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ORBIT

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NASA PHOTOGRAPHS DIGITIZED BY CORBIS CORPORATION AND PROCESSED TO MATCH ASTRONAUTS' VIEWS OF EARTH FROM SPACE

ORBIT

The Astronauts' View of Home

By JAY APT

Original photographs by NASA
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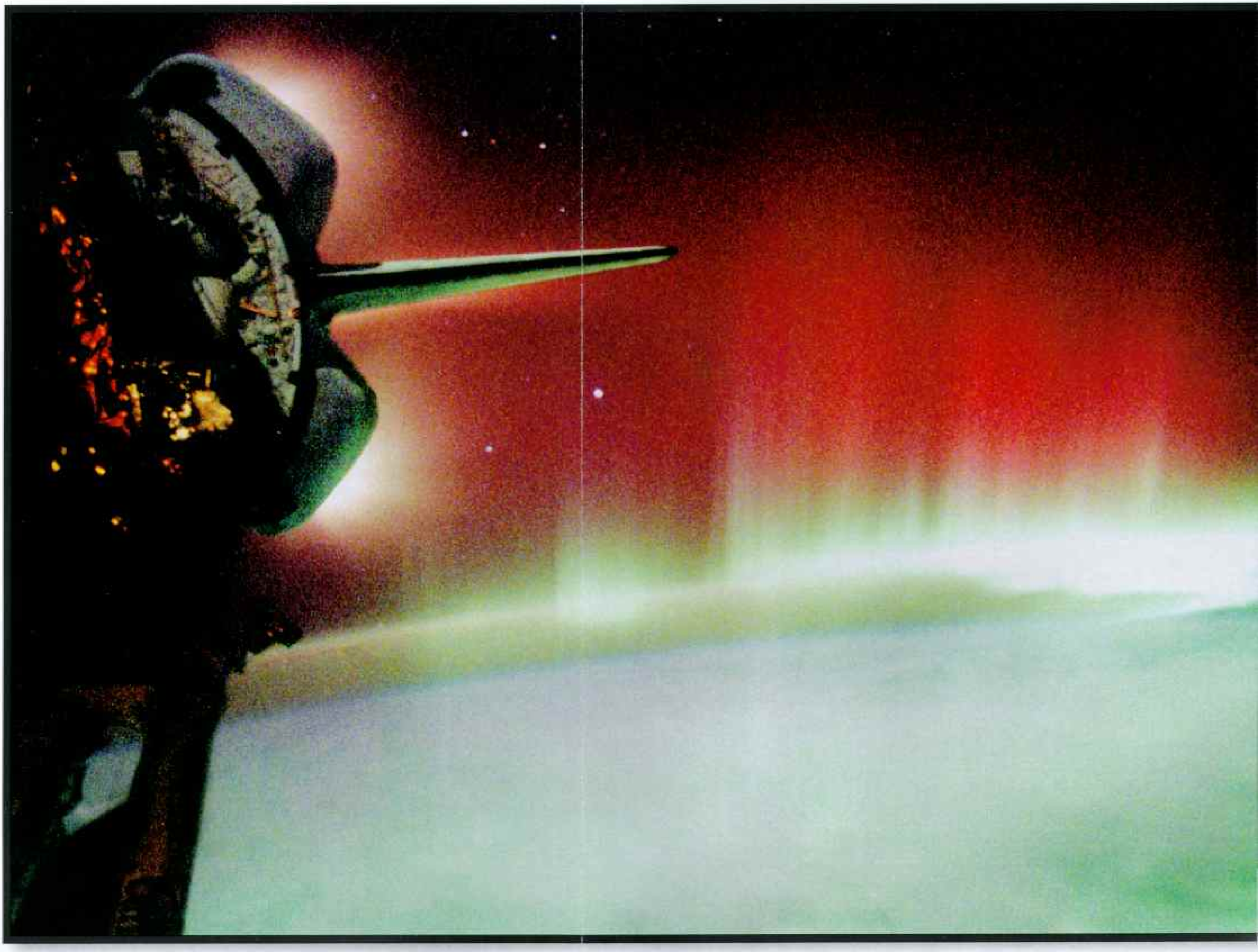
High-level Photography

From a vantage point 269 miles above Earth, an astronaut on the space shuttle *Discovery* sees a giant storm, reaches for a camera, and captures this image of Hurricane Elena, coiled to strike the U.S. Gulf Coast in September 1985. Such photographs, made by astronauts using handheld cameras, "have a scientific purpose," says shuttle astronaut Jay Apt—to "document what our home looks like and how it has changed in the past third of a century."

Where Soil Meets Sea

Burdened by tons of topsoil, Madagascar's raveling Betsiboka River struggles to reach the blue waters of the Indian Ocean, at right. Taken at the beginning of the monsoon season, this picture dramatizes the erosion that occurs upstream when farmers clear the land of trees and brush. Clouds and their shadows dapple the soil-choked river. The sediment hampers the port of Mahajanga, seen on the peninsula at lower right. This photograph was taken from *Discovery* in 1984.



Into the Aurora

Reflecting the radiance of dancing atoms, *Discovery* ignites its engines as it flies through the southern aurora. Auroras, named after the Roman goddess of dawn, appear around Earth's north and south geomagnetic poles when electrons in Earth's magnetic field are energized by the solar wind and crash into atoms and molecules in the upper atmosphere.

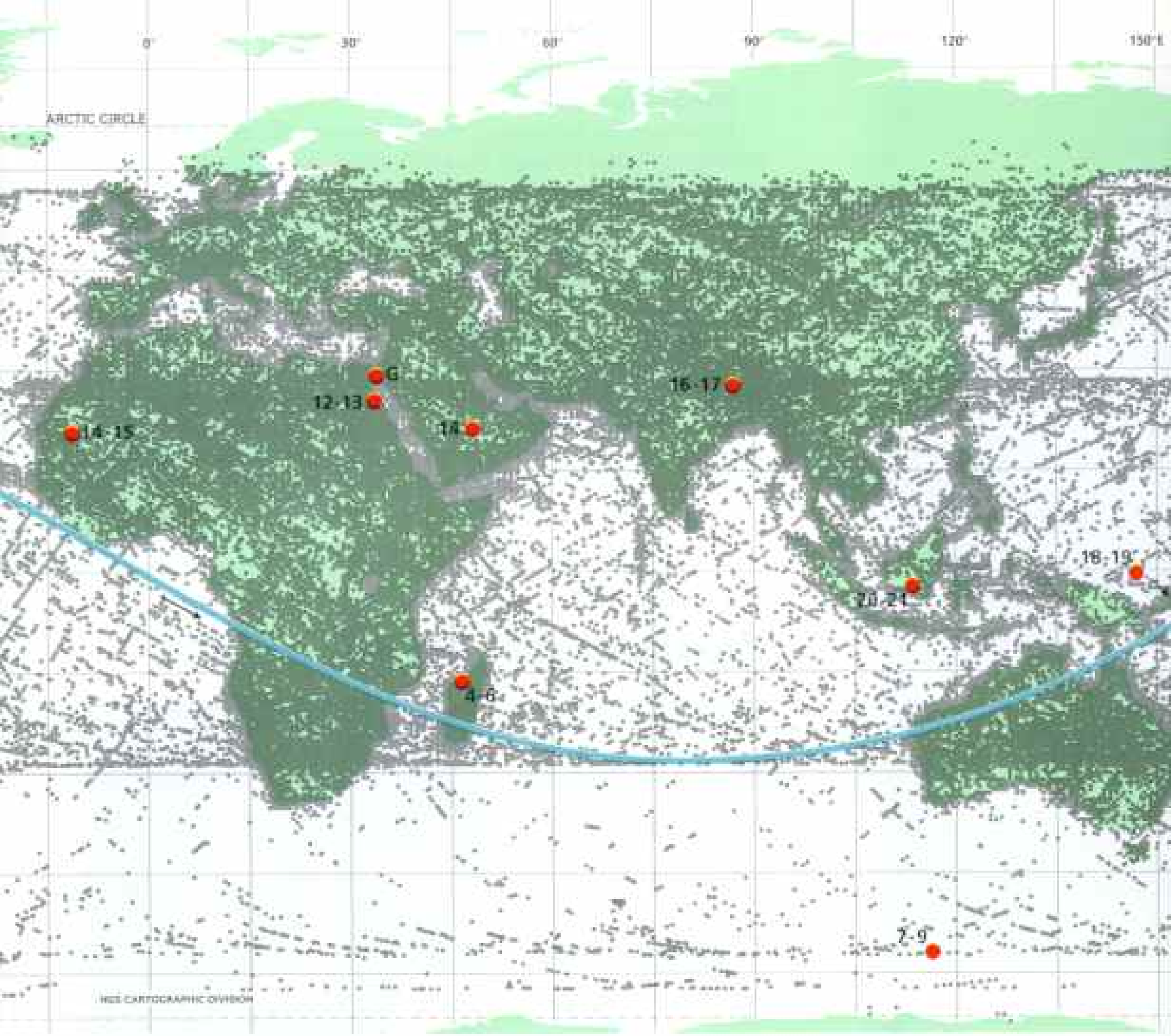
Astronaut Jay Apt, here photographing Earth from *Endeavour,* has flown through auroras many times and at press time was preparing for his fourth mission into space. What follows is an excerpt from the new National Geographic book *Orbit: NASA Astronauts Photograph the Earth.* Apt describes his thoughts as the shuttle passes over Africa, usually the first continent he sees upon wakening.

We floated in the windows, watching Africa with her clouds clearly outlined by moonlight.

For 20 minutes before the workday begins, each member of the crew seems to be glued to a window. The incredible change from Africa's huge deserts to its lush grasslands fascinates us.

As we fly south over the Sahara, we all strain to see Lake Chad, which is between the northern deserts and the green portion of equatorial Africa. Its level is a good indicator of how wet or dry this boundary region, called the Sahel, has been. It was mostly cloudy during my first flight: a good sign for those living below. On my second flight, 17 months later, we could see that the level had risen: The drought in the Sahel had abated for the moment.

One orbit (90 minutes) after we wake, our path crosses the Africa of childhood stories: the Serengeti Plain, 350 miles from



the east coast. This area is often cloudy, covered by a band of violent equatorial thunderstorms that give life to the land below.

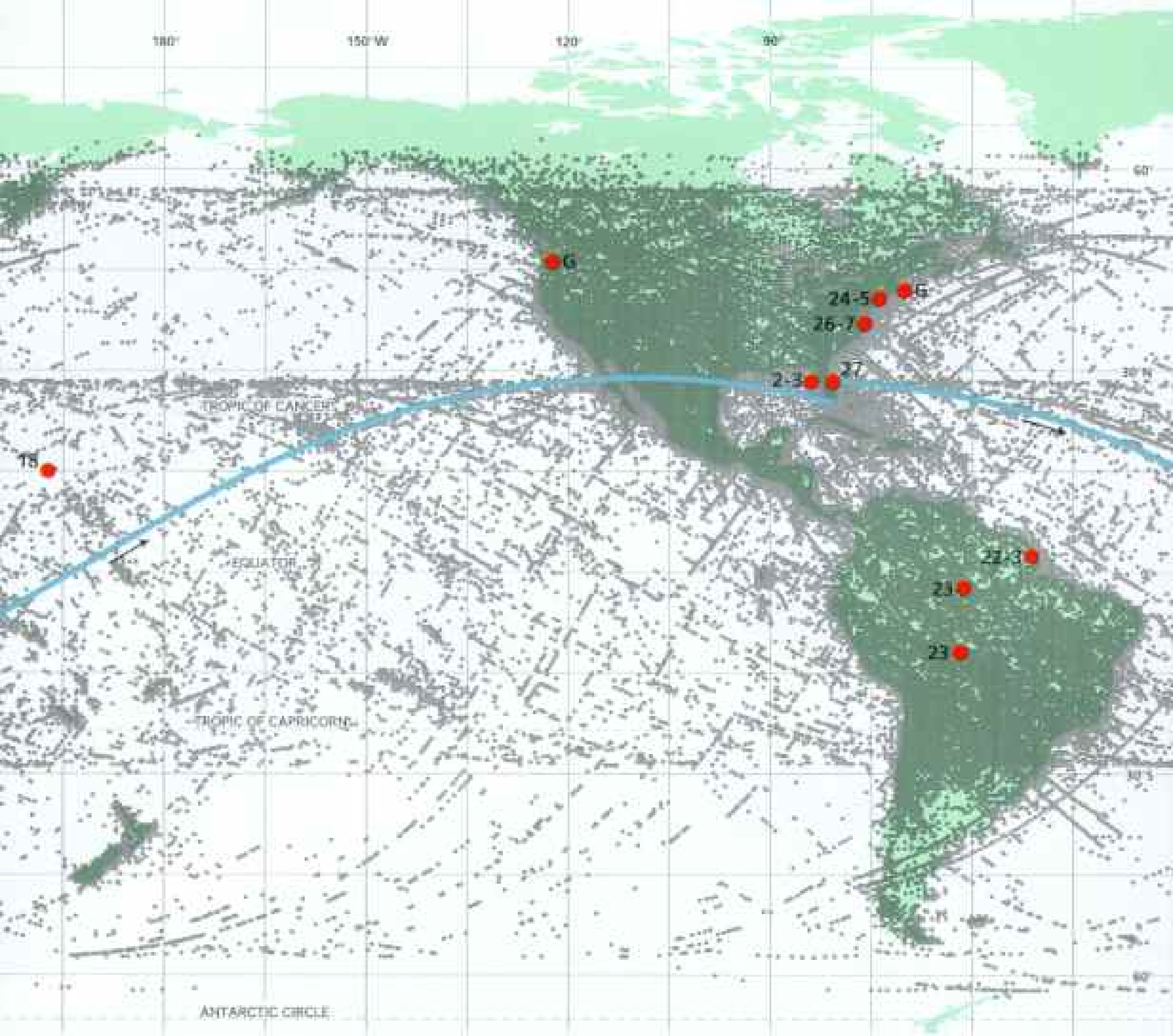
At night on each flight we floated in the windows, watching Africa with her clouds clearly outlined by moonlight, seeing lightning and the lights of cities passing below. What are the hundreds of small lights we see everywhere? Fires! By day, the smoke can be seen from Zaire to Madagascar. Africa is being burned to clear land for agriculture. The consequences are easy to see from our windows.

Flying over Africa, I think about change. Change in the Earth itself, when I fly over the volcanoes with their black rock in the middle of the orange desert or when I fly over the Gulf of Aden, which someday will be a new ocean. Change in the climate, and a realization of what a small perturbation in the air currents can do to millions of humans living on the edge of the green band. Change done to the Earth by humans, change that can be seen from hundreds of miles above the Earth.

Across Europe in four minutes, then the Middle East. Now Asia unfurls below.

The Caspian Sea is an excellent landmark, with its square southeast corner, the delta of the Volga River at the top, and a shallow gulf on its eastern shore. Next comes copper-blue Lake Balkhash in Kazakstan and then long, silvery Lake Baikal in Siberia. Finally, the Amur and Yellow Rivers both have snake-like coils that we can quickly recognize.

We look for the Great Wall of China. Although we can see things as small as



airport runways, the Great Wall seems to be made largely of materials that have the same color as the surrounding soil. Despite persistent stories that it can be seen from the moon, the Great Wall is almost invisible from only 180 miles up! Because of nearly continuous smog over Beijing, there is no good photograph of the Chinese capital from the space shuttle. Many of the great cities of coastal China hide from our cameras under a similar blanket of smoke from soft-coal fires.

Even in the most inhospitable part of China, the Taklimakan Desert, there are cities and farms. During one orbit the sun reflected off irrigation canals. Ear-shaped Lop Nur, a dry lake in Xinjiang Province, marks the end of the desert.

34-Year Time Exposure

On February 20, 1962, John Glenn became the first American to orbit Earth—and to photograph it. He used a $45 camera that he bought in a drugstore. Since then astronauts have taken some 300,000 photographs of the planet, most of which are plotted in the map above. Red dots indicate page numbers of photographs appearing in this article and in Geoguide. Most missions are launched due east from Florida, concentrating the photos in the tropical regions; the blue line traces a typical orbit. Some missions reach higher latitudes, widening the coverage to include most of the inhabited Earth.

Parting of the Red Sea

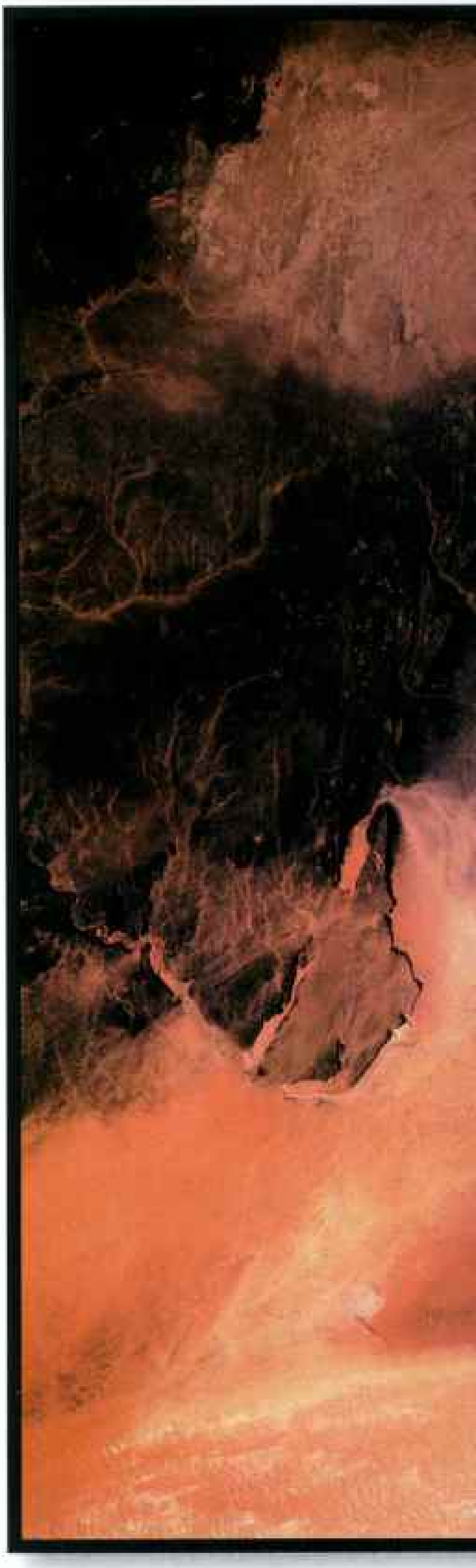
"From 170 miles above, Earth seems to be splitting apart before our eyes," Apt writes of the Middle East. As magma rises from Earth's mantle, the floor of the Red Sea widens and its shores grow farther apart. Since November 1966, when the crew of Gemini 12 took this photo, the sea has widened by almost two feet. This view was taken looking south, with Egypt and the Nile to the right. Saudi Arabia is across the Red Sea to the left. High clouds, borne on a hundred-mile-an-hour jet stream, course diagonally across the photograph.

Circles in the Sands

"The most striking feature we can see from orbit is the belt of desert that stretches, nearly unbroken, from northwest Africa to China, extending almost to Beijing," Apt says. Space travelers distinguish the deserts they pass over by watching for such landmarks as the Richât structure (right) in the sands of central Mauritania. A geologic curiosity 25 miles wide and 300 feet deep, it consists of layered rock ridges sandblasted into view by fierce Saharan winds. Hundreds of millions of years ago the rock layers formed from sediments deposited by advancing and retreating seas. Under pressure from deep within Earth, a

dome formed. As sandy winds gnawed away at the dome, concentric rings of harder rock endured.

Some 3,600 miles to the east, green circles—each encompassing 200 acres of farmland—dot the desert of Saudi Arabia (above). Center-pivot irrigation began transforming Saudi sands in the 1980s. By 1990, when this photograph was taken, astronauts saw a tripling of cultivated areas. In the center of each circle is a well drawing water from an aquifer thousands of feet below. No one knows how long this water will last.



Looking Down on Everest

The North Face of Earth's highest mountain is cast in pitch-black shadow in this panorama of Everest and its Himalayan neighbors. The photograph was made 184 miles above Everest, which appears just left of center. In 1953 Edmund Hillary and Tenzing Norgay were the first to reach the 29,028-foot summit; they got there via Everest's southeast ridge, which approaches in this photo from the left.

On Volcano Watch

Steam and dark clouds of ash billow from a volcano near Rabaul, Papua New Guinea (right), as the space shuttle *Discovery* flies overhead. The eruption began on September 19, 1994, spewing ash and pumice around Blanche Bay and blanketing the city in a layer one to three feet deep. A few hours after this photo was taken, heavy rains soaked the ash, collapsing all but a handful of buildings. An eruption in 1937 killed more than 500. This time, warnings kept the death toll down to five.

Scientists often ask astronauts to photograph volcanoes as part of NASA's Earth Observations Project.

On June 15, 1991, Mount Pinatubo in the Philippines—55 miles northwest of Manila—exploded in one of this century's largest volcanic eruptions, killing some 700 people. Less than two months later, the shuttle *Atlantis* sailed above the dirtiest atmosphere any astronaut could recall (above), a veil of dust shrouding Earth. Most of it was in two layers, at roughly 100,000 feet. Below them, anvil-shaped thunderstorm clouds just above 40,000 feet mark the top of the troposphere. The layers of dust in this photo took years to dissipate.

Nature's Matchless Fires

Forests blaze on Kalimantan, the Indonesian part of the island of Borneo, in September 1991, as *Discovery* flies 337 miles overhead. On the ground below, peat bogs had underlain the rain forest for centuries. Dried out by drought and the clearing of land, the flammable bogs smoldered unseen, then burst into flame at the surface in many places, igniting parched trees and starting hundreds of wildfires. The pall of smoke was so thick that it impeded airline traffic across Indonesia and into Malaysia.

Realm of the Amazon

From the muddy, 200-mile-wide mouth of the Amazon (left) to forests deep within Brazil, astronauts' photographs record an immense and changing land. In far northwestern Brazil vast stretches of forest still remain. Along the Rio Negro (above) there are only a few towns. But along Brazilian Road 364 in the state of Rondônia settlements scar what once was unbroken upland forest (top). The grid pattern grew as ranchers and farmers cleared more land; settlers, urged on by the government, rushed to colonize this new frontier. By 1995 1.4 million people were living in an area that in 1970 had a population of 110,000.

New York Nightscape
In the night sky over New York City, Jay Apt took this photograph "just before dawn, holding the shutter open while panning the camera by hand." City streets, airports, bridges, and darkened parks appear in the city that never sleeps. "Night is a magical time in the shuttle," says Apt. "One of my fondest memories is floating in the cockpit over South America. It seemed that we were in the gondola of a giant balloon drifting across the moonlit continent."

The Fragile Earth

Graced by the glint of the sun, sea and lacy land blend along the Delmarva Peninsula, whose name is a reflection of the three states—Delaware, Maryland, and Virginia—that occupy it. Chesapeake Bay lies west of the peninsula, to the left, while the Atlantic Ocean frames it to the right.

From 178 miles in space, these eastern wetlands seem untouched by humans. But a closer look reveals an unnatural, angular line—the Chesapeake Bay Bridge-Tunnel, which links Delmarva to mainland Virginia. The two underwater sections provide channels for ships and submarines. Norfolk, Virginia, sprawls near the southern end of the bridge. Offshore, eddies mark the mixing of warm bay and inlet waters with the cool coastal ocean.

Europe's first reusable spacecraft—the Eureca satellite—sails above another blend of land and sea at the Kennedy Space Center (below) in Florida. The crew of the shuttle *Atlantis,* which released Eureca, soared from a launch pad just to the north, or left, of the prominent cape in the photo. "When humans finally reach out to the stars," Jay Apt writes, "some of the crew will leave Earth from here." □

The Greening of the Empire

SIR JOSEPH BANKS

Driven by ravenous curiosity, blessed with immense wealth, an 18th-century British gentleman orchestrated a great flowering of the natural sciences. Joseph Banks astonished his countrymen with exotic plants and animals collected during his three-year voyage around the world with Captain James Cook aboard *Endeavour*. At Banks's side was artist Sydney Parkinson, who captured golden blossoms of a Brazilian climber among his hundreds of paintings. Returning to London in 1771, Banks posed triumphantly for painter Benjamin West amid trappings of his South Seas adventures.

By T. H. WATKINS
Photographs by CARY WOLINSKY

Stigmaphyllon auriculatum, Natural History Museum, London (opposite); Lincolnshire County Council, Usher Gallery, Lincoln

Armies of alien beetles marched into the annals of science under Banks's enthusiastic direction. His home on Soho Square became a kind of salon-museum where naturalists gathered to ponder his discoveries. Some of the nearly 5,000 insect specimens, many found on the Endeavour

expedition and now housed at the Natural History Museum in London, have yet to be identified. More than a collector, Banks went on to become the de facto director of the Royal Botanic Gardens at Kew and the longest serving president of that learned fellowship, the Royal Society of London.

OUTSIDE, along the traffic-choked boulevard of Cromwell Road, all the clatter of London beats against the stone walls of the Natural History Museum. But none of the noise seeps into this large, airy room in the museum's botany library, where I am hot on the heels of Sir Joseph Banks, botanist extraordinaire and world traveler, whose enthusiasm for scientific exploration set the tone for all who came later. I have been tracking him across half the world by now, finding traces of his legacy at Botany Bay in Australia, on the headlands of New Zealand, at Point Venus in Tahiti, and, among other places here in London, at the Linnean Society and the Royal Botanic Gardens at Kew.

My guide in the museum is Malcolm Beasley. Like most archivists

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T. H. WATKINS wrote "Hawk High Over Four Corners" for the September issue. CARY WOLINSKY's photographs have illustrated many GEOGRAPHIC articles, including "Wildflowers of Western Australia" (January 1995).

"It tickled," says Matthew Smales, who like Banks grew up in Lincolnshire free of squeamishness about wriggling creatures. Young Banks rubbed his face with toads to prove their harmlessness. The adult Banks beheld grander animals (opposite), plants, and intriguing sights, shown as vignettes in this article.

worth their salt, Beasley combines an eagerness to share his treasures with a thinly veiled concern that something dreadful could happen to them once they are removed from their repositories.

But at my request he opens a portfolio and reveals a sheaf of ancient, ivory-hued paper that seems to glow in the soft light from the room's high windows. I feel time slipping away as Beasley gently lifts a few of the big, deckle-edged pages to show me the faint, rusty impressions superimposed on the text of a 1768 commentary on John Milton's *Paradise Lost*.

It is not the antiquity of the pages that intrigues me; it is the use to which they were put that gives them magic. These dozen or so large scraps of paper are all that remain of the thousands that went around the world from 1768 through 1771 on one of the most ambitious botanizing expeditions ever launched. The rust-colored impressions were left by exotic and often unknown plants plucked from their natural habitats, sketched by the expedition's artists, then pressed between the soft, absorbent proof sheets. When removed, they left these stains behind, shadow signatures from a vanished age.

These dim reminders of once living plants provide an eloquent link to the life of a man little known today but one whose name still resonates among scientists more than 170 years after his death. "If I could be any person in the past," E. O. Wilson, Harvard's eminent biologist, once told me with uncommon passion, "it would be Joseph Banks."

That's *Sir* Joseph Banks, whose baronetcy was conferred by Banks's good friend King George III. And with good cause. For nearly 50 years Banks was a dominant figure of natural science in a time celebrated as the age of reason, an era when intellectual ferment, artistic and literary expression, and political and religious experimentation blossomed and science became an international language that crossed all borders.

No one nurtured the bloom of knowledge longer, more faithfully, or more

NEW HOLLAND JABIRU, OR BLACK-NECKED STORK, *EPHIPPIORHYNCHUS ASIATICUS*, AUSTRALIA; NATURAL HISTORY MUSEUM

Tropical hibiscus
Hibiscus rosa sinensis
Society Islands
Artist:
Sydney Parkinson

A Fruitful Voyage

Floral delights awaited Banks on Cook's first exploration below the Equator. The 1700s saw an explosion in the transplanting of species around the globe. Banks brought citrus and watermelon seeds from Brazil to Tahiti, where he saw a species of hibiscus that had long before made its way from Southeast Asia.

Macartney rose
Rosa bracteata
China
Artist: Pierre Joseph Redouté

Coral tree
Erythrina corallodendron
Jamaica
Artist: Attributed to Margaret Meen

Bird-of-paradise
Strelitzia reginae
South Africa
Artist: James Sowerby

Golden Guinea flower
Hibbertia scandens
Australia
Artist: Attributed to Margaret Meen

Cowslip
Isopogon anemonifolius
Australia
Artist: Margaret Meen

MAP ART BY JOHN KUSH
18TH-CENTURY FLOWER PAINTINGS COURTESY OF THE NATURAL HISTORY MUSEUM AND THE ROYAL BOTANIC GARDENS, KEW

Lily-flowered magnolia
Magnolia denudata
China
Artist: Sydenham Edwards

Globularia
Globularia salicina
Madeira
Artist: Sydney Parkinson

Franklin tree
Franklinia alatamaha
North America
Artist: William Bartram

Foxglove
Digitalis purpurea
Europe
Artist: Unknown

Bindweed
Convolvulus sepium
Europe
Artist: James Sowerby

Tree peony
Paeonia suffruticosa
Himalaya
Artist: Unknown

Tiger lily
Lilium lancifolium
China
Artist: Unknown

Variegated iris
Iris variegata
Europe
Artist:
James Sowerby

Trailing violet
Viola hederacea
Australia
Artists: Sydney Parkinson and Frederick Nodder

Reykjavik, ICELAND
Banks's voyage on *Sir Lawrence* 1772
GREAT BRITAIN
Edinburgh, SCOTLAND
Lincoln, ENGLAND
London, ENGLAND
Plymouth, ENGLAND
St. Petersburg, RUSSIA
NORTH EUROPE
Banks's voyage on H.M.S. *Niger* 1766
Lisbon, PORTUGAL
Madeira Islands
Philadelphia, PENNSYLVANIA
Savannah, GEORGIA
MEXICO
Jamaica
Caribbean Sea
St. Vincent
Sept. 27, 1768
TROPIC OF CANCER
ARABIAN PENINSULA
INDIA
AFRICA
EQUATOR
May 15, 1771
SOUTH AMERICA
Rio de Janeiro, BRAZIL
SOUTH
St. Helena
Feb. 13, 1771
TROPIC OF CAPRICORN
Cape Town, SOUTH AFRICA
Jan. 1, 1769
0 1,000
MILES AT EQUATOR
ANTARCTICA

effectively than Joseph Banks. Companion to Captain James Cook on H.M.S. *Endeavour*, he enlarged the Western world's knowledge of existing plant species by nearly 25 percent. Beyond that, he was father of the Commonwealth of Australia, confidant of kings and gardeners, a statesman of biological commerce who enhanced Great Britain's economic power, and the longest serving president in the history of the Royal Society of London, perhaps the most prestigious body of scientists in the world. Few men were as famous in his time or more important to the history of the natural sciences. Few saw more of the world; few did more to change it. And few enjoyed life quite so much as Banks, sitting at the center of the web.

HIS BACKGROUND argued against his making such a mark. At Harrow, Eton, and even Oxford he had been less than a diligent student. He was propertied and wealthy. The 9,000 to 10,000 acres of his estates in Lincolnshire and elsewhere, inherited at age 21 after the death of his father, assured him an income that made him one of the wealthiest men in England.

