hill, a pitiless grade on the Oregon Trail that broke the backs and spirits of a generation of pioneers. Or bicycled across Nebraska, as I did in the summer of 1980. That trek left me with both a working knowledge that Nebraska's eastern edge is at an elevation of 840 feet while its western is just over 5,400 feet and a lingering fascination for the way horizons fall away on the plains.

Nebraska is a land to be taken slowly, imaginatively. There are no mountain ranges in the distance to lure you on, as there are on the prairies in Colorado. Nebraska's character is more subtle, closer to hand: sunflowers drowsy with summer heat, the glow of a cornfield against the purplish backdrop of a storm, a flock of sandhill cranes rising from the marshes of the Platte River.

A lot of corn? Sure. More in fact than any foreign country except China and Brazil. But Nebraska is also a computing and telecommunications hub, part of an emerging "silicon prairie." Wholesome? Nebraska defines the word. But just as you can meet Miss "Middle of Nowhere" at the annual children's pageant in Ainsworth, you can also run afoul of big-city-style street gangs in Omaha. Speed through Nebraska's 19 million acres of cropland and read: homogeneity. Go slowly enough to make out the names on the farm gates—Zitterkopf, Foos, Swanson—and read the story of America's great melting-pot migration westward.

Yet for every person who chose to put down roots in Nebraska, countless more have used it as a doormat to somewhere else. In the mid-1800s more than 400,000 pioneers passed

Corn and cattle give way to strip malls and sprawl near Omaha and Lincoln. But western Nebraska still looks like home to cowboy Mark Vinton (right), who grew up in the Sand Hills on a 14,000-acre ranch.

AREA: 77,358 sq mi. **CAPITAL:** Lincoln. **POPULATION:** 1,652,093. **RACIAL/ETHNIC:** 93.8% white, 3.6% black, 2.3% Hispanic. **ECONOMY:** Agriculture (cattle, corn, hogs), manufacturing, telecommunications. **PER CAPITA INCOME:** $23,047. **UNEMPLOYMENT:** 2.9%.

Hanging on to a raging mass of muscle for eight seconds—that's the test for bull riders in the Big Rodeo at Burwell (right). This annual festival also features a race in which contestants attempt to ride some of the wildest horses around. In the 1992 competition one steed bashed Ron Jurgensen in the mouth, leaving him with a gap-toothed grin, two false teeth, and bar tales to last a lifetime (opposite). In 1996 he dislocated his elbow in the same event, and in 1997 he broke his wrist. So why doesn't he hang up his spurs? "The adrenaline," he says. "And to see if you can conquer the beast."

through on the Oregon Trail. By the 1870s people were streaming across on the Union Pacific Railroad, and even today more than 140 trains a day rattle the glassware in towns across the central part of the state—America's busiest rail corridor. Lindbergh learned to fly above the cornfields around Lincoln in 1922, as California-bound motorists were driving their Model T's down the Lincoln Highway on the nation's first coast-to-coast automobile route. Fifty years later Interstate 80 streaked across the prairie like a four-lane laser beam.

The object, more often than not, has been to cross the state as fast as possible to get someplace else. "I was headed for Nebraska," Bill Bryson, a native of Iowa, wrote in *The Lost Continent*. "Now there's a sentence you don't want to have to say too often if you can possibly help it." These days, however, it's a sentence some Americans are saying with enthusiasm.

"My 15-year-old was starting to run around with a very bad crowd back in Denver," says Terri Serna, a seventh-generation Coloradan who moved to a farm town in south-central Nebraska called Oxford. "Three weeks after we got here, he was wrestling and playing football. There are a lot of us from the city coming here. It's like the Oregon Trail's suddenly become a two-way street." Indeed, the population of Nebraska, now close to 1.7 million, grew by more than 78,000 between 1990 and 1997—an increase of 5 percent.

Nebraska remains a vestige of gold-standard America, where folks leave their doors unlocked and everybody is "sir" or "ma'am." "This is like America used to be when we were kids," says John Calk, 30, vice president of business development for ITI marketing services, who moved to Omaha from Connecticut. "Go to church on Sunday, and it's a sold-out show. And I don't mean just in the little farm towns but out among those $300,000 houses in the suburbs where corporate types like me live."

The community mindedness of Nebraskans no doubt has something to do with a hard past, especially during the Dust Bowl years of the 1930s, which forced generations of farmers off their land or sent their children looking for opportunity elsewhere. Back then this was the home of the "penny auction," like the one in Elgin in 1932. Neighbors of Theresa Von Bonn, a struggling widow who was unable to make payments on her farm's $449 mortgage, came to

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ROFF SMITH, who recently wrote about cycling around Australia, says the easy nature of Nebraska reminded him of down under. This story gave Nebraska-born lensman JOEL SARTORE a rare chance to focus on home.

the foreclosure auction and forbade anyone to bid more than five cents for any item. The bank got $5.35 for its foreclosure, and the successful bidders returned the goods to Von Bonn.

Better times haven't erased this neighborliness yet. "We all worked like elves to get this place ready for the wedding," recalls Rosemary Maly, the waitress at the Wigwam Cafe in Wahoo, a farm town in eastern Nebraska. She was talking about the November afternoon in 1995 when Silvia Wade, a woman who'd left Romania after the fall of communism, married her Nebraskan-born fiancé in the café the couple had bought a month earlier.

"It was always my dream to have a place of my own," Silvia told me, as she prepared "Bob's breakfast"—a regular's standing order. "When the people from the local newspaper asked me what I was going to do here, I told them: I know farmers, and I'm going to feed them."

NEBRASKA FARMERS are fond of saying there is Omaha ("Oh-my-God!" some call it), and then there's the real Nebraska. The reality, though, is that three-fourths of Nebraskans live in towns, with half the townsfolk residing in Omaha's suburban sprawl. At sundown, as I drove toward the city, the farm reports and Bible-country music stations faded on the city's outskirts, and Van Halen's "Runnin' With the Devil" accompanied the evening "rush hour."

Traffic jams in Omaha are infrequent and tend to be showpieces of Midwestern agreeableness, with drivers letting each other in with a wave and a nod. By 5:45 p.m. the radio stations have called in their eye-in-the-sky helicopters: Most folks are already home. Average commuting time is 19 minutes, but people complain about it. "I don't know how they can with a straight face," said John Calk. "I live in a beautiful home not ten minutes from my office. Back East I used to have to commute 90 minutes each way."

As Dodge Street, the main artery, pulses with car lights, a different kind of traffic is beginning to move. Omaha is the nation's telemarketing capital, and every evening about 30,000 of its citizens—more than 4 percent of the population—are dialing up their fellow Americans, trying to sell them anything from frozen steaks to CDs to the idea that they should switch phone companies.

Tonight at DialAmerica, they're pushing magazine subscription renewals. "Come on, folks! Let's go! Let's go! Let's start revving it up!" Shanda, one of the shift supervisors, calls out, and her team of sales reps, mostly university students, retirees, and second-income

Demolition derby is always a smash at the Phelps County Fair. According to 1997 winner Sam Robinson, the sanctioned mayhem actually sharpens his driving skills. "I get on the interstate, and it's surprising how defensively I drive."

spouses, hunker down for an evening of cold calling. Computers dial numbers, randomly selected from a list supplied by the client company, and the room buzzes with scripted conversation: "Hello. May I please speak to Mr. (Mrs.) ____. Hi, Mr. (Mrs.) ____. This is ___ from DialAmerica. How are you tonight?"

Shanda walks among her reps, eavesdropping on a cordless phone to check that their approach is bright and full of confidence. She gives pep talks where needed, congratulates others on a good sale. It is high-pressure work. In a four-hour shift each rep will place more than a hundred calls and be expected to score sales at least 8 percent of the time. Shanda tracks their successes (or failures) hour by hour in red marker on the "paceboard." If you achieve "elite" status, your extra commissions could earn you up to $14 an hour—well above the guaranteed $8.30 an hour minimum. Lag behind too often, and you could be going home. "If you last four months, you're a long termer," says David Haller, sales manager for DialAmerica's five Omaha offices. Haller is an ultra long termer who started working the phones 12 years ago. "A lot leave and then come back after a break. There's always jobs."

Selling by phone may seem modest roots for a high-technology boom, but Omaha's central time zone, neutral accents, and a diligent, modestly priced workforce made it a good bet for toll-free call centers and telemarketing operations. "This was the only place in the country where you could get a WATS line installed in a day," Haller recalls. Omaha's advantage was the U.S. Strategic Command, which has its nuclear weapons command center buried in rolling farmland nine miles south of the city. The facility required huge amounts of telecommunications capacity to cope with the flood of intelligence coming into the base and to be absolutely certain of communicating instantly anywhere in the world.

With the growth of more sophisticated data processing in the 1980s, the city spread out from the hulking redbrick warehouses along the riverfront to gleaming, campus-like facilities in the western suburbs on what had been cornfields. One such operation, First Data Corporation—a five-billion-dollar-a-year data processor for credit and debit card companies—is Omaha's largest private employer, with more than 7,500 workers on the payroll.

"Over here is what we call the War Room," Garold Bell, director of network installation, said, leading me to a glass viewing wall so I could peer into a hushed, dimly lit nerve center where scores of computer terminals, some

Foot soldier in an army of telemarketers, Charlotte Jones (right) bolsters one of the biggest industries in Omaha. The city (left) serves as a communications nerve center for the U.S. military, which financed the construction of, among other things, a state-of-the-art telephone network. That, plus the locals' mild midwestern accents, helped Omaha lure scores of telemarketing companies, which now employ more than 4 percent of the city's population. "Believe it or not," says Jones, "I've received only three calls from telemarketers in my life."

banked three high, glowed with graphs, digits, and charts in exotic colors. Five large screens lined the rear wall with more information, and digital clocks showed the time in each zone from Maine to California. About 30 men and women, with ID tags prominently displayed, hunched over their keyboards, sipped coffee from cardboard cups, or leaned back in their ergonomic chairs murmuring to one another.

This was the data center, a windowless, high-security facility built to withstand 200-mile-an-hour winds and other natural disasters, where workers have their palm prints scanned by computer to get inside. For 180 million cardholders around the world spending authorizations blip through the computers in here. "During the Christmas shopping season," Bell said, "we can handle up to 800 transactions per second."

Finding the people to keep this going is a perpetual conundrum for Mark Eibes, the company's staffing director. "I've got 750 vacancies at all levels I need to fill," he said, asking me only half jokingly if I'd like to apply for one. The story is the same all over this town. More than 40,000 people have moved to Omaha in the past decade, but that pool of newcomers is nowhere near deep enough to meet demand. Employers have set up toll-free job lines and offered cash bonuses to workers who bring in a prospective employee, and the Chamber of Commerce has websites extolling the good life in Nebraska. "Discover how living in Omaha can bring you one of the best environments for raising families in the nation." The chamber even has a recruiting team that roams the country trying to induce workers to come to the heartland—a resonance of Nebraska's golden age of the 1880s when railroad promoters scoured Europe looking for migrants willing to stake a claim on the prairie.

"It can be hard to get top talent to come out here from the coasts," says Eibes. "Either they don't know where Nebraska is, or they think we've got buffalo wandering the streets at night. Once we get them out here for a look, they don't want to leave."

If Omaha plays to its well-scrubbed stereotype of good schools, first-rate hospitals, and affordable housing, it spices that image with the unexpected: the Henry Doorly Zoo, which has the world's largest indoor rain forest; or the Joslyn Art Museum, internationally known for its Maximilian-Bodmer collection; or the birthplace of Malcolm X over on Pinkney Street.

"I'd wanted to see the American Midwest,"

said Christine Kriegerowski, a photographer from Berlin on a three-month residency at the Bemis Center for Contemporary Arts, America's largest urban artist colony. "My friends in New York warned me to expect beehive hairdos and butterfly glasses, but it's not like that at all. The cafés in the Old Market feel very European." Indeed Omaha has had its bohemian side from the beginning, with actors and singers coming up on Missouri River steamboats to perform in the theaters and saloons.

The city has a tough side as well. The heartland location, which made Omaha a crossroads for generations of Americans, has made it a convenient staging post on the drug pipeline between New York and California. Los Angeles street gangs have set up local chapters in the tough neighborhoods of North and South Omaha, which, with their cracked sidewalks and tacky neon signs, resemble the poorest parts of any of the nation's metropolises.

During my stay the *Omaha World-Herald* carried a front-page special report about the emergence in South Omaha of new gangs with Salvadoran connections. But assessing the extent of gang activity is difficult in this image-conscious city. Statistics on gangs were a city hall secret until this year, and the officer who spoke to the newspaper got a severe dressing-down from police brass and the mayor's office.

"Yes, street gangs have set up shop here," said Father Damian Zuerlein, whose church, Our Lady of Guadalupe, is the social focus of the Hispanic community in South Omaha. "And yes, we have drive-by shootings, street crime, and drugs—no city is immune these days, not

Reflected glory: Five-time national football champions, the University of Nebraska Cornhuskers pack 75,000 rabid fans into Memorial Stadium on game day. The team has sold out every regular-season contest since 1962. Husker Fever, it's called, and it shows no sign of breaking.

even Omaha. But this has to be put into perspective. We've gone from denial—it couldn't happen here—to breathless headlines exaggerating the problem. We're a long way from being another South Central Los Angeles."

According to FBI statistics for cities with a population of more than 100,000, Omaha's crime rate in 1996 was less than the Los Angeles/Long Beach area's, but greater than New York City's.

WHILE THE NEBRASKA of the 1990s may be unfolding against a backdrop of inner-city brick or freshly built suburbs, 96 percent of the state's land is devoted to the traditional pursuits of ranching and farming. At Kevin Swanson's farm near Overton in the central part of the state, the corn harvest was gathering pace when I arrived in mid-October. An unseasonal blizzard had plastered the cornstalks with heavy, wet snow a week earlier, adding a sense of urgency.

"Every day the crops sit out here is another day of risk," Swanson, 38, explained, lowering the header on his combine to scoop up the storm-damaged stalks. "Another storm could spell ruin." We were sitting in the heated cabin of his John Deere (cost: $175,000), riding above a sea of cornstalks. All the traditional harvest images were here, props in Nebraska's longest running play—heavily laden farm trucks growling in low gear down the roads taking the crop to town, blackbirds pecking at grain spilled on the blacktop, pheasants rocketing up from the cornstalks in front of us. A closer look revealed a more modern Nebraska.

"We've already done more work since breakfast than my grandfather would have been able to do in his whole season," said Swanson, a fifth-generation Nebraskan whose family homesteaded some of the 3,000 acres he farms today. And it was only 10 a.m.

The Homestead Act of 1862, which offered settlers 160 free acres, was written with people like Swanson's ancestors in mind. More than 68,000 homesteaders staked claims in Nebraska, and tens of thousands of others bought cheap land from the railroads—Germans mainly, but thousands of Russians, Czechs, Lithuanians, Swedes, and Irish as well. Emancipated slaves settled here, and Mexicans came to work the sugar beet fields, the railroads, and the meatpacking houses.

By 1900 Nebraska's population had reached a million, nearly half of whom were born overseas, and more than 120,000 family farms dotted the state. But economics changed farming, and settlers who had overcome drought, grasshopper plagues, and bank failures found themselves forced either to sell up or to buy out their neighbors to expand their operations. The 55,000 farms in Nebraska today average

A light dusting is in the forecast for the stuffed residents of Cabela's, a 75,000-square-foot retail store and catalog showroom in Sidney. Selling

bass jigs, rifle scopes, hiking boots, propane cookstoves, bicycle racks, and anything else an outdoor enthusiast might dream about, the store also features this "tribute to sportsmen"—an elaborate Rocky Mountain fantasy that must quicken the pulses of Nebraskan flatlanders.

Iron abs and buns of steel don't carry much weight with the Chickendales, a group of local college wags who parade during the Chicken Show, a daylong fowl celebration in Wayne. "There's not much to do out here," says photographer Joel Sartore, a native Nebraskan. "And that fuels our, uh . . . creativity."

just over 850 acres, about double the size they were in 1945.

"Farming is a big business, just like any other—you have to grow bigger to survive," said Swanson. As we rolled through the windswept field, each pass of the combine gobbled up eight rows of corn, picking, husking, and threshing at the rate of 2,500 bushels an hour—a full season's work in the hand-threshing days of the 1930s. Swanson pointed out that this particular tract would have been considered too hilly to plant just 30 years ago. "I'd love to see the look on my grandfather's face if he could see the kinds of things we're doing now. Forget your image of a Nebraska farmer in straw hat and overalls."

Swanson explained that seven satellites, 12,000 miles above Nebraska, were communicating with a global positioning device mounted on the dashboard and an onboard computer that provides second-by-second analysis of crop yield. "When I get home, I download this information onto my computer, which spits out one of these." He passed me a sheet of paper, whose patterned magenta, cyan, and yellow splotches reminded me of a CT scan. "This map shows acre by acre what my yield has been on that particular field. I've got a soil scientist working with me, and we'll go over all this and try to find more efficient strategies for planting and seeding."

As he spoke, I noticed that we were at 99 degrees 33 minutes west longitude—right on the edge of what used to be called the Great American Desert, which 19th-century Army explorers and surveyors believed began at the 100th meridian. Rainfall hereabouts averages 17 inches a year—7 more than in a true desert—but the label stuck, frightening off bankers and farm insurers who wouldn't lend a dime for any agricultural purpose beyond this invisible line. Nobody reckoned on the Ogallala aquifer, an underground pool larger than Lake Huron beneath Nebraska and eight other states.* Nebraska's share of the aquifer is sufficient to flood the entire state to a depth of 34 feet or, more usefully, to irrigate eight million acres of crops, including all of Swanson's land.

"The summer of '97 was the driest in 60 years," Swanson said. "But instead of a dust bowl, Nebraska harvested one of the biggest corn crops on record—over a billion bushels."

That's enough corn to fill 300,000 freight cars, yet about three-fifths of the bounty never leaves the state. For all Nebraska's Cornhusker image, beef is king—a four-billion-dollar-a-year industry rivaling that of Texas. And cattle eat a lot of corn. Farmers and cattlemen need

*See "Ogallala Aquifer: Wellspring of the High Plains," by Erla Zwingle, NATIONAL GEOGRAPHIC, March 1993.

each other, but flavors of the old range rivalries remain, even if today it's simply a matter of calling a cowpuncher a cowboy, and not a farmer. "Don't call us farmers," a rancher's wife named Marianne Beel said to me after I made a slip in conversation. "Farmers raise crops. Ranchers raise cattle. There's a big difference."

Ranching has always drawn the free-spirited and restless. Back in the 1870s the Nebraska cow town of Ogallala was known as the Gomorrah of the Plains—a shantytown of saloons and brothels where cowboys up from Texas liked to shoot billiards with six-guns. A hundred thousand head of cattle passed through in 1876 alone. Nowadays more than 160,000 head move each year through Ogallala's sale yard, one of the biggest in the state, although a drive down the main street—past Cornhusker Lanes & Lounge, Moose Lodge #1624, and the Optimist Youth Park—speaks more to Midwestern geniality than to Boot Hill.

