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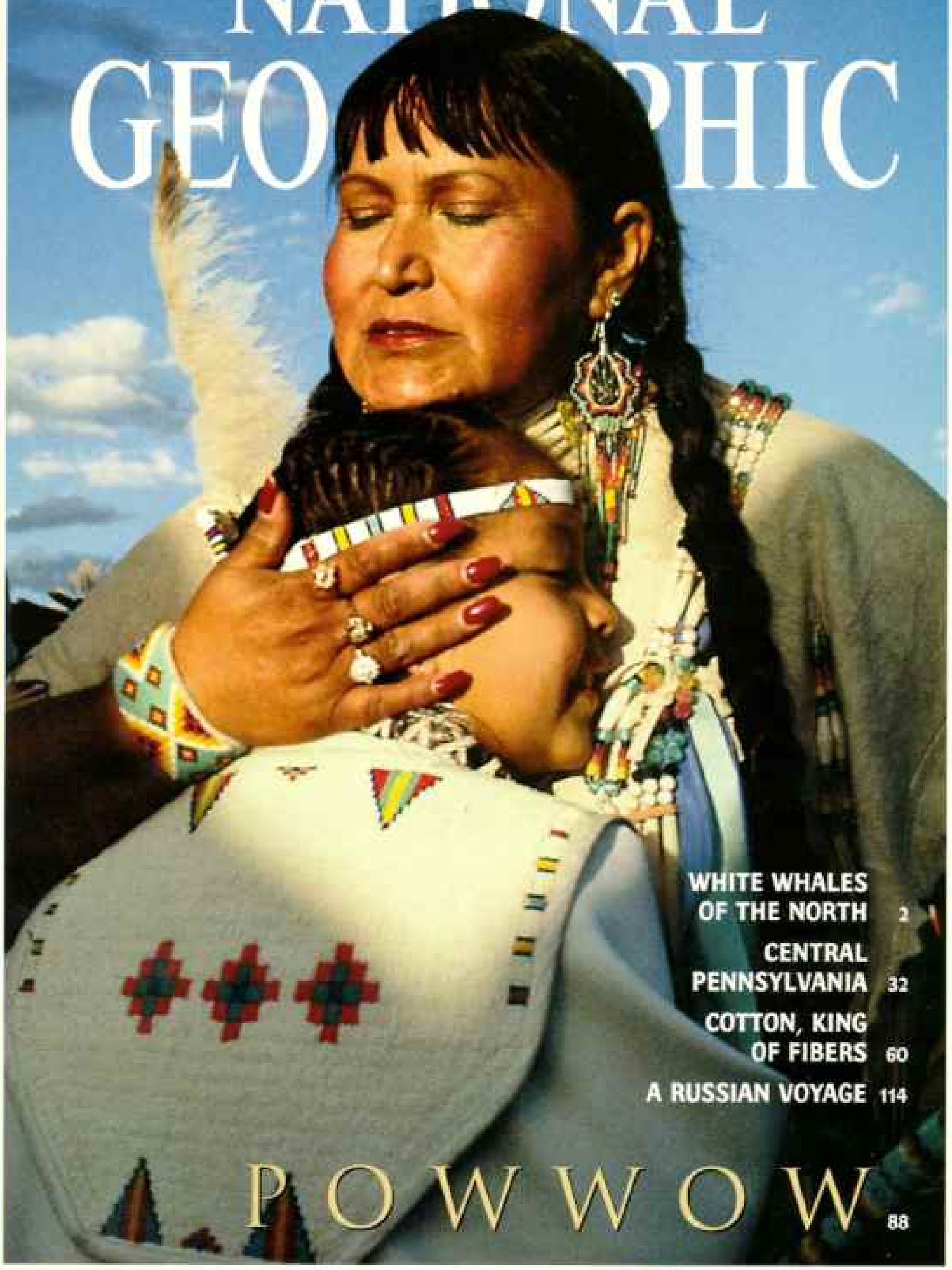

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COVER: A hug from Charlene Tsoodle-Marcus envelops great-niece Kimberly; both placed high in dance competitions at the Taos Pueblo Powwow. Photograph by David Alan Harvey.

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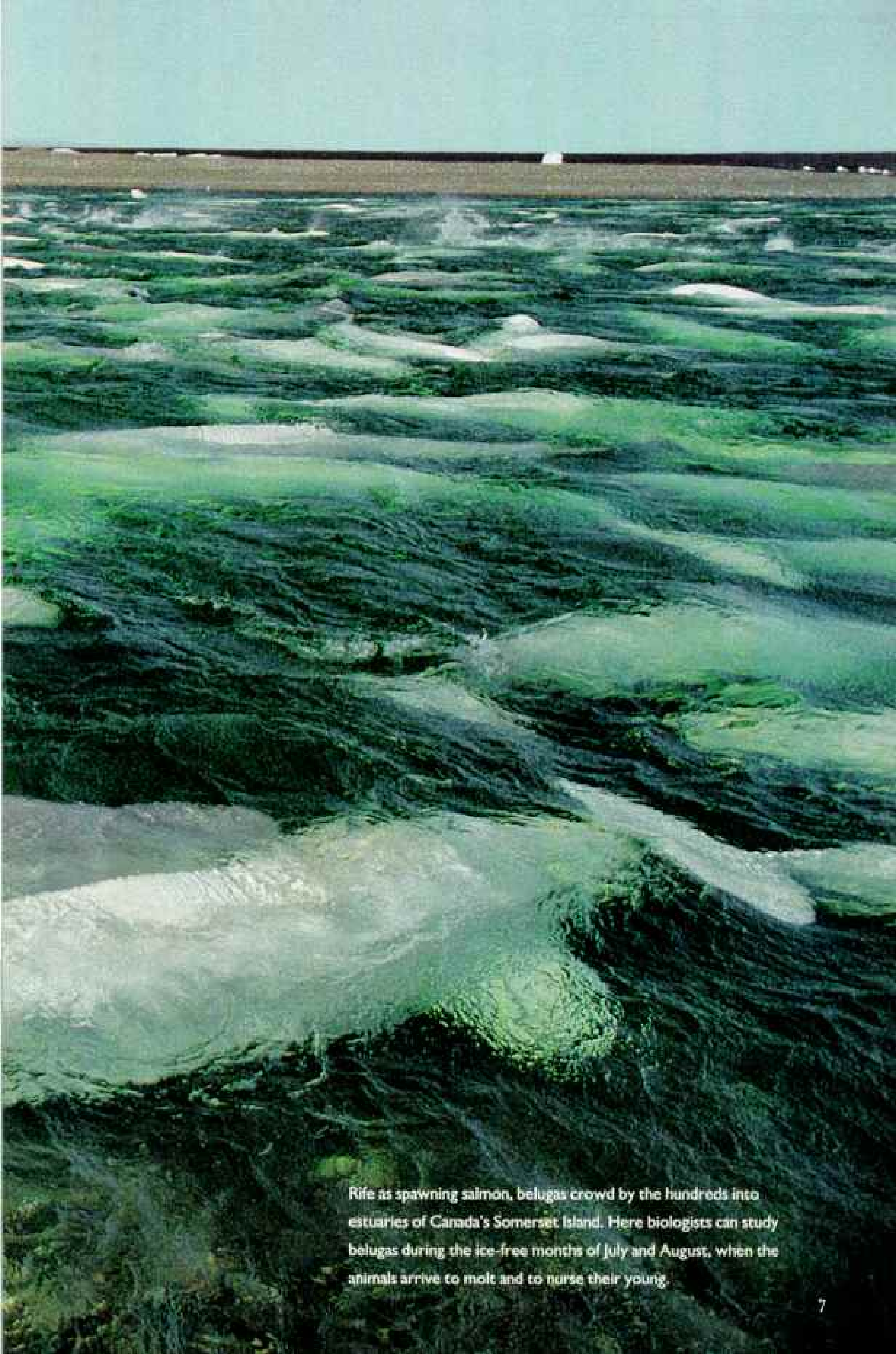
White Whale of the North

BELUGA

By KENNETH S. NORRIS
Photographs by FLIP NICKLIN

Luminous sentry in a sapphire sea, a beluga whale hovers upright, its curiosity piqued by a rare human intruder to Canada's Arctic depths. With its wry smile and flexible neck, the beluga is a whale of whimsy—small, white, agile, and elusive. Dwelling primarily in icy northern polar seas, belugas have been little studied. Scientists now strive to learn their migration routes—a key to detecting threats to the whales' survival.



Rife as spawning salmon, belugas crowd by the hundreds into estuaries of Canada's Somerset Island. Here biologists can study belugas during the ice-free months of July and August, when the animals arrive to molt and to nurse their young.

Unlike a fish out of water, a beluga whale stranded by a fast ebb tide breathes easy, resting unharmed until freed by rising seas. Landlocked belugas often "go absolutely dead quiet during their hours-long wait," says a seasoned whale-watcher. It's smart silence: Flailing may attract a lethal enemy, the polar bear.

PERFECTLY WHITE with dark lustrous eyes, the 12-foot-long beluga whale glided up and braked to a stop on the other side of a large window at the Vancouver Aquarium in Canada. Then he did a strange thing.

From the blowhole atop his head he slowly blew a big mushroom-shaped globe of air into the water. Backing away from the rising bubble, he extended his mobile, pursed lips and sucked it into his mouth.

Next the whale puffed the air back into the water ahead of him. He eyed his creation, which expanded as it rose. Then he matter-of-factly sucked it in again.

Not finished yet, he backed away a little and blew the air out once more. This time he nodded his head sharply downward, sending an invisible boil of water against the expanding bubble. It instantly became a twisting bracelet, shining and expanding until it began to break into flattened, rising spheres.

Then he sucked up the bubbles, pumped his flukes, and was off.

I didn't know what to think. In four decades of studying porpoises, dolphins, and whales all over the world, I'd never seen anything quite like it. Many animals engage in play, but this beluga seemed to be showing an interest in something more like art.

I'd watched belugas before, not only in captivity but also in the wild, but I'd never studied them seriously. Most belugas live in the icy Arctic, where only a few cetologists work. These scientists, in cooperation with native peoples and governments, have mainly done management studies to determine whether native hunting has harmfully reduced beluga populations.

But I was more interested in the beluga's personality and way of life. It seemed to be a wholly different animal from the marine mammals I know best. For 25 years I've

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KENNETH S. NORRIS is a retired professor of natural history at the University of California, Santa Cruz, whose latest book is *The Hawaiian Spinner Dolphin*. FLIP NICKLIN has photographed several whale species for the GEOGRAPHIC. The pair's most recent collaboration in our pages was "Dolphins in Crisis" (September 1992).

worked with the tropical spinner dolphin off the Hawaiian Islands. This open-sea dolphin avoids any obstacle, even a rope trailed in the water, as if its life depends upon it.

The beluga, by contrast, thrives amid the jumbled sea ice of the Arctic Ocean, dodging polar bears and killer whales. Swimming for a mile or more under the ice is nothing for a beluga, which, like Arctic seals or the giant bowhead whale, somehow manages to find or create openings through which to breathe.

These mysterious little whales intrigued me. So, with a spirit of adventure, I set out to visit my scientist friends studying the beluga.

THE NORTHERN COAST of Somerset Island high in the Canadian Arctic is a bleak, beautiful place of dark bluffs striped with snow. Strandlines pencil its shore like contour lines on a topographic map. The coast faces Barrow Strait, whose dark indigo waters are plated with gleaming white sea ice.

The ice up here is a part of life. The stuff seems alive, moving in the currents. One day leads, or open fissures of water, will extend for miles, and the next the ice will jam into the mouths of bays, locking them tight.

Tom Smith, a research scientist with Canada's Department of Fisheries and Oceans, invited me to visit his camp here. On a sunny day in July we looked down from a 25-foot-high observation tower to see some 1,700 white whales swimming in the shallow water of Cunningham Inlet off Barrow Strait.

"You're looking at almost 15 percent of the region's population of belugas," said Tom, who has discovered much of what we know about the whales in this part of Canada. His ginger beard and deeply lined face poked out of foul-weather gear. "If the ice is

Whale wranglers Tony Martin, Tom Smith, and Jack Orr, left to right, saddle a satellite transmitter to a beluga's back using nylon pins. "It gives your heart a jump start," says Orr of the tricky work in numbing water. Tagged at Somerset Island, this 15-footer was tracked for 86 days. Its signal eventually faded in Baffin Bay.

BELUGA BEARINGS

Favoring frigid seas, belugas can survive beneath near-solid ice, finding air in a maze of fissures. Scientists — who estimate as many as 100,000 belugas worldwide — monitor several distinct groups. The two largest, with more than 20,000 whales in each, swim the Beaufort Sea and the west side of Hudson Bay; dwindling handfuls ply Ungava Bay and Cumberland Sound. Hunting and chemical pollution may threaten some stocks.

right," he said, "they come here every year about this time."

Like a halo around the top of the earth, a population of 80,000 to 100,000 belugas ranges from Alaska, Canada, and Greenland to Scandinavia and Russia. As the sea surface freezes in winter, most of the far northern belugas move with the ice fronts, staying ahead of the congealing sea in great processions into the Bering Sea in the west and halfway down the coast of Greenland in the east.

Then in spring, when the winter ice begins to break up, the belugas parade back again, clustering at the newly opened Arctic river mouths. Along the way they feed on cod, squid, herring, and halibut; they also dive to the bottom to catch flounder and various crustaceans.

The belugas below us at Cunningham Inlet were yellowish white ghosts against the jade water. They wriggled against one another like tadpoles. The herd lay in a broad swath across the mouth of the Cunningham River. Many whales pounded their tails to keep stationary in the river's strong current, sending plumes of spray into the chilly air.

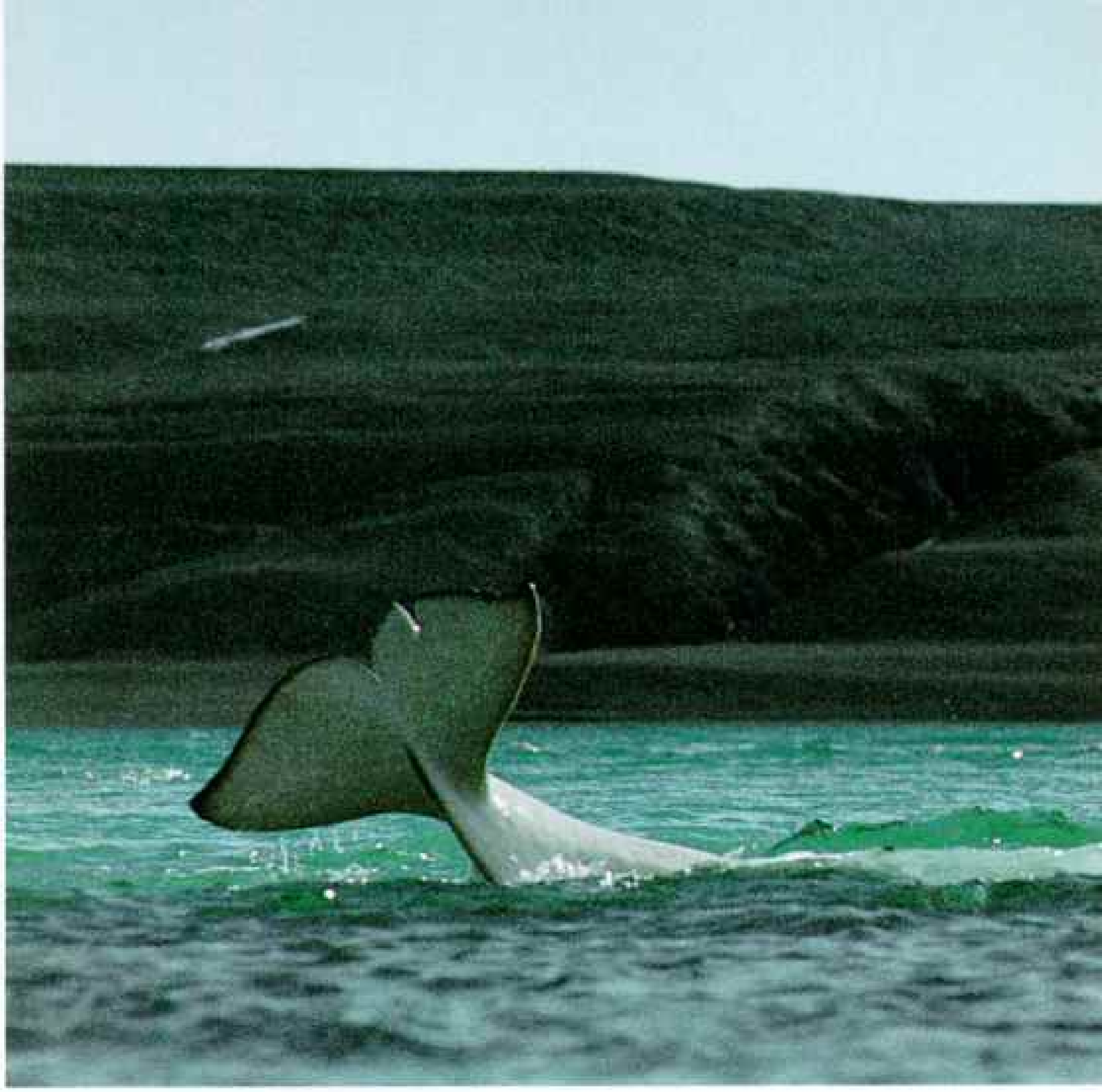
I looked almost directly down upon three mother whales tending their brownish gray young. A little one found a nipple on its mother's abdomen. Beluga milk can be eight times richer than cow's milk. Capable of supporting the baby's rapid growth, it quickly provides the young one with a warm blanket of blubber.

"Why do they all come here?" I asked.

"They're molting," Tom said. "Focus your binoculars on that one with the lemon yellow cast to its skin. It hasn't finished shedding." I could see tight little wrinkles of skin along the length of the whale's back. In a few days, it would turn white and smooth from swimming in the warmer freshwater and rubbing on the bottom.

Male belugas can reach lengths of 15 feet

Clogging a river vein on Somerset Island, belugas pour in from Peel Sound, at top, where they feed on squid and cod. Exposed in the shallows, belugas are wary. "One boot in the water can start a stampede," says photographer Flip Nicklin.



Its entire body a joyful grin, a beluga arches head and flukes to rub dead skin against limestone gravel in Somerset Island's Cunningham Inlet. Fresh, warm water in such estuaries stimulates the annual molt of wrinkled, yellow hides. "Skin comes off in floppy foot-long belts," says the author. Whales leave scarred, but renewed.

and weigh more than 3,000 pounds. Females are slightly smaller and proportionately lighter; they typically produce a calf every three years after reaching sexual maturity at around age five. The average beluga life span is thought to be about 25 to 30 years, during which time many are so wreathed in blubber that their round heads stick out from a ruff as if from the collar of a winter coat.

Though they have no back fin, which could be a terrible impediment under the ice, belugas do possess a long, low dorsal ridge of tough, fibrous tissue. Scientists in Russia report seeing belugas using their backs to break through more than three inches of ice to create breathing holes.

It may be hard for those of us whose feet get cold easily to understand how another mammal can live its whole life immersed in icy water. Yet the worst cold a beluga faces comes not from the water, but from the air it must breathe. During the black northern winter, the air may drop to minus 60°F, cold enough to turn a breath into a shower of ice.

John Burns, retired dean of Alaska beluga scientists, once told me of flying over the

frozen Chukchi Sea and spotting a herd of white whales in an open lead. The exhaled breath of each whale had built up a little dome of ice, like a tiny igloo over its exposed head, pierced by a hole through which the animal breathed.

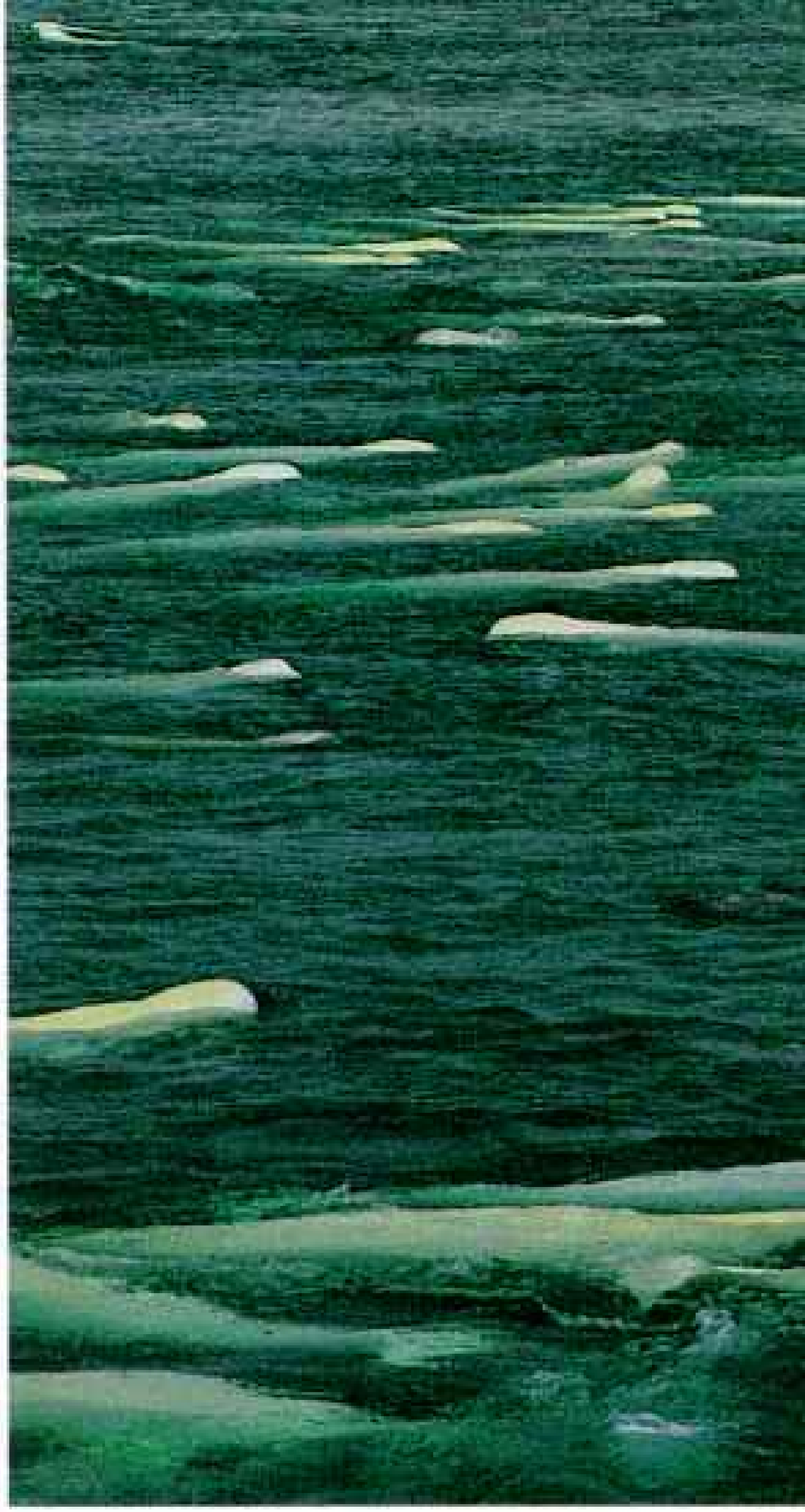
Belugas travel in a capsule of wild sounds, their lives spent in a symphony orchestra tuning up. As Tom and I watched, a deep tuba voice blared through the air, followed by a long, wavering tone, like a novice learning the trumpet, then a series of high trilling chirps, and the sibilant sound of exhaled air, a blat, a snore.

When I picked up a pair of earphones connected to an underwater microphone in the channel, I heard a cascade of clicks. The whales send these brief, sharp sounds out into their environment as sonar, using the echoes that return to help them navigate and locate objects. Mixed in were overlapping choruses of whistles, sounds cetologists believe are used to organize groups of whales.

Sailors in centuries past heard belugas through the wooden hulls of their ships and called them sea canaries. The first scientific attempt to analyze beluga sounds came in 1962. The study's authors, marine scientists Marie Fish and William Mowbray of the University of Rhode Island, nearly ran out of words, writing of yelps, clicks, creaks, canary-like whistles, blares, rasps, squawks, warbles, and trills. Such variety hints at the complexity of the beluga's experience, of birth, of nurturing and instructing their young, and of approaching death—the commerce of a seagoing life we humans can only dimly imagine.

Belugas combine these acoustic skills with a keen ability to adapt. At the mouth of the

Bellying up to gravel bars in Cunningham Inlet, male belugas float like froth on a brew. Upriver, a stranded group of females and their young await high tide and freedom (bottom right). One nearly grown juvenile with black-rimmed flukes assumes a nursing position, perhaps to take comfort while stuck. Born brownish gray, belugas nurse for up to two years and gradually turn white with age. Adults often remain segregated by sex.



Kvichak River in Alaska, site of the world's greatest sockeye salmon run, belugas gather every year to feed. Though the river is a murky maze of mudbanks and channels, where tides reach 20 feet or more, the belugas in the early 1970s were so successful that biologists worried about the salmon's survival.

To scare the belugas away, James Fish of the Naval Undersea Research and Development Center and John Vania of the Alaska Department of Fish and Game tried playing killer whale sounds underwater—clicks and long echoing screams. At first the belugas fled from the sounds of their natural enemies, swimming down channel toward the sea. After a time they returned but moved into other channels and took refuge behind submerged mudbanks to cautiously resume feeding far away from the sounds.

Tom Smith and I climbed down from the tower where we had been watching the whales, and I dipped a rubber-booted foot into the river's edge. The nearest whales, at least 30 yards away, reacted with a start, showing a sensitivity to sound far greater than even I had imagined.

"One more step," said Tom, "and they would have been gone."

Belugas also have what may be the most highly refined navigation system of all whale species. By emitting a stream of clicks in a narrow beam through the water, belugas manage to find their way in an environment replete with complex channels under the Arctic ice. They may even be able to listen around corners by bouncing echoes off the bottoms of floes.

They focus this beam of sound, some researchers believe, by changing the shape of the melon, or fatty organ on their foreheads. One moment this melon can be rounded and of normal whalelike contour, then the next it can be elongated like Pinocchio's nose until it completely overhangs the whale's snout. The beluga may focus its sounds just as you might twist a flashlight to focus a beam of light.

ONE GREAT MYSTERY about the belugas that come to Somerset Island each summer has been where they go the rest of the year. A team Tom Smith heads with Tony Martin from the Sea Mammal Research Unit in Cambridge, England, has tried to solve the puzzle by putting satellite transmitters on whales here in Canada to track them in winter, when no biologist has been able to follow them by ship or plane.

"We suspect the belugas go east across the

Bleached bones on Somerset's Elwin Bay are eerie reminders of 19th-century Scottish whaling. Choking off escape with flotillas, whalers trapped belugas in shallow inlets, slaughtering as many as 820 at once. Skin was sold for leather, oil for fuel and soap.

Today such commercial hunting is banned in North America. Native Inuvialuit of western Canada rely on a subsistence hunt of roughly 150 belugas each year for blubber, meat, and vitamin-rich skin, or muktuk. Cut like white diamonds to dry (above), muktuk is eaten raw or cooked. Effie Rogers (right), at her summer camp on the Mackenzie River Delta, rips an *ulu*, or woman's knife, through a flipper. Says Inuvialuit hunter William Day: "A family might take four whales and share some with elders. The hunt will never die. It's life out here."

TONY MARTIN (ABOVE AND TOP)

northern tip of Baffin Island, then continue to the west coast of Greenland where the sea doesn't freeze," Tony said. "But we don't know that yet. Large numbers migrate south along the Greenland coast each year, at about the time we would expect the belugas from Canada to arrive, and they're heavily hunted —about 700 animals are killed a year. If these really are the belugas from Canada's eastern Arctic, where native hunters kill about 100 each summer, then it could spell trouble."

Tom's camp was set up at Elwin Bay on the eastern side of Somerset Island. All around I saw a swirl of life. Magenta saxifrages, pale yellow arctic poppies, and prostrate willow trees were clustered in creases scribed across the stony land. A single sandpiper was trying to sleep near my tent in the perpetual daylight, while terns wheeled and called, and low-flying eiders strung out in flocks across the water.

We had just finished breakfast one morning when Tony came bounding down the gravel barren on a four-wheeler. "There's a whale where I think we can catch him," he said breathlessly, hopping off the vehicle to get a transmitter to attach to the animal. Tom and two other team members rushed to throw on dry suits and ran for the rubber boat, swooping up nets and tail lines as they went by. I ran across to the outer beach, arriving just as the boat did.

Tom and fellow biologist Jack Orr were both braced at the bow, one on each side, hoop nets in hand. A long white shape sliced ahead of them in the shallow water, and then the whale made an error, turning in toward the ice-edged beach. Jack leaped overboard and scooped a net over the whale's head. Tom left the boat and followed with the tail noose, which he deftly slipped in place over the flukes and cinched tight.

The two men then disappeared in a cascade of icy seawater as the whale sought to escape, beating its tail frantically. They tried to keep the hoop net in place. I raced down the berm to grab the tail rope, starting to pull the flailing beluga toward the beach.

Another team member took over from me, and soon Tony was pinning a transmitter the size of two small flashlights to the whale's dorsal ridge. The animal didn't even flinch. In about 20 minutes Tom and Jack pushed the beluga back into the channel. The next we would hear about the whale would be from Tony's lab at Cambridge, where his colleagues were tracking its radio signal.

DESPITE THEIR extraordinary sensory and communication skills, belugas struck me as terribly vulnerable when in shallow water, ripe for capture by humans and other predators.

One day at Cunningham Inlet as Tom and I sat watching the whales, Russ Andrews, a graduate student, ran up with an urgent message: "Pete Jess is on the radio about a bear kill." Pete, our neighbor on northern Somerset Island, had just flown over a hungry polar bear in the act of killing at least four belugas.

We scurried for a helicopter that, by chance, was in camp unloading gear. Tossing Tom's measuring and sampling equipment aboard, along with the camp's rifle, we lifted off for Cape Anne, about 20 miles to the west.

As our helicopter touched down on the gravel strand, I could see the shadowy forms of four whales lying in a still-water embayment behind the beach. They had been trapped by the dropping tide. One flopped its tail slowly up and down, breathing its last. The others were still. The whales were streaming blood, clouding a pool the size of a tennis court with red.

"When I first saw the bear, he was standing next to a young whale that had blood flowing from the top of the head," said Art Wolfe, a nature photographer who had been one of the first to reach the scene. "The bear had blood all over his mouth. He ran east along the shore, away from our airplane. I saw several more whales near the four lying in the water."

By the time we arrived, the polar bear had eaten a prodigious meal from the smallest whale. Now the bear was nowhere to be seen. Two other whales, apparently unharmed, circled nearby, keeping a somber station. Such "standing by" with injured or sick herd members is common among whales and dolphins, even when the lives of the waiting animals are in danger. Whales have even been known to press a stricken animal to the surface for vital breaths of air.

Tom and Russ pulled the dead belugas onto the beach. With a few awesome bites, the polar bear had ripped into the skin around each whale's blowhole and then begun feeding on the incapacitated animal. The technique was surgical and practiced,

Minced by the jaws of a prowling polar bear, a dead beluga lies inverted in the shallows. In this attack a lone bear killed four whales of a group trapped in a tidal pool on Somerset's north coast. Efficient as they are deadly, bears bite a whale's blowhole to disable the prey, then begin devouring skin and blubber.

and the thought of sharing the shore with so efficient a predator made me a little nervous.

The bear's capacity for killing, however, paled by comparison with the slaughter once carried out by humans for profit. On the rocky beach at Elwin Bay we camped just above whitened beluga bones spread in a half-mile-long arc. A team from Montreal's McGill University led by archaeologist James Savelle had pitched a camp here. Each day they trudged out among the bones—skulls, lines of vertebrae, and thickets of ribs—to map the remains of every animal.

"What happened here?" I asked, looking at a big skull now set in a lush flower garden of moss, saxifrages, and arctic poppies.

"Well, in the late 19th century Scottish whalers would herd belugas past the point over there at high tide, trapping them in the inner part of the bay and stripping their hides and blubber," Jim said. "In 1894 they killed 820 in one hunt."

How attitudes have changed. Back in 1894 every animal in the ocean was considered fair game. Now every whale species in the world is being watched, and in North America, at least, only subsistence hunters are allowed to kill belugas, or *qilalugaiit*, as the Inuit in eastern Canada call them.

Andrew Atagotaaluk, an Inuit hunter, was raised at Creswell Bay on southern Somerset Island. His father, Timothy Idlout, kept the family here rather than settle in one of the government villages established in the north in the 1950s and '60s. Timothy wanted to live in the traditional way, which meant hunting

Spared bulky dorsal fins that might snag on ice, belugas are nimble swimmers. New satellite data confirm that they can dive to at least 1,800 feet, popping up for air every 10 to 20 minutes. Migrating in small pods, they can travel 60 miles a day.

FLIP NICKLIN, MINDEN PICTURES

caribou, belugas, and narwhals and sharing the bounty with others in the camp.

"We catch narwhals just down from camp," Andrew said, pointing along the deep bay, "but the belugas are caught farther out along the north shore."

Hunters here take about ten belugas a year for their meat, blubber, and muktuk, or skin with a sliver of blubber. (They sell tusks of male narwhals, many of which are exported.) Native hunters from other villages in Canada's eastern Arctic take nearly a hundred belugas a year from the 12,000 that are thought to migrate to the area—about 15 percent of the number taken in Greenland, where hunting is only beginning to be controlled. In 1989 Canada and Greenland established a joint commission on the beluga and narwhal, which collects information on the stocks of whales that will eventually help the two countries regulate hunting.

A MORE INSIDIOUS THREAT to some belugas comes from industrial pollution. Far from Arctic ice floes, a remnant population of about 500 belugas travels up and down Canada's St. Lawrence estuary, where it is the focus of an environmental battle.

"A hundred years ago, there were at least ten times as many belugas here as there are today," said Pierre Béland of the St. Lawrence National Institute of Ecotoxicology. The original decline was due to overhunting. But even when commercial hunting stopped in the 1950s, after a series of bad years, the whales failed to recover. "Now they're just hanging on," said Pierre. "We're trying to find out why."

We boarded the institute vessel *Bleuvet* at Cap-à-l'Aigle, 80 miles northeast of Quebec City, and cruised out across the St. Lawrence channel, banked by the low forested hills of Quebec's Laurentian plateau. We were joined by Robert Michaud, who keeps track of the whale population for the institute. Soon we saw the gleaming white backs of belugas against the greenish water.

"Look at that one," said Robert, pointing to an animal swimming 50 yards away. "See those dark smears on its head? It's been digging in the bottom mud. We don't know why, but they do a lot of that here."

"Do they pick up poisons from the mud?"

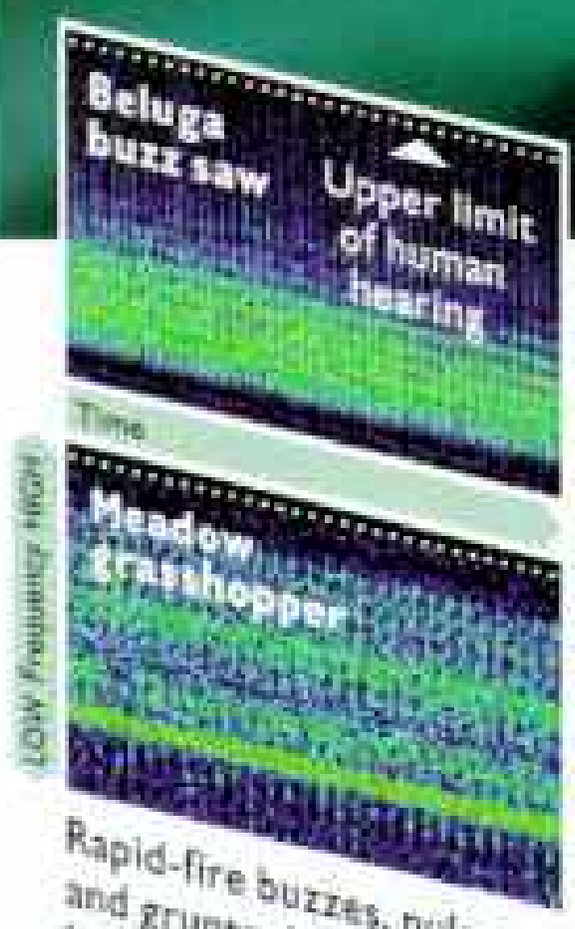
"It's apparently not as simple as that," Pierre replied. The *(Continued on page 30)*

SONGS OF THE SEA CANARY

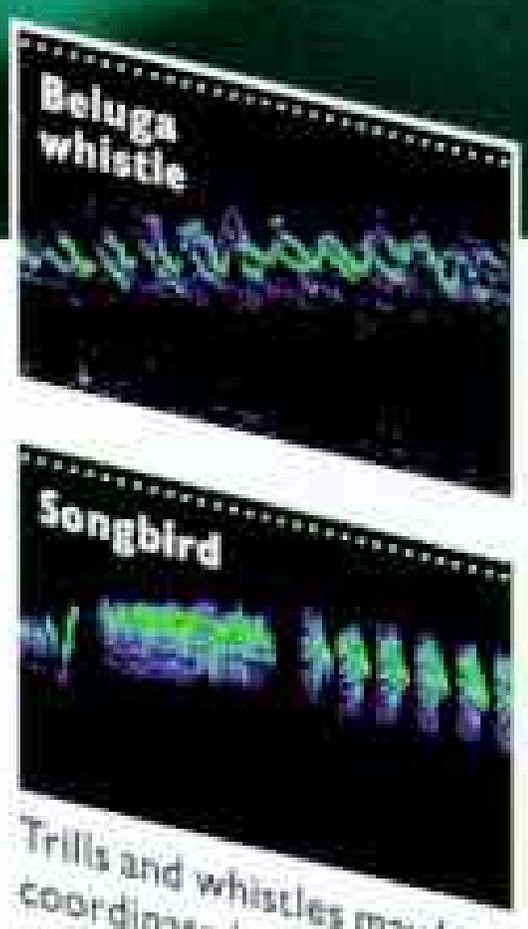
Awed by a white-whale symphony, sailors have dubbed belugas sea canaries. Biologists are still trying to learn how—and why—belugas broadcast their vast repertoire of croaks, whistles, and brays.

Many sounds originate from air sacs and organs adjoining the oil-filled melon in a beluga's forehead, as detailed at right. Fatty pouches (dorsal bursae) are embedded in lip-like structures that sputter as air shoots through them. Ted Cranford of the Naval Research and Development Laboratory in San Diego theorizes that the vibrations caused as the bursae slap together are then conducted out through melon oil. Belugas hear through oil lining the lower jaw that sends sound to inner ears.

Below are graphs of common beluga sounds and familiar sounds having similar patterns.



Rapid-fire buzzes, pulses, and grunts abound when belugas mill in a group. The cacophony may be a form of social chatter.



Trills and whistles may help coordinate herd movements. Scientists don't know how belugas make these melodic sounds.

Blowhole

Nasal air passages and sacs

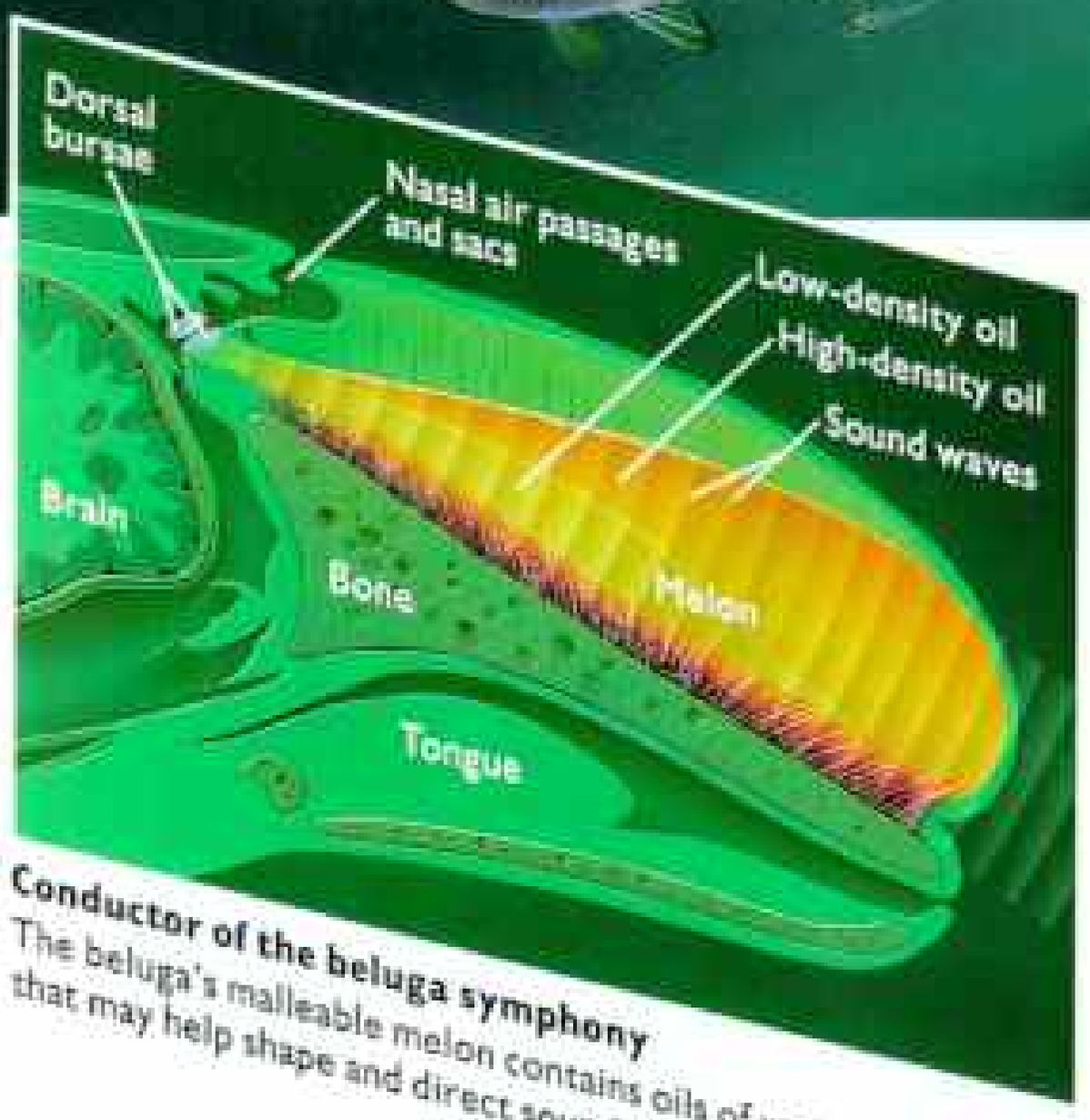
Skull

Melon

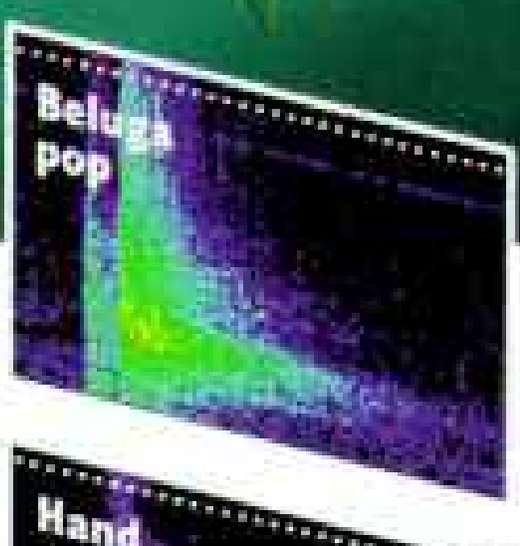
Lower jaw

Source of sound
"Lips" in the beluga's air passage help produce staccato sounds. Muscles control the sputter speed.

