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NATIONAL GEOGRAPHIC

A Personal Vision of Vanishing Wildlife 84

NATIONAL GEOGRAPHIC

APRIL 1990

SUNBATHING POLAR STYLE

GENERATIONS REACH OUT IN JAPAN

ONE OF A VANISHING BREED

BASHING DOWN THE WALL

COVER: *A six-year-old male orangutan, bred in captivity and known as Ollie, represents one of many animal species threatened with extinction. As their forest homes in Borneo and Sumatra fall to timber cutters, the great red apes may not reproduce fast enough to survive. Photograph taken at Marine World Africa USA, Vallejo, California, by James Balog.*

A LAND OF ISOLATION

ANTAR

NATIONAL GEOGRAPHIC PHOTOGRAPHERS GEORGE F. MOBLEY; BEN OSBORNE (FOLLOWING PAGES)

NO MORE ANTARCTICA

By BRYAN HODGSON NATIONAL GEOGRAPHIC SENIOR WRITER

It is larger than Europe or Australia, but it has no native human population. It contains more than two-thirds of the world's fresh water in the form of ice, yet some areas receive less than two inches of precipitation a year. Antarctica is the highest, coldest, most desolate place on the globe. But it irresistibly draws visitors. The fifth largest continent is a giant outdoor laboratory where scientists strive to decipher clues to our planet's history and detect early warning signs of global pollution. Climbing above the ice, geologist David Marchant hunts for evidence of past glacial activity (left).

Off the Antarctic Peninsula, a 50-foot schooner carrying researchers appears as but a toy boat next to icebergs drifting amid sheets of pack ice (overleaf). A place of far-reaching importance, earth's last terrestrial frontier is drawing increasing international attention.

Making a pointillistic canvas of the mountainside, multitudes of chinstrap and macaroni penguins congregate on Zavodovski, a volcanic island in the South Sandwich group. Near the top of the region's food chain, penguins have confronted no land-based predators in Antarctica other than man; early seafarers killed millions and boiled them for their oil.

Like most penguin species, chinstraps feed mainly on krill, small shrimplike crustaceans populating the frigid water in vast swarms that also nourish baleen whales. With the decline in whale populations from commercial harvesting, the krill masses burgeoned. Offered a newly plentiful food supply, penguins now number at least one hundred million.

JIM BRYDEN

DOUG ALLAN (ABOVE); BEN OSBORNE (RIGHT)

A gossamer curtain called the aurora australis, or southern lights, hangs above the British Antarctic Survey's Halley Station (above). Measurements here first revealed a "hole" in the atmosphere's ozone layer, which shields the earth from harmful frequencies of solar radiation.

Off the Antarctic Peninsula, unusual weathering of this rock resulted in a green web of copper tracings. The diversity and extent of Antarctica's mineral wealth remains largely undetermined, although extensive coal deposits are known to exist. But daunting logistical problems make exploration and mining, already controversial, commercially unfeasible.

BEIN BY COLIN MONTEATH

Where early explorers played out their agonies and triumphs, tourists now come to sightsee. Oblivious to his mantle of snow, a passenger nodded off aboard the *World Discoverer* as it plied the Bellingshausen Sea. At Cape Royds on Ross Island a storm rails against Adélie penguins at a point south of 77°, the most southerly penguin rookery known.

"Romantic ideas don't make it here. This is not a place to come to escape from something. It is a place to learn new lessons about yourself." —BILL COUGHRAN, Manager, Amundsen-Scott Station

ANTARCTICA has always been a place that explorers' dreams are made of, but modern realities are rapidly overtaking the romantic vision of a world apart, icy and forbidding.

Not long ago, on a brilliant 30-below-zero austral summer day, I watched a party of cross-country skiers gather at the South Pole to celebrate completion of a 50-day, 660-mile journey across the Antarctic ice sheet. By chance they had arrived only one day after the 77th anniversary of that bitter moment in 1912 when British explorer Robert Falcon Scott discovered that Norwegian explorer Roald Amundsen had beaten him to the Pole by 34 days.

Amundsen survived and won fame. Scott and four companions perished and won glory. For those and other reasons, many adventurers have followed in their footsteps.

But not until now had anybody done it just for fun.

The skiers had paid roughly $70,000 each to a professional expedition company whose experienced guides and bush pilots provided logistics. After celebrating with coffee and fresh sweet rolls at the U. S. Amundsen-Scott South Pole Station, the group clambered aboard a waiting Twin Otter aircraft to begin the return trip to Punta Arenas, Chile.

It was scarcely a historic moment, but it was another sign that Antarctica's splendid isolation is no more. For better or worse—and for the most part unprepared—this 5.4-million-square-mile continent of ice has become a part of the modern world.

Air traffic is growing, and some 3,000 tourists visit by ship each year. There's even a hotel. With few navigation aids, there have been accidents. In 1989 an Argentine Navy transport ran aground and later sank less than two miles from a U. S. research station on the Antarctic Peninsula. The 81 tourists on the vessel escaped injury, but the resulting 170,000-gallon diesel-oil spill killed hundreds of birds and disrupted science projects.

During two years of travel, I have seen many other signs of change, not all of them benign. Thirteen nations have joined the 12 original signatories as voting members of the Antarctic Treaty of 1959, building research stations and becoming eligible to vote on control of whatever resources the continent may possess. Today some 40 year-round bases dot the Antarctic. Fourteen additional nations have gained observer status, introducing a strain of international politics to a gentleman's agreement that guaranteed only that Antarctica would be used for peaceful purposes—without specifying clearly what those purposes might be.

And last October in Paris, the 15th biennial treaty meeting was thrown into turmoil by an unscheduled debate sparked by the announcement of France and Australia that they had revoked their approval of a 1988 agreement prohibiting minerals exploration without the unanimous consent of all members. Instead, they joined environmental groups demanding an outright ban on minerals activities and establishment of Antarctica as a world park. Some nations, such as Chile and Argentina, saw this as the first direct threat both to the treaty and to territorial claims they had agreed to hold in abeyance.

Antarctica has never been truly isolated. Although it is surrounded by a barrier of swirling ocean currents and ferocious winds and crowned by a gigantic ice sheet averaging nearly two miles thick, this coldest region of the planet is a powerful weather maker for the Southern Hemisphere. Its frigid waters surge along the deep seabeds into the Northern Hemisphere, modifying ocean temperatures and *(Continued on page 20)*

Morning chores include digging out from snowdrifts that engulfed the tent of Baiba Morrow, overnighting on an Antarctic Peninsula island. Operating from Punta Arenas, Chile, a Twin Otter aircraft brings visitors for skiing and mountain climbing. Some 3,000 tourists come to Antarctica annually. GORDON WILTSIE

ANTARCTICA
A cold, white world of untold bounty

NEW ZEALAND

Krill concentration (Euphausia superba)
Major penguin rookeries (Adélie, chinstrap, emperor, gentoo, king, macaroni, or rockhopper)
Major seal breeding area (crabeater, elephant, fur, leopard, Ross, or Weddell)
Ocean surface current
Metallic mineral occurrence (copper, iron, uranium, other)
Antarctic volcano (eruption confirmed or suspected within the past 10,000 years)
Historic site
Major research station

Modified Azimuthal Perspective Projection
SCALE VARIES

Oil and natural gas are thought to exist in sedimentary basins in and around Antarctica.

An iceberg measuring 1,750 square miles broke off in October 1987. Nearly the size of Delaware, the bery was equal to half the continent's annual ice discharge.

The southern ocean provides habitat for a variety of whales, including the blue, fin, humpback, minke, sei, southern right, sperm, and killer.

A world-record low temperature of minus 128.6°F was recorded here July 21, 1983.