I went to the cattle auction with Merle Knode, an independent buyer looking for bargain-priced beef. The first few animals didn't excite him. But when cattle from the Sand Hills were trotted into the ring, Knode began bidding in earnest. He bought 42 head before lunch. "They raise some of the finest cattle in the world up in the Sand Hills," he said with conviction. "You want to see the best of Nebraska cattle, you go up there."

Heading north on Highway 61 into that dusty immensity of earth and sky, an Easterner can feel the pull of the range as the horizon drops away. To some, like Atlanta media mogul Ted Turner, the lure is irresistible: He bought

Developing superior strains of corn requires a sophisticated understanding of plant genetics, vast amounts of land and water, and plenty of young kids hungry to make a buck (opposite). Their field assignment: to detassel corn—removing pollen-bearing tassels from plants to prevent them from self-pollinating, thereby giving strategically positioned male plants nearby a chance to do their job. To reach the top of the plant, field hands get a mechanical lift (right). The goal is to create improved hybrid seeds that will produce vigorous corn resistant to wind, drought, and disease.

52,000 acres out here and has established a buffalo herd. I was heading toward Purdum and the ranch of an old Nebraska family, where Leon and Judy Morris were branding 61 fall calves. The scene was pure Charles Russell: Blowing snow and wind-scoured starkness, cowboys on horseback, the bawl of calves and the smell of burned hide as the quarter-circle-triangle made its mark.

The Morrises own about 215 head of cattle—barely enough for a family of four to scrape by. The branding took all morning, then we rode back to the house to a hearty lunch of Swedish meatballs, casseroles, and salads. Leon showed me an old photograph of his grandfather standing beside a sod hut—Nebraska marble, it was called in those days. "They came from Iowa in a covered wagon sometime around 1891 and homesteaded 160 acres just west of Thedford," Leon said.

Leon talked of the blizzards that howl through the winter, the baking summer afternoons, and the winds that blow for days on end. During the spring branding, neighbors make the rounds of each other's ranches to help out. They finish the day with a barbecue, cold beer, and games of horseshoes. "Lots of prairie oysters," he said, referring to testicles cut that day from the young calves. "Lightly fried—it doesn't get any better than that.

"Ranching is a lifestyle, not a job," he continued. "At best we'll get only a 3 percent return—and face it, you could do better than that selling up and getting interest on the money. The past few years we've lost money. Beef prices are low, people are eating less meat, and we've got big city millionaires coming here, buying hobby ranches and driving up taxes and land values. But things go in cycles. This year we'll make a little money. For all ranching's hardships, I wouldn't do anything else."

Sitting across the table, Mark Carr, who owns a neighboring ranch, agreed about the way of life. But he admitted that as a parent he's relieved his youngest son has found a job with the Union Pacific Railroad down in North Platte. "He's earning $40,000 a year, with full medical and dental, and his wife is a brakeman on the railroad. She's also earning $40,000 a year. Nobody's ever going to give them anything like that out here." About 12,000 Nebraskans work the railroads—one of the state's biggest employers—although that's less than half as many as during the glory days of steam in the 1920s.

Trevor Cox, another neighbor come to help with the branding, is 13 years old but already knows his mind. When Carr joshed him about

maybe living in the city one day, he shook his head and laughed. He'd sized up Lincoln when he'd entered the state wrestling championship (he won his weight class). "There's no way I'd ever live in the city. I don't even like going into Broken Bow," he said, referring to a town of 3,698 some 50 miles away. "It's too cramped. Out here in the Sand Hills is where I belong."

If young Cox does stay on the land, he will be defying a long-term trend in rural Nebraska. Since the Dust Bowl years all but 19 of the state's 93 counties have lost population, mostly the young. The exodus has left redbrick main streets, once symbols of heartland American pride, boarded up and dying.

"I just want to sell up and get out," sighed Nicola Fraass, 73, who waits for customers behind the marble-topped soda fountain in Fraass' Sundries, her musty old cigar and candy store in Lodgepole, population 368. "But the only people that seem interested are antique dealers. They want to buy my cash register or these old-fashioned shelves or that Hamilton Beach malt machine. I tell them, 'No.' I want to wait and sell this place in one piece."

Some small towns, such as Broken Bow and McCook, have attracted telemarketing operations that haven't found enough workers in the overheated job markets in Lincoln and Omaha. Other rural towns, such as Sidney in the panhandle, have made their own luck. What Dick Cabela, a fisherman born and bred near here, and his wife, Mary, started in 1961 as a kitchen-table business selling fishing flies has grown into an outfitting empire in a new five-million-dollar complex on the edge of town. Cabela's catalog, shipped to 55 million customers in 115 countries, offers outdoorsmen 60,000 different items. Poke your nose into the Country Kettle café around lunchtime, and you'll see what a business like this can mean to a town of 6,000: Of the café's 21 patrons, 9 were wearing green Cabela's uniforms.

"Economists back East have been saying for years that small town U.S.A. is an endangered species," scoffed Jack Lowe, 90, who joined the *Sidney Telegraph* as a cub reporter in 1927 and has served as both its editor and publisher. Now in semiretirement, he's the paper's columnist. "Well, towns like Sidney have been proving them wrong time and again."

Sidney has had near-death experiences, however, most recently in 1967 when the Army closed a supply depot that had been the main employer. If Cabela's hadn't caught on, Sidney itself might have faded out, like scores of other farm towns across the plains.

A bird in the hand will soon become a tasty casserole, says John Ellsworth, who bagged this ring-necked pheasant during an annual shoot near

Broken Bow that attracts hundreds of participants. Hunting has always been big in Nebraska. "In pioneer days my great-grandparents hunted to provide extra food and to protect their livestock," says Ellsworth. "Me, I enjoy it for the outdoors, the exercise, and the challenge."

Whips of lightning crack the sky near Walton in this time exposure. The lean years of the 1980s drove many Nebraskans off their once prospering farms. Now rural areas are resurgent, thanks in part to personal computers and other high-tech gear that help people live where they like—and many like rural Nebraska.

We were sitting in the *Telegraph*'s editorial office in back of a brick building on Illinois Street, where Lowe and Ralph Olsen, the paper's present publisher, were plotting strategy. A few weeks earlier the *Sidney Daily Sun* had gone into production—the first new daily in Nebraska in 50 years and one of only five to open anywhere in the United States last year. The launch sparked an old-fashioned newspaper war among the *Telegraph*, the *Sun*, and a new weekly, *The Panhandle Town & Country*, for the hearts, minds, and advertising dollars of Cheyenne County's 9,000 readers. Tactics included advertising discounts and $100 rewards for hot tips. Lowe was loving the fight, boasting, however inaccurately, "Not even New York is a three-newspaper town anymore."

IT'S A LONG MENTAL HIKE from Manhattan to Sidney, but nevertheless a Big Apple-style restlessness descends over the Nebraska Panhandle on fall weekends. Driving east, I could feel it on the highway, as sedans and pickups with University of Nebraska bumper stickers sped past. We were all heading for the same place, Lincoln, whose capitol building—a monument to art deco—becomes visible 25 miles out. Designed by Bertram Goodhue in 1920 and built of pale brown Indiana limestone, its tower is capped by a dome and a 19,000-pound bronze of a man sowing grain. Looking up at it, I had the notion I was going into the Emerald City to see the Wizard. As a matter of fact I was, or at least the closest thing to it in Nebraska. I was going to "the Game."

Two hours before kickoff, and already there was a whiff of Christians versus the lions in Memorial Stadium. Whistles blew, horns sounded, and the Rolling Stones' "Start Me Up" blared on the public address system. Nebraskans in red Huskers sweatshirts, caps, and sweatpants shuffled through the gates, clutching tickets so valuable that divorcing couples have been known to fight over them in court. When I asked a policewoman if the crowd ever got violent, she laughed. "No. About the biggest headache we get is parents losing children, and when we ask what they were wearing, it's always the same—he was wearing red!"

Oklahoma trotted into this cauldron dressed in white. Their offensive line averaged 299 pounds a man, but—poor fellas—you had to feel sorry for them: It was like looking at heifers waiting to be slaughtered in the South Omaha stockyards.

Oklahoma's first drive ended in a crunching tackle, which shook the ball loose. Forty-seven seconds later Nebraska was on the board. Drums throbbed, the crowd screamed, and scores of red balloons rose from the stands. Late in the third quarter, with the score 55 to 0, Tom Osborne, then Nebraska's head coach,

judged the game safe enough to blood his second- and third-string players. This slowed the rout a little. Oklahoma actually scored once, stunning the crowd to a glowering silence. It was the first time in three weeks anyone had scored against Nebraska. "Well, there goes the shutout," a man beside me muttered angrily, hands on hips. From the look on his face you'd have thought the game was lost. Nebraska put two quick touchdowns on the board, to make up for this loss of face, then ran out the clock for a 69 to 7 win.

Although it was a typical score for the Cornhuskers, this game was special. It was Tom Osborne's 250th win in his 25 years as Nebraska's coach, making him, as we'd been reminded all afternoon, the "winningest active coach in college football history." As Oklahoma limped from the field, the band played martial music, 75,926 fanatics thundered in unison: "Go-Big-Red! Go-Big-Red! Go-Big-Red!" and the rainy skies over Lincoln exploded with fireworks.

Back in 1918 Willa Cather wrote about growing up in Nebraska, about "blustery winters with little snow, when the whole country is stripped bare and gray as sheet-iron. We agreed that no one who had not grown up in a little prairie town could know anything about it. It was a kind of freemasonry."

These days Nebraskan brotherhood draws strength from the college football team, which connects the people of this grassland, defines them as Nebraskans in a way that their state's straight, seemingly arbitrary, boundaries cannot. It makes them world beaters, in that genial way that can slip by unnoticed. □

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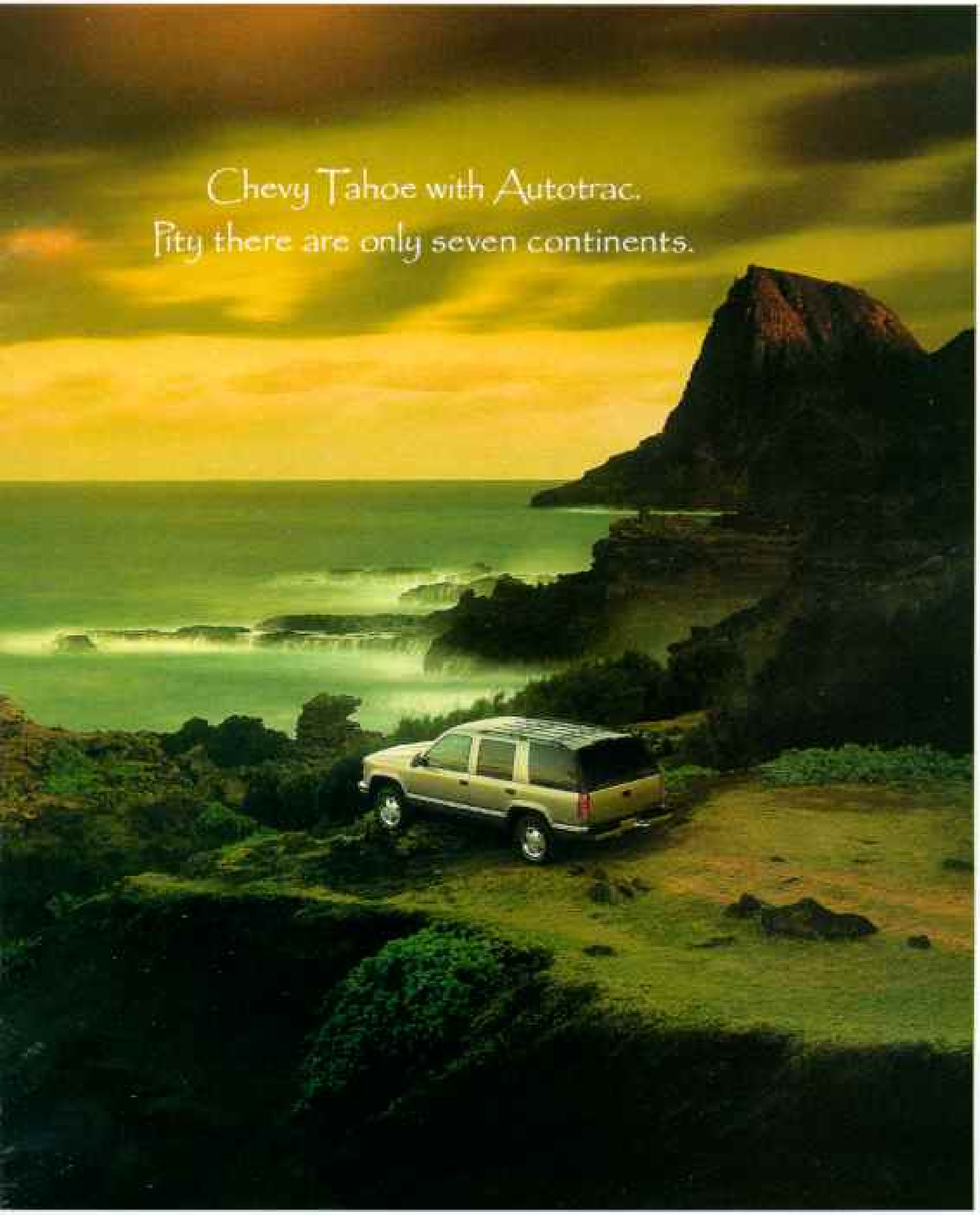

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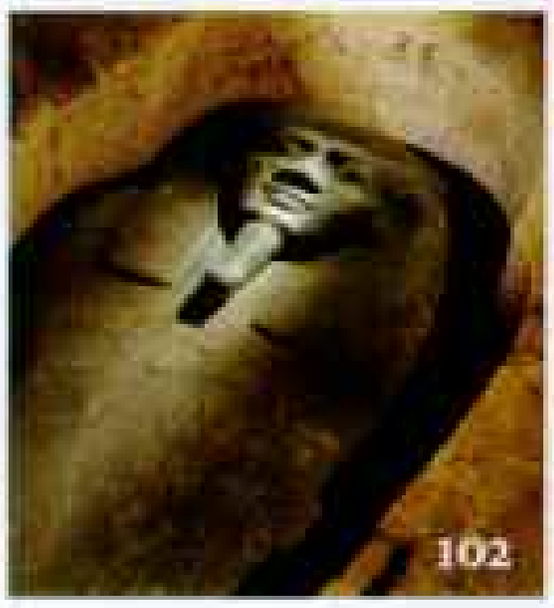

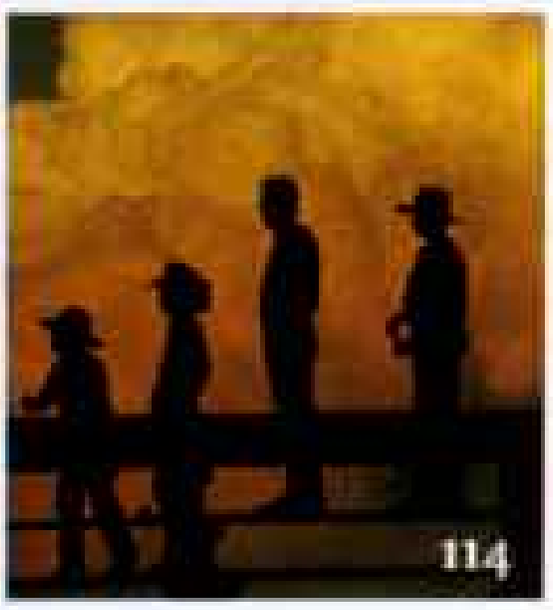

The Cover

Expert surfer Laird Hamilton plunges down the face of a colossal wave along the north coast of Maui. Photograph by Patrick McFeeley

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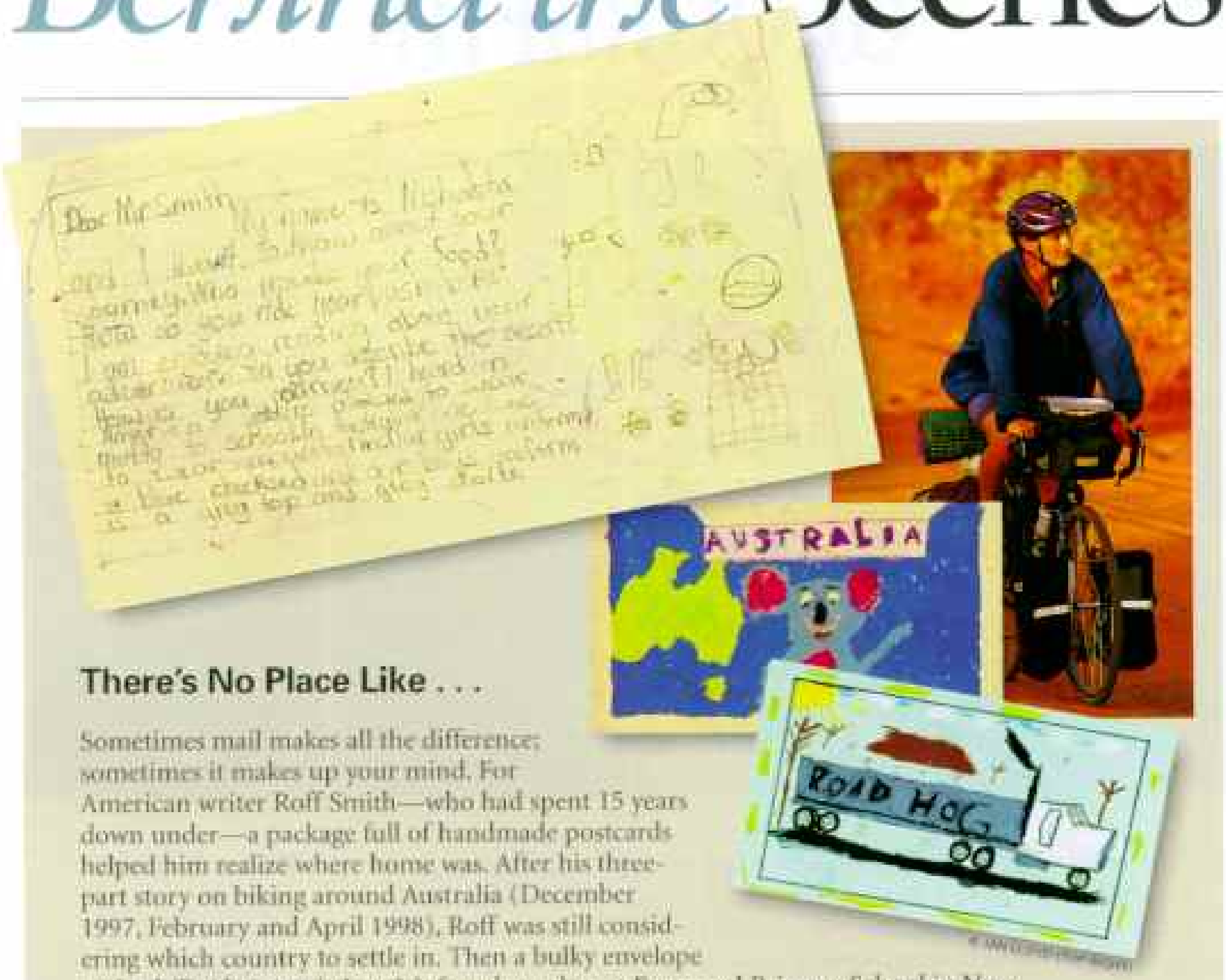
NATIONAL GEOGRAPHIC

Behind the Scenes



There's No Place Like . . .