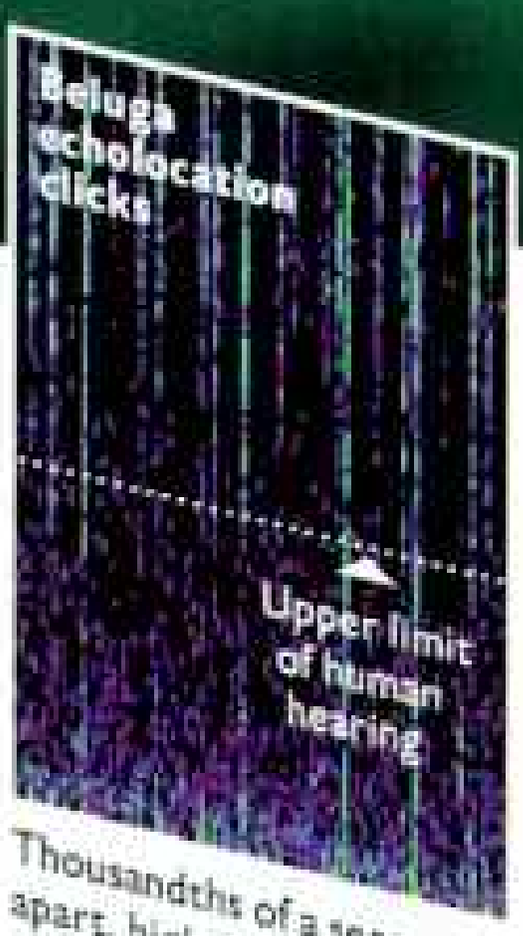
Muscles that alter melon shape



Conductor of the beluga symphony
The beluga's malleable melon contains oils of varied density that may help shape and direct sound waves.



This explosive bang signals aggression. Other whale species make a similar sound, apparently to startle and debilitate prey.



Thousandths of a second apart, high-frequency echolocation clicks act as sonar to help belugas navigate and target prey.

PAINTINGS BY KEITH KASNOT. SPECTROGRAMS AND SOUNDS PROVIDED BY WOODS HOLE OCEANOGRAPHIC INSTITUTION; LIBRARY OF NATURAL SOUND, CORNELL UNIVERSITY LABORATORY OF ORNITHOLOGY; AND CANADIAN DEPARTMENT OF FISHERIES AND OCEANS

Bloated by death—and a full-term fetus—a beluga towed to Tadoussac, Canada, awaits autopsy by toxicologist Pierre Béland. Cause of death: unclear. One possible culprit: pollution. Of an endangered population of some 500 belugas in the St. Lawrence River—isolated as glaciers retreated in the last ice age—15 wash ashore in an average year. Nearly all are heavily contaminated with a toxic stew of chemicals, which have come in part from farms, aluminum smelters (below left), and other industries along the river and its tributaries.

"These animals could qualify as hazardous waste," says Béland. Among dozens of toxics in beluga flesh is the pesticide mirex, banned since the 1970s but still found in eels from the Great Lakes, a common beluga meal. Of 68 whales autopsied since 1982, 40 percent had tumors; many suffered organ and reproductive problems.

"We're building a catalog of oddities," says biologist Robert Michaud (below), who, with Nathalie Boudreau, checks photographs for scars that help identify belugas in the St. Lawrence population. Michaud is not hopeful that herd numbers will rise; other experts remain optimistic.

Drifting like shards from an ice floe, a beluga cow and her calf navigate a strait near Somerset Island. Calves conserve energy by joyriding in their mothers' waves. Maternal bonds are strong: Cows have been seen pushing wooden planks for days, possibly as surrogates after a calf has died.

"You can tell winter is coming. It's a snow sky," says biologist Tom Smith, who saw this stately female, grounded in Cunningham Inlet, swim to freedom. When ice crusts this shore, the whales will be long gone. How many return depends on how far rifles, oil rigs, industries, and tourists invade the belugas' once pristine world.

(Continued from page 24) food the belugas catch carries the contaminants. For example, there is a big aluminum plant near here that once dumped waste containing a powerful carcinogen, benzo(a)pyrene, directly into the Saguenay River, which feeds the St. Lawrence. When a beluga ingests the pollutant, the chemical is quickly broken down, but traces called adducts remain bonded to the DNA of the whale, possibly causing tumors.

Pierre and his colleagues have measured high levels of adducts in belugas that died here. Other researchers, such as Michael Kingsley of Canada's Department of Fisheries and Oceans, are cautious when interpreting Béland's results, noting that his institute's scientists sample diseased animals and therefore don't know the incidence of adducts in the larger beluga population.

Pierre is undeterred. "We've detected more than 25 different potentially toxic contaminants in their blubber, including PCBs and DDT," he said. "Some of these were at levels rarely reported for a seal or whale."

Recently the institute's chemical sleuthing turned up another surprise in beluga tissue—a pesticide called mirex, banned in Canada and the United States since the 1970s.

"We researched the chemical and learned that it was manufactured upstream of the St. Lawrence near Niagara Falls," Pierre explained. There are few traces of mirex in the St. Lawrence. Instead, the pesticide appears to be carried to the St. Lawrence by eels migrating from the Great Lakes, where it's still found in sediment. These eels are then eaten by the belugas.

Of the 75 tumors ever recorded among the world's porpoises, dolphins, and whales, 28 have been discovered in St. Lawrence belugas, though the direct causes are still being debated by scientists.

THE FIRST REPORTS from Tony Martin's transmitters were disappointing. Unexpectedly, the batteries had given out early, before the half dozen whales he had tagged at Elwin Bay—including the one I had splashed around with—could be expected to reach Greenland. The whales had moved around Somerset and Prince of Wales Islands, then headed east toward Greenland along Canada's Devon Island shore. But the long traverse across Baffin Bay to Greenland remained undocumented.

Tony and his team went back to the drawing board, coming up with a new circuit designed to save power. The following season, transmitters featuring the new circuit were placed on nine whales—four in Canada's western Arctic and five in the eastern. The results, Tony told me when I saw him at Creswell Bay, were surprising.

"Look at these printouts from the belugas we instrumented over at Tuktoyaktuk on the Mackenzie River Delta," Tony said of the western group. "All the belugas in that area are thought to summer near the coast, then file back west along the Alaska coast. Well, look at this. Three of the whales went north, right into the heavy pack ice."

He put his pen point on one track. "This old male went northwest to about 79°N. There's more than 95 percent ice cover up there." He pointed at another track. "After we tagged this one, it turned northeast past Prince Patrick Island and has nearly reached where we are right now. That's almost 800 miles in what is supposed to be the wrong direction." He paused. "Every time I try to fix the limits of their range," he said, "they show me how little I really know."

In late 1993, Tony finally got proof of what he and Tom Smith had suspected: One of the whales he had tagged in eastern Canada reached Greenland, indicating that the two countries share the same stock of belugas. Yet much mystery remains—not only about the movements of the white whale of the north, but also about the deeper dimensions of its life. What we have learned so far suggests a creature of subtlety and nuance. What revelations await us when we know more of what goes on in the pellucid waters under the Arctic ice, where belugas sing their wild, enigmatic songs? □

Skies clearing, faces friendly, runs the forecast for the Milesburg bicentennial parade. From a pickup throne Verna Miles spots another smile among the 1,200 souls in this town founded in the Bald Eagle Valley by her husband's forebear in 1793.

Roots run deep in central Pennsylvania's ridge-and-valley country, which was tilled, built, and machined by European immigrants. The author, whose Irish kinsman arrived here from County Antrim in 1758, revisits the place of his youth and finds integrity, trust, challenge—and some surprises.

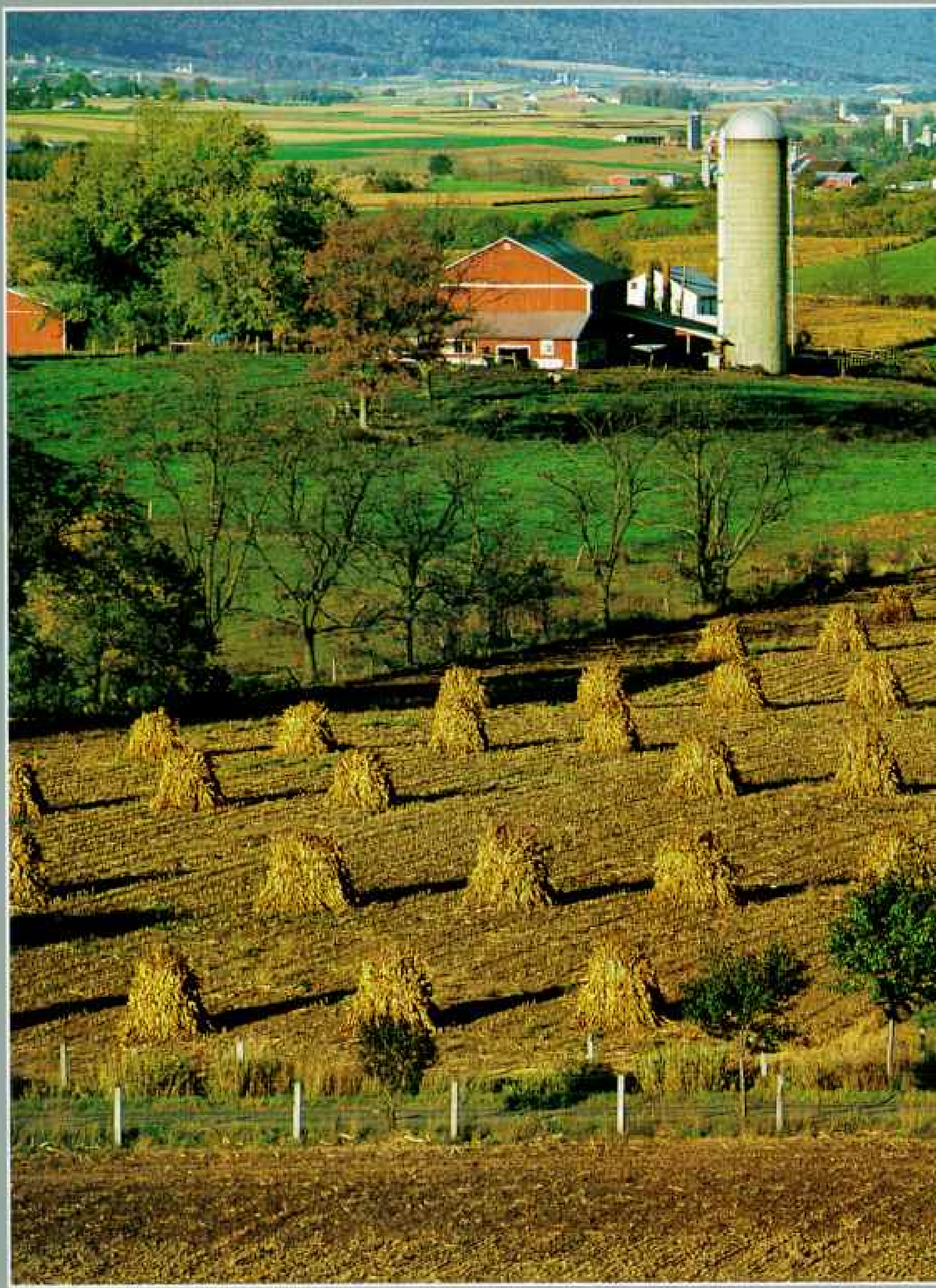
CENTRAL PENNSYLVANIA

My Home

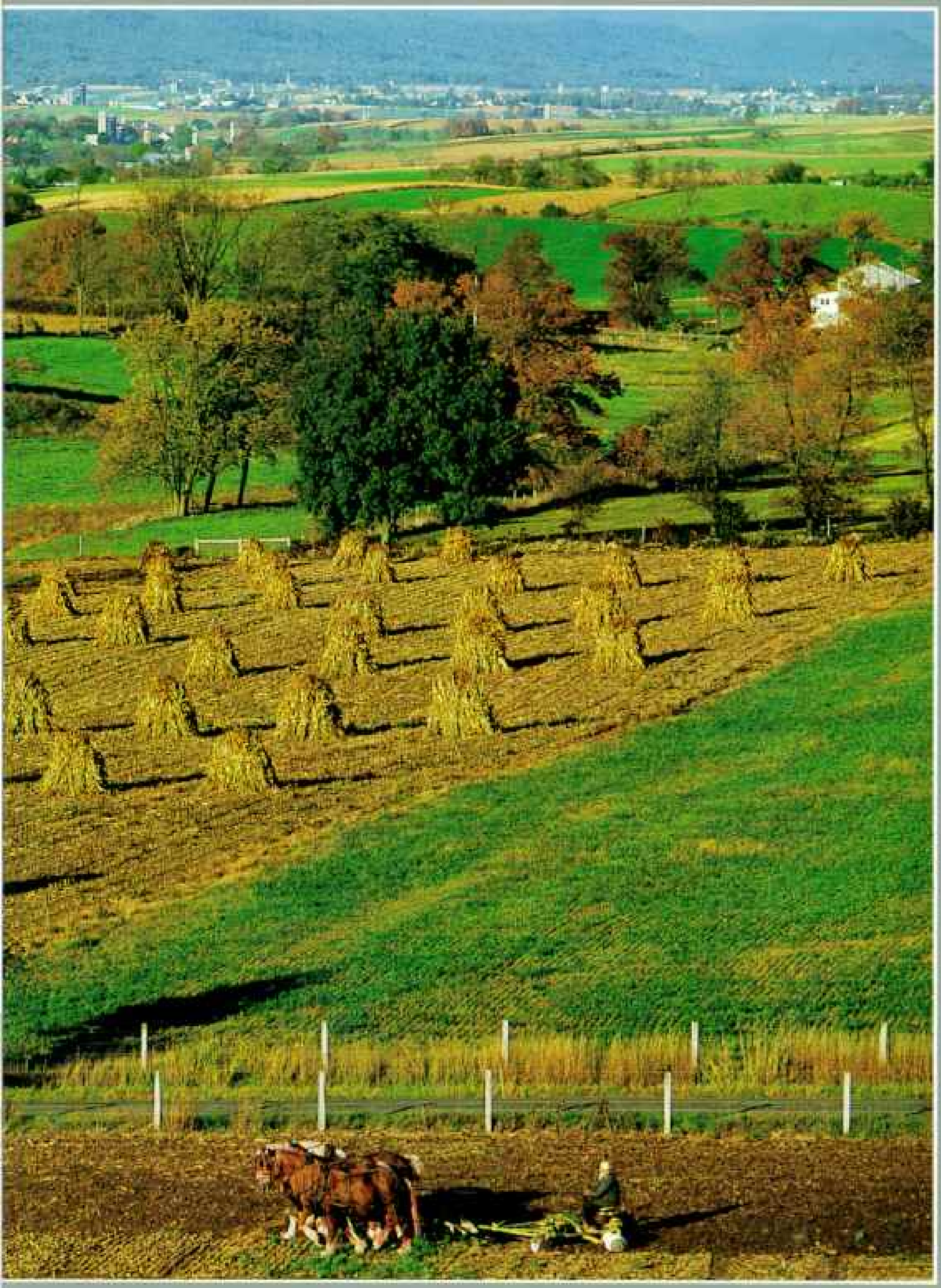
Place

By MICHAEL E. LONG
NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by
BILL LUSTER



Three-horsepower harrow needs no gas in Kishacoquillas Valley, or Big Valley, where Amish farmers make do with hoofs and hands. A flock of Amish teenagers shocked the field corn. Strong in community spirit and tolerant of others' viewpoints, immigrating Amish in 1791 planted the seeds of self-reliance in this region.



Rough but not quite ready for Pennsylvania's "smashmouth" style of football, youngsters learn the game in the Juniata neighborhood of Altoona, the author's hometown. His ancestors faced tougher tests without helmets—running Indian gantlets during the Revolutionary War.

IN MID-PENNSYLVANIA the Allegheny Mountains arch like wrinkles in a carpet. On a keen fall day atop Bald Eagle Mountain, Professor Peirce Lewis explains that here in ancient time a "hell-raising" collision of two continents begat an alpine range of Himalayan caliber, whittled by erosion to today's nubbins. "This is holy land," the Penn State geographer exults. "In these rocks you can see nearly from one end of the Paleozoic to the other." That's more than 200 million years of seeing.

He points across the valley to a bold escarpment called the Allegheny Front. Here the tectonic hell-raising ran out of wrench, demarcating central Pennsylvania's ridges and fertile valleys from a lumpish plateau trending toward Ohio, creating a boundary that defined human lives as well. "Behind the front people tried to farm and quit," Lewis says. Silently I think—"They dug coal instead."

For me, the front is an emotional boundary. I grew up in Bald Eagle Valley 30 miles from here in the city of Altoona. The known world extended up valley about 70 miles to Lock Haven on the West Branch of the Susquehanna River, a valley threaded by narrow roads, trout streams, and small farms with weathered barns tended by no-nonsense folk. It was bedrock America without trappings, not on any presidential candidate's must-stop list, but a fair place in the sun nonetheless.

After school, I left Altoona to seek opportunity, returning only to see family and friends. I have learned, however, that a sort of tether binds us to our birthplace. And when sprung by a restless urging, it finally reaches the limit of stretch.

In the grip of this urging, I revisited my home place and also explored its adjacent valleys as far as Lewistown in the east in a journey that brought insight as well as special surprise—an Amish man, in dress hat and vest, swirling down a country road on Rollerblades. In these domains I was refreshed by mountains, charmed by rural simplicities, bewildered by wary trout, and put to the test by, of all people, a gymnast from Kazakhstan. I grieved for my father and sought the truth in a family story about ancestors killed by Indians and British. I observed that, today, most folks here tend to abide by William Penn's advisement in 1681 to "live friendly."

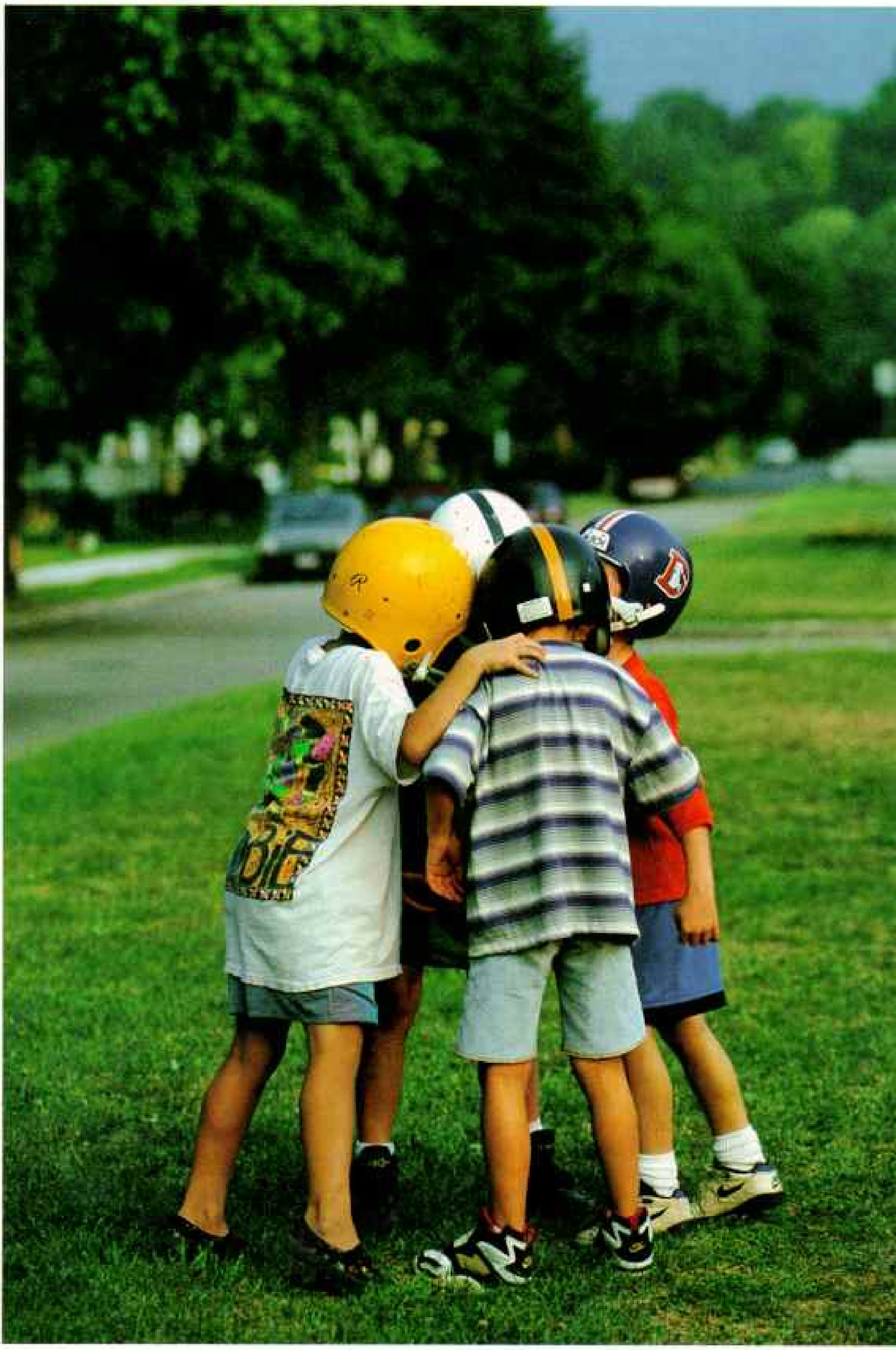
I began in Altoona, a railroad city that built freight and passenger cars and steam engines that, whistles shrilling, muscled trains over the Allegheny Front. My grandparents—Harvey a brakeman and Sadie a block operator setting switches—began their railroading careers near Summerhill, behind the front, and moved here after 1900.

Altoona had grease on its hands, beer on its breath, money in the bank, and wore dark clothes that never quite looked clean. After World War II the steamers were supplanted by diesels, full of efficiency, bereft of romance, and made elsewhere. As the city began to rust, various small industries kept a declining population in bread and butter, if not cream.

The horrific hills, some as steep as the 27.6 percent grade on 17th Avenue, still challenge. "No way I'm going to put a 26-ton fire truck up that hill," assistant fire chief Dick Saylor says. He explains that trucks bypass the steeper ones and attack from above with long hoses, like skeins of giant pasta.

My mother settled with her family on Dutch Hill, where they added their Bavarian name—Mittendorfer—to the roster of Wilmerdingers, Simendingers, Glashausers, Gerstbreins, Winklbauers, and other immigrant Germans. I wonder if they, or Altoona's Irish, Italians, or Poles, ever stumbled over the area's Indian names: Wopsononock, Chinklacamoose, Kishacoquillas, Cocolamus. I'm from a part of Altoona called Juniata, which outlanders regularly mispronounce as Juanita.

BILL LUSTER, on the staff of the *Louisville Courier-Journal*, was recently elected president of the National Press Photographers Association. His most recent story for the magazine was "A New Kind of Kinship" (September 1991).



I reminisce with a football-playing chum from high school, John Conlon, finally admitting that I found him irritating because he, a muscular guard, ran faster than I, a halfback. John recalls that once in a scrimmage we collided—"You busted my nose, remember?" I have no recollection of this, except that a doctor was telling me to quit football because of another concussion.

We played on Altoona's unique artificial turf—grassless soil blackened by cinders and soot from steam locomotives clearing their throats, a field of detritus now paved over for a shopping mall. In his pickup truck, John takes me to Altoona's new athletic complex at Mansion Park, where kids play on a gorgeous field of newer artificial turf, variety green.

Looking at the 12th Street bridge today, I remember the unusual man who walked over its unstable predecessor to an office where, holding a long-stemmed telephone, he directed the movement of trains—my father, Ed. He quit school after the eighth grade and began working for the railroad, there being mouths to feed and coal to provide at his parents' home. Because of my mother's continuing illness, he and I became a family of two very early. He sent me to a boarding school near Pittsburgh for eight years. Back and forth I chugged over the Allegheny Front a hundred times, never feeling connected to Altoona because I was always leaving it.

A STROKE felled my dad in 1980, took his speech, killed him a week later. I didn't get to ask him questions. I wanted to know, for example, where he learned to dress. In a photograph from the 1920s he wears a trim suit whose creases seem finger-cutting sharp, with vest, watch and chain, breast-pocket handkerchief, cuffed shirt, correct collar and tie, and fedora. He could have been in Paris, but he was in Juniata, where houses were unpainted and streets were unpaved.

My dad never had a car, traveling with such as Keats, Plutarch, Shakespeare, Douglas Southall Freeman, James Whitcomb Riley (a distant cousin), and his beloved *New York Times*. He was born to read and to discourse. With equal ease he could dramatically vignette the Battle of Gettysburg or the pummeling Jack Dempsey gave the French heavyweight Georges Carpentier—"Car-pen-TEER," my dad enunciated, never having studied French. He wrote natural, warm poetry in English, and he warmed my life.

To learn about the woods, I turned to my uncle, "Polly" George. In the 1920s Polly and his companions would head up Bald Eagle Valley by train, transfer to Hyner, and climb Hyner Mountain, killing rattlesnakes and nipping whiskey from small flasks. They walked miles, crossing the Coudersport Pike to deep woods and a ramshackle cabin with kerosene

Survivors of the Wednesday lunch rush, owners and staff at the Hay Loft Restaurant in Belleville ease up after feeding bidders at the livestock auction next door. Homes on Altoona's steep hills speak the same language: "Frnt pch w vu."


This is a Non Smoking Table
Table Closed

In sultry August when other anglers abandon the stream, Joe Humphreys, a former teacher of fly tying at Penn State, works the riffles of Fishing Creek with nymphs, taking and releasing fish almost at will. "Somehow, the trout do his bidding," says the author, himself a fly fisherman.

lamps, woodstoves, and a cold, indefatigable spring. They called it the Juniata Boone Rod and Gun Club—for short, Boone Camp.

Later Polly bought a car and began taking the family to Boone Camp. I remember pancakes and pinochle and butter-fried trout and the stricken look on some women's faces when they realized they had to make their first night trek to the outhouse a hundred yards away. Polly sneaked after one and impersonated a screeching wildcat. Retribution came on a moonlit night when he left the outhouse door ajar. A genuine wildcat looked in at him and growl-screamed, a sound which, at close range, can petrify blood. Polly ran, tugging at his petrified pants.

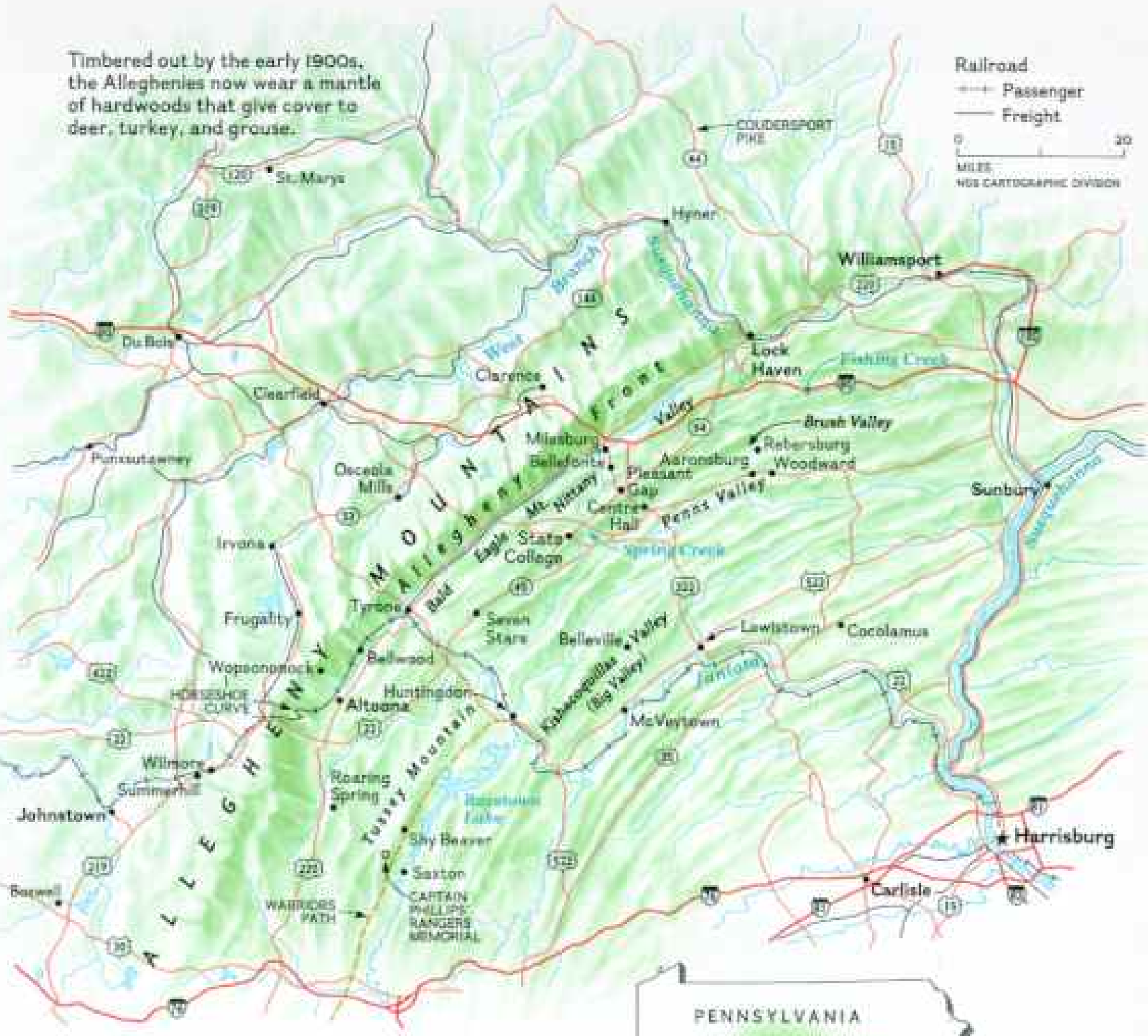
On the way back to Altoona, Polly would stop at Lock Haven, an old canal and lumber town, where an 86-million-dollar levee is now being constructed for flood control. The citizenry of Lock Haven divides into those who wanted the levee and those who didn't, and some of these folks do not live friendly.

"People called in the middle of the night and swore at me, warning me to get out of town," says the former mayor, beautician Diann Stuempfle, who favored the levee.

Bob Edmonston, who runs a sawmill, was later elected mayor on a crest of anti-levee sentiment. But contracts had been let, and the project had become a flood that swamped public opinion and left him with a bitter taste. "It had nothing to do with democracy," he says.

Behind the Edmonstons' riverfront home, a hydraulic excavator prepares the way for the levee, slithering like a crab on what remains of the backyard, compacting stones on the levee berm with heavy clanks of its steel fist. "I feel like I'm on a vibrating bed in a cheap motel," says Ginny Edmonston. Instead of seeing the river, as generations of Edmonstons have, Bob and Ginny now see an 18-foot-high levee and think of leaving.

William Piper, Jr., former president of the Piper Aircraft Corporation, whose home was bought and demolished by levee builders, is



building a new one high on a bluff, secure from all except biblical floods. He says, "It will probably take a generation for Lock Haven to get the animosity out of its system."

Ill feeling in a region that includes Pleasant Gap, Seven Stars, Bellwood, and Shy Beaver seems an aberration and is—most central Pennsylvanians do live friendly. Indeed, they may live friendliest in that part of Centre County some call Happy Valley, a metaphysical entity superimposed on real valleys—Penns, Nittany, and Brush.

Happy Valley has less to do with geography than with virtue. Stability and order pervade its environs, first tilled by immigrant Germans and Scotch-Irish, whose work-work-work ethic led to today's happy orderliness, tranquillity, and trust. Last year Maria Davison left her bed-and-breakfast in Brush Valley unlocked for two weeks, while she flew off to Germany to see relatives. Nothing happened.

To my citified senses, nothing much happens throughout Brush Valley. I observe that

The heart of Pennsylvania

Embedded in the Allegheny Mountains, central Pennsylvania seems "equally inaccessible from all directions," as newcomers put it. The mountains are relicts of a range that may have towered 25,000 feet after the collision of two continental plates 230 million years ago.

The Allegheny Front impeded westward commerce until 1854, when Pennsylvania Railroad engineers—aided by legions of Irish laborers with picks and shovels—fashioned an ingenious switchback called the Horseshoe Curve.

The first step off Hyner Mountain is a tall one for a hang-glider pilot—1,940 feet down to the West Branch of the Susquehanna River. In 1972 Hurricane Agnes dumped 18 inches of rain in three days, inundating often flooded Lock Haven downstream. A giant levee now girds the town and dares the river to try again.

"Happy Valley" goes delirious as 93,000 Penn Staters in Beaver Stadium demand victory over USC's Trojans. Before games, coach Joe Paterno fortifies himself with namesake ice cream made at the University Creamery—Peachy Paterno.

people plow, plant, cook, chat, clean, go over to McCoy's store in Rebersburg for an afternoon ice cream, until finally I apprehend that nothing has become something—the assembled mosaic of a country day, grander than its summed parts. In this valley scarcely three farms wide, the clock of life ticks so slowly that—in my opinion if not experience—the human aging process delays, as it is supposed to do for space travelers. After a weekend here, I always arrive in State College feeling a few minutes younger than city folk I know.

STATE COLLEGE is the home of Pennsylvania State University, a light in agronomy, engineering, and science, particularly meteorology. In a small office in the Walker Building, meteorologist Paul Knight peruses the *New York Times* weather page, which he and several colleagues have prepared since 1986.

"Oops, we lost Billings," he says. A student had failed to insert the name for Billings, Montana. Fred Gadomski presents another boo-boo, a forecast published December 12, 1990—"Tonight, some sun." Fred triumphantly explains, "We predict even the unusual events."

You can afford to be light when you are good, and Penn State is very, very good in meteorology, graduating more weather weenies—as many like to call themselves—than any other program in the country.

On this late summer day Lee Grenci is predicting that high-pressure Canadian air will cool New York City to 60 degrees from 90. Yet he worries about "big bust potential," whether jet-stream winds might stall the cold air and leave sweaty citizens angry at Penn State forecasters. Grenci says, "I've lost hair in this business." I call him next day. His forecast has been entirely fit to print. "You relish these victories," he says.

State College fattened after World War II, when veterans arrived in swarms, GI Bill in hand. The borough enjoys a harvest of high-tech industries and mansioned suburbs.

Meanwhile, in Bellefonte, the seat of Centre County 12 miles down the road, people chafe at brain drain and out-migration to their uppity neighbor. Founded in 1795, Bellefonte grew quickly prosperous and important producing iron and governors—seven to Pennsylvania and other states, including Andrew Curtin, who helped steel the North's resolve in favor of Lincoln during the Civil War.

Though the town hasn't yielded a governor since 1895, it musters Hugh Manchester, retired newspaperman and raconteur, to defend Bellefonte's role as the turning wheel of history in this neck of Penn's woods.

Hugh proclaims that Bellefontians succeeded General Custer after the Battle of the Little Bighorn, provided the Wright brothers with wire indispensable to the generator of the

airplane they flew at Kitty Hawk, entertained Ernest Hemingway and other expatriates in Paris, perfected the curve ball and pitched into baseball's Hall of Fame, and sang "After the Ball" for the first time in public.

The bearing of this news is gladsome toil, punctuated by chortles of emphasis. Hugh resumes: People born in or resident of Bellefonte invented the automatic voting machine, the electric light switch, the Tom Collins, the Cracker Jack box, the ice-cream cone—contested by St. Louis—and provided iron for the American fleet at the Battle of Lake Erie. "We have met the enemy and they are ours," Hugh declares, "with Bellefonte cannonballs!"

Much of this is true. I ask Hugh if it could be the water. Meaning the Big Spring, Bellefonte's gorgeous natural spring that has always watered the town's populace. Hugh shrugs. He has more shots to fire, but it's time to enjoy the town and its appealing mix of architecture: spired Gothic churches, a Greek Revival courthouse, the outrageously steep gables of the Brockerhoff Hotel, and classic Georgian houses—though city fathers allowed one of the best to be torn down in 1961 to make way for a gas station.

On a lustrous evening I attend a band concert at a park, where people listen in lawn chairs. I listen from a bridge over adjacent Spring Creek, tossing food pellets to giant trout, and I think—what a civilized place.

With my sense of wonder thus well tuned, I am prepared for the Grange Encampment and Fair at Centre Hall, which offers to view nearly a thousand large, military-looking tents

surrounded by more than a thousand camping vehicles. Unloading trucks, Centre Countians are filling tents with sofas, chairs, lamps, refrigerators, stoves, fans, and portable potties. It is humid August, and it's plain that heat, close quarters, and infrequent showers will be forthcoming at this unusual fair.

"If you don't like tent life, best not come," says Nellie Embick of Aaronsburg, in her 57th year of fairing. Nellie, whose carpeted tent is furnished with four beds, a table and chairs, a TV, two refrigerators, and a four-burner stove built for fair use, is waiting for 30-some relatives to visit and is ready to feed them. "We're a very close family," she says.

In truth, the Grange Encampment and Fair is a weeklong schmooze, an excuse for Centre County to catch up with itself, to converse on the little porches people build on their tents, to promenade, to attend all the birthdays, bridal showers, and anniversaries that seem to have been saved for this occasion. Suddenly, my colleague Bill Luster gets schmoozed.

Festooned with cameras, Luster has attracted the interest of John Strouse, 82, a retired farmer lounging on his tent porch in green suspenders and stocking feet, in a mood for teasing. "What're all the cameras for?" he asks. Luster replies that he is a photographer.

"Do you want some 'backy?" Strouse asks.

"I don't use tobacco. It might stunt my growth," says Luster, who is 4-feet-11.

Strouse leans forward, "Do you like whiskey?" Strouse's grin is getting wider.

"Not hard liquor, no," says Luster.

Strouse's next question politely translates—"You like women?"

"I'm very married."

The jaws of an old rhetorical trap spring shut—"Well, what good are you?" Strouse roars. Pleased with his drollery, Strouse declares, "I'm a jolly old bugger. When you're pushing daisies, you can't have much fun. I'm having mine now."

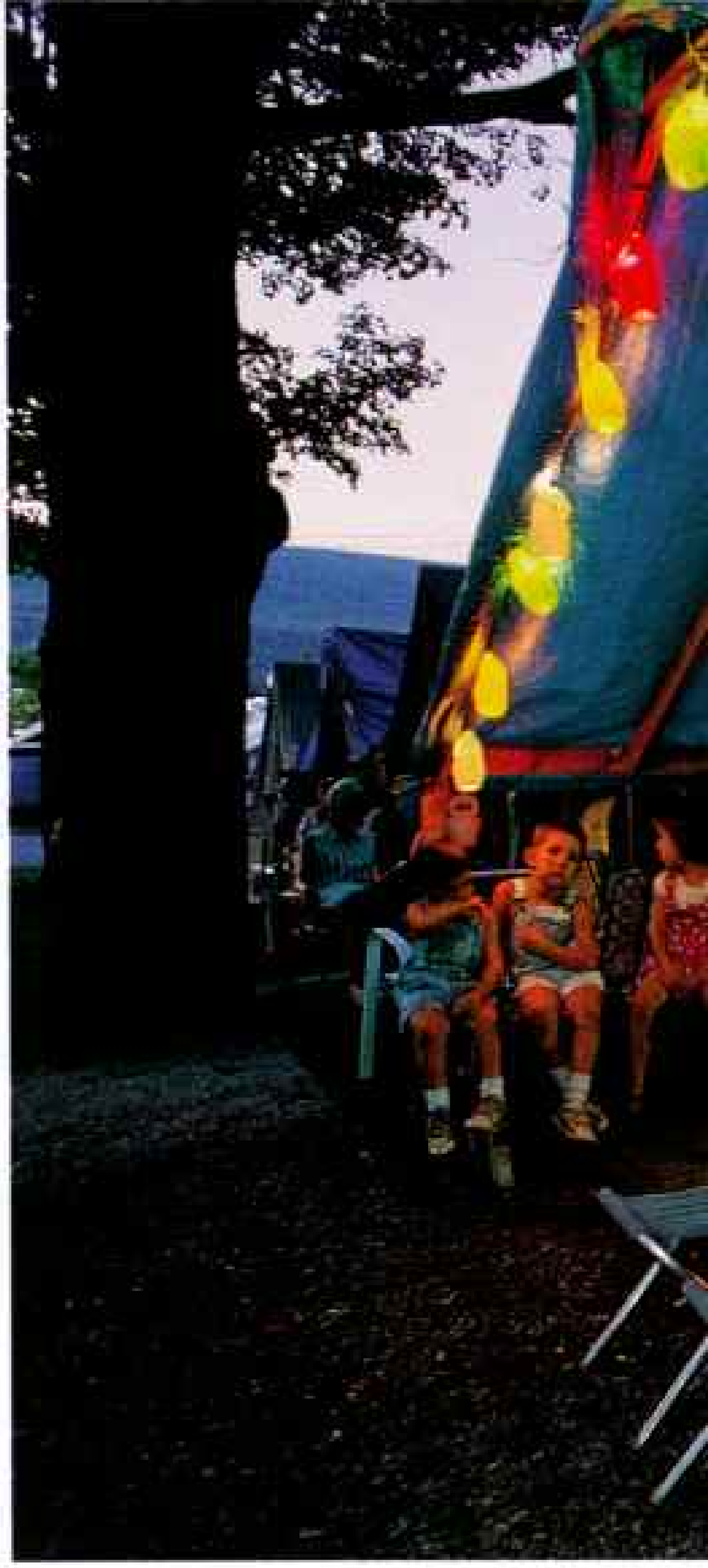
When I pass Sam's Dog House, a temporary restaurant, a familiar aroma captures me and leads me to an oilcloth-covered table inside. Soon I am relishing Phyllis Holderman's homemade potpie—squares of dough, potatoes, and her special broth of ham hocks, carrots, onions, and parsley. It is smacking good, spicier than the potpie my grandmother made.