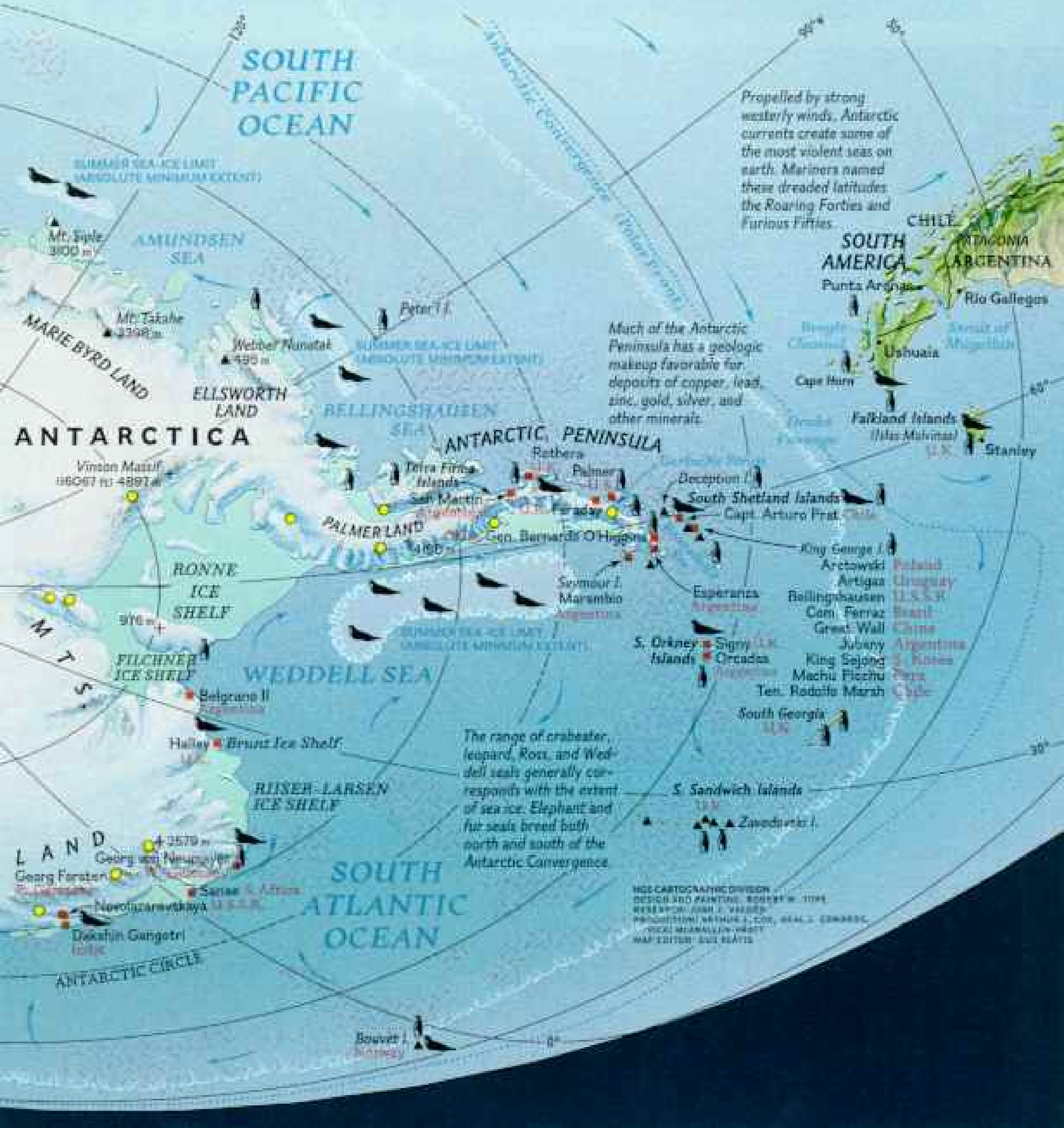
INDIAN OCEAN
ANTARCTIC CIRCLE
Scott I.
Balleny Islands
Borchgrevink Coast
Lenin Peninsula
Leningradskaya U.S.S.R.
1990 South Magnetic Pole
Dumont d'Urville France
Mt. Melbourne 2732 m
Cape Washington
SCOTT & SHACKLETON CAMPS
ROSS SEA
Iceberg B-9
Russkaya U.S.S.R.
Mt. Berlin 3498 m
Mt. Erebus 2794 m
Scott Base New Zealand
Ross I.
McMurdo U.S.
ROSS ICE SHELF
Darwin Glacier
Darnell Nunatak
Byrd Glacier
WEST ANTARCTIC
Beardmore Glacier
WILKES LAND
Casey Australia
SHACKLETON ICE SHELF
Mirnyy U.S.S.R.
EAST ANTARCTICA
Vostok U.S.S.R.
Amundsen-Scott U.S. SOUTH POLE 2835 m
Australian Davis Base
China Zhongshan
Progress U.S.S.R.
AMERY ICE SHELF
Heard I. Australia
Kerguelen Islands France
Mawson Australia
QUEEN MAUD
Syowa Japan
Molodezhnaya U.S.S.R.
Asuka Japan
Gamburtsev Subglacial Mts.

IMAGINED by the ancient Greeks and conjectured by medieval geographers, the large continent at the south end of the world was not actually seen until the early 19th century. The first two explorers to reach the South Pole, Roald Amundsen of Norway and Robert F. Scott of Britain, were honored in the naming of the U. S. Amundsen-Scott Station.

Reports of abundant whales and seals brought ships that harvested the southern ocean. A rich array of wildlife begins at the Antarctic Convergence, where northern currents meet fertile polar waters. Nutrients roiled up from the depths support a plankton community that sustains a menagerie of birds, dolphins, and other creatures.

The promise—and peril—of Antarctica has been that no one owns it, although seven nations have pressed sometimes overlapping claims. A 1959 treaty provides that the continent be used only for peaceful, scientific purposes. The agreement is open for review starting in 1991.

A U. S. congressional report estimates that at current prices profitable mining could not take place for at least three decades. In 1988 the United States and other nations agreed to a convention designed to protect the land from damage should mineral extraction ever be permitted. This has not satisfied Greenpeace and other environmental groups, which seek to preserve the continent as a world park.



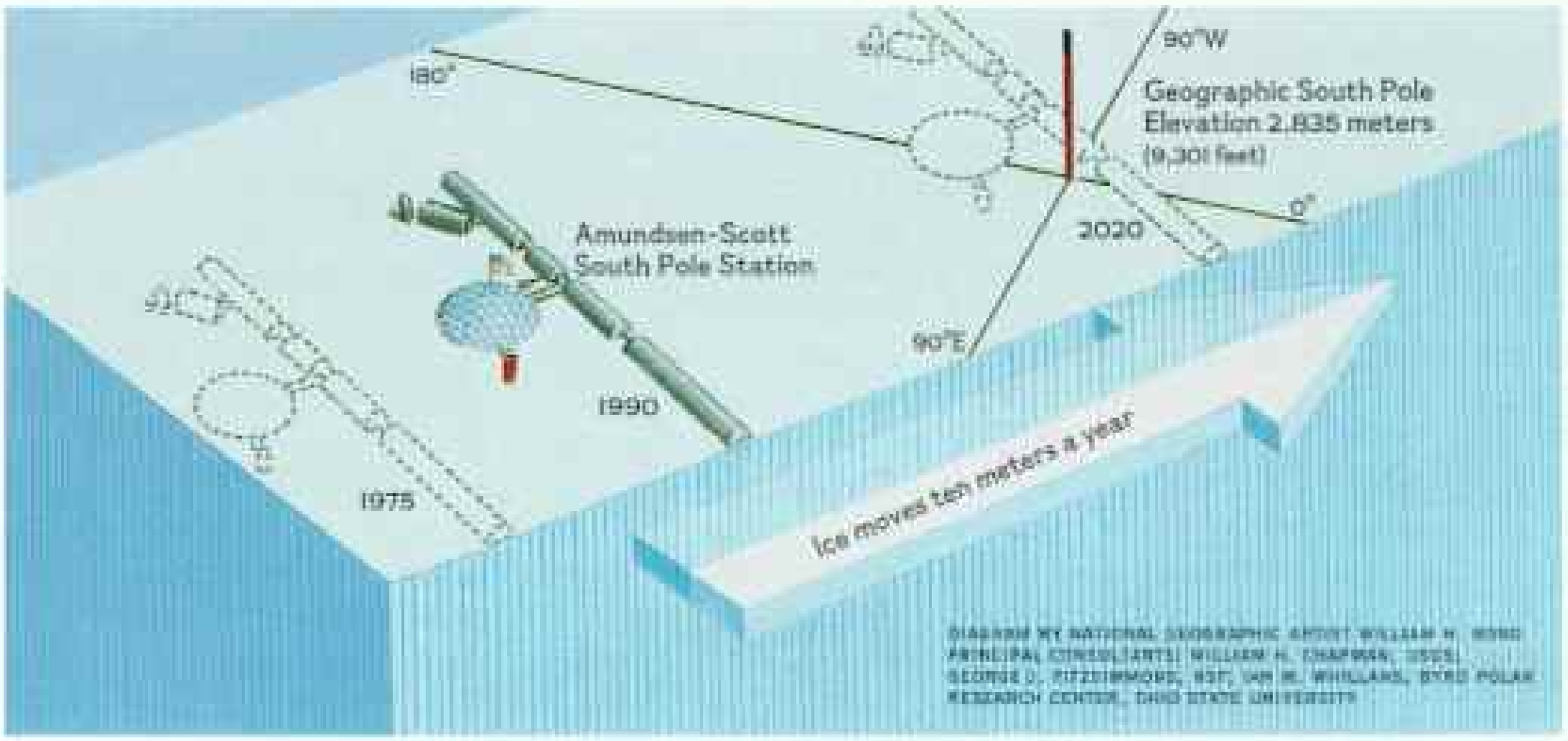


DIAGRAM BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BOND; PRINCIPAL CONSULTANTS: WILLIAM H. CHAPMAN, USGS; GEORGE D. FITZSIMMONS, BSP; IAN M. WILLIAMS, BYRD POLAR RESEARCH CENTER, OHIO STATE UNIVERSITY