Sometimes mail makes all the difference; sometimes it makes up your mind. For American writer Roff Smith—who had spent 15 years down under—a package full of handmade postcards helped him realize where home was. After his three-part story on biking around Australia (December 1997, February and April 1998), Roff was still considering which country to settle in. Then a bulky envelope arrived. Teacher Annie Laurie's fourth graders at Eastwood Primary School in New South Wales had been inspired to create these postcards scrawled with messages of appreciation. "They firmed my resolve to start contacting real estate agents in South Australia," says Roff. The cards "made me realize again how much the place had become home. It was there all the time."

Cartographers Give Bend a Break

This year a group of Bend, Oregon, sixth graders changed the world—on paper. When student teacher Dan Taylor of High Desert Middle School noticed that Redmond, Oregon, rather than the larger town of Bend, was listed on our political map of the world as the only city in the state's central region, his students mounted a campaign to put their hometown on the map instead. Their research, detailing everything from the size of Bend's police force to the number of telephone prefixes, was enough to convince our cartographers, who were making revisions when the students contacted them. Now our new world map—distributed free this fall by the Society and its Education Foundation to every school in the United States—will have a Bend in the middle of Oregon.

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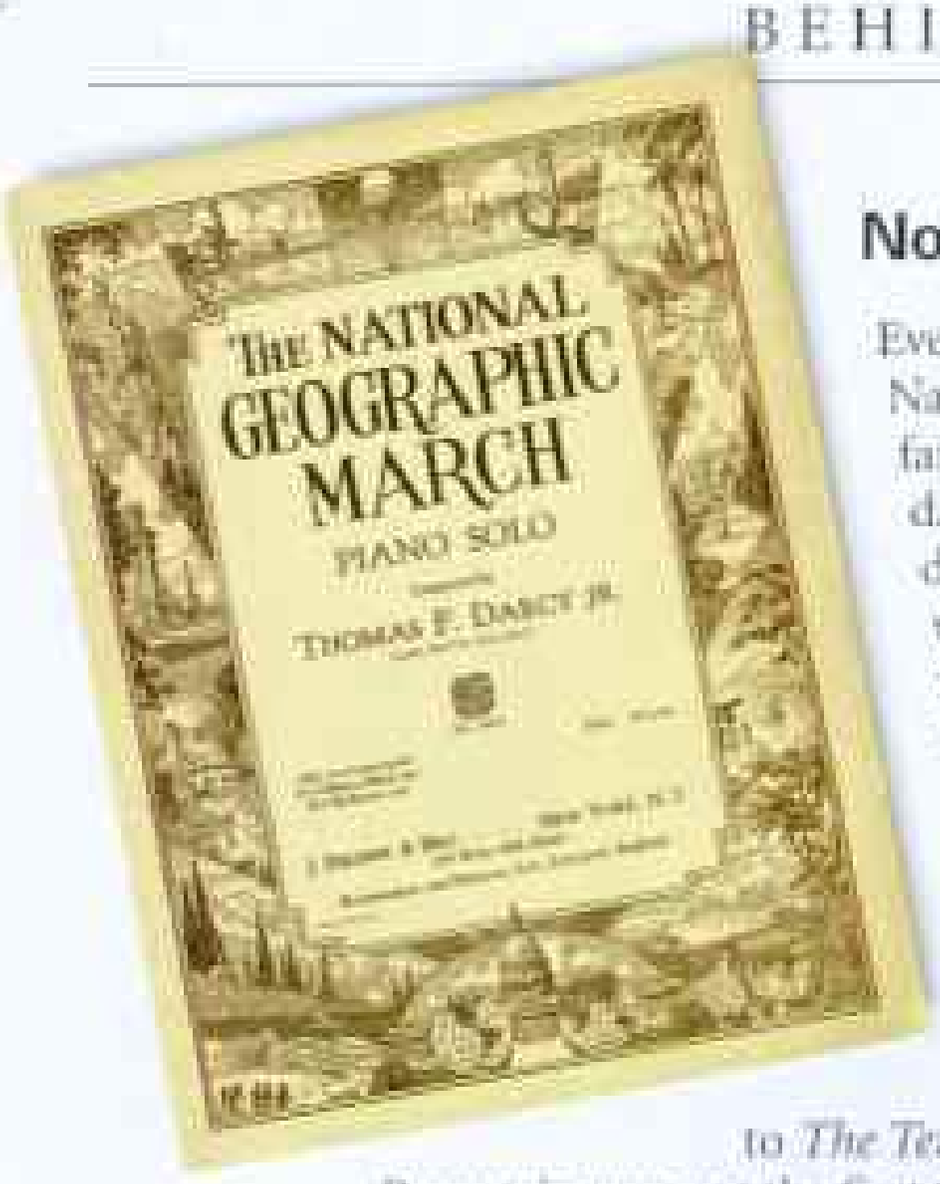

Note Our Music

Everybody knows the National Geographic fanfare: Da da-da daaah da, da da-da da da da da da da da—boom-boom. It was written for our series of television specials in 1965 by Academy Award–winning composer Elmer Bernstein, whose other works include scores for films ranging from *National Lampoon's Animal House* to *The Ten Commandments*. But Bernstein was not the first to put the Society to music. In 1935 U.S. Army Band leader Thomas F. Darcy, Jr., wrote "The National Geographic March" in honor of the stratosphere balloon *Explorer II*. The march debuted before nearly 5,700 people at an awards presentation for the balloon's crew, and the sheet music (above) became available soon afterward. According to our archives, Darcy said that the march would be featured regularly by the U.S. Army Band and that he would also try to have it played often by the U.S. Marine Band, the U.S. Navy Band, and other service bands. Somehow, the march never caught on. But during its brief revival, playing continually in our Explorers Hall during the Society's 1988 centennial year, many staffers learned it by heart—whether they wanted to or not.

R. VAN LLOYD

In Malaysia, We're What's in Store

Shopkeeper P. Kalaichelvan always knows what's on his shelves. His little store in Kuala Lumpur, SM Sunrise, sells only one thing: old NATIONAL GEOGRAPHIC magazines. He carries other titles in another shop, but customer demand for the GEOGRAPHIC persuaded him to specialize. In 1997 he visited the United States and returned with more than 50,000 back issues. Now he gets gold from the yellow. His highest priced items, magazines from the 1930s, go for as much as 150 Malaysian ringgit—about $36 U.S.

AL GIDDINGS

New Support for Sustainable Seas

Sustainable Seas Expeditions, a five-year program to promote deepwater exploration and awareness of the 12 U.S. national marine sanctuaries, has been given five million dollars by the Richard and Rhoda Goldman Fund. Headed by our explorer-in-residence, marine biologist Sylvia Earle (above), the program will also receive $775,000 from the Society and substantial support from the National Oceanic and Atmospheric Administration and the U.S. Navy. "The Society helped establish the idea of a National Park Service more than 80 years ago," says Dr. Earle. "Now we have the chance to make the same kind of impact offshore."

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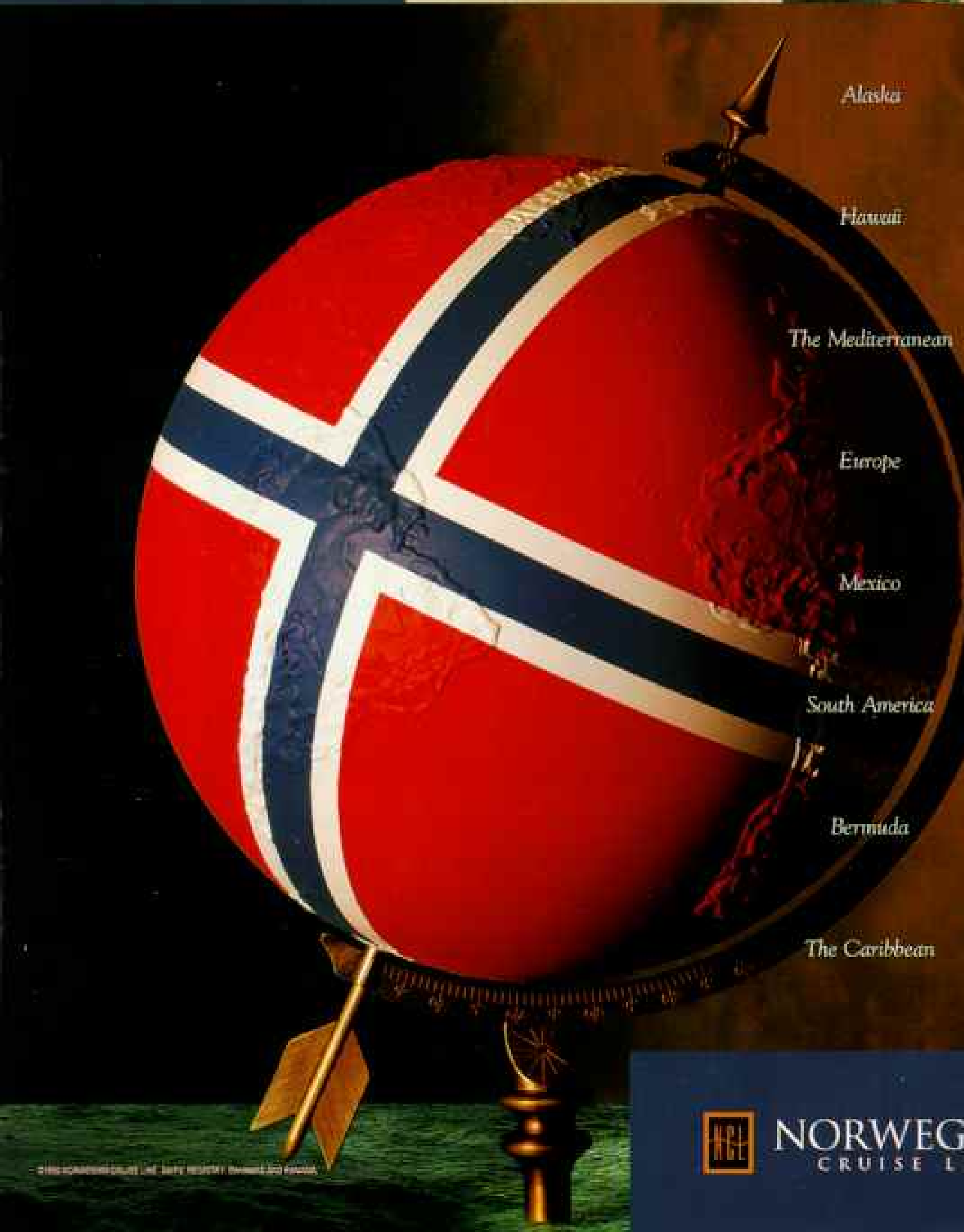
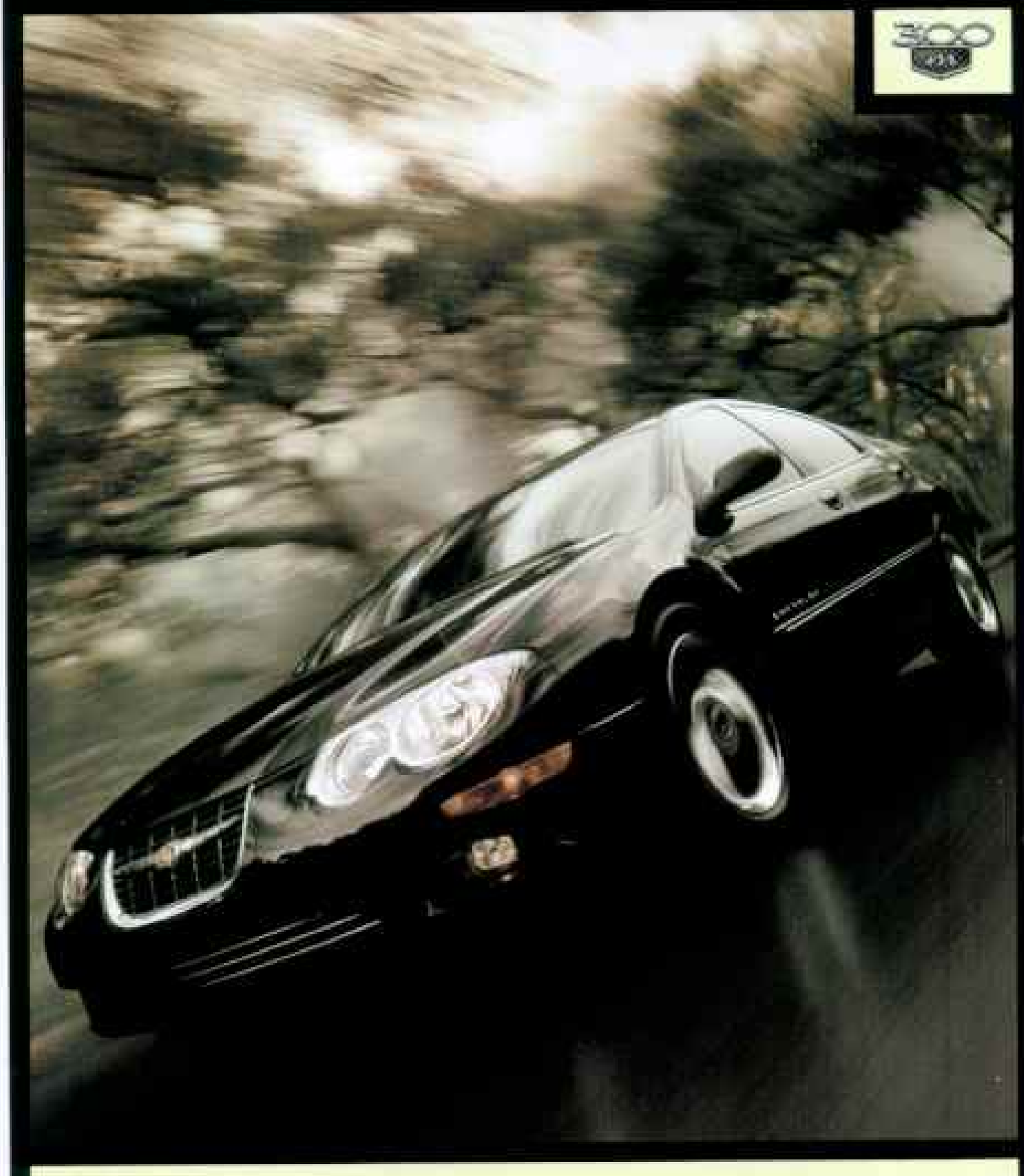


NORWEGIAN CRUISE LINE

A chip off the old high-output hemi engine block.



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Footnotes to History

These boots were made for . . . exploring. Over the years the Society has assembled quite a shoe closet. "We support expeditions, so sometimes we keep the equipment people come back with," explains Explorers Hall administrative manager Nancy Beers, who oversees the collection. One of the oldest pairs is a souvenir from writer-photographer Joseph Rock's 1924 journey to the mountains of western China. The leather boots (top left), cuffed in colorful woven wool, are thought to have come from the Kingdom of Muli. A fur-lined hide boot (top center) reached the stratosphere during the *Explorer I* and *II* balloon flights of 1934 and 1935. The thick-toed white space-suit shoe (bottom center) was engineered to go even higher, though it was used only in an exhibit, not on the moon. The best shod staffer represented in the collection was the late Barry C. Bishop, whose footwear from the first American ascent of Mount Everest, in 1963, includes the warm, reindeer-hide La Dolomite (above), a sturdy red-laced hiker (center), and a knee-high yellow overboot with crampon (bottom left)—the only one to make it to the summit.

Not all our shoes are museum pieces. A heat-resistant foil boot (top right) is available to any staff member with a really hot assignment; it's meant for tromping over lava.

Shackleton's Last Shots

Seeking financial backing for his 1914-16 Antarctic expedition, Ernest Shackleton did what explorers before him had done—he hired a skilled photographer. In Australian Frank Hurley he got his money's worth. Hurley not only documented Shackleton's polar attempt with still and moving pictures, he also proved resourceful in the face of disaster. Hurley fashioned a blubber-burning stove from an ash bucket and made crampons "from sundry bits of iron & screws," as he noted in his diary.

Before ice finally crushed and swallowed the stranded *Endurance*, the photographer (above) hacked through the splintered timbers of the abandoned ship to find his film and negatives. Diving into several feet of slushy ice, he retrieved some 500 glass plates but, to save weight during the crew's escape, kept only 120 of the best. "I had to preserve them almost with my life," Hurley wrote; "for a time came when we had to choose between heaving them overboard or throwing away our surplus food—and the food went over!" The photographs live on; see the article on pages 82-101 in this issue.

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Forum

Many readers of the July issue were prompted by the natural hazards article to write of their own experiences. A member from Canada praised the story for capturing "two of the essentials of survival—hope and the resiliency of the human spirit."

Dinosaurs Take Wing

Scores of wild turkeys live on our farm. They prefer to run rather than fly, using a powerful striding gait. Flight, when resorted to, is short distance, ungainly, and awkward. They even have a predatory gleam in their eyes! I've always regarded them as feathered dinosaurs.

LOUISE SAVAGE
Gisborne, New Zealand

The article asserts that *Confuciusornis sanctus* was capable of sustained flight, based on an analysis of its wing structure. But also important to bird flight is the tail, which is necessary to control that flight. Nowhere in the photo of the *Confuciusornis* fossils (page 93) is there any indication of the large tail feathers modern birds use as stabilizers.

JIM WELLER
Waco, Texas

I thoroughly enjoyed your article but found the interpretation of fossil evidence to be very one-sided. It only looks at the development of flight as coming from land-based animals that under evolutionary pressure developed wings. How do you know that *Caudipteryx* wasn't in the process of *losing* its ability to fly?

MATTE FOLAN
Newport, Kentucky

Living With Natural Hazards

When I was 17, my family was one of many on the Texas coast that suffered devastating losses when Hurricane Alicia struck one August night. It's the human heart and its capacity for hope that enable disaster victims to survive. People rebuild their physical lives relatively quickly; it's the emotional rebuilding that takes much longer. For me it's been 15 years, but I will remember that night forever. The experience was agony, but it taught me that I am stronger than I ever believed. Thank you for reminding me.