"I grew up on potpie," says Phyllis.

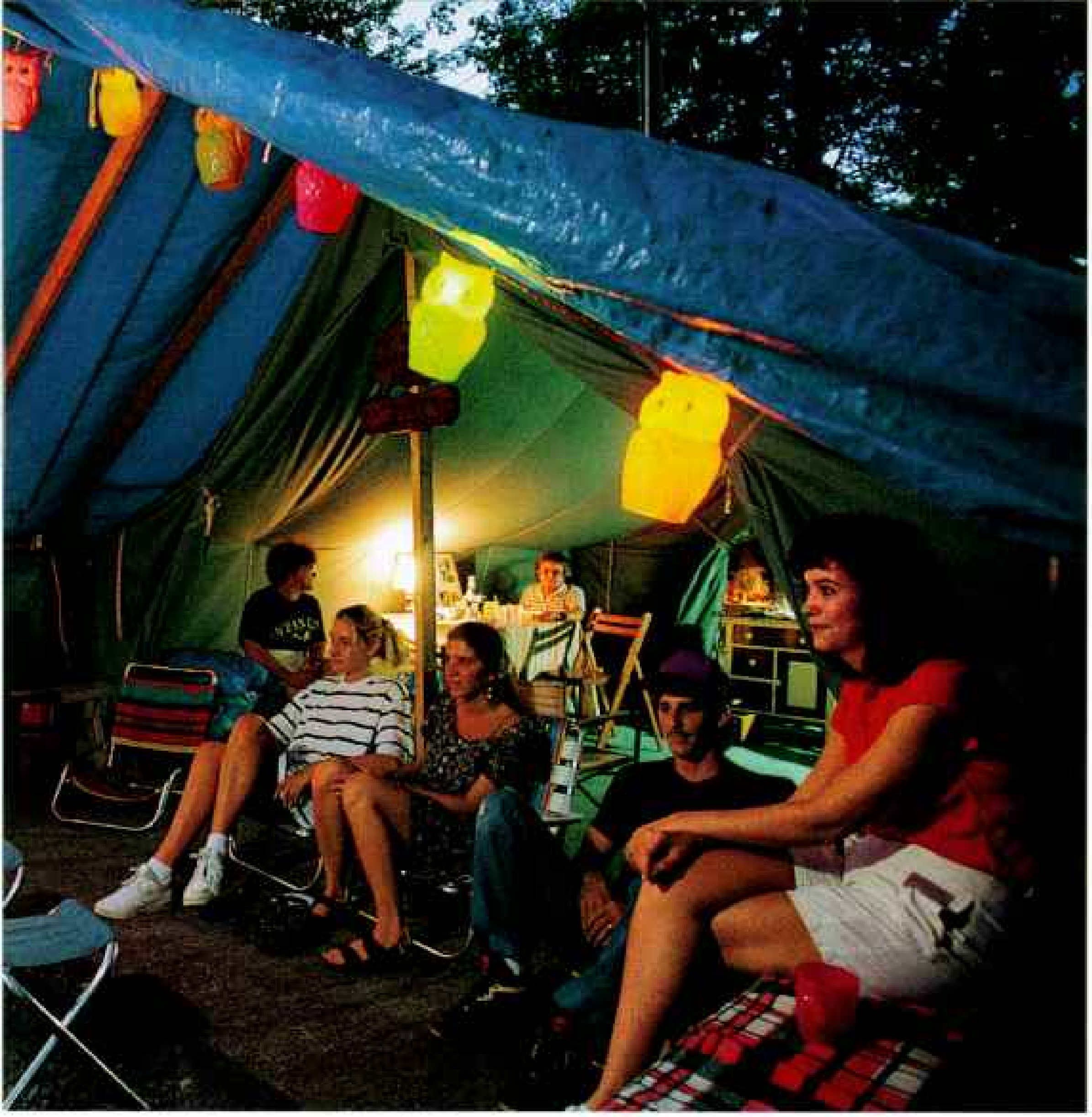
"So did I," I reply. "Thank you."

If you've forgotten clothing or hardware, or your fireplace, woodstove, electronic organ, or hot tub, you can buy those items at the fair. They sell tombstones too.

You can attend the tractor pull, where huge red and green machines chuff smoke and drag weight contraptions. Puzzled, I ask announcer Dennis Heggenstaller about the weight contraptions. He looks at me as if I've just flown in from Jupiter. "Haven't you ever seen this before?" he asks. "Don't you watch TV?"



They're back for the 119th year. Crowding tents and camping vehicles, seems like everybody in Centre County attends the Grange Fair at Centre Hall. "You just come," says a participant—for camaraderie, gossip, and Pennsylvania potpie.



On the beam at the Woodward Gymnastics Camp, where Olympic stars—some of them from the former Soviet Union—tutor young hopefuls, Jolene Tix pampers an ankle sprained three weeks earlier at home.

At tent number 8 on Cherry Tree Row, six double-decker cots are choked with 18 kids fighting sleep—the progeny, grand-progeny, and friends of Cathy Hook, Donna Reish, and Gloria Sendzik, who exert no pressure. The women—sisters—recall that their mother was satisfied if they were abed by midnight.

The sisters toss other fair memories back and forth—when someone rigged a storm window in the tent so Grandma could see out, when a skunk infiltrated, when the roof leaked rain and they had to dig trenches, when a green caterpillar fell out of the big maple tree into Uncle George's mashed potatoes. Uncle George never came back to Grange Fair, but you can bet his nieces will.

THE ALARM on my sense of wonder goes off again at the Woodward Gymnastics Camp, a youngsters' summer camp staffed by champion gymnasts near tiny Woodward in a cranny of Penns Valley. Director Ed Isabelle, a former Penn State gymnastics coach, explains that he and two other investors bought the site years ago. "They suggested I start a gymnastics camp," says Isabelle. "I thought it was a nutty idea until I found that the barn would accommodate a 42-by-42-foot floor exercise mat."

Here dozens of broad-shouldered, tiny-waisted kids, foreign as well as American, vault and tumble fearlessly into pits spongy with big cubes of polyethylene.

I meet Vitaly Scherbo, from Belarus, who won six gold medals in the 1992 Olympics, training here. Two of his fellow Olympians serve on staff, Vladimir Novikov, from Kazakhstan, a 1988 gold medalist, and Russian Alexander Kolivanov. Another staffer, 1988 American Olympian Rhonda Faehn, says, "I've trained all over the world. Woodward is unique."

Novikov has a contemplative face and a cajoling mind. He invites me to try the quad bungee, a catapult contrivance invented for acrobatic skiers and gymnasts to practice tumbling without killing themselves.

Imagine two sets of posts 32 feet high—like football goalposts—facing each other 20 yards apart. Taut bungees stretching from the tops of the posts are fastened on either side of the device's trampoline floor. Securely harnessed and attached to the bungees, you become the cat in a catapult cradle, explosively shot skyward at bungee release. At full travel the bungees tighten and sling you downward. Meanwhile, you are free to tumble, if so inclined.

Novikov repeats the invitation. At an age when calories tend to go south, I have little desire for this experience. Novikov persists. "It is safe," he promises, "and will improve your air sense," the ability to know which way is rightside up when you're upside down.

Who can resist that? Novikov and Kolivanov fasten the harness tightly around my waist and, grunting, attach the straining

bungees. I note that half the camp is turning out to watch the old man get launched. I am trying to appear calm. Everything is ready. "See you in hospital," Kolivanov jokes.

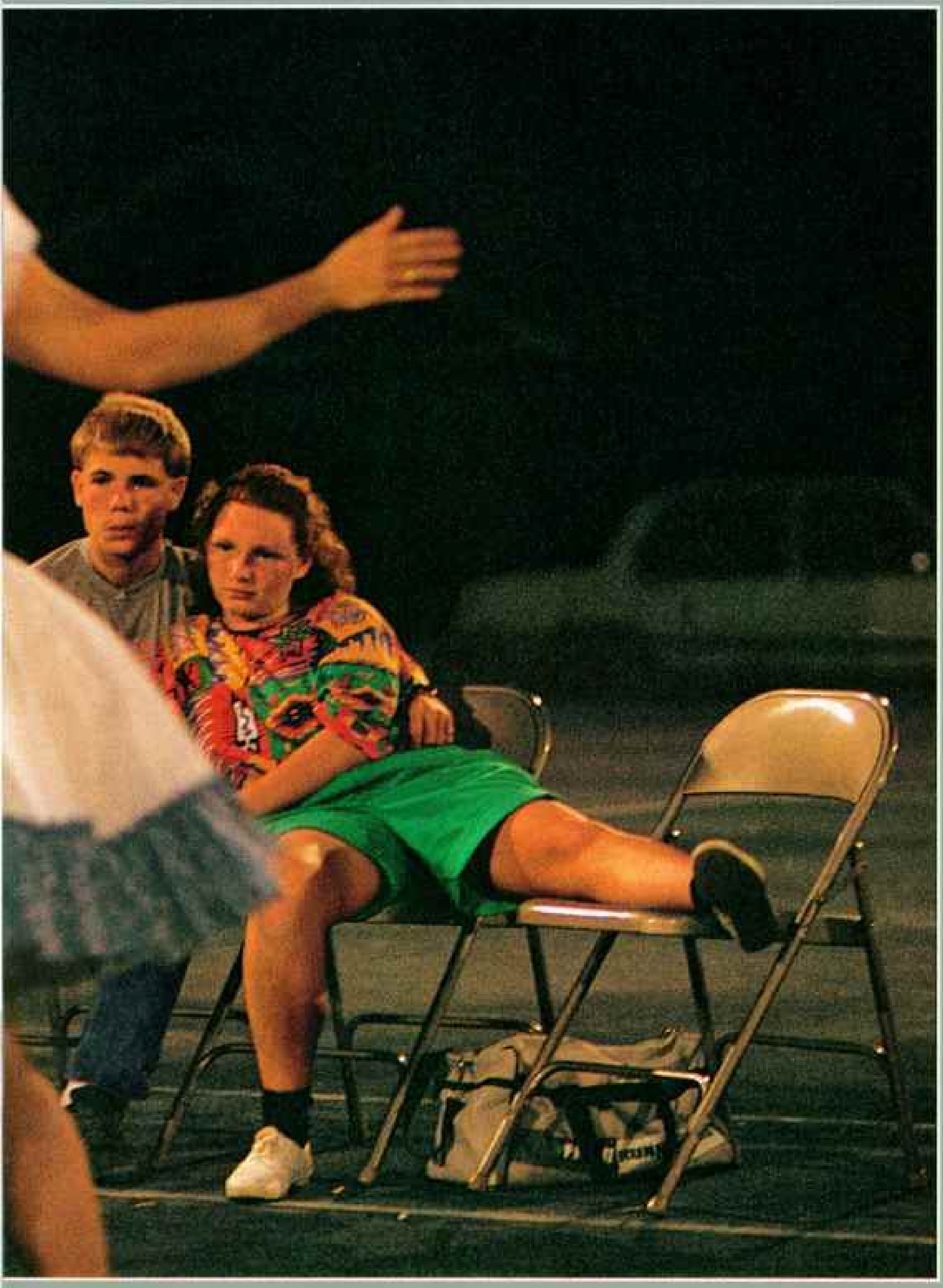
Zong! Suddenly I am 35 feet tall, groping for air sense, having a view of Thick Mountain over the snack building, feeling like a human field goal. The bungees tighten and hurl me toward my leaping antagonists, who grasp my ankles and fall into the trampoline to reload the catapult.

Zong! At the top I do a clumsy tumble. After some more slings I'm feeling shaky. I tell the launch team it's time for a final landing, glad news for camper Mary Corbett, who has waited patiently. Mary harnesses up and, *Zong!*, gives a master's lesson. Her tumbles number in the 30s when I stop counting.

THROUGH THE LIMESTONE aquifers of central Pennsylvania vast quantities of water course and, where gravity dictates, surface as springs, as large as the 11-million-gallon-a-day freshets at Bellefonte and at nearby Penn's Cave, where I take a boat tour. Guide Jason Faybik's voice booms in scripted cadence as we pass incredible rock formations—the Friendly Eskimo, the Hippopotamus Doing a Swan Dive, the Boy Chasing a Cow Over a Bridge. "I don't see that one," says a boatmate, young Jesse Leaman. Faybik pauses. "Neither do I."

Such springs deploy limpid streams inhabited by skittish trout that scatter like thieves at my approach. "You've got to keep low," says Joe Humphreys, my companion on Fishing Creek. Low means walking on our knees

Sitting one out, teenagers enjoy a square dance in Juniata, where railroads once called the tune. Nearby machine shops, built by the Pennsylvania Railroad before 1900, were among the largest in the world. Italian, German, Irish, and Polish workers built steam locomotives and railroad cars and repaired them when they broke.



through grass. I cast. My fly disappears, but the line does not tighten. "They're just bumping," Joe explains.

We proceed to another pool, which requires a stalk through shallow water. I'm on my knees, crawling over rocks in my hip boots, keeping very low. The water that suddenly floods my groin is very cold.

An expert fisherman, Joe taught fly tying and angling at Penn State, following his mentor George Harvey, a legend who caught big brown trout at night with a huge, hairy fly he invented. "I kept it secret for 15 years," Harvey told me. Then he told Joe.

"George said our friendship would be over if I revealed it," said Joe. That was before Harvey himself described in a book how to tie Harvey's Night Fly. Meantime, Joe used it to pursue a monster brown that had betrayed itself in Fishing Creek by an explosive splash—"like a tree falling," Joe remembers.

After three years Joe finally hooked the brute trout on a black night, grasped it in his arms, and threw it on the bank. He woke a fish warden, who said, "Joe, this better be good." It was, 15 pounds and 5 ounces of good, 34 inches long, the biggest brown ever caught on a fly in Pennsylvania.

Joe killed the trout, had it mounted, and somebody remarked that "a sportsman would have thrown it back." Joe responded, "A fish that big is a cannibal. It inhales catchable trout and should be harvested."

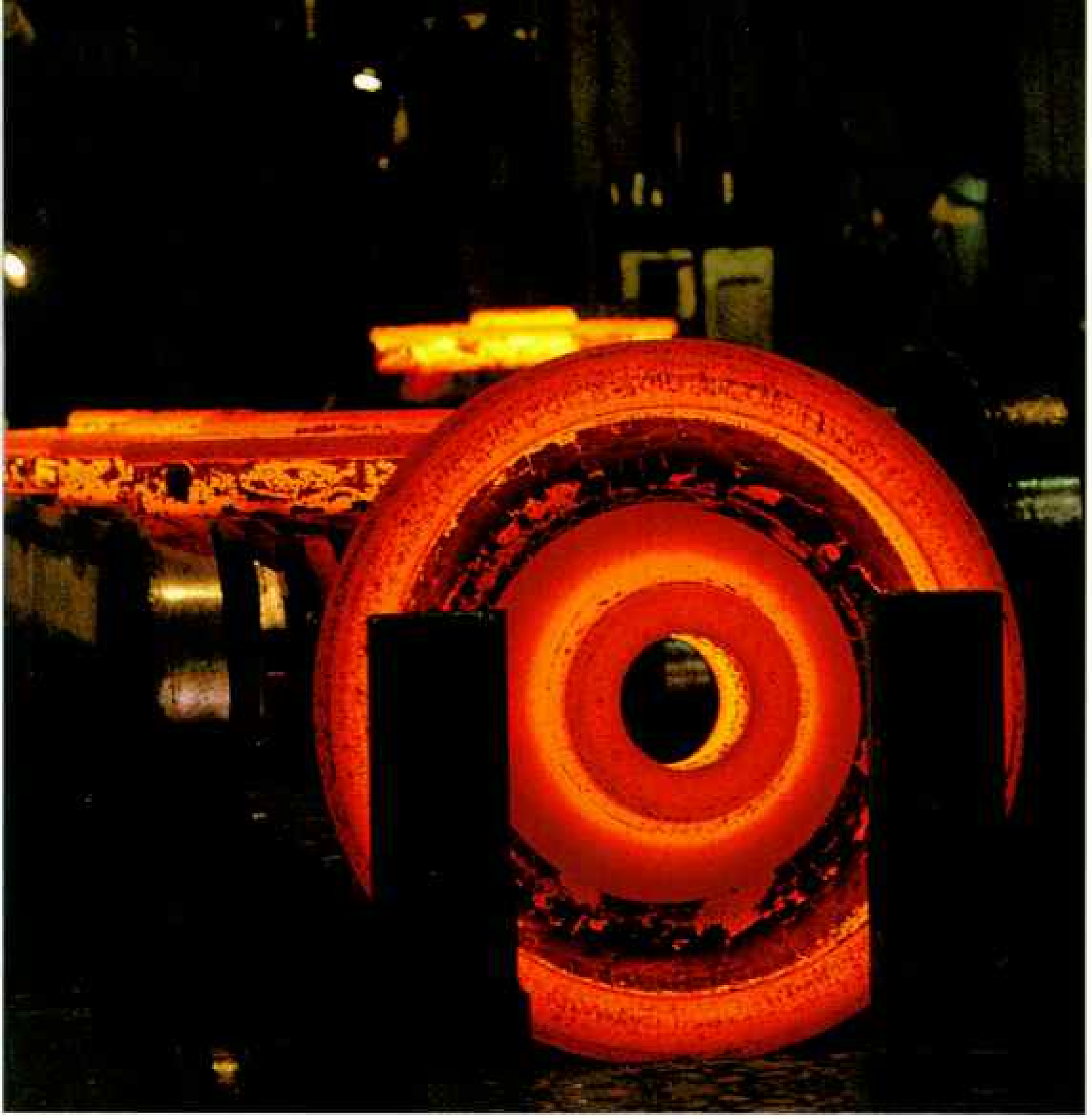
I never caught a big trout here, but Jim Strauss, president of the Spring Creek Chapter of Trout Unlimited and an empathetic man, takes me to a little bend in Spring Creek in late summer, when tiny mayflies arouse trout interest. Supple browns agree to be caught, and I agree to release them after admiring their golden bellies, red-and-white-stippled flanks, tails girded with red piping.

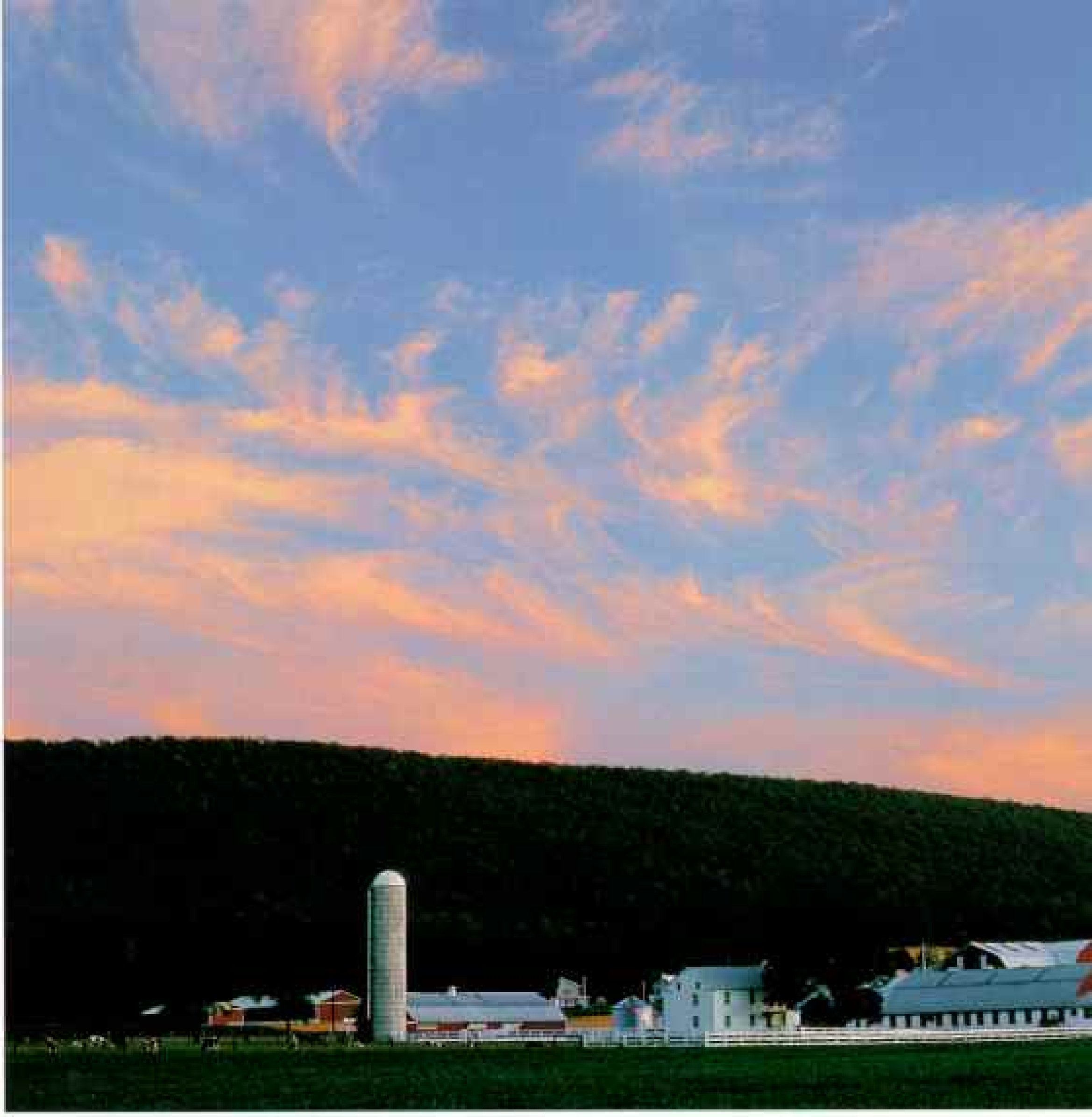
Except for a pristine middle reach owned by the state, Spring Creek is an urban stream, and it seems I am always fishing from somebody's backyard or factory. My special bend is ringed by a railroad spur, a highway, and a gas station. The trout don't seem to mind, except they cease rising whenever a Nittany and Bald Eagle freight train rounds the curve, wheels squealing like a thousand pigs.

Because of Spring Creek's urban setting, the stream and its tributaries are prey to pollution. Robert Carline, of the National Biological Survey, keeps a list of toxic materials dumped in the river in the past 40 years: Sodium cyanide, butyl alcohol, gasoline, kerosene, fuel oil, zinc and other heavy metals, PCBs, sulfuric acid, toluene, chlorine and chlorinated pool water, latex paint, canning wastes and pesticides, raw sewage, and lead, killing hundreds of thousands if not millions of fish.

Why am I catching nice brown trout in Spring Creek? It is an enormous irony. "The spills soon flush downstream," explains Carline, "but contaminants stay in sediment

Red-hot and soon ready to roll, a railroad car wheel takes shape at Standard Steel near Lewistown. The Conrail main line in Altoona awaits the day's rail traffic—and the buffs who come to watch.





and find their way into trout tissue via the food chain. So the state prohibited anglers from keeping the fish. The wild population was free to expand and more than doubled. Not many streams east of Michigan have more trout than Spring Creek." But you still can't eat them.

I HEAD SOUTHEAST to Kishacoquillas Valley, or Big Valley, so called because it is 30 miles long and up to nine farms wide. My destination is the K-n-Y store—for owners Kanagy and Yoder—an Amish general store in Belleville, to stock up on Amish grapenuts.

As I enter the parking lot, a little blond sprite in a blue dress bounds from the plain, wooden store and, barefoot, traverses walnut-size gravel as if it is carpet. At my fender she stops and raises her right arm. I brake. Eyeing me, she leans as if ready to sprint. I have a thought and raise my right arm in sympathetic image to hers. She smiles and flies down the road—I have finally acknowledged her wave.

The store is not much larger than the first floor of most people's homes but offers varied fare. After securing the grapenuts, I count nine kinds of flour and an infinity of candies, including root beer barrels, atomic fireballs, cinnamon hearts, smile rolls, horehounds, smarties, jelly beans, nonpareils—and pumpkin seeds. There is grand ola and natural ola cereal. The difference, I am told, is that natural is made with honey, grand with sugar.

I see a stack of wide-brimmed, Amish-style straw hats, which seem useful for hot-weather fishing. When I try one on, a sudden question

How wide is my valley? Tiny Brush Valley stretches just a mile and a half between Brush and Nittany Mountains. So does one of the region's large dairy farms, justifying its name—Valley Wide.

On Big Valley roads, clopping horses pull Amish buggies with white tops, yellow tops, and black tops, denoting degrees of conservatism, white being the strictest. On a white-buggy farm 14 cows are considered sufficient, and they must be milked by hand; no electricity is allowed, no unnecessary adornments like window curtains. A congregation argued whether to remove an eight-inch roof overhang on a bought farmhouse. Some considered it adornment. Some didn't. So they split.

Facing persecution during and after the Reformation—the price of their preference for adult baptism—many Amish and their more liberal counterparts, the Mennonites, fled Europe for the U. S., arriving here in 1791.

At a weekly auction attended by farmers of all persuasions, auctioneer Mark Glick intones the virtues of pigs, goats, cows, and hogs. When two pregnant sows waddle into the sawdust ring, Glick notes, "Looks like the table is set, boys, eight plates on a side." The bidding is as subtle as a twitch of a little finger. An English farmer gets the sows for $340.

At the Charolais Restaurant I discover a Bible in the men's john. Owner Susie Smoker says she tries to keep a dollar bill in the Good Book to separate saints and sinners. I meet David Koons, manager of Fairmount Foods, who says he takes in 2.5 million pounds of Big Valley milk a week. Fairmount produces 18 million pounds of cottage cheese a year under 40 different labels. "It's all the same cheese," Koons says.

In September I visit the one-room Green Gate Amish school off Back Mountain Road, named for a nearby farm's green gate. Here Frona Hostetler teaches 21 youngsters in grades one to eight. Near the blackboard hangs a flyswatter and a windup alarm clock. By twos and threes, pupils march to front desks to do sums, count syllables, and spell.

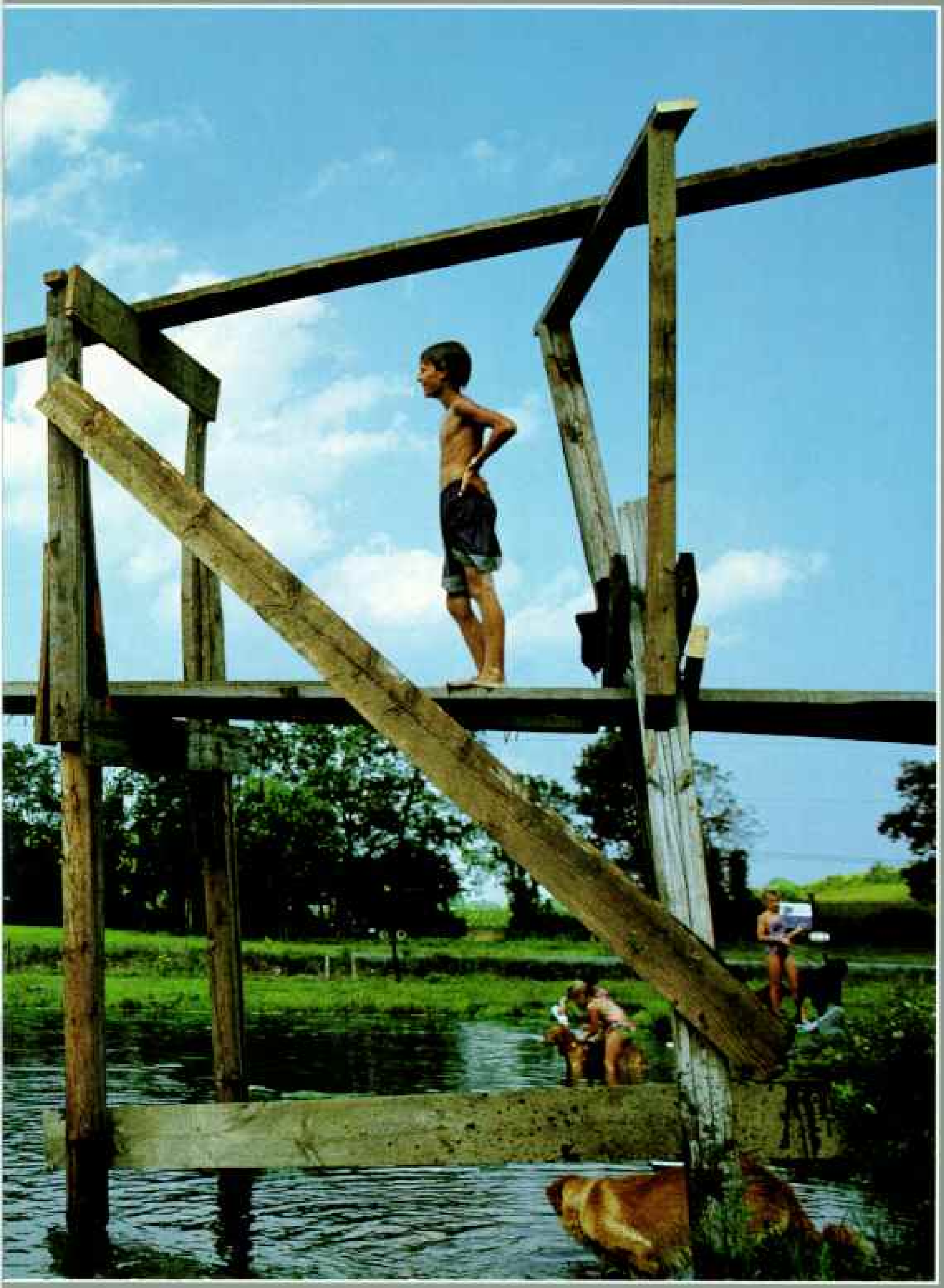
Round-faced Emma has been in school only two weeks, but she is confident when Frona asks her to count to a hundred and needs only one assist; Frona hovers over the child with back carefully bent. The class is well behaved, but don't you test Frona, whose circle of

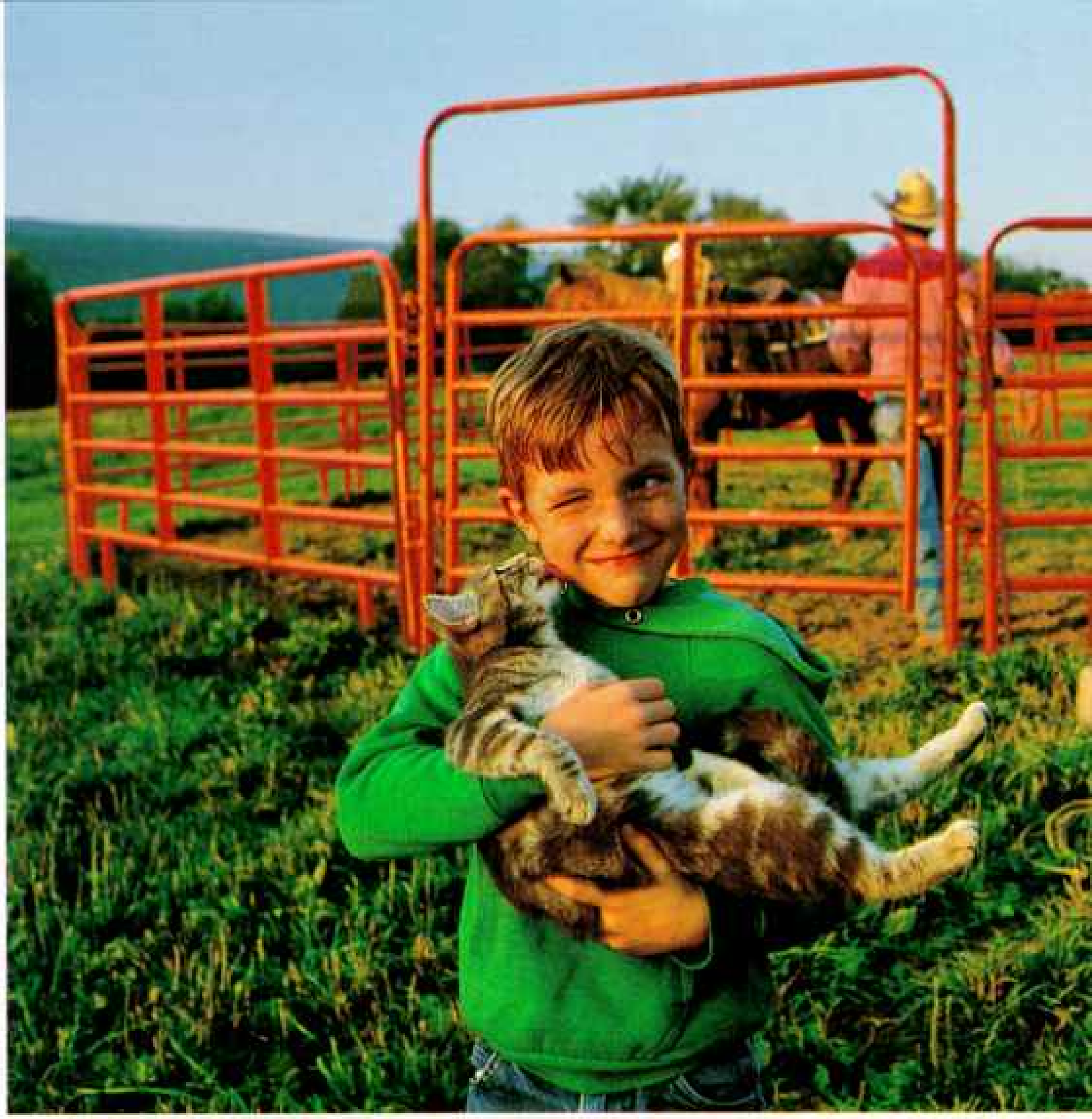
interrupts, puncturing my composure—"Are you man enough to wear an Amish hat?"

The questioner is an intimidatingly large man with thick forearms protruding from a sweat-stained shirt, his black pants held up by a single suspender. He is smiling. He has put an "English man" to the joke. Anyone not Amish or Mennonite here is English.

I explain that I was looking for a fishing hat and ask his name. He is Noah Kanagy, brother of the store owner and a "wood butcher," making pallets for shipping freight. Noah's hat is holed and dark with sweat and looks like a grenade has exploded inside. "I think I can get some more wear out of it," he says. I tell him about the blond sprite. "That was my daughter Mary." I ask why he uses one suspender. "Why, to hold up my pants."

"It sure creaks and flexes when they jump," says the photographer of a rickety diving platform at a farm pond near McVeytown. The kids built the structure and made it even more challenging when they later added a third, higher diving board. The deep-freeze winter of 94 turned the pool into a skating rink.





awareness encompasses the room. When two boys buzz, she commands, "Get busy."

The morning wears. As blood-sugar levels fall, stretching, squirming, and yawning commence. Barbara stares out the window, her arm like a ticking pendulum. Barbara's eyes glaze. Barbara's head sinks into her book, her nose fitting nicely into the valley between the pages. Frona says nothing.

Later I return to Big Valley and knock on Noah Kanagy's door. "Do you remember me?" I ask.

"Yes, the hat," he replies. He says his wife used his old hat to start a fire. He produces a handsome new one he has bought. "Try it on," he says. It fits. "It's yours for ten dollars." He says he can get another.

"Done," say I.

AFTER THE LAST FLARE of autumn on Tussey Mountain near Saxton, the bare branches of oaks point like accusing fingers. I turn off the highway to follow a crumbling macadam track, my pulse primed with anticipation. Where Tussey realizes it is a mountain and rears, a sandstone obelisk memorializes ten Pennsylvania Rangers massacred here July 16, 1780, during the Revolutionary War. On a marble tablet I search for the name of Skelly.

As a kid I never paid much attention to my grandmother Sadie's story that Indians and British had killed forebears of ours. On my journey I verified it, assisted by genealogists as well as local historian Jon Raughman, editor of the *Broad Top Bulletin*, who has led me to this spot. With emotion I am touching the

At a corral in Aaronsburg, Samantha, the cat, shares a secret with Zach Fink, the boy: Central Pennsylvania is a good place to grow up in, a good place to come home to.

names of Philip and Hugh Skelly—Irishmen rooted in County Antrim—my grandfather and granduncle four generations removed.

They were members of a militia raised to protect settlers in the Woodcock Valley. Baughman tells me the Rangers' decision to stay overnight in a cabin near Warriors Path, a trail used by marauding Indians, was fatal.

When the men awoke the next morning, they found themselves surrounded by 50-some Seneca and two British officers in paint, a guerrilla band bent on terrorizing the frontier by collecting scalps for the crown. A firefight commenced, and my ancestor Philip shot the chief's brains out from nearly a hundred yards. After volleys of fire arrows set the cabin ablaze, the Ranger commander sought terms and was promised that his men would be treated as prisoners of war.

The Rangers were promptly murdered. Their bodies were found the next day—some disemboweled, all scalped—tied to saplings and pierced with as many as five arrows.

Philip's pain had ended, and with it the pain of an earlier loss to Indians of his two sons, Michael killed and Felix captured. When Indians took Felix and his aunt, Mrs. William Elder, the previous May, they loaded the robust youth with plunder and Mrs. Elder with a long-handled iron frying pan, and everybody marched west. At a village on the Allegheny River, Felix was made to run the dreaded gantlet. Fast and agile, he dashed through the files of club-wielding braves with only light blows and won exemption from further harm.

The angry, vengeful captors forced Mrs. Elder, widowed in a previous Indian attack, also to run for her life. With her frying pan she uppercut the first brave in his genitals, sprawling him and greatly amusing the chiefs. When she clouted another on the head, the remaining braves let her pass.

Felix later escaped, while Mrs. Elder reaped the harvest of her courage and comeliness when a smitten Indian began to woo her. She led him on until the party finally reached the British garrison at Detroit, where she dumped him and spent the rest of the war cooking for the British.

Standing here and now on ground where Skellys fought, bled, and died, I wanted to tell them things. I wanted to tell Felix that I was not fast or agile enough to survive the gantlet of Pennsylvania football. I wanted to tell Philip that I too was a shooter, that on record day at Camp Upshur, Virginia, I fired the highest rifle score in my company of Marine officers. I wanted to tell the widow Elder that when it came to good sense, guile, and grit, she was a woman for all seasons.

Most of all, I wanted to tell them how proud I was of them. And how thankful. When I drove away from Tussey and up the Woodcock Valley, I felt I was on turf where I had a right to be. I felt connected. In this place I was always leaving, I finally felt at home. □

BY JON THOMPSON

PHOTOGRAPHS BY CARY WOLINSKY

King of Fibers

Spun into thread, ground into currency, crushed into vegetable oil, cotton tests the human imagination. As uses multiply, demand keeps growing for the plant (inset) that can be tough as rope and sheer as fine muslin—or as useful as a terry cloth towel.

A HOT SUMMER MORNING in Mississippi, once the heartland of cotton. In a narrow field near the town of Abbeville, white puffs clung like snow to spindly branches. Floyd Holmon, an 82-year-old black man whose father was a sharecropper, strapped a long canvas bag across his shoulder and moved gracefully down the rows, picking his cotton almost by touch.

As we walked side by side, he told me his story. "When I was 16, my father hired me out to John Landers, a white man," he said. "I wanted to buy some land, but Landers wouldn't give me a loan. So I did construction, washed dishes at the university, and got my money. I got nearly 300 acres now, built it up slowly. You know it takes a long time to come up in life and no time at all to fall down."

It didn't take long for the land of cotton to fall, at least for small-scale farmers like Floyd. Since 1945, shortly after the invention of the mechanical cotton picker, more than 70 percent of Mississippi Delta farms have closed down. Today one family can easily farm 500 acres using mechanical pickers that collect about 50,000 pounds a day—a thousand times the amount Floyd picks in one afternoon.

Just 125 miles southwest of Floyd's farm, I met Raymond Brown, who farms 500 acres of good bottomland along Mississippi's Yazoo River the modern way. "Fella that invented that machine, they ought to let him go to heaven," said Raymond. We were in the middle of a field, watching his brother Bill drive an air-conditioned picker as tall as a two-story house.

Dust clouds swirled around the machine as rotating barbed spindles plucked the white lint and fans blew it through huge air ducts into a cage in the back. I had the feeling that I had just seen two centuries of cotton's history unfolding before me in the short distance between Floyd's farm and Raymond's.

Crowned with an overstuffed basket of cotton, a worker delivers a load to a gin near Ahmadabad, India, where seed will be separated from lint. From field to factory, a vast and inexpensive labor pool is crucial to India's cotton industry. The country's cotton crop —the world's third largest, after China and the U. S.—is almost all handpicked.

For solid comfort..

Vintage denim, circa 1955, draws a chichi crowd to Drouot, the prestigious Parisian auction house. Originally priced at under eight dollars, the matching Levi's cotton jeans and jacket were snapped up for more than $3,500 by Denmark's largest Levi Strauss distributor for display in its private collection.

Giant loaves of cotton, protected from moisture by plastic wrap, await ginning in central California at J. G. Boswell Co., the world's largest private cotton grower. On a 2,500-acre family farm in the Mississippi Delta, a driver at the wheel of a $135,000 mechanical picker can do the work of 500 people. Cotton yields are rising across the U. S., even as fewer farmers grow the crop.

THE ORIGIN OF COTTON is something of a mystery. There is evidence that people in India and Central and South America domesticated separate species of the plant thousands of years ago. Archaeologists have discovered fragments of cotton cloth more than 4,000 years old in coastal Peru and at Mohenjo Daro in the Indus Valley. By A.D. 1500, cotton had spread across the warmer regions of the Americas, Eurasia, and Africa.

Today cotton is the world's major nonfood crop, providing half of all textiles. In 1992, 80 countries produced a total of 83 million bales, or almost 40 billion pounds. The business revenue generated—some 50 billion dollars in the United States alone—is greater than that of any other field crop.

Most of the five billion pounds that U. S. mills spin and weave into fabric each year ends up as clothing. "Cotton is a wonderful classic," says Adrienne Vittadini, a New York designer of women's sportswear, who uses cotton in 65 percent of her collection. "It takes color beautifully. You can achieve a lot of different textures just by knowing what sort of cotton to use. You have combed cotton, with a dull finish; high-twist cotton, with a crepey finish; all sorts of cotton bouclés for hand knitting. For any reputable company, cotton signifies quality. It's our bread and butter."

But cotton spins its way into much more than apparel. It makes bookbindings, fishnets, handbags, coffee filters, lace, tents, curtains, and diapers.

Few other fibers endure tough conditions as well as cotton, perhaps the main reason it figures so prominently in the medical supply industry. "Cotton is used for bandages and sutures for exactly the same reason it's used in textiles: It's durable in a lot of different environments," says Dr. Thomas Stair, head of emergency medicine at Georgetown University Hospital in Washington, D. C.