ALL BY GEORGE F. MOBLEY

Under the dome at the bottom of the earth, a worker at the Amundsen-Scott Station draws a sled across an ice sheet nearly two miles thick (left). Managed by the U. S. National Science Foundation, the base (above) sits a fifth of a mile from the South Pole and is getting closer, since the station is literally on the move (above left). At the rate of ten meters (33 feet) a year it drifts with the ice toward South America.

The U. S. Antarctic research program utilizes some 2,500 people to operate programs dealing with upper atmospheric physics and chemistry, astrophysics, and biology. The continent's relatively pristine skies are also drawing increasing interest from astronomers.

The staggering cost of transporting building equipment puts a premium on living space. A killer whale and Opus the penguin share a scientist's cramped quarters (right). Prospective winter employees at the three year-round U. S. research stations must undergo psychological screening to assess their ability to withstand Antarctic duty. At one American base, bored workers reportedly played the same movie 87 times. Bases offer libraries, gym facilities, and game rooms. But isolation and monotony sometimes lead to alcohol abuse.

As the combined staffs of the U. S. and 22 other nations reach 4,000, environmentalists decry pollution from refuse and human sewage. Citing budget limitations, U. S. officials say they are cleaning up problem areas as quickly as possible.

COLIN MONTEATH (ABOVE); GEORGE F. MOBLEY (BELOW)

Weathering the elements for 82 years, a hut built by British explorer Sir Ernest Shackleton stands at Cape Royds. Shackleton and his expedition came within 112 miles of the Pole in 1909. In 1961 the New Zealand government restored the building, in which cans of food still sit, as a historic monument.

(Continued from page 14) carrying nutrients to nurture marine life.

More recently, scientists have discovered that Antarctica is a sensitive barometer of mankind's use and abuse of the planet.

Comparing today's atmospheric gases with those trapped in core samples of ancient Antarctic ice, they have found that the burning of fossil fuels has helped raise carbon dioxide to the highest level in history. Some have warned that this might cause a melting of the ice sheet by trapping heat from the sun. Other scientists have learned that man-made gases called chlorofluorocarbons, trapped over Antarctica by a stratospheric vortex of winter winds, react with spring sunlight to release chlorine atoms that destroy much of the ozone, which helps protect living organisms from harmful ultraviolet radiation.

These are some of the signs and wonders of the modern age, and the answers lie in the future. But I was soon to learn that there are old-fashioned ways in which damage is still being done.

I BEGAN my Antarctic travels on a tropical night, sailing down the long glittering skyline of Rio de Janeiro in the sturdy if somewhat rusty *Profesor Siedlecki*, a 293-foot-long Polish research vessel that had been chartered by the National Marine Fisheries

CHRIS ROSSE, DSIR, ANTARCTIC DIVISION, NEW ZEALAND

Preserved by the cold, the scavenged body of a sled dog lies near Robert F. Scott's hut at Cape Evans on Ross Island. Scott's race to be the first to the Pole ended in disappointment in 1912 when he learned that Amundsen had arrived a month earlier. Scott and four companions died on the return trip.

Service in Narragansett, Rhode Island. Aboard were ten U. S. and Canadian scientists, headed by marine biologist Rick Crawford, and a 21-member Polish contingent led by Miroslaw (Mirek) Mucha of the Sea Fisheries Institute at Gdynia.

As early as 1975 scientists had warned that Antarctic waters were being overfished. In 1980 agreement was reached on a Convention for the Conservation of Antarctic Marine Living Resources. By 1983 Soviet fishing fleets had seriously depleted the population of Antarctic cod around the French islands of Kerguëlen. Other fisheries appeared on the verge of destruction.

"There is a fish at South Georgia called *Champsocephalus gunnari*, which we think is in danger," I was told by Kenneth Sherman of the National Marine Fisheries Service. "Some nations recommended a fishing limit of 10,000 tons for *gunnari* in 1986. The Russians reported catching 69,000 tons—seven times the proposed limit. They claim our estimates were wrong and that the protein will just go to waste unless fishing is done at the optimum level."

To investigate such matters, the United States Congress requested a major study of Antarctica's marine ecosytems. We were part of that study.

For seven days we sailed the seasons upside down, from languid tropical heat to the chilly frontier of the Antarctic Convergence, where cold, nutrient-rich southern waters mingle with the warmer but less fertile waters of the north.

It is a visible frontier, marked by a prodigal display of life. Elegant black-browed albatrosses described the myriad currents of the air and then squabbled gracelessly for scraps in our wake. Tiny Wilson's storm-petrels dabbled their feet in the sea as they hunted for minuscule prey. Cape pigeons in dazzling black-and-white plumage swirled across our bow. Dolphins and seals and penguins provided a tirelessly leaping escort as we sailed south.

Such exuberance of life, coming after weeks of looking at empty ocean, led early explorers and hunters to believe that the southern ocean possessed boundless fertility. By 1830 hunters had almost exterminated the fur seal. As we neared South Georgia in late December, we saw only a single humpback

whale in an area where some 900 whales were killed in December 1926. In four weeks of trawling around South Georgia, we amassed convincing evidence that similar destruction was being visited upon Antarctica's fish.

This is how ocean science is done:

At 11:30 p.m., it's bitterly cold in the windblown fog. The trawl is dragged for 30 minutes, then hauled in to dump its catch on the slippery, heaving deck. Here is an entire underwater neighborhood: jellyfish, silica-spiked sponges, starfish, octopuses, bright red spiny crabs, strange invertebrate organisms that look like yards of intestines.

Among them squirm an exotic assortment of fish: *Pseudochaenichthys georgianus*, exuding slime and baring nightmare teeth; *Chaenocephalus aceratus*, wearing a crocodile nose. Most numerous is *C. gunnari*, the slender creature that has become the main quarry of fishing fleets.

Scientists shovel the catch to the lab below, sort the fish by species, then weigh and measure them. Scott Folsom of the University of Hawaii wields a surgeon's scalpel to take ovaries and tiny ear bones called otoliths to determine sexual maturity and age. Jim McKenna of the University of Rhode Island takes stomachs, which suggest feeding patterns. Work goes on around the clock.

Like generations of Antarctic mariners before us, we celebrate holidays at sea. I'm deeply moved by the Polish Christmas custom of offering small bits of unleavened wafer in a sort of personal communion. The New Year is ushered in with a volley of rockets—red, green, and white balls of flame whose brilliant reflections vanish abruptly from the frigid waters and leave them somehow lonelier than they were before.

Sounding an alarm for environmentalists, the Argentine supply ship* Bahia Paraiso *ran aground in early 1989 after hitting underwater rocks near Palmer Station, apparently because of inaccurate navigation charts. Thousands of gallons of diesel fuel fouled beaches and killed wildlife. Antarctica's first environmental disaster may stand as the benchmark for studies of any future spills and their cleanup.

THE NEW YEAR brings howling force 9 winds. As the ship lurches back toward South America, Rick Crawford adds up the results.

"Measured 36,243 fish of 24 species. The vast majority of them were immature. Small sizes were fairly strong for *gunnari*—a good sign—but we are missing a hell of a lot of fish in age groups over three years."

Mirek Mucha, the Polish chief scientist, is on his fourth trip to Antarctica. He shows me meticulous handwritten records of Polish fishing vessels kept since the mid-1970s.