TESSLYN MUSTAIN
Humble, Texas

Despite what your author says, there are some people who try to avoid disaster-prone areas. As a relocation consultant, I have clients (especially in

the Los Angeles area) who have insisted on locations without major earthquake faults. And lots of Northeasterners want to get away from ice storms and snowdrifts. I once read that Hobbs, New Mexico, has fewer threats to well-being than any other place in the U.S. It is also rather flat, remote, and boring; I certainly never sent anyone there.

WILLIAM L. SEAVEY
Oxnard, California

I get tired of Easterners saying, "How can you live in California, with all those earthquakes?" while they blithely ignore the floods, hail, blizzards, tornadoes, and hurricanes that kill people all around them. Last summer I visited Wisconsin and was caught driving during a tornado warning, and a week later a blinding hailstorm. It made me homesick for a good Richter 5.0 earthquake, thank you!

SHARI PRANGE
Bonny Doon, California

On page 17 it says that the Galveston hurricane of 1900 "took 8,000 lives." In his 1998 Weather Almanac, Neil Frank, former director of the National Hurricane Center in Miami, states that "at least 6,000 were killed" in that storm. Numerous historic sites in Galveston also use the 6,000 figure. What did you base your number on?

FRANK PARENT
Houston, Texas

Some 6,000 people died in the city of Galveston, as Mr. Frank reports. Our figure includes an additional 1,000 casualties elsewhere on Galveston Island and another 1,000 on the Texas mainland.

Natural Hazards Map

I was surprised not to find the path of the hurricane of 1938 shown. For years my wife and I have listened to our parents and grandparents tell stories of New England's Big One, which wreaked havoc throughout most of the region and devastated cities such as Providence. I can remember as a boy looking with awe at the notch, which was well over my head, that my great-grandfather had carved on a doorframe in the family summer home on Fire Island. It indicated the high-water mark in one of only a few houses to survive. Was the omission an error, or have the memories of my elders been embellished as they've grown older?

TOM STRATTON
Goffstown, New Hampshire

The 1938 storm needs no embellishing. Though it did not meet our criteria for inclusion, it was the 46th deadliest hurricane recorded in the North Atlantic.

In your reference to California wildfires you mention the city of Laguna Beach as being in Los Angeles County. Unless the Newport-Inglewood Fault has been playing jokes on us again, Laguna Beach is safely ensconced in Orange County, where it has resided for a very long time.

RICHARD TYLER
Redmond, Washington

Civilized Denmark

Garrison Keillor's article gave me more information on Denmark and the Danes than I had learned in several trips there. I guess that is what good writing is all about. The land of the "silk safety net" sounds marvelous until I consider a 52 percent income tax and a 25 percent sales tax.

KERMIT M. BIRD
Christiansburg, Virginia

When the author says Danes are very much like Germans and Swedes (page 64), I think he hasn't spent enough time south of the border and in other Scandinavian countries. It's true though that few Danes say that "Denmark is a great country," because they are too spoiled and, therefore, lack a sense of appreciation.

MARTIN N. JOHANSEN
Harsholm, Denmark

As a descendant of Danes and as one who lived in Denmark from 1940 through 1945, I appreciated all the fine details and nuances of the article. However, the island of Ærø, which the author had difficulty pronouncing (page 67), is not really all that hard to say. The acid test for proper pronunciation is the tongue twister *"Rødgrød med Fløde"* (red fruit gelatin with cream).

Permit me to add that the small fishing village of Gilleleje (page 58) was the only place in Denmark where fleeing Jews were caught by the Germans and sent to concentration camps. Approximately 80 people had sought refuge in the village church. While they were waiting to be transported to Sweden, a Danish woman collaborator betrayed them. She was severely punished after the war. A plaque and two monuments recall this tragedy.

IB NATHAN RAMBERGER
Bronx, New York

Your article notes that Denmark has no nuclear power plants (page 64), although considerable nuclear energy is imported from its highly nuclear neighbor, Sweden. It is further stated that the Danes prefer wind energy. In 1996 Denmark generated 49.4 billion kilowatt-hours from coal, oil, and gas, and 1.2 billion from geothermal and other, which presumably includes wind. If the latter category were all wind, it would constitute about 2 percent of Danish electricity.

HERBERT INHABER
Las Vegas, Nevada

The Untamed Yukon River

Fisherman Stan Zuray, described in the caption on page 121, pretty much sums up the salmon problem. Killing 700 salmon in one day and feeding 90 percent of them to your dogs is obscene.

SALLY HINGLEY
Carmen, Oregon

The photograph on page 112 shows hydraulic mining in the Yukon Territory. After the tremendous devastation to California streams caused by such operations, why is this still allowed in Canada? Haven't we learned anything from this experience?

ROBERT V. CARLSON
Volcano, Hawaii

I am one of those dreamers who suspects that my soul's home is in Alaska. It's only by the error of some cosmic shipping clerk that I ended up here in Michigan (though Michigan is beautiful in its own right). However, I'm realistic enough to understand that I'm not cut from cloth tough enough to eke a living out of the Yukon River. Mr. Parfit's article gave me a delicious taste of life there. I'm in the middle of reading his story for the third time.

B. IONE SKAGGS
Canton, Michigan

New Inca Mummies

Am I the only one who chuckled at the title? If "new" Inca mummies are 500 years old, how old are old ones?

JOSEPH "JEFF" FISHER
Chicago, Illinois

The laboratory where I am a consultant obtained a hair sample of an alleged 1,200-year-old Peruvian mummy. Our analysis revealed levels of lead, cadmium, and aluminum 5 to 13 times higher than would be acceptable in the typical patient of today.

Since we were reasonably sure that he did not eat junk food, work as a mechanic, or live by a polluting factory, consensus was that he received the contaminants from improperly glazed clay pottery. Whether the toxic metals hastened his demise is not known, but in today's society an individual with those levels of pollutants would be very sick.

WILLIAM B. RISLEY
Scottsdale, Arizona

Geographica

There is more to the story of the Bicknell's thrush netted in the Dominican Republic that had been banded in Vermont six months earlier. The next spring this same thrush was again found on Mount Mansfield back here in Vermont! We birders believe this to be a wonderful, goose-pimple-raising event.

CECILIA M. OAKMAN
Rutland, Vermont

Letters for Forum should be sent to National Geographic Magazine, Box 98198, Washington, D.C. 20090-8198, or by fax to 202-828-5460, or via the Internet to ngsforum@nationalgeographic.com. Include name, address, and daytime telephone. Letters may be edited for clarity and space.

Orange-bellied Parrot (*Neophema chrysogaster*) **Size:** Length, 21 cm **Weight:** Approx. 48–51 g **Habitat:** Coastal plains and sedgelands in western Tasmania and southern Australia **Surviving number:** Estimated at 200
Photographed by Dave Watts

WILDLIFE AS CANON SEES IT

Afternoon sun highlights an orange-bellied parrot perched near a buttongrass plain, its favorite feeding area during the summer nesting season in Tasmania. Paired for life, orange-bellied parrots nest in the hollow of a tall eucalyptus. The male feeds his mate during the three weeks she's sitting on the eggs. Around April, small flocks begin a nocturnal migration across to the mainland. Loss of winter habitat and the bird trade have caused a decline of these colorful little birds. Today, they are still threatened by further loss of their favored feeding habitats on Australia's southern coast. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

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My Photo

This is my bird's-eye view of Omar — "King of the Petting Zoo" as he was eyeing my son Toby for lunch.

This is the five-point passive autofocus system that measured how tall Omar was, chose the optimum setting, and captured every feather in perfect detail.

This is the easy-to-read dial that let me quickly pick the daylight-sync shooting mode so not a single shadow crossed Omar's kissable mug.

This is the power zoom lens that went from 38mm to 160mm in the blink of an ostrich's eye. It let me get to Omar's level without having to get in Omar's path.

This is the fail-safe loading technology that let me slip in a new roll of film while Toby was circling my legs and Omar was circling Toby.

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Untying the Sunspot-Aurora Knot

For more than a century scientists believed that auroras—those spectacular curtains of colored light that appear in the sky—occurred more often during the peak of the 11-year solar cycle: the more sunspots, the more auroras. Wrong!

Earlier scientists based their idea on the handful of auroras seen where they lived, in the middle latitudes. But worldwide data collected over a 12-year period by U.S. Air Force meteorological satellites reveal that the frequency of auroras in darkness does not vary across the solar cycle. And sunlit auroras are actually *rarer* at the solar peak, says physicist Patrick Newell of the Johns Hopkins University Applied Physics Laboratory, who led the study.

Auroras are most often visible about 1,200 miles from either magnetic pole. "If you live near Baltimore, Maryland, they're rare," Newell says. "But you can see one almost every night if you live in Fairbanks, Alaska, and your odds of seeing a good aurora there are the same no matter where you are in the solar cycle."

However, energy released at solar maximum can cause huge magnetic storms that, in the upper atmosphere, produce auroras visible at lower-than-usual latitudes. "Really big auroras that can be seen in populated areas are more likely when sunspot activity is at its peak," Newell says. "But that's an insignificant part of the total number."

CARY ANDERSON, AURORA & OCEANIA PRODUCTIONS

RUDOLPH DIESEL

A Speedy Shift From Sea to Land

Unlike most crabs, this Jamaican variety, nearly an inch across, spends all its time on land. It lives in pools of water that collect in the leaves of plants that colonize trees. A genetic study of the bromeliad crab and eight other Jamaican species that live at least some of the time on land—including one that breeds in snail shells—found that they all evolved from a single ancestor, probably a marine species. In the past four million years, the blink of an evolutionary eye, the nine diversified to fill a range of ecological niches. "That's amazingly fast," says Penn State biologist Blair Hedges. "With differences so extreme, it usually takes up to 50 million years."

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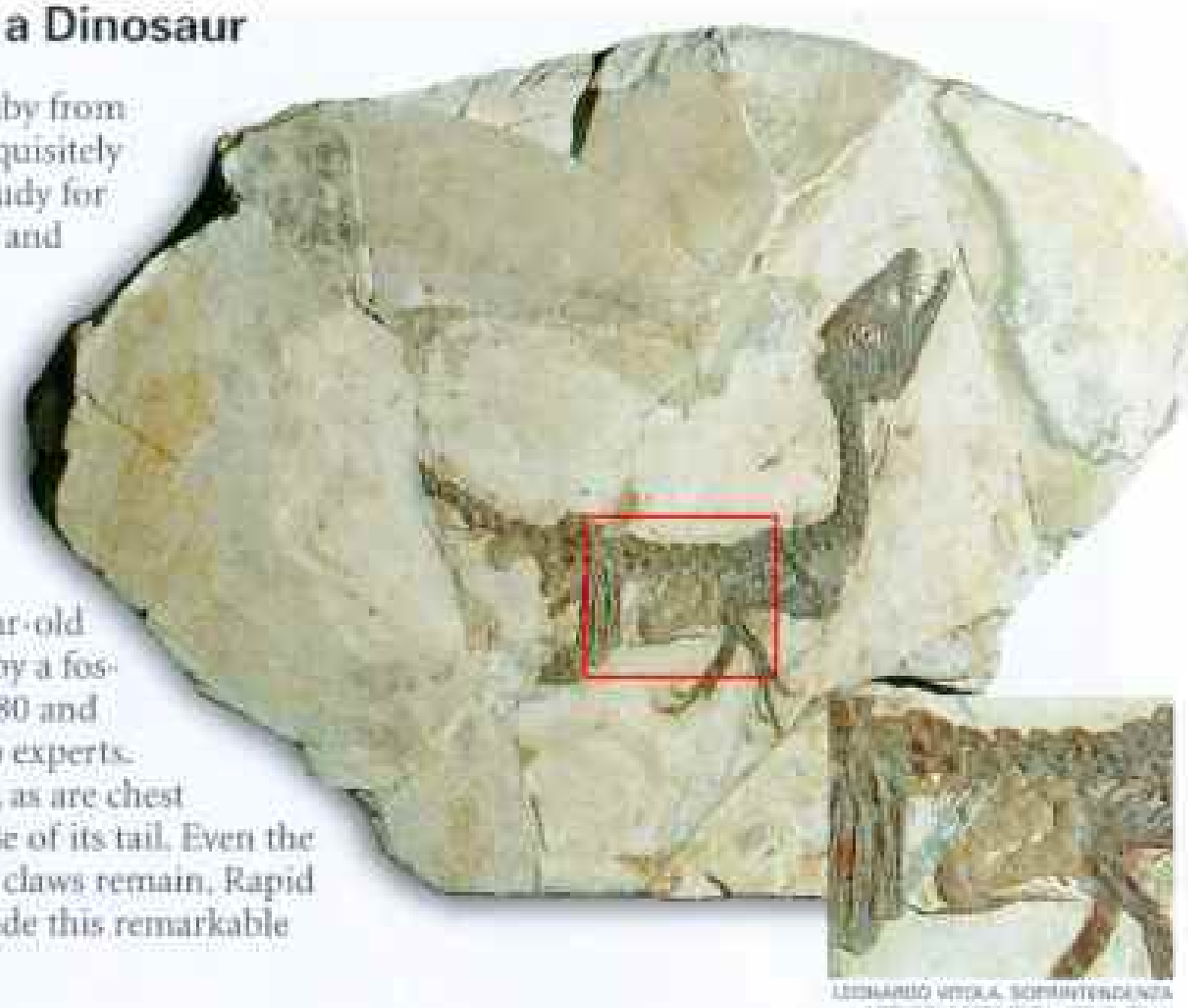
Probing the Inside of a Dinosaur

Meet Italy's first dinosaur: a baby from a new genus and species, so exquisitely preserved that scientists can study for the first time a dinosaur's liver and intestines (inset).

Over nine inches long, the dinosaur—given the name *Scipionyx samniticus*—probably preyed on small lizards, says Cristiano Dal Sasso of Milan's natural history museum. Dal Sasso teased the remains of the 110-million-year-old hatchling out of a rock found by a fossil collector near Salerno in 1980 and only recently made available to experts.

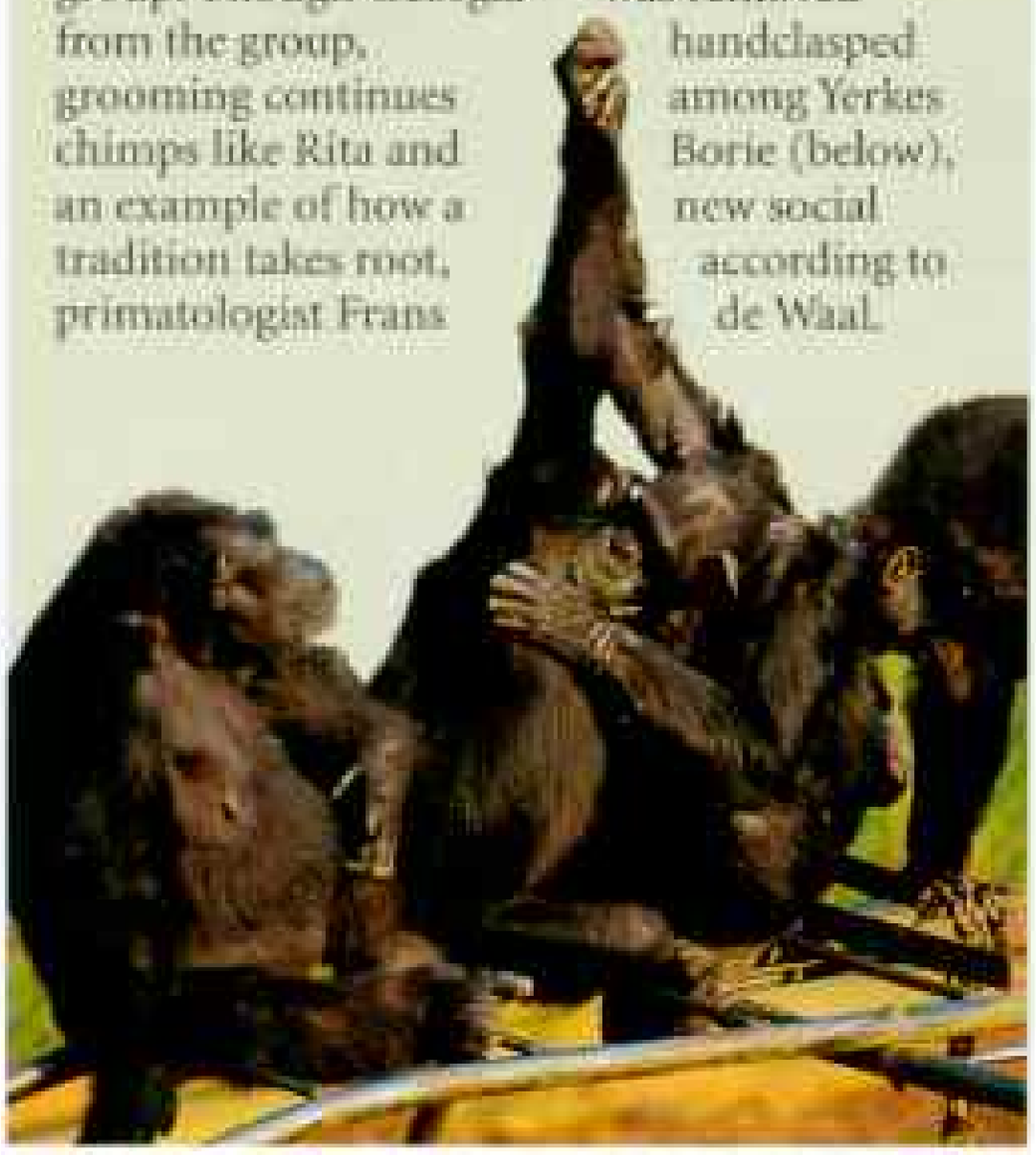
The dinosaur's gut is visible, as are chest muscles and muscles at the base of its tail. Even the tiny nails that sheathe its bony claws remain. Rapid burial in marine sediments made this remarkable preservation possible.