Such attributes may explain why firefighters once preferred cotton fire hoses: The fibers soaked up enough water to keep the hose wet and protect it from flames. Modern fire hoses are usually made from synthetics, which are less expensive and last longer than cotton. But U. S. armed forces still use cotton hoses on their ships, where scorching, sunbaked decks melt the man-made material.

JON THOMPSON, a writer who lives in London, has a special interest in textiles. NATIONAL GEOGRAPHIC contract photographer CARY WOLINSKY has developed a similar interest, covering both wool (May 1988) and silk (January 1984) for the magazine.

Scientists have found that cotton may even clean up oil spills better than polypropylene fibers, which are the usual material for sopping up such waste. A few years ago researchers showed that cotton absorbed more crude oil in a saltwater bath. Other researchers had already demonstrated that cotton worked as well as polypropylene in freshwater—and cotton is biodegradable. Recently a Texas firm began marketing InstaSorb, a cotton sorbent that oil companies have successfully used to clean up spills in lakes and rivers.

Crane & Co. of Dalton, Massachusetts, has been turning cotton rag into high-quality stationery and paper for U. S. currency for more than a century. Tim Crane, a sixth-generation papermaker, recently came up with a novel idea for recycling the 13.6 million pounds of money taken out of circulation each year, which would otherwise end up in landfills. "I said, let's just grind it up, add water, and see what it looks like," says Tim, who has turned more than 750 million dollars' worth of discontinued bills into stationery called Old Money. "As it turns out, it's a rather pleasing color of green."

"Everywhere you looked was cotton, cotton, cotton," says Parlee Bradley, remembering the fields that once flourished outside Eloy, Arizona. Guided by an old photograph, she and her husband, James, returned to the spot, now a barren wasteland, where they and hundreds of others picked cotton until the early 1960s. "We could clean a stalk of cotton in just a few seconds," Mrs. Bradley, now 80, recalls. Yet their skill was no match for mechanical pickers. And later, when wells ran dry, many farmers were forced to abandon their fields.

IN THE 1850s, while Tim's ancestors were collecting rags from farmers' wives in New England, one William Fee of Cincinnati invented a device to knock the hard hulls from the kernels of cottonseed and thus firmly established the cottonseed oil processing industry. After Fee's invention, cottonseed mills sprang up around the South. By 1879 Procter & Gamble had created Ivory soap from the oil, and three decades later it introduced crystallized cottonseed oil as Crisco, America's first vegetable shortening.

Since then the little seed and its component parts have become big business. Oil from the kernels is used in margarine, salad dressings, and cooking oils. Meal from the kernels makes fish bait and organic fertilizer and provides feed for cattle across the nation.

Cotton zealots love to boast about what's been called "fabulous fuzz," the short fibers, or linters, left on cottonseed after ginning. Chemically, linters are almost pure cellulose, a carbohydrate found in all plants. When the linters are washed, bleached, and dried into pulp, they can be mixed with chemicals and converted into such disparate things as guncotton (a smokeless gunpowder), sausage casings, linoleum, cellophane, rayon, photographic film, dynamite, fingernail polish, and molded plastics. Nitrocellulose helps propel solid-fuel rockets. Methylcellulose thickens ice cream, smooths makeup, and puts the chew in chewing gum.

For years scientists have known that cottonseed is one of the most nutritious vegetable seeds in the world, having all nine essential amino acids, which help build the proteins needed for a well-balanced diet. They realized the humble seed's promise for alleviating hunger, especially in nations where people cannot afford high-protein foods such as meat, milk, and eggs, but there was a catch: gossypol, a potentially toxic chemical that is taken out of cottonseed oil during refining but remains in the meal. As early as the 1960s researchers had discovered a strain without gossypol, but the new plants had short fibers and were hard to grow.

Most scientists gave up the search, but Woodrow T. Rogers, a cotton farmer in Waco, Texas, never conceded defeat. After 25 years of painstakingly crossbreeding wild cotton plants low in gossypol with long-fibered Texas strains, the 79-year-old Rogers has developed a plant that he believes will be a commercial success. It has an edible cottonseed and the long fibers wanted by farmers for textile production.

Last year Rogers contracted with Alliance USA, a health-food company in Dallas that has sold hundreds of thousands of energy bars fortified with cottonseed. The firm also adds cottonseed to caramel popcorn.

"This is only the beginning," says Rogers, who plans to increase the land planted with his cotton from 2,000 to 100,000 acres over the next five years. "If you replaced a quarter of the corn in a tortilla with cottonseed meal, you

would increase the protein from 4 percent to 12. If you replaced a fourth of the wheat flour in a hamburger bun, it would have more protein than the hamburger."

TO FOLLOW THE STORY of cotton, I traced its rise and decline by visiting the derelict 19th-century textile mills in my native England. I went to India, where cotton production encompasses the ancient past and the high-tech future. I attended an elaborate funeral in Ghana, where death provides a vibrant textile industry for the living. And from Mississippi I tracked cotton's movement west to California, where organic cotton farming may one day reduce or even eliminate the need for pesticides that can poison the land, air, and water.

Cotton's ubiquity in everyday life began in a small English village little more than 200 years ago. Cromford, a cluster of old cottages set in the rocky gorge of the River Derwent in Derbyshire, is picturesque aside from its forlorn, fortresslike mill. It was in this building that cotton began the factory system.

Sir Richard Arkwright, a former barber who had once fashioned the hair clipped from his clients into wigs, invented a water-powered spinning machine, the first mechanical device to produce cotton thread efficiently, and established a factory at Cromford in 1771.

In the decades preceding Arkwright's invention, English women had developed a fancy for Indian-made chintz, a glossy, multicolored fabric. Men like Arkwright realized that a fortune might be made if cotton could be spun and woven faster in England than it could be by the Indian producers.

They turned to the West Indies, primarily, to satisfy the demand for raw cotton. America was not yet a supplier. When the first shipment of American cotton, about 3,500 pounds of it, reached the port of Liverpool in 1784, a customs officer confiscated it as suspected contraband, doubting there was that much cotton in all America. He wasn't far wrong. American farmers didn't grow much cotton because it was too labor intensive to be profitable. It took one person a whole day to remove the seeds from just one pound of cotton.

All that changed in 1793 when Eli Whitney, a native of Massachusetts living in Savannah, Georgia, invented the cotton gin, a hand-cranked device consisting of a roller with teeth that stripped the plant's fluffy fibers, or lint, from the seeds. With Whitney's gin, a worker could clean 50 pounds of cotton a day. Almost overnight American farmers in the South turned their fields to cotton.

By 1859 the 3,500 pounds on the Liverpool dock had multiplied. America exported 3.5 million bales—1.75 billion pounds—or 80 percent of its crop that year, and England was the best customer by far. Mill and plantation owners had become fabulously wealthy.

But the prosperity of the few depended on the wretchedness of many. As cotton flourished, so did the slavery that supported it. By 1861, when the first shots of the Civil War were fired, some 2.5 million blacks were enslaved on cotton plantations. "It is an offence invariably followed by a flogging, to be found at the quarters after daybreak," wrote

"Everyone said it couldn't be spun," says cotton breeder Sally Fox, standing triumphant in West Texas with a 20,000-pound module of FoxFibre, her patented brown cotton. Defying skeptics, Fox spent years crossing long-staple white varieties with short, coarse, colored cottons whose fibers must be hand-spun. The result: colored cotton with fibers long enough for machine spinning. Woven into clothing, linens, and upholstery, her green and brown hues don't fade like dyed materials—or require polluting dyes to produce.

Solomon Northup, a slave who labored on a Louisiana plantation in the 1840s. "Then the fears and labors of another day begin; and until its close there is no such thing as rest."

Meanwhile, life for the textile workers in the north of England wasn't much better. "Not a spark of pity was shewn to the sick of either sex," wrote Robert Blincoe, who had worked as an indentured apprentice at the Litton Mill in Derbyshire in the early 1800s. "If they dropped down, they were put into a wheelbarrow and wheeled to the 'prentice house . . . and there left to live or die."

To recapture the era of workers like Blincoe, I called at the greatest of Arkwright's factories, Masson Mill, an imposing six-story building that stands on the banks of the Derwent just half a mile from his original plant. Part of the 1783 mill was still running when I was there, but soon it would be silent, a victim of economics and increased international competition. Yet the mill will remain standing because of its new owner, Robert Aram, a 48-year-old historian and real estate developer who collects mills and chimneys the way less eccentric people collect coins or stamps.

Tall, ruddy, with a head of thick gray curls, Aram refuses to divulge how much he paid for Masson, though he says it was "a king's ransom." His voice softens when he speaks of his collection. "I'm just passionately interested in the remains of our industrial past," he said. "Masson is the jewel of my collection."

Aram plans to convert his jewel into office and retail space, using the profits to make part of Masson into a museum.

Shredded and pulped, old dollars find new life as light green stationery at Crane & Co. of Dalton, Massachusetts, which also makes all the paper for U. S. currency from cotton and linen. The recycled paper retains the distinctive hue of the original bills—an idea pioneered by New Mexico papermaker Stefan Watson (lower right), the first to turn denim waste into paper the color of faded jeans.

One day I joined him on a grassy knoll overlooking the old mill town of Dukinfield, whose crumbling mills and smokeless chimneys sit in soft green hills six miles east of Manchester. "It used to be as far as you could see there were chimneys," Aram said wistfully, casting an eye over his native North Country. "But most of them have been demolished."

The toll of the mill closures on the people of England is certainly as heavy as that on their industrial heritage. Where once workers could dream only of escaping the satanic mills, today they clamor for jobs in the few remaining factories.

SUCH IRONIES ABOUND in the history of cotton. In a curious twist, the increasingly profitable cotton industry in India has played a major role in the collapse of the English mills, whose cheap machine-made cloth almost ruined the Indian producers nearly two centuries ago.

In India the story of cotton travels full circle. Village weavers and spinners practice their centuries-old art, factory workers run machines imported from the British mills of the 19th century, and futuristic textile mills virtually run themselves. India once shipped much of its cotton to England but now grows the plant for the benefit of its own people.

But this self-sufficiency has not come easily. In Ahmadabad, where in 1918 Mahatma Gandhi held his first fast—in support of textile workers striking for higher wages—I walked through a mill owned by Arvind Mills Ltd. An enormous weaving shed was packed with more than 400 looms. Shipped from England to India, some of these machines are nearly a hundred years old.

Inside the mill the industrial revolution was a reality. To drive the looms, huge wheels along the ceiling clattered and clanked, now run by electricity but powered by steam engines in the 19th century. Cotton dust had accumulated on the windows and on every pipe and loom and wire.

Overhead pipes sprayed mist into the air to moisten the cotton fiber. The workers, all men, wore only cotton loincloths, or *dhotis*, because of the unbearable heat and humidity. I stopped to talk with one of them, but he couldn't hear me. Then I realized he was deaf. Although some of the workers were speaking, no sound came from their mouths. They were lip-reading—some of them permanently deafened by the unrelenting noise. How could this

mill, with its antiquated machines and intolerable conditions, be the world's second largest maker of denim, as I'd been told?

I found the answer in another part of Arvind's plant, a new operation that may foreshadow the future. In a nearby building a machine opened bales of cotton, gobbled it up with mechanical fingers, and sucked it into more machines to be cleaned, combed, and spun. Here the white floors and walls were spotless. I saw a delivery boy who took the spun yarn to the mill, but there were few other signs of life, and I envisioned a time when the manager would sit alone in his air-conditioned glass booth watching over a crew of robots.

Factories like this one could take away thousands of jobs from desperately poor people if they replaced India's small mills and traditional handweavers. Recognizing that danger, the Indian government restricted the growth of modern mills and is attempting to expand the market for handicrafts.

"THERE ARE ONLY two important things in life: food and cloth," said a woman cloth merchant in Accra, the bustling capital of the West African nation of Ghana. Here, markets are lined with stalls overflowing with mountains of colorful cotton cloth. Women dressed with great style set out bolts of these patterned cottons for display until a blaze of color surrounds the early morning crowds.

While cotton is a mainstay in Ghanaian life, it plays an equally large role in the fashions of the dead, for cotton funeral cloth has long since passed from trend to tradition.

Such cloth is made of assorted fabrics, but cotton is often favored. One of the most distinctive types is called *adinkra*, made especially for funerals. It is densely patterned with hand-printed designs and produced by a centuries-old, painstaking technique. An artist prints the cloth with calabash stamps dipped in a thick, black dye made from boiled tree bark. The result is a pattern of astonishing boldness, each of the hundred or more designs rich in symbolism.

One night photographer Cary Wolinsky and I drove to Berekum, a town near the Côte d'Ivoire border that is home to the Brong people, to attend the funeral of the chief's mother, Nana Ekua Dufie. When we arrived at dawn, the sky was overcast, and crowds were already gathering in the streets. Men were magnificently arrayed in adinkra. Women wore black skirts, and their shoulders were draped with brilliant red *kobene* (worn to show that a close relative has died) and their heads crowned with wreaths of *nyanyina*, a vine

Inspired by leaves of the sapi karta tree (above), the Cuna Indians of Panama's San Blas Islands apply nature's designs to cotton panels called molas. Prized by collectors, molas are usually sewn into Cuna women's blouses; Estellita (right) wears a classic pattern as she works a sugarcane press.

worn as protection against the powerful spirits that are feared at funerals.

We walked into the chief's compound, a walled-in maze of adobe houses surrounding a courtyard, to greet the family and offer the customary gifts of schnapps and beer to a row of local chiefs seated under an awning.

To pay our respects, we passed through big wooden doors into a larger courtyard draped with fabric in the style of *kente* cloth. A patchwork material prized for its intricate patterns and often associated with wealth and status, kente cloth has become a worldwide symbol of African pride. But genuine kente would be too costly to buy in such quantities, so inexpensive printed cotton adorned the walls.

Women dressed in kobene cloth encircled the ornate brass bed where the body of the queen mother lay. A procession of mourners arrived. Turning to face the crowd, they let out great wails.

The colors and patterns I had hoped to see were everywhere, and despite the occasion the room was filled with life. There are few places left in the world with such strong ties between tradition, color, and textiles.

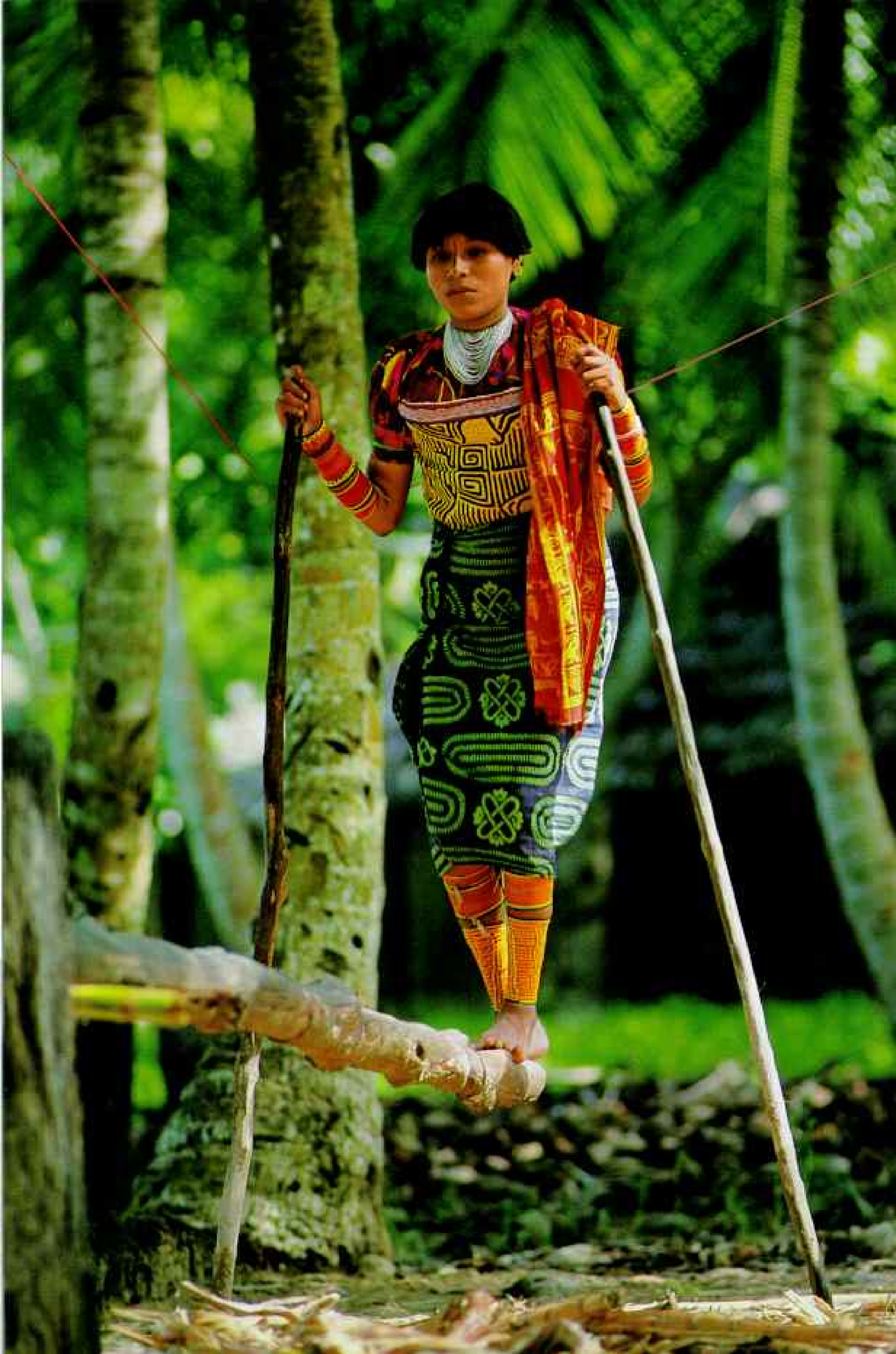
Halfway around the world, in small Mexican villages, Indians have strengthened those ties and woven cotton into every aspect of their lives. I traveled to the hills of the state of Guerrero in southwestern Mexico to watch Amuzgo spinners and weavers create cottons as fine as those once worn by Aztec kings.

At midday the heat was relentless. Clouds of dust rose from the road and swirled into the bus as it rattled through the forest. Now and then a few men following donkeys plodded by patches of red earth cleared by farmers for cotton and corn.

In the village of Xochistlahuaca I watched as a woman dressed in a white cotton tunic, or *huipil*, woven with delicate patterns of orange, pink, and blue, spun cotton thread. In a courtyard in nearby Zacualpan, 13 women sat in a circle, weaving and chatting, the rhythm of their movements never wavering.

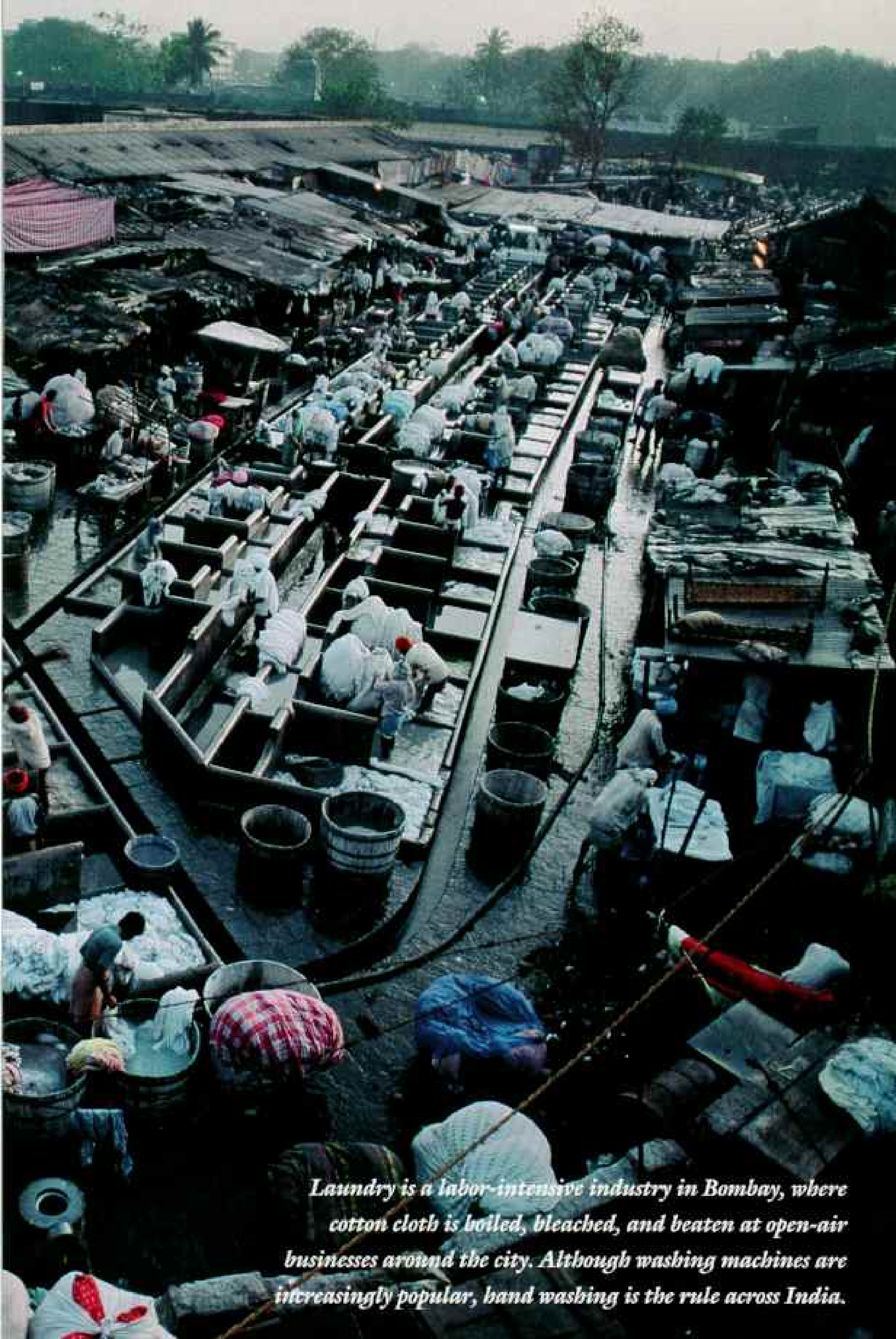
That rhythm has flowed since the ancestors of the Amuzgo and other Middle American Indians developed naturally colored cottons ages ago in hues of reddish brown, yellow, and camel. By the time of the Spanish conquest in the 1500s cotton had spread as far north as Arizona and New Mexico.

About 400 years later so had one of the worst scourges of agricultural history: an evil-looking bug about the size of the end of your little finger—the boll weevil. When it swept north from Mexico *(Continued on page 80)*



Industrial revolution: cotton's legacy

Spawning textile towns such as Burnley, England (left), the 18th-century industrial revolution eventually moved to India. A mill in Bombay (above) spins cotton thread much as it did at its 1908 opening, while a factory in Ahmadabad recently replaced its British-made looms (right) after a century of use.



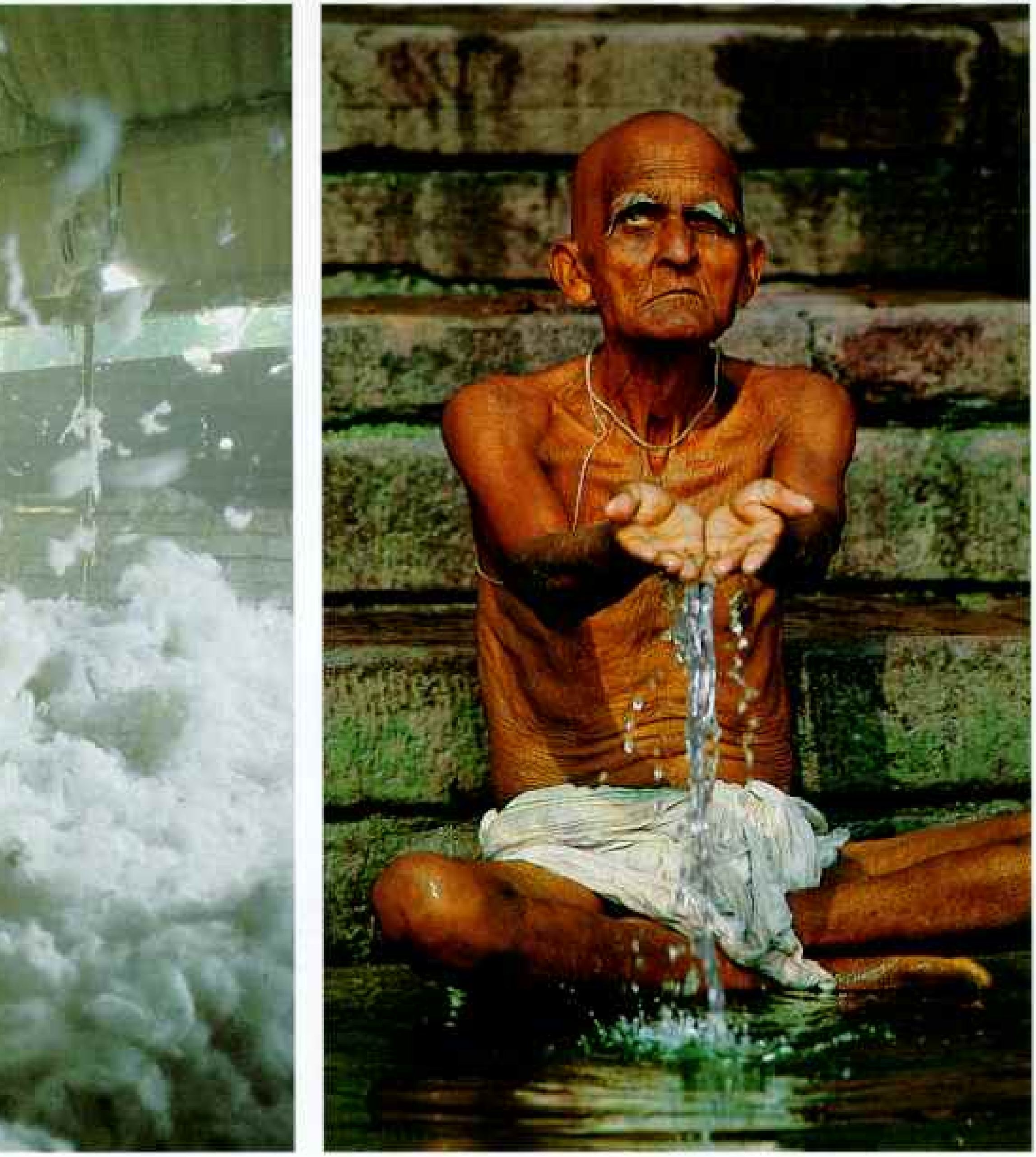
Laundry is a labor-intensive industry in Bombay, where cotton cloth is boiled, bleached, and beaten at open-air businesses around the city. Although washing machines are increasingly popular, hand washing is the rule across India.

(Continued from page 74)

weevil laid waste vast tracts of land. Southern farmers finally turned to pesticides out of desperation.

Today cotton farmers in the U. S. spend 500 million dollars a year on pesticides. They are caught in a vicious cycle: Farmers spray pesticides, pests build up a resistance, farmers spray more often or use stronger chemicals. In California's Imperial Valley, for instance, the pink bollworm, a caterpillar that eats its way through cotton bolls with rapacious speed, has caused the amount of land planted with cotton in 1892, the to drop from 140,000 acres to only 7,000 during the past 17 years. The farmers tried one chemical after another, but the hardy bollworm resisted every insecticide used. Meanwhile, many beneficial insects that otherwise would have helped control harmful bugs were destroyed, leaving crops vulnerable to a whole new series of pests.

This reliance on pesticides has had dire consequences for land and people. The deadly gas that escaped from Union Carbide's plant in Bhopal, India, in 1984, killing more than 3,000 people, came from a pesticide often



sprayed on cotton crops. In California alone, where the pink bollworm found its way from Arizona in 1965, some 6,000 tons of pesticides and defoliants are used on cotton in a single year. Each autumn during defoliation season in the cotton fields, residents of the San Joaquin Valley complain of nausea, diarrhea, and throat irritation.

In Arizona, where pests are numerous, thousands upon thousands of acres have been ravaged by intense cotton farming. The use of chemical fertilizers, pesticides, and saline irrigation water has led *(Continued on page 86)*

A blizzard of cotton sweeps a worker at the Bavala Ginning Factory near Ahmadabad, where packing methods have changed little in 75 years. Steadied by a rope and protected by a hood, he stamps down ginned cotton blown clean by a fan. Crucial economically, cotton also plays a spiritual role for many Indians. By the Ganges River a Hindu worshiper wears the yagnopavita, or sacred thread—strands of cotton yarn that remind him of his religious duties.

Balancing on bamboo racks, a worker steps across silk-screened cotton saris hung to dry in Ahmadabad. Traditional cotton handicrafts flourish across India; in Dhamadka (inset), villagers practice centuries-old tie-dyeing methods.

Ghana: cotton for the final farewell

Wrapped in red—the color of sorrow—a mourner (right) attends a funeral in western Ghana. Her leafy crown is worn to protect against spirits, while the brilliant red cotton cloth called kobene speaks of her closeness to the deceased. Traditional across Ghana, adinkra, another funeral cloth, is stamped with symbolic patterns (above). A finely woven cotton kente cloth (below), symbol of family status, covers the feet of the late Nii Sackey Quarcoopome, an Accra taxi driver.

(Continued from page 81) to a buildup of salts in the desert soil, has disturbed the natural drainage, and has destroyed the native vegetation. Says Laura Jackson, an Arizona ecologist who studies the environmental effects of cotton growing, "Probably, if we were environmentally sensitive, we would wear polyester."

MAYBE WE WON'T HAVE TO. Will Allen, an organic farmer in the San Joaquin Valley and a director of the California Institute for Rural Studies, has spent the past three years teaching farmers how to grow cotton without chemicals. "We started out with about 600 acres of organic cotton, and now there are 10,000 acres in the state," he said proudly. "Organic cotton is being grown across the continent. We know farmers aren't going to have an alternative down the road.

"The pink bollworm was finally controlled in the San Joaquin Valley by imposing a 90-day cotton-free period," Will added. "Each year at the end of the growing season, cotton crops must be completely mowed and plowed in, so there is no place for the pests to hide out. During the winter months bollworms like to hide at the base of the stalk of the cotton plant, ready to spring forth."

But Allen and others realize it's not easy for farmers to get away from pesticide use. Because of lower initial yields and higher labor costs, going organic costs more than conventional farming, though that is offset in part by the absence of the cost of chemicals.

Another environmental concern is cotton's manufacturing process—especially dyeing, which is one of the most polluting aspects of the clothing industry. Each year countless gallons of dyes, bleaches, and heavy metals that are used to fix dye to cotton fabric end up as toxic waste.

But there may be solutions. In Texas I met Sally Fox, a remarkable woman who has discovered a way to brighten cotton's future as well as the clothes we wear: She has bred varieties of naturally colored cotton that can be machine spun and woven into fabric. Not only do the colors resist fading, they actually darken when washed. Her cottons save mill owners money while eliminating much of the pollution caused by dyeing. Last year, Fieldcrest came out with a line of towels and bedding made from Sally's cottons. These plants, which now grow on 10,000 acres, including farms in Arizona and New Mexico, may also help organic farmers because they derive from seeds with a higher resistance to pests than other strains of cotton.

Sally showed me the results of her work. As we walked up and down the rows of cotton—the tufts in one field a lovely rust brown, in another as green as avocados—Sally uprooted the occasional white plant. I asked her how she got started. "I was employed by a man in California who was breeding pest-resistant cottons," she said. "He had plants with naturally brown lint. When I left the job, he gave me some of his specimens, and I set up my own program. I wanted to improve the fiber qualities of the natural brown cottons."

Sally labored for five years, crossing short-fibered brown cottons (grown for hundreds of years by the Indians in Middle and South America but ill-suited for machine spinning into yarn) with long-fibered white cottons. Her experiments set off alarms at California's Acala Cotton Board, which feared her new strains might contaminate the state's esteemed acala cotton. The board stopped Sally's research, so she set off for Texas, where the climate for experimentation was more congenial. From those beginnings a cleaner and safer way of growing and processing cotton is emerging.

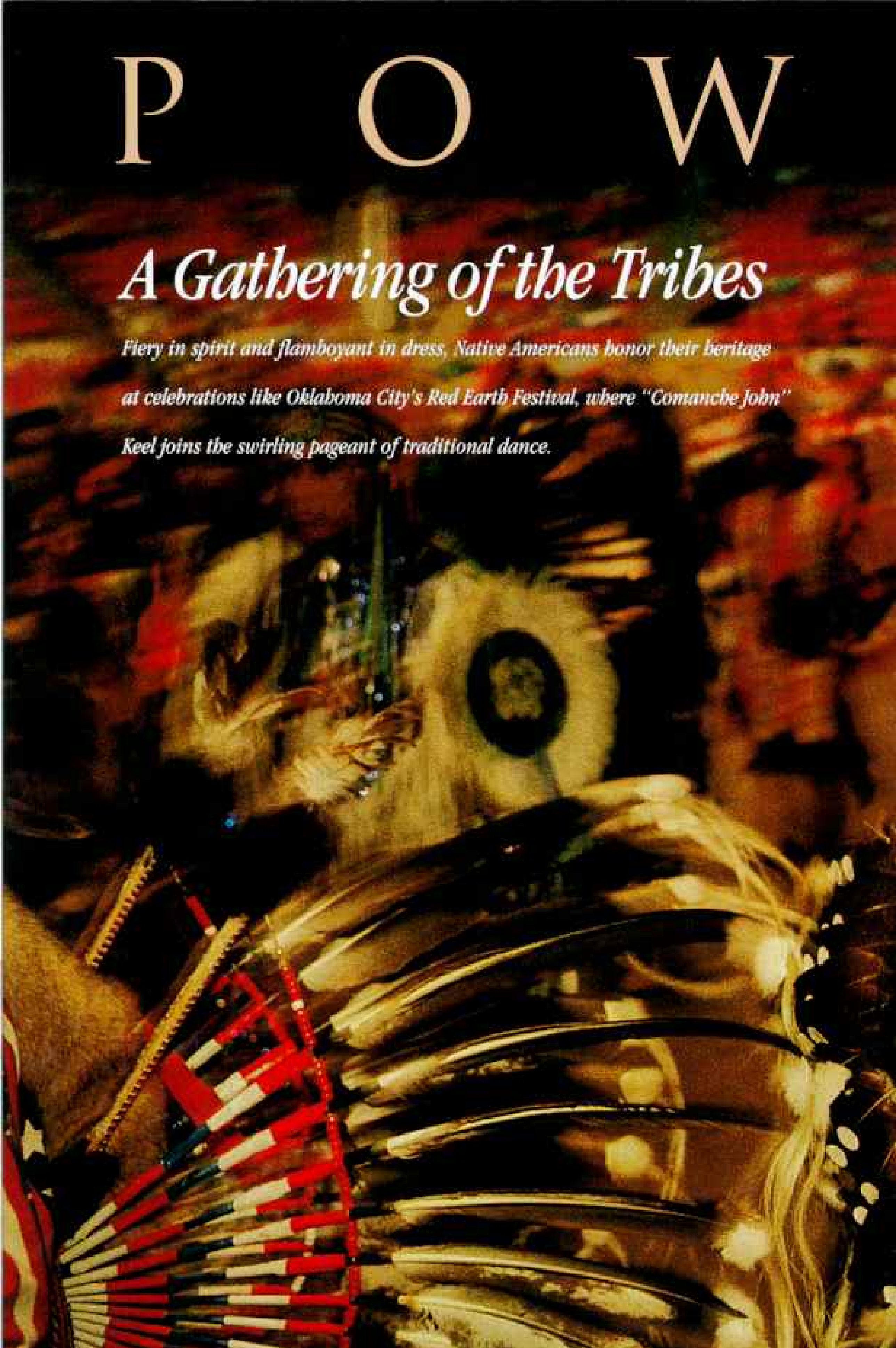
And so the story of cotton repeats itself. From its start as a semiwild plant tamed by prehistoric peoples to its maturity as a cash crop fueling the industrial revolution, cotton is once again becoming a naturally grown fiber. Perhaps its grim eras of slavery, Dickensian squalor, and hazardous pesticides will all be relegated to history—never to be forgotten and, if the future is kind, never to recur. □

A head for fashion serves a vendor peddling wax prints in Lomé, Togo. Introduced by 19th-century European traders, the cotton prints are created by the "wax resist" technique—similar to tie-dyeing—and used in women's garments. "When a woman wants a print," says a seasoned merchant, "she'll do anything to buy it." Brilliant or somber, plain or patterned, comfortable cotton translates into almost every culture.

POW

A Gathering of the Tribes

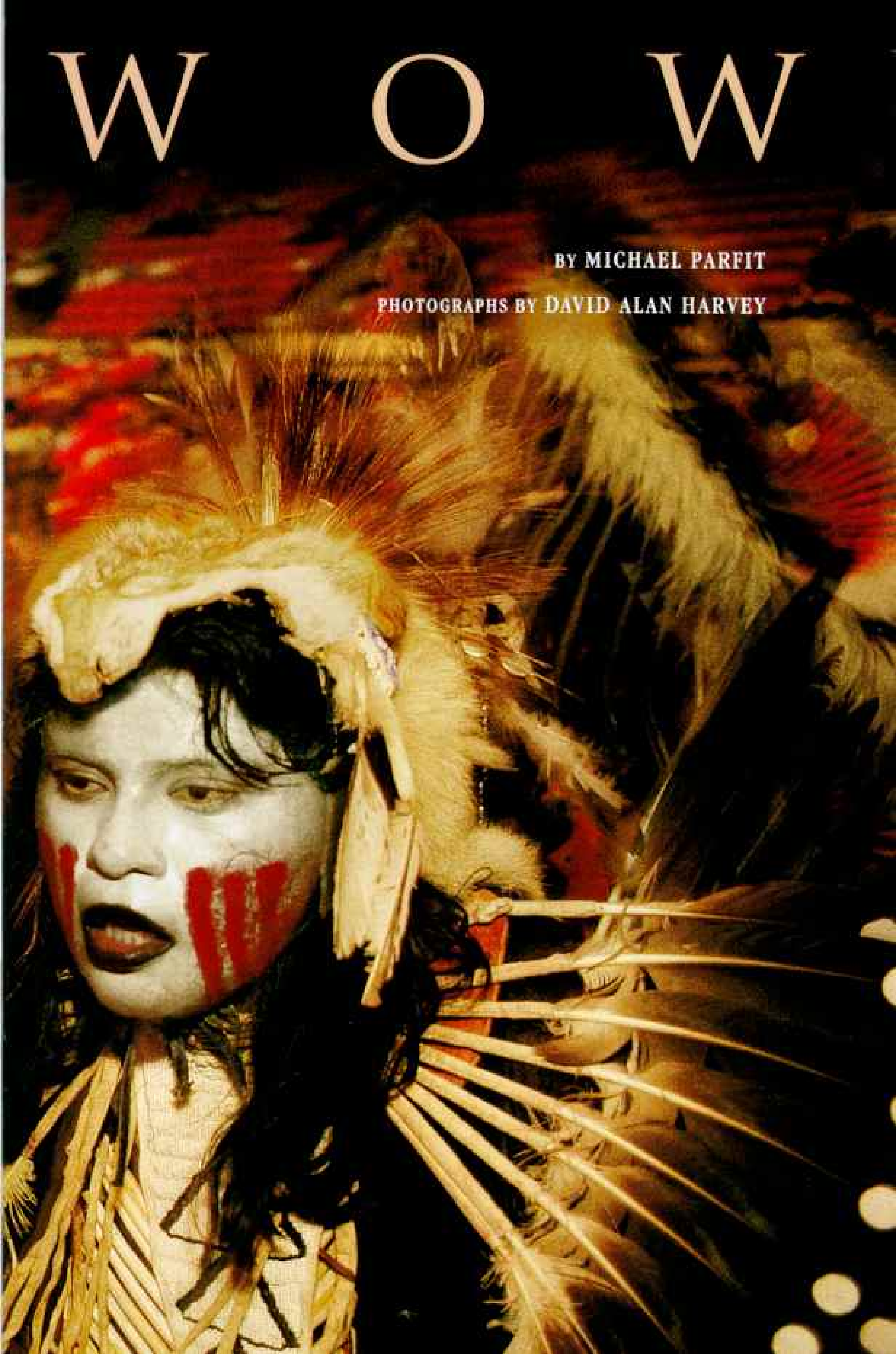
Fiery in spirit and flamboyant in dress, Native Americans honor their heritage at celebrations like Oklahoma City's Red Earth Festival, where "Comanche John" Keel joins the swirling pageant of traditional dance.



W O W

BY MICHAEL PARFIT

PHOTOGRAPHS BY DAVID ALAN HARVEY



Resplendent in the golden hues of evening, dancers join in a Grand Entry at Rocky Boy Reservation in Montana. Nurtured during the past century by Plains Indians, today's powwow is part family reunion, part cultural revival, part dance contest—and all shimmering spectacle.

It was sometime after midnight, but

time didn't matter. In the arena voices shouted through the public-address system. It sounded as if three men were having a fight, but it was almost the opposite. They were calling their friends in Crow, giving them blankets and money. I couldn't understand a word, but I knew they were shouting things like: "Max Spotted Bear! You are a good man! Your clan child would like to give you a gift!"

Sounds overlapped in layers. Underneath the shouting was music: Ten men beat on a drum and sang a wild, high-pitched song into microphones. Under that was a rhythmic jingle, the sound of hundreds of bells on ankles and thousands of rolled-up snuff-can lids sewn onto dresses, all jangling with the drumbeat as 500 men, women, and children danced. The dancers, in regalia, wove a forest of feathers; the forest jumped and fluttered and flew, as if windblown by the hurricane of noise.

"Coca-Cola Man!" shouted the announcer. "We need you here immediately!" "AH HEY YAH," sang the men at the drum. The manager of the powwow, Gilbert Bird In Ground, rocked a lost child in his arms. Next to me on a bench in the announcer's stand my fellow scorekeeper, Thelma Other Medicine, scribbled figures in a notebook and spat tobacco juice on the plywood floor. She handed me pages of the notebook—the judges' rankings of dancers. I typed the endless lists of numbers into a laptop computer. A whiff of Mace, squirted outside the arena by some practical joker, drifted past us, making everyone cough. My eyes watered, my head hurt, my ears rang. But like everyone else there, I was happy.

"We go to powwows to make us happy," Gloria Matthews, a Cherokee social studies teacher, had told me in June in Oklahoma. I heard that often. Later in the year, while I was riding hunkered down in a car going about 95 miles an hour (the officer said it was 89) between a powwow in Connecticut and another in central Washington State, a singer named Bernard Bob said the same thing: "When you get to a powwow and hear the drums," he said, "it makes you feel happy."