This patrimony might have nudged Banks into a life of stultifying indolence, but he was more than what his origins might have made him. In his 20s he was full of the juices of life, standing six feet tall and weighing in at about 13 stone (182 pounds), with dark liquid eyes and a mouth that a romance novelist of today probably would describe as sensuous. His voice boomed with good fellowship, and he displayed a talent for the social arts and a passionate interest in the world around him. Once, when asked by a friend where in Europe he would go for the traditional grand tour expected of any young man of means, Banks is said to have replied: "Every blockhead does that. My grand tour shall be one round the whole globe."

Encouraged by indulgent parents, Banks as a boy loved to wander the meadows, woods, stream banks, and dark, mysterious fens surrounding Revesby Abbey, the family estate in Lincolnshire. He was an avid angler after trout and an enthusiastic hunter of wild ducks and wood pigeons. And he liked to rub toads on his face to demonstrate his conviction that, contrary to popular myth, the toad was harmless and of great service to humankind because of the pests it ate.

At Eton he taught himself botany and began his first plant collections, and later at Oxford he joined (and probably helped found) the Botanical Club, the Fossil Club, and the Antiquarian's Club.

Then there was Chelsea, a largely rural suburb of London, where his widowed mother kept a grand house on Paradise Row just around the corner from the Physic Garden, a medicinal herb research center

Long wake of Captain Cook lapped the shores of New Zealand's Queen Charlotte Sound, now plied by a new Endeavour, *a replica commissioned in 1994 as a floating museum. The original vessel—a slow, thick-hulled converted coal carrier—had spacious holds ideal for Banks's*

BUSH FLAX, *ARTELIA NERVOSA*
NEW ZEALAND; NATURAL
HISTORY MUSEUM

operated by the Society of Apothecaries. Banks would escape the polite confines of his mother's home to prowl the tiny empire ruled over by Philip Miller, the gardener. It was here that Miller produced the eight editions of his famous *Gardeners Dictionary*, for its time the definitive work on horticulture; where seeds of the genus *Gossypium* (cotton) from Arabia were cultivated then shipped to the American colony of Georgia; where Carl Linnaeus, the great Swedish botanist and originator of the first universally adopted classification system for species, once collected.

generously outfitted expedition and natural history library, all financed with his inherited fortune. The voyage's official missions were to improve navigation for British ships and to search for the Unknown Southern Land—a hypothetical continent now called Antarctica.

When I go there on a hot summer morning, I enter a world that entranced Banks—a four-acre piece of the past stitched into the patchwork of Chelsea between Royal Hospital Road and the Chelsea Embankment of the River Thames. Though the plants that Banks saw here have vanished, it is still possible to wander through neat

beds of delphinium and foxglove, of sage, rosemary, and thyme and get a hint of the delight that energized him.

Memories of Banks himself are present. On one south-facing wall grows what is believed to be the direct descendant of a specimen of kowhai, New Zealand's national flower, brought here by Banks in 1772. In the beds of the garden's Historical Walk are samples of numerous species he collected, and a small pile of volcanic rocks from Iceland, used as ballast on his last field expedition in 1772, form the mound of a small rock garden.

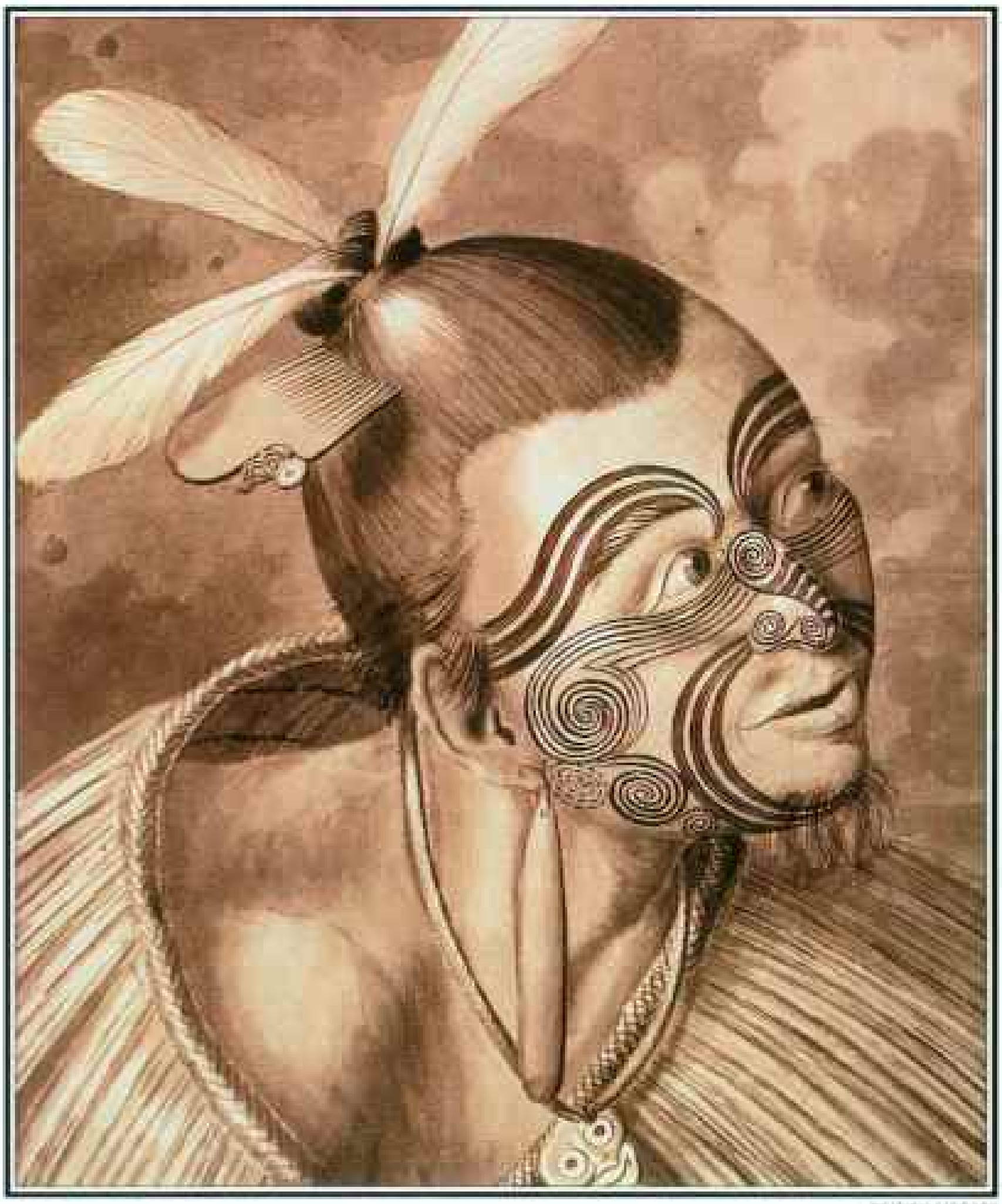
If Banks could not be found in the Chelsea Physic Garden, he probably would have been in Montagu House, site of the first incarnation of the British Museum, rubbing elbows in the tiny reading room with such luminaries as Thomas Gray, the poet, David Hume, the philosopher, and William Blackstone, the jurist. And here Banks began to cultivate his long friendship with Daniel Solander, a Swede who had studied under Linnaeus and was busily cataloging the museum's natural history collections.

Good connections among the museum's habitués eventually got Banks sponsored for membership in the Royal Society. But the nominee was not present to discuss his qualifications, having sailed off to Newfoundland in April 1766 to do a little botanizing with a friend. When he returned nine months later, he learned that he could now append FRS (Fellow of the Royal Society) to his name.

Not long after that, at the urging of the Royal Society, the Lords Commissioners of the Admiralty ordered Lt. James Cook of the Royal Navy to take command of the 368-ton bark *Endeavour* and sail the South Pacific to Tahiti. There, Cook was to set up a post "for making observations on the passage of the planet Venus over the sun's disk. . . ." The Royal Society's scientists believed this would give a precise measurement of the sun's distance from the earth and thereby greatly improve navigation techniques. They needed readings in the southern hemisphere, and Tahiti seemed likely to produce good

Crimson plumes of an 'i'iwi have faded since it was caught in Hawaii on a later Cook voyage and presented to Banks. Age also dulled a specimen of Banksia dentata, *an Australian evergreen. It lies in front of Banks's magnum opus—his herbarium, the botanical soul of the Natural History Museum. His attempt to bring a Polynesian to England ended when Tupaia, a Tahitian prince, died en route. Cook later introduced a handsome Tahitian named Omai to polite society, including Banks's friend King George III.*

OMAI, A TAHITIAN MAN; BY PERMISSION OF THE BRITISH LIBRARY, LONDON



BRITISH LIBRARY

results. Cook was also to do some general exploration, including the search for a great southern continent (Antarctica) whose presence was only suspected.

Banks knew the botanical opportunity of a lifetime when he saw it—a whole quarter of the globe where God only knew what wonders lay. He pulled most of the many strings at his command and shortly had himself, his friend Daniel Solander, artists Sydney Parkinson and Alexander Buchan, a secretary, and four assistant collectors—two of them servants—signed on to Cook's voyage.

It was no small enterprise. In a letter to Linnaeus one of Banks's Royal Society colleagues described the scientific manifest *Endeavour* carried when she weighed anchor in Plymouth harbor on August 25, 1768: "No people ever went to sea better fitted out for the purpose of Natural History, nor more elegantly . . . they have all sorts of machines for catching and preserving insects; all kinds of nets, trawls, drags, and hooks for coral fishing. . . . They have many cases of bottles with ground stoppers, of several sizes, to preserve animals in

The art of tattooing spread after expedition artists re-created the elaborate filigrees of New Zealand Maori. The adornments became popular with British sailors, then caught on among others.

The intense culture clash sparked by Endeavour *is reenacted as a 60-man Maori* waka, *or canoe, intercepts the replica at Ship*

Cove on South Island. In 1769 Cook's arrival was met by ritualized feinting and posturing as the Maori wondered: friend or foe? Despite grisly evidence of cannibalism, the ship stayed for six months, and Banks collected a thousand specimens.

spirits . . . in short, Solander assured me this expedition would cost Mr. Banks ten thousand pounds."

THE SOUND OF THE SEA breaking against the Great Barrier Reef, a 1,250-mile chain of submerged coral islets along the Queensland coast of Australia, was once enough to turn most sailors away. "This . . . was the voice of God," explorer Louis-Antoine de Bougainville wrote in 1768, "and we obeyed it."

I can't hear God's voice over the roar of my chartered Cessna, but I can see what inspired the phrase. Even from 500 feet it is a fearsome sight, the whole weight of the Pacific crashing with terrible power into a line of snaggletoothed coral reefs. Any ship caught between the immovable rocks and the force of such seas would be ground to flinders.

Now, just off Green Island, Daniel Takai, the Cessna's pilot, taps me on the shoulder and points down to an odd sight—a boxy-looking bark under sail, beating her way west toward the coast. We have been looking for this *Endeavour* replica, as faithful to the original as

MAORI CANOE, BRITISH LIBRARY

technology and historical memory can make it, designed to sail Australia's east coast as a bit of floating history.

Fascinated, I watch the replica heading into port at Cairns, surrounded by flag-flying private yachts and fireboats whose pumps throw arcs of water around her. Take away the accompanying vessels, and it is easy to picture the original *Endeavour* down there, a lonely, vulnerable chip of wood and sail almost lost against the spreading enormity of the steel-blue sea.

COOK'S *ENDEAVOUR* VOYAGE produced a wealth of geographic knowledge. It brought many of the Society Islands, including Tahiti, Bora-Bora, Moorea, and Raiatea, into the sphere of British influence. It established that New Zealand was not one but two big islands; Cook charted their coastlines by circumnavigating both for the first time. He did not discover the great southern continent of Antarctica (time and weather were against him), but he did find the east coast of Australia, setting in motion the establishment of Britain's colony there. By charting that coast, Cook filled in the last gap in the cartographic record of a continent whose true expanse had until then been only guessed at. (While navigating the Great Barrier Reef, the ship ran aground, and it took the efforts of the entire crew to free *Endeavour* from a rocky shoal on which it might have broken to pieces.) Meticulous journals kept by Cook and Banks illuminated the culture of the Tahitians, revealed for the first time the lively and belligerent Maori of New Zealand, and gave the world its first description of Australia's Aborigines.

Reason enough, then, for me to look upon the ship's modern incarnation and marvel at what its great ancestor accomplished. But I am even more intrigued by what 26-year-old Joseph Banks must have been thinking as he stumbled into all these brave new worlds. He had to have been positively drunk on exploration. For a botanist, after all, this expedition was breathtaking: tangled green islands and whole continents offering up a feast of plant life no one in the Western world had even imagined existed.

Tahiti was *Endeavour*'s first South Pacific landfall. I try to conjure what might have been spinning through Banks's mind as I sweat my way up a trail along the Fautaua River above Papeete. Sunlight beams greenly through a profusion of trees that amazed Banks as they do me—umbrella-like tree ferns ten feet high, banana and breadfruit trees, the palmlike pandanus, a few towering *mape* with their smooth, fluted trunks, and the broad-leaved *mati*, ornamented with tiny red fruit. The rare open spaces are pocked with species of gardenia,

Passion of Banks's life found expression in Botany Bay, a New South Wales inlet where flannel flowers nod above a profusion of banksia. Cook first called the anchorage Sting Ray

including the tiare Tahiti, the national flower of Tahiti, as well as hibiscus, wild ginger, and morning glory.

Harbour but renamed it for Banks's energetic botanizing here—so prolific that artist Parkinson had a hard time keeping up.

Throughout the island, Banks and Solander collected tirelessly, bringing plants back to the main camp on a spit of land they called Point Venus. Here Cook followed the transit of Venus across the sun one fine June day in 1769, and the expedition's artists feverishly sketched and mounted the growing pile of specimens. In all, they collected about 300 plant species, as well as fish, birds, and insects.

Banks helped seed the Australian nation when he promoted the settling of Botany Bay with convicts, a plan realized at nearby Port Jackson, now Sydney.

Banks did not merely take from Tahiti; he brought things to it. "I employd myself in planting a large quantity of the seeds of Water melons, Oranges, Lemons, limes . . . which I had brought from Rio de Janeiro," he wrote in his journal on July 4, 1769. Thus he encouraged what later scientists would call the "antipodean exchange," the movement of plants (and later animals) among the nations of Europe, the

BANDED BANDICOOT, PERAMELES BOUGAINVILLE, AUSTRALIA, NATURAL HISTORY MUSEUM

Americas, and the lands of the South Seas, all of which helped shape the look of the green world we see today.

IN THE MIDDLE OF JULY 1769 Banks and Cook left Tahiti for New Zealand, in whose waters they arrived early in October and remained for six months. They put in when and where they could. In spite of difficult seas and the threat of conflict with the sometimes cannibalistic Maori—"I suppose they live intirely upon fish dogs and Enemies," Banks wrote—*Endeavour*'s botanists managed to collect about a thousand specimens, with the headlands and islets of Queen Charlotte Sound, at the northern tip of South Island, being especially productive.

Those headlands are cold and rain-swept as I walk through dripping tree fern forests and across tundra-like plains above the gunmetal sea. I have better luck on North Island with John Dawson, a retired professor of botany from Victoria University in Wellington. In the hills above Wellington he marches me through the Otari Native Botanic

Wonders of the Great Barrier Reef beckon at Australia's Whitsunday Island. Endeavour *ran aground so violently "we could hardly keep our legs upon the Quarter deck," Banks wrote. Solace came with the sweet flesh of the giant clam, "one of which was more than two men could eat. Many indeed were larger. . . ."*

DAVID DOUBILET

Garden. Many of the species here, he says, would have been found by Banks on one of the two islands: nikau palms whose fronds sprout like the feathers on an arrow, the spreading kohekohe tree, the slender lancewood tree, the kawakawa shrub with its heart-shaped leaves.

From New Zealand *Endeavour* turned west toward the unknown east coast of Australia where, on April 28, 1770, the ship sailed between Cape Banks and Point Solander (as Cook would name them) and anchored in a large bay. Here Banks and his people found hundreds of plant species waiting to be gathered, drawn, classified, dried, and preserved between the sheets of that commentary on *Paradise Lost*. Among the specimens were more than 70 entirely new species—including the first four species of a genus of an improbable shrub forever after called *Banksia*, each with clustered blooms thrusting like wasps' nests from its stems.

"The great quantity of New Plants . . . Mr Banks and Dr Solander collected in this place," Cook wrote in the ship's log on May 6, 1770, "occasioned my giveing it the name of Botany Bay." At Botany Bay

SEA DRAGON, *PHYLLOPTERYX TAENIOLATUS*, AUSTRALIA; NATURAL HISTORY MUSEUM

National Park south of Sydney, I see plenty of banksias along the shadow-dappled Banks-Solander Track, a nature trail that loops through the bush above the original landing spot. The vegetation has remained essentially the same for 200 years. The trail weaves through a rich jungle populated with gum trees, fig trees, grass trees, flame trees; with herbs, ferns, flowers, and shrubs too numerous to count.

While few other places gave up so many treasures as Botany Bay, Banks and Solander searched at every anchorage, bushwhacking into the hills, rowing pinnaces up rivers, slogging through swamps of mangrove where, Banks wrote, "we were continualy stooping and often slipping off from their slimey roots on which we stepped."

In August 1770 they made their farewells to Australia at Cape York and headed west for home. A stopover in Batavia (now Jakarta) in the East Indies left the bulk of the expedition's members sick, most from dysentery, though Banks himself may have gotten typhus. By the time *Endeavour* anchored in English waters in July 1771, there were only 41 men left from the 94 who had set out three years before. Artist Sydney Parkinson was not among them, having died of dysentery at sea.

THEY BROUGHT BACK whole empires of genera, an accomplishment that would not be equaled until the voyages of Alexander von Humboldt to tropical America 30 years later. Packed in kegs and bottles or pressed between proof sheets were an estimated 30,000 specimens of plants and animals, and Harold Carter, Banks's most assiduous biographer, writes that the

Eyes sharp as spear-points guide Thomas Ling, hunting stingrays in northern Queensland. After observing the ways of Aborigines, Banks realized "how small are the real wants of human nature, which we Europeans have increased to an excess."

A crewman's reaction to a flying fox—like those congregating in Queensland's Forty Mile Scrub National Park—reflected

the prevailing ignorance of the benign nature of bats. "As black as the Devil," he told Banks, "and had 2 horns on its head." Banks marveled at a pupa that glistened "as if it had been silverd over." Hanging from a twig, Euploea core corinna *will hatch a common crow, a dark-chocolate-colored butterfly with white spots.*

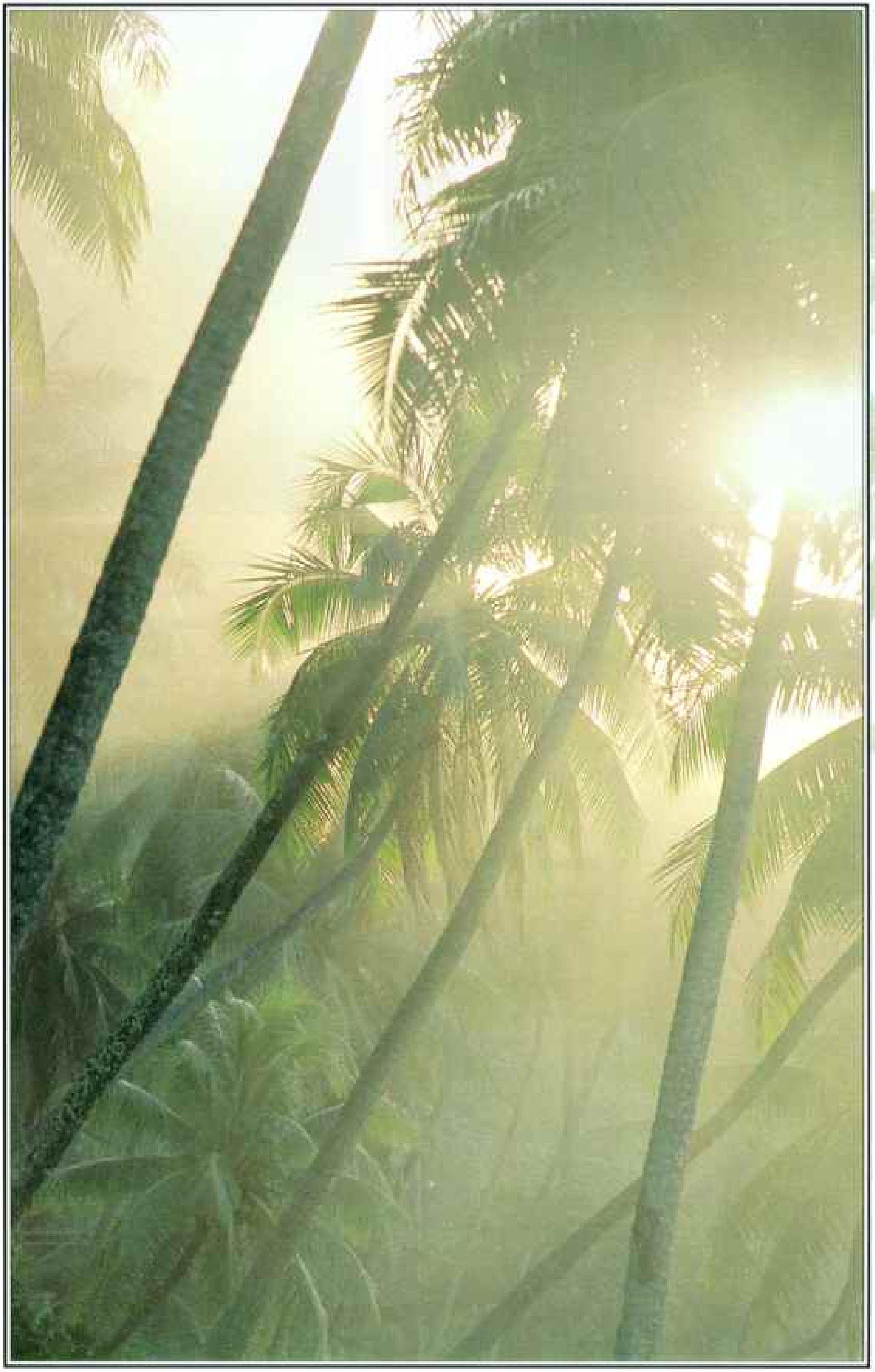
LACE MONITOR OR GOANNA, VARANUS VARIUS, AUSTRALIA; NATURAL HISTORY MUSEUM

collection yielded "some 3,600-odd described species, of which it is probable that the plant species new to science may exceed 1,400." Just how large an accomplishment that was, Carter notes, can be understood when that number is compared with the 6,000 species described by Linnaeus in his *Species Plantarum*, the compilation against which all species were then measured. To this was added evidence of a thousand species of animals, ranging from the skins and skeletons of kangaroos to the shells of mollusks.

When Linnaeus heard that Banks and Solander might join another expedition with Cook before continuing the work of classifying and cataloging the fruits of the first expedition, he was appalled. He feared that Banks's "matchless and truly astonishing collection," as he described it in a letter to a British scientist, might be "thrust into some corner, to become perhaps the prey of insects and of destruction."

Linnaeus need not have worried about losing Banks to another ocean voyage. Banks's plan foundered when he insisted on taking with him 17 people, including two horn players, along with a pack of greyhounds. The superstructure needed to contain such a party on H.M.S. *Resolution*, the principal ship chosen for the journey, would have made it unseaworthy. Cook sailed in July 1772 without Banks.

No matter. Only 29 years old, Banks was perhaps the most famous young man in England. His was an incredibly busy and increasingly prominent life, one that gave him little time in the field, though he managed the odd excursion. His estate at Revesby Abbey and other landholdings took time to manage. So did the *Endeavour* collections.



Smitten by the grace of coconut palms, Banks pledged to build in England a house of glass spacious enough for the trees he saw in Tahiti. Watching women cook breadfruit, just as Tutaha Tetuanui does today, Banks hatched a scheme: export the plant to the Caribbean to feed African slaves. The plan flopped, however, when the slaves shunned the bland fruit, delivered on the second voyage of Captain William Bligh.

He had installed Solander and a few hired artists in his London house to refine the cataloging of the specimens and to finish Parkinson's paintings. He hoped to have all the drawings engraved on copperplates and published in a multivolumed "florilegium." But while 743 plates were indeed completed over the next 13 years, it would be more than a century before the Australian material would be published, and not until 1988 would all of Parkinson's great work be given the illumination of full-color printing in *Banks Florilegium*, published under the aegis of the Natural History Museum.

During the next several years Banks became a familiar of the portraitist Sir Joshua Reynolds (who would, of course, paint him) and was accepted into the Literary Club, Samuel Johnson's renowned group, which gathered at the Turk's Head Tavern on London's Gerrard Street. Banks also may have fathered an illegitimate child and certainly took a mistress, Sarah Wells, keeping her until his marriage in March 1779 to Dorothea Hugessen, whom Solander described as "rather handsome, very agreeable, chatty & laughs a good deal. . . ."

IT WAS THE COOK EXPEDITION that had given Banks fame, but it would be his work with the Royal Society that would absorb the rest of his life and mark his most enduring contributions to science. In November 1778 he was elected president of the organization, a position once held by Sir Isaac Newton. Within the next quarter century Banks would be given his baronetcy, would serve on the Privy Council, whose members are advisers to the crown, and would become a member or honorary member of no fewer than 40 societies, from the Imperial Academy of Sciences in St. Petersburg, Russia, to the American Philosophical Society of Philadelphia.

BREADFRUIT, ARTOCARPUS ALTILIS, TAHITI; NATURAL HISTORY MUSEUM

There was no denying the power that centered in his London house at 32 Soho Square (long since torn down), a kind of scientific crossroads where a constant stream of the learned and the connected came and went with Banks's blessings for more than four decades. Scholars from all over the world

were welcome to sift through the specimens in his herbarium and the books in his ever growing library, which ultimately would include nearly 8,000 titles. In any week, visitors might include government officials from Whitehall, emissaries from foreign courts, and members of an expanding international network of natural scientists.

It was in the house on Soho Square that Banks schemed to promote the colonization of the Botany Bay region by British convicts, once the Revolutionary War closed America as a convenient dumping ground for undesirables. In 1787, nearly 800 convicts were carried off in 11 ships, bound for Australia to begin the colonization of the first Australian state of New South Wales at Sydney harbor.

It was from the house on Soho Square that Banks supervised the biological colonization of New South Wales, hardly less complex than the state's human settlement. Each ship that sailed for Australia carried sheep and cattle as well as seeds and cuttings and living plants from England—peaches and pomegranates, limes and lemons, mustard and garlic, carrots and clover and dozens of other cultivated species—the genesis of Australia's agricultural industry, which thrives to this day.

The house on Soho Square also saw the continuation of the antipodean exchange that Banks had begun in Tahiti. In December 1787 he sent Captain William Bligh to the South Pacific in H.M.S. *Bounty* to gather breadfruit stock for replanting in the British West Indies as a staple for slaves. That a mutiny interrupted the mission is well-known. What is less well-known is that after Bligh made it back to England, Banks sent him out again. This time the mission succeeded. "I give you joy of the success of your Plants," Bligh wrote to Banks in December 1792. "I most sincerely pray you may live to hear they flourish, and to know Thousands are fed with their Fruit." (The slaves refused to eat the strange Pacific staple, but breadfruit does "flourish" in the West Indies today.)

And then there was Banks's magnificent effort to nurture the Royal Botanic Gardens at Kew, which he was determined to make the most important repository of plant species in the world. King George III shared that goal, and the two men often could be seen strolling around the grounds together.

While Banks was never given any official responsibility for Kew, his role was clear. "He didn't have the title of superintendent," says Ray Desmond, the former librarian at Kew, "but he had the money, he had the influence, and he had the support of the monarch, so he was in effect de facto director."

For years Banks used the grounds at Kew as a kind of training

Flowery monument to Banks, the world's largest rose tree grows in Tombstone, Arizona. After young Mary Gee arrived from Scotland with her new American husband in 1885, her family sent her roots of a Lady Banks's rose, named for the botanist's wife. The bride gave some to her

LADY BANKS'S ROSE, ROSA BANKSIAE, CHINA, © TRUSTEES, ROYAL BOTANIC GARDENS, KEW

landlady, who planted shoots behind her boarding house, now the Rose Tree Museum. Covering 8,660 square feet, the tree is supported by 71 posts and a metal-pipe trellis. Banks himself often gave away cuttings to help ensure his own plants' survival.

camp for his worldwide network of collectors. His botanical ambassadors scoured the earth for living treasure from satellite gardens in places like Ceylon and St. Vincent and transported them to Kew. As a result the number of species represented at Kew during the years that Banks supervised its growth swelled from 3,400 to more than 11,000.

All this was accomplished not merely for the sake of knowledge but also for the improvement of the human condition and, not incidentally, the greater glory of the British Empire. Banks practiced a brand of biological imperialism, and his collectors were ordered to be alert to how the medical or economic potential of what they found might further British interests.

"Banks wanted his king to have a bigger collection—a better collection—than anybody else," says Grenville Lucas, head of information services at Kew. And when Banks moved things around the globe—

breadfruit to the West Indies, Chinese tea to India, cochineal (for red dye) from Mexico to England—it was to promote British prospects, not necessarily local needs.

SIR JOSEPH BANKS, FRS, died full of years and honor and gout on June 19, 1820, age 77. We don't know what he would have considered the monument closest to his heart. The gardens at Kew? The plaque that bears his likeness at Botany Bay? The 75 species of banksias? Or maybe the memorial in Tombstone, Arizona, of all places, where a little patch of England grows in the heart of the Sonoran Desert.

Here, in the backyard of the Rose Tree Museum, the world's biggest rose tree rises from a thick twisted trunk, its branches curling through 8,660 square feet of overhead trellis. The tangle of leaves splits the sun's rays into hundreds of bright fingers that speckle the ground in a calico pattern of light and shade.

The tree was planted in 1885 from cuttings taken from a species introduced to England in 1807. One of Banks's far-flung collectors had found the previously unknown rose on the China coast and sent it to Kew Gardens. It was named *Rosa banksiae* in honor of Banks's wife and soon became commonly known as the Lady Banks's rose. From Kew it spread over much of the globe, until today it is one of the hardiest and most popular roses in cultivation.

Looking down on the spreading limbs from a viewing platform the inn's proprietors have built, I am struck by how precisely this rose tree exemplifies a man whom Linnaeus called "the immortal Banks." Here is this most spectacular descendant of *Rosa banksiae*, its tendrils creeping relentlessly into every part of the trellis, even as Banks insinuated himself into virtually every corner of the scientific world and several excellent crannies of the political and commercial worlds as well. I think Linnaeus was right. If the rose tree looks as if it might live forever, so does the intellectual legacy of Sir Joseph Banks. □

PINEAPPLE, ANANAS COMOSUS. TROPICAL AMERICA; NATURAL HISTORY MUSEUM

The dream of a palm house outlived Banks, who died in 1820 before its creation. Now a part of Kew Gardens, the greenhouse harbors an orderly riot of plants, including a hibiscus called Lae orange. Banks's legacy lingers in the perfume of a Georgian-style flower arrangement made of plants introduced at Kew or their cultivars. Banks did live to achieve another goal: to grow a pineapple for his Christmas table.

Britain's Precarious Stronghold GIBR

Looming just south of the Spanish border town of La Línea, the Rock of Gibraltar has come to symbolize strength and stability—despite its turbulent history. Under British control for three centuries, Gibraltar now grapples with the same question nagging European nations as they blend into a single market: Who are we, really?