LEONARDO VITOLA, SOPRINTENDENZA ARCHEOLOGICA DI SALERNO, ITALY

A New Pattern in Chimp Culture

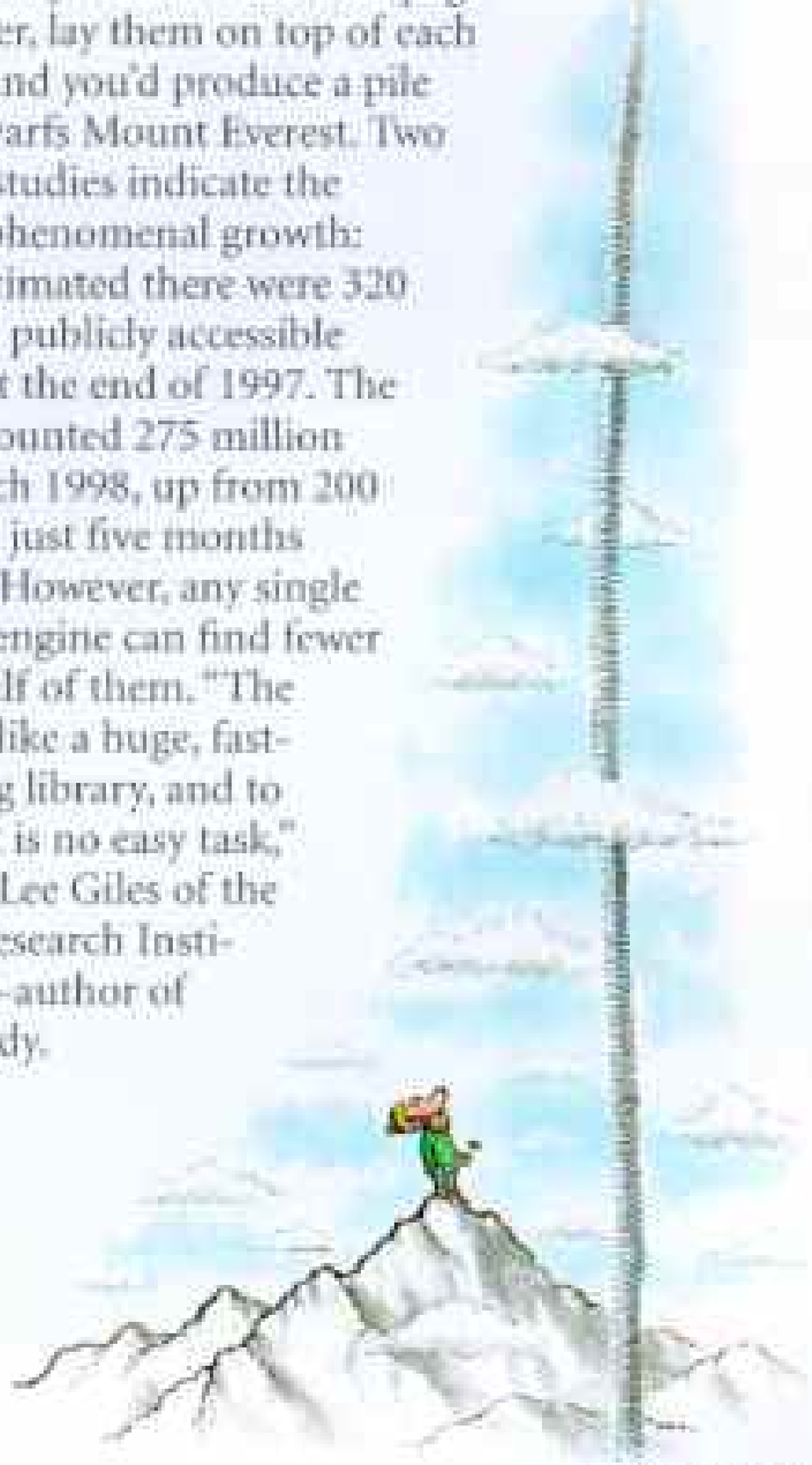
Georgia started it. Early in 1992 she suddenly grasped the hand of another chimpanzee at the Yerkes Regional Primate Research Center in Atlanta and held it overhead while the two chimps groomed each other. Over the next five years, the rare bit of behavior—never before seen in captive chimps and observed at only two sites in the wild—spread within the group. Though Georgia was removed from the group, handclasped grooming continues among Yerkes chimps like Rita and Borie (below), an example of how a new social tradition takes root, according to primatologist Frans de Waal.



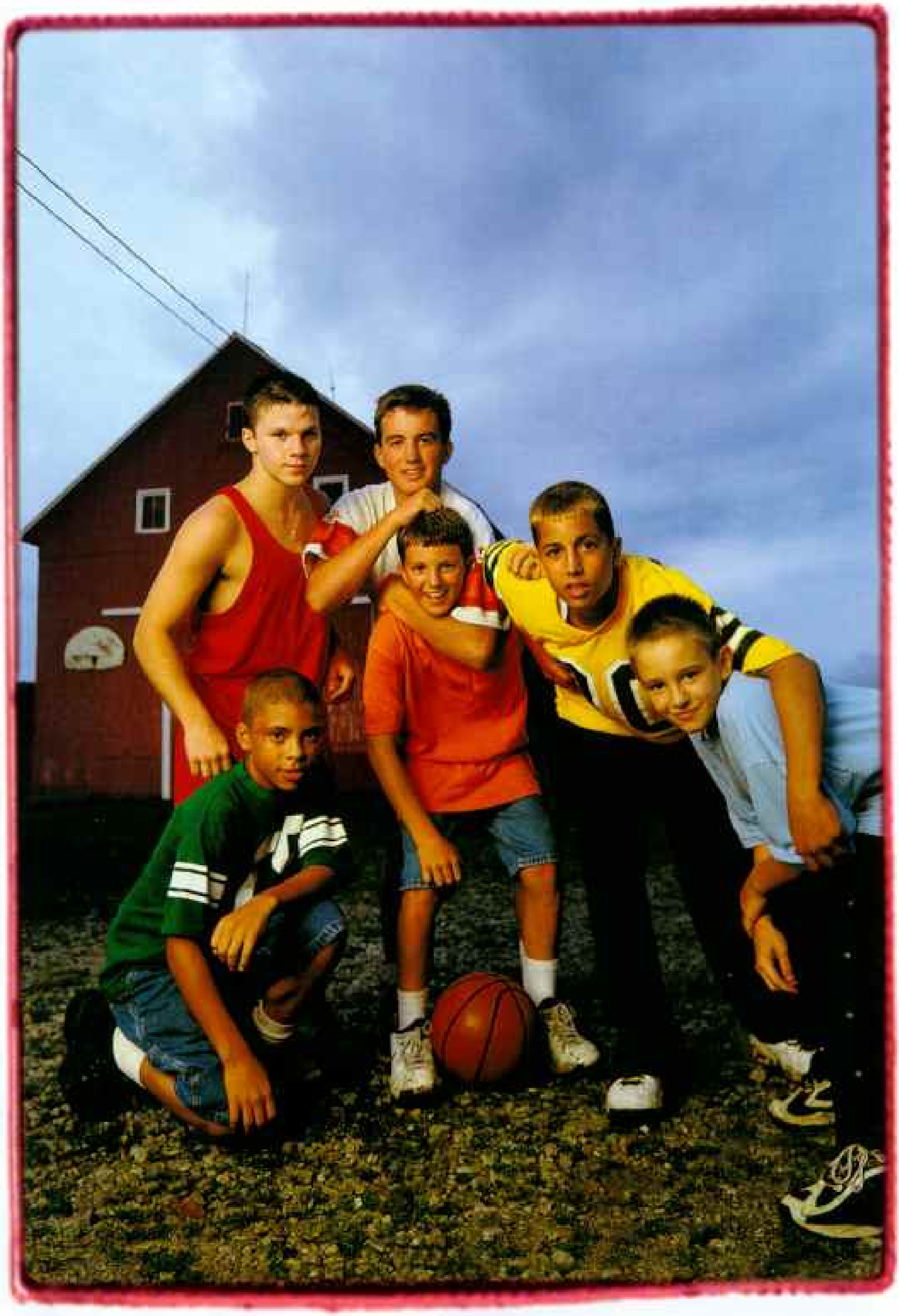
JOHN D. HOLLOWAY

What a Massive Web We Weave!

Print every World Wide Web page on paper, lay them on top of each other, and you'd produce a pile that dwarfs Mount Everest. Two recent studies indicate the Web's phenomenal growth: One estimated there were 320 million publicly accessible pages at the end of 1997. The other counted 275 million in March 1998, up from 200 million just five months earlier. However, any single search engine can find fewer than half of them. "The Web is like a huge, fast-growing library, and to index it is no easy task," says C. Lee Giles of the NEC Research Institute, co-author of one study.



ART BY JEFF MEDKEFF



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Sure, it makes good business sense for Toyota. But it also builds growth and competitiveness in the communities where we do business. That's what team spirit means to Toyota. It's how we play the game.

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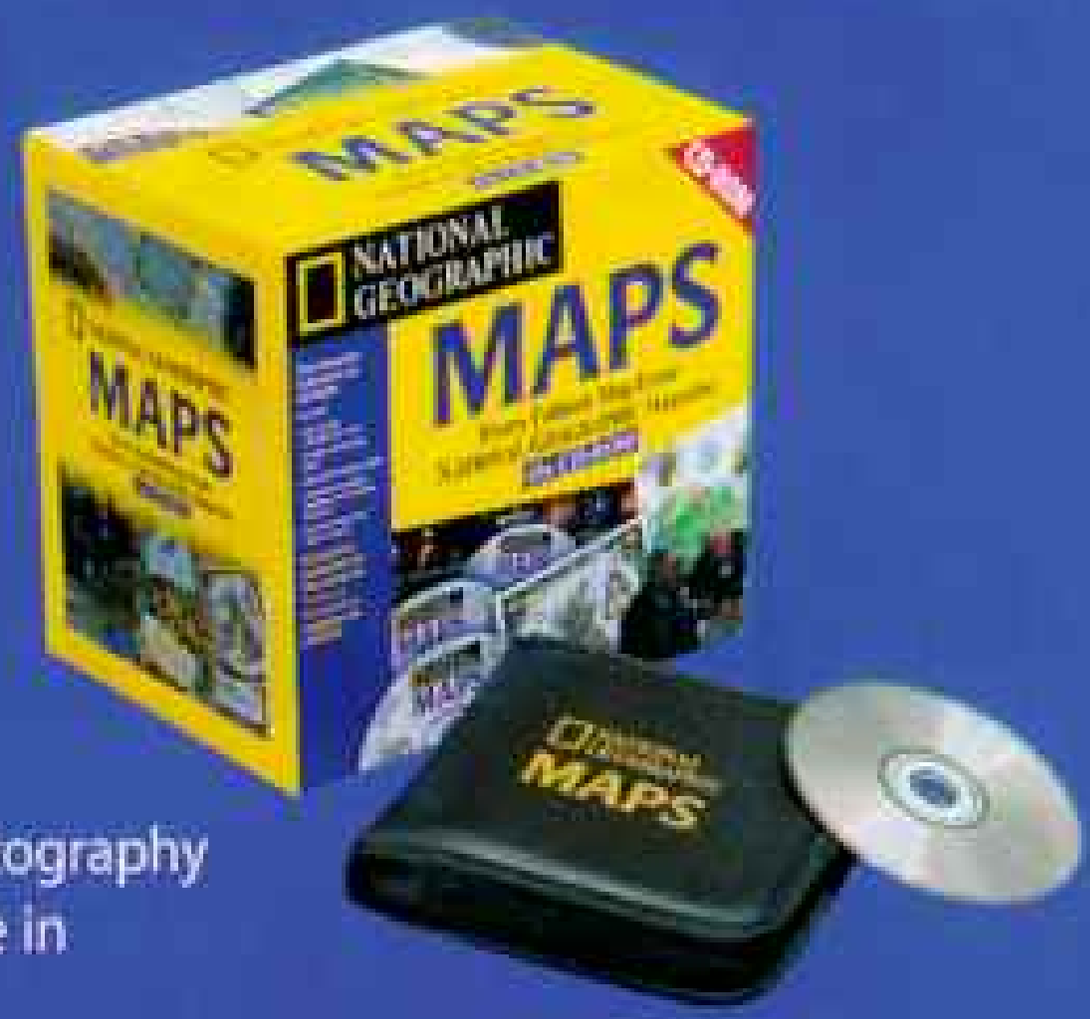

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Dust Bowl Voices —on the Internet

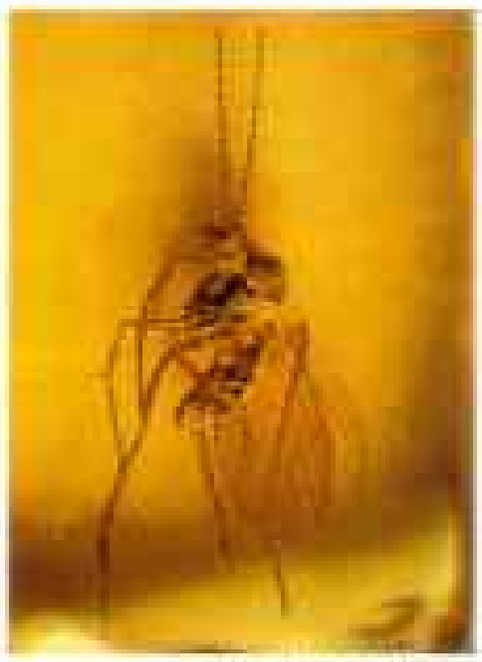
Searching for songs and singers, musicians and storytellers, Charles Todd and Robert Sonkin combed the Farm Security Administration's California migrant worker camps in 1940 and 1941. "These people were dying to sing about their plight; they wrote a lot of songs about it," Todd, now 86, recalls. "The camps were full of guitar players and mouth harps and banjos."

The Archive of American Folk Song of the Library of Congress asked Todd and Sonkin to go to the camps to document the lives of those who had trekked west after the great dust storms of the 1930s drove them from their homes.

ROBERT SONKIN, AMERICAN FOLK LIFE CENTER, LIBRARY OF CONGRESS

"They loaded us up with this recording machine, a great boxlike thing. It weighed 80 pounds," says Todd, seen here capturing the songs of Frank and Myra Pipkin at the Shafter Migratory Labor Camp.

The recordings can now be heard on the library's American Memory website at *http://memory.loc.gov*. Field notes, letters, and photographs also help bring the drama of the Dust Bowl back to life.



JEAN-JACQUES MENIER

Beads of Amber Worth a Fortune to Science

Trapped forever in amber, this moth fly represents a tiny sample from a treasure trove of fossilized tree resin recently uncovered in France during a commercial excavation. The 53-million-year-old amber is the oldest known from flowering plants, says Jean-Jacques Menier of the French Museum of Natural History. Making their way through 660 pounds of amber—some pieces as small as a marble, a few as big as a tennis ball—Menier and colleague Andre Nel have so far detected the remains of some 10,000 insects, including more than 200 new species. A few dozen truly exceptional pieces contain flowers and leaves.

A Seagoing Human Ancestor?

Did *Homo erectus* sail? This stone flake, one of many tools found on the Indonesian island of Flores, has been dated to between 800,000 and 900,000 years ago—*Homo erectus* prime time. The only way to reach Flores then was by watercraft, according to archaeologist Mike Morwood of Australia's University of New England; the absence of ancient animals found on nearby islands rules out the chance that a prehistoric land bridge linked them to Flores. "*Homo erectus* must have been smarter than generally believed," says Morwood.

TEXT BY BORIS WEINTRAUB

MIKE MORWOOD (STONE TOOL)

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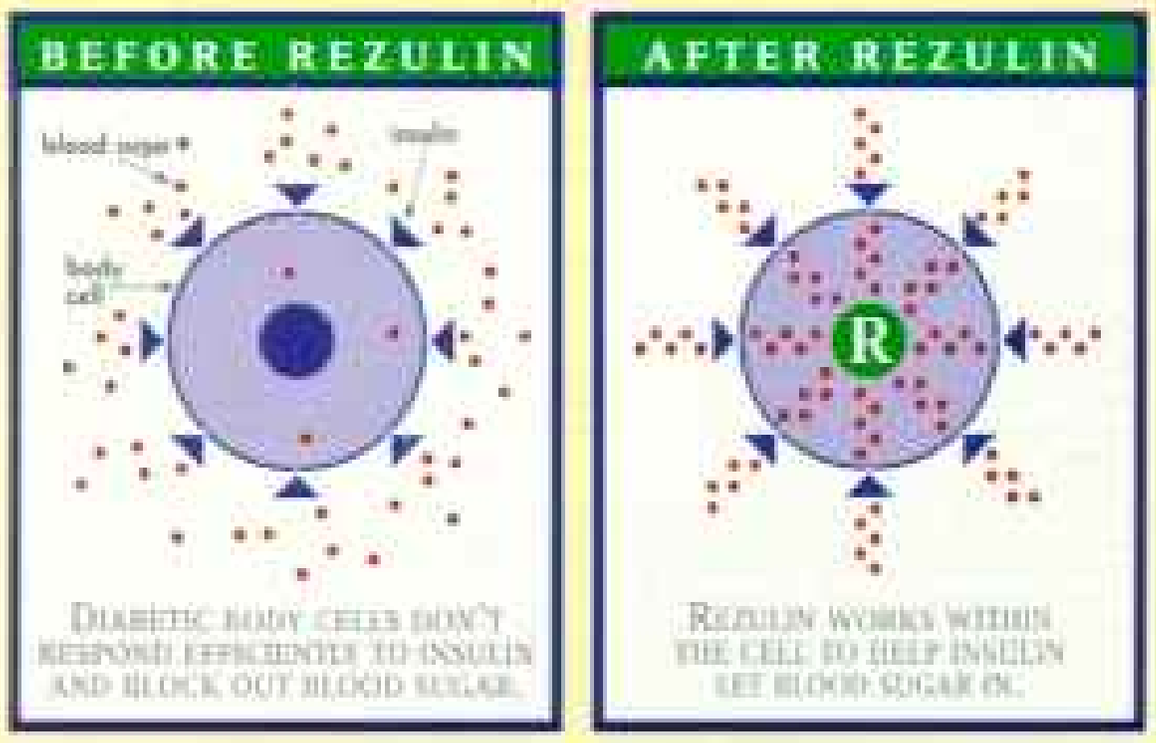
YOUR DOCTOR TREATS TYPE 2 DIABETES.

REZULIN®: FOR IMPROVED CONTROL OF TYPE 2 DIABETES.

Rezulin (troglitazone) is a once-a-day pill for diabetes that helps your body use its own insulin for improved blood sugar control. Rezulin may be used for patients not well controlled with diet and exercise alone, oral pills known as sulfonylureas, or insulin.



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Because Rezulin makes improved use of insulin, it can make a difference if insulin injections are part of your type 2 diabetes treatment. With Rezulin, you may be able to decrease the amount of insulin or the number of injections you're taking. You may even be able to eliminate injections altogether.

Increases The Effectiveness Of Many Oral Medications. Your doctor may find that Rezulin provides better blood sugar control when added to diabetes pills known as sulfonylureas such as Amaryl,®* Glucotrol XL,®* Glynase®* PresTab,®* glipizide, or glyburide.

Ask Your Doctor If Rezulin Is Right For You. Rezulin can provide a useful treatment option for millions of people with type 2 diabetes. Please be aware that Rezulin should not be used by patients with type 1 diabetes.