What's this? We don't often hear about happiness from Native Americans. For hundreds of years their story has been sad. They have lost a great, free way of life. They're beset by legal difficulties in trying to protect religious practices and the remnants of their homelands. They're troubled by high rates of disease and alcoholism. What is there to be happy about?

Over the past year, as I followed Indians from one powwow to another around the country, I found out.

The phrase *pau wau* once meant medicine man or spiritual leader to Algonquian tribes, but Europeans who watched medicine men dance thought the word referred to the whole event. What those Europeans watched, though, did not resemble what happens today. The tradition of Indian dancing is ancient, but today's powwows only developed in the past hundred years. Powwows are gatherings—usually held on weekends—in which Indians of many tribes come, often from far away, to dance, sing, gamble, and visit friends and family. The focus is dance—a series

As dance time approaches, Ed Blackthunder, a Sioux from Agency Village, South Dakota, puts the final touches on his Traditional Dance outfit at Rocky Boy. His wife, Oriann Baker, at far right,

affixes her eagle plume, a revered symbol. A renaissance of cultural pride draws Indian and non-Indian alike to more than a thousand powwows in the United States and Canada each year.

"Powwows today are far more than a salute to the past. They're not shows. They're not entertainment. Most Indians call them celebrations."

of open social dances called Intertribals mixed with competition in several dance categories. The categories, such as Men's Fancy and Women's Jingle Dress, are based on traditional dances that were once part of spiritual ceremonies, preparation for war, healing rituals, or celebrations of triumph.

Powwows are booming. Twenty years ago most took place only on reservations; now some of the biggest happen in convention centers and gyms in major cities. A book that catalogs this year's powwows lists 930. And this doesn't take into account the many smaller powwows that occur throughout the year.

The reason for the growing popularity of powwows may be what many have called a resurgence of Indian identity. Part of it may be that today's powwows are largely free of alcohol; part of it is that prizes are big enough now that a good dancer can scratch out a living. The very best, like dancer and singer Jonathan Windy Boy, can make up to $50,000 a year by competing almost every weekend. But there's more going on here than bigger prizes or freedom from booze.

Powwows today are far more than a salute to the past. They're not shows. They're not entertainment. Most Indians call them celebrations. At first these loud, rambunctious events were largely unintelligible to me. But as I followed what Indians call the Powwow Trail and slowly began peeling back the layers, I learned that there is something to celebrate, after all.

A Saturday in June, Red Earth Festival, Oklahoma City, Oklahoma

Gloria Matthews sits in the Myriad Convention Center stands with her grandson Timmy, listening to the song of a drum group called No Shame and watching the Men's Traditional Dance competition.

"Fancy Dance is exciting," she says, "but Traditional touches you in your heart, where you're Indian."

Red Earth is one of the big events of the season, and it's been partly adapted to entertaining non-Indians. "It's not just another dusty Indian happening," one of its founders told me. To me they're still mostly noise, color, and movement, but I'm getting to know the dazzling surface of every powwow: the dance.

The dances are intricate and varied. Women in fringed buckskin dresses dance slowly—the Women's Traditional Buckskin Dance. Men with fur-and-feather headdresses and bustles dance a story of the hunt or of scouting before a battle—the Men's Traditional. The Men's Grass Dance is sinuous and smooth; it looks like wind blowing across a prairie of men dressed in flowing streamers of yarn. In the Jingle Dress Dance—an Ojibwa dance originally used in healing—women wear dresses adorned with hundreds of jingles made from the lids of snuff cans. In the flamboyant Fancy Dance men wearing double bustles, ribbons,

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MICHAEL PARFIT, who lives in Montana, often writes for NATIONAL GEOGRAPHIC. His most recent contribution was to the Special Issue on Water (November 1993). Photographer DAVID ALAN HARVEY, based in Washington, D. C., has covered more than 25 articles for the magazine.

and bright streamers of yarn dance wildly, color swirling around them as if each were aflame.

"Watch!" Gloria says over the thunder and cry of the song. "They have to stop exactly on the last beat of the drum." In the urgent rhythm I can't hear the last beats coming, but the dancers can: When the song ends, the arena full of flames is suddenly as still as a rose garden, and the crowd erupts with cheers.

Saturday evening, Red Earth

On a platform above the No Shame drum group the announcer, Dale Old Horn, booms into a cordless microphone: "Ladies and Gentlemen, rise if you can rise!"

It's Grand Entry time. This is a feature event of the festival and every powwow, a wonderful procession of color and sound that usually happens twice a day. Old Horn is a Crow from Montana. He wears a black vest and black hat. His black hair goes halfway down his back; today long hair is a symbol of Indian pride. He's tall, and lean as a knife. His voice is deep and eloquent, and he loves that cordless mike.

"We sing to the victories of our grandfathers, of our fathers," he shouts. "We sing to victory. We are still here!"

Late Saturday night, Red Earth

Dale Old Horn is telling one of his favorite jokes. "R. G. Harris believes in reincarnation," he says, referring to a champion Fancy Dancer. "He likes Jingle Dancers so much that he wants to come back as a jingle." He chuckles, then shouts into the mike: "Whitefish Bay! Give us an Intertribal!"

Kids roam free through an instant village of 250 tepees pitched at the Pendleton Round-Up in Oregon. Alcohol is banned in the village to discourage roudiness, a policy of most powwows. The tents are hauled in by visitors from the Pacific Northwest and beyond—and though canvas has supplanted animal hides, tepees provide a taste of what life was like before the arrival of whites.

Taking a breather, Rocky Boy resident Rena Denny, at right, leads visitors on a tour of her homeland as the powwow continues below the Bears Paw Mountains. Powwows have survived despite

the efforts of early government agents determined to snuff out Indian culture. Indians gathered anyway, says a modern chief—"even under a guise of celebrating the white man's Fourth of July."

To put the jingle in the jingle dress, dancers sew silvery cones made from snuff-can lids onto ceremonial outfits. In the old days women used elk teeth, small bones, coins, and cowrie shells as noisemakers. A gentler sound comes from James Winterhawk Seymour's cradle board at the annual September powwow in White Swan, Washington. Beads strung above the infant's head rustle to alert his parents when he stirs—and to lull him back to sleep.

I'm sitting with the drum group called Whitefish Bay, behind Andy White, its lead singer. Whitefish Bay consists of 15 men from Ontario and an elk-hide-covered drum. Members of drum groups play the instrument, but their recognized skill is in song.

Indians crowd around the group with tape recorders, Andy picks up a drumstick and strikes the drum, and the song begins. The sound is overwhelming. The men pound the drum in unison and sing at full volume. This has no roots in Western tonal music. To me it sounds of wolves; some Indians say it is a gift from the wind. It is both a howl and a shout of triumph. As the floor fills with dancers, the beat of bells and jingles mixes with the music of the drum and makes a high and rhythmic roar.

"The drum was given to us for our survival," Andy White says when the song is over. "To be healthy, to feel healthy." Andy has a gentle face, an unself-conscious air of kind amusement, and silver stubble on his chin. He tells me he has been a drug and alcohol counselor for 17 years, which reminds me of a powwow bumper sticker: "Drums, not Drugs."

How important is the powwow in the daily lives of Indians? An estimated 90 percent of Native Americans attend powwows, but at first I wonder if the dance and the music are just games played with the past. An answer is sitting next to Andy. He's a 19-year-old Northern Cheyenne Comanche athlete named Jimmy Galey. Andy White had invited him to sing with Whitefish Bay.

"For me," Jimmy says, "this is like winning the sweepstakes." Jimmy's facing a tough decision: Whether to sign to play second base with a minor-league team that had offered him a spot or to go on the Powwow Trail with Whitefish Bay. He can't make up his mind.

A Sunday afternoon in July, Standing Arrow Powwow, Elmo, Montana

One of the best recent books about Native American life is called *The Business of Fancydancing*. It's a gritty and honest book of stories and poetry, about basketball, booze, dreams, family, and powwows, by a Spokane Coeur d'Alene Indian named Sherman Alexie. I think of it today as I sit on a long grassy slope and watch this small powwow from a couple hundred yards away.

This would indeed be a "dusty Indian happening" if it hadn't rained yesterday. Now it's a mucky Indian happening. This is the opposite end of the powwow spectrum from Red Earth: There's just a field full of cars, campers, tents and tepees, a circular arena with a metal roof where competitors dance, some shedlike buildings where people play gambling games with sticks and small hand drums, and a cluster of plywood buildings and trailers where you can buy coffee, jewelry, Indian tacos, beads, elk teeth, or snuff-can lids for dancers' regalia.

It's a clear day here at Elmo, on the shore of Flathead Lake, and the sound of bells and jingles ringing to the heartbeat of the drum seems small but hopeful against the expanse of sky and

Filled with the comforts of home, the tepee of Ellen Cowapoo Johnson makes for a cozy stay at the Pendleton Round-Up. Beside the headdress that distinguishes him as a Walla Walla chief, William

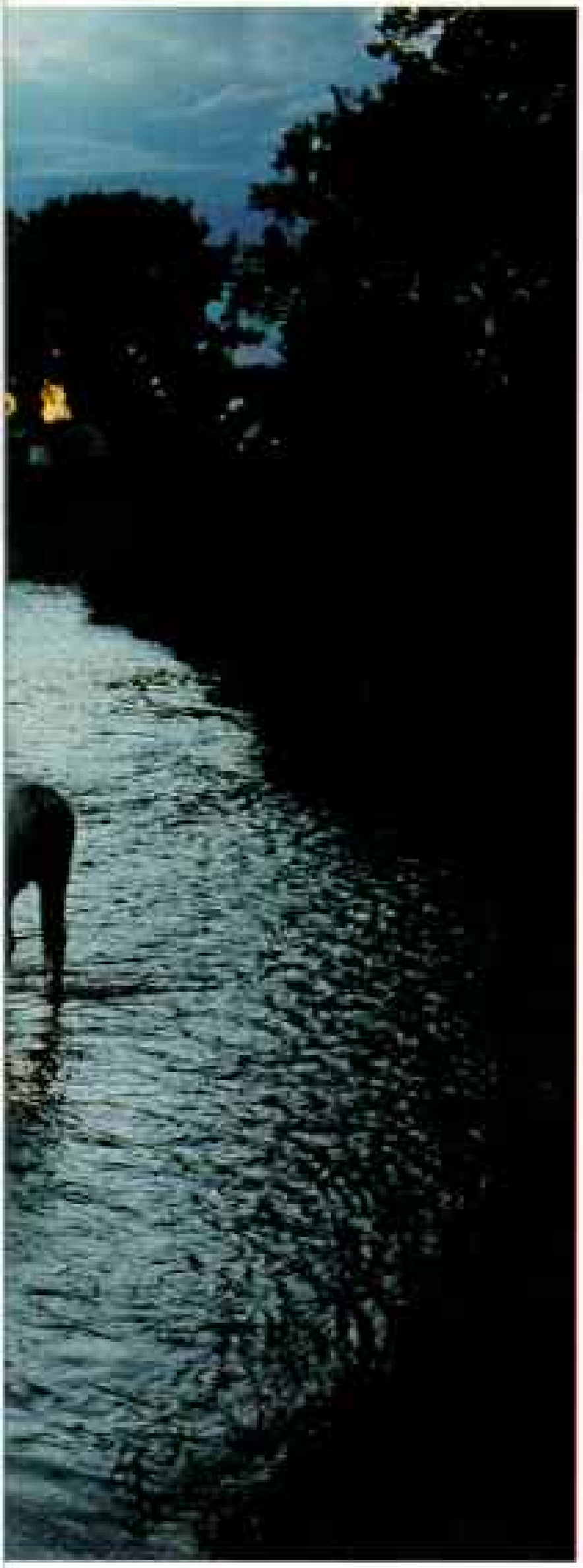
Burke visits with Ellen's granddaughter, Candice Cowapoo. The fight to preserve Indian culture is endless, he says. "Reservation kids are enthralled by what's happening in the white community."

Young riders pause at sundown in the Little Bighorn River during Crow Fair in Montana. Legendary horsemen, Crow stage a rodeo at their powwow in which competitors ride bareback and jump from mount to mount in a three-horse relay race.

mountain. I've only been to a few powwows, and already this sound is familiar to me, bearing memories of beauty, excitement, and friendship. It must be very powerful to someone who has grown up with it. "Every Indian," Alexie writes, "has the blood of the tribal memory circling his heart. The Indian . . . must come back, repeating, joining the reverse exodus." Today more and more Indians are coming back, not to the despair that has marked reservation life but to the strong sound of the drum.

In a poem called "Powwow," Alexie writes:

today, nothing has died, nothing
changed beyond recognition
dancers still move in circles
old women are wrapped in shawls . . .
still, Indians have a way of forgiving anything
a little but more and more it's memory lasting longer. . .



I sit on the grass at Elmo, listening to the music, trying to figure out what he means. Maybe the powwow makes people happy because it brings that long memory back into the framework of real life.

A Wednesday night in August,
before Crow Fair, Crow Agency, Montana

Gilbert Bird In Ground calls himself a born-again Indian. Crow call him "Popcorn," for a radio disc jockey he listened to as a kid in East Los Angeles. He's the manager of Crow Fair, one of the biggest powwows of the year. He's a mixture of old and new himself. For years he ran a huge dragline in nearby coal mines and kept his hair cut short. Now he's quit the mine and made that reverse exodus. One of the symbols of that change is his long black hair. "I'm not a competitive dancer," he tells me, "but I let my hair grow."

"The tribe lives from one Crow Fair to the next," Gilbert said later. "Every year you pray to make it to the next one."

His responsibilities range from making sure the 150 portable toilets are pumped out to setting off fireworks to announce the Grand Entry, and he looks as if he's praying just to get through this one. But he's the most peaceful worried man I've ever seen. Every time I turn around, he's got some kid on his lap, soothing away tears.

Crow Fair is a pragmatic place. In the effort to carry ancient memory and culture into their lives today, Indians don't hesitate to use modern tools. This seems perfectly in character; they didn't scorn horses or rifles either. Crow Fair is a city of a thousand tepees—and hundreds of pickup trucks, campers, and tents. Young Crow boys on horses race bareback through camp, but a camp crier comes around every morning at sunrise in a pickup truck, shouting wake-up calls in Crow through speakers mounted on the cab.

The singers have handmade elk or deerskin drums but also use high-powered amplifiers. Dancers wear brain-tanned buckskin that they clean with white cornmeal, beadwork that takes months to complete, eagle feathers that are hard to get and require federal permits—and big printed numbers safety-pinned to their regalia to identify them for competition. Indians are practical; they use whatever comes to hand.

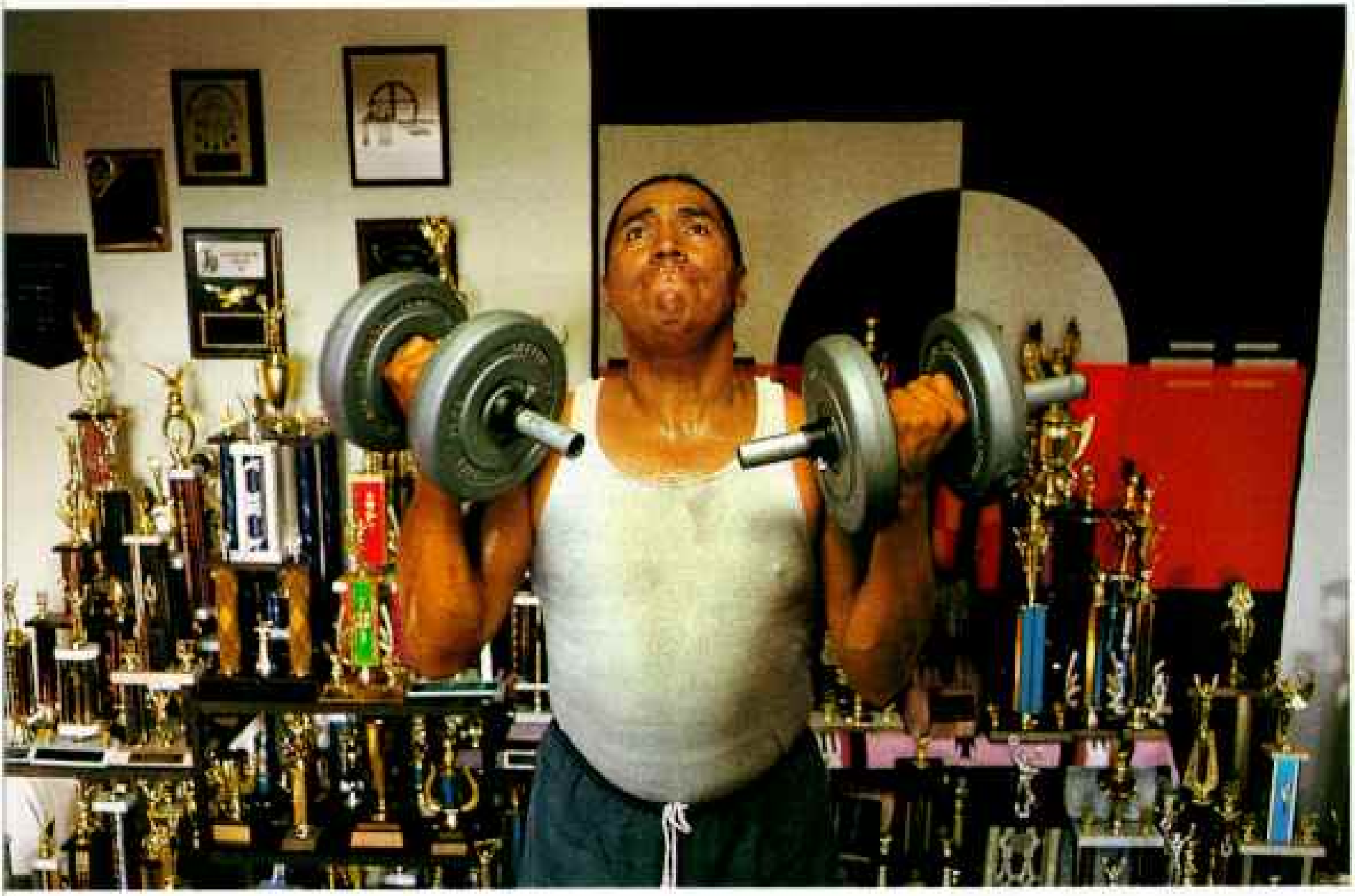
Before I know it, I'm one of those things that came to hand—Gilbert signs me up to record scores in my laptop computer.

Saturday night, Crow Fair

This happening is dusty; fine brown grit settles on everything. "It's good us Indians don't sweat," Dale Old Horn booms into his wireless mike. "Or we'd all have muddy necks."

I sit in the back of the announcer's stand and type results. Familiar names rise to the top of the standings. Terry Fiddler is running away with the Men's Traditional, and Jonathan Windy Boy will take home a thousand dollars for the Men's Grass.

He dances as if his body were put together entirely of sinew. At



"My dad made me start dancing at age 3," says Jonathan Windy Boy, 35. "He never said why, but I didn't question him." A full-time professional powwow dancer, Windy Boy logged 26,000 miles in just two months last year as he drove the Powwow Trail, collecting prize money and more trophies for his Montana home. By training for stamina, he says, "I'm probably good for another 20 years."

the end of each session he rushes up and down the line of fellow competitors, shaking their hands, as if pumping them all up with his extra energy. Like many dancers he was a high school athlete. He played basketball and ran the 100, 440, 880, and mile.

At other powwows I've dipped in and out of the arena, as do most people. Now, locked to my keyboard on the announcer's stand, I see it in one piece.

It is not, after all, just a dance contest. It's a family reunion, a big party, a place where kids go courting—known as "snagging." It's a place where you can get a little wild. "If your marriage survives Crow Fair," Gilbert says with a smile, "you're good for another year." "The powwow committee," an announcer said at another celebration, "is not responsible for divorces, separations, or babies."

People also mark their most important transitions here. They come to the powwow to honor their athletes, their scholarship students, their friends, their retirees, their dead. Contests are regularly interrupted by Specials or Giveaways, 20- or 30-minute events. During a Special, Old Horn gives the cordless mike to another speaker, who describes the person to be honored. Then a drum group sings, a crowd of aunts, uncles, grandparents, brothers, sisters, parents, and children dance in a circle; people come out of the crowd to shake hands and dance with them, and then the family gives away blankets and cottonwood branches with dollar bills taped to the twigs.

"We believe in generosity and family," Gloria Matthews had told me back at Red Earth. It shows.

Visitors to powwows are sometimes disappointed at the fancy

sound systems, the paper numbers pinned on buckskin, the Indians in regalia using tape recorders. It doesn't seem authentic. But as I watch a long Giveaway in honor of a teenager who died in a car crash, I realize that these Indians are not playing games about how it was. They're trying to carry a long heritage right into the future. This is not how it *was*. This is how it *is*.

Eleven p.m., Monday night, Crow Fair

Now, at the end of the fair, Gilbert Bird In Ground has his own Giveaway ceremony. The powwow is winding down. He's still married. He's happy. Suddenly, out of the cacophony of shouts and music, I hear my own name. I go out into the arena, amazed. He and his wife give me a blanket, a shawl, and a ten-dollar bill.

An anthropologist from the Smithsonian Institution who led a research team at Crow Fair rushes up to me. "Do you know what that means?" she says. I just grin. But when I get back on the stand, I ask a Crow tribal leader:

"What does that mean?"

"He's asking you to be his friend," the man says.

"What's the right response?"

The man looks at me for a moment. He says:

"Be his friend."

A Friday morning in September,
United Tribes International Powwow, Bismarck, North Dakota

A dust devil whips through the tent camp just outside the arena at yet another powwow. I've never seen anything like this before: The dust devil picks up a tent and flings it 30 feet in the air. The tent floats to the ground like a big green bird. The wind swirls back into the sky. What sort of omen is this?

Over at the arena I hear a voice I recognize—Dale Old Horn.

"Luke Warm Water, Luke Warm Water," he says into the cordless mike. "You are wanted in the showers."

Everything's familiar. It's just a big family. Terry Fiddler stands at his camp between two pop-up trailers, and Jonathan Windy Boy drives past and yells a greeting. Once again Terry is leading the Traditional Dance contest with his crisp, light footwork, and Jonathan is supple and unbeatable in the Grass Dance. Jonathan is also singing with his drum group, Haystack, and I ask him if we can talk for a while about singing and the powwow.

He's been laughing raucously with his fellow singers, telling jokes that would burn a hole through this page. When I make my request, he gets very solemn and puts on the stone face that non-Indians think is characteristic. I think of Alexie: ". . . used to be only whites expected Skins to have monosyllabic faces," he writes, "but now, we even expect it of each other."

"Do you have any cigarettes?" Jonathan asks.

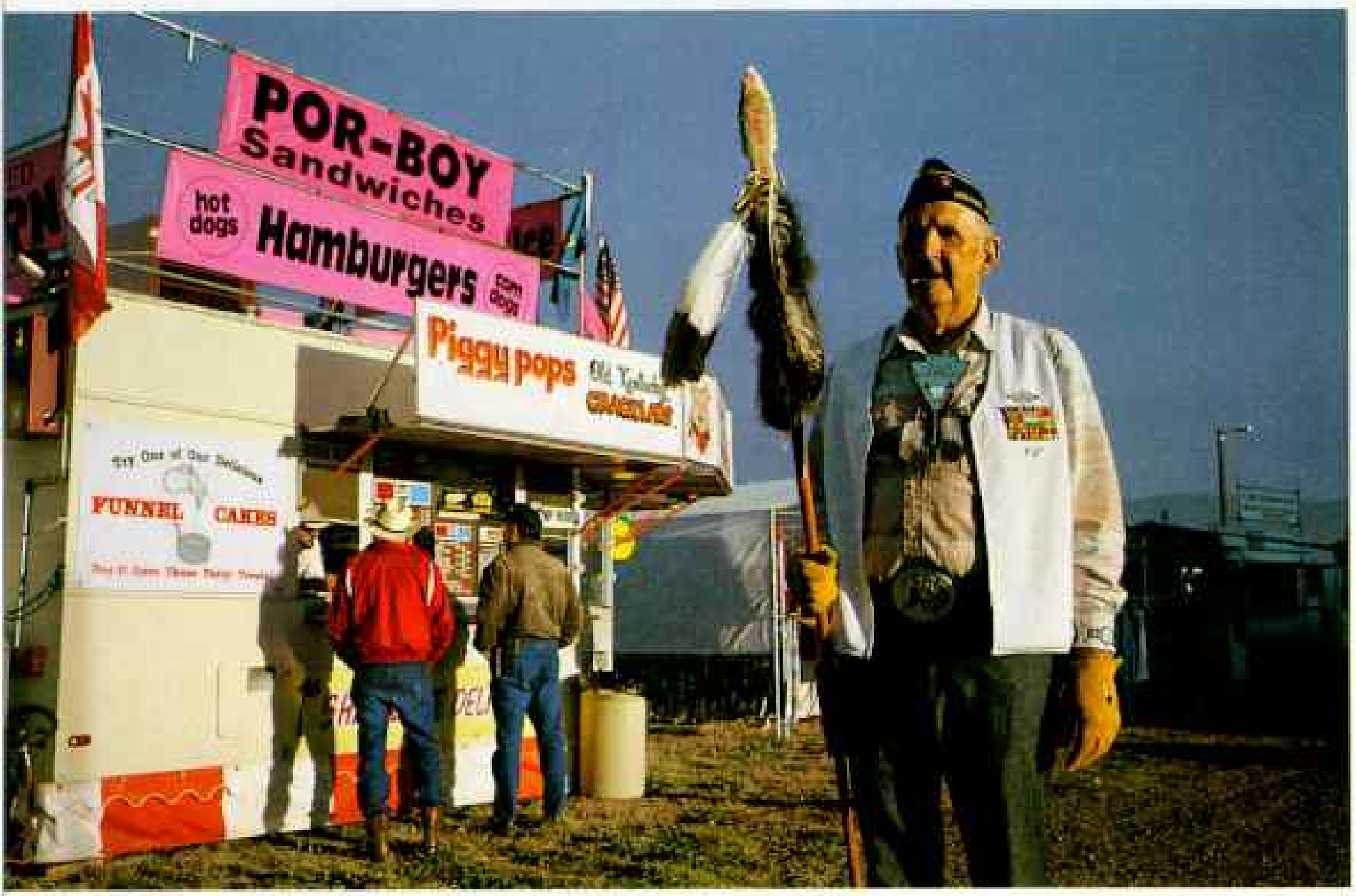
"No."

"As soon as I see tobacco," he says seriously, "I will tell you stories."

"They come to the powwow to honor their athletes, their scholarship students, their friends, their retirees, their dead."

A small splash of finery takes the floor at Red Earth as a youngster moves with the throbbing drum beat during a dance competition. Rooted in ancient ceremony, powwow dances sprang from the

activities of Indian life: warfare, healing, and the hunt. Contestants began embellishing their outfits at the turn of the century at the urging of show promoters in Oklahoma Territory.



Old Warrior was the nickname earned by Jim Swearingin—of Chippewa, Osage, Cherokee, Scottish, and Irish descent—who commanded a gunboat in Vietnam in his forties. "We got shot at a lot by snipers," said Swearingin. "That'll make your hair turn gray." With his lance and Yakama Warriors Association cap, he joined the color guard that carried the U. S. and Yakama tribal flags at White Swan last fall.

Tobacco is a traditional substance of honor. I have seen it sprinkled on a powwow ground as part of a blessing ceremony, and I have seen it left as an offering on a sacred stone on the Montana plains. I bring a carton of cigarettes and slide them under the drum, and later Jonathan tells me stories—off the record—of buffalo, coyotes, and creation.

I have often been told that the powwow is not a spiritual event. "Powwows are traditional, but they're not religious," Gloria Matthews had said. "You just want to share your good times." But there is no separation of church and state in Indian life, and every once in a while something like Jonathan's request for tobacco reminds me that the dance, the songs, the regalia, even the conversation of the powwow are connected to fundamental ideas about life and the universe that are very different from those of the cultures that came from Europe.

These ideas are private. Indians are willing to explain things like Fancy Dancing, but often consider it improper to discuss more spiritual ceremonies.

Once or twice at some powwows a dancer blows an eagle-bone whistle during an Intertribal dance. The dancers crowd around the singing drum group while the man with the whistle plays eerie, high music. I was not allowed to photograph the playing of the whistle, which meant it was a ceremony. When I asked what the ceremony was for, the question was evaded. After that, every time I heard the whistle I knew they were going somewhere I could not follow, and goose bumps crept across my skin.

At United Tribes I asked a Native American writer what he thought of a recent film about whites and Indians. "I saw two

different approaches to religion," he said. "A priest who followed the holy book and Indians who followed their dreams."

This was not fanciful. When I talked to a noted Lakota dancer about the unusual design of his regalia, I expected a description of history and research. He said: "It came in a vision."

I had a sudden image of a way of life whose surface is less solid than my own, a life in which you can see through the skin of the earth and time, as if it were only painted gauze, to the texture of the past and the visions beyond it. Indians scatter litter on the surface as if they don't care, but they attend carefully to the layers they see on the other side. No wonder music and dance, those tools we use to reach beyond words, are so important.

Tonight, as dancers file into the arena, one of the dance judges stands by the trash-strewn entrance with a burning braid of the herb called sweet grass. Many Indians believe its incense is purifying. As the dancers pass by, each of them reaches into the smoke with his hand and washes it across his face.

Sunday noon, United Tribes Powwow

Every time I grow too serious about all this, I get reminded that the Indian's monosyllabic face is only paint. An Indian may look solemn for cameras, but behind that face is laughter.

At his camp Terry Fiddler is putting on his outfit for the weekend's last Grand Entry. I drop by and talk about the past few days. I remind him of the dust devil that picked up the tent.

"Hey," I say, "did you see that big wind that came by?"

Terry looks at me without cracking a smile: "That was me."

A Wednesday morning on I-94, somewhere in North Dakota

I have been racing across the country with Jonathan Windy Boy and Bernard Bob, a Canadian Cree who sings with Haystack. I've caught a ride with them from one powwow to another, a 3,000-mile cross-country jaunt that will take four days. Jonathan dances like an athlete and drives like an athlete: a sprinter. In two days he has already had two tickets—one for 89 and the other for 85. A cop in Minnesota, who was familiar with the Powwow Trail, said: "You're going to have to slow down to at least close to the speed limit." Jonathan didn't.

Two eagle feathers and a braid of sweet grass lie on the dash. A radar detector and a digital clock are clipped to a visor; no matter where we are the clock shows Montana time. Eagle plumes, a small glass-and-metal headdress, and a circular web called a dream catcher hang from the mirror. As the little van sways down the miles, the eagle plumes seem to Grass Dance in the sun.

Jonathan eats sunflower seeds and drinks coffee. We zoom through a vast landscape of farms. " 'Skins lost a lot of their land here," Jonathan says thoughtfully, spitting shells. I'm driving now, trying to keep up the pace, while Jonathan tells me more creation stories, working hard on my education.

Suddenly there is a tremendous noise behind me. BANG! I

"Today many non-Indians are fascinated by the Indian way of life. Some want a new religion, and some believe Indians have a better relationship with our beleaguered earth."

manage not to flinch. The car's fine, and I don't seem to have been shot. It's just Bernard. He's given a hand drum a mighty stroke. The men start a Grass Dance song. We careen along, looking out at tasseled corn on what was once buffalo prairie, the song and the stories passing through the settled landscape like some subversive Indian dream.

Wednesday morning,
Frazer, Montana

We stop to take a breath at Jonathan's home. It's a simple rectangular frame house in a subdivision. He isn't here a lot; he returns occasionally to put more trophies in the living room and give his daughter a hug.

Her name is Jennifer, and she's eight. She has Jonathan's energy. She sings to me out of her schoolbook: "Peter Piper picked a peck. . . ." Signs and pictures on the wall make this look like a Christian household. But that night, when I start to whistle a tune, Jennifer stops me.

"Shhh," she says, and looks at me crossly as if I ought to know. "Don't whistle at night. Ghosts." So Jonathan tells her his stories too.

The landscape is big, open, and empty. The cluster of houses seems too quiet. The long wind of the western plains sings a song of desolation; these survivors are just a remnant. If I whistle, ghosts will come around, of people and hopes dead before their time. But then I think of all those warriors slipping back and forth across the continent in their powwow wagons, eating at truck stops and singing their Grass Dance songs. Not all the old life is dead.

"It's a free country," Dale Old Horn says into his mike. "Because the white folks ain't paid us for it yet."

Friday afternoon, Hartford, Connecticut

In the streets of downtown Hartford, I hear bells. I look out the window. The view is of brick, concrete, glass. But down on the sidewalk someone in a Fancy Dance outfit is walking past the hotel. This Powwow Trail is really getting strange.

All summer I have been hearing about Connecticut. "How are you getting to Connecticut?" "Those dancers at Connecticut. With all that money, they're going to pull out the moves!" The Mashantucket Pequot tribe of Connecticut, whose new casino rivals Atlantic City, has money to spill. The tribe has invited 32 drum groups and hundreds of dancers to the Hartford Civic

The exaltation of flight fairly bursts from an eagle-feather bustle at White Swan. The supply of eagle body parts is regulated by federal authorities, who provide the feathers of dead birds to qualified Indian applicants.

At a powwow in Richmond, Virginia, the Stoney Creek Singers focus on the drum. "It's sacred," said one young member. "We don't play around it or use foul language."

Center and will pay $2,500 for first prize in some events.

Terry Fiddler flew from South Dakota. Jonathan Windy Boy drove via Minneapolis, no doubt leaving a trail of sunflower seed shells and speeding tickets. Andy White and Whitefish Bay came down from Ontario in their '78 Chevy van. Jimmy, the young singer at Red Earth, is not with them—he chose a third option, college. The streets are full of Indians. They're staying at the Sheraton, the Ramada, the Holiday Inn.

This is the first big powwow ever in the Northeast. It's big time; no dust. TV cameras pan around the blue-carpeted floor, there are people from the *New York Times* and *USA Today*, and down behind the arena in a little room a photographer is shooting portraits of Indians in regalia for *Life* magazine.

Today many non-Indians are fascinated by the Indian way of life. Some want a new religion, and some believe Indians have a better relationship with our beleaguered earth. "A lot of people are spiritually bankrupt these days," says Floyd Hand, a Lakota who runs a food kitchen at Pine Ridge Reservation in South Dakota and acts as "spiritual consultant" for celebrities.

Outside the door to *Life*, I meet the white editor of an environmental newsletter. He's enthusiastic. "It's come full circle!" he says eagerly. "We're going to get to the point where the planet can't take any more, and these guys are going to save us!"

I think of Alexie's cynical eye, which sees the other side: "... the only time Indian men / get close to the earth any more," he writes, "is when Indian men / pass out and hit the ground. ..."

Near the escalators is a booth operated by the Native American Rights Fund, which is seeking donations and help to fight legal battles over religious freedom and land. There I talk to Marilyn Pourier, the fund's development officer. She has the same kind of unromantic view. We discuss a law professor's theory that over the years United States policy has always attempted to remake Indians in the image of the ideal man. In the late 19th century the ideal man was a farmer, so we gave Indians pieces of land to plow. In the 1970s he was a corporate executive, so in settling Alaska land claims we gave natives a maze of corporations. And who is seen as the perfect man today, when so many people are looking for old spiritual roots or environmental ethics?

Marilyn laughs.

"Now," she says, "the ideal man is an Indian."

Saturday night, Hartford

It's another Grand Entry. The dancers are jammed into the underground space behind the arena, waiting to go out on the big blue carpet. It's dark back here. Six young Indian men are playing basketball at a hoop over an emergency exit. The Fancy Dancers wriggle and stretch like the athletes they are, keeping loose. Kids dash around underfoot. Jonathan Windy Boy combs his fingers through his yarn, and tells a friend another pungent joke. The Traditional Dancers wait stoically in the dim light, sweating in their paint and feathers.

Proud and relieved, Kimberly Marcus hugs her great-aunt, Charlene Tsoodle-Marcus, after taking first prize in the young girl's Fancy Dance competition at the Taos Pueblo Powwow. "It's very stressful," says Charlene, herself a third-place winner among women. "You have to have a personal style."

For Kimberly and her peers, powwows keep the ancestral traditions vigorously alive.

"These celebrations," a friend told me, "are how we maintain continuity in the face of incredible change."

After all those attempts to mold Indians, Indians still will not be molded, even into our image of perfection. They take what comes to hand and use it to hang on. White society may have tried to make them into farmers or executives, but they're still doing just what they choose—being gambling moguls, spiritual advisers, Fancy Dancers: pragmatists who live on dreams.

A spotlight comes on in the arena. It reaches down into the twilight of the entryway to draw out the color guard, the senior men, the veterans, the many tribes. Eagle feathers are backlit with gold, as if by the sun. A drum begins. Feet pick up the beat. I hear bells and song. I hear Dale Old Horn at Red Earth, shouting into his mike.

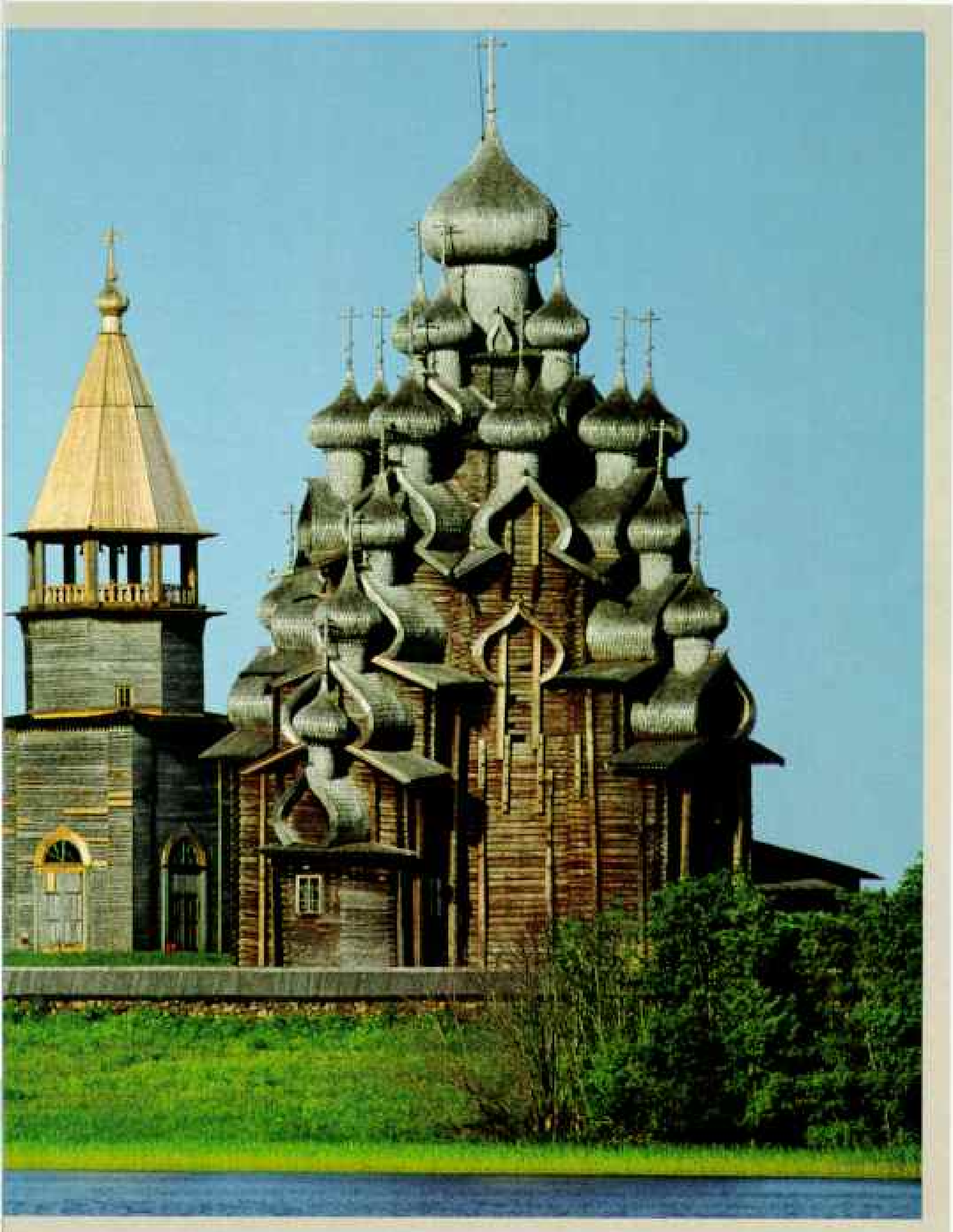
"We sing to victory! We are still here!"

Dancing, the Indians move out of the darkness. □

A RUSSIAN VOYAGE

By MILES CLARK

Photographs by JAMES P. BLAIR
NATIONAL GEOGRAPHIC PHOTOGRAPHER



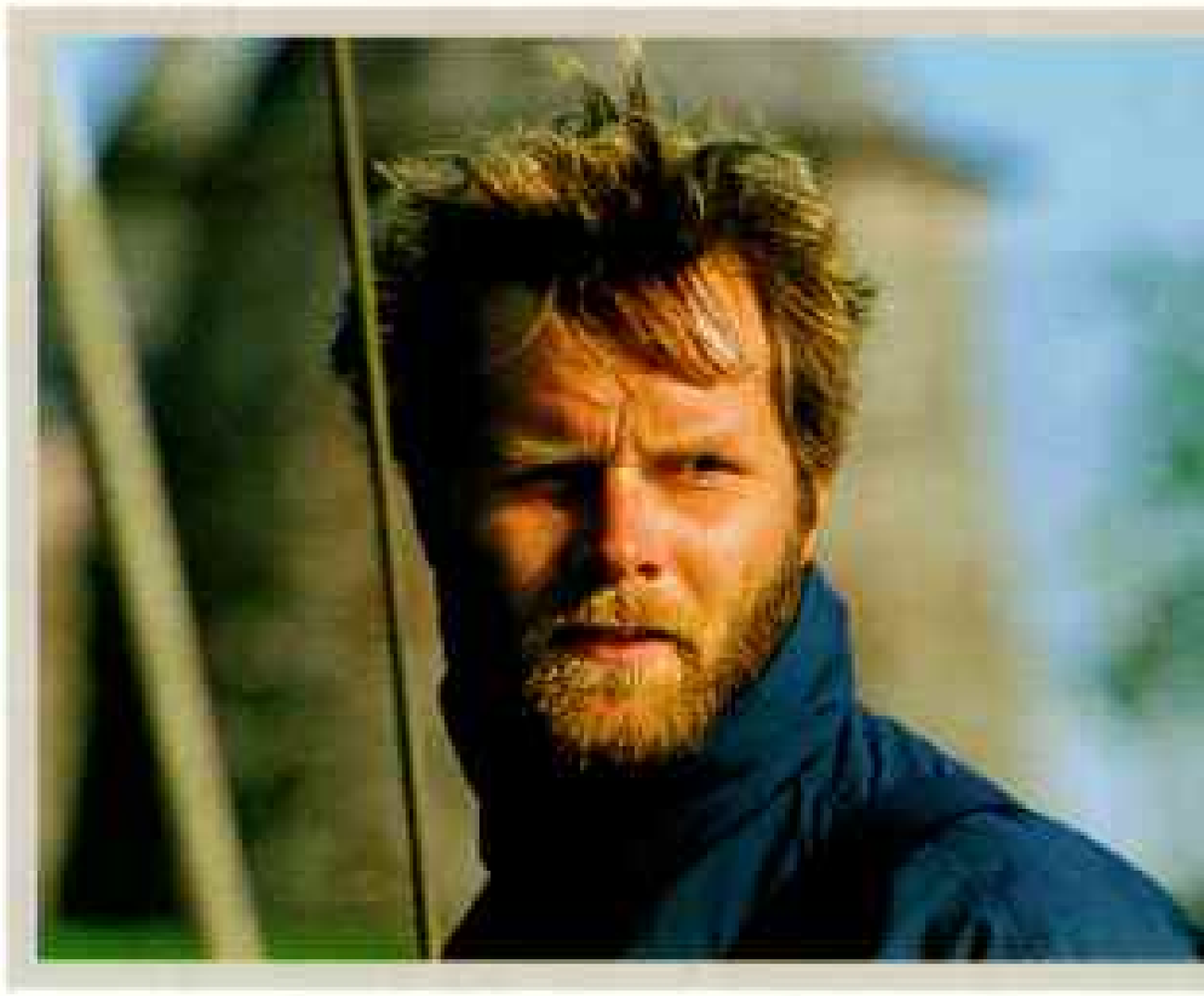
From the White to the Black Sea

On a wind and a prayer, the author's cutter *Wild Goose* sails by the churches of Kizhi Island, bound for the Black Sea.