By BILL BRYSON

Photographs by DAVID ALAN HARVEY

ALTAR

The Rock

Gibraltar's 31,000 residents, whose roots run back to Britain, Genoa, Portugal, Spain, and Malta, squeeze onto 2.5 square miles of land. To add bits of acreage, Gibraltar has laid down fill at water's edge.

MOMENTS AFTER you arrive in Gibraltar, an odd thing happens. The road into town abruptly takes on the expansive dimensions of an airport runway. In quick succession three mildly befuddled observations pass through your mind—that it *is* an airport runway; that, indeed, a couple of hundred yards to your left a Boeing 737 is giving every indication of imminent takeoff in your direction; and that this may be the biggest blunder you have made in some time.

In fact, no. This is Gibraltar, where space is so tight that jetliners and automobiles must periodically share paved space and where most things seem designed to surprise.

Just two and a half square miles, and most of that towering rock, Gibraltar is a little piece of Britain on the southwestern tip of Spain—a place of red phone booths, Union Jacks, blue-helmeted bobbies, and afternoon teas. English is the official language, pounds and pence the local currency. London newspapers hang on racks outside news agents' shops, and the store windows along Main Street are filled with British goods. But for the blazing Mediterranean sun and the commanding presence of the Rock, looming over the jumble of houses pressed against its lower slopes, you could almost be in some small, half-forgotten coastal town in Sussex.

Closer up, however, you realize that Gibraltar is a place like no other. Thanks to its uncommon topography and setting, at the point where the Atlantic meets the Mediterranean and Africa and Europe nearly touch, Gibraltar enjoys many singularities—in the variety of its flora and fauna, as a crossing point of unparalleled importance for migratory birds, as a laboratory for the study of prehistory. "It is more like an island than

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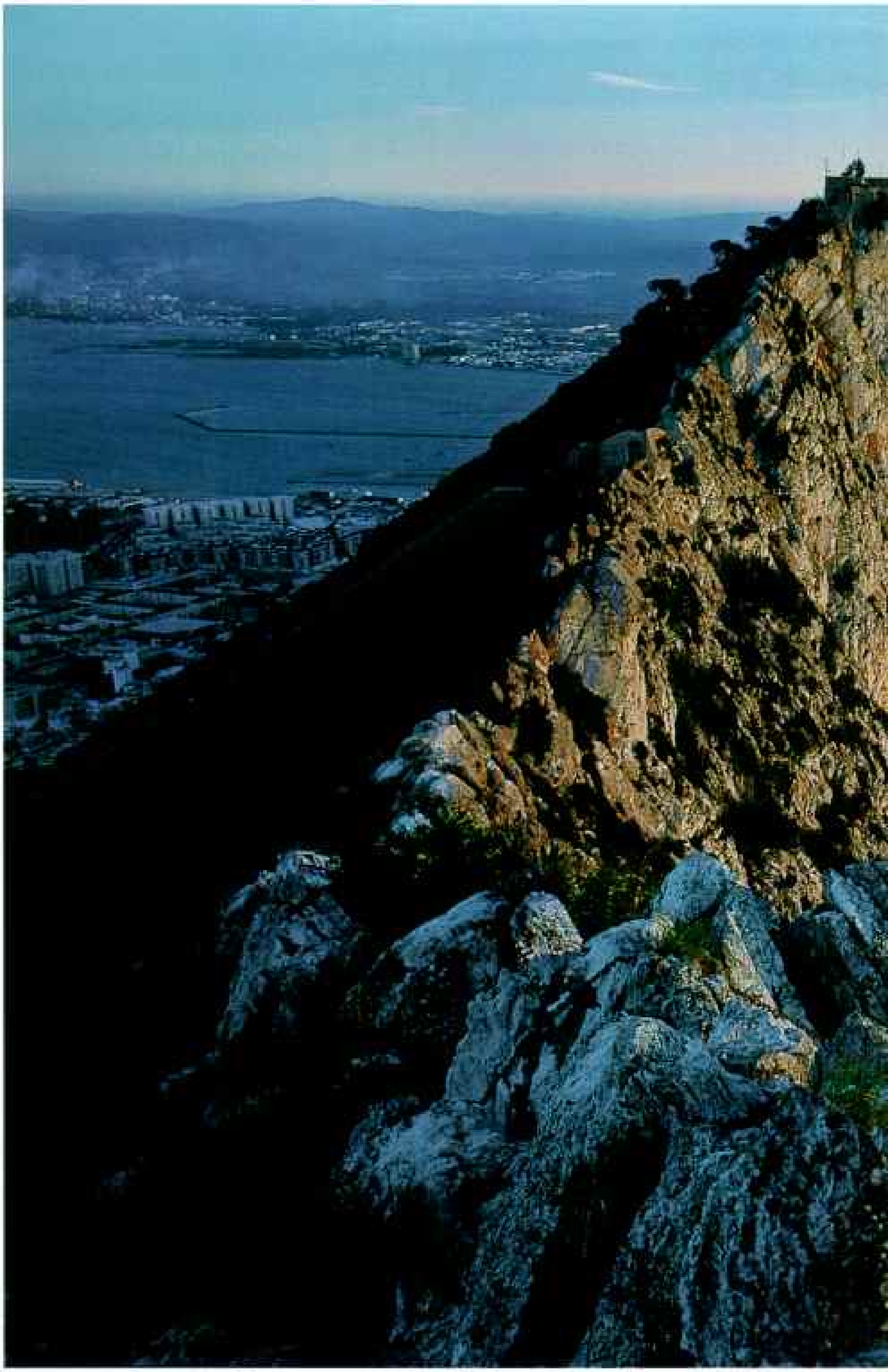
BILL BRYSON, a frequent contributor, grew up in the landlocked Midwest, which may explain his propensity for small places surrounded by water. *Notes from a Small Island* (Morrow, 1996) is his latest examination of Britain and its inhabitants. DAVID ALAN HARVEY, a native of San Francisco, California, has photographed more than 30 articles for the magazine, contributing most recently to the special issue on Mexico (August 1996).

most islands," says John Cortés, a local botanist. "We are in the interesting position of being politically attached to one country, physically attached to another, and not really part of either."

The 31,000 people of Gibraltar are a blend of British, Spanish, Genoese, Portuguese, and Maltese stock. "Most were brought in as workers after Britain took over in the early 18th century," says Clive Finlayson, director of the local museum. "Often they would marry Spanish women from nearby villages, so English became the language of business and education and Spanish the language of the home."

The result is a comfortable bilingualism and a wildly variable but engagingly distinctive local accent that runs the gamut from Mayfair to Mediterranean. "We have many words that don't exist in standard Spanish or English," says Finlayson. "The Spanish for sidewalk, for instance, is *acera*, but here it is *marchapie*—the same word, slightly modified, as in Genoa. Other words are corrupted from English—*tipa* for teapot, for example. It's all a consequence of our cosmopolitan makeup." And a gentle reminder that, after

Peddle power: Within eyeshot of La Linea (below), Gibraltar cashes in by promoting its proximity to Europe's open market. By trumpeting its low taxes and discreet financial services, the colony sells itself as an offshore banking haven. By highlighting its history, Gibraltar builds its tourist trade. And by promoting its port facilities, it attracts cargo ships and cruise lines, which keep the wheels of commerce spinning.



Acres of iron sheets have long funneled rainwater into reservoirs beneath the Rock, but new desalination facilities eliminate the need for this catchment, which will soon be dismantled. The face-lift will restore the profile of the Rock, a monolith the

ancient Greeks considered one of the Pillars of Hercules. Moors made it an Islamic citadel when Tariq ibn Ziyad conquered the Rock in 711. He dubbed it Jabal Tariq —Tariq's Mountain—a name the English tweaked to beget "Gibraltar."

300 years as a political enclave, Gibraltar has a flavor and identity all its own.

It was never intended that the Gibraltarians should become a *people*. They came merely as dockworkers and other support staff after the Rock was captured by Anglo-Dutch forces in 1704 during the War of the Spanish Succession. In the following centuries the colony grew into an important garrison and naval base, keystone to British ambitions in the Mediterranean, but with Britain's decline as a global power the Rock's strategic importance has grown increasingly attenuated. Today Gibraltar is essentially an oddity—an awkward relic of empire, a cultural anomaly on the Spanish mainland, a town whose 31,000 residents make no secret of their impatience with colonial status and even talk of independence.

Showing his true colors—Britain's Union Jack and the red and white of Gibraltar—Stephen Robba sends a signal on National Day. "Spain wants to gobble us up," says Robba, "but we don't want it." Though Gibraltarians are virtually unanimous on that issue, they are divided over continued status as a British colony, with some residents calling for independence.

TO SPAIN, Gibraltar is an irritant of long standing. As one Spaniard explained it to me: "Imagine if a foreign power occupied part of your country and stationed troops and police there and subjected you to passport controls on your own soil. Wouldn't you resent it?"

It is an argument that Gibraltarians have heard to the point of exasperation. "Spain has no more right to Gibraltar than it has to any of its former holdings," says Joe Bossano, minority leader of Gibraltar's House of Assembly, with a hint of thunder. "Look, we have not been part of Spain for nearly 300 years. California was Spanish as recently as the 1840s—shall Spain therefore have it back as well?"

He opens his hands in a look that mingles wearied patience with frank incredulity. It is an expression you get used to seeing in Gibraltar when the topic turns to Spain, and it seldom turns anywhere else.

To underline its resentment, Spain in 1969 closed the border and kept it closed for 16 years. Phone lines were cut, and mail from Gibraltar to the neighboring town of La Línea, a few hundred yards away, had to make a 2,200-mile detour via London. Those cut off from family or friends could communicate directly only by shouting across a barren strip of no-man's-land between security fences.

"On Sundays you would see people on one side holding up a baby and their relatives on the far side viewing it through binoculars," one Gibraltar resident recalls.

The resentment lingers, but in a curious way the isolation is also remembered with a kind of fondness. "Oh, it brought us much closer together," says another Gibraltarian. "Suddenly there was no place else to go. It did wonders for our sense of community."

Despite the reopening of the border in 1985, Spanish customs officials still commonly institute exacting searches of cars and trucks, which can cause holdups for hours. The Spanish say it is to stop the smuggling of cigarettes and alcohol, which are cheaper in Gibraltar. Most Gibraltarians see it as petty harassment.

"It is very irksome and totally counterproductive since its only effect is to increase our hostility toward Spain," says Peter Caruana, the chief minister. If there is one matter on which there is virtual unanimity of sentiment

in Gibraltar, it is opposition to Spanish control. When Spanish sovereignty was proposed in a referendum in 1967, the Gibraltarians rejected it by the resounding margin of 12,138 votes to 44—and that, I was frequently reminded, was before the full border closure. "Today," one young professional assured me, "you'd have trouble finding 44 people willing to make a day trip to Spain, much less form a permanent union."

Surprisingly, those whom you might expect to visit Spain—namely younger Gibraltarians—seem even less inclined to go than their elders. Joseph Garcia, a historian in his mid-20s, explains: "When people of my generation were growing up, we couldn't cross to Spain, so it didn't become part of our lives, and really it still hasn't. Anyway, we have pretty well everything you could want right here—restaurants, pubs, a cinema, good shops, even a casino if you want that sort of thing. There's no reason to go."

But doesn't he sometimes find Gibraltar just a trifle dull, claustrophobic even?

"Claustrophobic? Never. Dull? A little—but you could say the same of any small community. The Spanish towns aren't any livelier, believe me."

Up close it can seem ironic, indeed bewildering, that a place as small and genially sedate as Gibraltar could attract the notice, much less heat the blood, of politicians in far-off capitals. But move back a mile or two to the neighboring Andalusian foothills, and in a glance you grasp why nations have coveted and fought over it for centuries. The Rock of Gibraltar is a breathtakingly commanding presence—1,398 feet of Jurassic limestone

rising nearly sheer from the sea and forming one of the most noble and recognizable profiles in the world. To the Greeks it was one-half of the legendary Pillars of Hercules. (The smaller eminence of Jabal Musa, on the Moroccan side of the strait, was the other.) To the Romans it marked the end of the world, *ne plus ultra*—no more beyond—the point beyond which no one should venture.

For the Moors, however, it was just the beginning, a toehold that facilitated the eventual conquest of Spain. In 711 the Berber commander Tariq ibn Ziyad led a force that conquered the Rock and gave it a name, Jabal Tariq, or Tariq's Mountain, from which the modern "Gibraltar" is descended. Not until 1462 would the Spanish regain the Rock, only to lose it again to the British. In 12 centuries Gibraltar has spent just 266 years in Spanish hands. Little wonder then that its control has taken on an almost mystical significance to that country.

"THE HISTORY of modern Gibraltar has been a history of sieges—Moors besieging Spaniards, Spaniards besieging Moors, Spaniards besieging Spaniards," Clive Finlayson told me one day as we made our way down 350 steep, narrow steps along the eastern, seaward face of the Rock. "Altogether there have been 14 major sieges here—though people often call the present situation the 15th siege." Finlayson is a keen and genial Oxford-educated biologist and historian, with interests ranging from ornithology to paleobotany—the kind of person whose mind is so brimming with knowledge that he often jumps subjects. He did so now, as we paused to take in the view. "Six million years ago the Mediterranean dried up, and a land bridge formed between Africa and Europe. Eventually the wall gave way, and a 5,000-foot-high series of cascades opened up. What a sight that must have been. The Mediterranean took about a century to refill."

We stared across the bright waters to the Moroccan coast and the outcrop of Jabal Musa outlined against a denim blue sky, 17 miles away but looking much closer in the clear spring air—close enough to see houses clustered on its lower slopes and the movements of cloud shadows across fields. Below us, less encouragingly, the steps continued to an improbably distant vanishing point, like the view down an inverted telescope.

Running out of open space, Gibraltarians make the most of it—while playing a game or planting a garden. Tito Garcia and his wife, Pat, sculpted the hill behind their home into seven terraces, where they grow garlic and chives, lemons and figs, pears and plums.

"We have no factories," says Tito. "Everything is imported. All we have is our history."

In 1907, long before these steps were cut, a British military man whom records name only as Capt. A. Gorham somehow made his way down this forbidding drop and discovered a cave of such significance that nearly 90 years later it is still exciting archaeologists. Roughly 60 feet high and more than a hundred feet deep, with a large opening to a secluded, rocky beach, Gorham's Cave is the sort of cavern you find in adventure stories—full of moist stalactites, hanging ferns, and cobwebs like fishing nets.

"This is probably one of the ten best caves in the world in archaeological terms, with a history of human occupation going back 100,000 years," Finlayson told me as we entered. "It's been used by everyone from Neandertals to Phoenician and Carthaginian sailors, who stopped here to make offerings to their gods *(Continued on page 67)*

Britain's Precarious Stronghold, Gibraltar

Guarding the gateway between the Mediterranean Sea and the Atlantic Ocean, this long-range gun is one of three installed in the 1930s by the British, whose claim to Gibraltar is almost 300 years old. In 1713, after the War of the Spanish Succession,

Britain was granted control of Gibraltar "in perpetuity." Sort of. In 1779 Spain and France launched an unsuccessful four-year siege of Gibraltar—an episode that may have given birth to the expression "safe as the Rock of Gibraltar."

to ensure safe passage through the strait."

Deep in the cave we found a party of visiting archaeologists and speleologists from Cádiz—which surprised me, given the historic enmity between Spain and Gibraltar. "Oh, that's a political problem," Finlayson said airily, as if it existed in another dimension. "This is science." He introduced me to José Maria Galafate, an amiable and bearded speleologist who was about to start a laborious ascent up the cave wall to a small opening recently discovered in the gloom high above.

For two hours we watched as Galafate slowly advanced up the wall by means of a rope harness and metal anchors hammered into the rock face. At last he reached the hole and wriggled through.

"The hope is always that we'll find definitive evidence of Neandertal occupation," Finlayson whispered anxiously. "There's reason to believe that Gibraltar was their last refuge before extinction."

At length Galafate wriggled back out through the hole and returned to the cave floor, bearing something black and fibrous—an old rope, almost certainly left by the mysterious, and evidently tireless, Captain Gorham—but otherwise the upper chamber had been disappointingly bare.

Finlayson gave a wan smile. "It was a long shot, but one lives in hope. And do you know what the worst of it is?"

I told him I couldn't guess.

His smile broadened. "Now we have to walk *up* those 350 steps."

IF GIBRALTAR is a haven for archaeologists, it is no less so for botanists. Some 530 species of flowering plants are native to the Rock, including four found nowhere else. "For a while we thought it was just three, because the Gibraltar campion appeared to be extinct," says John Cortés. "Then last year we found three campions growing high up on the Rock. I can't tell you what a wonderful moment that was."

Nor, one might add, what a fortunate thing for Gibraltar that it has John Cortés. Like Clive Finlayson, Cortés was educated at Oxford and returned to Gibraltar, where he worked for some years as a civil servant. Then in 1991, when he learned that the care of the Alameda Gardens, the town's historic but run-down central park, was to be put out to private tender, he impulsively submitted a bid. To his surprise, and occasional subsequent dismay, he won.

"The gardens were a wreck," he recalls. "There was a staff of 28, but they hadn't watered for ten years. This, you understand, is a very special park—it has more dragon trees than any other park in the world and much else that is botanically significant. It had been tragically neglected."

With a much reduced staff Cortés set about restoring this 15 acres of semiwilderness. Today the park is a joy to walk through and well on its way to fulfilling his dream of becoming one of the finest botanic gardens in the Mediterranean.

Cortés earns no profit on the project. "It's a labor of love," he says with a small shrug. "Almost all the money we receive from the government goes straight back into the gardens."

The good times roll during a post-regatta party in Catalan Bay (top) and at the Miss Gibraltar pageant, where contestants Tyrene Camilleri (left, at left) and Monique Chiara share a laugh. "What career do you want to pursue," asked the master of ceremonies. "I want to be managing director of a bank," said Monique, crowned Miss Gibraltar 1995.

Certainly I can confirm that very little of it goes into Cortés's car, as I discovered when he took me on a rattling, quietly terrifying drive to the field center of the Gibraltar Ornithological and Natural History Society, of which he is general secretary, high on the Rock. "Gibraltar is a crossroads for bird migration," he told me when we reached the lofty summit. "Because it's the shortest route across the Mediterranean, virtually the whole European population of large birds passes through."

Cortés scanned the sky, but my gaze was drawn to the town far below, drowsing in the pinkish wash of a setting sun. To me the most striking thing about Gibraltar was that it was, inescapably, a sleepy little backwater—a place of charm but not a great deal of excitement—and yet full of gifted, dedicated people like John Cortés and Clive Finlayson. Later, sitting in a quiet town-center pub, I asked Cortés what kept him in a little town on the farthest edge of Europe.

"English pubs and a Mediterranean climate—what better combination than that?" he said with a large smile, and then grew more thoughtful. "I don't know really," he went on. "It's home, you know. It's friendly, it's safe, I feel as if I can do useful and important work here, and it's mine. It's part of me. I can't give you a better answer than that. I just wish it had a more certain future."

For Gibraltarians, uncertainty has become a chronic condition. In the 1980s Gibraltar underwent a surge of optimism that was almost giddy. Grandiose plans were laid to turn the colony into a banking and financial services center along the pattern of Bermuda

One month melts into the next for 19-year-old Gail Busto, who works nine hours a day at a local cosmetics shop. In the evening she practices ballet and then—if her friends are around—scoots off for a night of drinks and dancing. "Gib is nice and safe, but you see the same thing every day and you get a little bored," says Gail. "Madrid is more exciting."

or the Cayman Islands and to tap into the lucrative tourist industry of the neighboring Costa del Sol. Stylish marinas and waterside condominiums were built to accommodate the expected influx of British expatriates drawn by the promise of low taxes and banking secrecy, while alongside the old harbor there arose a gleaming 150-million-dollar office complex called Europort, with associated apartments, stores, and 16-story hotel.

And then the boom died. For a while Europort had the air of a ghost town. The hotel never opened, and even now most of the apartments and retail units await their first tenants. At the nearby marinas waiters stand idly at open-air cafés and restaurants.

"People thought it was simply a matter of throwing up a lot of buildings and everything else would follow," one official told me. Unfortunately, the new offices and apartments came on the market just as Europe was sinking into recession. Delays in implementing the necessary financial legislation and uncertainty over the political future of the colony acted as further disincentives.

As another observer put it: "Potential investors came and looked but quickly realized that Gibraltar is a long way from the main business centers of Europe, that it has no air links to anywhere on the Continent, that it has poor beaches, no golf courses, and little nightlife, and that there is already a glut of tax havens where none of these shortcomings exist, and they said, 'No thanks.'"

Nor did tourism blossom in the way that had been hoped. Although Gibraltar receives at least four million visitors a year, most come for no more than a few hours, generally to tour scenic St. Michael's Cave, photograph the famous (and famously willful) monkeys that inhabit the upper Rock, and perhaps do a little shopping. Few stay the night, and fewer still trouble to experience Gibraltar beyond its two or three best-known attractions.

"It's a great shame," says Christopher Terry, an architect who specializes in restorations, "because there's nowhere else with a history quite like Gibraltar's, and most of it escapes them." We were standing on the lofty terreplein of an 18th-century fortress called Parson's Lodge Battery, one of a string of mighty defenses that once dotted the Rock. A hundred feet below, waves brushed the beach of Rosia Bay, where the British fleet returned with Nelson's body after the Battle of Trafalgar in 1805.

"For a long time," Terry continued, "Gibraltar was one of the most heavily fortified places in the world. Unfortunately the military didn't always look after this legacy."

THE POINT could hardly be better illustrated than by the imposing sprawl of the battery on its rocky outcrop above the sea. Abandoned by the military in the 1950s, the site became an unofficial dump. When Terry and a crew of volunteers began its restoration, they had to remove 400 tons of accumulated rubbish. Today Parson's Lodge is once more pristine, its battlements rebuilt, its stout walls seamlessly patched—but it is just one small salvaged fragment of a much more immense military history.

Terry took me to a ramshackle shed overlooking the former naval dockyard. Behind the shed, half buried in undergrowth, was an iron cylinder perhaps 20 feet long. It took me some moments to recognize it as the barrel of a gun. "This is one of the wonders of late 19th-century military engineering—a 38-ton gun," Terry said. "And it's just lying here. There are 467 pieces of loose ordnance like this on Gibraltar. You see what I mean when I talk about the potential for this place?"

I did indeed, but I saw it more clearly a day or two later when I met a soft-spoken lawyer named Lionel Culatto, whose passion in life is a remarkable series of tunnels called the Northern Defences. To reach them, we ascended the narrow streets above the town, squeezed through a gap in a rickety fence, and followed a path along the side of the hill till we came to an arched opening in the rock.

"This is it," Culatto said tentatively, as if apologizing for having such an unlikely preoccupation, and with two steps vanished into the blackness. I followed him—or rather his voice and a restless beam of flashlight—down a dank, eerily echoing passageway about eight feet high and wide. At intervals his flashlight picked out side rooms, stone staircases, and connecting passageways, each labeled with a neatly painted designation—"Hanover Gallery 1789," "Bombproof Gallery 1792."

"Street signs, in effect," Culatto explained. "It's such a complex network that you could easily get lost without them. Altogether there are some 30 miles of tunnels in the Rock. There's nothing like it anywhere else."

For two hours we ventured through a mere fraction of this immense labyrinth. Most of the tunnels were just as they were when the last soldiers left at the end of the Second World War. Beside one embrasure we found a gunner's map carefully sketched on the wall in colored chalk, 50 years old but as fresh as if it had been rendered the day before. It was hard to believe that such a singular network had escaped commercial exploitation.

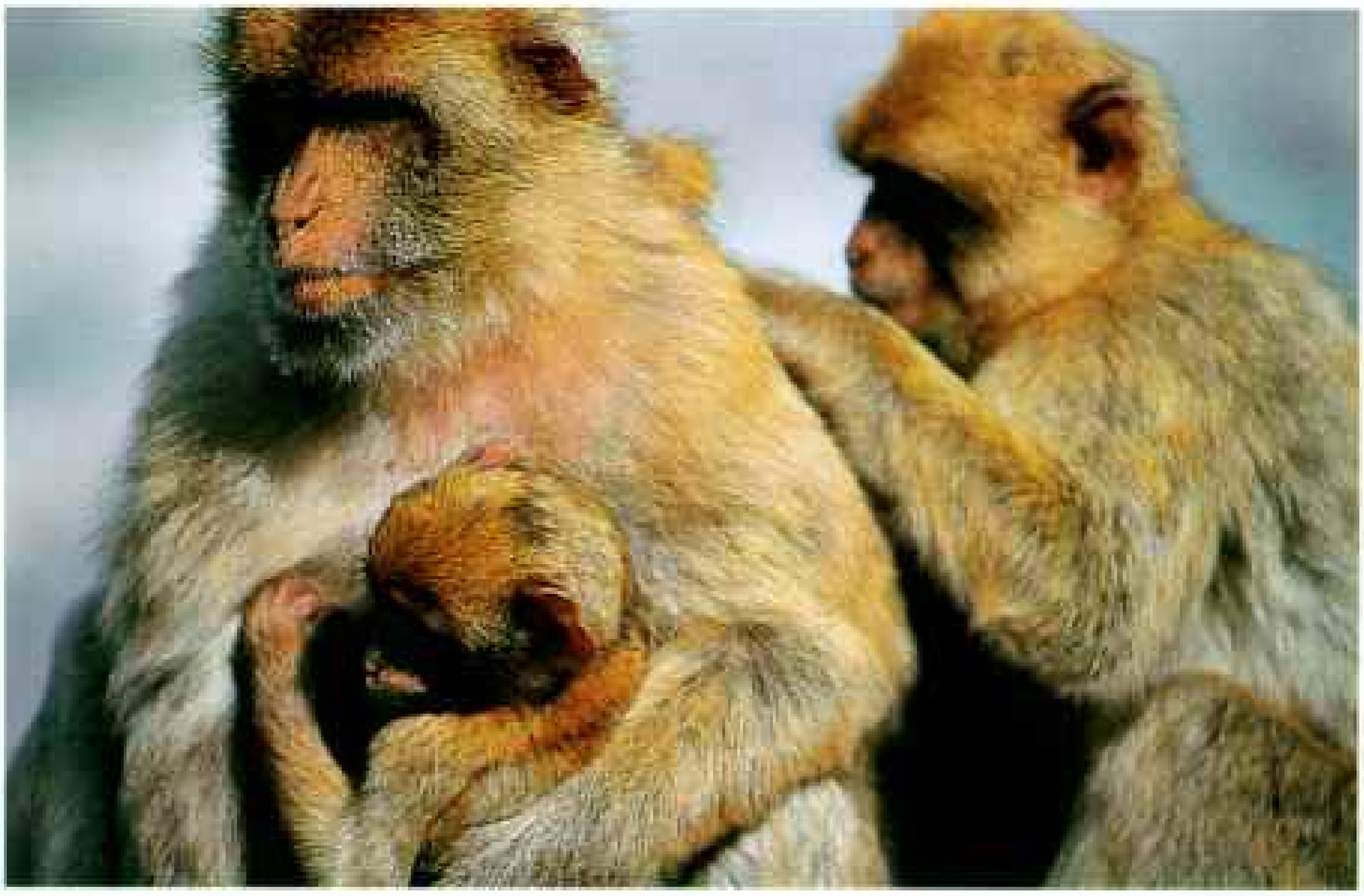
"Most members of the local government have never been up here," Culatto said at length, "scarcely even know it's here. All their efforts go into modernizing the town. But when you think about it, the only future for Gibraltar is its past. It's the heritage that makes it unique, and they're just letting it crumble away."

Mediterranean mist rolls over the Rock, leaving Gibraltar as foggy as its future. Will residents remain British subjects or seek independence? A local legend says Gibraltar will break from Britain when the Barbary apes (tailless monkeys, actually) no longer live on the Rock. At last count, the monkeys—190 of them—were fine, thanks to their care and feeding by a local tourism company.

OF ALL THE ALTERNATIVES that might lie ahead for Gibraltar, none was expressed more eloquently to me than by a young government minister named Peter Montegriffo, who many predict will one day be chief minister—or president or prime minister if Gibraltar ever becomes independent.

"Gibraltar faces two possible futures," he said. "Either we can slowly bleed to death, as many people fear, or Britain and Spain can resolve their differences and we can become an example of European cooperation at its best. Naturally I hope for the latter.

"We are special for many reasons. We have a unique history. We are a blend of cultures. We are a shining example of tolerance. In a word, we are in a tiny place everything that Europe is trying to be in a big place. What a shame it would be to lose that." □



Britain's Precarious Stronghold, Gibraltar

By BILL CURTSINGER

Photographs by the author and EMORY KRISTOF

Realm of the Seamount

Sprinting near the summit, a Steller sea lion streaks by while patrolling the rich feeding grounds around Canada's Bowie Seamount, a 10,000-foot volcanic mountain beneath the Pacific.

EUMETOPIAS JUBATUS; BILL CURTSINGER

To explore this marine oasis 120 miles off British Columbia's Queen Charlotte Islands, my longtime colleague Emory Kristof and I divided photographic duties. In scuba gear I worked to depths of 160 feet with my assistant, Eric Hiner, to document the top of the seamount, which peaks 90 feet below the surface. Emory, with the help of National Geographic electronics engineer Mike Cole, maneuvered a remotely operated vehicle (ROV) nicknamed Gump. It descended (below) through clear surface water to the dark of 500 feet.

Like the islands of Hawaii, Bowie was created as the Pacific plate moved over a hot spot in earth's mantle. But it was not always a submerged mountain. Scientists believe that its crown was likely an island, or at least a shoal, during the Pleistocene, when North America was largely covered by ice sheets and sea levels were lower. From Bowie's terraced summit, thought to have been sculpted by surface wave erosion, researchers have collected additional evidence of wave action: rounded lava rocks and shell fragments.

Now its upper reaches are covered with red algae, giant scallops, sea anemones, kelp, and sea stars. In the water column above the summit, clouds of juvenile rockfish feed on a teeming community of plankton. When ocean currents meet a seamount, they can swirl above it in a slow-moving vortex that traps plankton and other nutrients. This bountiful feast attracts a wide range of marine life.

Sablefish, or black cod—popular as a smoked fish—migrate from the coast to Bowie as juveniles and remain here as adults. To control fishing pressure on these stocks and collect information for their management, the Canadian government allows commercial fishing here only under scientific permits. One day

Submerged Worlds

BOTH BY BILL CURTSINGER

the four men on the vessel working the seamount during our dives each pulled in a thousand dollars' worth of sablefish from traps set as deep as 4,000 feet.

One of the principal obstacles to studying Bowie Seamount is simply getting there. We were fortunate that Society member Art Hall (above, piloting his craft through the Queen Charlotte Islands) volunteered the services of his 75-foot charter yacht *Sumdum*, with space for our mountain of equipment.

In *Sumdum*'s main salon Emory and Mike built a wall of electronic gear to steer and observe Gump in action far deeper than Eric and I can dive using scuba. I kid Emory about his "Nintendo diving." He comes back with: "I don't get wet to do these kinds of pictures."

Nestled in red algae at 110 feet, a wolf eel stares at Gump's camera. Growing as long as eight feet, the large-toothed eel has been known to accept food from a diver's hand.

At 400 feet a hundred-pound Pacific halibut (insets) is lured to Gump by herring in a wire basket. Moving in on the bait, an agile sunflower sea star also attacks the basket but nearly loses a limb.