Rezulin, like all the diabetes medications currently available to treat type 2 diabetes, has been associated with side effects. Although they are not usually serious, you should discuss these possibilities with your doctor. In rare cases, Rezulin has been associated with serious liver problems, which are generally reversible, but in very rare instances, these have resulted in liver failure and fatality. Your doctor can advise you about the new recommendations for regular liver monitoring with Rezulin, which will require routine blood tests. The most common side effects reported in medical studies were similar to placebo (a tablet with no medicine); they include infection (22% placebo vs. 18% Rezulin), headache (11% placebo vs. 11% Rezulin), and pain (14% placebo vs. 10% Rezulin). Talk to your doctor immediately if you have nausea, vomiting, stomach pain, fatigue, lack of appetite, dark urine, or yellowing of the skin (jaundice), as these may be signs or symptoms of a liver problem. Adhere to any dietary, exercise or weight-loss recommendations made by your doctor, and test your blood sugar regularly. As with any drug, tell your doctor or healthcare professional about any other medications you may be taking. If your therapy includes Rezulin and pills known as sulfonylureas, there is a chance you may incur a manageable weight gain. If you are a premenopausal woman who is not ovulating, you should know Rezulin therapy may result in resumption of ovulation, thus putting you at risk for pregnancy.

Over 1,000,000 People Have Begun Using Rezulin To Help Manage Diabetes. And the number keeps growing. Your doctor or healthcare professional is the best source for finding out if Rezulin is right for you. To know more, see the important information on the adjacent page, and call:

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TABLETS

WARNINGS

Hepatic

Rare cases of severe idiosyncratic hepatocellular injury have been reported during marketed use (see ADVERSE REACTIONS). The hepatic injury is usually reversible, but very rare cases of hepatic failure, leading to death or liver transplant, have been reported. Injury has occurred after both short- and long-term troglitazone treatment.

During all clinical studies in North America, a total of 48 of 2510 (1.9%) Rezulin-treated patients and 2 of 475 (0.4%) placebo-treated patients had ALT levels greater than 3 times the upper limit of normal. Twenty of the Rezulin-treated and one of the placebo-treated patients were withdrawn from treatment. Two of the 20 Rezulin-treated patients developed reversible jaundice, one of these patients had a liver biopsy which was consistent with an idiosyncratic drug reaction. An additional Rezulin-treated patient had a liver biopsy which was also consistent with an idiosyncratic drug reaction. (See ADVERSE REACTIONS, Laboratory Abnormalities.)

Serum transaminase levels should be checked at the start of therapy, monthly for the first eight months of therapy, every two months for the remainder of the first year of Rezulin therapy, and periodically thereafter. Rezulin therapy should not be initiated if the patient exhibits clinical evidence of active liver disease or increased serum transaminase levels (ALT > 1.5 times the upper limit of normal). Liver function tests should be repeated within a week and then promptly until the levels return to normal. If at any time a patient has jaundice or ALT rises above 3 times the upper limit of normal, Rezulin should be discontinued.

BRIEF SUMMARY

Consult Package Insert for full Prescribing Information.

INDICATIONS AND USAGE

Rezulin may be used concomitantly with a sulfonylurea or insulin to improve glycemic control. Rezulin, as monotherapy, is indicated as an adjunct to diet and exercise to lower blood glucose in patients with type II diabetes (see DOSAGE AND ADMINISTRATION in Package Insert for full Prescribing Information). Rezulin should not be used as monotherapy in patients previously well-controlled on sulfonylurea therapy. For patients inadequately controlled with a sulfonylurea alone, Rezulin should be added to, not substituted for, the sulfonylurea.

Management of type II diabetes should include diet control. Caloric restriction, weight loss, and exercise are essential for the proper treatment of the diabetic patient. This is important not only in the primary treatment of type II diabetes, but in maintaining the efficacy of drug therapy. Prior to initiation of Rezulin therapy, secondary causes of poor glycemic control, eg, infection or poor injection technique, should be investigated and treated.

CONTRAINDICATIONS

Rezulin is contraindicated in patients with known hypersensitivity or allergy to Rezulin or any of its components.

WARNINGS

SEE BOXED WARNING.

PRECAUTIONS

General

Because of its mechanism of action, Rezulin is active only in the presence of insulin. Therefore, Rezulin should not be used in type I diabetes or for the treatment of diabetic keto-acidosis.

Hypoglycemia: Patients receiving Rezulin in combination with insulin or oral hypoglycemic agents may be at risk for hypoglycemia and a reduction in the dose of the concomitant agent may be necessary. Hypoglycemia has not been observed during the administration of Rezulin as monotherapy and would not be expected based on the mechanism of action.

Ovulation: In premenopausal anovulatory patients with insulin resistance, Rezulin treatment may result in resumption of ovulation. **These patients may be at risk for pregnancy.**

Hematologic: Across all clinical studies, hemoglobin declined by 3 to 4% in troglitazone-treated patients compared with 1 to 2% in those treated with placebo. White blood cell counts also declined slightly in troglitazone-treated patients compared to those treated with placebo. These changes occurred within the first four to eight weeks of therapy. Levels stabilized and remained unchanged for up to two years of continuing therapy. These changes may be due to the dilutional effects of increased plasma volume and have not been associated with any significant hematologic clinical effects (see ADVERSE REACTIONS, Laboratory Abnormalities).

Use in Patients With Heart Failure

Heart enlargement without microscopic changes has been observed in rodents at exposures of parent compound and active metabolite exceeding 7 times the AUC of the 400 mg human dose (see PRECAUTIONS, Carcinogenesis, Mutagenesis, Impairment of Fertility, and Animal Toxicology). Serial echocardiographic evaluations in monkeys treated chronically at exposures of 4-9 times the human exposure to parent compound and active metabolite at the 400 mg dose did not reveal changes in heart size or function. In a 2 year echocardiographic clinical study using 400 to 800 mg/day of Rezulin in patients with type II diabetes, no increase in left ventricular mass or decrease in cardiac output was observed. The methodology employed was able to detect a change of about 18% or more in left ventricular mass.

In animal studies, troglitazone treatment was associated with increases of 8% to 15% in plasma volume. In a study of 28 normal volunteers, an increase in plasma volume of 8% to 9% compared to placebo was observed following 6 weeks of troglitazone treatment.

No increased incidence of adverse events potentially related to volume expansion (eg, congestive heart failure) have been observed during controlled clinical trials. However, patients with New York Heart Association (NYHA) Class III and IV cardiac status were not studied during clinical trials. Therefore, Rezulin is not indicated unless the expected benefit is believed to outweigh the potential risk to patients with NYHA Class III or IV cardiac status.

Information for Patients

Rezulin should be taken with meals. If the dose is missed at the usual meal, it may be taken at the next meal. If the dose is missed on one day, the dose should not be doubled the following day.

It is important to adhere to dietary instructions and to regularly have blood glucose and glycosylated hemoglobin tested. During periods of stress such as fever, trauma, infection, or surgery, insulin requirements may change and patients should seek the advice of their physician.

Patients who develop nausea, vomiting, abdominal pain, fatigue, anorexia, dark urine or other symptoms suggestive of hepatic dysfunction or jaundice should immediately report these signs or symptoms to their physician. Patients should be informed that blood will be drawn to check their liver function at the start of therapy, monthly for the first eight months of therapy, every two months for the remainder of the first year of Rezulin therapy, and periodically thereafter.

When using combination therapy with insulin or oral hypoglycemic agents, the risks of hypoglycemia, its symptoms and treatment, and conditions that predispose to its development should be explained to patients and their family members.

Use of Rezulin can cause resumption of ovulation in women taking oral contraceptives and in patients with polycystic ovary disease. Therefore, a higher dose of an oral contraceptive or an alternative method of contraception should be considered.

Rezulin may affect other medications used in diabetic patients. Patients started on Rezulin should ask their physician to review their other medications to make sure that they are not affected by Rezulin.

Drug Interactions

Oral Contraceptives: Administration of Rezulin with an oral contraceptive containing ethinyl estradiol and norethindrone reduced the plasma concentrations of both by approximately 30%, which could result in a loss of contraception. Therefore, a higher dose of oral contraceptive or an alternative method of contraception should be considered.

Terfenadine: Coadministration of Rezulin with terfenadine decreases the plasma concentration of both terfenadine and its active metabolite by 50-60% and may result in decreased efficacy of terfenadine.

Cholestyramine: Concomitant administration of cholestyramine with Rezulin reduces the absorption of troglitazone by 30%. Thus, coadministration of cholestyramine and Rezulin is not recommended.

Glyburide: Coadministration of Rezulin and glyburide does not appear to alter troglitazone or glyburide pharmacokinetics.

Digoxin: Coadministration of Rezulin with digoxin does not alter the steady state pharmacokinetics of digoxin.

Warfarin: Rezulin has no clinically significant effect on prothrombin time when administered to patients receiving chronic warfarin therapy.

Acetaminophen: Coadministration of acetaminophen and Rezulin does not alter the pharmacokinetics of either drug.

Metformin: No information is available on the use of Rezulin with metformin.

Ethanol: A single administration of a moderate amount of alcohol did not increase the risk of acute hypoglycemia in Rezulin-treated patients with type II diabetes mellitus.

The above interactions with terfenadine and oral contraceptives suggest that troglitazone may reduce drug metabolism by CYP3A4. Studies have not been performed with other drugs metabolized by this enzyme such as: astemizole, calcium channel blockers, cisapride, corticosteroids, cyclosporine, HMG-CoA reductase inhibitors, tacrolimus, triazolam, and nonsteroids.

The possibility of altered safety and efficacy should be considered when Rezulin is used concomitantly with these drugs. Patients stable on one or more of these agents when Rezulin is started should be closely monitored and their therapy adjusted as necessary.

Carcinogenesis, Mutagenesis, Impairment of Fertility

Troglitazone was administered orally for 104 weeks to male rats at 100, 400, or 800 mg/kg and to female rats at 25, 150, or 200 mg/kg. No tumors of any type were increased at the low and mid doses. Plasma drug exposure based on AUC of parent compound and total metabolites at the low and mid doses was up to 2½-fold higher than human exposure at 400 mg daily. The highest dose in each sex exceeded the maximum tolerated dose. In a 104-week study in mice given 50, 400, or 800 mg/kg, incidence of hemangiosarcoma was increased in females at 400 mg/kg and in both sexes at 800 mg/kg; incidence of hepatocellular carcinoma was increased in females at 800 mg/kg. The lowest dose associated with increased tumor incidence (400 mg/kg) was associated with AUC values of parent compound and total metabolites that were at least 2-fold higher than the human exposure at 400 mg daily. No tumors of any type were increased in mice at 50 mg/kg at exposures up to 40% of that in humans at 400 mg daily, based on AUC of parent compound and total metabolites.

Troglitazone was neither mutagenic in bacteria nor clastogenic in bone marrow of mice. Equivocal increases in chromosome aberrations were observed in an in vitro Chinese hamster lung cell assay. In mouse lymphoma cell gene mutation assays, results were equivocal when conducted with a microtiter technique and negative with an agar plate technique. A liver unscheduled DNA synthesis assay in rats was negative.

No adverse effects on fertility or reproduction were observed in male or female rats given 40, 200, or 1000 mg/kg daily prior to and throughout mating and gestation. AUC of parent compound at these doses was estimated to be 2- to 9-fold higher than human exposure.

Animal Toxicology

Increased heart weights without microscopic changes were observed in mice and rats treated for up to 1 year at exposure (AUC) of parent and active metabolite exceeding 7 times the human AUC at 400 mg/day. These heart weight increases were reversible in 3- and 13-week studies, were prevented by coadministration of an ACE inhibitor, and 14 days of troglitazone administration to rats did not affect left ventricular performance. In the lifetime carcinogenicity studies, microscopic changes were noted in the hearts of rats but not in mice. In control and treated rats, microscopic changes included myocardial inflammation and fibrosis and karyomegaly of atrial myocytes. The incidence of these changes in drug treated rats was increased compared to controls at twice the AUC of the 400 mg human dose.

Pregnancy

Pregnancy Category B: Troglitazone was not teratogenic in rats given up to 2000 mg/kg or rabbits given up to 1000 mg/kg during organogenesis. Compared to human exposure at 400 mg daily, estimated exposures in rats (parent compound) and rabbits (parent compound and active metabolite) based on AUC at these doses were up to 9-fold and 3-fold higher, respectively. Body weights of fetuses and offspring of rats given 2000 mg/kg during gestation were decreased. Delayed postnatal development, attributed to decreased body weight, was observed in offspring of rats given 40, 200, or 1000 mg/kg during late gestation and lactation periods; no effects were observed in offspring of rats given 10 or 20 mg/kg.

There are no adequate and well controlled studies in pregnant women. Rezulin should not be used during pregnancy unless the potential benefit justifies the potential risk to the fetus.

Because current information strongly suggests that abnormal blood glucose levels during pregnancy are associated with a higher incidence of congenital abnormalities, as well as increased neonatal morbidity and mortality, most experts recommend that insulin be used during pregnancy to maintain blood glucose levels as close to normal as possible.

Nursing Mothers

It is not known whether troglitazone is excreted in human milk. Troglitazone is excreted in the milk of lactating rats. Because many drugs are excreted in human milk, Rezulin should not be administered to a breast feeding woman.

Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

Geriatric Use

Twenty-two percent of patients in clinical trials of Rezulin were 65 and over. No differences in effectiveness and safety were observed between these patients and younger patients.

ADVERSE REACTIONS

Two patients in the clinical studies developed reversible jaundice, one of these patients had a liver biopsy which was consistent with an idiosyncratic drug reaction. An additional patient had a liver biopsy which was also consistent with an idiosyncratic drug reaction. Symptoms that are associated with hepatic dysfunction or hepatitis have been reported, including: nausea, vomiting, abdominal pain, fatigue, anorexia, dark urine, abnormal liver function tests (including increased ALT, AST, LDH, alkaline phosphatase, bilirubin). Also see WARNINGS.

The overall incidence and types of adverse reactions reported in placebo-controlled clinical trials for Rezulin-treated patients and placebo-treated patients are shown in Table 1. In patients treated with Rezulin in glyburide-controlled studies (N=1392) or uncontrolled studies (N=519), the safety profile of Rezulin appeared similar to that displayed in Table 1. The incidence of withdrawals during clinical trials was similar for patients treated with placebo or Rezulin (4%).

TABLE 1. North American Placebo-Controlled Clinical Studies
Adverse Events Reported at a Frequency ≥ 5% of Rezulin-Treated Patients
% of Patients

	Placebo N = 492	Rezulin N = 1458		Placebo N = 492	Rezulin N = 1458
Infection	22	19	Nausea	4	6
Headache	11	11	Rhinitis	7	6
Pain	10	10	Diarrhea	6	7
Accidental Injury	8	8	Urinary Tract Infection	6	5
Asthenia	5	6	Peripheral Edema	5	5
Dizziness	5	6	Pharyngitis	4	5
Back Pain	4	5			

Types of adverse events seen when Rezulin was used concomitantly with insulin (N=543) were similar to those during Rezulin monotherapy (N=1731), although hypoglycemia occurred on insulin combination therapy (see PRECAUTIONS).

Laboratory Abnormalities

Hematologic: Small decreases in hemoglobin, hematocrit, and neutrophil counts (within the normal range) were more common in Rezulin-treated than placebo-treated patients and may be related to increased plasma volume observed with Rezulin treatment. Hemoglobin decreases to below the normal range occurred in 5% of Rezulin-treated and 4% of placebo-treated patients.

Lipids: Small changes in serum lipids have been observed (see CLINICAL PHARMACOLOGY, Pharmacodynamics and Clinical Effects in Package Insert for full Prescribing Information).

Serum Transaminase Levels: During all clinical studies in North America, a total of 48 of 2510 (1.9%) Rezulin-treated patients and 3 of 475 (0.6%) placebo-treated patients had ALT levels greater than 3 times the upper limit of normal. During controlled clinical trials, 2.2% of Rezulin-treated patients had reversible elevations in AST or ALT greater than 3 times the upper limit of normal, compared with 0.6% of patients receiving placebo. Hyperbilirubinemia (>1.2X upper limit of normal) was found in 0.7% of Rezulin-treated patients compared with 1.3% of patients receiving placebo. In the population of patients treated with Rezulin, mean and median values for bilirubin, AST, ALT, alkaline phosphatase, and GGT were decreased at the final visit compared with baseline, while values for LDH were increased slightly (see WARNINGS).

Postintroduction Reports

Adverse events associated with Rezulin that have been reported since market introduction, that are not listed above, and for which causal relationship to drug has not been established include the following: congestive heart failure, weight gain, edema, fever, abnormal test tests including increased CPK and creatinine, hypercalcemia, syncope, anemia, malaise.