MILES CLARK

Bureaucracy—not belligerence—musters a naval party to inspect *Wild Goose* off Murmansk. After a document check, author Miles Clark (right) was free to ply 3,000 miles of Russia's inland waterways—most closed to Westerners for decades.

The welcome party arrives from nowhere.



We haven't seen a soul all morning as we've sailed east around the northern tip of Norway into the frigid Barents Sea. But now a huge, gray tramp ship suddenly appears, steaming straight toward us. She is joined by first one, then two Russian patrol boats, a torpedo boat, and a light cruiser. In minutes our 34-foot wooden cutter, *Wild Goose*, is surrounded.

Davits are swung from the cruiser and a boat is lowered, followed by a scramble net and swarm of life-jacketed figures who immediately take to the oars. Heavy boots land on our side deck, and six armed sailors take up positions from bow to stern.

For the past 40 years the only foreign vessels to enter these cold northern waters have been fishing boats, research ships, and NATO submarines listening to the comings and goings of the Soviet Northern Fleet. Now here we come in our Irish sailboat, intending to penetrate the very heart of Russia.

The officer in charge of the boarding party is a picture of courtesy—black side hat, brown shirt, black tie, black uniform, outstretched hand, and the faintest hint of a smile.

"Good morning, Captain. I am Lieutenant Popov," he says.

"*Dobrayooh ootra. Minya zavoot* Miles Clark," I reply.

We have exhausted our knowledge of each other's languages.

After our papers are checked and rechecked, *Wild Goose* is escorted into an uncharted anchorage. At last Lieutenant Popov pulls out a small battered phrase book. He studies it for a moment, then hands me an open page. At the top are the lines:

YOU ARE ARRESTED.

I AM SEARCHING FOR THE SPACESHIP IN DISTRESS.

AERIAL BOMBING IS BEING CARRIED OUT IN THIS ZONE.

And finally, at the bottom: WE ARE GLAD TO BID YOU WELCOME ON OUR HOSPITABLE SOVIET SOIL AND WISH YOU EVERY SUCCESS.

"Welcome to Russia," he says. "Have a best journey."

"What's the use of Yeltsin going abroad when he should stay home and work on our market system?" huffs an angry villager in Nadvoitsy (right). Economic chaos sparked by President Boris Yeltsin's capitalist reforms has aroused bitter nostalgia for calmer—if more brutal—days among many Russians. Grim reminders of those iron-fisted times molder throughout the countryside, such as the toppled fence of a communist-era labor camp near the White Sea.

I have dreamed of this voyage since I was a boy. On imaginary wanderings across the pages of my world atlas I would run my finger along the thin blue line that twisted and turned from the White Sea in the north to the Black Sea in the south, following a 3,000-mile maze of canals, lakes, and rivers through the wilderness of western Russia. The journey, I knew, would take me down the continent's greatest natural highway from the dense timberlands of the northern lakes to the giant reservoirs of the Volga River to the open steppes of Cossack country. It would carry me to historic, exotic cities: Archangel, Nizhniy Novgorod, Volgograd.

Not until the failed coup of August 1991, however, did I dare to imagine that such a voyage was possible. For decades Soviet xenophobia barred the way. Now in the fall of 1991 a fragile window was opening—and fragile was the operative word. Several parts of the route were still officially closed. Month by month, corruption and organized crime were threatening to strangle Moscow. The Soviet Union itself was stumbling toward dissolution.

There was no time to lose. By February 1992 I had arranged for a crew: Hugh Clay and Willy Ker, my British crewmen, who would leave once we entered Russia; Vitaly Chankseliani, a 28-year-old interpreter from Omsk, who would accompany me for the entire Russian voyage; Nikolai Litau, 38, a skipper from Moscow, who would go as far as the middle Volga; and Arkady Gershuni, 40, an experienced sailor from Moscow, who would sail from Nizhniy Novgorod to the Black Sea.

The risks would be high. A severe gale, iceberg, or mishap with a freighter could disable

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Born in Northern Ireland, MILES CLARK was part of a team that sailed a replica of a 16th-century galley from Ireland to Scotland three years ago. The author of books and articles on subjects from Chinese medicine to skydiving, he died in April 1993 at the age of 32.

or sink our 60-year-old sailboat. Political permissions could be withdrawn or simply held up for a few disastrous weeks. Because the White Sea is normally covered by ice until mid-June and weather on the Black Sea becomes savage by mid-September, any delay en route—locks closed for repairs, a severe grounding, civil unrest, an engine breakdown from contaminated diesel fuel—could leave *Wild Goose* a permanent feature of the Russian landscape.

My seafaring father, usually an optimist, reckoned our odds as two to one against.

"But never mind," he told me. "She's an old boat, we've had a lot of fun with her over the years, and if you have to abandon her in Russia, so be it."

JUNE 15, 1992

WE PICK UP Vitaly Chankseliani in Archangel, capital of Russia's northern timber industries. The air is sweet with the smell of sawdust, and lumberyards run for a mile along the river. Wooden beacons lead past wooden boats tied to wooden jetties by wooden houses.

"So you are really here," says Vitaly, whose mop of red hair is rumpled by sleep when I collect him at dawn from the city's ramshackle, tsarist-era yacht club. "I didn't believe it would happen until I saw your boat coming through the timber rafts."

Of my three Russian crew members, Vitaly is the toughest to decipher. Having grown up in Siberia, he is less sophisticated than Nikolai or Arkady and acts moody and uncooperative at first. But later I realize that his occasionally sullen exterior hides a steadiness and loyalty more important than social graces.

Vitaly's first day aboard is miserable. Leaving Archangel in a heavy storm, we toss for hours on choppy waves in the White Sea, motoring into a driving rain. Vitaly, who has never before traveled on a sailboat, takes refuge in his cramped quarters below. His face

Gridlock in the lock: Barges and seagoing tugs clog the Volga-Baltic Waterway, Russia's link to the top of the continent. Locks lifted *Wild Goose* hundreds of feet on her passage south—and sometimes raised the author's spirits too. "A lock lady to whom I had playfully blown a kiss returned to drop flowers onto the deck," recalled Clark.

wears the vacant expression of a man wondering if he has taken the wrong train.

By the time we reach the Solovetskiye Islands the next day, the sea is calm once more and the skies are clear. The Solovetskiyes, cut off from the outside world for seven months a year by storms and ice, were the site of a historic monastery in the 15th century. More recently the isolated chain served as headquarters of the northern labor camps.

The scent of pine wafts across the water from northernmost Anzerskiy Island, still officially closed in the guise of a nature reserve. But there is no one to stop us. Leaving *Wild Goose* in a small bay, Vitaly and I climb through dog roses, heather, forget-me-nots, and sages—all buzzing with insects—to the hilltop remains of the Golgotha Crucifixion Monastery. It is a place I will never forget.

At one end of the narrow nave stands the vestibule where, during some of the darkest days of this century, frozen corpses of political prisoners were stacked to take up less room.

From 1923 to 1939 some 83,000 "counter-revolutionaries" and common criminals were held here in the most brutal conditions, starving and often semi-naked. Every race, creed, and profession was represented: bishops, doctors, murderers, princesses, and prostitutes. Beatings, drownings, shootings, epidemics, and the "mosquito treatment," in which offenders were tied naked to boulders and trees, were only part of a litany of terror that claimed more than 43,000 lives.

The next evening we anchor under the great kremlin on Solovetskiy Island, where a chapel echoes with the hypnotic tones of the Old Slavonic liturgy. In the 1400s two monks sowed the seeds here of a community that came to rank among the most honored in the Eastern Orthodox world. Today six monks minister to the island residents. I ask one if tranquillity can ever return to the scene of so much misery.

"Certainly, it is a place full of emotions,"

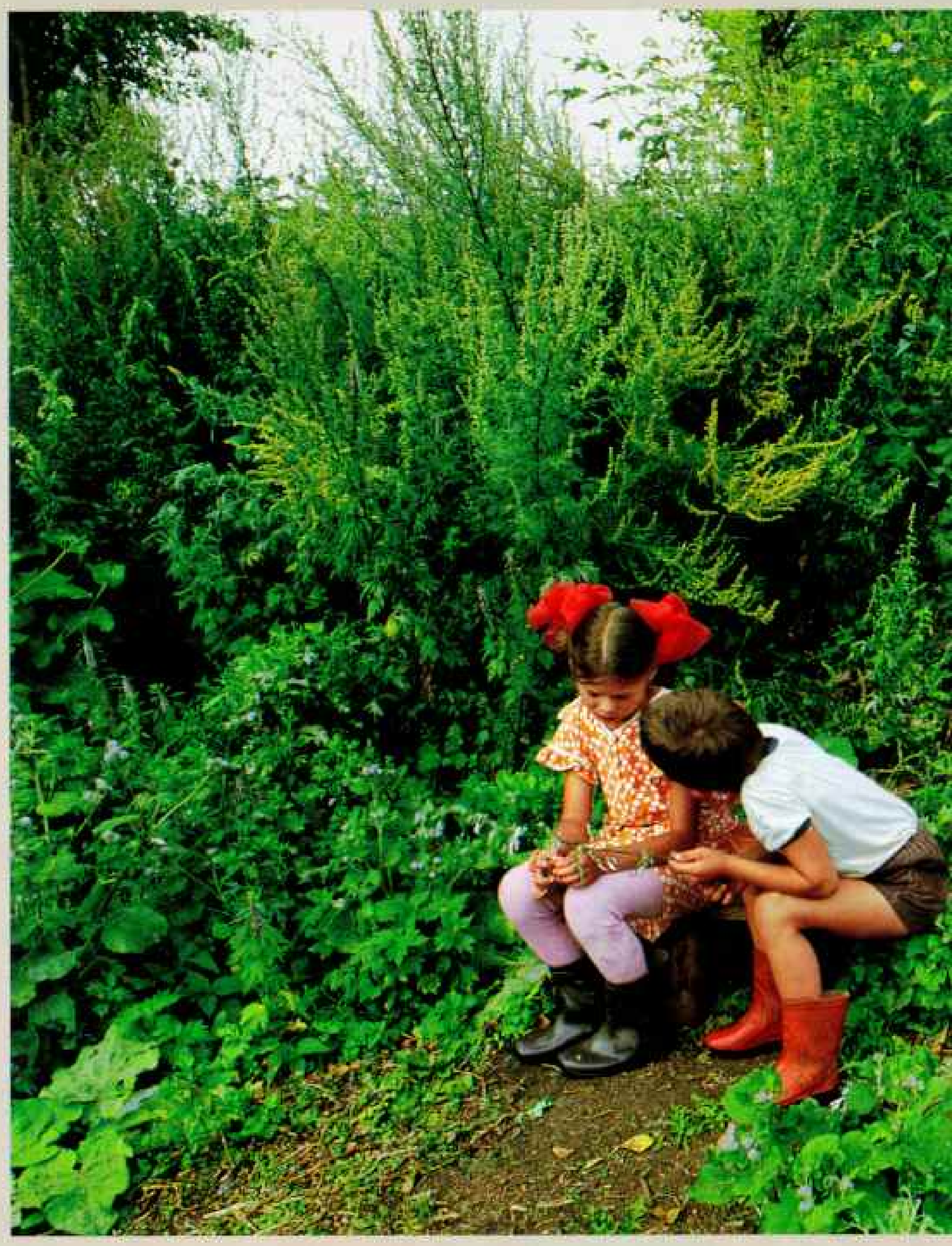
Mother Russia by sail

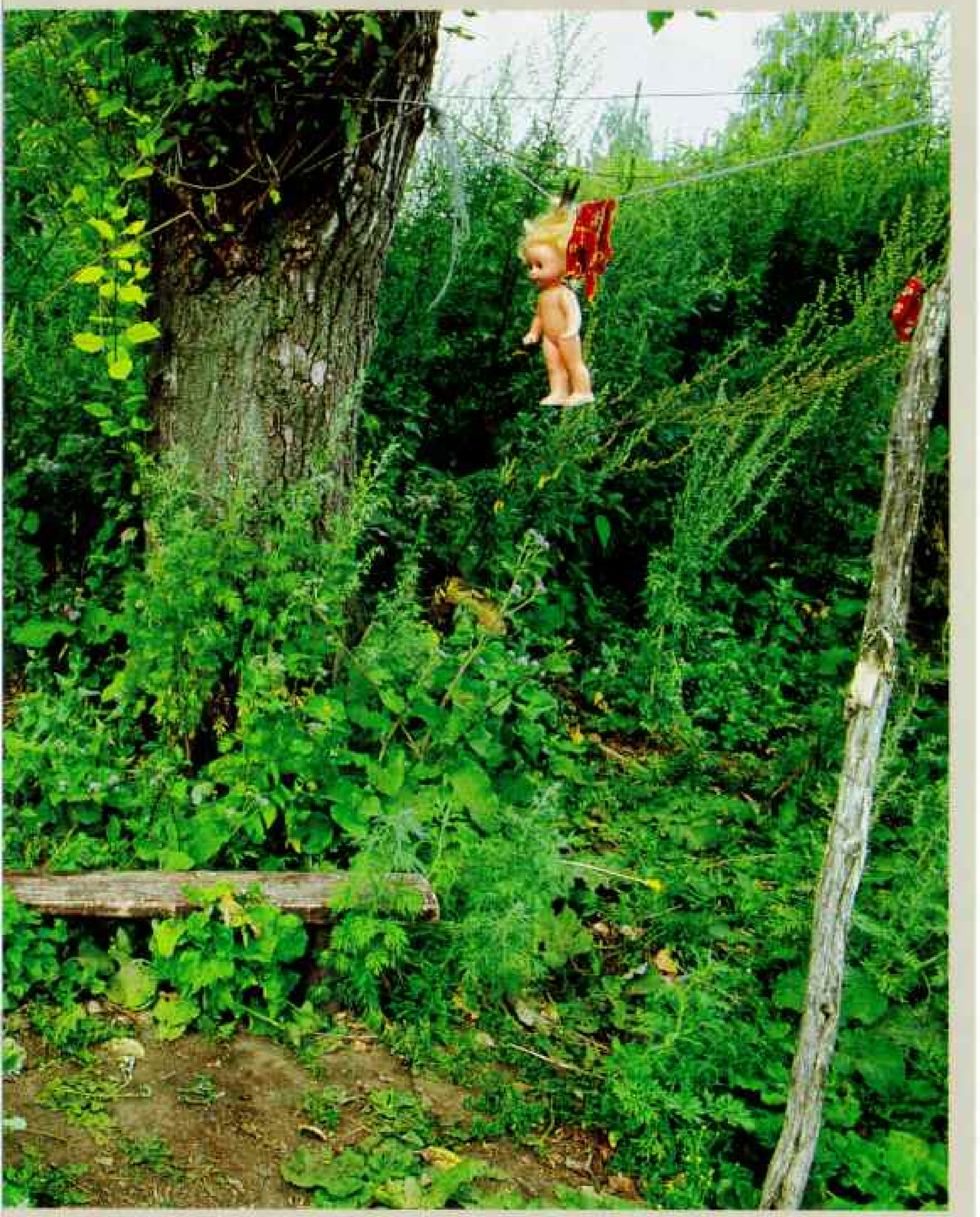
Navigating the soul of a nation, the author traversed subarctic lakes, canals carved by slave labor, and the fabled Volga River on his four-month journey through the cradle of European Russia. Pollution and damming have taken a heavy toll on the Volga. Even so, Russia's busy, brawny waterways remain powerful symbols of identity for a people who, in the words of Trotsky, "found their community on the great rivers."

Kola Peninsula
ARCTIC CIRCLE
SWEDEN
White Sea
Solovetskiye Islands
Solovetskiy I.
Belomorsk
WHITE SEA-BALTIC CANAL
Nadvoitsy
Arkhangelsk
Archangel
Wild Goose enters the White Sea-Baltic Canal.
FINLAND
Gulf of Bothnia
Lake Onega
Under Stalin, 300,000 people died digging shipping canals here.
Kizhi I.
Petrozavodsk
Northern Dvina
Helsinki
Lake Ladoga
VOLGA-BALTIC WATERWAY
Gulf of Finland
Tallinn
St. Petersburg
ESTONIA
Shuksma R.
Cherepovets
Rybinsk Reservoir
Novgorod
Valdai Hills
Mologa
Rybinsk
Kostroma
Yaroslavl
Riga
LATVIA
Volga
Gorodets
Miles of dam-flooded forests line the river.
Izhevsk
Kozmodemyansk
LITHUANIA
Vladimir
Nizhniy Novgorod
Kazan
Vilnius
BELARUS
Moscow
Grebeni
Cheboksary Reservoir
Kuybyshev Reservoir
Simbirsk
Tula
Saransk
RUSSIA
Samara
Lipetsk
Saratov
Volgograd Reservoir
Stained with algae, the Volga flows past steppes as seamless as the Russian sky.
Belgorod
KAZAKHSTAN
Volgograd
Krasnoarmeysk
Dubovyy Ovrag
Tsimlyansk Reservoir
VOLGA-DON CANAL
Volgodonsk
MOLDOVA
UKRAINE
Chişinău
ROMANIA
Rostov
Sea of Azov
Dolphins escort Wild Goose into the Black Sea — and homeward.
Crimea
Kerch Strait
Krasnodar
Stavropol
Novorossiysk
Caspian Sea
BULGARIA
Black Sea
Caucasus Mountains
ABKHAZIA
Sokhumi
GEORGIA
Wild Goose
Sinop
Tbilisi
Istanbul
AZERBAIJAN
Baku
ARMENIA
TURKEY

Route of *Wild Goose*
Dam

MILES
NGS CARTOGRAPHIC DIVISION





Childhood secrets sprout in a weedy garden in Grebeni, one of hundreds of villages lining the banks of Volga Matushka, or Mother Volga. Though mechanized farming has transformed rural life throughout the Volga's heartland, echoes of Russia's past still linger in the sounds of laughter skipping across the river, the sunset barking of dogs, and the distant splashing of fishermen's oars.

Faith blooms anew at Tolga Convent, where a young nun embodies the rejuvenated Russian Orthodox Church. Orthodox chapels (below) were flooded along with their towns by Stalinist dams on the Volga-Baltic Waterway. But the tide has turned, and religions of all types are resurfacing in Russia—from Baptist to Hare Krishna to Islam.

says Father Peter, an expressionless face in a simple black cowl. "So many people died here that the land is almost running with blood. And yet, what could offer a more plaintive call to future generations to follow the ways of mercy and peace?"

JUNE 22

THE BAROMETER IS FALLING like a stone as we leave the Solovetskiyes. This is our last open-sea passage for three months, and it turns out to be the most difficult sailing of the entire trip. Squalls and heavy rain cut visibility to less than a mile, and a gale-force wind blasts from the southwest. I steadily reduce sail, erring on the side of caution not only because of the boat's advanced age but also because of Vitaly's nervousness.

Struggling to make out the outermost buoy, I search for the narrow, labyrinthine channel, crudely marked by tree trunks, that leads to the White Sea-Baltic Canal. At last we reach the town of Belomorsk, guarding the northern entrance to the canal. A wilderness of broken buildings and prowling dogs, the city strikes me as a scene of irretrievable gloom. Here, in a freezing, horizontal rain, we find Nikolai Litau waiting on a wooden pier.

"I knew it was you the moment I spotted a tiny white speck on the horizon," he says. "No Russian yachtsman would ever go out in weather like this if he could avoid it."

A descendant of German immigrants, Nikolai has film-star looks and a talent for persuasion. He has arranged for us to enter the White Sea-Baltic Canal, the first time a foreign vessel has been allowed in sight of it. Built by prison labor from 1930 to 1933—at a cost of 200,000 lives—it cuts through 130 miles of forest and swamp to Lake Onega.

To guard against officialdom, Vitaly now replaces the British ensign on *Wild Goose* with the Russian tricolor, and on June 24 we begin motoring south through the canal. Here the

landscape is bleak. But every now and then the forest opens onto scenes of irreducible simplicity: a flock of goats tended by a figure in a sackcloth shawl, a cluster of rain-stained cabins, the echo of a woodpecker, and the scent of smoke climbing upward through the trees.

JUNE 27

THE DEAL I MAKE with Nikolai is that he steers and works the engine, while I do the cooking. It has to be that way because only I can read the instructions on the tins and packets I have brought from Ireland. Fortunately, we usually find better food in local markets: peppers, smoked sausages, slabs of butter and cream cheese, and heavy Russian bread.

Nikolai is a pleasure to cook for, but Vitaly is a picky eater. He spends hours removing the carrots from my soups and stews, and he teases Nikolai, the only member of my Russian crew who once belonged to the Communist Party.

"You're a sellout to bourgeois Westerners," he tells him. "You eat everything they give you." I sincerely hope he's joking.

Emerging from the canal into the 70-mile expanse of Lake Vyg this afternoon, we anchor off a low, narrow island where a dozen small *izbas*, or cottages, are gathered in a meadow of buttercups and cowslips. What was once a small fishing community is now home only to Aleksei and Nastasia Antsiferov, an aging couple with sallow eyes. Their tumbledown house, guarded by two vicious dogs, is made of logs, the cracks chinked with local grass.

Nastasia invites us inside into a small dark room, where winter clothing hangs on birch twigs nailed to the wall. There is almost nothing to indicate that we are in the 20th century.

"We have a generator and a small transistor radio," Aleksei says, "but we hardly ever use them. What's the point? We're old and have no education. Only ourselves." In the gaps of our conversation, the sound of mosquitoes becomes an audible whine, ceasing only when Nastasia drops a smoldering log into a bucket to drive the insects away with smoke.

For 30 years salting and drying pike for local fishermen provided them with a small trickle of income, says Aleksei, whose shirt cuffs are completely worn away. "But now it's very difficult. Food is very expensive, and the fishermen come only two or three times a month. Next year, we will probably have to leave."

The only thing Aleksei asks for is insect repellent, and the next morning he judges the

Morning sun spotlights the interior of Voskresenskiy Cathedral, a jewel of Russian Orthodox architecture on the Volga. The church's main icon has a reputation for miracle making: Lost during the upheaval of the Russian Revolution, the icon is said to have spawned a spring where it was later found.

brand we give him even more effective than vodka, his usual anesthetic.

"Bug juice very good!" he says, laughing until a fit of coughing rakes the very bottom of his lungs. I'm still convinced he drank it.

JULY 7

NIKOLAI'S CHARM proves valuable in negotiations for supplies. On a trek ashore to search for diesel fuel, we come across a dilapidated gas station supervised by a shy, freckled young woman. She looks at us with suspicion.

"I'm not supposed to sell you diesel unless you have ration cards," she says. "Why lose my job for a few liters of fuel?"

Nikolai fixes her with a frank, steady gaze, calculated to instill confidence.

"I work for a transport company in Moscow, and if they fire you, I'll make sure you get a better job in Moscow. Believe me, I'll reward you well for the risk you're taking."

She shrugs, gives a demure smile, and begins filling our canisters, but only after naming a price well above the norm.

Before leaving Northern Ireland, I had secretly doubted the consuming fondness that the Russians are said to feel for the great Volga River—mother, lifeline, and savior of the nation. But over the 1,200 miles that we follow it, from Rybinsk to Volgograd, the river seems to confirm everything I have heard.

Draining nearly a third of European Russia, the river flows 2,300 miles from the Valdai Hills northwest of Moscow to the Caspian Sea. Until early in this century the idea of taming it was regarded as absurd. Each spring the river became a swollen torrent of broken ice and each autumn a maze of invisible shallows. All manner of ships and men coped with its vagaries, from horse-driven paddle barges to the sweating, singing *burlaki* in human harness—the famous Volga boatmen.

Then in 1941 Joseph Stalin sent Russian "volunteers" and German prisoners of war

History and laundry soap mingle in the Volga's currents at Kostroma, birthplace of the Romanov dynasty—Russia's last line of tsars. Lenin, who snuffed out their reign, was born 500 miles downstream. Long a river of empire, the Volga has been contested by Viking and Cossack, German and Mongol.

to construct a huge dam near Rybinsk, where the river turns southeast toward the distant Caspian Sea. Over the next six years the gathering waters of the Volga, Sheksna, and Mologa Rivers rose steadily northwest through forests, villages, and towns. The resulting reservoir was the third in a chain of monumental dams and power stations that turned the Volga from a river into a series of six massive inland seas, some with coastlines of more than 3,000 miles.

Fifty years later the Rybinsk Reservoir remains an unsettling stretch of water. The charts still warn of submerged forests, and a few miles south of Cherepovets the dome of Lyubets Church still stands precariously above the waves.

On our 14-hour passage to Rybinsk, much of it out of sight of land, there is never more than 15 feet under the keel, and once or twice the depth gauge flickers alarmingly. The next day we mention this to a rather humorless Rybinsk archivist. She allows herself a laugh.

"I'm not surprised," she says. "Only 20 years ago, when my husband went out fishing, you could still see the houses and streets beneath the water. Now everything is covered by silt and mud."

JULY 18

THE ONLY SAILBOATS we have seen till now have been owned by chemical plants, trade unions, or textile factories. But today, north of Gorodets, Vitaly spots a schooner beating toward us. The binoculars reveal an unlikely crew: a man in a sailor's cap and Hawaiian shorts, a woman in a pink designer track suit, a boy panning with a video camera.

"We are private yacht on holiday from Kostroma," the man announces on a loudspeaker. "We have good meat and French wine. You are very welcome to Russia." And then, just in case the uniqueness has been lost on us, he repeats, "We . . . are . . . private . . . yacht."

Vadim Romanov, 38, is both a son of the Volga and a shining product of the country's embryonic market reforms. His card introduces him as foreign economic relations director of a Russian-Danish textile venture in Kostroma, heart of Russia's linen industry and spiritual home of the Romanov dynasty. Whether or not he is really descended from the tsars, the difficulty of proving the lineage has in no way stunted his pride.

"I am hoping my son Roman will also call his son Roman," he says, "so that my grandson will be Roman Romanovich Romanov."

Farther north I had met the widespread feeling that it is now impossible for an honest Russian to make money, so that evening, after plenty of French wine, Glenn Miller, and Bruce Springsteen, I put it to Vadim.

"Listen," he says, "for 70 years our mentality has been completely spoiled. Now each person has to make a change for himself. Our private company took two years to create and faced 16 different administrative bodies. If

Their patience on hold, citizens of Yaroslavl (right) wait to test their mettle against Russia's aging phone system. "You get crossed lines all the time," notes one Russian caller. "So you have to shout over each other until the other party hangs up." Mixed signals are no problem in the Kozmodemyansk market, where a woman peddles both cigarettes and athletic footwear. Only serious shoppers need ask for the other shoe—stashed under the table to discourage theft.

people sit and wait for the government to help them, then they will have nothing."

As a successful businessman, he says, he could live in any country he wanted to. But he prefers to stay in Russia.

"Of course, if there is another putsch, my family and I will be killed in the front row."

JULY 19

BELOW THE GREAT DAM at Gorodets, almost halfway through our journey, the river suddenly narrows to less than 350 feet. The Volga, newly fed by water from the reservoir we have just left, streams south between steep muddy banks lined with grazing cattle. All the time the volume of traffic is increasing. A month earlier, the idea of threading *Wild Goose* through this chicane of tugs, tankers, and hydrofoils would have had my eyes revolving in opposite directions, but by now it is simply an accepted part of the journey.

Once, however, as we are motoring around a narrow bend, we are almost driven to the bottom of the river by a 5,000-ton tanker. The ship, issuing warning honks from astern, forces *Wild Goose* into the center of the channel just as another tanker appears from the bend ahead. To make matters worse, I see a large dredger—a mass of rusty buckets and protesting pulleys—creeping slowly into the channel from the opposite shore. There's no time to turn, no time to run ourselves aground outside the buoys, no way even to judge our chances.

I shout a warning to Nikolai. But he's already staring at the gap between the tankers. Two immense bows loom over us and for a long moment *Wild Goose* seems to stand still, held in a sliding canyon of steel plate and rivet heads that tears past us at a combined speed of more than 20 knots. We're passed by two roaring engine rooms. And then, just as suddenly, we burst out onto the marbled brown water of opposing wakes.

Nikolai gives a short, rather nervous laugh. "You see," he says with a shrug. "Nothing is impossible for a good Bolshevik."

JULY 20

BALDING AND BESPECTACLED, with a neatly trimmed gray mustache, Arkady Gershuni joins us at Nizhniy Novgorod, where Nikolai takes his leave. "I hope you know what you're getting into," Nikolai warns him.

A former engineer, Arkady has a perfect sense of how to deal with bureaucrats—when to plead, when to banter, when to stand firm. As we're passing through a canal, a lockkeeper tries to stop us. "You are to go straight back to the entrance," he screams down at us. "The chief inspector says you should not be here."

Arkady calmly but firmly stands his ground, insisting that permission has been granted—it actually has, but only orally—and hoping that no one demands written proof. Finally the lockkeeper relents.

"It's late Friday afternoon," Arkady explains. "The entire management of the canal is about to go away for the weekend. They obviously want us to go back and wait at the entrance until Monday. But I know, and they know, that if we quietly keep on going, we'll be a hundred miles south by then and everybody will have forgotten all about us."

The city of Nizhniy Novgorod, until recently, has been off limits to foreigners. Known as Gorkiy under the communists, its factories were the very heart of the Soviet military machine, producing fighter aircraft, submarines, and nuclear weapons. Today the town is being hailed as a model of market reform. And so, in some respects, it is.

The main hotels are full of foreign businessmen brokering deals they prefer not to discuss. State-owned shops are being auctioned into private ownership. And only a few miles from the small drab apartment where Andrei Sakharov endured his long exile from Moscow,

Government housing in Samara girds a skyline in soulless shades of gray, the concrete aesthetic of cramped quarters and long waiting lists. "You can wait ten or fifteen years for an apartment," sighs one jaded urbanite. "And everything that's built is already falling apart. The walls have bulges." In its switch to capitalism, Russia has privatized millions of apartments since 1992.

JAMES P. BLAIR AND MILES CLARK (OPPOSITE)

the city's first American restaurant is selling everything from fried chicken to T-shirts.

"The people here are super nice, super naive, and very hospitable," chirps owner Mary Khoury, a Texan commodity broker who, with her husband, Viktor, has shipped in everything except the building. Posters of New Orleans and Tina Turner parade across the walls.

For their part the people of Nizhniy Novgorod are making no headlong dash to privatization: Less than half the shops so far offered at auction have found a buyer. Throughout the spring, inflation was running at more than 800 percent, and by July most banks are hoarding cash for wage payments and major withdrawals. Few will exchange even small amounts for foreign currency.

For interest I try the state bank in Nizhniy Novgorod, but a policeman stops me at an inner door. "I'm sorry," he said, "it's impossible for you to obtain rubles here now." He glances around and then leans forward. "How much do you want to change?"

I suggest a hundred dollars.

"Come back in ten minutes."

Five minutes later, in full uniform and full view, he is waiting on the steps of the bank.

Vitaly gives me a resigned smile. "Corrupt policemen are a very small example of the cancer in our country. There probably isn't a ministry or department or factory in Russia where someone doesn't expect money for his agreement or for turning his back. There has always been corruption in Russia, but never like now. I'm afraid it will ruin our country."

AUGUST 10

FROM HERE ON I sense something increasingly unnatural about the Volga, now swollen to more than a mile wide. Along the northern shore the water has crept deep into the forests where the bleached bodies of the largest trees are sometimes all that remain above a thickening soup of decaying vegetation.

Sixty years ago a raindrop entering the river's source would reach the Caspian Sea in 50 days. The Volga was able to flush and renew herself. Now the same journey through six giant reservoirs takes nearly 18 months. Though the river may look clean—in more than a thousand miles, I have seen hardly any rubbish—it is not.

"You might not be able to see the pollution," says Asahat Kayumov, a young ecologist in Nizhniy Novgorod. "But every day the toxics and heavy metals accumulate on the floor of the inland seas."

Later we hear on Moscow radio that fighting has broken out in the Black Sea resort of Sokhumi in northwestern Georgia, where Vitaly's wife, Larisa, and their daughter, Yana, have gone for a holiday. The streets are said to be echoing with small-arms fire between government troops and Abkhazians, an ancient people bent on secession.

Vitaly takes it in stride. Because of the Russian telephone system, he must call Nikolai in Moscow for word about his family. But even

Leaving a wake of troubled waters, *Wild Goose* slices through the algae-clotted Volga south of Saratov. Feasting on agricultural pollution, algal blooms deplete the river's oxygen. "It may take decades to clean up," says Nikolai Litau (in yellow, above), one of the author's Russian co-captains.

then, the only news is that there is no news.

Every day reports grow worse. There is talk of artillery exchanges and approaching tanks, of volunteer fighters from the northern Caucasus streaming in to aid the Abkhazians. All appeals for a cease-fire have been ignored.

Powerless to help, Vitaly stubbornly remains on board, determined to finish the voyage. "Even if I could get to Sokhumi," he says, "I wouldn't know where to look."

AUGUST 19

WILLING OURSELVES a little faster now to the Black Sea, we reach Volgograd, formerly Stalingrad, at last light. Fifty years after the German siege of Stalingrad, one of the bloodiest in history, we sight the cranes and smokestacks of the metropolis that has grown from the rubble. There is still hardly a family that does not count a loved one among those who died—some 800,000, according to the government.

Beneath the shattered brickwork of Flour Mill No. 17, left unrepaired as a memorial to the fighting, members of a small choir are being fed vegetables and rice from a Red Army field kitchen. The women wear white blouses and long scarlet dresses adorned with tiny badges. Vitaly asks them who they are.

"We are the Children of Stalingrad," says Nadia Nikolayeva, a silver-haired babushka whose father and mother both died somewhere in the city. "All of us here went through that nightmare, living as best we could among the rubble. Every five years we come to this spot to remember." Her own badges cover six previous reunions.

Today Volgograd faces another enemy: pollution. In the southern district of Krasnoarmeysk, between the river and the Volga-Don Canal, there is a blighted landscape of apocalyptic proportions. At one end of a miniature industrial city, a huge chemical plant spews effluent into 50 square miles of settling ponds, some cracked into hideous patterns of orange

Poisoned from below, farmers such as Aleksandr Pitersky (left) irrigate fields with industrially tainted groundwater in the village of Dubovyy Ovrag. One culprit: effluent from a converted chemical-weapons plant that now churns out detergents and pesticides. The factory's gelatinous waste ponds (below) stain almost 50 square miles. "The wells are polluted too, but we still drink the water," says village mayor Aleksandr Krupenko. "There is no alternative."

and brown, others so glutinous that the wind barely riffles their surface.

AUGUST 21

WE ENTER the Volga-Don Canal. Almost nowhere else in the world do two great rivers flow so close to each other as do the Volga and the Don and still drain into different seas—the Volga into the Caspian and the Don into the Azov. Yet not until 1952 was a canal carved between the two. As we pass into the first lock, arms reach down the walls to sell us apples and tomatoes. Parents chatter, children stare, and cruise passengers wave.

"Where are you going?" they ask.

"From the White to the Black," Arkady shouts. We have traveled 2,500 miles of our 3,000-mile journey.

On the second evening the final gates of the canal open onto the country of the Cossacks, the free-spirited peasant horsemen who for 300 years protected the southern margins of imperial Russia. To the north lie naked hills and purple-shadowed valleys, to the south the semidesert. And yet, for devotees of Mikhail Sholokhov's epic novel of Cossack life, *And Quiet Flows the Don*, the scene before us is enough to make the spirits plummet. Within the broad 130-mile expanse of the Tsimlyansk Reservoir, the Don now barely flows at all.

AUGUST 31

BELOW THE DAM at Volgodonsk the river recovers its legendary character. Between the narrow banks of willow there are kingfishers, herons, egrets, and sea eagles, and in the older villages life still follows seasons with an almost biblical simplicity. Troops of wild horses stand switching their tails in the shallows. In the evening tens of thousands of crows congregate in the trees around us, and a hundred miles from the sea the first cormorants appear, flying stiff-winged over the water.

At one o'clock this morning—after two and

Beneath a sky of hammered gold, *Wild Goose* skims past the minarets of Istanbul—the ancient city of Byzantium, Russia's spiritual source. "Watched the sun go down like a red ball, with dolphins jumping clean out of the water in front of it," the author wrote in his log on leaving Russian waters behind. "Russian courtesy flag down. Half moon."

MILES CLARK

a half months, nearly 3,000 miles, 52 locks, and some unnervingly low bridges—the banks finally run out. Arkady trails a hand over the side, licks his finger, and laughs.

"Over 20 years of sailing," he says, "and finally I get to sea!"

All next day and the following night, before a northeasterly gale, *Wild Goose* surfs south across the Azov, the world's shallowest sea. By afternoon she enters the strait between the Caucasus and Crimea, and at last light we sail out into the dark blue water of the Black Sea, led by a twisting vanguard of dolphins.

For the moment our euphoria is muted, since we still do not know whether Vitaly's wife and daughter are trapped in fighting up the coast. Only two days later does word finally arrive from Moscow that they are safe.

They escaped by chance, Vitaly learns. Their friends' home was in the heart of the fighting, and a neighbor was killed trying to buy flour. Larisa and Yana got out on one of the last two ships to leave Sokhumi, taking with them only what Larisa could carry.

SEPTEMBER 12

FIRST LIGHT reveals the far-off shoulders of the Bosporus, and by evening we are sailing into the wonderful floating madness of Istanbul. Passing beneath the bridge linking Europe to Asia, we come upon ferries criss-crossing the water, dinghies dodging Volga freighters, Turkish torpedo boats speeding north, and fishing boats easing back to port.

We have come a long way, my Russian companions and I, across the heart of a vast country. And yet, in the great chronicle of comings and goings, I know that ours is simply another arrival—the culmination of a voyage made possible only through untold sacrifice. As for those I have met along the way, the strangers who never showed me an open palm but only a helping hand, I hope that their prodigious spirit can sustain them forever. □

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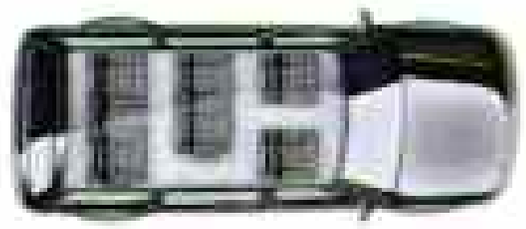

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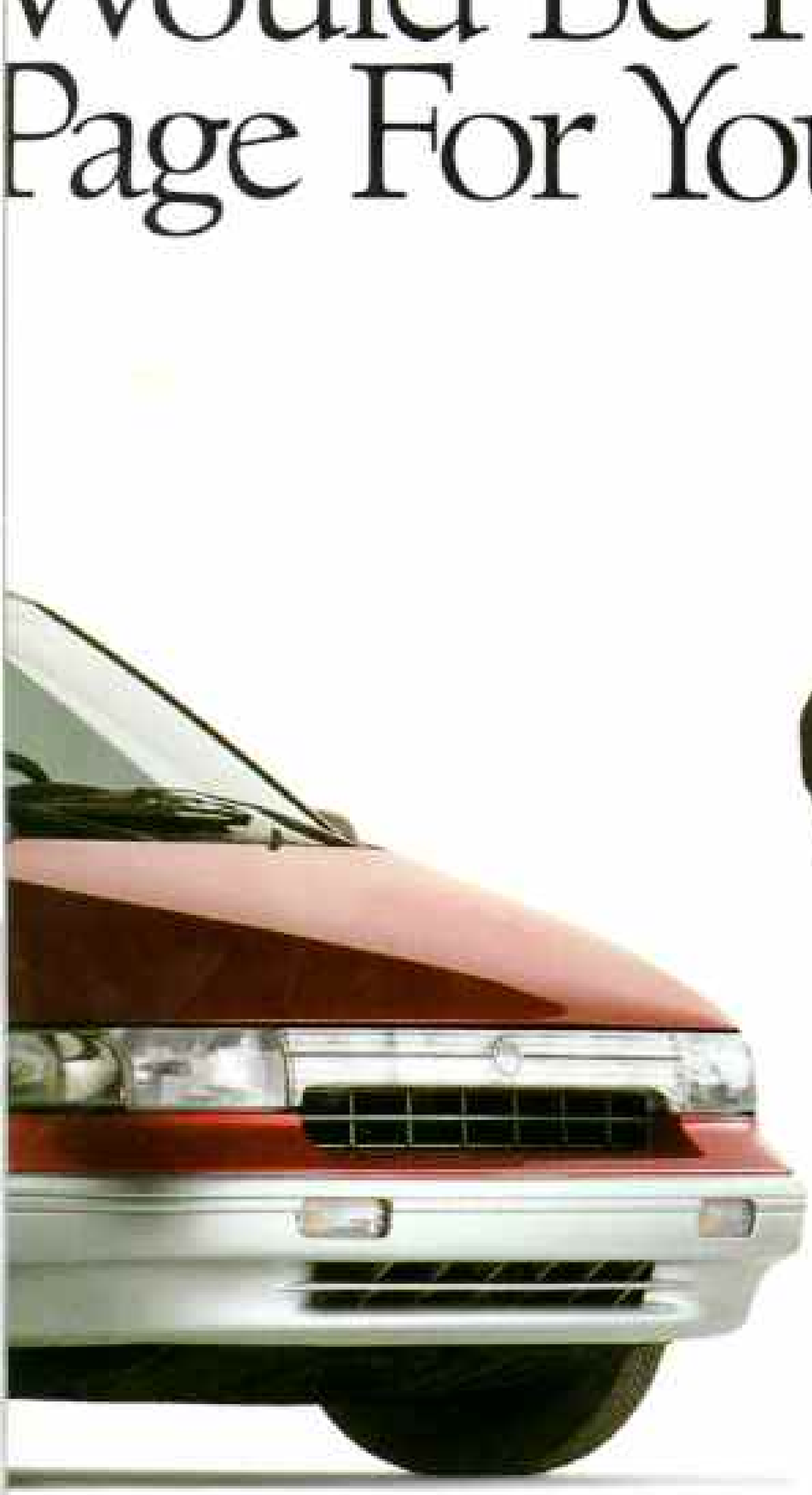

For years, Sandy Fitch taught business education using textbooks and standardized tests. Yet for years, she also felt there had to be another way. One that her students would find more relevant, more involving, more motivating. Sandy admits even she was bored with her old teaching methods.