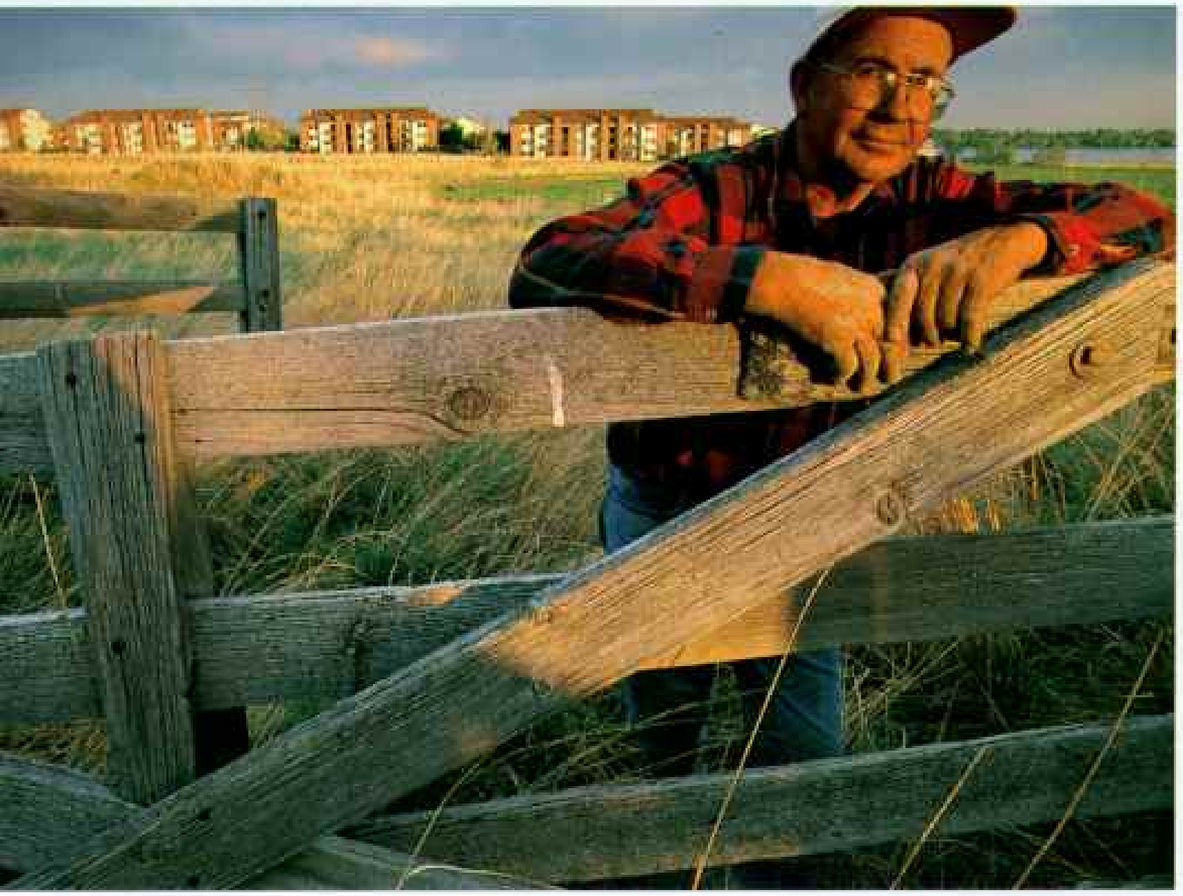
HIPPOGLOSSUS STENOLEPIS (HALIBUT); *PYCNOPODIA HELIANTHOIDES* (SEA STAR); *ANARRHICHTHYS OCELLATUS* (WOLF EEL); ALL BY EMORY KRISTOF

The gossamer tribe of the seamount includes a mollusk (inset opposite) whose organs reflect my strobe through a transparent shell wrapped with hitchhiking polyps. A jellyfish carries a speckling of amphipods (inset below). Illumination reveals salps, zooplanketers that "bud off" strands of individuals up to 20 feet long. To the right of the light, a solitary salp produces the first bud of this intriguing chain reaction. □

CLIO SP., 1.5 IN LONG (MOLLUSK); CYRIMA SP., 8 IN WIDE (JELLYFISH); SALPA ASPERA; ALL BY BILL CURTSINGER

Rappelling down a flatiron, a climber is just ten minutes from his office in Boulder far below. A robust economy and swift access to mountains, canyons, trails, trout streams, and ski slopes have lured hordes of new suburbanites to the Front Range, all seeking their slice of the West's open spaces and blue skies.

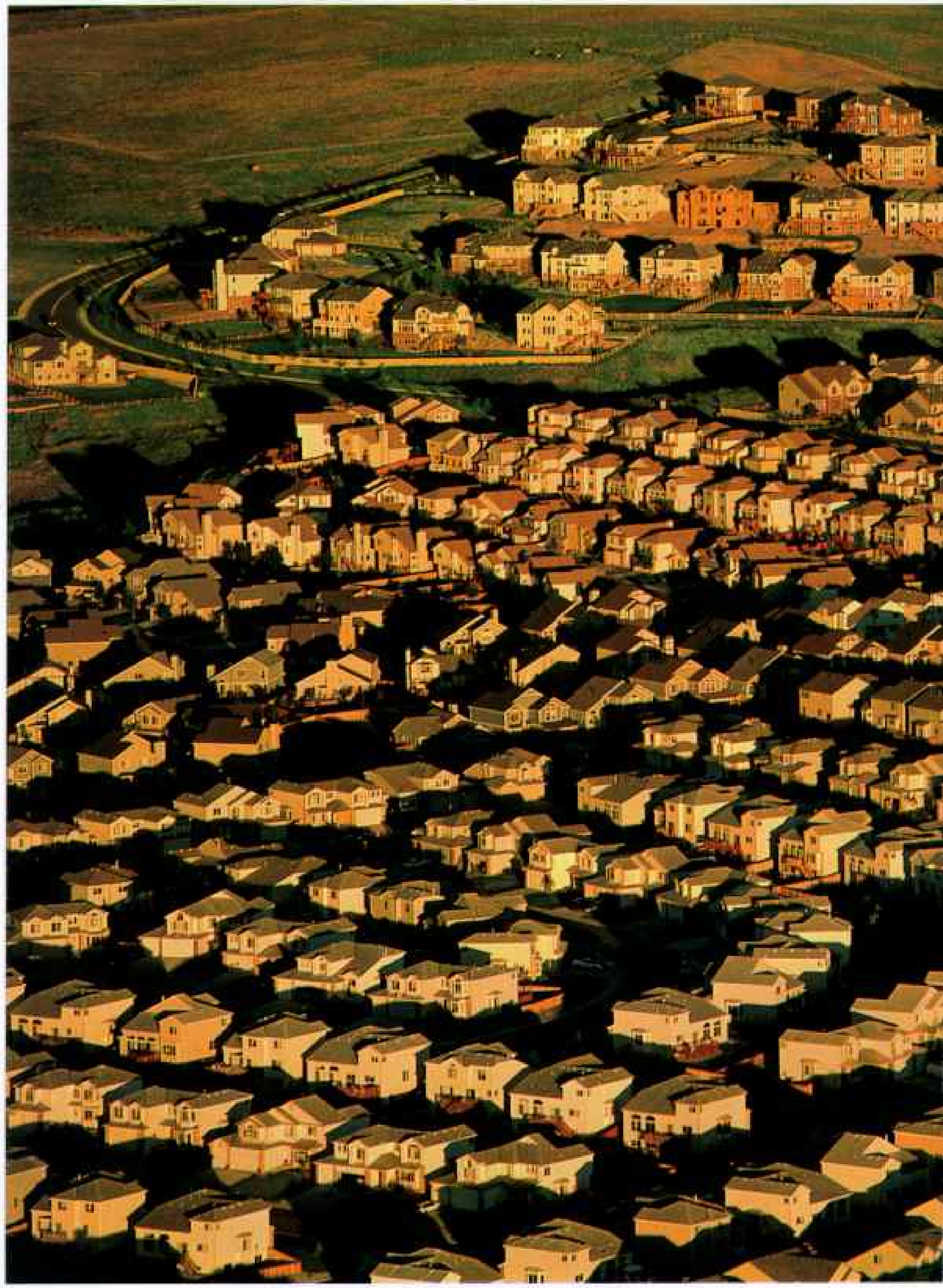
COLORADO'S

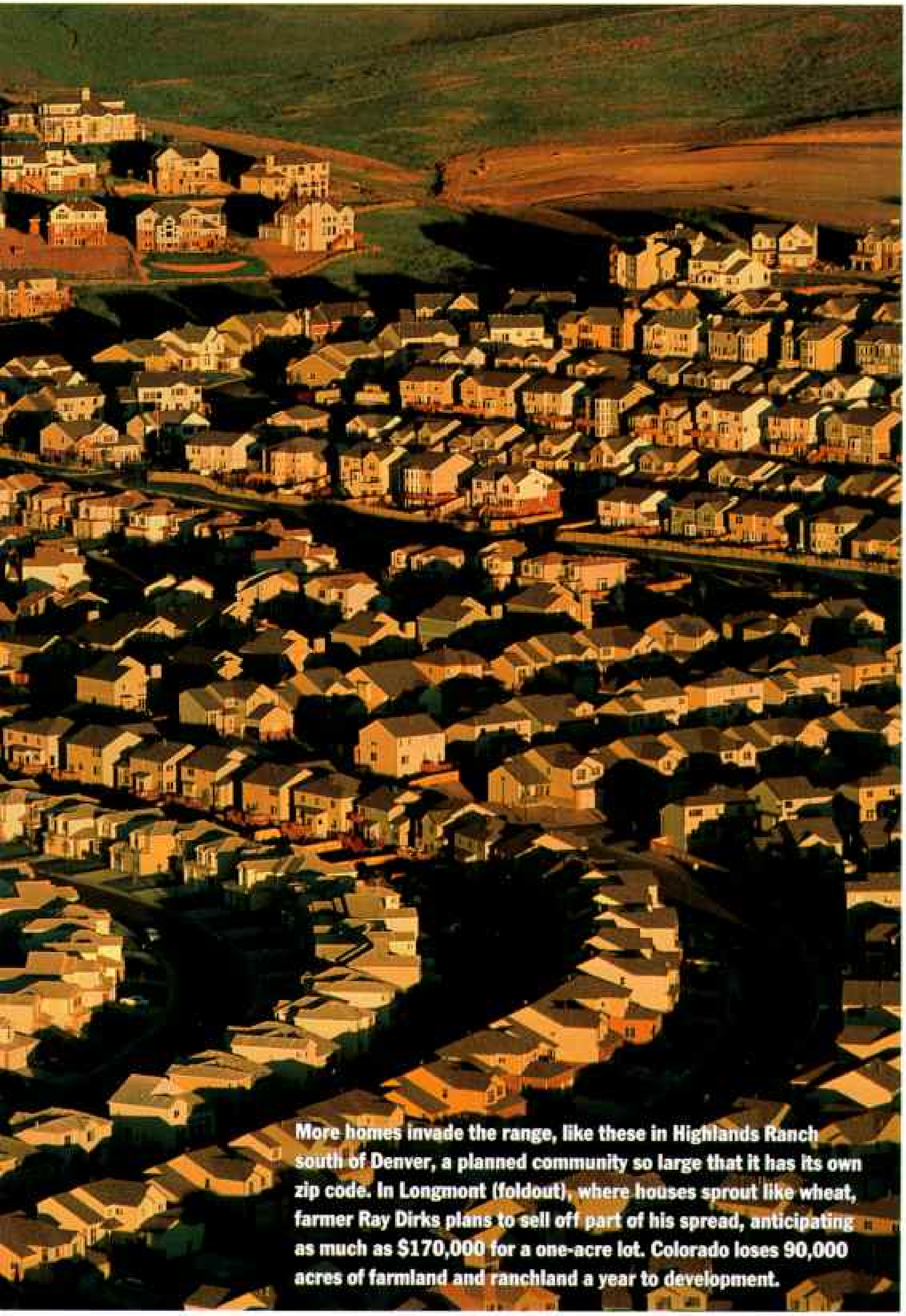


FRONT RANGE

By MICHAEL E. LONG

Photographs by JIM RICHARDSON





More homes invade the range, like these in Highlands Ranch south of Denver, a planned community so large that it has its own zip code. In Longmont (foldout), where houses sprout like wheat, farmer Ray Dirks plans to sell off part of his spread, anticipating as much as $170,000 for a one-acre lot. Colorado loses 90,000 acres of farmland and ranchland a year to development.

"IT'S A BEAUTIFUL EVENING TO DIE," Moses Street has persuaded himself, hugging bark high in a lodgepole pine and contemplating the cougar crouching below, which is contemplating him. A beautiful September evening it is indeed in Rocky Mountain National Park. Blood-red streaks of twilight are fading, and Street, a man of sensitive soul, finally loses sight of the animal that interrupted his jog near Big Meadows.

For no reason he can remember, Street had stopped and spun around, confronting the gray-furred cat "in the pounce" close by his right leg. Energized by adrenaline, Street raised his arms and screamed at the silent animal, which backed slightly. To defend himself, Street ripped a stout branch from the trail brush, then shinned up the tree. His only fear: "If I screw up, the cat gets me."

That was around 7:30 p.m. Five hours pass. He clasps his arms around his wind-chilled body, does knee bends, yells for help that never comes. Where is the cat? Street imagines the black humor of friends—"How do you get Moses up a tree?"

Bam! He feels the lodgepole quiver at the impact of the leaping cougar, hears the *scritch-scratch* of claws coming closer. Enraged, Street jabs his branch at the animal, feels a hit. The cougar flees, leaving blood and fur on the bark.

Alerted by Street's wife, rangers arrive around 2 a.m. and inquire why he's in the tree. His reply stuns. In this park there had never been a cougar attack.

This is not to say that Colorado is up to its lodgepoles in cougars. A few days after Street's experience, my wife, Connie, and I hiked without incident—if not without some concern, passing a claw-gashed aspen—into the nearby Never Summer Wilderness.

But it is true that confrontations are increasing. Cougar and bear sightings in the foothills of the Front Range, practically nonexistent ten years ago, now exceed a hundred a year. "People are moving into animal habitat," explains R. Bruce Gill, a researcher with the Colorado Division of Wildlife. Vice versa too. One summer night an employee of Boulder Community Hospital encountered a cougar with cubs on a hospital patio. A black bear eating a bagel was sighted on a city bicycle path.

Of more conventional symptoms of growth, there are plenty along the Front Range, an area that takes its name from the easternmost ramparts of the Rockies. For residents, Front Range also refers to the string of flatland cities and towns that, more or less, edge up against the mountains: From north to south they include Fort Collins, Boulder, Denver, Colorado Springs, and Pueblo.

The cities seem in the process of reaching out to touch one another, and the latest crops on former farms and ranchlands are malls and subdivisions. At rush hour on Interstates 70 and 25, reddish rivers of taillights congeal

It takes two rainbows to pinpoint Denver, pot-of-gold financial hub of the Rocky Mountain West and home to five major-league teams. At Coors Field, where the Rockies play baseball, another sell-out game is about to begin. Postgame, many fans hasten to nearby bars and eateries of a rejuvenated LoDo, or lower downtown. Never bashful, Denver was tagged by a 19th-century English visitor as "the great braggart city."

A staffer for 28 years, MIKE LONG specialized in science and aviation. In 1994 he moved to Colorado to write about western subjects. JIM RICHARDSON, whose photographs appear frequently in NATIONAL GEOGRAPHIC, was raised on a farm in Kansas and now lives in Denver.

in Denver's notorious Mousetrap interchange. For an unfortunate few in this arid region, wells have gone dry. Girding Denver and its environs, the "brown cloud" born of thermal inversions stings nostrils and eyes.

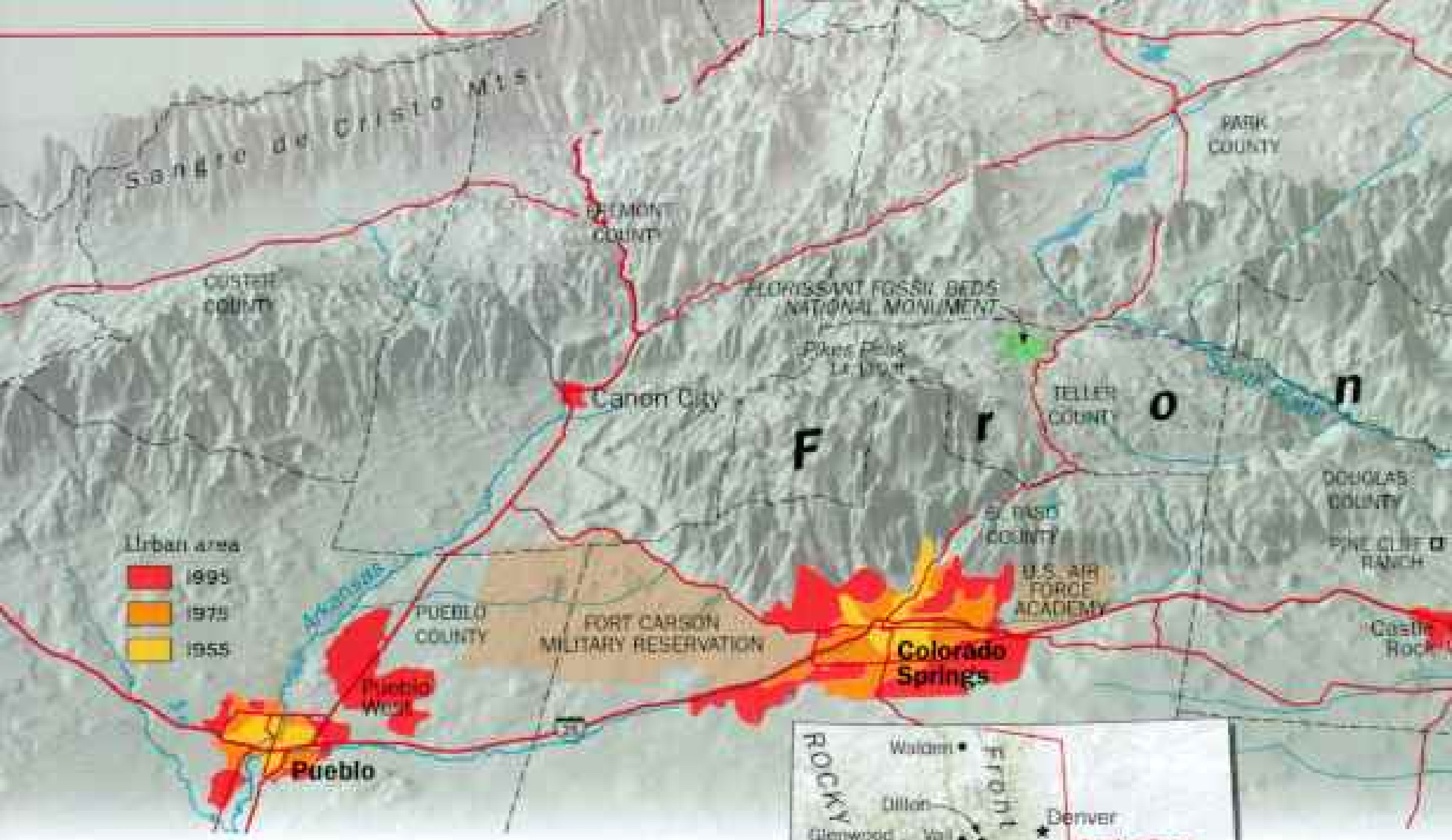
More than 350,000 people have come to the Front Range since 1990; nearly one million more are expected by 2020. Colorado's growth is among the fastest in the Rocky Mountain West, and the Benedictine nuns of the Abbey of St. Walburga, in Boulder, have had enough.

In 1935, when the sisters moved from Eichstätt, Germany, to build a retreat house, South Boulder Road was a country lane. "There were a couple of cars a day, if that," Sister Hildegard tells me.

Now a four-lane highway edges less than a hundred feet from the abbey, and the whiz of vehicles is background buzz to our stroll. Sister Hildegard explains that the nuns have sold their 150-acre site and are moving to Douglas County south of Denver. So are a lot of other people. I remind Sister Hildegard that Douglas is the fastest growing county in the United States. The new abbey will be soundproofed, she replies.

THE GROWTH is occurring despite an economic crash in the mid-1980s. "Speculators had been riding a building boom, and when oil prices collapsed, they all left town," says Bill Pauls, a Denver real estate magnate. Office vacancies soared. "It took this economy years to work its way out."

In 1995 Denver resurrected itself, filling vacancies, opening a baseball stadium (215 million dollars); adding a hockey franchise to



major-league football, baseball, and basketball teams; refurbishing its Central Library (76 million dollars); and inaugurating service at Denver International Airport (4.3 billion dollars) on a site larger than Manhattan. Meanwhile, people flocked to the restaurants and brewpubs of LoDo, the brightly renovated lower downtown.

Some of the principal reasons for this, whitened by the year's first snow, are framed in the west window of Pauls's office in the Denver Tech Center—Longs Peak to the north, Mount Evans due west, and Pikes Peak bulking to the south. "You can't explain Front Range growth without the mountains," Pauls says. Last year the Colorado Rockies drew millions of skiers, along with legions of climbers, backpackers, hunters, and fishermen.

Pauls forecasts that Denver, despite its lack of an ocean, will become "*the* port city of the next century. Port cities used to be on the coasts," he explains. "With a new airport, a port city can be in the center of the country."

That Denver's new airport will come into its own on a world scale is a belief shared firmly by most Denver boosters. Compared with Front Range boosterism of the historic kind—chutzpah, sass, and untruth riding great hyperbolic arcs—this wave of rhetoric is fairly modest.

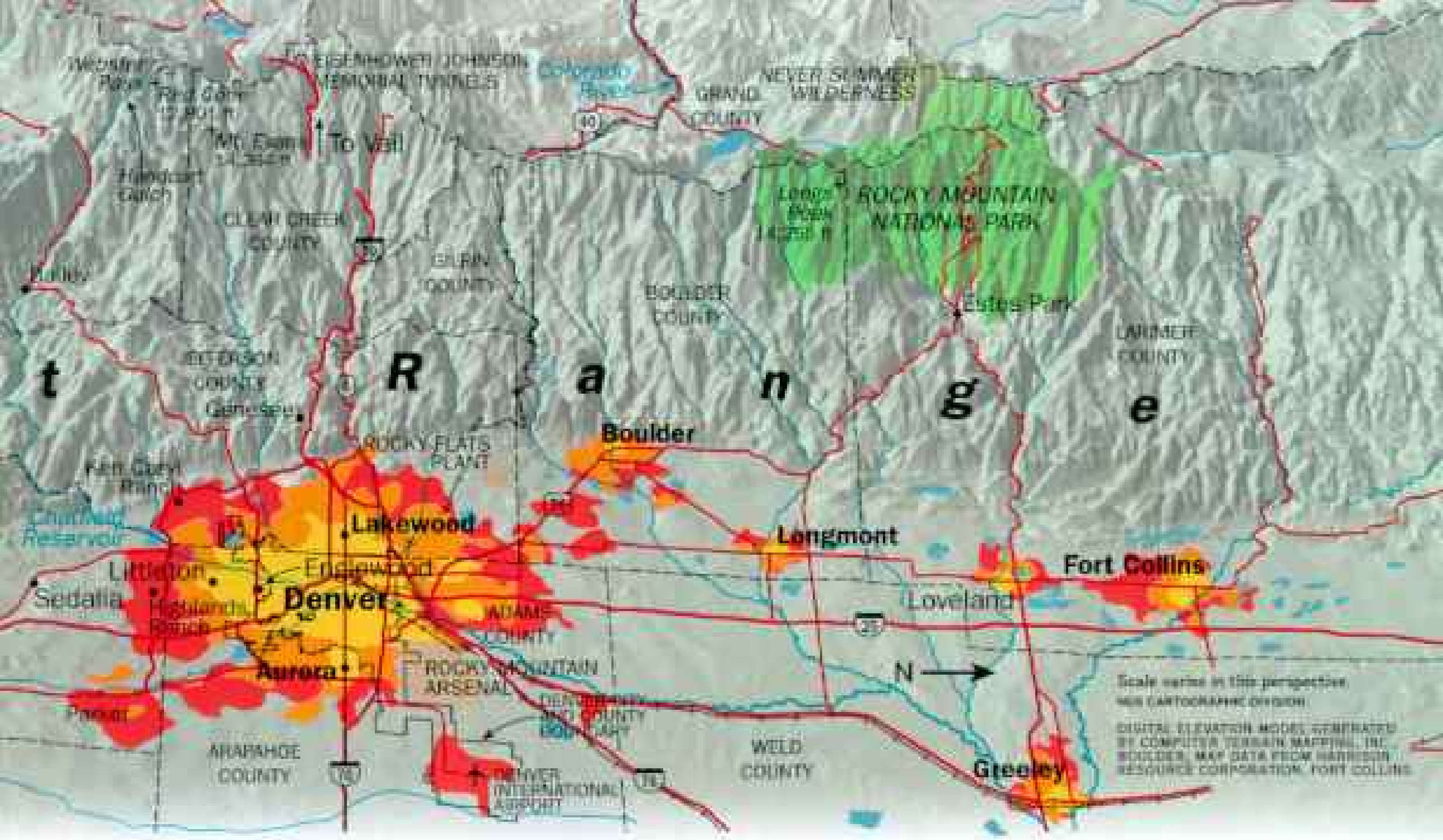
From the earliest days Denver fought for survival through transportation, says Tom Noel, chairman of the history department at the University of Colorado at Denver. In 1859, he tells me, the *Rocky Mountain News* blatantly promoted Denver as a steamboat capital in a shipping-news column that recorded the alleged departure of boats bound for New Orleans and Pittsburgh on unnavigable rivers such as the South Platte. "You can hardly canoe the Platte," says Noel.

I asked Noel why such extraordinary energy and money were poured into the new airport (DIA) when Denver already had a major airport. "Bypassphobia," he responds. "The translucent top at the new airport glows at night so anybody approaching from Mars or Jupiter, wondering where the center of the world is, can see it's DIA."

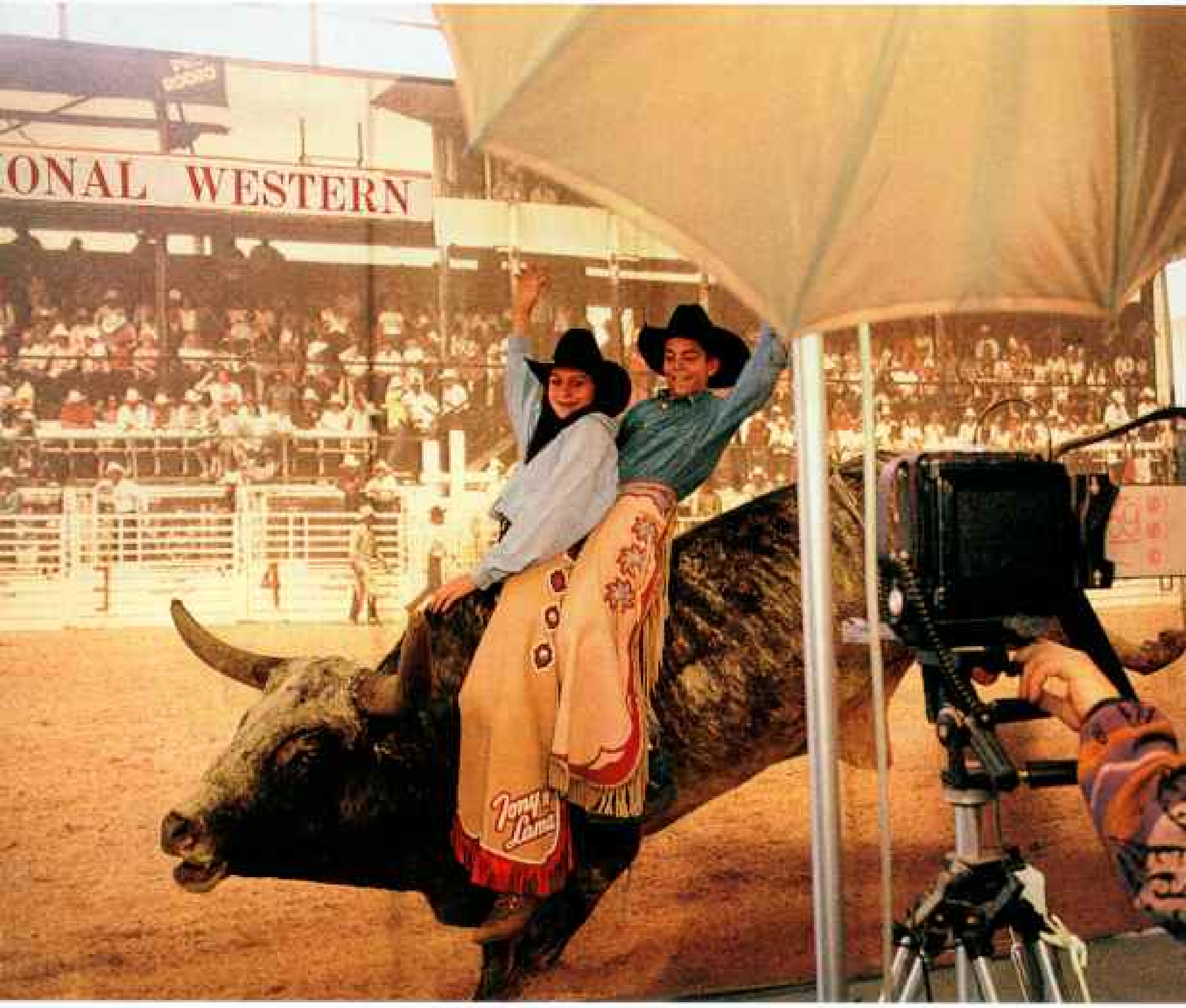
Noel pauses for effect. "Now that's a bit of a stretcher," he admits, "but it's plain that Denver doesn't want to be ignored."

In 1972 state legislator Richard A. Lamm argued that Colorado should ignore a chance to host the Winter Olympics, which had a reputation for red ink. Voters vetoed state funding for the games and elected Lamm governor for three successive terms.

Trying to dam the tides of growth, Democrat Lamm battled a Republican legislature



Like blots in a geographic Rorschach test, Front Range cities ooze toward one another. While some observers see progress, others fear a Los Angeles-style megalopolis in the 21st century. With westward expansion blocked by mountains, Denver now reaches east, where Peña Boulevard (below) arrows toward the new Denver International Airport. An embryonic interchange awaits another link in a beltway being built around the city.



and admits he lost. "I don't mind people moving to Colorado," says the Wisconsin native. "The question is, how do we accommodate them? With suburb after mindless suburb?

"I've seen Denver metastasize all the way up to Boulder and increasingly down to Colorado Springs. We're growing a Los Angeles of the Rockies right here, an endless strip city, and we're doing it knowingly! Knowingly!"

The "knowinglys" explode like land mines on the desk under his fist, and the shrapnel finds me. I am one of those newcomers, as are more than half the people quoted in this story. Many of us came to Colorado seeking mountains, open space, clean air, blue sky. I didn't give much thought to the indispensable element—water.

A FIRST LESSON for transplants is that water is wealth; the Front Range receives only about 14 inches of precipitation a year. John Afshar, a fireman, and his family woke up one winter morning in 1987 in their home in Braley Acres, south of Chatfield Reservoir in Douglas County, to discover that his account was overdrawn—his well had dried up.