"*Notothenia rossii* used to be the target at South Georgia, as it was at Kerguélen," he tells me. "Now they are almost gone, and *gunnari* are getting smaller and smaller. We need detailed studies. If the Russians would share their data, I think we would know much more."

How extensive the Soviet activity is can be learned by listening to their fishing boats on the radio. They were taking as many as 20 tons a day of *Patagonothen brevicauda guntheri* and *C. gunnari* at Shag Rocks. At the South Shetlands some 18 vessels were taking krill at 85 tons a day. At the convergence 400 miles northeast of South Georgia, one boat reported catching two tons of squid.

Mirek raised his eyebrows: "This is the first information about commercial quantities of squid in that area. Everybody is looking for squid in Antarctica."

Squid I know about. A year earlier I had seen the night sky around the Falkland Islands blazing with lights from a fleet of squid boats that were bringing more than 40 million dollars in profits to the islands each year. There the fishery is rigidly controlled by the British government. In Antarctica, I now knew, scientists had scarcely begun to study squid, let alone suggest fishing limits.

After 37 days at sea I had reached a fishing limit of my own, and when the *Profesor Siedlecki* entered the Strait of Magellan and docked at Punta Arenas, I gratefully abandoned ship.

Chile's southernmost city, Punta Arenas, appears as merely a dot on the Patagonian map. But in reality it is a thriving commercial

ART WOLFE

COLIN MONTEATH (ABOVE); MITSUAKI IWAGO

A natural hot tub beckons tourists to a welcome soak on Deception Island. Incautious bathers risk scalding in these waters, which can be set to boiling by volcanic activity. Relaxing in its own way, a Weddell seal basks near a boat left over from the island's days as an anchorage for whaling ships.

center, whose harbor, shipyard, airport, and communication facilities have made it the major gateway to the Antarctic Peninsula. In my travels I passed through seven times. Once I joined a group of tourists aboard a Chilean Air Force C-130 Hercules transport for a two-and-a-half-hour flight to King George Island, site of Chile's Teniente Rodolfo Marsh station and airfield.

While the tourists checked into a barracks-like 80-bed hotel, the Estrella Polar (Polar Star), I went to visit Col. Juan Bastias Silva, air force chief of Antarctic planning.

Eight other nations have research stations on the island: Argentina, Uruguay, Peru, Brazil, Poland, South Korea, the Soviet Union, and the People's Republic of China. King George's popularity stems more from its location, only 600 miles from Punta Arenas, than from its scientific potential.

To gain voting status under the Antarctic Treaty, members must demonstrate "substantial scientific research." In summertime member nations maintain as many as a hundred temporary stations on the continent and its surrounding islands, with an estimated population of 4,000.

"Every day it is easier to get to Antarctica," Colonel Bastias told me. "The French and British are building new airstrips. On the continental ice plateau you can land ski-equipped aircraft almost anywhere. It is also possible to land large-wheeled transports on areas of permanently bare ice, such as those near the Vinson Massif. We are planning to establish a base there to give us a regular airway from Punta Arenas to the South Pole."

CHILE'S BASE on King George Island is actually a colony, with quarters for some 240 airmen and scientists. Many sign on for two-year tours and live with their families in a suburban-style apartment complex called Villa Las Estrellas, which has its own bank, post office, commissary, hospital, and a schoolhouse where I visited 11 students.

This complex, together with the tourist facilities, reflects Chile's long-standing policy of "proving up" its territorial claim to a large sector of Antarctica, even though such claims are held in abeyance under the treaty.

Argentina has a similar policy. I visited Esperanza, an Argentine Army base on the tip of the Antarctic Peninsula a hundred miles south of King George Island. An Argentine Air Force Twin Otter ferried us across Bransfield Strait, and we landed on a glacier high above the rocky cove that shelters the headquarters buildings.

"Our main purpose is to support scientific work, but that has ended for the season," said army Capt. Jorge Villamayor, the base commander. "Thirty-three of us will spend the winter here—18 men, 5 wives, and 10 children."

By Argentine reckoning, Antarctica's first natives were born at Esperanza. Army wives delivered five boys and three girls in the base clinic between 1978 and 1983. A bronze bell

in Esperanza's schoolhouse reminded me that the country has pressed its claims in other ways as well. Cast in 1982, it bears the inscription *"Para Las Islas Malvinas"*—a somber reminder of Argentina's failed attempt to wrest the Malvinas, or Falkland Islands, South Georgia, and the South Sandwich Islands from Britain.

Argentina and Chile have been frequent adversaries at home, but their huge and overlapping territorial claims have made them allies within the Antarctic Treaty organization. Issues such as mineral exploitation may loom large in 1991, when under terms of the treaty any voting member may propose a reexamination of its provisions.

THE ANTARCTIC PENINSULA and its island chains have been an international crossroads since 1820, when U. S. sealing skipper Nathaniel Palmer, Britain's Edward Bransfield, and Russian explorer Thaddeus Bellingshausen arrived to claim first sighting of the continent after braving the savage weather of Drake Passage in wooden ships.

Today's mariners are better equipped, but some things haven't changed. When I boarded the U. S. National Science Foundation's chartered research ship *Polar Duke* at Punta Arenas, I found Capt. Henry Flight pondering a satellite weather map that showed a malevolent-looking storm ready to engulf us when we left the shelter of the Beagle Channel.

"No use worrying about it," he said. "We've got to go anyway."

Happily the weather abated, and we sailed calmly onward, our ultimate destination Palmer Station, where the NSF's Division of Polar Programs has supported studies of the region's rich bird and marine life since 1965. There were stops along the way.

We anchored first at Deception Island, where a placid lagoon fills the ten-square-mile caldera left by an ancient volcanic catastrophe. Today a smattering of abandoned buildings and wooden boats line a shore that still steams with volcanic heat.

In 1924 the bay literally boiled, blistering the paint on a fleet of factory ships used to process some of the thousands of whales killed in these waters.

Major eruptions in 1967, 1969, and 1970 destroyed Chilean and British bases here, and some think that volcanic activities could threaten the region again.

"The Bransfield Rift is a very active volcanic zone. It has widened about four centimeters in the past eight years, and recent seismic activity tells us the magma is welling up," I was told by Oscar Gonzalez-Ferran, a Chilean volcanologist from the University of Chile in Santiago.

"The type of magma we see here creates a fairly quiet eruption above ground, since it is highly fluid and has time to cool to crystals when it contacts air. But on the seafloor it reacts instantly with water to produce a tremendous explosion. And there is no reason why it shouldn't happen again.

"I think this danger is real enough that the treaty nations should think about setting up emergency evacuation plans for scientists and tourists, both along the rift and in the very active zone around Mount Erebus in the Ross Sea as well."

OUR NEXT STOP was a rocky shore called Copacabana Beach at the south tip of King George Island. There I met Wayne and Susan Trivelpiece of the Point Reyes Bird Observatory in California, who have been studying penguins here since 1976. Their work has now become part of a major effort to understand the unique Antarctic food chain.

Microscopic plants called phytoplankton bloom in the ocean each spring, nourishing vast swarms of the shrimplike crustaceans called krill that form the main food for many of the continent's creatures. Commercial krill catches now approach 500,000 tons a year, and scientists are concerned about the effects of heightened levels of ultraviolet radiation on phytoplankton.

"So far we have no way to measure the volume of krill swarms accurately. Estimates have been off by orders of magnitude," Wayne told me. "So we are working to use the year-to-year health of penguin colonies as a way of estimating the stocks of krill.

"Penguins really do have personalities, but you wouldn't want one as a pet," he said, as we climbed a snowy hillside covered with the curving tracks of tobogganing Adélies. Beyond, braying and wheezing and squawking, and exuding a truly cosmic smell of guano, was a colony in the midst of nesting season.