On the Mac, family teacher for student, through Excel and Aldus PageMaker, as well as many other programs widely used in business today.

More important, she was concerned that her students weren't getting the hands-on training they'd need to compete in the workplace. So, in the spring of 1992, Sandy decided to try a different approach: Macintosh® personal computers. With this new teaching tool, Sandy developed a three-month-long project in which each student was asked to complete 11 business-related activities — all on the Mac.® Her students started in with enthusiasm. They wrote résumés. They assembled databases of employees and salaries. They produced a company newsletter. They even created a profit/loss statement. After they were done, the students were evaluated on their innovation and creativity, as well as their ability to follow directions and write — all critical workplace skills. "What a difference!" Sandy says. "Their work — and their evaluations — improved dramatically. They really got into the project because it had meaning for them, unlike my earlier methods of teaching and testing. The Mac gave them a chance to be more innovative." Now, Sandy proudly declares, her students have the skills for an entry-level job anywhere in the country. "They are computer literate and have strong enough communication skills so they'll feel comfortable in the workplace." Plus, with the multiple operating systems capabilities of Apple's new Power Macintosh,® proficiency on the Mac prepares students for practically any office computer environment.

Sandy Fitch created the most successful school-to-work program at Yarmouth High. But she didn't do it by the book.

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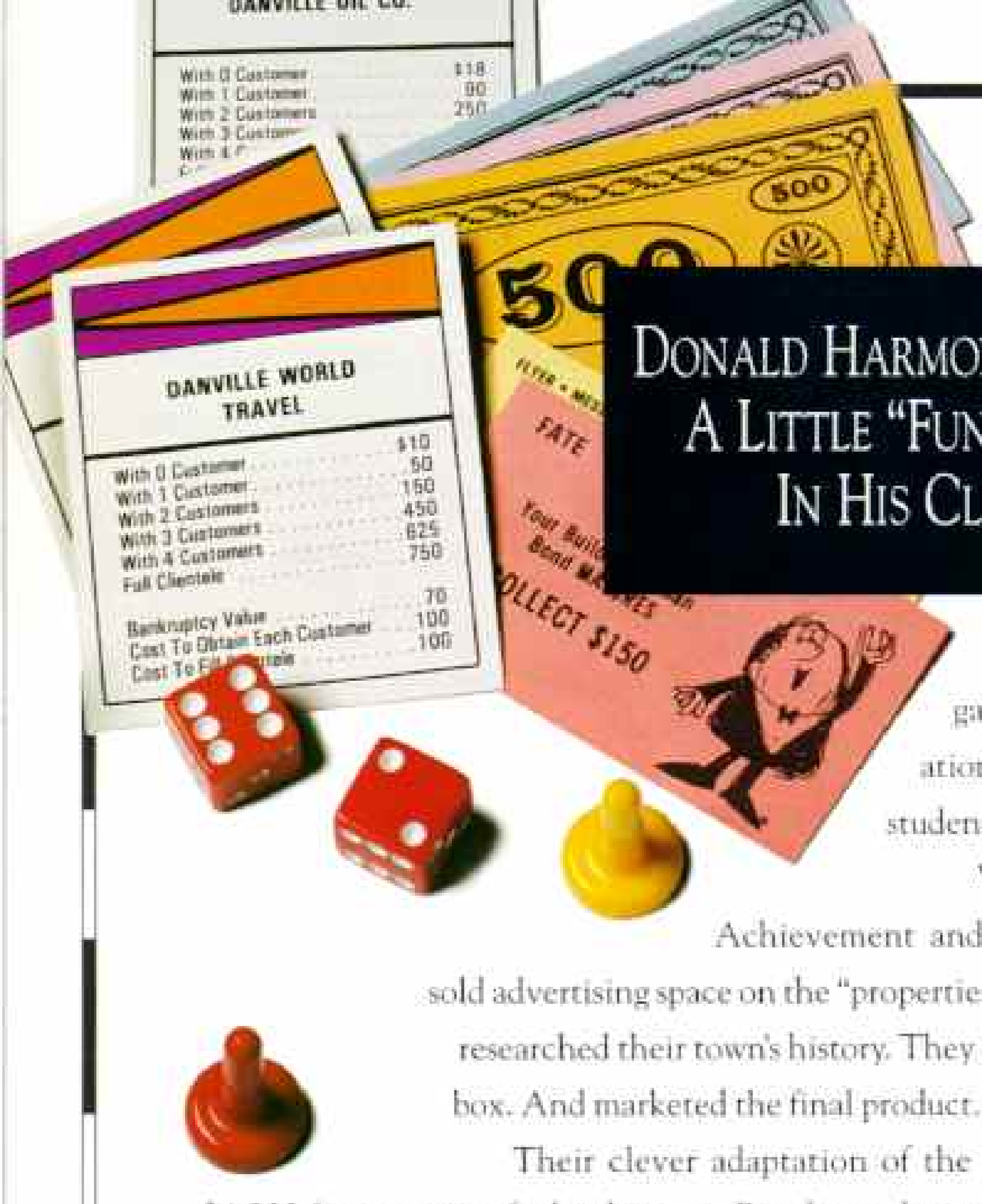

DONALD HARMON DOESN'T MIND A LITTLE "FUN AND GAMES" IN HIS CLASSROOM.

Especially when the game is "Danopoly," the creation of his high school honors students in Danville, Indiana.

With the help of Junior Achievement and Donald's guidance, they sold advertising space on the "properties" to local businesses. They researched their town's history. They designed a game board and box. And marketed the final product.

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THE PRESIDENT'S REPORT ON THE

Education Foundation

Finding the World Around the Block

For once, teachers got to take a field trip to the zoo—and leave their students back in the classroom. The Washington, D. C., teachers weren't playing hooky though. The Society's Geography Education Program and the Eugene and Agnes E. Meyer Foundation sponsored the study tour last March as part of a nationwide effort to help inner-city educators use local resources to make geography exciting for their students.

At the National Zoo's Amazonia exhibit they toured a simulated tropical rain forest and studied the plant life (above). In keeping with the theme of the D. C. workshop, "Brazil and the Amazon," they also visited the Brazilian Embassy.

Virtually every block of every city holds a geography lesson. A church, an ethnic store or club, a museum can push back city borders that all too often become the ends of the earth for urban youngsters.

While cities have endless lessons to teach, I believe the greatest learning resource of all is a supportive and informed family. That's the philosophy behind another Society educational effort about to be launched in several U. S. cities based on a model created by the Michigan Geographic Alliance.

The Family Geography Challenge presents families with their own world maps. They're asked to post the map on the TV room wall, watch the evening news together once a week for ten weeks, and use the map to discuss current events.

It works: The families not only learn geography together, they have fun. The Michigan program has had more than 6,000 families participate. In Lansing last February, 60 children, parents, and grandparents braved a blizzard to attend a Family Geography Challenge workshop.

Urban families find that the program enhances their kids' ability to understand the world beyond their city limits. The IBJ (Industrial Bank of Japan) Foundation recently awarded a generous grant to the Society's Education Foundation to help expand the program to Los Angeles, Chicago, and New York.

The IBJ Foundation's goal in supporting efforts like this is to educate a new generation of "global citizens." President Yuji Suzuki adds, "The great value of the Family Geography Challenge is that it brings geography learning into the home."

Thanks to such missions, kids can better see their place in the world and their role in shaping its future.

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Cuban-U. S. Teams Study Island's Biology

Cuba's flora and fauna, which are the most varied of any Caribbean country, have sparked a major collaborative effort between scientists from the U. S. and the island nation—transcending strained relations between the governments in Washington and Havana. Researchers from the American Museum of Natural History (AMNH), Cuba's Museo Nacional de Historia Natural, and other institutions have spent the past five years conducting original studies of Cuba's biodiversity, which includes such species as the Cuban clearwing butterfly (right) and the bee hummingbird (below left), the world's smallest bird (NATIONAL GEOGRAPHIC, June 1990). They've also found dozens of new species and subspecies, including a large blue lizard and a pupfish.

AMNH mammalogist Ross MacPhee joined the project after Cuban scientists found the fossilized skull and upper jaw (below right) of an unknown prehistoric monkey. "Its ancestry appears to be different from any South American monkey group," says MacPhee, who adds that the animal probably became extinct after humans arrived in what is now Cuba some 7,000 years ago.

Last fall MacPhee uncovered another primate fossil, this one about 19 million years old. The primate and a sloth and rodent from the same period are the oldest land mammals ever found in the West Indies. Researchers also found fossilized dugongs, marine mammals now limited to the Indian Ocean and parts of the western Pacific.

ALFONSO SILVA, MUSEO NACIONAL

ROBERT A. TYRRELL (LEFT); LORRAINE MEDER, AMNH

No Peace Yet in Brunswick Stew Wars

"Whereas, the celestial sustenance known as Brunswick Stew first appeared on earth in Brunswick County, Virginia, in 1828," begins the 1988 proclamation of the Virginia General Assembly. "Whereas. . . ."

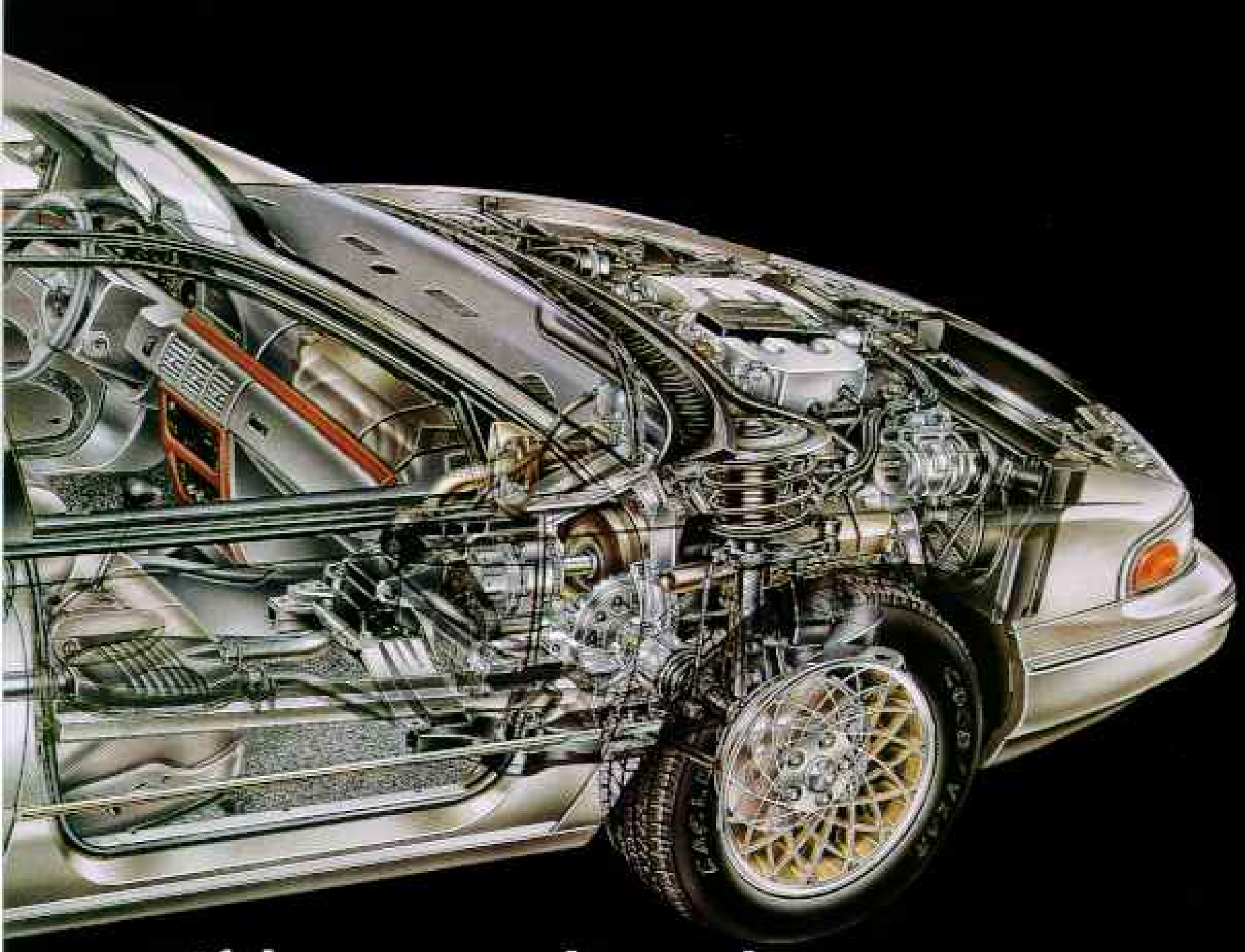
Hold it! Why does a 25-gallon iron pot along U. S. Highway 17 in Brunswick, Georgia, bear a plaque declaring it to be the very pot in which Brunswick stew first was cooked in 1898? What about Brunswick County, North Carolina, and other places across the South, all claiming to be the stew's birthplace?

What's more, there's little agreement on what exactly goes into Brunswick stew. "I doubt if there are two recipes alike for it," noted the late food writer James Beard, who called the stew "one of the most famous of American dishes."

Impartial stew experts—and yes, there are some—agree that early recipes featured squirrel; the "gustatory invention" created by camp cook Jimmy Matthews for an 1828 Virginia hunting party certainly did. Gradually chicken took over throughout the South, though cooks in many locales added beef, pork, and veal.

RICHARD THOMPSON

National Geographic, June 1994



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Historic Casualty: The *Monitor* Disintegrates

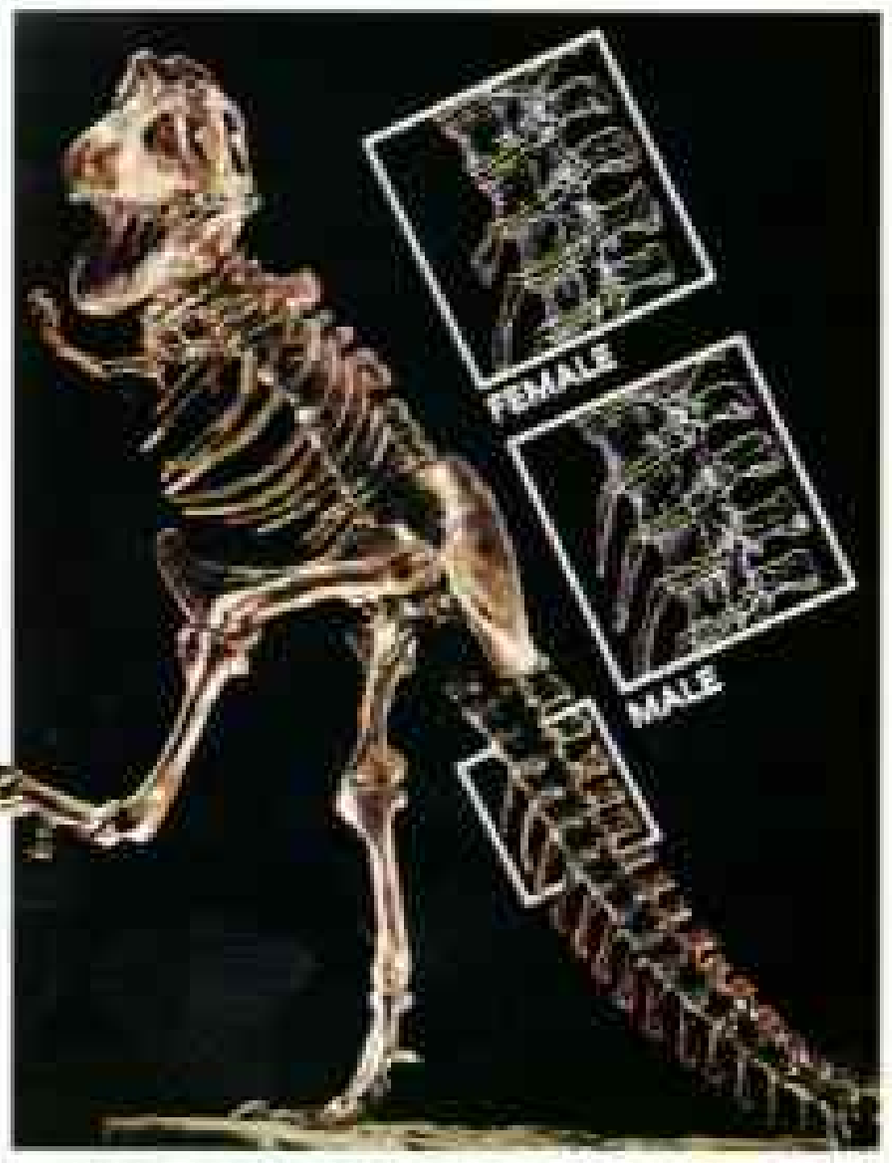
Some 230 feet beneath the surface of the Atlantic Ocean, a historic treasure, the U.S.S. *Monitor*, is rapidly deteriorating.

The *Monitor* sank in a gale near Cape Hatteras, North Carolina, on December 31, 1862. Ten months earlier she had fought the Confederate *Virginia* (known in the North as the *Merrimack*) in the famous but inconclusive "battle of the ironclads" (engraving, inset). The *Monitor*'s precise location was unknown until 1973, when Duke University researchers, aided by the National Geographic Society, found her about 16 miles southeast of Hatteras (GEOGRAPHIC, January 1975).

Divers from the National Oceanic and Atmospheric Administration (NOAA), using a diving bell and a four-person submersible, inspected the remains last summer. They examined a gaping hole in the stern, which had increased in size since observed by divers a year earlier (above). Deck plating had come loose, exposing the wood below to shipworms, but the distinctive armored revolving turret remained mostly intact.

NOAA scientists, who have been documenting the warship's deterioration since 1973, are dismayed by the new findings. A ship's anchor may have struck her, says John Broadwater, manager of the *Monitor* National Marine Sanctuary. Strong currents and seawater corrosion, he says, are responsible for additional damage.

THOMAS VOSELOFF, INC.



LOUIS PSIHOYOS, MATRIX; DOROTHY SIGLER NORTON (INSETS)

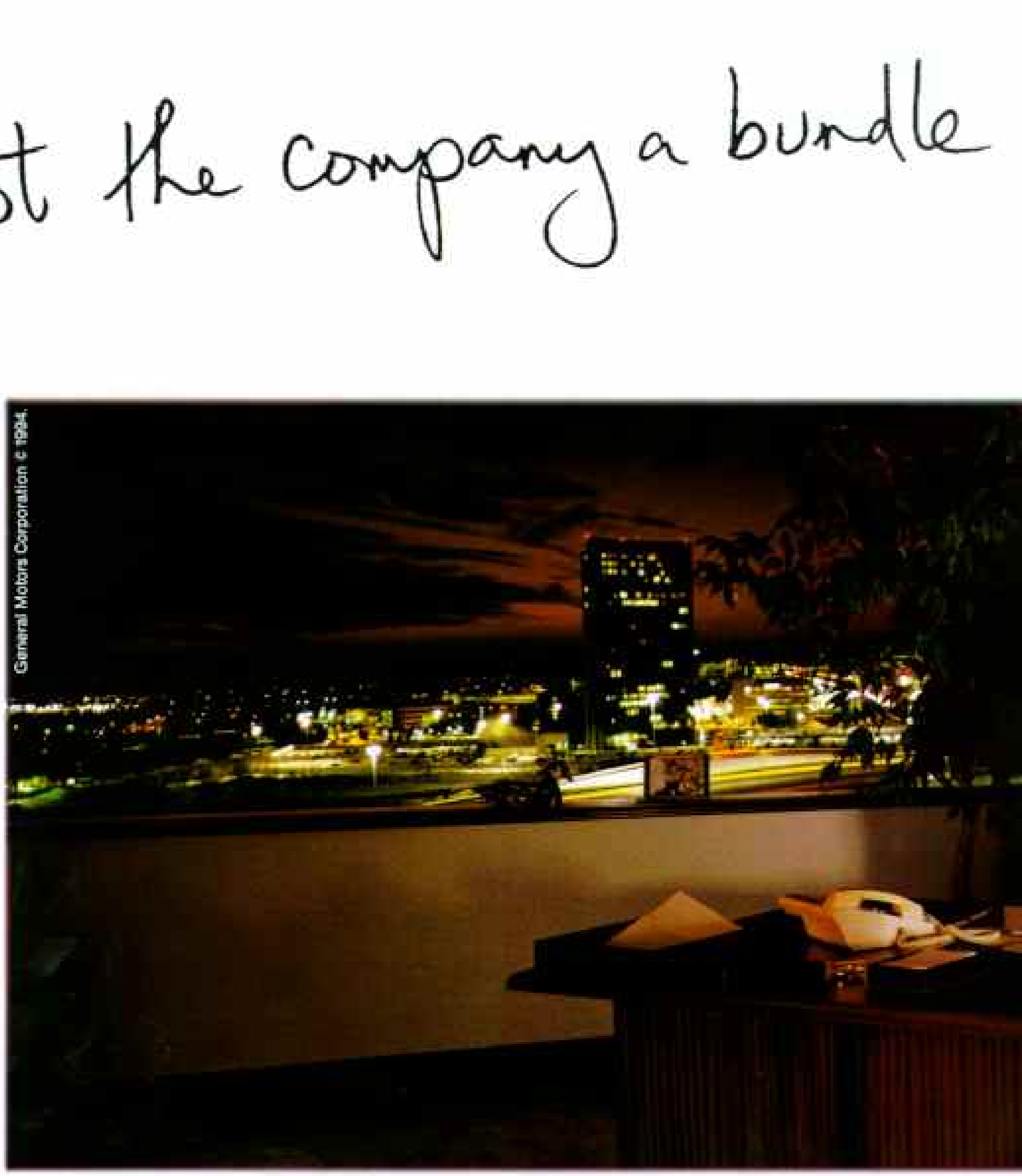
Tyrannosaurus Sex: How Can You Tell?

How do you identify male and female when you're dealing with dinosaur bones? The same way you distinguish kittens, says paleontologist Peter Larson: Look under the tail.

Some experts have suggested that size differences between adult dinosaurs of the same species indicate sexual dimorphism. Larson, of the Black Hills Institute of Geological Research, thinks he has found a trait to support that theory.

He first studied a *Tyrannosaurus rex* in South Dakota dubbed Sue. He then looked at more dinosaur specimens and found that in smaller adults, the first chevron—one of the bony spines attached to the tailbone—was near the base of the tail (lower inset). Larson believes that a muscle attached to this chevron was also linked to the male sexual organ. In larger adults, which he identifies as females, the chevron was shorter and farther down the tail (upper inset), easing passage of eggs. This full-size *T. rex* cast at the Denver Museum of Natural History, Larson says, is a he.

"We blew a deadline,
cost the company a bundle



What if you ran a division of General Motors and were due to debut an important flagship model...and it wasn't quite ready? Nothing drastic you understand, just a few little glitches that meant not every car coming off the line was just right. What if you'd sworn to your bosses you'd be ready? What if you had a lot of potential customers

ticked everyone off,

and we did the right thing."

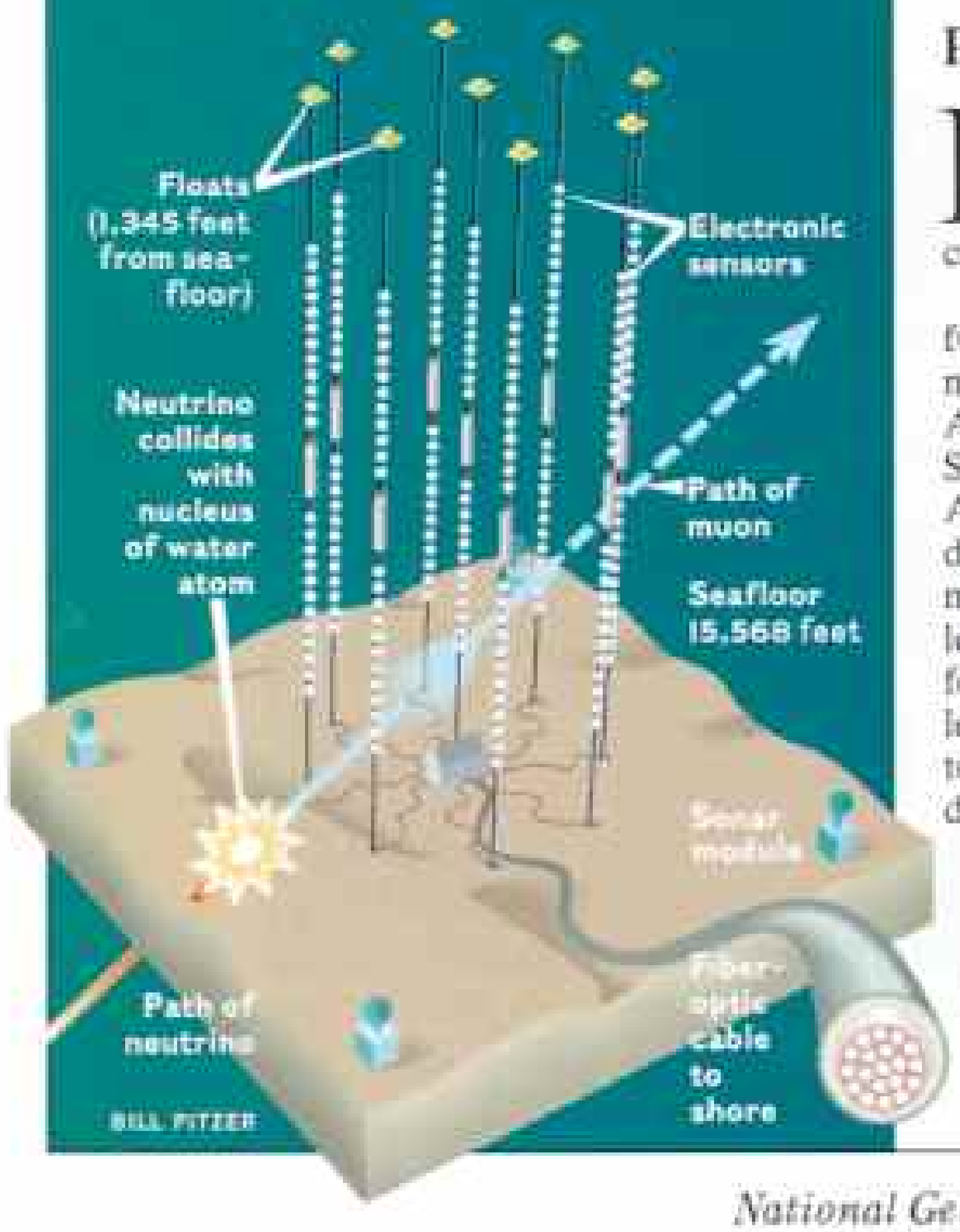
waiting to get a first look? What would you do? Here's what Chevrolet's Jim Perkins and his team did: they pulled the plug on the introduction and said, "When we know we've got it right, we'll bring out the car." That night, Jim Perkins did what people who do the right thing always do. He got a good night's sleep.

Geographica

Underwater Probes Hunt Clues to Far-off Galaxies

Granted, it sounds bizarre: an underwater observatory that gazes downward rather than overhead, looking for neutrinos—chargeless particles from space with little or no mass that zip through earth at the speed of light. Putting the apparatus deep in clear water, says the University of Hawaii's John Learned, filters out most of the "cosmic ray junk" that interferes with neutrino detection.

Anchored three miles deep off the island of Hawaii, one such observatory (below) uses strings of electronic sensors—their positions monitored by sonar modules—to detect the wake of blue light generated by a muon, a charged particle created when a neutrino collides with the nucleus of a water atom. By tracking the light, astronomers hope to determine the direction and point of origin of the neutrinos, which they believe emerge from black holes, quasars, and the nuclei of active galaxies. Similar devices are being placed in the Aegean Sea, in Lake Baikal, and in the ice under the South Pole, but Learned admits that they may not pay off. "We're like Columbus," he says, "sailing into new territory."



SHAWN E. HENRY

Vermont Grants Keep Barns, Heritage Alive

The Robinson family of Strafford, Vermont, built a three-story "round barn" (above) in 1917 with lumber from the farm's trees. Three generations later, Marge and Dan Robinson still stable and milk 30 cows there.

Two years ago when the roof began to leak, the Robinsons worried about finding money for repairs. Then they heard of a new Vermont program offering matching grants to repair historic farm buildings. They applied for and received $2,500 to begin repairs. Last year brought a new $3,750 grant.

"Vermont's economy is changing, and we're losing farm buildings at an alarming rate," says Mary Jo Llewellyn, who runs the barn grant program. "But many Vermonters want to continue to farm, and visitors come to see our agricultural heritage." The program has awarded $115,000 for 17 projects and serves as a model for preservationists nationwide.

Potato Scourge Returns in New Guises

In the 1840s a fungus hit Ireland's potato crop—causing a famine that killed more than a million people. Another million Irish emigrated during the course of the disease, called late blight (GEOGRAPHIC, May 1982).

Now new strains of the fungus have surged across northern Europe, South America, the U. S., Japan, South Korea, and parts of Africa. In the U. S. cool damp weather brought major outbreaks in 1993, leading growers to look for telltale signs: spots on leaves, dry and corky or rotten tubers. "The blight can destroy fields of potatoes with astonishing speed," says William Fry of Cornell University. The new variants resist metalaxyl, the most effective fungicide for late blight, but older chemicals—along with disease-resistant potato varieties—offer some protection. Nobody expects a new famine, since most people now eat a diverse diet, but potato growers risk economic ruin if they fail to keep a watchful eye on their crops.

PLANT PATHOLOGY DEPARTMENT, CORNELL UNIVERSITY

—BORIS WEINTRAUB

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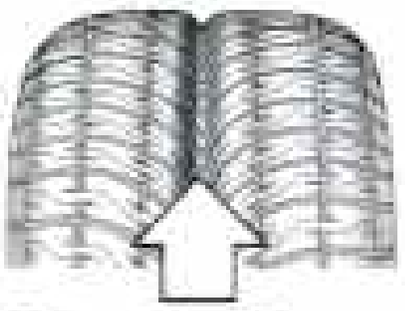

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GOODYEAR

Forum

Federal Lands

Richard Conniff's experiences in Idaho (February 1994) epitomize the intensity of emotions surrounding the management of federal lands. I worked for 13 years as a firefighter–forestry technician with the Forest Service. There and in my current position I've traveled to more than 75 federal areas; none has escaped controversy between those who seek to prolong historic use and those who seek greater protection. No matter how hard I've tried to work with local loggers, ranchers, and miners, I am still seen as the enemy because I urge changes that would benefit wildlife, watersheds, and air quality.

JOHN BUCKLEY, *Executive Director*
Central Sierra Environmental Resource Center
Twain Harte, California

The article "New Showdowns in the Old West" was well-balanced and brings to life the fact that what ranchers do is not all bad. Tourists can do just as much damage with their mountain bikes and cars. Also elk and deer walk in creeks and relieve themselves, just as cattle do. It seems to me that environmentalists want the western U. S. to become one big park and to let some other country worry about feeding us.

JODY L. PETTY
Asotin, Washington

I was delighted to see the photograph of Howard Blair and his granddaughters (page 13). I have been all over the BLM rangeland occupied by their cattle in all seasons. I have also enjoyed Joshua Tree National Monument nearby. From my observations, wildlife and plant life seem far more diverse, plentiful, and healthy on the Blair range than in the national monument. This appears to be a result of the cattle pruning the vegetation and fertilizing the ground and the ranchers maintaining water tanks that benefit wildlife and cattle.

MARGARET M. MAHER
Sacramento, California

I'm from Alaska (the state tucked under Texas on the map on *Good Morning America*), and I assumed that since more than half of all federal lands lie in our state we'd be included in your article. Wrong. Alaska's 58 million acres of wilderness, which are closed to development of any kind, cover an area larger than Pennsylvania, New Jersey, West Virginia, and Maryland combined. Alaska continues to be micro-regulated by "Beltway bureaucrats" and misunderstood by most Americans because of land-scarcity and land-abuse myths conveyed by articles like this.

FRANK BAKER
Chugiak, Alaska

I'm sorry you placed mountain bikers in the same category as strip miners and clear-cutters. The National Offroad Bicyclist Association and the International Mountain Bicyclist Association both stress low-impact riding and channel money into trail maintenance.

ADAM PAUL HUNT
Chico, California

Let's put things in perspective. Florida grows oranges, Iowa grows corn, and Oregon grows trees. The wood-products industry is Oregon's economic backbone and largest industry. This activity has been almost completely halted by President Clinton. Where are the replacement materials going to come from? Oregonians invented environmentalism. We own God's country, and we cherish it and protect it. We do not want outsiders telling us what to do with our forested lands.

BILL BOWEN
Klamath Falls, Oregon

As a mining engineer I am frustrated by the explanation of the economics of metal mining. I have no doubt that a "Canadian venture has been mining almost half a billion dollars a year in gold from a site in Nevada," but this is only one side of the story. It costs between $200 and $250 to mine and process an ounce of gold in the U. S. Companies must repay capital costs, plus pay federal and state taxes. Adding on confiscatory taxes would result in only the richest portions of deposits being mined, shorten the working life of the mines, and reduce employment. Mining will move out of the U. S. (as we are seeing in Canada) and go elsewhere.

LAWRENCE DEVON SMITH
Toronto, Ontario

Return to Hunstein Forest

The efforts of Edie Bakker and her parents to protect the rain forest and culture of the Bahinemo people in Papua New Guinea are laudable. However, I will never understand why the advent of tourists and beer is considered damaging to the culture while introducing Jesus is not. These people have survived centuries with their own beliefs, invoking their own gods.

RICHARD A. BONI
Budapest, Hungary

Thank you for revealing the incredible beauty of this little-known area. What I appreciated most was the fair reading the article gave to the hope in Jesus Christ that the Dye family brought to the Bahinemo culture.

CURT L. GOLIKE
Quito, Ecuador

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The world's just too big to be left unexplored.

Pied Bare-face Tamarin *Genus:* Saguinus **Species:** bicolor **Subspecies:** bicolor ***Adult size:*** *Head and body length, 20–28 cm; tail, 38 cm* ***Adult weight:*** *400–600 g* ***Habitat:*** *Rain forests in the state of Amazonas, Brazil* ***Surviving number:*** *Unknown* *Photographed by Luiz Claudio Marigo*

WILDLIFE AS CANON SEES IT

A curious pied bare-face tamarin ventures in for a closer look, revealing its strikingly bizarre features. Living amid the suburbs and surrounding areas of the expanding city of Manaus, these little primates have adapted to secondary forest, and in some areas have become familiar with people. However, the species is still at great risk from continuing habitat loss.

To save endangered species, it is vital to protect their habitats and understand the role of each species within the earth's ecosystems. As a global corporation committed to social and environmental concerns, we hope to foster a greater awareness of our common obligation to ensure that the earth's life-sustaining ecology survives intact for future generations.

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This program is funded, in part, by Canon U.S.A., Inc.

Canon

The *Wildlife As Canon Sees It* photo book is available for US$25.00 from Mediahouse Inc., C.P.O. Box 1333, Tokyo, Japan.

It was never made clear what aspects of the Bahinemos' way of life Edie Bakker would like to have preserved. One assumes that the list would not include cannibalism, intertribal warfare, and high infant mortality. One hopes that those wistful spectators to Sarah's unpacking could eventually have the same sort of possessions and aspirations that little Sarah has. To do this, the Bahinemos need money, education, and other things we take for granted. For example, if the men had a steel ripsaw, stainless-steel screws, and epoxy, they could make ten marketable canoes from that tree trunk, instead of one dugout.

MILTON G. MITCHELL
Department of Economics
University of Wisconsin
Oshkosh, Wisconsin

The juxtaposition of photographs of colorful birds and forest with those of colorful people supports the dangerously prevalent notion that Third World peoples are to be properly placed among the world's array of natural resources and wonders as exotica, along with cassowaries and special frogs. I suggest that greater effort be made to avoid portraying unfamiliar peoples as simple and benign, helplessly acquiescing to the inevitable onslaught of monolithic Western technology and greed.

NATHALIE ARNOLD
Bloomington, Indiana

Connecticut

Why couldn't you have done this article in the 1980s, when everything seemed to be going so well here? If anyone had told me six years ago that things were going to change so dramatically, I would not have believed them. Just when I think it can't get any worse, more layoffs are announced somewhere in the state. But unlike some people, I believe that things will get better.

THOMAS DISCORDIA
East Hartford, Connecticut

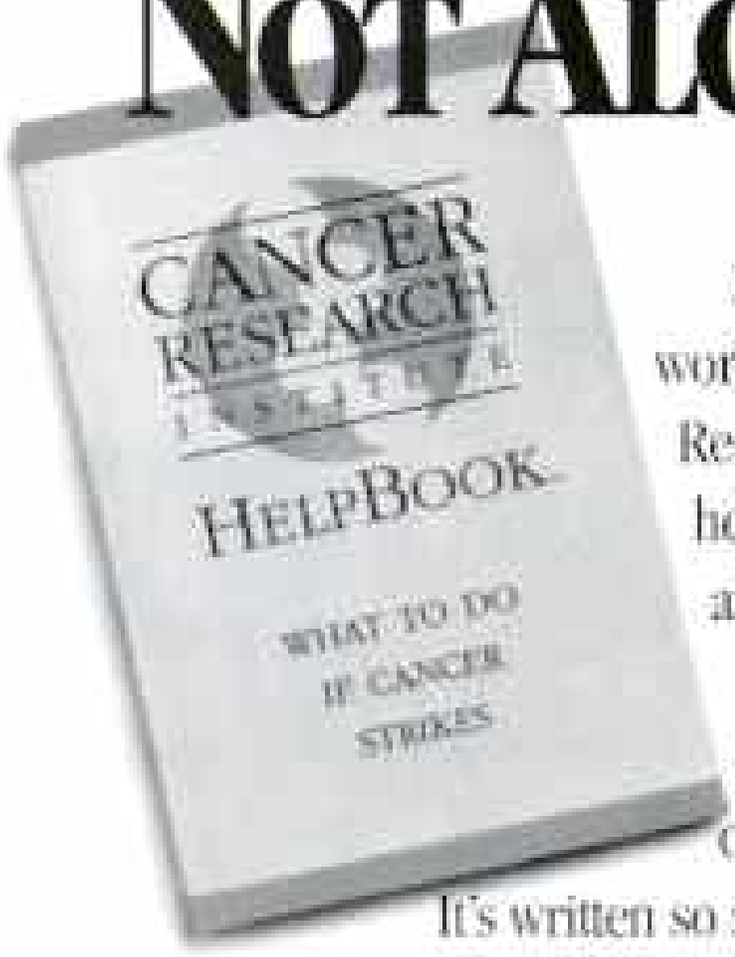
My family and I moved to Oklahoma from Connecticut in May 1993 by choice. No more crowded, impoverished cities, no more upside-down politics, no more bitter nor'easters. This 12th-generation Connecticut Yankee is proud to call himself an Okie and was happy to get out while the getting was good.

RANDALL F. JENKS
Broken Arrow, Oklahoma

Why didn't you have at least a paragraph or two about the educational system, including Yale, Wesleyan, University of Connecticut, Trinity College, and many others. These institutions had and have a great influence in the state, our country, and the world.

ALVIN D. JOHNSON
Wakefield, Rhode Island

IF THE THOUGHT OF CANCER SCARES YOU, YOU'RE NOT ALONE.



It's a frightening word. But the Cancer Research Institute is here with help — and hope.

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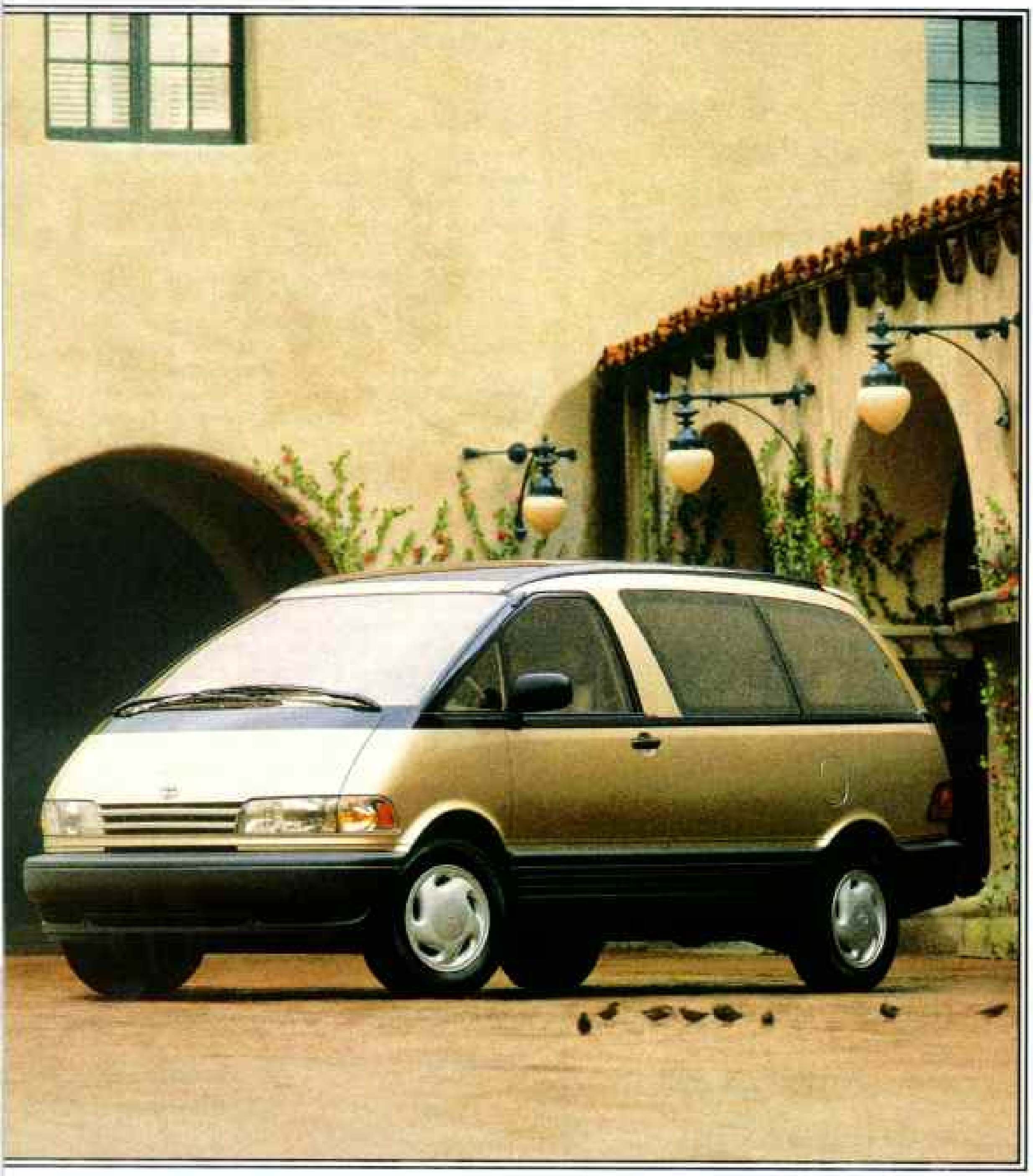

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Tune into books.
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horizons.
Read for fun.
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information.
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American Library Association

I'm originally from New Jersey and have lived in Plattsburgh, New York, Springfield, Massachusetts, and now New Haven for 12 years. This is the best by far. I live downtown near Yale University, with stores within walking distance. The beach in West Haven is a 30-minute bus ride away. It's almost like I've found utopia.