With no water, he had no heat from his gas-fired water-heating system. His breath condensed and froze on his mustache. His wife Lisa's eyelashes froze. Afshar began schlepping five-gallon buckets in his pickup from taps at the reservoir. In the morning the family had to break ice in the buckets. "It was the winter from hell," his mother, Valerie, remembers.

Afshar spent $15,000 drilling a new well,

No bull: Youngsters pose on a stuffed animal against a fake backdrop at the National Western Stock Show, Denver's annual January celebration. During 16 days of cattle judging, bronc busting, Grand Prix jumping, and sheep shearing, more than 600,000 spectators injected some 50 million dollars into the local economy in 1996. Carrying grist for the suburban boom (below), a gravel truck and an earthmover plod along Highway 36 toward Boulder.

which also dried up. Most of his neighbors in Braley Acres have redrilled, investing as much as $20,000 for a 1,200-foot well. Patricia Mancuso spent a year of her daughter's college money on a new well. Afshar finally bought a 1,500-gallon water truck, which he drives to the nearby Roxborough water district and fills up at a cost of less than five dollars. He shares some with neighbors and puts the rest into his homemade cistern.

In 1994 Afshar and 120 families in five subdivisions formed the Chatfield South Water Association and appealed to the Denver Water Department for help. Denver said they were outside its service area. Chatfield South members, now negotiating for a pipeline from Roxborough, are wary of a catch-22 result if the availability of water attracts developers. "We fear that we'll do all the work, and suddenly we'll find 2,000 acres of California right next to us," says Afshar.

Afshar and his neighbors have been drilling into the Denver Basin, a four layer, bowl-shaped aquifer of ancient, rockbound water that holds about the same volume as Lake Erie. The problem, geologists say, is that they're on the western edge of the bowl, which slopes eastward. Municipalities and developments to the east, also drilling the aquifer, are drawing down the water. Hal D. Simpson, state water engineer, reports that water forced upward by artesian pressure has dropped as much as 800 feet in northern Douglas County.

Fingers point to a state law that permits

using one percent of the aquifer's water annually—theoretically depleting the aquifer within a hundred years. What then?

"We're very concerned about that," says James S. Lochhead, executive director of Colorado's Department of Natural Resources. His agency now affixes warnings on Douglas County wells. "Don't expect this water to last a hundred years" is a rough translation.

Denver's infamous "brown cloud"—particulates that include airborne road dust and combustion aerosols—mixes with West Sixth Avenue traffic. Medical researchers link such fine particles to an increase in cardiopulmonary problems among residents.

Steven A. Boand, former mayor of Castle Rock and a consulting hydrologist, makes an analogy to the national debt. "We're borrowing against the future," he warns. "There's not enough water for everybody, and who gets it? That's a major policy question."

While a state task force mulls the problem, experiments to replenish the aquifer with surface water have met with some success, but that leads to another conundrum—most of the rights to Front Range surface water have already been claimed.

In Colorado, water rights are property that can be bought, sold, or inherited. Senior holders have priority. If my forebears got here in 1861 and yours arrived in 1862, I get first dibs. In a dry year when a river is down, the law says I get the water. Confrontations can be serious. I was told of an argument over water rights along Fourmile Creek in which one rancher killed another with a shovel.

Water districts from Fort Collins to Pueblo abet the skimpy rainfall by diverting the flow of Western Slope rivers via giant tunnels bored through the Front Range. They include one of the world's longest water tunnels, a 23-mile-long, 10-foot-wide conduit that connects a reservoir at Dillon with the South Platte River.

Largest of the Front Range water districts, the Denver Water Department gets nearly half its water budget from the Western Slope. According to the *Denver Post*, it went after this water with "the same sensitivity that Godzilla displayed" rampaging through Tokyo, rubbing Western Slope folks raw. Dave Wattenberg, a state legislator from Walden, recalls that it wasn't until he came to the legislature that he discovered that the " 'damn Denver Water Department' wasn't all one word."

"There's probably a good 30 years of hostility," Chips Barry, general manager of the department, told me. "Both sides tended to send their lawyers off for a 15-year court battle. But that is changing. We need to work

with them; they need to work with us, like the dam on Muddy Creek, a Colorado River tributary, completed last year. We paid for most of the project but shared the water yield with the Western Slope."

Eagle County commissioner Bud Gates, whose Western Slope county turned down a water deal with Colorado Springs and Denver's neighbor Aurora, agrees. "We have to work toward a win-win situation," he says.

SOON AFTER MOVING to Glenwood Springs, a mountain hamlet 160 miles west of Denver, I learned it's a bad idea to drive to Denver on a Sunday afternoon. That's when the people who spend the weekend in the mountains return to Front Range cities, creating the Sunday afternoon clog.

There always was a clog, remembers David Fraser, a veteran highway worker now a supervisor, who has drilled, blasted, patched holes, and plowed snow as late as the Fourth of July on U.S. 40 and U.S. 6.

One summer day in 1955 highway engineers told him, "We're gonna fix it,"—with Interstate 70. Beginning in 1961, the modern conduit—with its interchanges, overpasses, underpasses, fences, rest areas, and tunnels—snaked through Denver and then worked its way through the incredible mountain scenery to the west. The highway pierced the Front Range crest in 1973 with the first of two bores of the Eisenhower/Johnson tunnel.

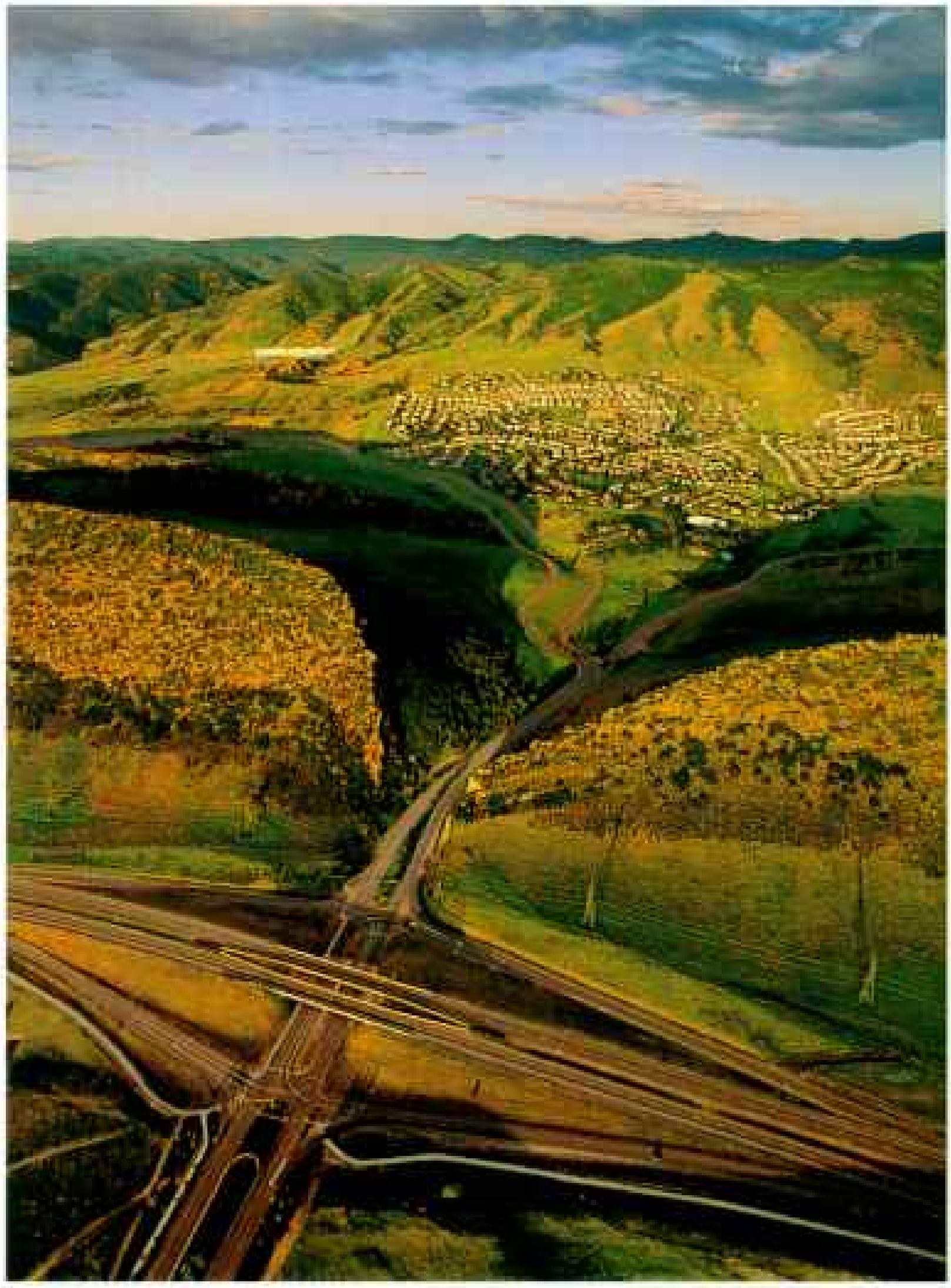
I-70 seems too successful for its own good. Last year more than nine million vehicles transited the tunnel, more than a fourfold increase since its opening. State officials consider widening I-70 here and adding another tunnel bore; they cringe at the cost—around one billion dollars.

Fraser is amused. "It's the same as it was in the '50s. It's like trying to force six inches of water through a one-inch pipe."

Traffic weary, I flee to the backcountry for a traverse of Red Cone, a stark and windswept peak whose formidable terrain attracts four-wheel-drive enthusiasts from all over the country. "If you've never driven off a cliff, Red Cone will be a new experience," advises Larry Heck, an Auroran who writes about four-wheeling in Colorado. He classifies Red Cone as VDL, which stands for "vehicle damage likely."

Trucking water to the family cistern is a daily chore for Manouch Afshar of Braley Acres, where many wells have slowed or dried up since the late 1980s. Reliance on groundwater has drawn wellheads down by as much as 800 feet elsewhere in Douglas County.

Spires of the Denver International Airport suggest mountains and tepees. Hurt by early problems with automated baggage handling and disappointing air traffic, the 4.3-billion-dollar facility now rates well above the national average for on-time arrivals and departures.



As if squeezed through a crack in the Dakota Hogback (above), the Ken Caryl Ranch subdivision comes to rest in Front Range foothills near Denver. Houses or heifers? For now it's both in Parker (right), where cowboys, their stock pastured, secure the day's operations.

Damage seems unlikely for the Land Rover belonging to my companion, expert driver Bill Burke. Off-highway gear includes a 7,000-pound jack, a winch with portable anchor, heavy-duty everything. Two batteries and a pumped-up alternator can power an onboard repair shop—air compressor, drill, grinder, welder—if something breaks.

County Road 60 west of Bailey disappears into gray, threatening murk, which could mean snow, even in July. "Nothing we can't handle," says Burke. As we turn into Sawmill Gulch, my throat tightens at a rock arrangement that could qualify as a tank trap.

Burke gives me the wheel and says, "Stay on the road. We don't want to tear up the neighborhood." The "road" is a steep, circuitous slope of scree that looks like the work of some giant who landscaped it with conifers and aspen on either side.

Transmission screaming, tire pressure reduced to 18 pounds, the Land Rover becomes a land lizard that propels itself over brutish rocks, pitching from side to side like a boat in a storm. We toil and grind and burst above the tree line. Here the road is comparatively smooth. I stop to admire platoons of old-man-of-the-mountains, alpine sunflowers braced by thick stems against an insistent

wind. With relief I return the wheel to Burke, who pauses at Red Cone's 12,801-foot summit. Across steep slopes lie the avalanche chutes of Handcart Gulch. Ahead the Mount of the Holy Cross, pyramidal and distant.

"Now for some excitement," Burke says. He locks both axles, drives over a cliff-like 45-degree slope and skillfully maneuvers us down a roller coaster of rocks to the more normal terrain of Webster Pass. I feel privileged to have made the mountain's acquaintance rock by rock.

OPEN SPACE is in danger of becoming a privilege in Front Range country. According to state figures, Colorado is losing some 90,000 acres of rural land a year to subdivisions, malls, and the other et ceteras of development. Voters in several Front Range counties and municipalities have agreed to increase the sales tax to buy land and set it aside. But, says Carolyn Holmberg, director of Parks and Open Space for Boulder County, "I don't think we're making a dent." Since 1975 her county has set aside around 40,000 acres.

Throughout Colorado 34 land trusts pitch in to help preserve open space. They manage tens of thousands of acres set aside through bequests, donations, and a type of preservation known as a conservation easement.

Colorado Open Lands, a land trust founded in 1981, administers the 3,800-acre Pine Cliff Ranch near Sedalia, hemmed in by subdivisions on three sides and a mountain ridge on the other. "What you see today will be preserved forevermore," says Lee Dusa, a retired IBM executive and the trust's president.

TO MANAGE PINE CLIFF as a working cattle ranch, the first such arrangement on the Front Range, the land trust has engaged Ron Knodel, who grew up on a "little bitty old farm" in Highmore, South Dakota, and remembers "frost on the nails" in his upstairs room. A natural horseman, Knodel hired out as a cowboy and ranch hand in Montana and Wyoming, moving cattle, mowing hay, harvesting corn and wheat, loving every moment. "I determined to live my life this way," he told me.

Knodel has settled into Pine Cliff with his wife, Lynn, and their children, Cody and Kendra, who helped him bring in 600 bales of hay in only one day last year. Eventually Knodel aims to increase his cattle from 350 to 500 head. Meanwhile he manages "everything from the wildlife to the weeds," including a beaver whose dam, growing ever taller, threatened to flood a ranch road.

"I didn't want to tear the dam down," he said. "The beaver would just rebuild it." So Knodel fooled the beaver by inserting a drain pipe below the crest to stabilize the water level. The beaver, thinking his dam was complete, proceeded downstream to build more dams. Just what Knodel had in mind for "waterfowl habitat and erosion control."

To move a herd of black Angus cattle to fresh graze, Knodel subtly motions floppy-eared Taz, his eager Border collie, which has been waiting for this moment. Taz launches like a torpedo and makes course corrections according to Knodel's chirpy whistles and voice commands. The cattle move on smoothly. "I don't have to tell her a whole lot," says Knodel.

It's plain that Pine Cliff Ranch will be in Knodel's good hands and Taz's swift feet for a long time. If the Front Range keeps growing as it has been, years hence Pine Cliff will be something of a museum for suburbanites who might want to see what a cattle ranch looks like. Increasingly these days, ranches are that in name alone.

Hungry for living space, metropolitan Denver has pushed south to Highlands Ranch, 12 miles from downtown. The new suburb is being carved from 22,000 acres of ranchland by the Mission Viejo Company, a subsidiary of Philip Morris. Joseph Blake, senior vice president of Mission Viejo, tells me everything is planned. "People want to know where the schools are, the parks, the roads." Blake takes me for a drive down Highlands Ranch Parkway, past obedient files of homes that wind like conga lines among corridors of open space. "It's really great," Blake says, adding that 7,000 acres to the south are reserved for wildlife habitat.

Forecast to top out at 90,000 people early in the next century, Highlands Ranch now holds 36,000 people and uncounted numbers of prairie dogs, which face extermination as construction nears. When fumigators gassed a colony near her home last July, Kathryn Carlton circulated a protest petition to Mission Viejo management. Blake vowed to relocate the animals in the future—when possible.

I have visited Highlands Ranch several times and am always struck by two things: its

"S.O.S. Save Our Small Town Way of Life," says a badge worn by a participant in a town council meeting in Parker. A former stagecoach stop and country crossroads, the Denver suburb had 11,075 people last January. At Loveland (facing page) the boundary between town and country is drawn stick-in-dirt style.

variety of attractive housing—for humans, at least—and a lack of pedestrians. Today I drive by precise lawns and precise homes whose garages front Glenhaven Road, their closed doors like closed mouths that have swallowed residents being digested inside.

Perhaps these folks have merely escaped to Colorado's high country to ski or to snowboard, the area's fastest growing winter sport. On a frigid January morning at Buttermilk Mountain near Aspen, I watch as 18 women present anxieties to Kevin Delaney and his corps of coaches at the Delaney Snowboard Camp, women's division.

They are working professionals, mothers, and one grandmother—my wife, Connie, a "never-ever," or snowboard neophyte. The women are searching for snowboarding's characteristic "breakthrough" moment when everything clicks and they're no longer afraid of falling. Delaney passes out kneepads, elbow pads, wrist guards, hip and butt pads.

Never-evers buckle one foot and learn to maneuver their boards, looking like club-footed mummies escaped from Egyptian tombs. They start on the bunny hill, a gently sloping training run. Some are quickly promoted to the upper slopes. For Connie it's a frustrating afternoon, with many falls and stifled tears.

Next day nearly everyone returns from the upper slopes grinning accomplishment. On the bunny hill, Connie glides into a biting wind and blowing snow, links a dozen turns, and rides to the bottom, falling once. Coach Suzanne Gouda exults, "It's your breakthrough moment!" Connie smiles broadly.

Elk spill out of Rocky Mountain National Park to feed in traditional wintering grounds, now part of Estes Park's expanding suburban fringe. Each year about 75 elk are killed by cars. Wildlife manager Rick Spowart has had to tranquilize the animals to remove tangles of clotheslines, wind chimes, extension cords, and tomato cages from their horns. One cow has menaced skaters on a bike path. "She really dislikes rollerbladers," says Spowart.

"I REALLY ONLY WANT TO SAY that we may love a place and still be dangerous to it," wrote Wallace Stegner, a son of the West who loved its past, questioned its present, and feared for its future. A breakthrough is needed.

"I can't smell the sage anymore when I open my window," Saundra Vitaliano Eberhard of Littleton told Governor Roy Romer at a press conference in 1994. When her remark appeared in the *Denver Post*, a firestorm of readers responded with letters ruing decline in the quality of life. John Gates of Aspen claimed that pollution was obscuring the stars—"the Pleiades are just a smudge."

On the other hand, folks like Mission Viejo's Joe Blake stand up for growth. As for a centralized state response—"It won't happen," Blake says. "Coloradans have a strong sense of property rights and a suspicion of government. The state is not going to say, 'We've had enough growth; we're going to limit building permits.' The locals would rise up and smite them. Great cities are not built by pessimists."

Governor Romer senses the tremors preceding a political quake. "I know what sage smells like," says Romer, who grew up on a farm in Holly. "And I value property rights." Taking hold of Colorado at its roots, Romer convened statewide Smart Growth meetings, asking citizens, "What do you want Colorado to be like 50 years from now?" Romer says he is trying to "motivate people community by community to mold their own destinies."

One man's destiny may prove another's despair. At the meeting in Vail, Aspen mayor and restaurateur John Bennett rose to report that pay parking was easing the traffic problems. "You can walk around downtown Aspen now," he said. "Life is good."

Rick Stevens, mayor of Basalt, 20 miles downvalley, said he knew where those Aspen cars were—they were parked by the scores in Basalt, where their drivers could take the bus to Aspen.

For now, Colorado is confronting the questions growth brings. The Front Range has not yet attained megalopolis status or the congestion of the Washington-Boston corridor or the San Diego Freeway. Not yet. I remember the cautionary words of Wallace Stegner.

Leaving Denver on a cold December day, I drive toward Front Range foothills. The buildings and houses wear a faint cast of mustard—the pall of the brown cloud. Ascending I-70, I pull off at an exit, look back toward Denver, and gasp. From this angle the afternoon sun has mutated the brown cloud into a great purple smear that obscures the city, as if by an inland sea.

The view is riveting, threatening. Though I know that a fresh wind will soon dispel the cloud and cleanse the city, I ask myself whether I and the others who love this place will prove dangerous to it. Land, water, and clean air are finite quantities; the number of people looking to use them seems bound only to increase.

An imminent danger, I think, is that we'll be bored to death. In my own neck of the woods in tiny Glenwood Springs, a new development popping up in the Roaring Fork

Glittering Denver seen from above the tract mansions of a foothills subdivision near Genesee recalls a prediction of the city's founder in 1859: "Everyone would soon be flocking to Denver for . . . fine air, good water, and everything to make a man happy."

Valley offers the common denominators of a certain kind of visual blight in these parts: trophy golf course nestling amid trophy houses going up beside a trophy trout stream.

Will these houses be like the gabled giants that elbow each other for space on the hillsides of Vail and Aspen? I share the concern of Diane Wilk, associate professor of architecture at the University of Colorado at Denver, about the lack of a regional architecture.

"There isn't any," she says, "that would give this area an enduring sense of its history and identity."

We are busy getting rid of possibilities. On a flank of the new development, a rough-hewn log-and-sod potato barn, big as a three-car garage, has been demolished, one of the fixtures from old-time Colorado that I admired. It told me stories about heat, cold, and wind, about straining muscles, the chunk of axes, and sweating men working up a thirst. I like to imagine that a young architect, tuned to the statement of its angles and proportions, its sturdy silhouette, and the way it was rooted to the ground, might have been inspired to include some of these characteristics in a modern dwelling—all amenities included, of course.

Not that we should live in potato barns.

Our predecessors were long on survival, short on frills. But it would be nice to live in something that is particular to this region, that is, so to speak, part of the family, that would state without fanfare or embarrassment or self-consciousness: This is where I belong. Come live in me and learn about yourself. I can help you understand why you wanted to come here.

VERNA TIBBETTS GARDNER is a fourth-generation resident of this valley who works in a shoemaker's shop. Her father was born in a log house, now demolished, on a ranch near the confluence of the Eagle and Colorado Rivers.

"I don't like new," Verna tells me. Instead of buying toys for her kids, she gave them the smell of baking bread when they got home from school, so that the smell would "rush into them and make memories."

Verna needs around her the old furniture and other familiar things that make her own memories and tell stories about her roots and other permanencies. That doesn't mean she would turn down, say, a new pickup truck, if offered. But she'd still keep the family's old "gutwagon" her husband uses to bring back elk and deer he kills. Even though it's "old and crunched," when you put it in "granny," the lowest gear, it goes places where other trucks don't.

Thus Verna is a conservator of old and new. Because she knows where she came from, she knows who she is and where she's going. That's a pretty good way to keep your feet on the ground while the tremors of growth are rocking Colorado. □

PORTIA SPIDER

Mistress of Deception

By ROBERT R. JACKSON

Photographs by MARK W. MOFFETT

Trespassing with intent to kill, *Portia fimbriata* stands on another spider's web and plucks at the silken threads, imitating the vibrations made by a mosquito, the victim's prey. Like Shakespeare's *Merchant of Venice* heroine, this Portia disguises itself to trick its enemies. The eight-legged version stages elaborate masquerades to sneak up on other spiders—or lure them within striking distance. Researchers wonder: Is Portia running on instinct, or is it just plain smart?

Web of Trickery

Among spiders Portia is the great nonconformist. Spiders are often informally separated into two behavioral groups: those that build webs to capture prey and those that hunt away from their webs. Portia does both.

Odd in appearance, it resembles a scrap of vegetation blown into a web by the wind. And rather than scurrying about like other jumping spiders, Portia has a slow, choppy gait—much like robots in science fiction movies.

Most spiders prefer insects as prey. Again Portia is the oddball. One of its specialties is invading another spider's web—and devouring the owner.

The genus *Portia* contains 15 species of African, Asian, and Australian jumping spiders. Measuring up to ten millimeters (.39 inches), the Queensland *Portia fimbriata* is featured in this article.

Landing on the web of a *Hygropoda dolomedes* spider (top), Portia slowly approaches. The deceit begins as it manipulates, plucks, and slaps the web silk with one or a combination of its eight legs and two leglike palps, mimicking a trapped insect.

In this case Portia seems to have hypnotized the other spider with the monotony of signals, closing in for the kill while playing the deadly vibratory lullaby.

Occasionally Portia will land on a web while the wind is blowing or while an insect is struggling to free itself. Such strong vibrations mask the shaking caused by a Portia on the prowl,

and the raider can forgo the use of stealth tactics.

My colleague Stim Wilcox (bottom right), of the State University of New York at Binghamton, has developed an ingenious method of recording the seemingly countless patterns of web vibrations that Portia can imitate.

He attaches a voltmeter pointer, a device something like a record player stylus, to a web. Whenever Portia makes a move, the web shakes the pointer, triggering an electrical signal that is recorded on tape. The signal is also digitized and fed into Stim's computer.

We can also do our own mimicry—altering the vibrations to change the message Portia sends. We attach a magnet to Portia's head and place an electrical coil (bottom left) above the spider. As we play back the computer-generated signals through the coil, the magnet vibrates, simulating Portia's plucking on the web. Once we start transmitting to the magnet, Portia stops making its own signals.

For this experiment we increased the intensity of the vibrations. That provoked an attack from the host spider, a *Badumna longinqua*, causing our somewhat confused Portia to flee.

ROBERT R. JACKSON has studied Portia spiders under Society research grants. He is associate professor of zoology at the University of Canterbury in New Zealand. MARK W. MOFFETT photographed tarantulas for the September 1996 issue.

Reversal of Fortune

Portia plays a dangerous game as it tries to lure other spiders to their doom. This Portia (left) is crawling along the rolled-up-leaf home of the aggressive *Achaearanea camura* spider. Going in after the prey is too risky, so Portia creates a series of vibrations that eventually draws the curious *A. camura* outside. The finely tuned vibrations elicit a cautious approach from *A. camura* (top). When its victim is within reach, Portia strikes with a lethal bite to the head (center).

Sometimes Portia overplays its hand. Startled by some false move, a spider on another web turns (bottom) and throws sticky silk over Portia. The gummy shroud keeps it captive until *A. camura* is ready to feast.

Fatal Attraction

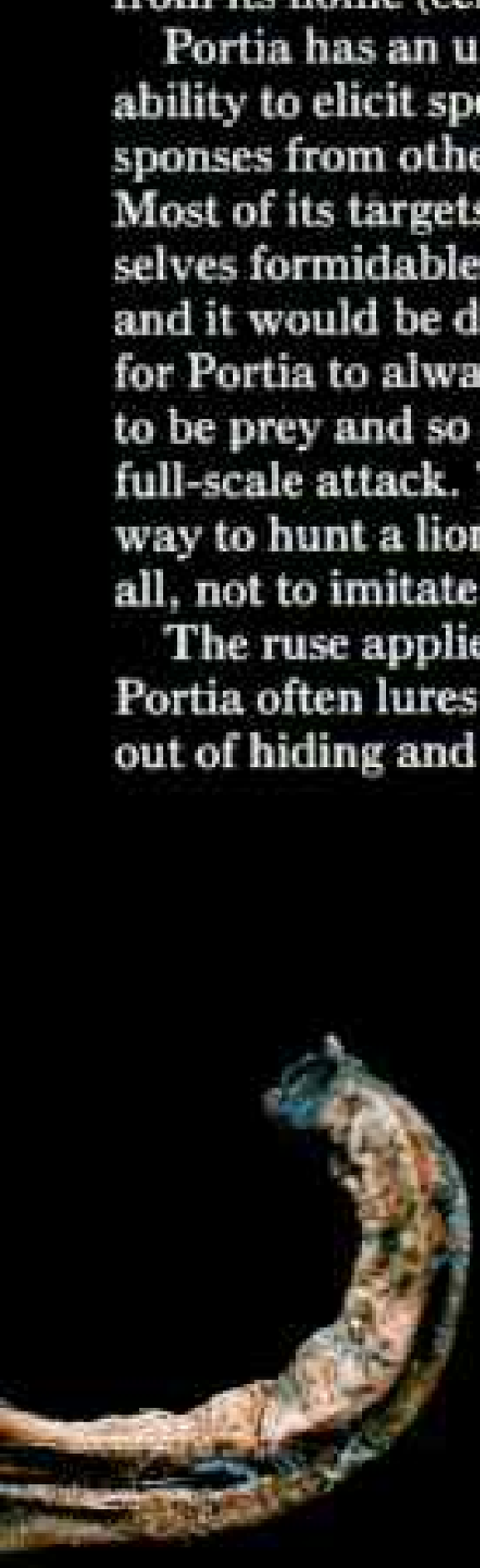
Death comes courting when Portia mimics the mating ritual of the *Euryattus* sp. spider, which lives in a rolled-up leaf suspended by silk cables. Sitting atop a female spider's home (far left), Portia rocks the leaf, dancing atop it like a *Euryattus* male. Fooled for the moment, the spider emerges from its home (center).

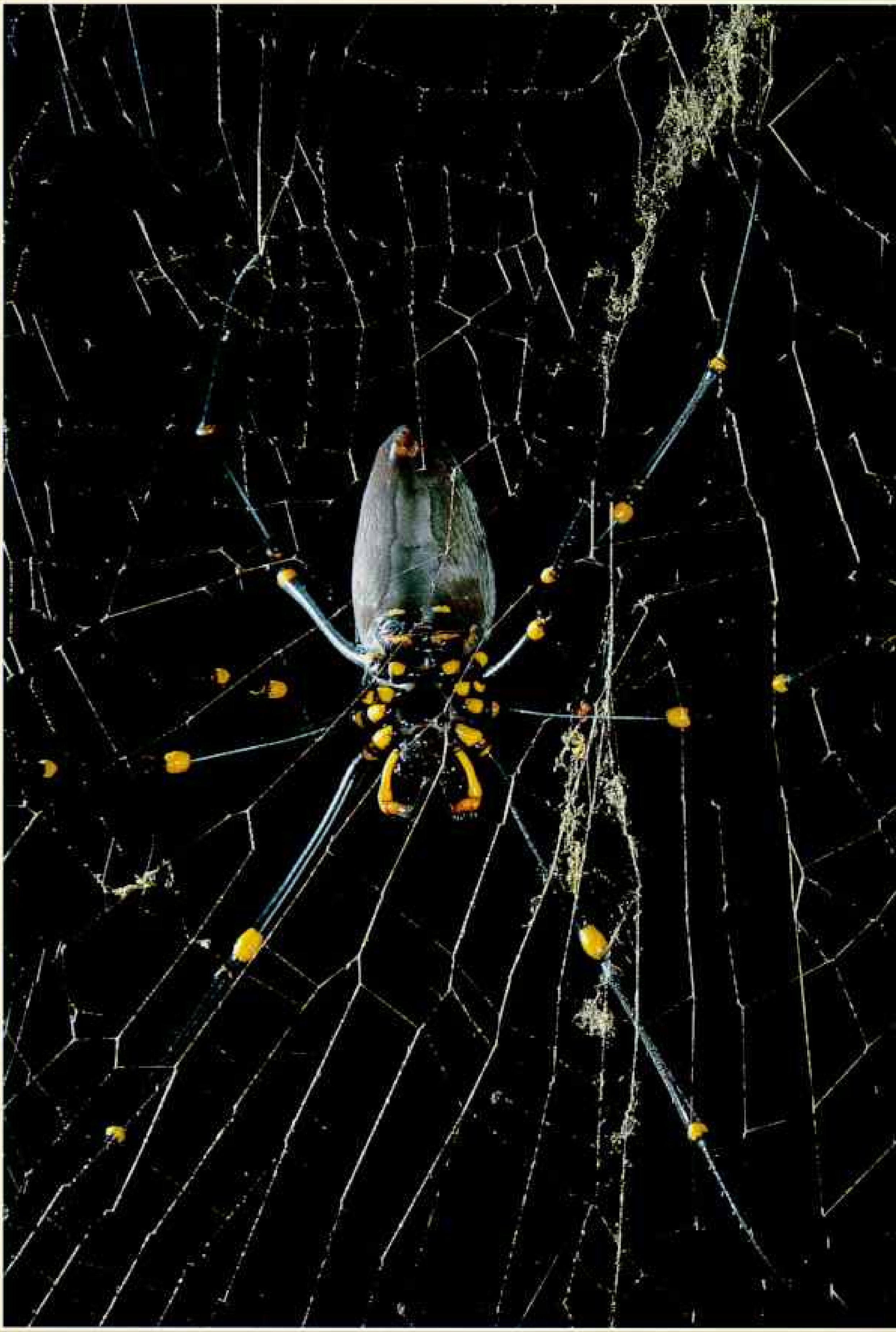
Portia has an uncanny ability to elicit specific responses from other spiders. Most of its targets are themselves formidable predators, and it would be dangerous for Portia to always pretend to be prey and so provoke a full-scale attack. The best way to hunt a lion is, after all, not to imitate a gazelle.