"All the Adélies we see at the moment are

WILLIAM J. ZINSMEISTER

SEYMOUR ISLAND

Proof of warmer days

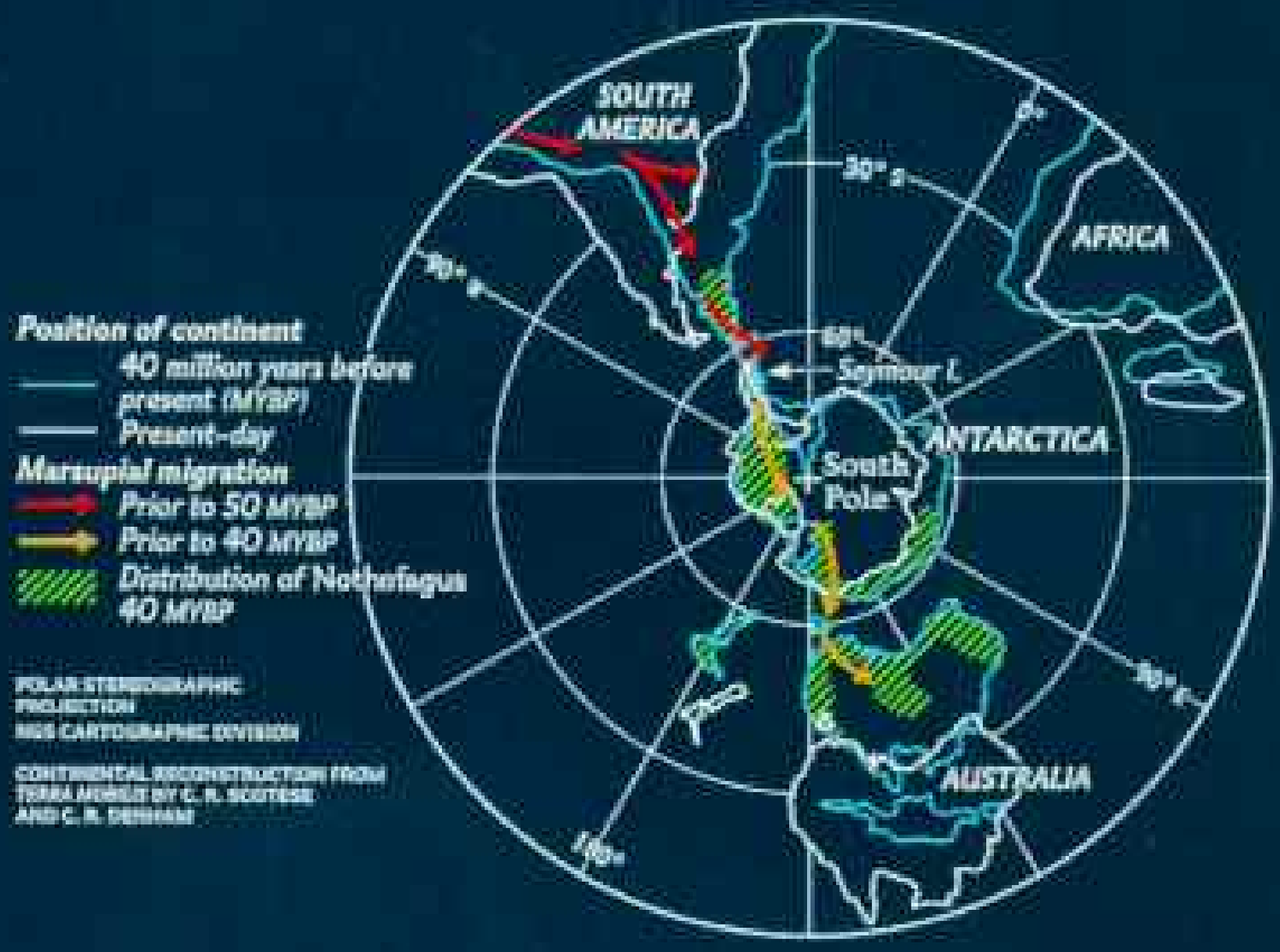
IT IS HARD to imagine Antarctica covered with dense forests, but scientists studying fossil beds on Seymour Island (above) have found evidence that plant life once thrived here in a moist, temperate climate.

Further discoveries came in 1981, when paleontologists unearthed the fossil jawbone (right) of a primitive marsupial that lived about 40 million years ago, when global temperatures were much warmer than today. Named *Antarctodolops dailyi*, the foot-long mammal (right) supports the theory that marsupials migrated from origins in the Americas and Antarctica to Australia, along a continual landmass that spanned the Southern Hemisphere (following pages).

DRAWING BY WILLIAM H. BOND; PRINCIPAL CONSULTANT: MICHAEL O. WOODBURNE, UNIVERSITY OF CALIFORNIA, RIVERSIDE; JAWBONE PHOTOGRAPH BY MICHAEL O. WOODBURNE

LAST of the ammonites may have postponed the inevitable in Antarctica, say scientists studying fossil-rich strata on Seymour Island. Conventional wisdom holds that these mollusks were wiped out with dinosaurs during the mass extinction that ended the Cretaceous period. Yet on Seymour Island paleontologists have found fossilized mollusks—including the ammonite species *Maorites densicostatus* (above)—that appear to have briefly survived the cataclysm. If extinctions were triggered, as many believe, by sky-darkening particles injected into the atmosphere by an asteroid impact, the South Pole's circular winds may have shielded Antarctic species.

TORNBERG P. DICKINSON, COMSTOCK (LEFT); MARK STEPHENSON, WEST LIGHT (ABOVE)



Missing link for paleobotanists, a Nothofagus leaf fossil from Seymour Island suggests that this beech, still found in South America and Australia, spread across Antarctica before the continents drifted apart.

BILL BALLENBERG

ANOTHER near survivor of the Cretaceous extinction was one of the ammonites' favorite foods—the lobster *Hoploparia stokesi* (above), its fossilized form preserved in Seymour Island sediments. In the relatively warm Antarctic seas of 65 million years ago dwelt another invertebrate—a newly discovered species (as yet unnamed) of sea urchin (right), also unearthed from Seymour's fossil beds.

MARK STEPHENSON

GEORGE F. MOBLEY (ABOVE AND RIGHT); ANN HAWTHORNE, BLACK STAR (BELOW)

females," Wayne told me. "The males have just been relieved from a two-week stint of egg sitting and are off feeding. They'll be back to relieve the females in about ten days. After hatching, this changing of the guard goes on for about three weeks, but then the chicks' appetites grow so enormous that both parents must hunt food for them."

Unguarded chicks are prey to pairs of skuas, large predatory seabirds that aggressively patrol territories that include about a thousand pairs of penguins.

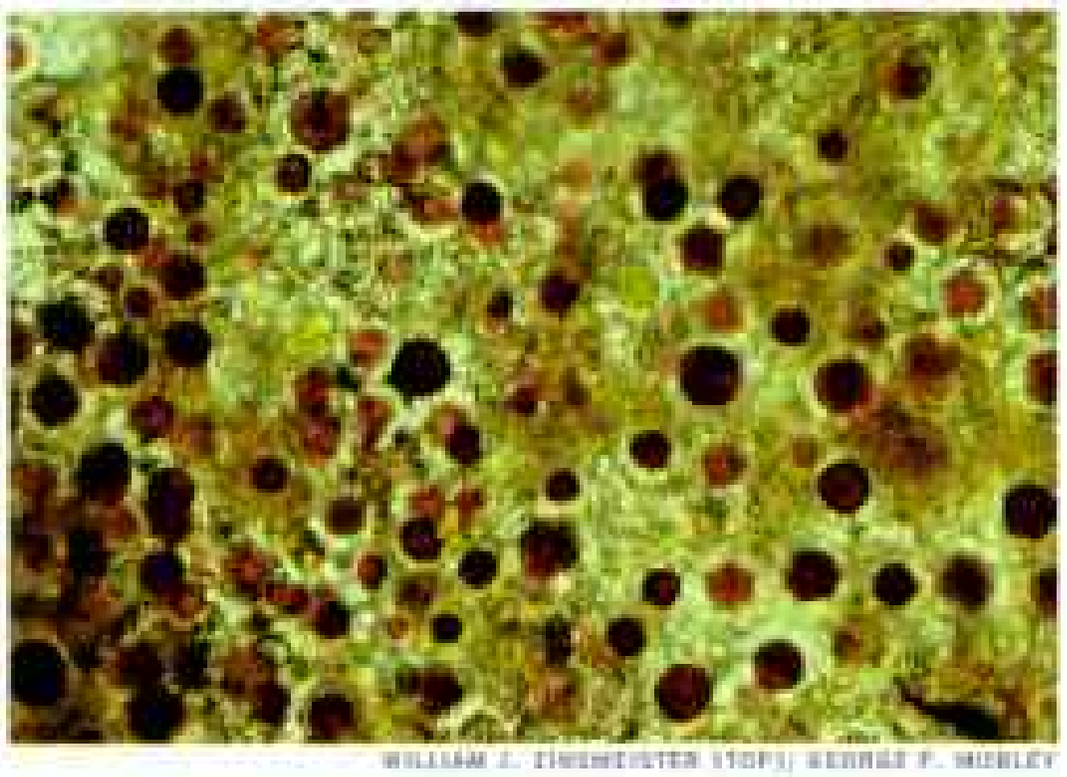
Copacabana's colonies include about 8,000 pairs of Adélies, 2,000 pairs of gentoos, and about 300 pairs of chinstraps. All eat krill, but recently, by attaching radios, it was found that gentoos dive deep to feed, while the others feed at shallower levels.