ROBERT UNDERWOOD
New Haven, Connecticut

Sea Turtles

Your article was a perfect cap to our Cub Scout study of threatened and endangered animals. For the past two years my Scouts have participated in managed releases of loggerhead hatchlings from Eglin Air Force Base on Santa Rosa Island on our Gulf Coast. They helped the turtles' survival by closing numerous ghost crab holes. The sight of more than 250 young loggerheads racing for the water made a very positive impression on them.

The Jackson Guard, natural-resource managers of the vast Eglin complex, work with landowners and business leaders to enhance survival of young sea turtles. For instance, simply turning off excess lights during release times has done much to help.

DAVID CASEBEER
Niceville, Florida

Geographica

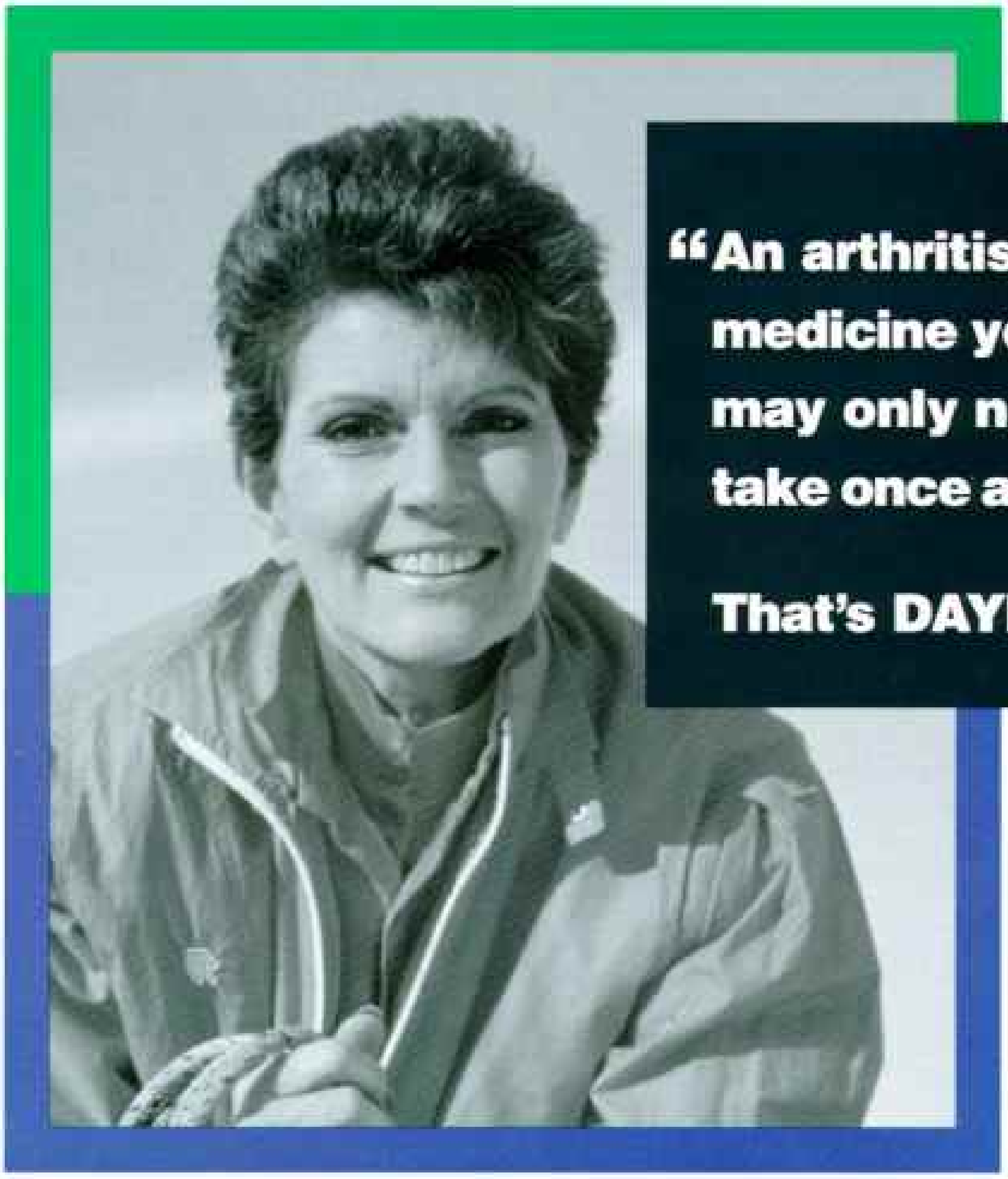
As the first chairman of the committee that planned the quadricentennial commemoration of the Roanoke voyages, I urge my fellow North Carolinians to be careful about accepting the attribution of Fort Raleigh as "Colonial America's First Science Center" (January 1994).

A similar claim might be made for Kodlunarn Island in Frobisher Bay, Baffin Island, where in 1577 Jonas Shutz, a German metallurgist in the second Martin Frobisher expedition, set up an assay furnace to test black ore that London financiers were convinced contained gold. Robert Denham, a London goldsmith, did the same thing on the third voyage the next year. More than a thousand tons of the ore, mined and taken to England, proved to be almost worthless. Discoveries on Kodlunarn by a joint Canadian-American team are detailed in *Archeology of the Frobisher Voyages* (Washington: Smithsonian Institution Press, 1993). Few claims of "first" survive without challenge.

H. G. JONES, *Curator*
University of North Carolina Library
Chapel Hill, North Carolina

Unlike the Frobisher expeditions, Fort Raleigh established a science center that undertook a variety of investigations, not just the assaying of ore.

Letters should be addressed to FORUM, *National Geographic Magazine, Box 37448, Washington, D. C. 20013-7448, and should include the sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.*



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While there is no cure for arthritis; your doctor can prescribe DAYPRO, which may relieve the pain and swelling associated with arthritis. DAYPRO is available by prescription only. DAYPRO is not recommended for pregnant or nursing women. DAYPRO should not be used if you are allergic to aspirin or any other arthritis medicines. DAYPRO can cause serious side effects, including stomach ulcers and intestinal bleeding. If you have any stomach or intestinal problems or if you have ever had high blood pressure, heart, liver or kidney problems, be sure to tell your doctor. The most common side effects associated with the use of DAYPRO can include abdominal pain, constipation, diarrhea, stomach upset, nausea, and skin rash.

Please see adjacent page for additional important information.

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SEARLE

BRIEF SUMMARY - DAYPRO® (oxaprozin) 600-mg caplets

CONTRAINDICATIONS: Hypersensitivity to oxaprozin or any of its components or in individuals with the complete or partial syndrome of nasal polyps, angioedema, and bronchospastic reactivity to aspirin or other nonsteroidal anti-inflammatory drugs (NSAIDs). Severe and occasionally fatal asthmatic and anaphylactic reactions have been reported in patients receiving NSAIDs, and there have been rare reports of anaphylaxis in patients taking oxaprozin.

WARNINGS: RISK OF GASTROINTESTINAL (GI) ULCERATION, BLEEDING, AND PERFORATION WITH NONSTEROIDAL ANTI-INFLAMMATORY DRUG THERAPY: Serious gastrointestinal toxicity, such as bleeding, ulceration, and perforation, can occur at any time, with or without warning symptoms, in patients treated with NSAIDs. Although minor upper gastrointestinal problems, such as dyspepsia, are common, and usually develop early in therapy, physicians should remain alert for ulceration and bleeding in patients treated chronically with NSAIDs, even in the absence of previous GI tract symptoms. In patients observed in clinical trials for several months to 2 years, symptomatic upper GI ulcers, gross bleeding, or perforation appear to occur in approximately 1% of patients treated for 3 to 6 months, and in about 2% to 4% of patients treated for 1 year. Physicians should inform patients about the signs and/or symptoms of serious GI toxicity and what steps to take if they occur. Patients at risk for developing peptic ulceration and bleeding are those with a prior history of serious GI events, alcoholism, smoking, or other factors known to be associated with peptic ulcer disease. Elderly or debilitated patients seem to tolerate ulceration or bleeding less well than other individuals, and most spontaneous reports of fatal GI events are in these populations. Studies to date are inconclusive concerning the relative risk of various NSAIDs in causing such reactions. High doses of any NSAID probably carry a greater risk of these reactions, and substantial benefit should be anticipated to patients prior to prescribing maximal doses of Daypro.

PRECAUTIONS: **General**: ***Hepatic effects***: As with other NSAIDs, borderline elevations of one or more liver tests may occur in up to 15% of patients. These abnormalities may progress, remain essentially unchanged, or resolve with continued therapy. The SGPT (ALT) test is probably the most sensitive indicator of liver dysfunction. Meaningful (3 times the upper limit of normal) elevations of SGOT (AST) occurred in controlled clinical trials of Daypro in just under 1% of patients. A patient with symptoms and/or signs suggesting liver dysfunction or in whom an abnormal liver test has occurred should be evaluated for evidence of the development of more severe hepatic reaction while on therapy with this drug. Severe hepatic reactions including jaundice have been reported with Daypro, and there may be a risk of fatal hepatitis with oxaprozin, such as has been seen with other NSAIDs. Although such reactions are rare, if abnormal liver tests persist or worsen, clinical signs and symptoms consistent with liver disease develop, or systemic manifestations occur (eosinophilia, rash, fever), Daypro should be discontinued. Well-compensated hepatic cirrhosis does not appear to alter the disposition of unbound oxaprozin, so dosage adjustment is not necessary. However, the primary route of elimination of oxaprozin is hepatic metabolism, so caution should be observed in patients with severe hepatic dysfunction. ***Renal effects***: Acute interstitial nephritis, hematuria, and proteinuria have been reported with Daypro as with other NSAIDs. Long-term administration of some NSAIDs to animals has resulted in renal papillary necrosis and other abnormal renal pathology. This was not observed with oxaprozin, but the clinical significance of this difference is unknown. A second form of renal toxicity has been seen in patients with preexisting conditions leading to a reduction in renal blood flow, where the renal prostaglandins have a supportive role in the maintenance of renal perfusion. In these patients administration of an NSAID may cause a dose-dependent reduction in prostaglandin formation and may precipitate overt renal decompensation. Patients at greatest risk of this reaction are those with previously impaired renal function, heart failure, or liver dysfunction, those taking diuretics, and the elderly. Discontinuation of NSAID therapy is often followed by recovery to the pretreatment state. Those patients at high risk who chronically take oxaprozin should have renal function monitored if they have signs or symptoms that may be consistent with mild azotemia, such as malaise, fatigue, or loss of appetite. As with all NSAID therapy, patients may occasionally develop some elevation of serum creatinine and BUN levels without any signs or symptoms. The pharmacokinetics of oxaprozin may be significantly altered in patients with renal insufficiency or in patients who are undergoing hemodialysis. Such patients should be started on doses of 600 mg/day, with cautious dosage increases if the desired effect is not obtained. Oxaprozin is not dialyzed because of its high degree of protein binding. Like other NSAIDs, Daypro may worsen fluid retention by the kidneys in patients with uncompensated cardiac failure due to its effect on prostaglandins. It should be used with caution in patients with a history of hypertension, cardiac decompensation, in patients on chronic diuretic therapy, or in those with other conditions predisposing to fluid retention. ***Photosensitivity***: Oxaprozin has been associated with rash and/or mild photosensitivity in dermatologic testing. An increased incidence of rash on sun-exposed skin was seen in some patients in the clinical trials. ***Recommended laboratory testing***: Because serious GI tract ulceration and bleeding can occur without warning symptoms, physicians should follow chronically treated patients for the signs and symptoms of ulceration and bleeding and should inform them of the importance of this follow-up (see *Warnings*). Anemia may occur in patients receiving oxaprozin or other NSAIDs. This may be due to fluid retention, gastrointestinal blood loss, or an incompletely described effect upon erythropoiesis. Patients on long-term treatment with Daypro should have their hemoglobin or hematocrit values determined at appropriate intervals as determined by the clinical situation. Oxaprozin, like other NSAIDs, can affect platelet aggregation and prolong bleeding time. Daypro should be used with caution in patients with underlying hemostatic defects or in those who are undergoing surgical procedures where a high degree of hemostasis is needed. **Information for patients**: Daypro, like other drugs of its class, nonsteroidal anti-inflammatory drugs (NSAIDs), is not free of side effects. The side effects of these drugs can cause discomfort and, rarely, serious side effects, such as gastrointestinal bleeding, which may result in hospitalization and even fatal outcomes. NSAIDs are often essential agents in the management of arthritis, but they may also be commonly employed for conditions that are less serious. Physicians may wish to discuss with their patients the potential risks (see *Warnings*, *Precautions*, and *Adverse Reactions*) and likely benefits of Daypro treatment, particularly in less-serious conditions where treatment without Daypro may represent an acceptable alternative to both the patient and the physician. Patients receiving Daypro may benefit from physician instruction in the symptoms of the more common or serious gastrointestinal, renal, hepatic, hematologic, and dermatologic adverse effects. **Laboratory test interactions**: False positive urine drug screening tests for benzodiazepines have been reported in patients taking Daypro. This is due to cross-reactivity. Confirmatory testing is recommended when such screening test results are positive. **Drug interactions**: *Aspirin*: Concomitant administration of Daypro and aspirin is not recommended because oxaprozin displaces salicylates from plasma protein binding sites. Coadministration would be expected to increase the risk of salicylate toxicity. *Oral anticoagulants*: The anticoagulant effects of warfarin were not affected by the coadministration of 1200 mg/day of Daypro. Nevertheless, caution should be exercised when adding any drug that affects platelet function to the regimen of patients receiving oral anticoagulants. *H_2-receptor antagonists*: The total body clearance of oxaprozin was reduced by 20% in subjects who concurrently received therapeutic doses of cimetidine or ranitidine; no other pharmacokinetic parameter was affected. A change of clearance of this magnitude lies within the range of normal variation and is unlikely to produce a clinically detectable difference in the outcome of therapy. *Beta-blockers*: Subjects receiving 1200 mg Daypro qd with 100 mg metoprolol bid exhibited statistically significant but transient increases in sitting and standing blood pressures after 14 days. Therefore, as with all NSAIDs, routine blood pressure monitoring should be considered in these patients when starting Daypro therapy. *Other drugs*: The coadministration of oxaprozin and antacids, acetaminophen, or conjugated estrogens resulted in no statistically significant changes in pharmacokinetic parameters in single- and/or multiple-dose studies. The interaction of oxaprozin with lithium and cardiac glycosides has not been studied. **Carcinogenesis, mutagenesis, impairment of fertility**: In oncogenicity studies, oxaprozin administration for 2 years was associated with the exacerbation of liver neoplasms (hepatic adenomas and carcinomas) in male CD mice, but not in female CD mice or rats. The significance of this species specific finding to man is unknown. Oxaprozin did not display mutagenic potential. Results from the Ames test, forward mutation in yeast and Chinese hamster ovary (CHO) cells, DNA repair testing in CHO cells, micronucleus testing in mouse bone marrow, chromosomal aberration testing in human lymphocytes, and cell transformation testing in mouse fibroblast all showed no evidence of genetic toxicity or cell-transforming ability. Oxaprozin administration was not associated with impairment of fertility in male and female rats at oral doses up to 200 mg/kg/day (1180 mg/m²); the usual human dose is 17 mg/kg/day (629 mg/m²). However, testicular degeneration was observed in beagle dogs treated with 37.5 to 150 mg/kg/day (750 to 3000 mg/m²) of oxaprozin for 6 months or 37.5 mg/kg/day for 42 days, a finding not confirmed in other species. The clinical relevance of this finding is not known. **Pregnancy**: Teratogenic Effects—Pregnancy Category C. There are no adequate or well-controlled studies in pregnant women. Teratology studies with oxaprozin were performed in mice, rats, and rabbits. In mice and rats, no drug-related developmental abnormalities were observed at 50 to 200 mg/kg/day of oxaprozin (225 to 900 mg/m²). However, in rabbits, infrequent malformed fetuses were observed in dams treated with 7.5 to 30 mg/kg/day of oxaprozin (the usual human dosage range). Oxaprozin should be used during pregnancy only if the potential benefits justify the potential risks to the fetus. **Labor and delivery**: The effect of oxaprozin in pregnant women is unknown. NSAIDs are known to delay parturition, to accelerate closure of the fetal ductus arteriosus, and to be associated with dystocia. Oxaprozin is known to have caused decreases in pup survival in rat studies. Accordingly, the use of oxaprozin during late pregnancy should be avoided. **Nursing mothers**: Studies of oxaprozin excretion in human milk have not been conducted; however, oxaprozin was found in the milk of lactating rats. Since the effects of oxaprozin on infants are not known, caution should be exercised if oxaprozin is administered to nursing women. **Pediatric use**: Safety and effectiveness of Daypro in children have not been established. **Geriatric use**: No adjustment of the dose of Daypro is necessary in the elderly for pharmacokinetic reasons, although many elderly may need to receive a reduced dose because of low body weight or disorders associated with aging. No significant differences in the pharmacokinetic profile for oxaprozin were seen in studies in the healthy elderly. Although selected elderly patients in controlled clinical trials tolerated Daypro as well as younger patients, caution should be exercised in treating the elderly, and extra care should be taken when choosing a dose. As with any NSAID, the elderly are likely to tolerate adverse reactions less well than younger patients.

ADVERSE REACTIONS: The most frequently reported adverse reactions were related to the gastrointestinal tract. They were nausea (8%) and dyspepsia (8%). **INCIDENCE GREATER THAN 1%**: In clinical trials the following adverse reactions occurred at an incidence greater than 1% and are probably related to treatment. Reactions occurring in 3% to 9% of patients treated with Daypro are indicated by an asterisk(*); those reactions occurring in less than 3% of patients are unmarked. Abdominal pain/distress, anorexia, constipation*, diarrhea*, dyspepsia*, flatulence, nausea*, vomiting, CNS inhibition (depression, sedation, somnolence, or confusion), disturbance of sleep, rash*, tinnitus, dysuria or frequency. **INCIDENCE LESS THAN 1%: Probable causal relationship**: The following adverse reactions were reported in clinical trials or from worldwide marketing experience at an incidence of less than 1%. Those reactions reported only from worldwide marketing experience are in *italics*. The probability of a causal relationship exists between the drug and these adverse reactions: Anaphylaxis, edema, blood pressure changes, peptic ulceration and/or GI bleeding (see *Warnings*), liver function abnormalities including *hepatitis* (see *Precautions*), stomatitis, hemorrhoidal or rectal bleeding, anemia, thrombocytopenia, leukopenia, ecchymoses, weight gain, weight loss, weakness, malaise, symptoms of upper respiratory tract infection, pruritus, urticaria, *photosensitivity, exfoliative dermatitis, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis*, blurred vision, conjunctivitis, *acute interstitial nephritis*, hematuria, renal insufficiency, *acute renal failure*, decreased menstrual flow. ***Causal relationship unknown***: The following adverse reactions occurred at an incidence of less than 1% in clinical trials, or were suggested from marketing experience, under circumstances where a causal relationship could not be definitively established. They are listed as alerting information for the physician: Palpitations, alteration in taste, sinusitis, pulmonary infections, alopecia, hearing decrease, increase in menstrual flow.

DRUG ABUSE AND DEPENDENCE: Daypro is a non-narcotic drug. Usually reliable animal studies have indicated that Daypro has no known addiction potential in humans.

OVERDOSAGE: No patient experienced either an accidental or intentional overdosage of Daypro in the clinical trials of the drug. Symptoms following acute overdose with other NSAIDs are usually limited to lethargy, drowsiness, nausea, vomiting, and epigastric pain and are generally reversible with supportive care. Gastrointestinal bleeding and coma have occurred following NSAID overdose. Hypertension, acute renal failure, and respiratory depression are rare. Patients should be managed by symptomatic and supportive care following an NSAID overdose. There are no specific antidotes. Gut decontamination may be indicated in patients seen within 4 hours of ingestion with symptoms or following a large overdose (5 to 10 times the usual dose). This should be accomplished via emesis and/or activated charcoal (60 to 100 g in adults, 1 to 2 g/kg in children) with an osmotic cathartic. Forced diuresis, alkalinization of the urine, or hemoperfusion would probably not be useful due to the high degree of protein binding of oxaprozin.

See package insert for complete prescribing information.

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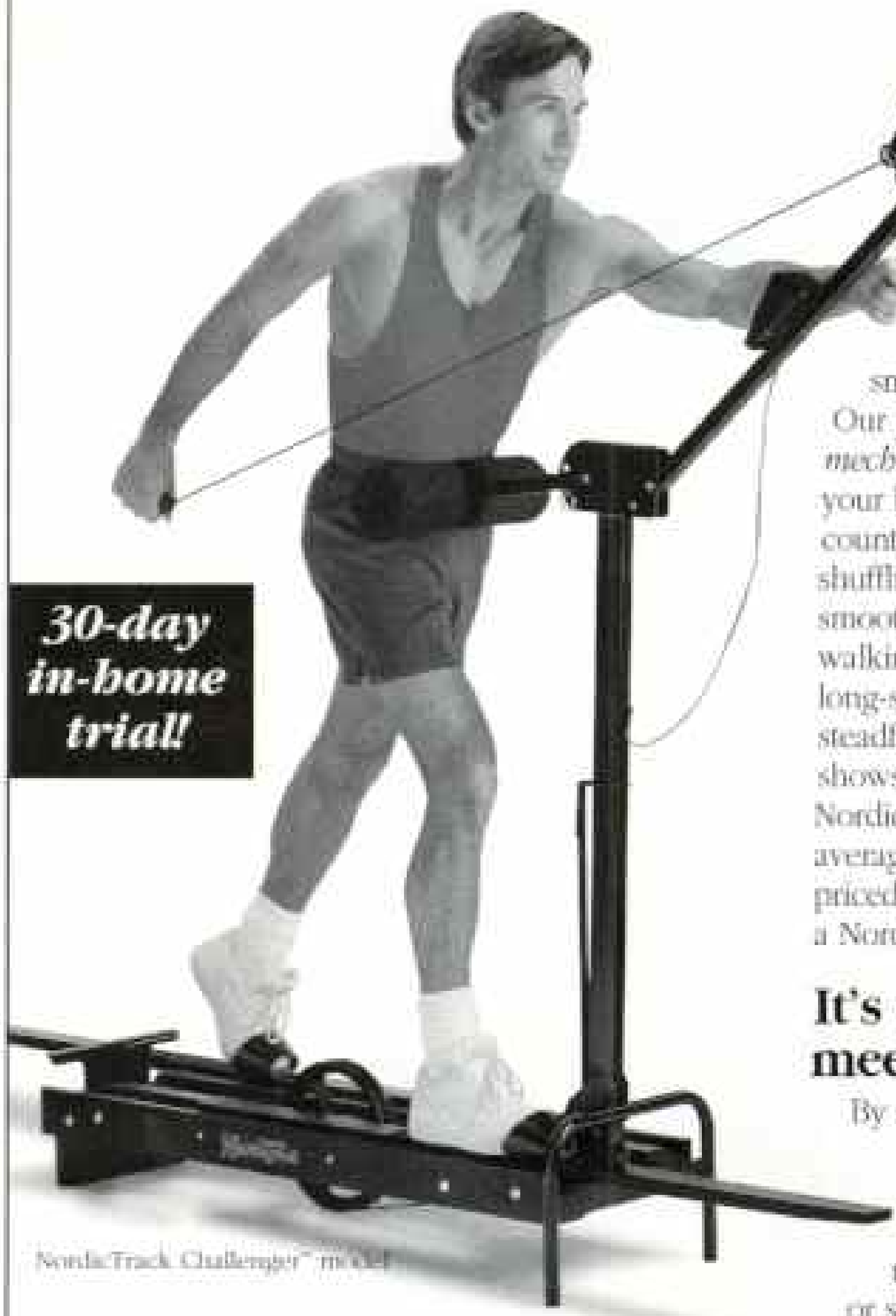

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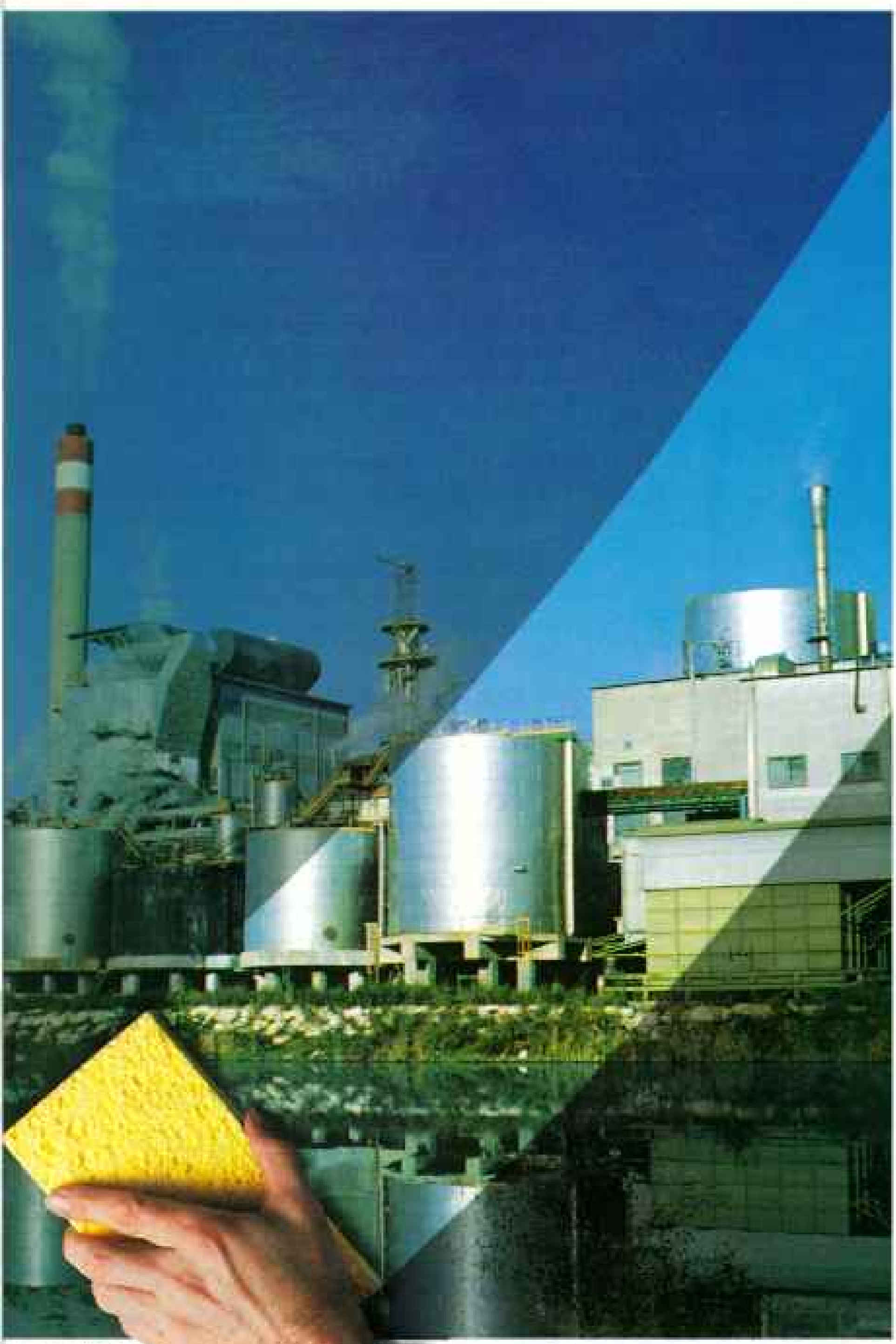

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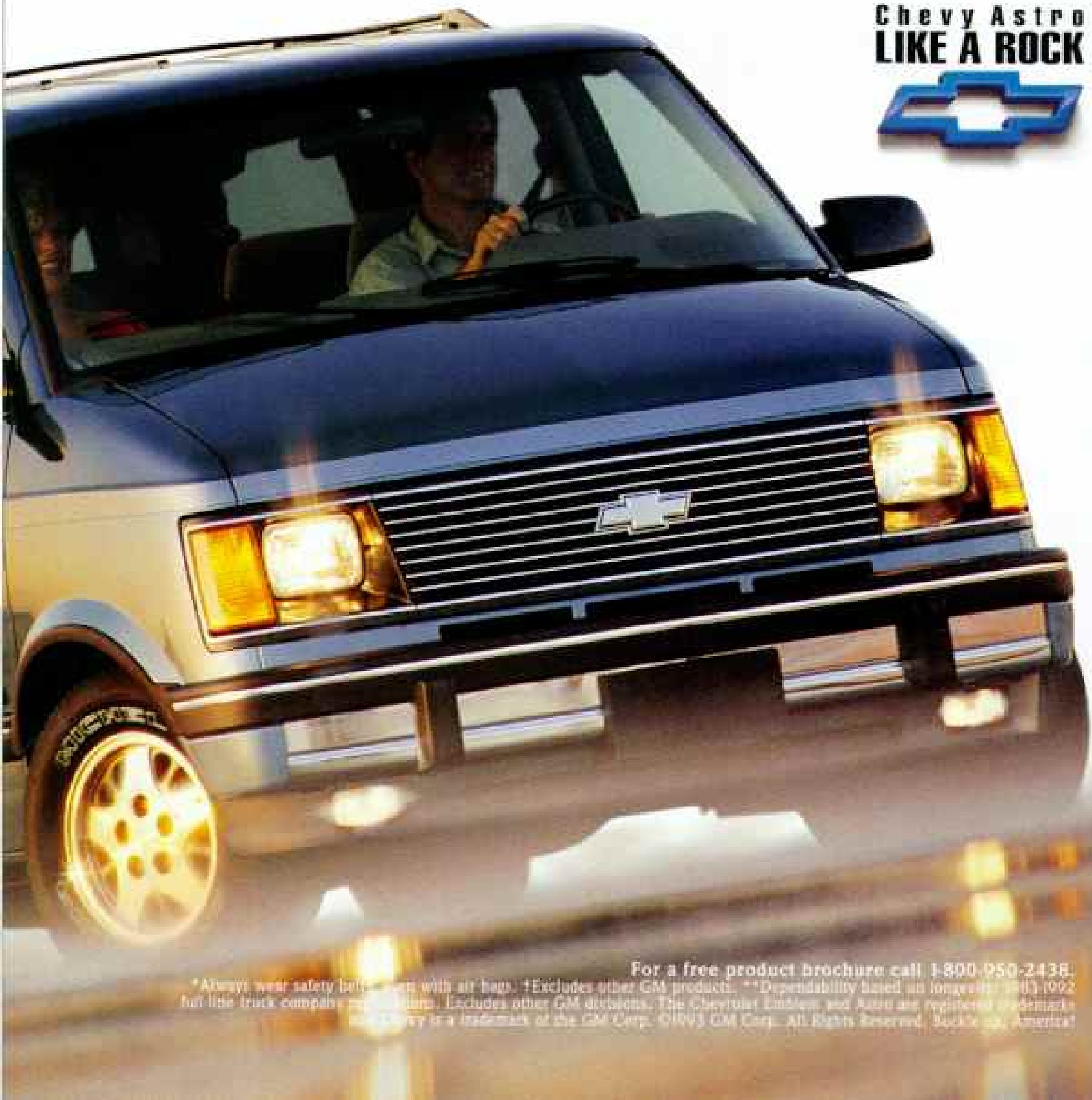

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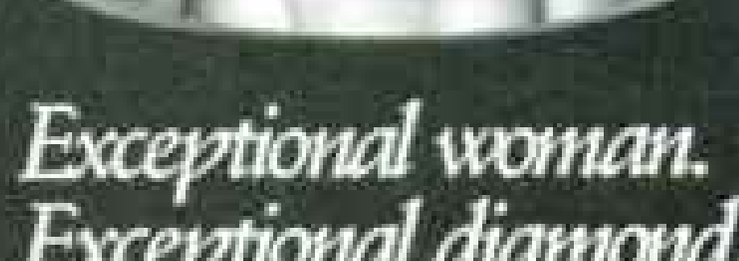

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ROBERT F. GRIGGS

Monumental Eruption Echoes Through Time

"I can never forget my sensations at the sight which met my eyes," wrote botanist Robert Griggs of the countless steaming vents—some pluming more than 500 feet high—that stretched away as far as he could see (above).

In 1916 Griggs led a National Geographic-sponsored expedition to study the Mount Katmai area of Alaska, where in 1912 a monster volcanic eruption had left a blasted landscape that Griggs named the Valley of Ten Thousand Smokes.

For years the valley remained so hot that cooking over a fumarole (right) meant watching bacon leap from the frying pan into the air.

Griggs's published findings led to the creation of Katmai National Monument. Now the expanded 4.1-million-acre national park and preserve is revisited in an EXPLORER film produced by Emmy-winner Christine Weber.

By juxtaposing past and present, "Valley of Ten Thousand Smokes" examines the cause and impact of this volcanic event of the century—when rivers vaporized and days darkened as seven cubic miles of pumice and ash clogged the air.

"The blast was four times greater than Pinatubo and 100 times greater than the initial explosion of Mount St. Helens," says John Eichelberger of the Geophysical Institute of the University of Alaska. Even 82 years later, terrain surrounding the true source (not Katmai as Griggs thought but a nearby vent called Novarupta) remains lunar-like.

E. C. KOLB

A comparable eruption today would devastate fisheries and tourism based on the area's abundant salmon and brown bears. With the volcano once again swelling and earthquakes trembling close by, Novarupta may blow again.

"Valley of Ten Thousand Smokes" airs Sunday, June 26, at 9 p.m. ET on TBS Superstation.

Earth Almanac

TORI SHIBLEY, HORNOCKER WILDLIFE RESEARCH INSTITUTE (BELOW); TODD KONDI

Bang, You're Busted: It's Lulu, the Coy Decoy

She's as easy to hit as the broad side of a barn, this cow moose that poachers can't resist. What they don't know is that she is a decoy assembled by Saskatchewan conservation officers, who have dubbed her Lulu. They set her up near a road—all roadway corridors are designated game preserves—hunker down in a blind with a video camera, and wait. It usually doesn't take long for an itchy trigger finger to let Lulu have it. Then the officers make the arrest.

"Sometimes the poachers seem totally dumbfounded. They'll look at their gun, then look at Lulu and wonder why she doesn't drop," says Dave Harvey, the province's enforcement coordinator.

In three years Lulu has helped collar more than 50 illegal hunters, each fined about $400 (U. S.). Harvey's arsenal of deception also includes three elk models and a dozen deer decoys.

But his team is seriously outgunned by organized rings that sell to meat and hide dealers. Harvey figures that more than 20,000 moose and deer are shot illegally in Saskatchewan every year.

Decoys won't work for other offenders, who annually kill 1,000 black bears for their gallbladders, prized as medicine in Asia. "Those guys are different," says Harvey. "They select each bear and stalk it, so they know it's alive."

Most Endangered Big Cat—the Amur Leopard

If ever a leopard would want to change its spots—and its fate—it would be the Amur leopard. Only 30 to 50 of these 90- to 140-pound cats remain. This one roams Kedrovaya Pad, a Siberian nature preserve; a handful more may live in China and North Korea.

The Amur leopard, a subspecies, joins a grim roster of animals that have suffered from the collapse of the Russian economy. Local officials sell Siberia's forests, the cats' habitat, to loggers for hard currency. Poachers covet the skins; one was offered in a Vladivostok newspaper for $3,000.

The leopards and Siberian tigers are the focus of a Society-sponsored research project spearheaded by the Hornocker Wildlife Discovery Institute. Siberian tigers have dwindled to about 300, but the leopards' peril is worse. "Captive breeding may help," says team co-leader Maurice Hornocker, "but the key is to promote an international reserve on the Russian-Chinese border."

PANTHERA PARDUS ORIENTALIS

National Geographic, June 1994

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Earth Almanac

PETER ESSICK, AURORA

Arizona's Costly Imported Water Hard to Swallow

Promoted as a means of reducing dependence on dwindling groundwater, an engineering colossus called the Central Arizona Project (CAP) is nearly complete after 26 years. But customers are finding its imported water too expensive for their taste.

Federally built, the CAP diverts Colorado River water into a 336-mile-long aqueduct that ends near Tucson. It can deliver some 1.5 million acre-feet a year, targeted mostly for agriculture, which uses 80 percent of the state's water. But rising pumping and maintenance costs, combined with fewer agricultural users than expected, have made its water too pricey for most cotton growers. With cotton prices at rock bottom until recently, many still use cheaper groundwater—a practice the CAP was designed to reduce.

With demand at a third of capacity, conservationists have asked that 10 percent of CAP's water be used to restore fish and wildlife habitats that have suffered from agricultural and urban development. "We've pumped a lot of rivers dry in this state," says Dale Pontius, vice president of American Rivers, an environmental group.

Saving a Plant Becomes a Burning Issue

Few people have seen the pink blossoms of Peters Mountain mallow. Now they have a better chance, because the plant has been rescued from extinction by an agent once thought destructive—fire.

LEANNA CORZO, MARYL

Botanists discovered the rare species—with just 50 specimens—in 1927 atop Peters Mountain in Virginia, its only home. In 1986 an alarmed survey crew turned up only four. Onto the endangered species list went Peters Mountain mallow.

Near the survivors, a rescue team from the Nature Conservancy and the state's Department of Conservation found dormant seeds, which depend on fire to crack them and let water in. But cores from nearby trees showed that no fires had burned for two decades. So in 1992 the team lit a small blaze. A few mallows soon sprouted. After a repeat burn last year, 500 seedlings poked up. The botanists hope the mallow will regenerate naturally, but scientists at Virginia Tech are propagating some, just in case.

Black Coral, Coveted Jewel of the Sea

On an undersea cliff in a New Zealand fjord a branch of black coral is entwined by a striped snake star (below). The living coral polyps that build the colony are white; eventually, the skeleton secreted by the polyps darkens. Divers have long sought the coral to make lustrous jewelry.

New Zealand law protects more than seven million distinct colonies of black coral. These feathery forests grow in most oceans, but they have been depleted in some Caribbean and Pacific waters.

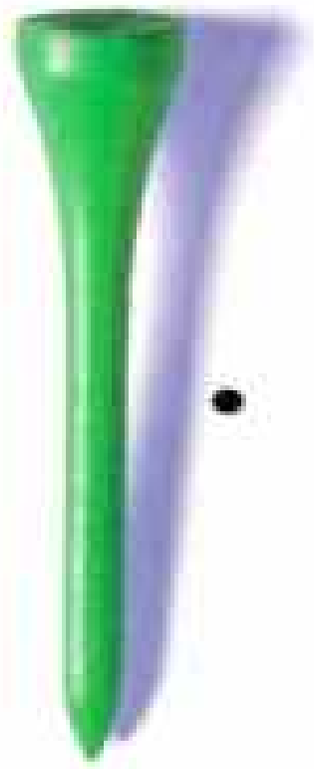
Black coral is not officially endangered, but its trade is controlled by the Convention on International Trade in Endangered Species. Since 1991 the U. S. Fish and Wildlife Service in Hawaii has seized 25 illegal shipments, most from Taiwan. Last year a judge sentenced two California men to six months in jail for taking more than 6,300 pounds of black coral from Guam's waters. The two men plus a third defendant were also fined $32,500. They intended to grind up the coral to sell with aquariums. The case is under appeal.

—JOHN L. ELIOT

CORAL, ANTIPATHES FIORDENSIS; DARRYL TORCKLER

National Geographic, June 1994

IT FITS YOU TO A T.



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On Assignment

DAVID ALAN HARVEY

The fine points of powwow dancing absorb freelance writer MICHAEL PARFIT at the Red Earth Festival in Oklahoma City. Cherokee schoolteacher Gloria Matthews points out subtleties of movement. "You really have to look and listen," says Michael, "and sit in one place for a while."

He hasn't done much of that in his lifetime. London-born Parfit was educated around the world as he traveled with his filmmaker parents. A college journalism class in California sparked his writing. "Minutes into my first story, I knew this was what I wanted to do," he says.

After gaining experience as a freelancer for newspapers and magazines, Parfit purchased a small-town weekly in Idaho. On constant deadline, he had no time for writer's block, he says. A move to Montana and more magazine writing led him to the GEOGRAPHIC. His first article, "The Hard Ride of Route 93," in December 1992, was a finalist for a National Magazine Award. The latest of his four books, *Chasing the Glory*, records his experiences as a journalist-pilot. Michael and his son and daughter—and Cessna—still make Montana home.

Casting for trout—and memories—in central Pennsylvania, Senior Writer MICHAEL LONG wasn't sure he'd hook either. "I never felt rooted to the place," says the Altoona native, who by the age of 18 had left, he thought, for good. College at Notre Dame was followed by training as a Marine fighter pilot, graduate school, and 28 years at the GEOGRAPHIC. Mike earned bylines—and awards—for both writing and photography. After so much time away, Mike was glad to find that his return to Pennsylvania "really made me feel like I belong."

BILL LUSTER

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