The ruse applied here by Portia often lures a female out of hiding and to her death. *Euryattus*, however, sees better than most spiders. This time the would-be victim recognizes Portia as an impostor and charges. In an unexpected rout, the spider rams into Portia, knocking it from her leaf (right).

How does Portia match signals with different types of spiders?

The answer defies the conventional wisdom that spiders are simply instinct-driven automatons. Portia can find a signal for just about any spider by trial and error. It makes different signals until the victim spider finally responds appropriately—then keeps making the signal that works.





Stalking a Giant's Consort

Even the gutsy Portia knows better than to tackle the huge female *Nephila maculata* (left). But the male of the species, a comparative midget that lives on the same web, is just the right size for a meal.

There's one complication, though: Portia must tailor its signals just for the *Nephila* male. If the female is alerted, she'll attack. Amazingly, Portia lures the male in for the kill—while maintaining "radio silence" with his mate.

Stealth is also essential when Portia stalks a fellow jumping spider (above). If the sharp-eyed quarry wheels about, Portia poses as debris, a deception that proves deadly for its prey.

Scrambling Over Eggs

Portias have no trouble spotting one another on the prowl, so when one female invades the leaf where another is tending her eggs, all-out war erupts (above). During these vicious wrestling matches, legs may get torn off, and often one spider is killed.

This time the intruder wins. After driving the loser from the leaf, she rips open the defeated spider's egg sac, devouring the eggs and spiderlings within (right).

She eats her booty one egg at a time (opposite), pulling each into her mouth with her palps.

Because Portias recognize one another so easily, they have developed what appear to be ingenious methods of mounting surprise attacks.

For example, we observed one Portia as she apparently planned a rear attack on another female's web. After she was repelled by the resident spider, the attacking Portia seemed to retreat.

Once she was out of sight of her rival, however, she climbed some nearby vegetation and ventured out across a vine that extended above the web. From above, Portia dropped on her own silk line alongside the web. Then Portia began to swing toward her unsuspecting victim . . . until she made a kill. Lab experiments suggest that Portias must plan such detours.

We may be uncomfortable with the idea of spider intelligence. After all, with a brain no bigger than a pinhead, a spider like Portia is supposed to follow rigid, simple behavior patterns. There's not much room in there for thinking. But from its deadly skill at mimicry to its elaborate attack strategies, Portia is one of the most behaviorally complex predators in the animal kingdom. □

CHINA

RAPID DESCENT

FIRST RUN DOWN THE SHUILUO RIVER

DIGGING DEEP, rafter Bruce Smith exults as he paddles through rapids on China's remote Shuiluo River. For seven days 18 adventurers rode a boulder-strewed ribbon of white water locked within steep canyon walls.

The blinds are drawn in Eric Hertz's hotel room in downtown Kunming, China, though it's nearly noon. There's a towel draped over the floor lamp. The 40-year-old river outfitter from New York State badly needs rest. His eyes are bloodshot from jet lag and worry, and his face is darkened by two-day-old stubble. The room smells of cheap pesticide and years of sweat.

"I'm scared," Eric says. "Too many things can go wrong on this trip. The best maps we have are 47 years old. We weren't allowed to scout from the air. We could get in way over our heads."

BY JON BOWERMASTER
PHOTOGRAPHS BY ED KASHI

Clinging to wooded hills (opposite), a Buddhist monastery was a passing blur on the team's dusty three-day drive through the Shaluli Shan range. As ethnic Tibetans saw them off near the headwaters (bottom), all knew these choppy waters could turn treacherous, and soon.

I've rafted with Eric down some tough rivers—the Futaleufú in Chile, the Colca in Peru. He's one of the best in the business—obsessed with safety. Coming to China was his idea. First thing tomorrow morning we plan to set out for the Shuiluo (SHWAY-lo), a wild tributary of the Yangtze, or Jinsha, River whose 150-mile-length, locals say, has never been run before. Paralleling the border of Tibet and Burma, the Shuiluo carves a deep gorge through a series of 16,000-foot mountains. The few hundred ethnic Tibetans who live nearby hunt wild goats and sheep, grow wheat, and pan the river for flakes of gold.

For many years this region was off-limits to outsiders. Only recently have Chinese officials relaxed control, sensing perhaps the public relations value in allowing expeditions to discover its striking wilderness. Truth is, the chance to make a first recorded descent, rather than the majestic scenery, has drawn me here. Fewer and fewer rivers in the world have never been run. Yet first descents are risky. Once on the river, our biggest concern is getting trapped in one of the many canyons. If anyone gets badly injured, help will be out of the question. Chinese officials forbid us to carry radios.

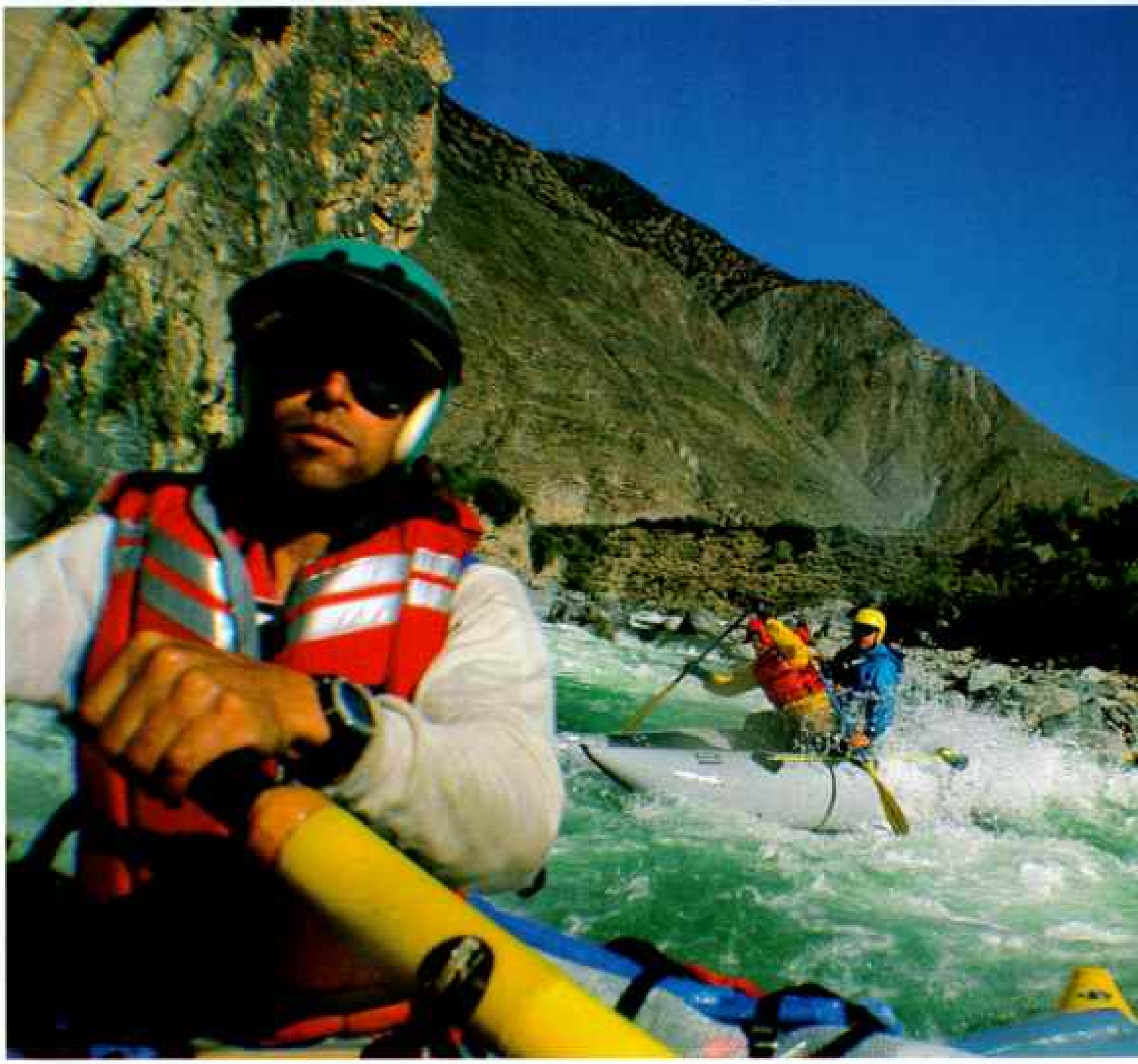
A resident of New York's Hudson Valley, JON BOWERMASTER specializes in adventure and the environment, writing most recently on Chile, Kenya, and the Arctic. ED KASHI, based in San Francisco, has photographed stories on Crimea, the Kurds, and Middle Eastern water for the GEOGRAPHIC.

As the organizer of our trip, Eric has been losing sleep over such worries.

"This is definitely the last first for me," he says.

We reach the Shuiluo at noon on October 20, 1995, after a year of planning and three days of hard driving from Dayan (Lijiang), a prosperous frontier city of 39,000 in northern Yunnan Province. The rainy season has ended, and golden poplars climb the hills as we drive to where we put in, about 80 miles above the Shuiluo's juncture with the Yangtze. This is the first navigable section accessible by road. We pass blue trucks loaded down with logs, and yaks carrying freshly cut kindling.

"It's more water than I hoped for," says Joe Dengler, frowning at the deep blue waters rushing by. A descendant of a scout on the Lewis and Clark expedition, Joe is our team leader on the river. Six feet tall with short black hair and blue eyes, the 30-year-old guide from California is hard as an ax handle but gentle in spirit. He estimates the flow as 1,200 cubic feet per second—20 percent more water than we'd expected. The stretch of the Shuiluo we're running drops 3,000 feet before joining the Yangtze, but we don't know whether it descends gradually or in a series of steep waterfalls.



We've brought two kayaks, two 14-foot rafts, two 12-foot Shredders (black pontoons connected by a rubber floor), and a 16-foot "cataraft" (two yellow pontoons attached by an aluminum frame). There are 18 of us, half professional river guides and half experienced amateurs. We're taking food and fuel for ten days as well as ropes and gear to climb out if necessary.

It's late afternoon by the time we paddle away from shore. Children chase us along a trail beside the river, racing past white prayer flags on poles. For the next two hours we ride gentle rapids, then stop to make camp. A local hunter has told our Chinese teammate, Zhang Jiyue, that a waterfall waits just ahead. Jiyue is not worried. What looks like a waterfall to the hunter may be a rapid we can easily run. But we are all concerned by how slowly the river is dropping. It means there are big falls ahead—somewhere.

LATE THE NEXT DAY, just past a tributary that nearly doubles the volume of the river, we enter a deep gorge where the water picks up steam. As ebony granite walls rise 200 feet on either side of us, I realize there's no place to pull over. Ahead the river disappears to the right into blackness. I can hear the roar of a big, big drop. Just like that—in less than a minute—our worst fear has been realized. We're trapped in a canyon with no escape but downriver.

Determined not to round the corner blindly, Joe steers our boat to the right side of the river, where I grab onto the slick wall. As I cling to the granite with my fingernails, Joe climbs 20 feet straight up the cliff to scout ahead.

"Looks like the river turns hard right, then goes left over a ten-foot drop," Joe shouts over the roar. "We've got to hug the right wall, then paddle straight over a big rock. We can't allow the boat to be sucked left!" If we do, the river's powerful hydraulics will yank it under, tossing us all into the river.

The other boats stack up behind us, rafters paddling furiously against the current, as we head into the violent rapids. Grunting and groaning, we sink our paddles deep into the froth, trying desperately to keep to the right. As we drop over the waterfall, the front of our raft gets sucked under, burying all five of us at once. It feels as if somebody has dumped a swimming pool on top of our heads. We keep paddling and pop out like a cork at the bottom of the rapid, where we pull into a shallow alcove. Eric's Shredder, taking the same plunge, flips as soon as it hits the big drop.

"They're over," shouts Marco Gressi, one of our two scouts, paddling his kayak 60 feet below the rapid.

Eric and his raft mate, Henry Black, are tossed into the water, which churns like a washing machine. From downriver the kayakers can see Henry's orange helmet bobbing, his eyes wide open, arms striking out for the walled shore. Eric is trapped at the bottom of the waterfall beneath an overhang. In high school Eric was a champion wrestler, but nothing has prepared him to fight a waterfall.

As Eric struggles, the second Shredder enters the rapids and flips, landing almost on top of him. One paddler clings to the boat, while another struggles toward the slick wall. Now we've got four swimmers.

Cool head in rough waters, Paulo Castillo rows his twin-hulled "cataraft" through rapids within hours of setting out. Though the boat is designed for stability, on day two photographer Ed Kashi let his guard down and was hurled out. "I got cocky," he admits.

GET OUT AND WALK. Even the most intrepid river runner won't tangle with a Class VI-plus rapid. Faced with an impassable stretch and no shoreline, the team unloaded every boat, then hauled the craft and supplies onto and along a ledge some 30 feet above the torrent. "You sweat like a pig," recalls team member John Reilly.

a Boston lung-transplant specialist and something of a river novice. "You go one, two, three, *heave*, and move maybe two feet with each pull. And on this day, once we got the boats back into the water and loaded up again, we got to paddle 50 feet across the river . . . and do it all over again!"


EARTH
RIVER
SOTAR

"Grab him!" Marco shouts as Henry floats past the first raft. A rafter reaches out to pull him in but can't. The river is too swift. Seeing him drift almost out of reach, Beth Rypins, a river guide from San Francisco, makes a last stab over the stern, seizes him by the life jacket, and wrestles him into the raft. The next swimmer floats by, hanging on to the overturned Shredder. Then Eric and another teammate appear, looking like waterlogged cowboys riding the other Shredder.

We are all safe for now. But it's getting dark, and we can't stay here. As soon as we push away, however, we come upon another blind turn 60 feet downriver. We steer back toward the right wall and grab onto the rock again. Joe and Beth climb above us for a look.

"No problem," Joe says. "Just one big drop." His words ring hollow. I've seen Joe in enough tough spots to know he isn't telling us the whole story.

He gives me a tight smile and tugs on his helmet strap: "Paddle hard, but be ready to throw your weight to the center if we drop off something big."

The next half hour is terrifying as we run one Class V rapid after another (on a scale where Class VI is virtually unrunnable). Rounding turn after turn, we run smack into six-foot waves. Finally, about 7 p.m., we spot a rockslide on the right, where we pull out for the night. Exhausted and cold, we haul our boats onto the rubble. There isn't a flat spot in sight. Not wanting to carry extra weight, we haven't brought tents. We unroll our sleeping bags onto sharp rocks. Dinner for 18—freeze-dried noodles—is prepared over a small propane stove. Our mood is as dark as the moonless night.

"We couldn't see a damn thing," Joe admits over our meal. "But what could we do? We had to run it."

Rock-a-bye holds new meaning for campers on the Shuiluo's stony shores (opposite). Beth Rypins slipped and slashed her wrist on a jagged rock; Reilly assisted as another physician, Tanya Hrabal, stitched her up (above).

"MAN, I'M LOST," Joe grumbles on day three as he studies one of our maps, a muddy photocopy of a 1948 Russian topographical map. "If I'm right, we should hit a flat section soon where we can make up some time."

No such luck. As soon as we emerge from the steep gorge that just tried to

swallow us, we find ourselves facing a half mile of rock-choked canyon. Boulders as big as mobile homes block the middle of the river, followed by two waterfalls beyond, one tumbling 15 feet, the other 20.

Beth, Joe, and a few others hike down past the lower falls and toss a couple of small logs into the waves. The logs submerge instantly, disappear for 30 seconds, then shoot back up, minus the bark, into the cauldron of white water.

"They didn't plan those rocks well, did they?" Beth says.

It takes Joe only ten minutes to decide this stretch is unrunnable. Moving gear around the rapid, however, takes us nearly all of day four. We're still 55 miles from the Yangtze, and our kayakers, scouting ahead, report another stretch of boulders in our path.

"It's even worse than before," Marco says.

Pushing and pulling our boats along the rocky left shore of the river, we reach a 40-foot waterfall where the river disappears into a narrow canyon—certain death for anyone swept inside. There's no room to hike farther on the left side. We'll have to cross the river. That night we make camp less than half a mile from where we spent the night before. None of us sleeps well.

Sitting stiffly on the cold bank of the river as dawn breaks, I sip warmed-up goat stew and watch a flock of starlings slowly rise into the sky, their wings silvered by the morning's brightness. Pillowy clouds hover over the golden peaks as a single shaft of sunlight spotlights the forested slopes.

Joe and Eric have come up with a plan. Paulo Castillo and Joe will carry a 200-foot-long rope to the other shore on Paulo's cataraft, the only large boat nimble enough to keep from being swept over the waterfall. A white-water rafter since he was a teenager, Paulo is more at home on the water than off. As he prepares his gear, Paulo changes from sandals to running shoes, a sure sign he's taking the crossing seriously. I've never seen him wear sneakers on the river before.

"As soon as we bump the rocks on the other side, jump off and pull us in," he tells Joe. "I don't want to have to make the approach twice."

With a big push, the pair launch the cataraft into the crystal blue water, and Joe mounts the bow like a bronco rider, gripping the frame with one hand, a red-and-yellow rope slung over his shoulder. The pulsing current pulls the boat down the left side—the wrong side. But with a half-dozen strong strokes, Paulo propels the craft across the lip of the falls and into the rock-laden eddy on the opposite shore. Joe leaps off, stumbles briefly, then pulls the cataraft to safety. We all whoop with relief.

Though it has seemed like hours, the nerve-racking crossing has taken all of 20 seconds. We spend the rest of the morning rigging ropes and pulleys to pull the rest of us across the river.

Once we're together again on the right side, we begin a two-hour portage-from-hell around the falls, climbing boulders and hacking through the brush along the shore. In the midst of our labors, we discover a human body draped over a log crammed between two rocks. The back

Pushing the limits in Class V rapids, Rypins, at the rear, was thrown out seconds later. Such slam-bang excitement was offset by grueling portages. "The challenge was to focus," she says, "and to keep moving downstream."

of the man's head was fractured, his shirt stripped away by the rushing water. He must have gotten too close to the river during the spring meltdown and been swept away. Tanya Hrabal, one of the team's two physicians, estimates that he has been dead for several months. We soon find two more victims of the same fate.

WE BEGIN DAY SIX with a sense of euphoria—the sun is bright, the rapids are runnable, and the canyon is starting to widen. But shortly after noon we hit yet another steep drop that requires pushing the boats up and over 20-foot-tall boulders. We camp alongside a long, unrunnable rapid squeezed between a field of rocks and a wall. That night by a roaring fire Joe announces to the group that he and Eric, as the trip's leader and organizer, have decided to end our journey at the next village, one or two days away, 30 miles short of the Yangtze. Three thousand feet above the village is a supply depot and a road, he says, the last place for us to hike out. From there, we can hitchhike to Dayan.

"I know you're all disappointed that we won't be dipping our toes in the

Yangtze," Joe says. "But if we hit another gorge, it could take us ten days to finish, and we're running out of time and supplies."

It's a difficult decision to accept.

"I've never quit anything I've ever started," says Jon Dragan, a seasoned guide from West Virginia.

"I agree," says Henry Black, a veteran rafter from California. "You don't get many opportunities in life to go into the unknown. I think we should keep going."

I'm tempted to argue for staying too, but I know that we are exhausted and several of us are quite sick.

"None of us wants to die on this river," Eric argues. "We were lucky to have survived the first gorge. We might not be so lucky a second time."

The following day is the most fun, running Class III and IV rapids under a hot sun as the valley spread out on both sides. We stop for lunch on a broad beach opposite a small gold mine. A surprise to us all, at day's end we arrive at the bridge that will lead us by foot out of the canyon. We spend our last night on the river sleeping on sand brightened by the glimmer of gold flakes. The next morning, October 27, we roll up the boats, load them onto pack mules from the mining camp, and climb the steep trail back into the world.

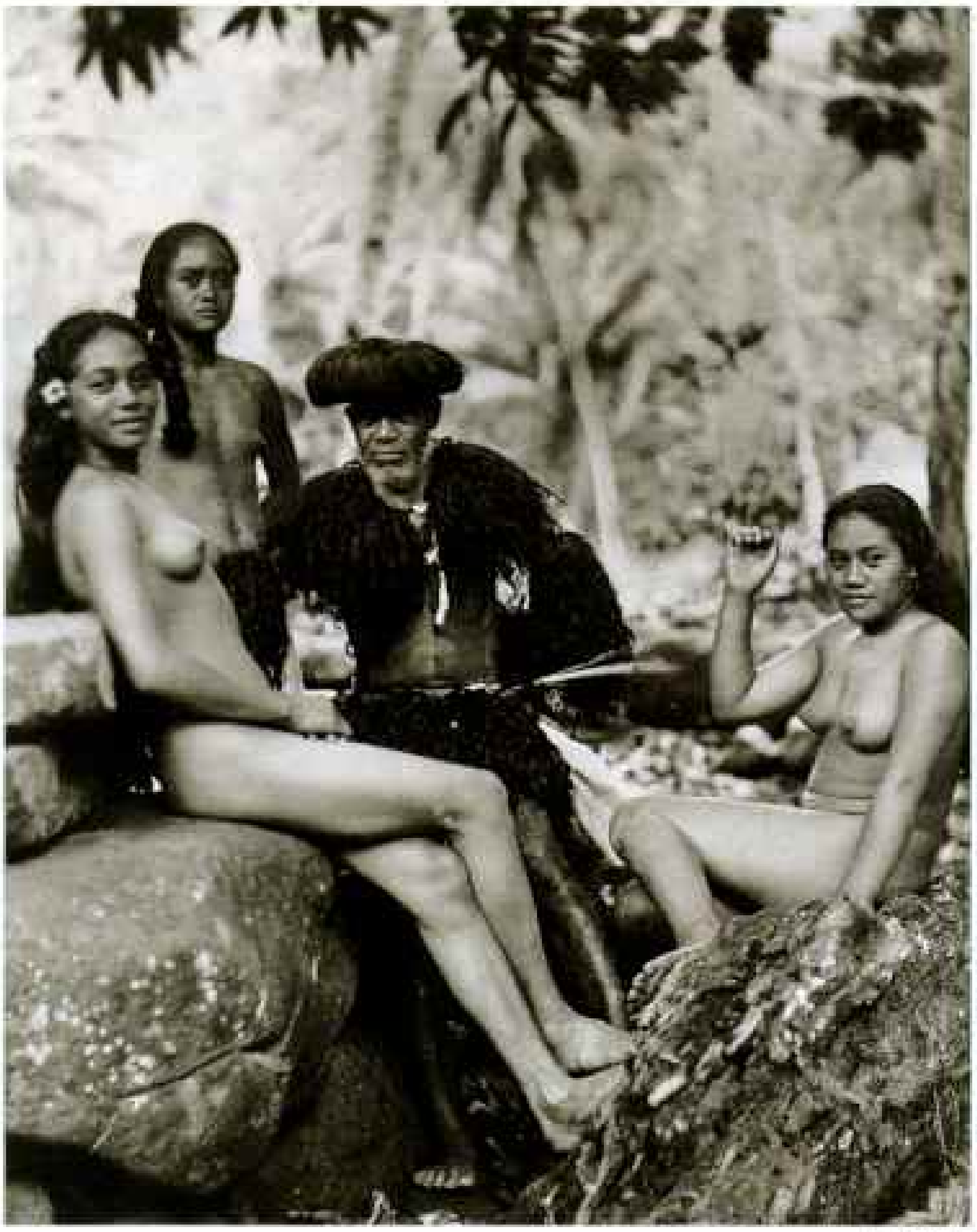
Corpses in a canyon were a sobering discovery (opposite), but it was time—as well as danger—that forced the team to call it quits 30 miles short of river's end. Said John Reilly, sitting at the last campfire, second from right: "I was just glad I hadn't been killed."

Eric's premonition back in Kunming has come partly true. The Shuiluo has proved more jumbled and more difficult than he expected. But with skill and a little luck, we're leaving it alive—if disappointed.

As we cross the narrow bridge over the Shuiluo, I look upriver at the tall mountains we've passed through. From this perspective I can see how far we've come. The river dropped 2,000 feet during our seven days on the water, and we've seen sights no outsider has ever seen. Then I turn my head and gaze downriver, where the Shuiluo twists and narrows into yet another mysterious canyon, disappearing into the unknown.

"No more firsts?" I say to Eric, who is standing at my side.

"No more firsts—after the Shuiluo," he replies. "We'll come back and finish it one day." □



L. GAUTHIER

■ FROM THE GEOGRAPHIC ARCHIVES

What Joseph Banks Missed

When Editor Gilbert H. Grosvenor published photographs of unclad Philippine women in 1903, he said the pictures were "a true reflection of the customs of the times in those islands." So was this photo of a Marquesan chief, in a cape of human hair taken from enemy dead, and his companions. But it was not selected for our October 1919 article "A Vanishing People of the South Seas: The Tragic Fate of the Marquesan Cannibals, Noted for Their Warlike Courage and Physical Beauty." Botanist Joseph Banks missed visiting the Marquesas Islands on Captain Cook's second voyage in 1772, having quit in a dispute over the size of his quarters.

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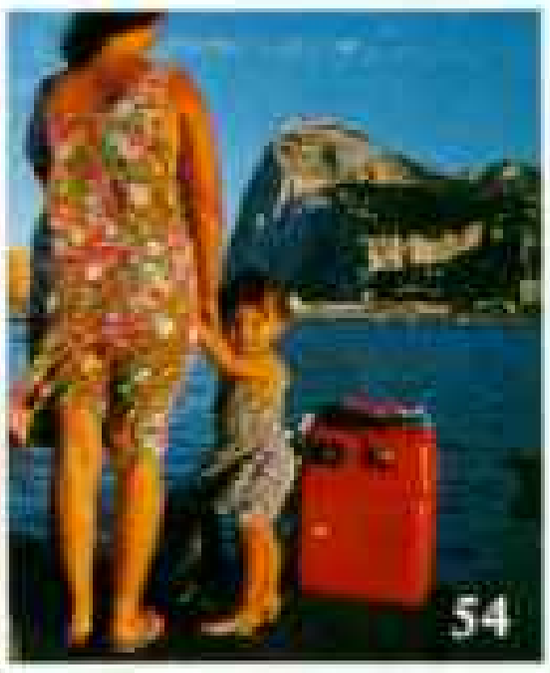

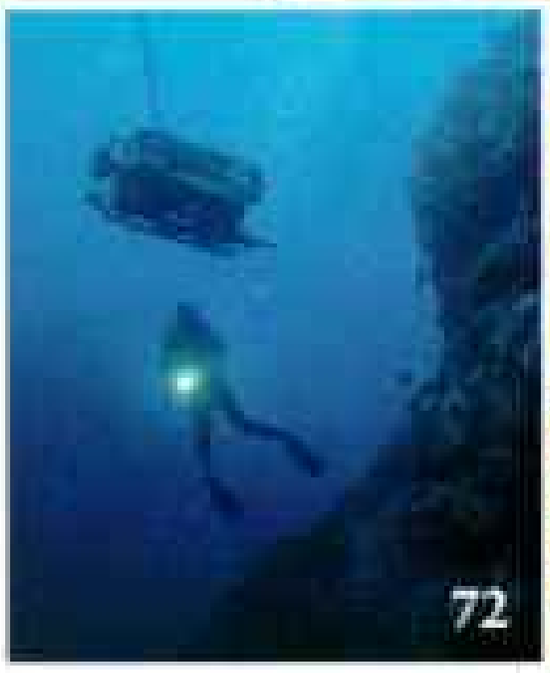

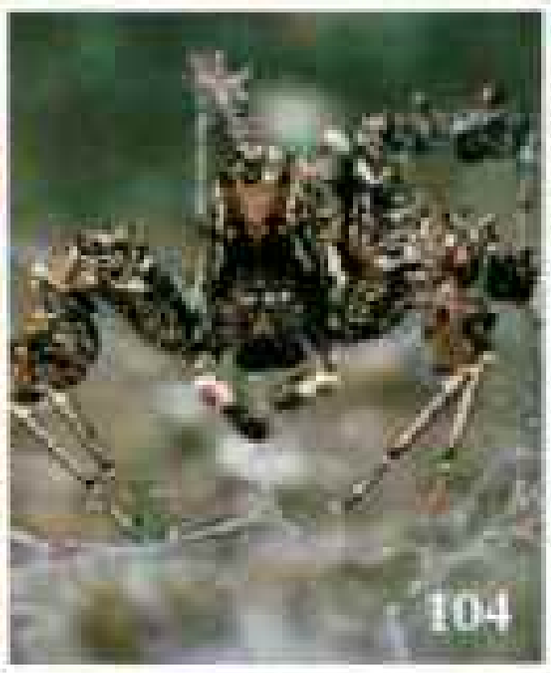

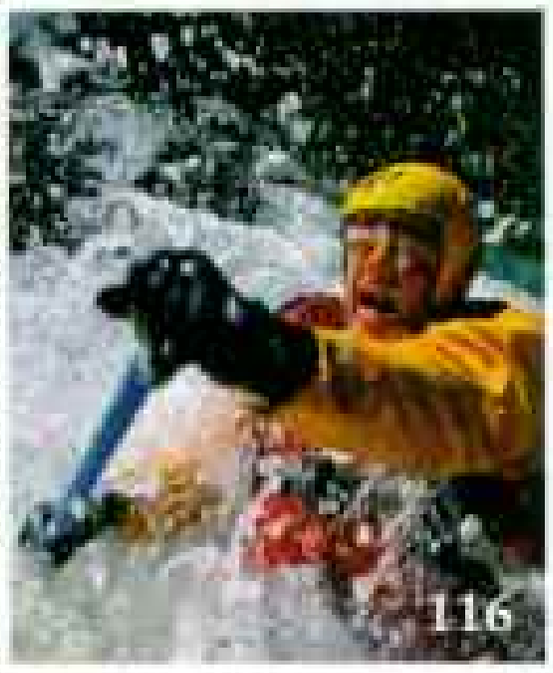

Departments

The Cover

Some 200 miles up, the tail of the space shuttle Discovery *arrows toward the mouth of the Amazon. Digitized NASA image © 1996 Corbis*

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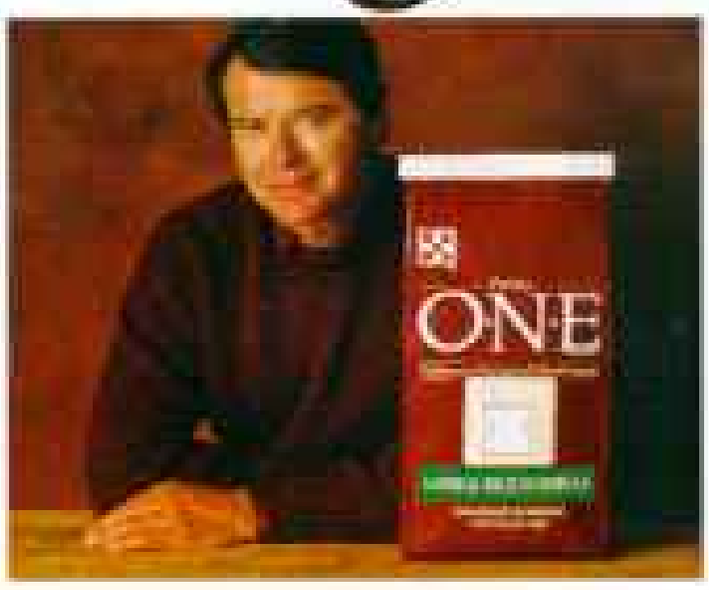
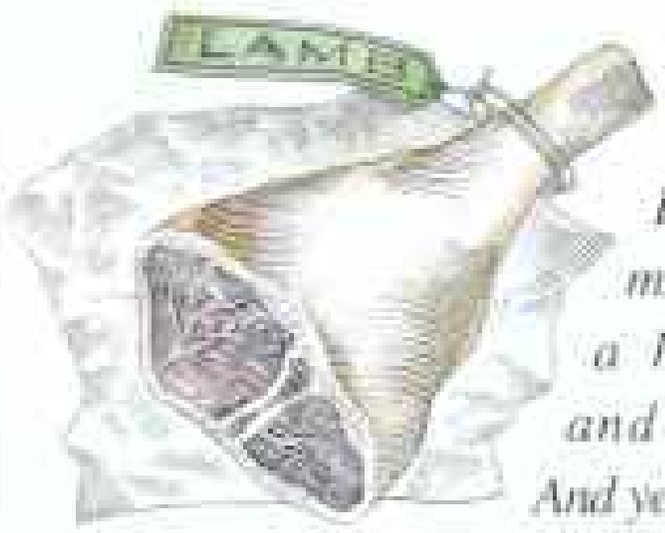


—Robert Urich



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Behind the Scenes

Pool Coverage

SHOOTING our TV film "Inside the White House," producer John Bredar was asked if he'd like to see the swimming pool. A hatch in the pressroom floor was opened, and a startled John climbed down a ladder. It seems the pool, built for FDR and later used by guests like astronaut Edward H. White (below), was drained but not filled in when President Nixon built over it to make room for the expanding press corps. So John wasn't just "Inside the White House." He was under it too.