"Bird populations can change radically from season to season, and we don't always know why," Wayne said. "The colonies here and at South Georgia were severely affected in 1982 and 1983 by a widespread krill shortage. But overall the population has been growing. Chinstraps have tripled in the last decade, and gentoos doubled. That's an encouraging sign."

Yet he cautioned: "Never before has our knowledge about Antarctica been in such a state of flux. Estimates for crabeater seals have just been revised from 30 million to 8 million, based on more sophisticated observation techniques."

Stark white lobe of a glacier advances across the dry valleys region, so called because of the scarcity of snow. The courses of intersecting glaciers—created at different times—resulted in a hanging valley (right).

Lichens and bacteria live even within frozen rock. Temperature and moisture levels sensed by probes (below) are beamed to a satellite and relayed for monitoring.



WILLIAM J. ZIMMERMAN (TOP); GEORGE F. MOBLEY

Overwhelming feature of Antarctica, ice covers 98 percent of the land and much of the surrounding water, where it fluctuates with the seasons. Ice appears in a dizzying array of forms, and its weight is so crushing that it has depressed bedrock 2,000 to 3,000 feet.

But ice does not preclude life. In the South Orkney Islands, British geologist Mike Thomson walks an ice field stained by algae. Internal pigments cause a reddish hue (above).

Small forms of plant life called phytoplankton abound in the ocean—even on the bottom surfaces of sea ice. Scientists study these tiny barometers to gauge the impact of pollutants and global climate changes.

LEAVING COPACABANA BEACH, the *Polar Duke* passes through several miles of heavy pack ice, which makes the hull shudder and echo like a drum. Overturned ice floes reveal muddy-looking bottoms—phytoplankton, the base of the ocean food chain, explains Robin Ross of the University of California's Marine Science Institute at Santa Barbara, who has been studying krill at Palmer Station for eight seasons with her husband, Langdon Quetin.

"What we've learned suggests that the life span of krill is more like six or seven years, not three years as was previously thought. And they usually reproduce beginning in the third summer. In Bransfield Strait and the South Shetland region krill lay their eggs between mid-December and early March. The eggs sink to between 600 and 1,200 meters before hatching, then the larvae ascend through the water column to begin maturing."

In recent years scientists also have learned that unpredictable ocean currents can move krill swarms far out of reach of bird colonies. In the 1983-84 season ten research ships in Bransfield Strait found no concentrations of krill, while in nearby Gerlache Strait Langdon found krill in abundance.

One astonishing discovery was that adult krill can go without food for as long as a year and survive, larvae as long as two months without nourishment—a necessary defense against seasons in which phytoplankton are scarce or hard to find.*

Like land plants, phytoplankton use sunlight to produce food by photosynthesis, utilizing carbon dioxide and such primary nutrients from the sea as nitrogen and phosphorus, plus trace elements. Lately the threat of increased ultraviolet radiation pouring through the ozone "hole" over Antarctica has made the question of the effect on phytoplankton an urgent one.

Deneb Karentz, a marine biologist at the University of California at San Francisco, places a small dish of seawater beneath a 50-power stereo microscope and introduces me to this wondrous garden of the sea. I see a brilliant three-dimensional universe crowded with exquisite translucent organisms. Some phytoplankton glitter like jade. Others are brown. There are cone-shaped objects seemingly made of glass, propelling themselves by flicking diaphanous filaments.

*See "Krill—Untapped Bounty From the Sea?" by William M. Hamner, GEOGRAPHIC, May 1984.

CHRISTIANA P. CARVALHO (TOP); BEN OSBORNE

Congregations of chinstrap penguins cover hillocks on Deception Island, their guano fertilizing a carpet of algae. Beside a moss-covered rock in the Terra Firma Islands appear growths of Antarctica's only two flowering plants (above). Long blades of Deschampsia *sprout at upper left and at lower right, next to a patch of tufted* Colobanthus.

Multiple factors conspire against plant life: the seasonal cycle of darkness and light, temperatures that hold nearly all moisture hostage as ice, the scouring of wind-driven snow. Plant fossils in Antarctica suggest that it once was part of a supercontinent that included Australia, South America, India, and Africa.

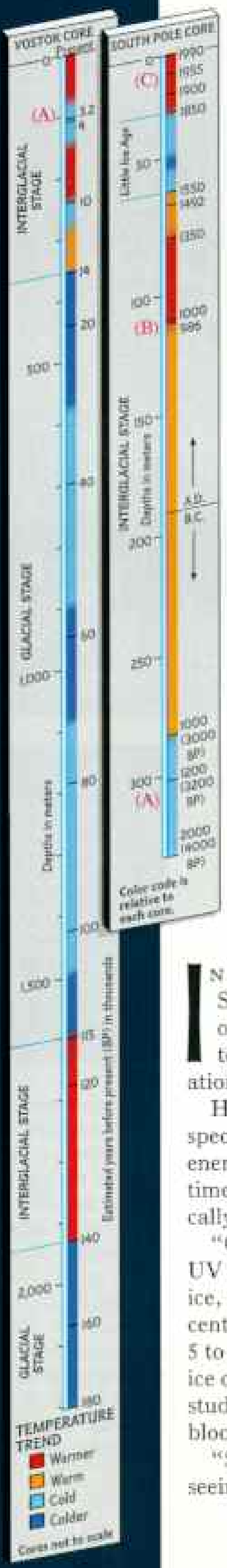
Wresting history from the ice

DRILLING DEEP into the ice surface of Antarctica gives climatologists a kind of frozen printout of past global weather conditions and cataclysmic events that affected the atmosphere. Measuring 7.6 centimeters across, an ice core emerges from a drilling pipe on the Ross Ice Shelf (below).

By studying a core's composition, scientists can measure the level of particles such as ash and dust as well as estimate the air temperature at the time the ice was formed. Time-and-depth chart (right) reflects samples from the South Pole, where snow accumulation is scant. With deeper drilling and even less annual snowfall, samples at the U.S.S.R.'s Vostok base span a longer period.

The samples recorded such incidents as a volcanic eruption some 3,200 years ago (A), a global warming trend that corresponded to the Vikings' settlement of Greenland (B) before the Little Ice Age froze them out, and the appearance in 1955 of radioactive fallout from earlier nuclear tests (C).

NGS CARTOGRAPHIC DIVISION
CONSULTANTS: LONNIE G. THOMPSON AND ELLEN MOSLEY-THOMPSON, BYRD POLAR RESEARCH CENTER.
PHOTOGRAPH BY BRUCE DALE



"The cone-shaped organisms are tintinnids, feeding on bacteria," Deneb says. "The squarish-looking ones are diatoms. Their outer shells are made of silica, so they are really like plants in glass houses. Each one of those is a single cell, and normally they link up to form colonies that look like necklaces. This sample contains about ten species. The species and numbers change continually, decreasing as winter darkness approaches," Deneb tells me.

Her studies at Palmer have convinced her that ultraviolet radiation can harm the organisms. But she also believes that Antarctic phytoplankton have the capacity to adapt to increased amounts of ultraviolet radiation by producing their own sun-block pigments or by using a mechanism that, through exposure to daylight, enables them to repair UV damage.

"Australian researchers are developing a sunscreen preparation for use by humans based on UV-absorbing compounds found in coral. Similar compounds have been found in fungi. And 85 percent of lichens we studied in Antarctica have compounds that absorb radiation in the ultraviolet ranges. But some organisms adapt less efficiently than others, and increased UV will cause significant damage."

IN A SMALL WOODEN HUT above Palmer Station I find Dan Lubin of the University of Chicago, who is running an experiment to measure the amount of ultraviolet radiation falling on Antarctica.

His instrument separates UV light into a spectrum from which the amount of solar energy can be measured one wavelength at a time. These readings are recorded automatically every hour by computer.