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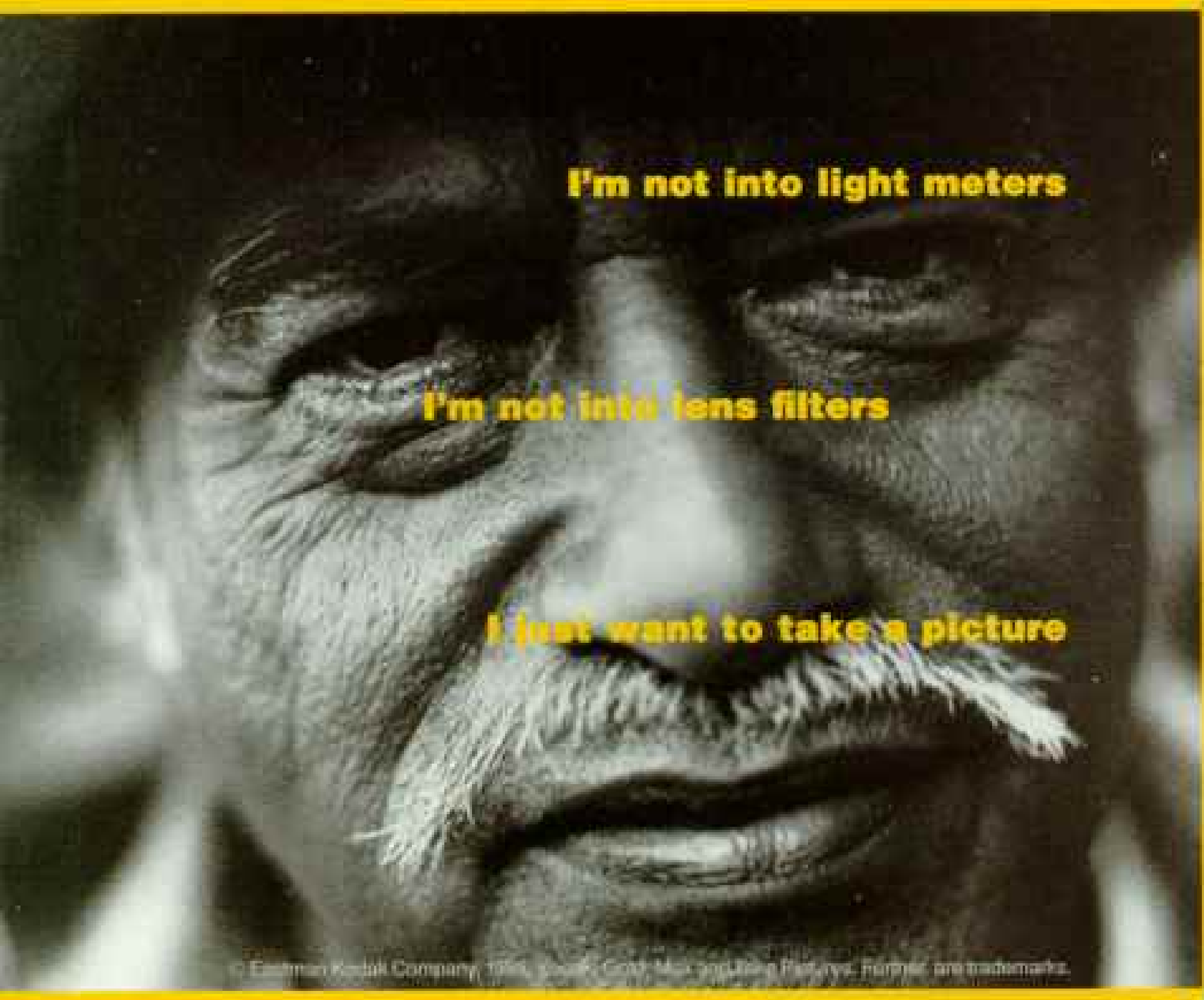

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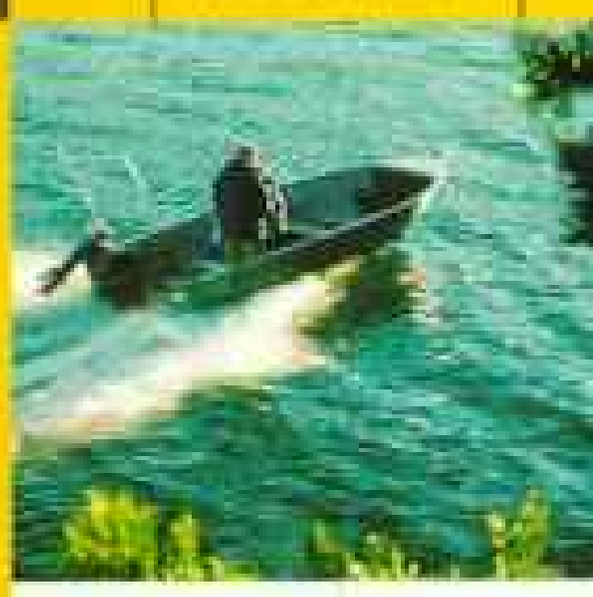

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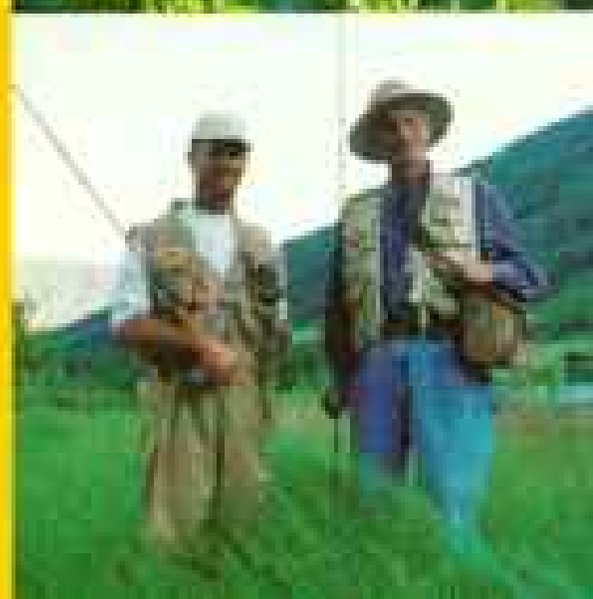

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Amanda Vincent, for conserving seahorse populations in the central Philippines.

Wijaya Godakumbura, for replacing dangerous home-made kerosene lamps in Sri Lanka with safer versions.

Cristina Bubba Zamora, for recovering ancient ceremonial textiles in Bolivia.

Louis Liebenberg, for improving wildlife management in Africa by preserving ancient tracking skills.

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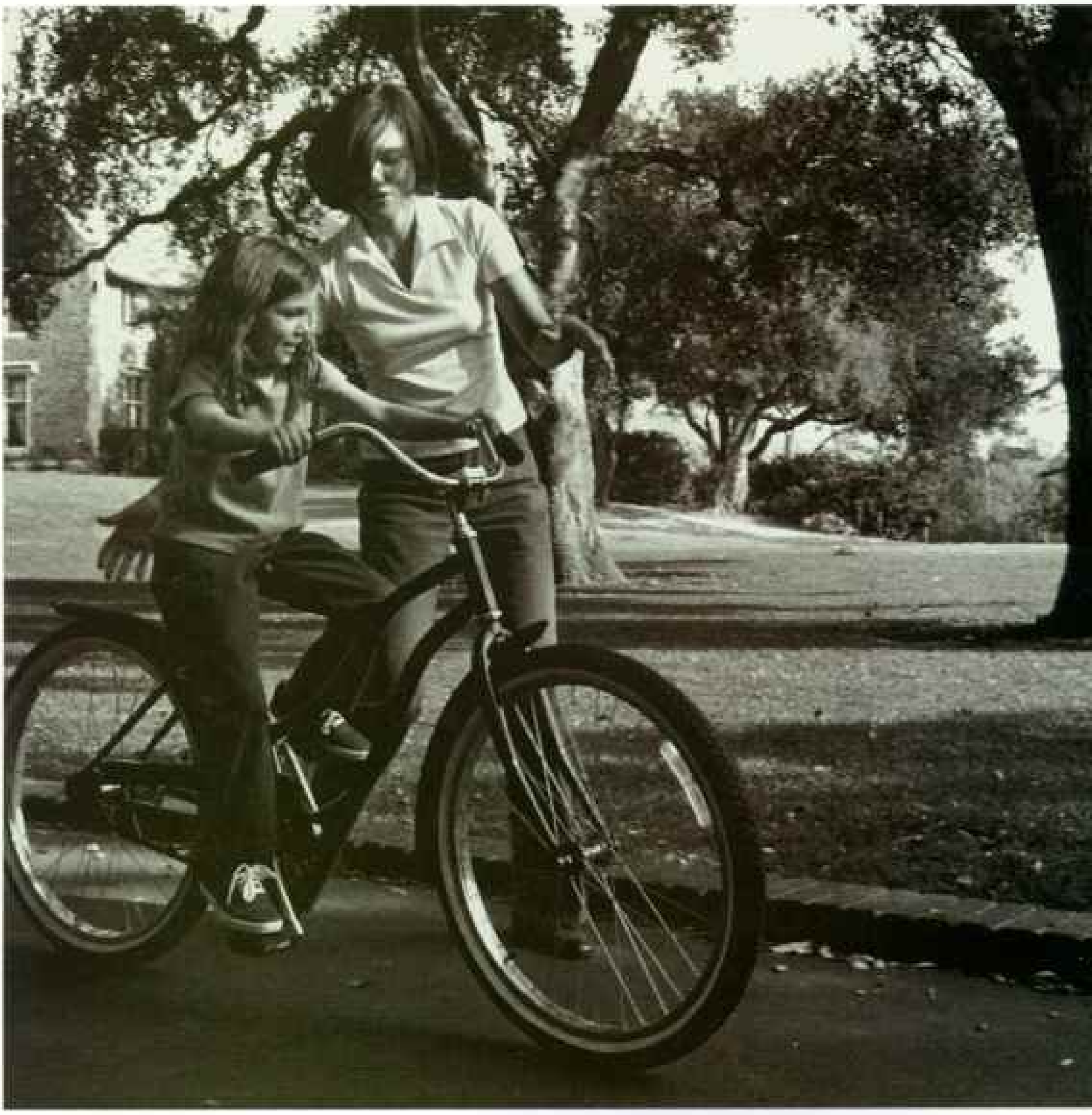

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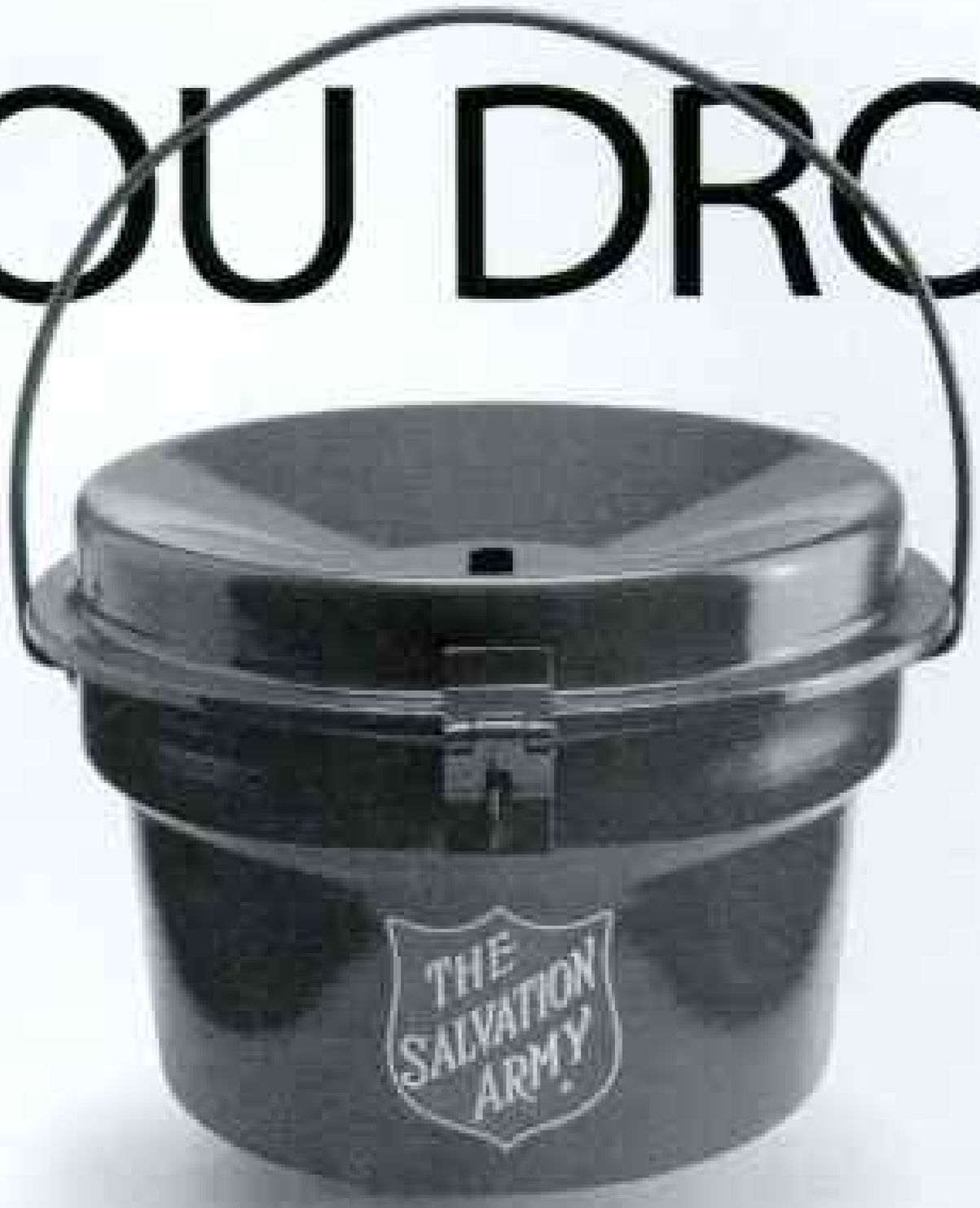

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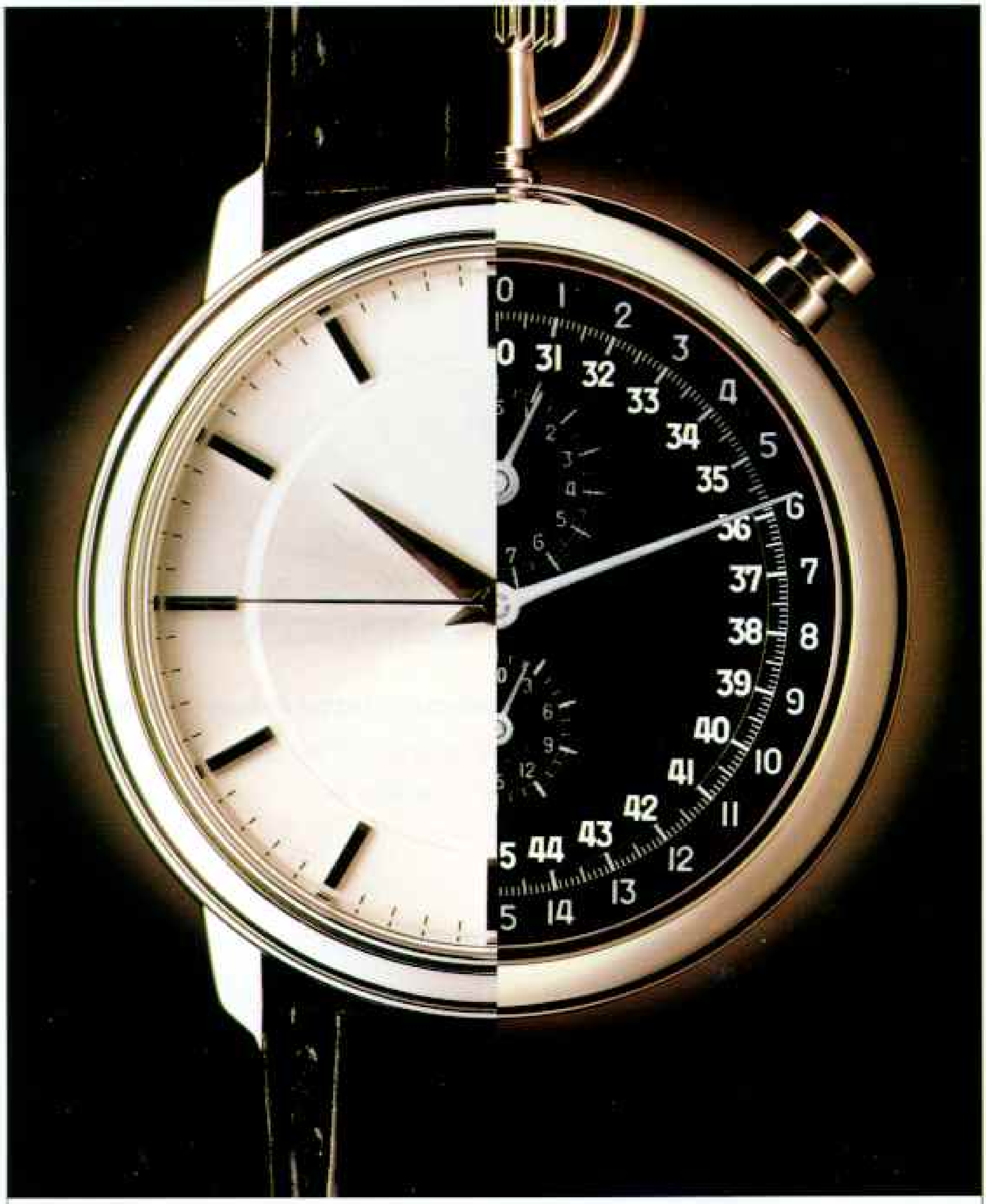

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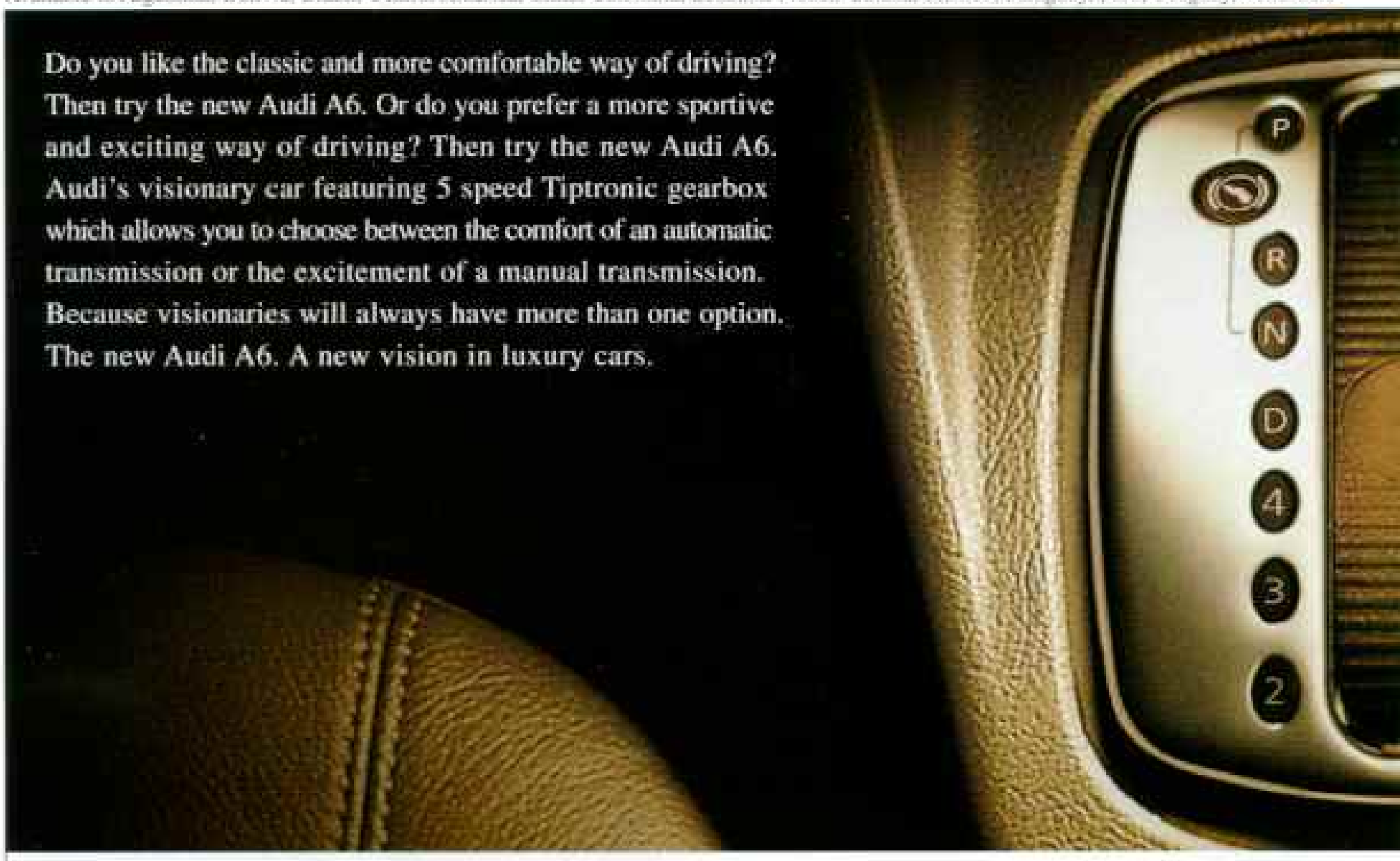