SETH RESNICK (ABOVE); JOSEPH J. SCHERSCHEL

A Feather—Pink and Plastic—in Our Cap

THE FLAMINGO LAWN ORNAMENT celebrates its 40th anniversary next year, and we can take part of the . . . credit.

In 1957 designer Donald Featherstone used photographs published in the GEOGRAPHIC's October 1957 article about the birds, "Ballerinas in Pink," to help model the first plastic flamingo statues. He sculpted them in two poses, "so you can choreograph them," he says. Ever since, the flamingos have been manufactured by Union Products, Inc.—where Donald is now president—in Leominster, Massachusetts. In recent years his wire-legged wonders have flown off store shelves. More than 20 million have been sold so far. "They're really not tacky," insists Donald. "I think they make a nice accent to the yard. It all depends on how you use them."

Sticking to Our Stories

DON'T CALL IT DUCT TAPE. "It's gaffer tape," corrects writer Don Belt, who used the stuff to remove hundreds of baby ticks from his legs in Belize. "It looks like duct tape, but it's cloth-backed and even stickier." Whatever it is, the big silver rolls keep this magazine's contributors from falling apart. During aerial photography Joel Sartore tapes his seat belt shut—just in case. For a hard-to-reach shot, Mark Moffett taped his feet to the top of a towering platform. Photographer Chris Johns reattached his Land Rover's fuel tank in South Africa. Now he won't venture on assignment without at least 20 rolls in his camera bags. Says Chris, "It's as important to my job as film."

DAVID CLARK

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Cecilia Guzman,
Environmental & Safety Engineer, Philips Lighting Co., Juarez, Mexico.

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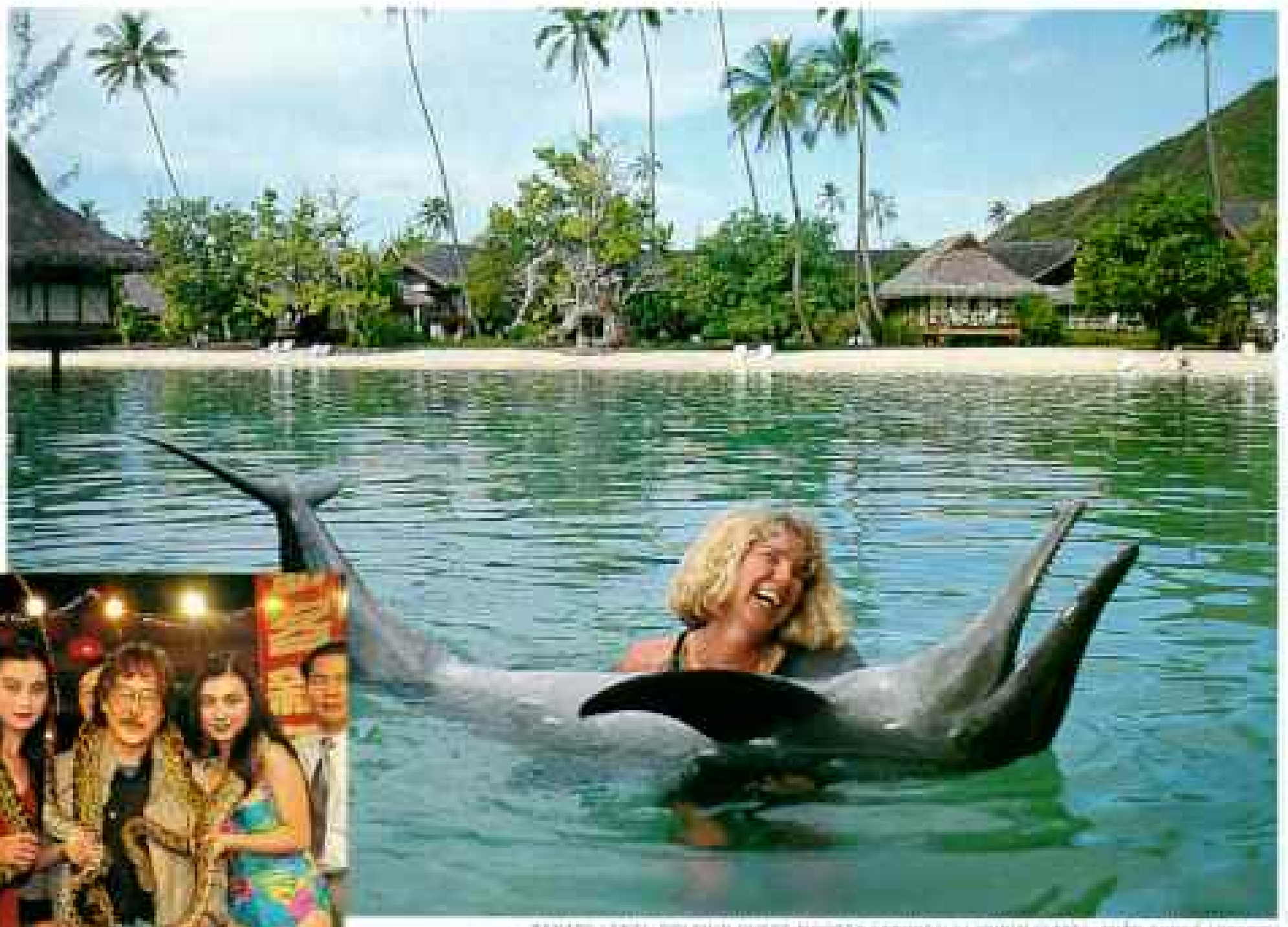

RENATO LEROI; DOLPHIN QUEST BOOKER (ABOVE); JJ HUBIN (LEFT); MIKE YAMASHITA (BELOW)

JAMES L. STANFIELD (LEFT)

MICHIKO TAYLOR

Coming Up Soon

PHOTOGRAPHERS WORK PORPOISE-FULLY and wombats make spectacles of themselves in stories we're working on for next year. Jodi Cobb mingles with dolphins in French Polynesia, and Mike Yamashita investigates the beauties—and beasts—of China's Pearl River Delta. In Ukraine Lida Suchý records Hutsul villagers in black and white. Jim Stanfield gets bogged down in Mongolia on the trail of Genghis Khan for a two-part report beginning next month. And what happens when writer Tom O'Neill cuddles up to a source in the Australian outback? Stay tuned.

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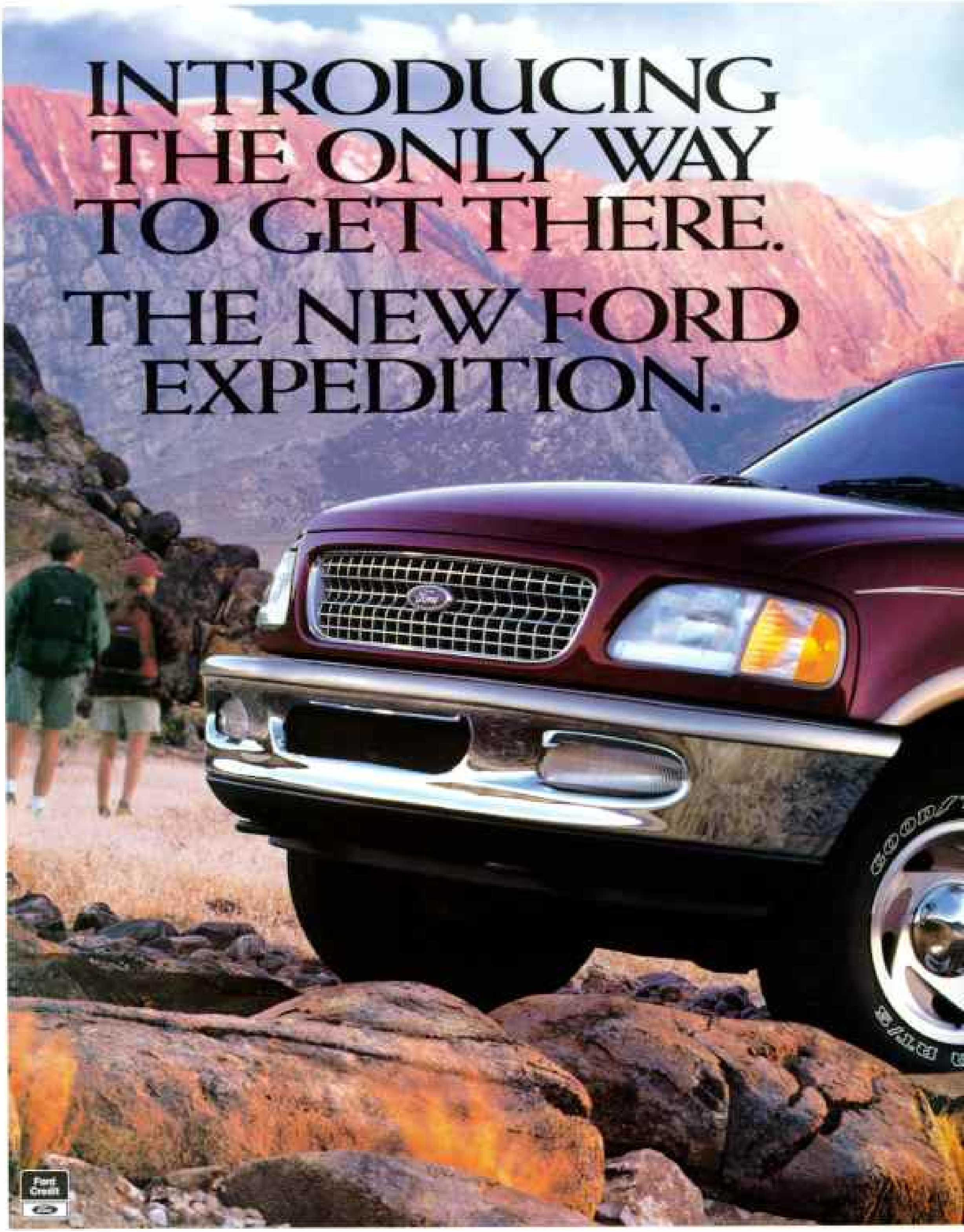

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BILL LITTER

Keeping It in the Family

"EVERY TIME anyone in our family gets married," says Jennifer Pease, of Key Largo, Florida, "and it's a big family, Great-aunt Eleanor gives a subscription to NATIONAL GEOGRAPHIC as a present . . . and renews it every year." Now 95-year-old Eleanor Berkshire of Alexandria, Virginia, maintains 45 gift memberships. *Her* mother began the tradition in 1950. "When people pick up the magazine," Mrs. Berkshire says, "they'll think of me." Though she was unable to attend the Pease family reunion in Ohio this past June (above), Great-aunt Eleanor was in everyone's thoughts. More than a hundred Peases—from ten states and two countries—hold copies of the magazine for this photographic salute to their absent relative. She really is a great aunt, after all.

CARY WOLINSKY

Bat Weather Lately

FOLLOWING THE TRAIL of Joseph Banks in Australia, photographer Cary Wolinsky hoped to find the furry fruit bats the British botanist described in his journal. "We looked six places for these bats. I wanted to shoot them from below, flying, with the sun shining through their wings." As he moved into position under the tree-roosting creatures, some suddenly took to the sky. "You know what bats do when frightened?" asks Cary. "I felt a warm rain, smelling oddly like the New York City subway."

Celebrate Geography This Month

EDUCATORS AFFILIATED with our state geographic alliances will observe National Geography Awareness Week, November 17 through 23, by focusing their students' attention on biodiversity. This year's theme: "Exploring a World of Habitats, Seeing a World of Difference."

—MAGGIE ZACKOWITZ

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Forum

South Africa's Parks

Douglas Chadwick's moving account of South Africa's parks (July 1996) brought back countless memories of park visits that have enriched my life for nearly 30 years. On my first visit to Kruger Park at the age of ten, we camped near a dry riverbed and slept peacefully as lions roared in the distance. If international funding could be found to extend our parks in the arid west, vast migratory herds of springbok and zebras could be restored, and South Africa could become the world's number one ecotourism destination.

MICHAEL BRETT
Pietermaritzburg, South Africa

It was refreshing to read about the protection of big game and the preservation of our global environment instead of the usual stories about how the earth's treasures are being lost. This piece provides hope, not only for South Africa but also for the developing nations worldwide.

JASON KAMINSKI
Somerville, Massachusetts

Elephants are a "keystone species" essential to the survival of the environment of many other species. When their populations increase, they open up scrub, encouraging the growth of grasses, which helps grazers and improves soil permeability. However, since grassland is unable to support as many elephants as thicket, the elephants move elsewhere, and weaker individuals die. An elephant die-off was observed in Kenya's Tsavo National Park, where no culling took place, and woodland returned with new vigor.

If park managers insist on reducing the number of elephants, the best solution is relocation. In a 1993 operation funded by Care for the Wild, 480 elephants were moved from Gonarezhou National Park in Zimbabwe to a new, private conservancy called Save Valley. This was the first time elephants had been moved in family groups, allowing their social structure to remain intact.

LINDSEY GILLSON
Researcher, Care for the Wild
Rusper, West Sussex, England

It is a pity that Mr. Chadwick did not meet more of the black senior managers and staff in our parks. The chief executive of the National Parks Board, Dr. "Robbie" Robinson, introduced affirmative action policies and created opportunities years before the change in government and in the face of strong opposition. Since then, neighboring communities have been involved in and are benefiting from the parks. Through Robbie's goodwill and negotiating skills, the local communities agreed to participate as partners in the establishment of Richtersveld National Park, a unique conservation treasure.

OLUF MARTINY
Past President, Wild Life Society
Johannesburg, South Africa

Let the Games Begin

Your interesting piece on the Olympics seems to associate the essence of sport with athletic play. David Sansone in his 1988 study, *Greek Athletics and the Genesis of Sport* (University of California Press), defines sport as "the ritual sacrifice of physical energy" by participants acting for themselves or as substitutes for others in their group. While exuberant play can be a major part of sporting activities, recognizing the ritual aspects of the events is especially appropriate when discussing the Olympic Games, among the most ritualized of them all.

ROBERT TURNER
Folsom, California

The author spent the last page trying to justify why sport should be considered art. Art is a creative process, using the mind. My Webster's dictionary defines art as "the activity of using imagination and skill to create beautiful things." While sport has a certain element of creativity, competition encourages sameness, not originality. Sport is a mostly physical activity, where strategy comes into play more than creative thought.

KATHLEEN BERNARDIN
Pottstown, Pennsylvania

I was pleasantly surprised to find a rather philosophical essay that puts the Olympics as well as sports and games in general into perspective without taking anything away from the skill and dedication of the athletes. One might not agree with everything said, but the article is a rare gem nonetheless.

J. L. MASSÉ
Saint-Hyacinthe, Quebec

Dinosaurs of the Gobi

In Donovan Webster's article I experienced the desert sandstorms, mechanical problems, and excavations at the "camel's humps" firsthand with the crew. The article says the specimens will be brought to the U.S. for further analysis. Is it legal to take Mongolian resources out of their country?

MURAT TUKEL
Cleveland, Ohio

Yes, with proper permissions. As analysis is completed, the fossils are being returned to Mongolia.

Very little was said about the dinosaurs themselves. I found it really hard to understand the significance of this work.

ANAMITRO BANERJEE
College Park, Maryland

THE FINE ART OF MESSING WITH SUCCESS.

February 26, 1992: Chrysler minivans are named top safety choice in the passenger van category in Prevention magazine's Safe Car of the Year Awards.

October 11, 1995: Accompanied by the Whetstone HS Marching Band, Chrysler CEO Bob Eaton delivers the five-millionth Chrysler Corporation minivan to the Lombard family of Columbus, Ohio.

November 1, 1995: New Dodge Caravan is named Motor Trend's Car of the Year—first time a minivan wins the award. Second straight year that a Chrysler Corporation vehicle has won.

August 1, 1996: Chrysler Town & Country minivan named top safety choice in the 1995 passenger van category by Prevention magazine. (Anyone see a pattern developing here?)

Having invented the category, we at Chrysler Corporation knew that tampering with something as popular as our minivan would be a delicate operation. (Of course, introducing it in the first place was a bit chancy too.) But what we finally decided was that the greater risk was resting on our laurels. When making great cars and

*Visit our World Wide Web site at http://www.chryslercorp.com, or call toll-free 1-800-GREATCARS. *Chrysler minivan owner loyalty at 63% in '92 second-quarter (January, February, March) sales period. †Always wear your seat belt.*

May 15, 1992:
Multidisciplinary platform team convenes to begin work on the next generation of the minivan.

August 1, 1992:
Dodge and Plymouth minivans get optional sport handling suspension. Car pools across America become approximately 37% less boring.

September 18, 1992:
Consumer Attitude Research announces that Chrysler minivans have the highest repeat purchase rate of any platform sold in the United States.

July 15, 1992:
Platform team reads letters from minivan owners asking, "Why not put a sliding door on the driver's side too?"

May 9, 1993:
Sales of Chrysler minivans in Asia pass 2,000. Reports that minivan interior is more spacious than average Beijing apartment are unconfirmed.

March 10, 1995:
Redesigned Chrysler, Plymouth, and Dodge minivans reach dealerships with features including dual front air bags, optional dual sliding doors, Easy Out Roller Seats,™ and enough storage space for the most acquisitive of families.*

April 18, 1994:
Fuel-door problem solved. (Sorry, but if we told you how, we'd have to kill you.)

September 15, 1993:
Problem: How to keep driver's-side sliding door from banging into fuel door.

trucks is your goal, the right decision is usually fairly obvious. Kind of like the idea of putting a sliding door on both sides of your minivan, come to think of it.

compilation of 62,583 new car and light truck buyers conducted during the

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The caption on page 85 appears to accept the claim that *Mononykus* was a bird, based on the keel on the animal's sternum. But its keel is different from that of birds. Keels are of little morphological significance anyway, as they develop and vanish easily and are merely adaptations to increase the attachment surface for muscles. The keel of *Mononykus* is clearly not linked with the kind of rotation of the humerus evolved by birds.

ALBERTO M. SIMONETTA
Professor of Zoology
University of Florence
Florence, Italy

The Gobi expedition team bases its argument on many skeletal characteristics shared by Mononykus *and modern birds, especially in the skull, pelvis, and vertebrae.*

As author and illustrator of the prehistoric fauna of Mongolia, including my recent book *Dragons From the Dunes* (1993), I have followed your dinosaur series with particular interest. This July article reiterates the popular idea that Roy Chapman Andrews was the first Western scientist to study this part of the world. Although leadership of the American Museum's Central Asiatic Expeditions was his responsibility (and one that he carried out admirably), his role was promotional and organizational. In scientific matters leadership of the expeditions fell to chief paleontologist Walter Granger.

JOHN LAVAS
Auckland, New Zealand

Treasure From the Silver Bank

The article is interesting, but it was written by treasure salvors. As a graduate student in nautical archaeology at Texas A&M University, I have worked on projects partly sponsored by your Society that have recovered and conserved lost treasures. Those projects have used mapping and recording techniques ensuring that scientific information is gleaned. The Silver Bank expedition was simply a monetary grab with little interest paid to the scientific or historical value of any objects.

CLIVE J. CHAPMAN
Auckland, New Zealand

Previous salvagers, going back to 1687, had destroyed the archaeological value of this site. The current salvagers documented the location and depth of all artifacts and turned over those items of greatest historical significance to the Dominican Republic for display.

The painting by Richard Schlecht (pages 96-7) will remain in my memory long after fancy photography has been forgotten. Nothing else could have better portrayed the feelings of those 500 shipwrecked passengers and crew.

WILLIAM M. WILKERSON
Groveland, Florida

I'm a university student studying Spanish civilization. I read the article "Treasure From the Silver Bank," and I visited your Internet site. I think it's fantastic!

GIAN LUCA SCAFFINI
Pavia, Italy

Syria Behind the Mask

In an otherwise interesting article, author Peter Theroux omitted to mention that from the time the State of Israel was established in 1948 until 1967, the Syrians sitting on the Golan Heights harassed Israeli settlements below by shooting at civilian targets day and night. In 1967 and again in 1973 the Syrians attacked Israel but were beaten and pushed back, and so they lost the Golan Heights.

P. KALMAR
Holon, Israel

I congratulate you on your coverage, even though you did not visit Christian churches. Syria is a good representation of the mix of different races in Greater Syria, which included Palestine in the old days. Everybody was welcome to stay regardless of their religion or ethnic background, including the defeated Crusaders. It was the Zionists who came in the beginning of this century and declared a Jewish state is only for the Jews.

FAISAL S. ALZAMIL
Alkhobar, Saudi Arabia

The article fails to mention Syria's occupation of Lebanon, her hospitality to drug traffic, her support of terrorists who attack Turkey and Jordan, and her transporting Iranian rockets that rain down on Israel.

ANITA LIFSON
Washington, D.C.

Using state-of-emergency laws in place for years, Syrian security forces still systematically arrest, detain, and torture political opponents.

PAT GERENCSER
Amnesty International USA
Phoenix, Arizona

Who says you have to be half naked to enjoy the beach? By the looks of the women on pages 128-9, you can be fully clothed and love every minute.

SUSAN CATHERINE RAY
Auburn, Alabama

Letters for FORUM *should be sent to National Geographic Magazine, Box 37448, Washington, D.C. 20013-7448, or by fax to 202-828-5460, or via the Internet to ngsforum@nationalgeographic.com. Include name, address, and daytime telephone. Letters may be edited for clarity and space.*

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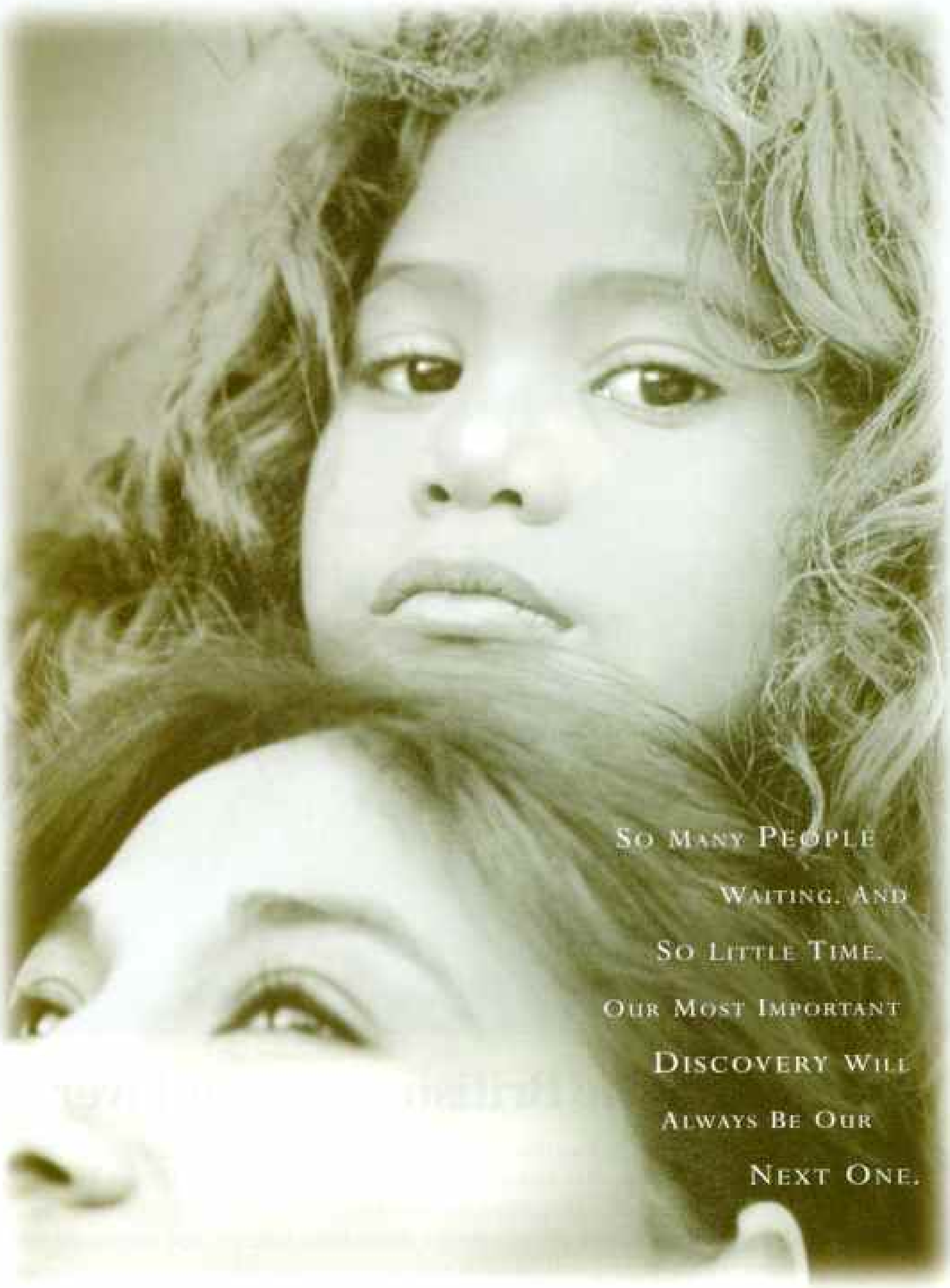

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NATIONAL GEOGRAPHIC

Geographica

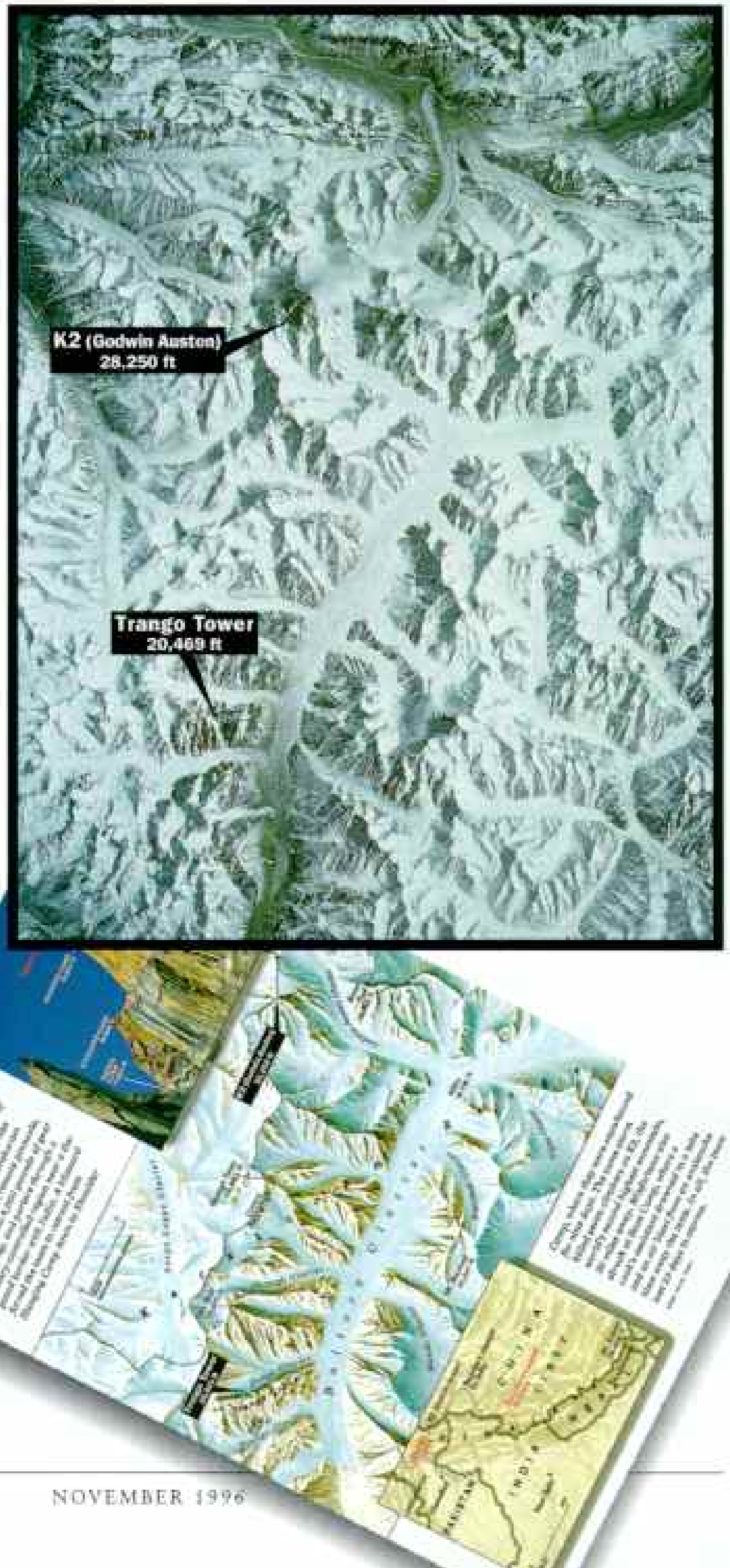
Our Map Pinpoints a View From Space

ASTRONAUT Rick Searfoss couldn't "devour" the April GEOGRAPHIC the minute it arrived as he normally does. He was 240 miles out in space, piloting the shuttle *Atlantis* in its linkup with the Russian space station Mir. And he was taking photographs.