"Ozone is not the only thing that affects UV reaching the ground," he said. "Glacial ice, for instance, reflects as much as 95 percent of UV back to the sky. The ocean reflects 5 to 30 percent, depending on the amount of ice cover. One of the important goals of this study is to determine to what extent clouds block UV.

"So far it appears that organisms are seeing in October the ultraviolet levels that

National Geographic, April 1990

they would normally get in December—meaning that their summer has become two months longer."

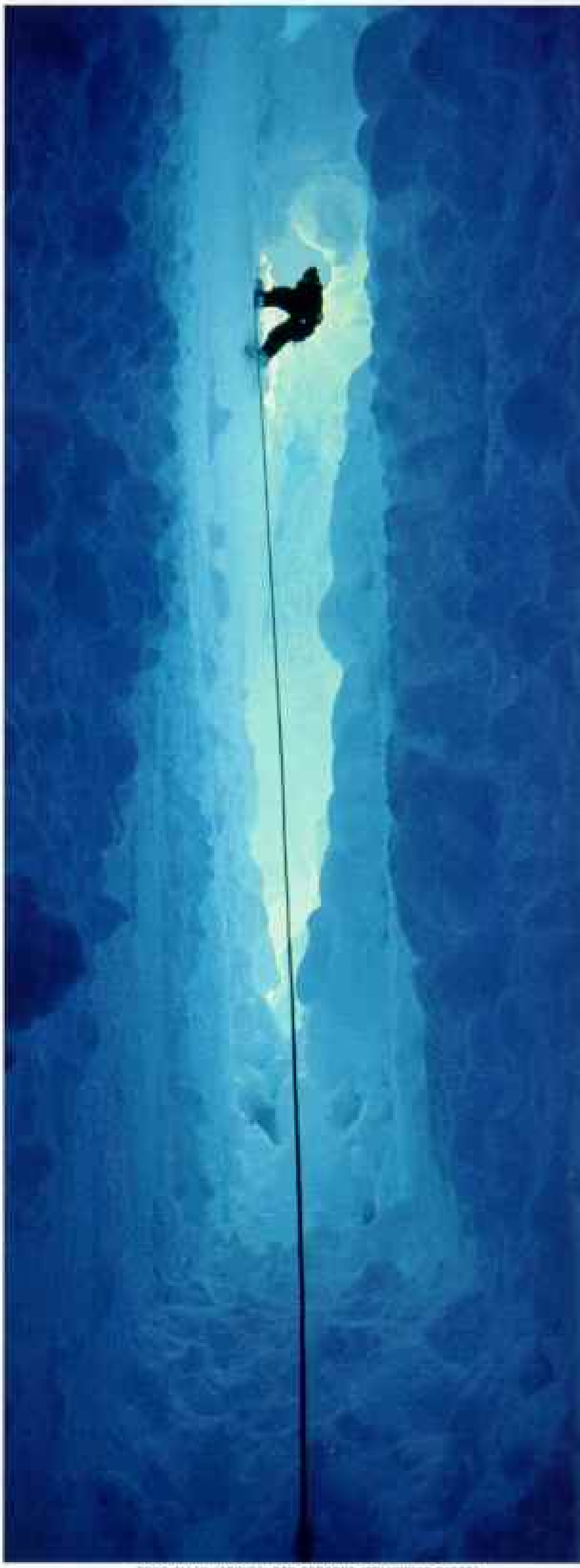
MOST STUDIES of heightened UV effects on sea organisms have used artificial light. Conditions in the real world are radically different. Aboard the *Polar Duke* I watch Osmund "Ozzie" Holm-Hansen and Greg Mitchell, of the University of California's Scripps Institution of Oceanography, lower a module carrying remote-controlled sampling bottles and light-sensing instruments into the heaving waters of Gerlache Strait.

Racing clouds laced with snow make it seem impossible that sunlight could penetrate the gray and inimical sea. But on the computer screen, wavering lines trace instrument readings that show red light penetrating only 10 to 20 meters, blue as deep as 90 meters. Ultraviolet is undetectable at 20 meters.

"Physics drives biology here, as far as we're concerned," Greg says. "Temperature, salinity, light—they all determine whether the phytoplankton make a good living, a bad living, or no living at all."

When the module is recovered, Ozzie places water samples in fragile transparent containers and injects them with radioactive carbon dioxide. These containers, secured on racks attached to a large buoy, are allowed to drift for several hours. Phytoplankton in each sample proceed with photosynthesis as if they hadn't been disturbed.

Late at night, while Greg's plotter cranks out graphic displays of his readings, Ozzie analyzes the water samples. It's a painstaking process of filtering out the phytoplankton and using a scintillation counter to determine the



Plumbing the depths, a scientist from Britain's Halley Station lowers himself into a crevasse on the Brunt Ice Shelf. Despite the obvious danger they pose for researchers, crevasses serve science—their walls contain climatological data similar to that in ice cores.

FOLLOWING PAGES

Towering from the sea, a strikingly marked iceberg dwarfs a research vessel off the Antarctic Peninsula. Scientists theorize that the dark stripes are layers of volcanic ash.

DOUG ALLAN (ABOVE); BEN OSBORNE (FOLLOWING PAGES)

amount of carbon that has been incorporated during the exposure to sunlight. He compares his results with Greg's light profiles for the day.

Photosynthesis rates of phytoplankton in surface waters are reduced by 50 percent by the ambient UV radiation, and by 20 percent at five meters. At 20 meters there is no observable ultraviolet effect.

"These results were obtained in moderately clear water," Ozzie says. In clearer waters the effect of UV radiation would extend to greater depths. When there is a phytoplankton bloom, the water becomes more opaque to light, and the effects of UV light can be detected only to five meters or less."

"Phytoplankton change depth as water layers are mixed by wind and heat," says Greg. "They quickly produce pigments to protect against increased sunlight. We know they also make UV-absorbing compounds, and it's reasonable to hypothesize that these can also limit UV damage. This is an important area for new research."

WHILE PALMER STATION concerns itself with the sun and the sea, I find different priorities 2,400 miles away at McMurdo Station, Antarctic headquarters of the National Science Foundation, which sprawls beneath the fuming peak of Mount Erebus on the shore of the Ross Sea. Here the talk is of what is happening to ice, air, and rock.

"This place isn't static. You've got moving ice, moving rock," I'm told by geophysicist John Behrendt, Antarctic coordinator for the

DOUG ALLAN, OXFORD SCIENTIFIC FILMS

Well known to austral travelers as ship followers, cape pigeons feed in the South Orkneys. The population of this petrel exploded when whaling stations offered abundant offal as food, then dropped as the industry waned.

U. S. Geological Survey. "This is one of the world's great rift systems. There is a thinning earth crust beneath the Ross Sea. We should be having earthquakes, but we're not. Why? Is this related to the weight of the ice? And why do we have a rapid uplift of the Transantarctic Mountains, possibly two kilometers per million years? The conventional wisdom is that East Antarctica is an ancient continental shield, and yet its Gamburtsev Mountains are relatively young. There has been no geologic study of these subglacial mountains."

I ask about the possibility that oil or minerals may be exploited in Antarctica.

"We know there are many minerals. There's a lot of coal in the Transantarctic Mountains. Geologists have found traces of copper, gold, and silver on the Antarctic Peninsula. But these wouldn't be economic even if you found them in Minnesota.

"We still don't know about petroleum. The United States, Brazil, France, Norway, West Germany, Poland, Japan, Australia, the British, Italians, and Soviets have all done seismic research. The Japanese have been surveying for eight or nine years. Only the U. S. and Australia have released hard data, as required by the Antarctic Treaty.

"One thing we're sure of. You'd need a five-to-ten-billion-barrel field, something like Alaska's Prudhoe Bay, to make it pay, even at a price of $70 to $80 a barrel."

UNCERTAINTY plagues scientists about the possible effects of the warming of earth's climate. Glaciologists know that Antarctica's ice sheet, which covers 98 percent of the continent, moves toward the sea in the form of glaciers and ice streams. But they are divided over whether it is shrinking, growing, or remaining in balance.

"We believe that world sea levels are rising as much as six millimeters a year, but this is thought to be caused by a combination of thermal expansion of the water plus a melting of Northern Hemisphere glaciers," I was told by Olav Orheim, head of Antarctic studies for the Norwegian Polar Research Institute.

He will soon be testing the present state of the ice from a new base in Queen Maud Land on the coast.