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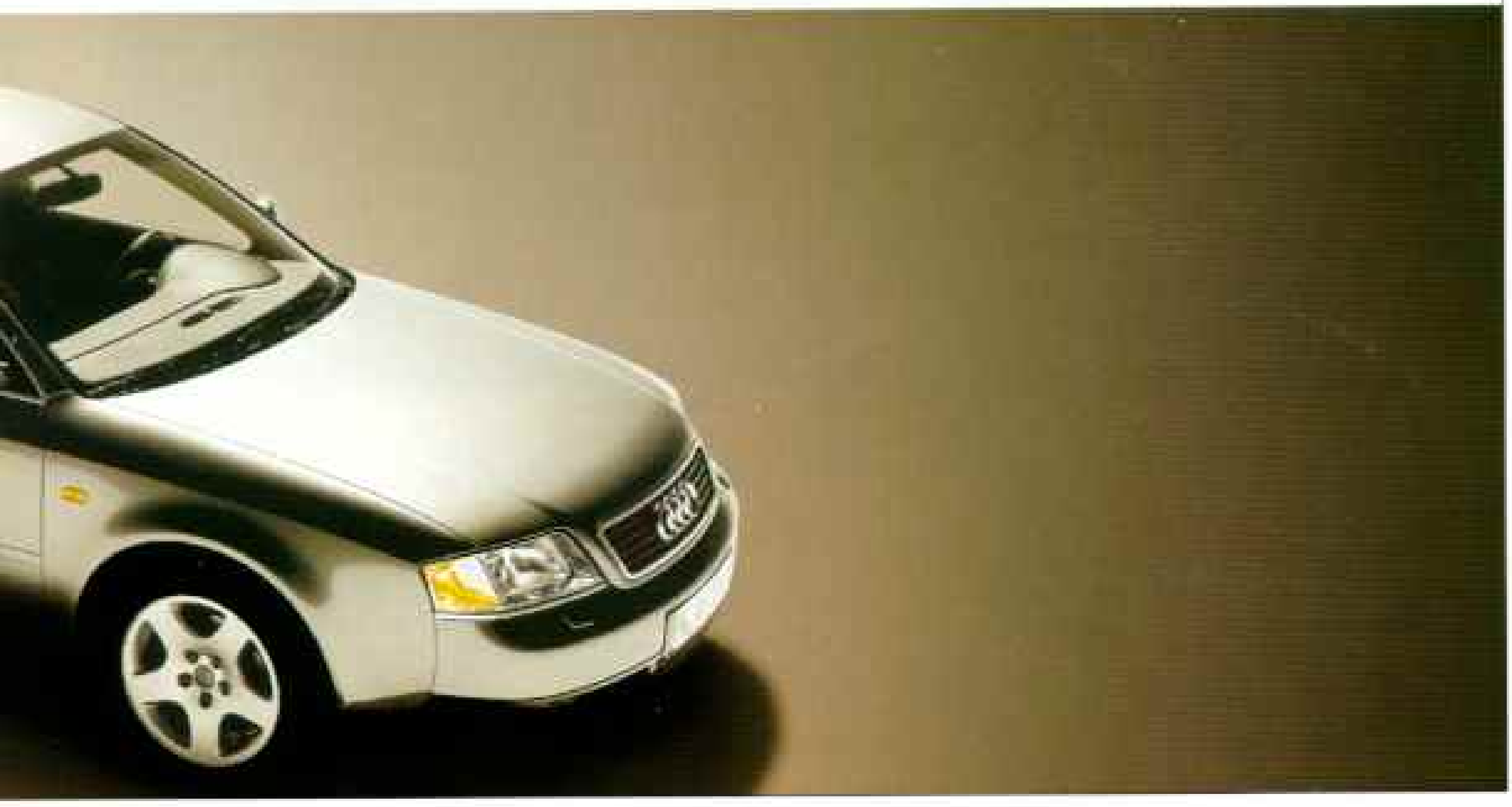

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Chairman of the Boards

The ancient sport of surfing was enjoying a revival when Tom Blake arrived in Hawaii in 1924. The blond Midwesterner used knowledge he gained restoring antique boards for Honolulu's Bishop Museum to fashion his own collection (above). He patented the hollow paddleboard and was the first to fit a surfboard with a fin. Blake is also known for pioneering photography from the waves. In 1930 he submitted to the GEOGRAPHIC photos taken from a surfboard. The pictures, tinted blue at Blake's suggestion, appeared in May 1935 under the title "Waves and Thrills at Waikiki."

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First in His Field

Known for his research on Everglades alligators (left), Brady Barr joins EXPLORER as its first field specialist, covering reptiles and amphibians and their ecosystems. Recently in Australia the University of Miami biologist reported on saltwater crocodiles. "One took a chunk out of our boat," says Barr, "and it crossed my mind that my first field story might be my last."

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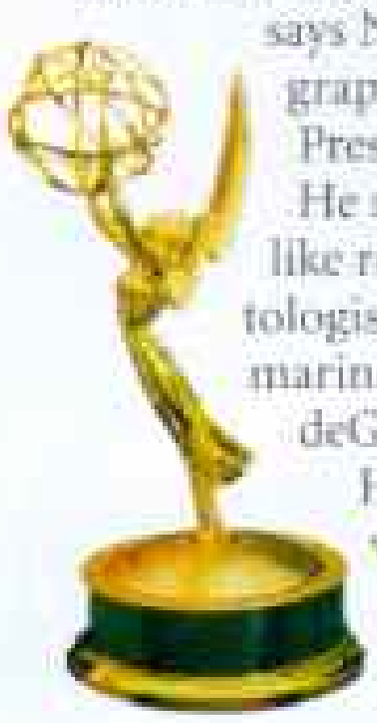

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NATIONAL GEOGRAPHIC

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Mississippi Kites: Flying High

Many raptors are in peril, but Mississippi kites thrive, expanding far to the north and west from their original range in the southern and central U.S. They gained nesting habitat during the 1930s when trees were planted to stem erosion, creating shelterbelts. These flightless young kites were taken temporarily from nests in a Kansas belt by biologist Jim Parker so he could weigh and band them.

JIM HUMMEL

Maine Fish Win: Dam To Be Torn Down

SCOTT RUSSELL

For more than 20 years fishermen in Maine have been trying to get rid of the Edwards Dam on the Kennebec River. Next summer they should finally get their wish.

For the first time the Federal Energy Regulatory Commission has ordered a dam removed when its owner wanted to keep it operating. Built in 1837 near the Kennebec's mouth on the Atlantic, the Edwards flooded a 17-mile fish-spawning stretch. "It damaged the seagoing fisheries," says Sue Scott of the Atlantic Salmon Federation. Nine migratory species—Atlantic salmon, striped bass, shortnose sturgeon, Atlantic sturgeon, American shad, blueback herring, American eel, alewife, and rainbow smelt—have all but disappeared above the dam.

The dam generates one-tenth of one percent of Maine's electricity. Its removal may set a precedent: More than 600 other privately owned dams are due for review and relicensing in the next 15 years. Environmentalists have also targeted four federal dams on the Snake River in Washington State.

Harpy Eagles Have Friends in High Places

With a bird's-eye view of the Venezuelan rain forest, biologist Eduardo Alvarez-Cordero (top, at left) and field manager Rafael Alvarez prepare to fit a young harpy eagle with a satellite transmitter. Eduardo uses a global positioning system (GPS) receiver to check the nest's position. Many threats endanger the eagles—largest in the Americas—here in the Serrania Imataca mountains. "Logging is ongoing, and now the area may be opened to gold mining," says Eduardo.

Sometimes he wins the trust of local farmers who may have hunted eagles but agree to show him the nests. "Indians kill them for feathers, and prospectors shoot them for food," he explains. "There is one farmer who has a stuffed harpy decorated with Christmas lights. We've seen it all."

He uses both GPS and geographic information systems (GIS) to locate and map a nest before loggers zero in, then persuades them to leave a buffer zone around it. He works for the Peregrine Fund, which runs the Harpy Eagle Conservation Program, also operating in Panama. There researchers measure a fledged eagle (above). Females, the larger sex, have a seven-foot wingspan and weigh 20 pounds. Both sexes are armed with thick, powerful legs with huge talons for snatching up sloths on the fly. Raised at the Peregrine Fund's Boise, Idaho, headquarters, this chick (above left) and three other captive-bred harpies were released into Panama's Saberania National Park.

The sky keeps

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BOTH BY SUSIE POST

Polishing Up the Rust Belt in Old Buffalo

Abandoned by industry, as many as 450,000 hazardous sites, dubbed brownfields by the EPA, blight U.S. cities. Contamination, real or suspected, thwarts redevelopment. With state and federal funding Buffalo, New York, has tackled three dozen brownfield sites. A demolished paint company (above) is on the renewal list, and golfers already tee off from a driving range nearby. Where sparks flew in a Republic Steel complex, an 18-acre greenhouse produces some seven million pounds of hydroponic tomatoes a year.

CARLO FUSCO

Illegal Wildlife—Status Symbols for Mob Bosses

Last spring in Naples during a crackdown on the organized-crime ring known in that city as the Camorra, Italian police discovered that several powerful bosses were illegally collecting exotic animals. While one gang member was in prison, officers found a lion, named Simba, on the grounds of his villa. Now the Naples zoo cares for Simba, as well as a leopard and a python confiscated during raids of other Camorra homes.

TEXT BY JOHN L. ELIOT

If You Own or Owned Property with Masonite Woodruf® Roofing or Masonite OmniWood® Siding

Please read this legal notice

Notice is hereby given, that proposed Settlements have been reached in the class action lawsuits, *Quin v. Masonite Corp.*, and *Cosby v. Masonite Corp.* Plaintiffs in both *Quin v. Masonite Corp.* and *Cosby v. Masonite Corp.*, allege that the Masonite products are defective, causing Class Members to suffer damages. Defendants vigorously deny these allegations in both lawsuits.

Settlement Hearing

A hearing will be held before the Hon. Robert G. Kendall, located at Government Plaza, 205 Government Street, Mobile, Alabama, 36644 at 9:00 a.m. on January 6, 1999 to determine whether the proposed Settlement Agreements on file with the Court are fair, reasonable adequate, and in the best interests of the Settlement Classes and whether a Final Judgment should be entered approving the Settlement Agreements.

Masonite Woodruf Roofing

Who is Involved?

You are a member of the Settlement Class in *Quin v. Masonite* if you owned or own Property on which Masonite Woodruf Roofing has been incorporated and installed in the United States and US Territories from January 1, 1980 to the Date of Final Order and Judgment in this Action.*

Product Description

Masonite Woodruf Roofing is a roofing product composed of pressure bonded fibers designed to emulate the look of natural cedar roofing. It is made of real wood fibers that are molded in 12" x 24" shingles.

Proposed Claims Period

7 years from date of Final Order and Judgment for roofing installed from January 1, 1980 through December 31, 1989.
10 years from date of Final Order and Judgment for roofing installed January 1, 1990 and after.

Masonite OmniWood Siding

Who is Involved?

You are a member of the Settlement Class in *Cosby v. Masonite* if you owned or own Property on which Masonite OmniWood Siding has been incorporated and installed in the United States and US Territories from January 1, 1992 to the Date of Final Order and Judgment in this Action.*

Product Description

OmniWood Siding is an exterior Oriented Strand Board lap, panel, siding or trim product.

Proposed Claims Period

10 years from the Date of Final Order and Judgment.

**Excluded from the Class are persons who, while represented by counsel other than Class Counsel, resolved claims through full release, dismissal with prejudice or judicial action.*

Settlement Terms

Eligible claimants, upon proper verification and independent review of damaged siding or roofing will be awarded damages according to a Compensation Formula established by the Settlement Agreements, unless the damage is subject to one of the specifically agreed upon causation exceptions. Class Counsel's attorney's fees will be paid by the Defendants based on 13% of actual claims made and will not be deducted from Class Members' payments.

Your Rights

Complete information about your rights as a Class Member, the Settlement approval process, how to exclude yourself from the Settlement Class, how to object or comment on the Settlement, and how to make a claim for repair or replacement costs including important dates and deadlines is available in the Notice of Proposed Class Action Settlement for each lawsuit. To obtain a copy:

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The Honorable Robert G. Kendall, Judge of the Circuit Court

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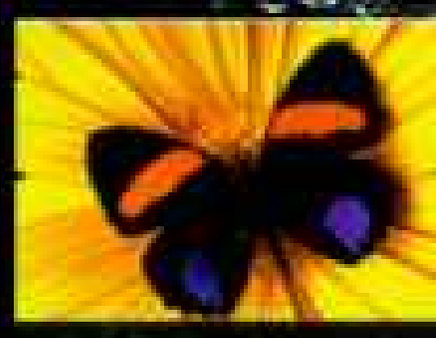

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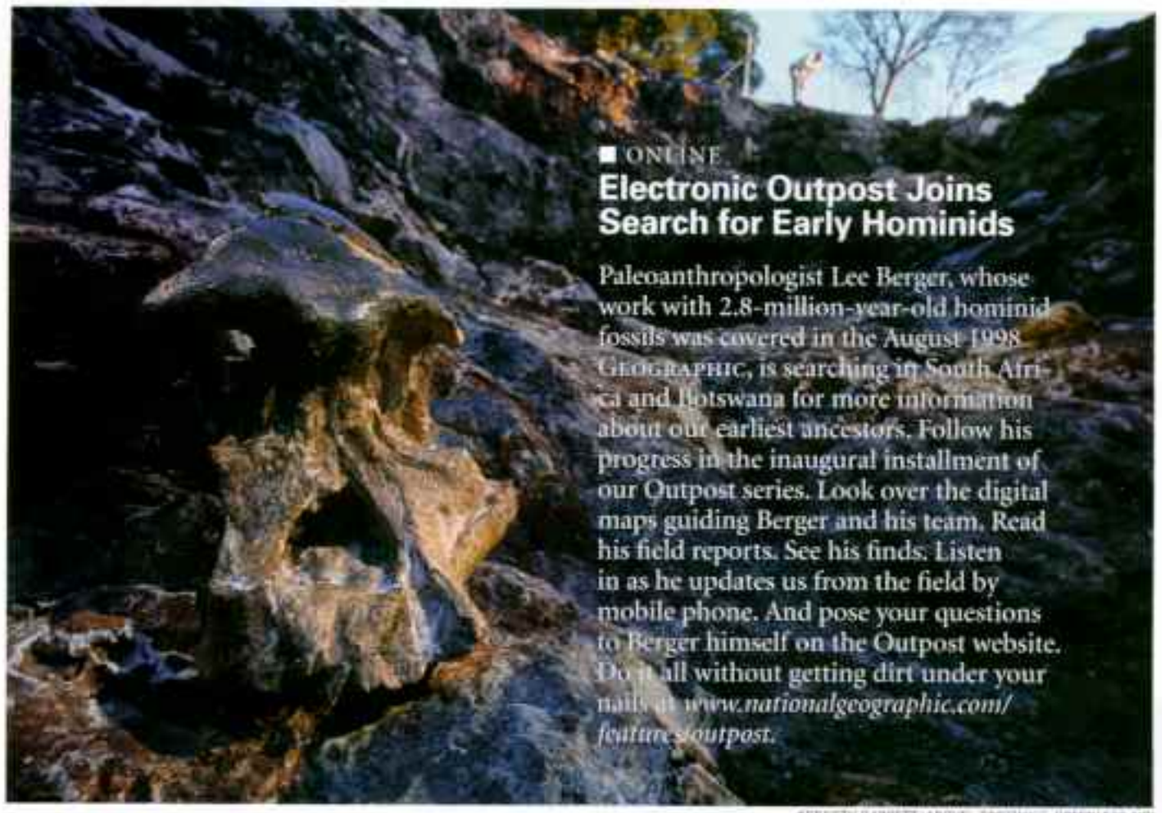

■ ONLINE

Electronic Outpost Joins Search for Early Hominids

Paleoanthropologist Lee Berger, whose work with 2.8-million-year-old hominid fossils was covered in the August 1998 GEOGRAPHIC, is searching in South Africa and Botswana for more information about our earliest ancestors. Follow his progress in the inaugural installment of our Outpost series. Look over the digital maps guiding Berger and his team. Read his field reports. See his finds. Listen in as he updates us from the field by mobile phone. And pose your questions to Berger himself on the Outpost website. Do it all without getting dirt under your nails at *www.nationalgeographic.com/features/outpost.*

KENNETH GARRETT (ABOVE); TIMOTHY C. GREENLEAF, MD

■ ONLINE

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NATIONAL GEOGRAPHIC

On Assignment

JOEL SARTORE

■ NEBRASKA

A Cornhusker at Home

"I grew up going to these festivals," says Nebraska native Joel Sartore (above), bellying up to shirtless "Chickendale" dancers at the town of Wayne's annual celebration of local poultry.

He may have made a career out of photographing exotic places for the GEOGRAPHIC, but Joel says Nebraska was his favorite assignment so far. "It was nice, for once, to sleep in my own bed."

Joel and his wife, Kathy, wouldn't consider leaving the state they grew up in. "We want our kids to be Nebraskans too," he says. Joel likes the gentle pace of life. "I don't even know if the horn on my car works. It would be considered rude to honk at somebody around here. You know the light is always going to change back to green."

■ A COMEBACK FOR THE COSSACKS

Cossack Costume Party

"It wasn't a good look for me," admits Gerd Ludwig (below), who joined in the fun while students were fitted for uniforms at the Royal Cossack Cadet Academy in Novocherkassk, Russia. The Cossacks were almost too helpful. "I went out to photograph them directing traffic one day," he says, "and there they were—in full parade costume. An officer had ordered them to dress up for me! Normally they'd be in fatigues. I shot some film to be polite," Gerd says, "and promised myself I'd come back later."

MAGNUM KOLLENTSOV

NATIONAL GEOGRAPHIC (ISSN 0027-9358) IS PUBLISHED MONTHLY BY THE NATIONAL GEOGRAPHIC SOCIETY, 1145 17TH ST. N.W., WASHINGTON, D.C. 20036-4688. $27.00 A YEAR; $5.00 A COPY. PERIODICALS POSTAGE PAID AT WASHINGTON, D.C., AND AT ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, P.O. BOX 63002, TAMPA, FLORIDA 33663-3002.