On an earlier mission he had made a picture of Mount Everest that impressed NASA scientists. Now they wanted a view of K2. So on a pass over the Himalaya region he aimed his camera, with its 250-mm telephoto lens, out the shuttle's overhead window and, with 20 seconds available, shot several photographs.

When Searfoss returned to Houston's Johnson Space Flight Center and started sorting the pictures, he had trouble determining just where K2 was: All the mountains looked alike. Then he went home and in his GEOGRAPHIC found the hand-drawn relief map (bottom) in the Trango Tower article. "It blew me away," he recalls. "I took the map right back to the office, went to the scenes with K2 in them, and spotted it. I thought that was awesome, just as if I'd planned it."

His image (top) was one of 4,000 photographs of Earth made by crewmen on the nine-day flight. "Geologists have itched for a great photograph of that region," says the two-time space traveler. "Every astronaut loves to take pictures of the Earth. To me, that's the best part of flying in space."



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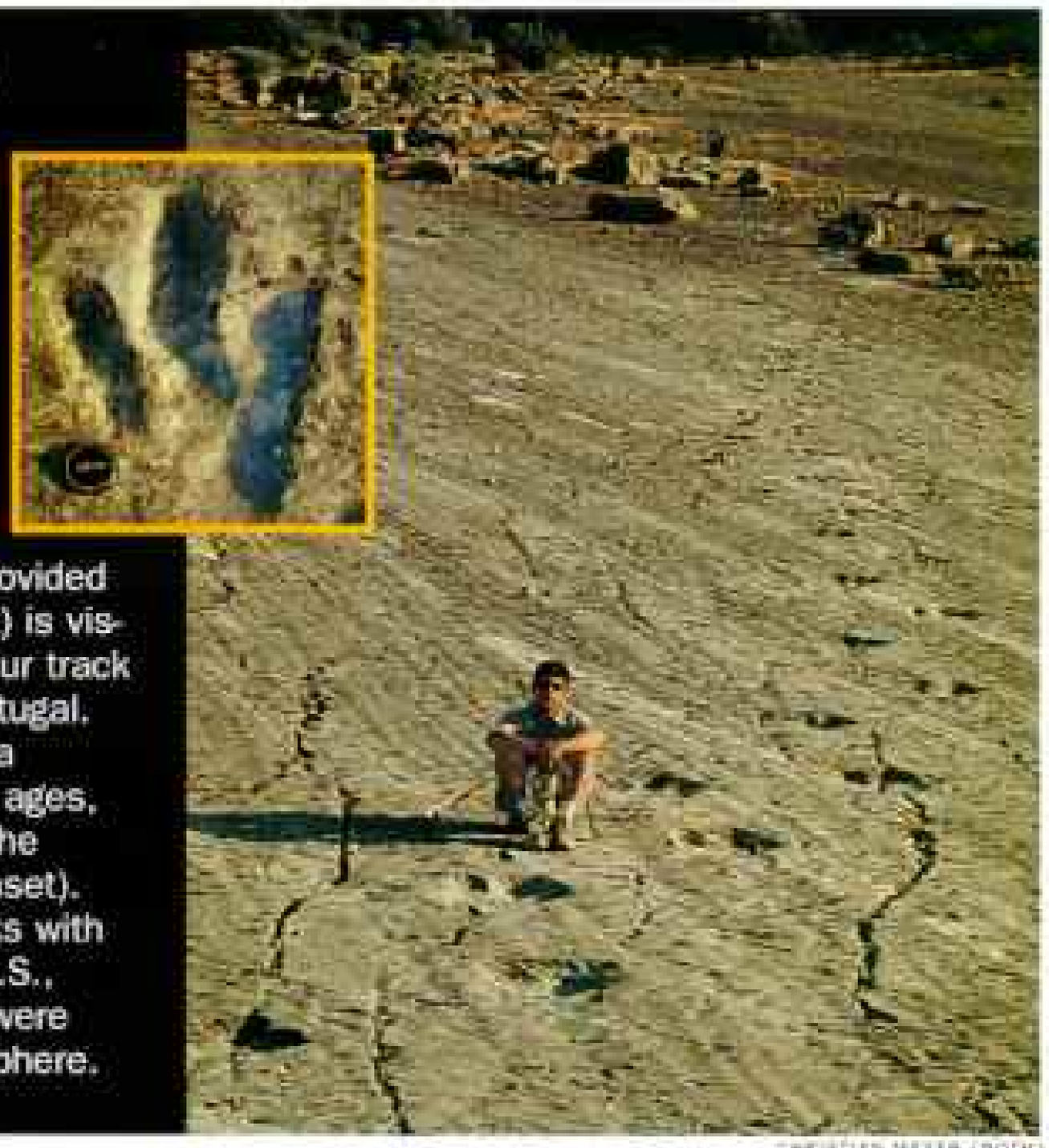
Long March of the Dinosaurs

MAYBE THEY CAME to drink from streams here. Whatever brought dinosaurs to an area now along the Turkmenistan-Uzbekistan border, they left signs of their presence in the damp ground. A Society-funded team led by Martin Lockley of the University of Colorado at Denver has found prints made by huge, meat-eating megalosaurs 155 million years ago. One path (with scale provided by paleontologist Christian Meyer, right) is visible for 1,020 feet. The longest dinosaur track previously known, 482 feet, lies in Portugal.

Lockley also found rare evidence of a gathering of 31 individuals of different ages, most of them megalosaurs, including the adult that left this 26-inch-long print (inset).

Lockley has matched the Asian tracks with megalosaur paths in Europe and the U.S., proving that these Jurassic dinosaurs were ubiquitous across the Northern Hemisphere.



CHRISTIAN MEYER (BOTH)

BILL CURTSINGER

Sport Divers Explore Bikini's Ghost Fleet

HALF A CENTURY after two atomic bombs sank U.S. and Japanese warships in tests at Bikini Lagoon, sport divers—up to a dozen a week—are visiting such fabled vessels as the aircraft carrier U.S.S. *Saratoga* (above). The uprooted Bikinians and their descendants receive a hefty share of the divers' fees.

A study commissioned by the National Park Service (GEOGRAPHIC, June 1992) found insignificant radiation levels at Bikini, a premier diving site known for its calm, clear water as well as its place in history.

Did Medieval English Jews Worship Here?

UNSEEN FOR 700 YEARS, a tiny room beneath a clothing shop in the old English town of Guildford presented a mystery. The room came to light last January after developers proposed new stores on High Street and experts from the Guildford Museum asked to check the site.

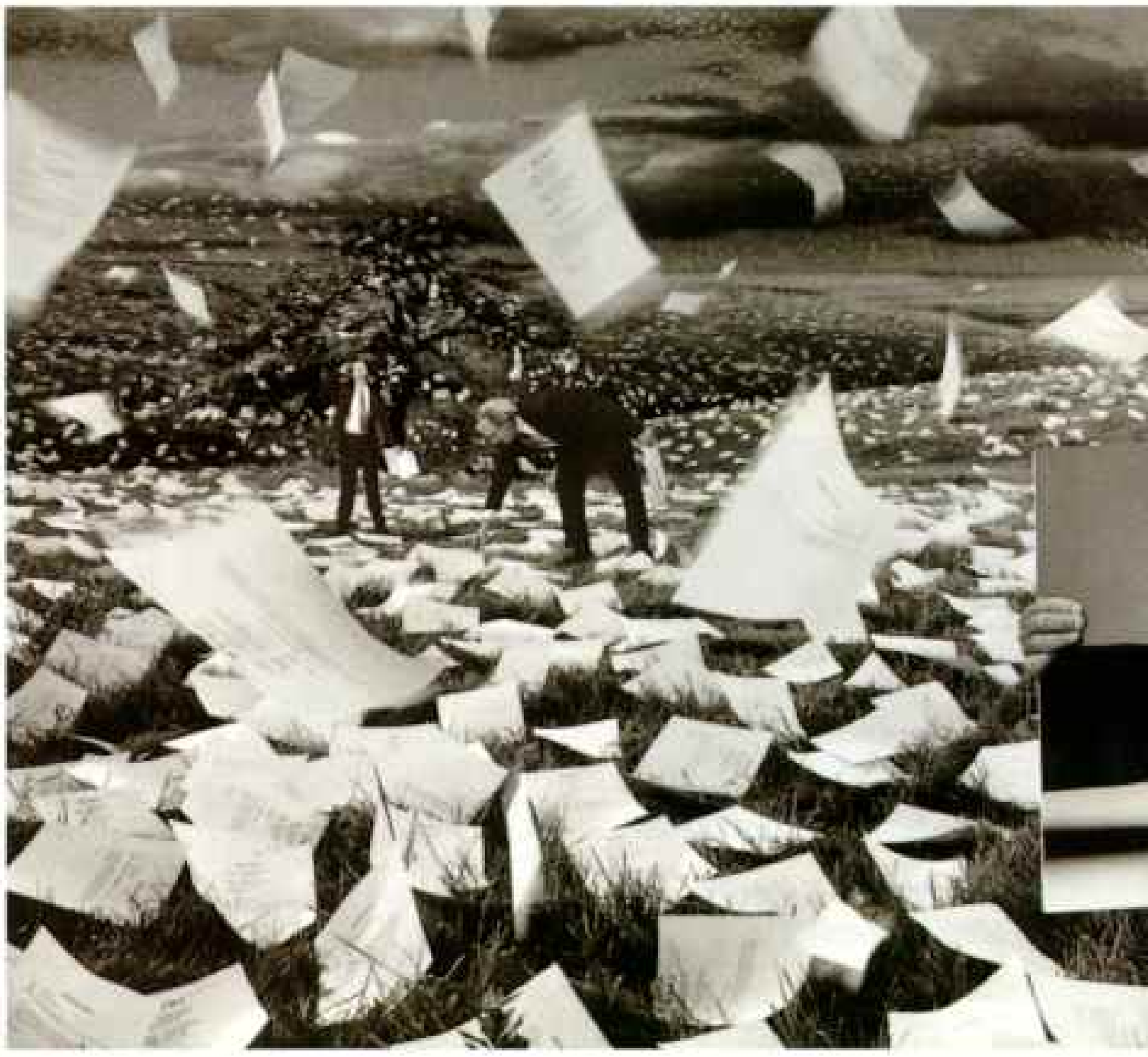
Poking through cellar walls, they found clues that they had reached a medieval synagogue. The ornate room, whose paint bore faint traces of precious indigo, lay in the rear of the building, as the law required of Jewish places of worship. It was located in a neighborhood near Guildford Castle, where Jews—considered chattels of the crown—would live. Stone benches ran around the ten-foot-square room. Its chalk-block walls date construction to about 1180, when a prosperous Jewish population lived in Guildford, a wool trade center; several Jewish families are known by name. This history and the artifacts suggest a synagogue, says archaeologist John Boas (below). But no Hebrew inscriptions have been found.

Boas did find the room filled with debris, including pottery sherds dating from the 1270s. A silver coin found by the east wall went out of circulation in that decade. Catholic monarchs ordered Jews expelled from England in 1290.

—BORIS WEINTRAUB

CARY WOLINSKY

If They Were Using They Would Have



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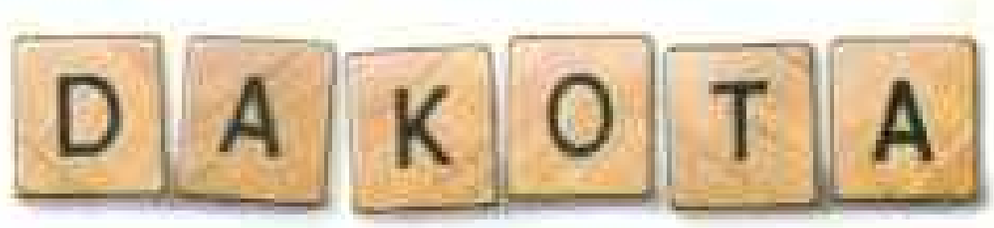

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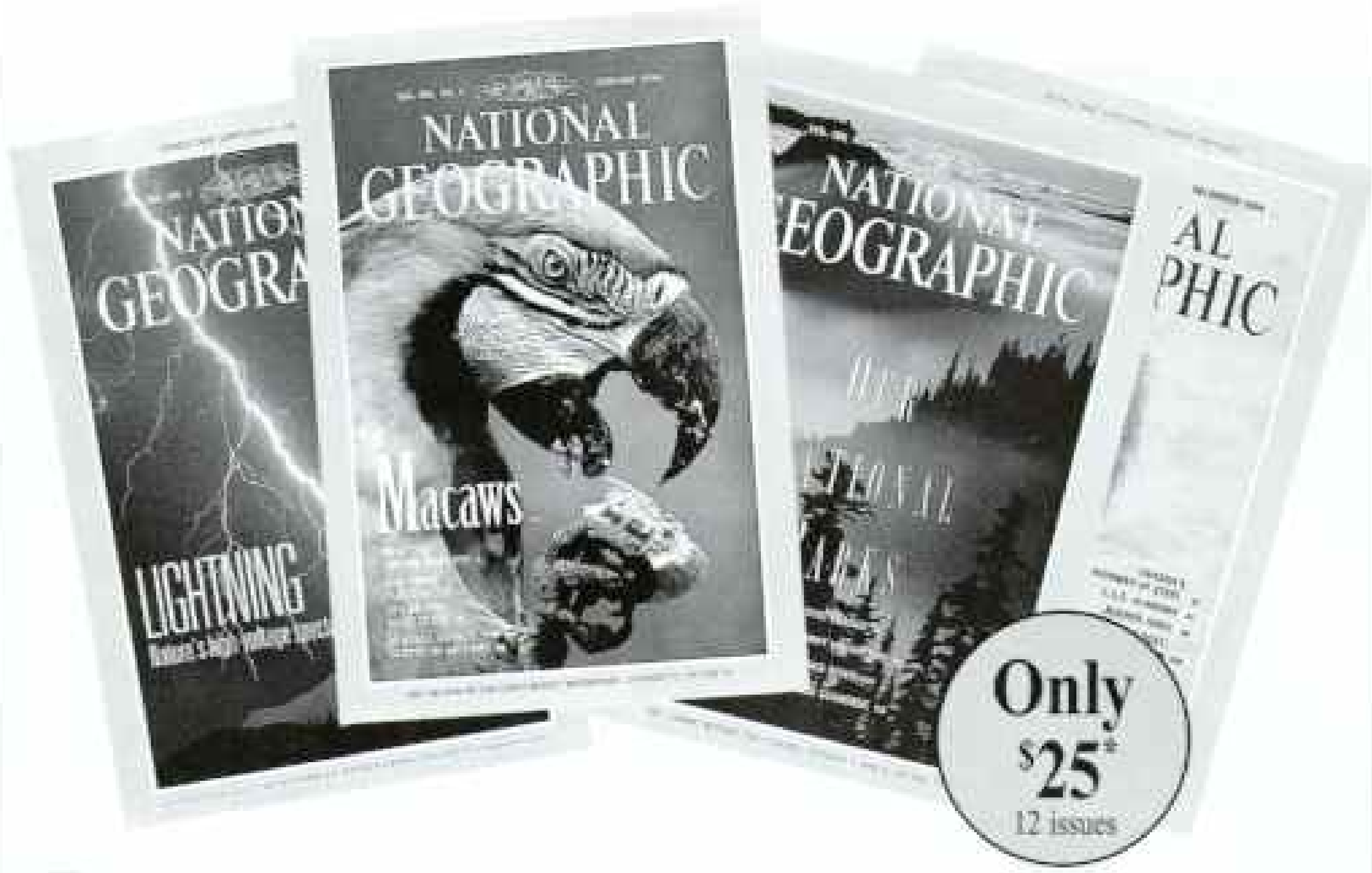

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507335

NATIONAL GEOGRAPHIC

EarthAlmanac

Aircraft-aided Wolf Hunt on Alaska Ballot

ART WOLFE

ALASKA'S WOLVES can run, but they can't hide . . . from airplanes. This wolf, safe in Denali National Park, would be fair game outside its borders. Though shooting wolves from aircraft was banned in 1972, airborne hunters can spot wolves, land nearby, and, if they walk at least 300 feet from the plane, legally shoot them. The "land and shoot" practice has been under fire for 20 years. This month Alaskans will vote on whether to abolish it.

Proponents favor predator control to increase moose and caribou for hunters. Often using aircraft, Alaskans killed some 1,500 of the state's 5,000 to 7,000 wolves in 1993-94. "The issue is so volatile that until this vote, no one can say how the Alaska public feels," says Joel Bennett, a sponsor of the ballot initiative. It would bar private citizens from shooting wolves on the same day they have flown in a private plane. But state officials would be permitted to shoot from the air those wolves that had seriously reduced a particular moose or caribou population.

Toxic Mistake Kills Hawks en Masse

"HAWK THAT EATS THE LOCUST," farmers in Argentina's La Pampa Province call the Swainson's hawk. Each fall the birds migrate from the western U.S. and Canada to La Pampa. Recently farmers who have been plagued by many more destructive insects than the hawks can feed on began using a cheap, plentiful insecticide in the organophosphate group. For their allies, the hawks, the results were disastrous.

"At first I was very upset; then I became sort of shell-shocked," recalls Brian Woodbridge of California's Klamath National Forest. Last January he led a team that found about 4,000 dead hawks in a study site in La Pampa, leading to an estimate of a staggering 20,000 dead in the raptors' overall area of concentration. Toxicologist Michael Goldstein displays one victim (left). Woodbridge, who has studied the species with a National Geographic grant, is working with Argentine, U.S., and Canadian agencies to find a safe, economical chemical substitute for the farmers.

RICARDO MALIA, BLACK STAR

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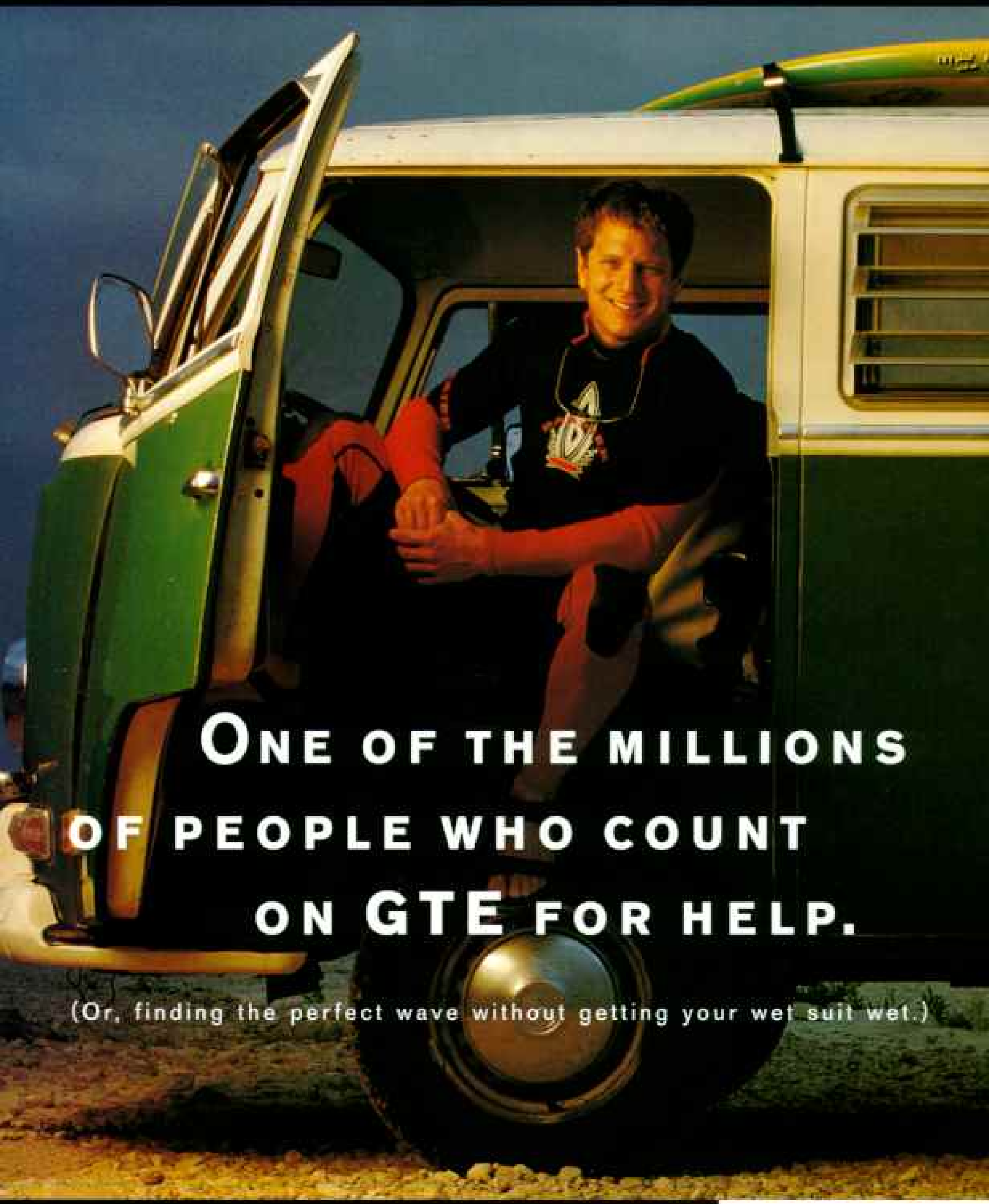
Rob Fleisher, Santa Barbara, California.



With the help of GTE's Surflink Web site, Rob checks out California beach conditions just by surfing the Net. So he can see waves 30 miles away without even leaving his bedroom. He counts on GTE people, quality and reliability to make his life easier. If you think telecommunications have only complicated your life, remember, there's one company you can count on for help: GTE.

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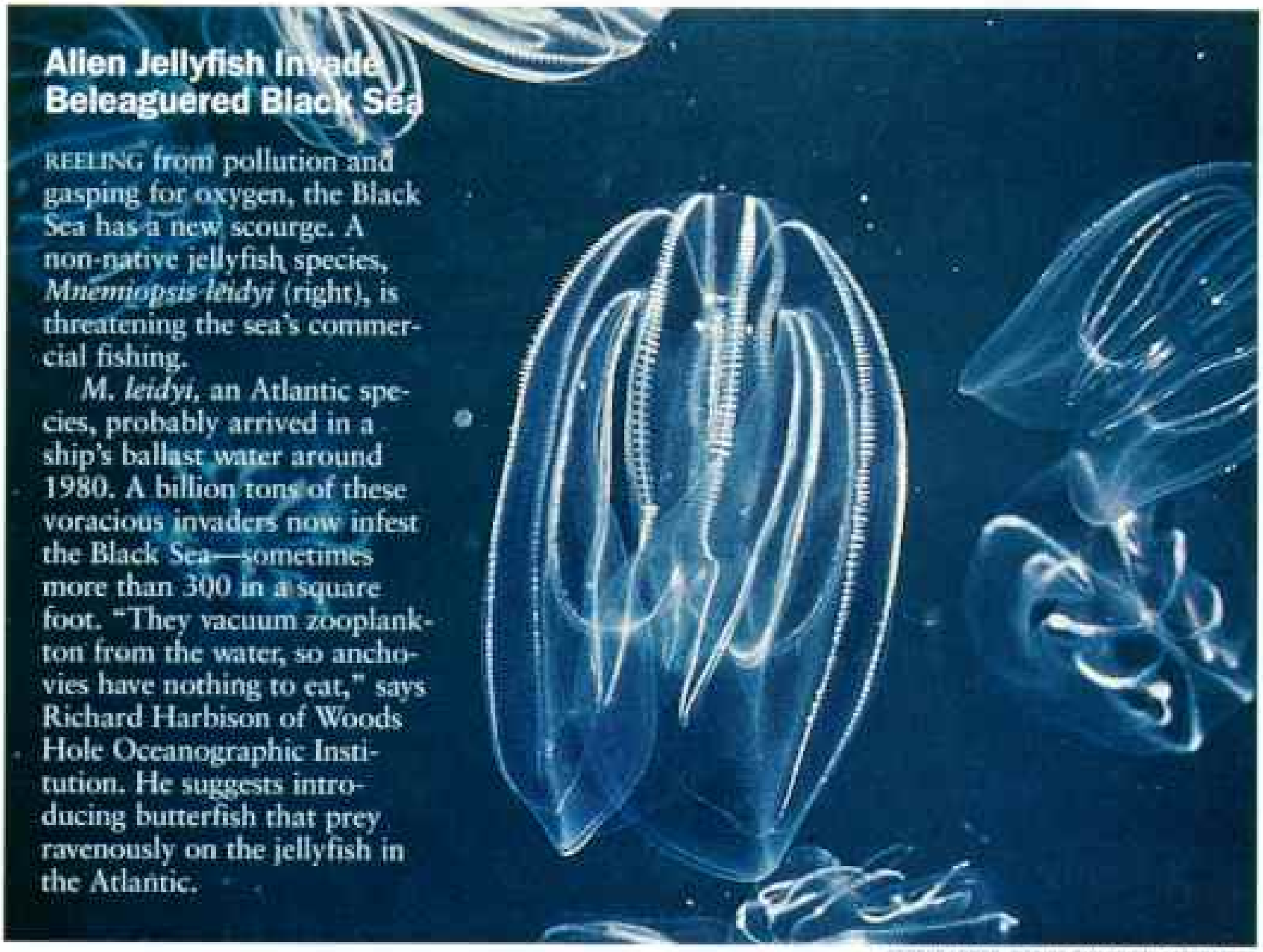
Alien Jellyfish Invade Beleaguered Black Sea

REELING from pollution and gasping for oxygen, the Black Sea has a new scourge. A non-native jellyfish species, *Mnemiopsis leidyi* (right), is threatening the sea's commercial fishing.

M. leidyi, an Atlantic species, probably arrived in a ship's ballast water around 1980. A billion tons of these voracious invaders now infest the Black Sea—sometimes more than 300 in a square foot. "They vacuum zooplankton from the water, so anchovies have nothing to eat," says Richard Harbison of Woods Hole Oceanographic Institution. He suggests introducing butterfish that prey ravenously on the jellyfish in the Atlantic.



GEORGE LOWER, MARINE BIOLOGICAL LABORATORY

Sprouting From the Seeds of War, Tallgrass Prairie Will Rise Again

BILLIONS OF TONS of explosives that fueled conflicts from World War II to Vietnam rolled out of sprawling Joliet Arsenal in northeastern Illinois. It was shut down in the late 1970s, freezing in time this ammunition-storage bunker, one of about 400, and the abandoned train rusting beside it (right). But this month the resurrection of Joliet begins, as the U.S. Army transfers 19,165 acres of its land to the Forest Service, inaugurating the Midewin National Tallgrass Prairie—the first such preserve. The joint project of many groups will also include 985 acres for a national cemetery and 2,800 acres for economic development.

TERRY EVANS

Once the Army has cleaned up toxic waste in the arsenal, the largest tallgrass prairie restoration ever undertaken will begin. Volunteers will plant big bluestem and other native grasses to re-create the ocean of grass that amazed 19th-century settlers. Bison and elk may be reintroduced. The preserve "could become as popular as Yellowstone; nearly nine million people live within 45 miles," says John Turner of the Conservation Fund. He is also excited because much of the adjacent land "belongs to corporate landowners who may eventually be willing to contribute."

In light of the arsenal's history, the preserve is appropriately named: Midewin is a Potawatomi healing society.

—JOHN L. ELIOT

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How much more personal c

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And although the life span of some computers may appear to extend just beyond that of the average goldfish, we've loaded the Performa 6400 with ample power and plenty of expansion options so you and your family will enjoy it for years to come.

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NATIONAL GEOGRAPHIC

Geoguide

Where on the World?

IF YOU RODE in a NASA space shuttle, zooming along at 17,500 miles an hour, you'd see views like these. Peering through a window at Earth, about 150 miles below, could you answer the following questions? An atlas or globe will help.

■ In the photograph that includes the Sinai Peninsula (above), can you identify three well-known seas and parts of five countries? A famous canal is also visible. Can you find and name it? Why is it significant to shipping and trade?

■ In the photograph of part of New England (top right) can you locate Rhode Island's capital city, at the head of a major bay—and name the city and the bay? What other state's even larger capital city is visible on what even larger bay? A retreating Ice Age glacier left deposits that created Cape Cod and two large islands nearby. What are their names?

■ The Hudson, Harlem, and East Rivers surround the island of Manhattan (pages 24-5). Can you distinguish the rivers? Can you find the George Washington Bridge, linking Manhattan with New Jersey? What are the veins of light that web the landscape?

■ Although human settlement has affected the waters of the Amazon Basin, other factors play a major role in the Amazon River's muddy discharge into the Atlantic Ocean (pages 22-3). What features of the river account for its color?

Relic of a catastrophic 1980 eruption, Mount St. Helens's ruptured summit (above)—seen in 1994 from 161 miles up—stands above a scarred landscape. From 173 miles the Sinai Peninsula (top left) shows age-old barrenness. From 145 miles Massachusetts's Cape Cod seems to flex its muscle.

USE GEOGUIDE ALONG WITH THE ARTICLE "ORBIT: THE ASTRONAUTS' VIEW OF HOME" IN THIS ISSUE TO CAPTURE THE INTEREST OF YOUNG READERS AND STIMULATE DISCUSSION WITH THEM.

White-naped Crane (*Grus vipio*) **Size:** Height 1.35 - 1.50 m **Weight:** 4.75 - 6.50 kg **Habitat:** Wetlands and adjacent grassland areas in East Asia **Surviving number:** Estimated at 4,900 - 5,300
Photographed by Sture Traneving

WILDLIFE AS CANON SEES IT

A pair of white-naped cranes nest along a lake's edge in China's Zhalong Nature Reserve. Aptly named, this is the only crane with a white stripe extending down the back of the neck. Cranes are monogamous, and in spring a mated pair jointly incubate two eggs which hatch in about 30 days. The chicks develop quickly, and by fall they are ready to take flight and learn the migratory route to their wintering grounds. The white-naped crane is mainly threatened by habitat loss, but recent migratory bird agreements between countries sharing its range now provide increased protection for the crane and its wetland habitat. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

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NATIONAL GEOGRAPHIC

On Assignment

■ JOSEPH BANKS

That Clammy Feeling

PEERING INTO a live giant clam wasn't enough for Cary Wolinsky, visiting the James Cook University research station in Great Barrier Reef Marine Park. "I'd heard these bivalves can't close tightly," says the photographer, who stuck his whole arm in, "but I had to see for myself."

Seeing for himself got Cary into photography in the first place. As a freshman at Boston University he borrowed a camera and "just walked around the city, shooting. I was smitten."

Cary had the same feeling as he followed Joseph Banks's journal along the Australian coast. He also saw how the environment has changed. "The only reason we still have these giant clams is that within the national park they are protected from fishing."

ALLAN WOODWARD

■ BOWIE SEAMOUNT

Deep Thinker

IT WAS A COD'S-EYE VIEW for the crew of the fishing boat *Star Wars II*, who boarded the yacht *Sumdum* to watch Bowie Seamount videos shot by photographer Emory Kristof from a remotely operated vehicle. Emory (at front) combined his loves of diving and tinkering 20 years ago, when he helped develop deepwater camera technology to search for the Loch Ness monster (June 1977). His innovations have changed the face of underwater photography. Says the former staffer, now a freelance, "Like any explorer of any frontier, I want to make people aware."

BILL CURTSINGER

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