"We know that ocean currents carry warmer water under the seaward edge of the ice shelf and melt it from the bottom at about three meters each season," Dr. Orheim told me. "Now we will bore through the ice shelf down to water level and place 40 permanent temperature, current, and salinity sensors. Those should tell us whether warming currents we know nothing about are causing melting a hundred kilometers 'inland' from the ice edge.

"As far as Antarctica is concerned, we have no real confidence in today's computer-generated climate models, because none of them can explain how the previous ice age came to an end. Why was the earth 2°C

DOUG ALLAN, OXFORD SCIENTIFIC FILMS (ABOVE); R. W. GILMER (FACING PAGE)

DEREK KARENTZ

GEORGE F. MOBLEY

Life in an ice-cold sea

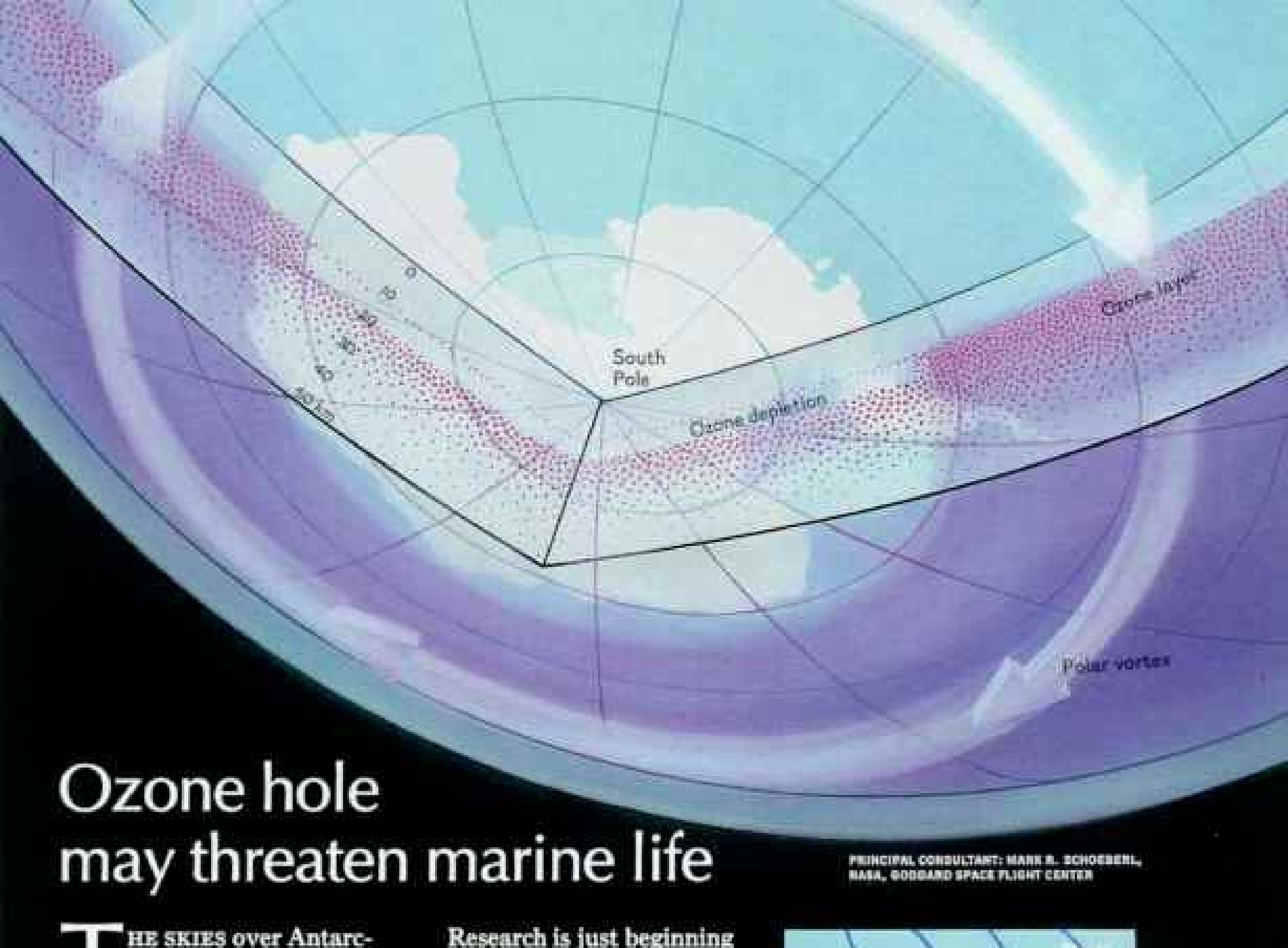
LIVING in a sea growing cold, species in the Antarctic ocean became cold-water experts during the past 20 to 30 million years, as waters went from temperate to about 28°F.

Trematomus (bottom) evolved blood and other body fluids containing a chemical "antifreeze" that keeps the fish from freezing.

Host to tiny amphipods, the jellyfish *Dipulmaris* (right) goes with the flow, filtering Antarctica's oxygen- and nutrient-rich waters for food.

Ice algae (center, left) colonize the underside of sea ice, where krill (center, right) and other organisms graze. And a world of sponges and soft corals can exist under a rock ledge (above), sheltered from the huge blocks of ice that scrape along the sea bottom.

STEPHEN P. ALEXANDER

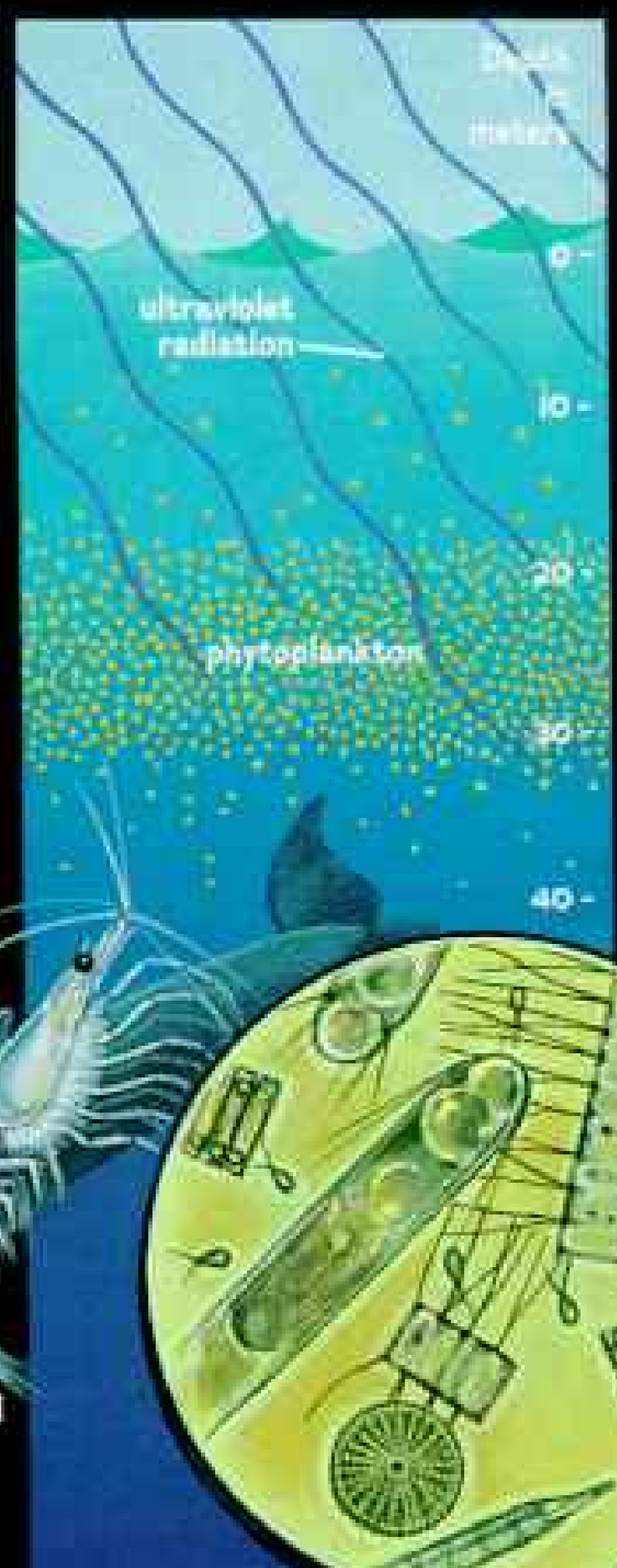


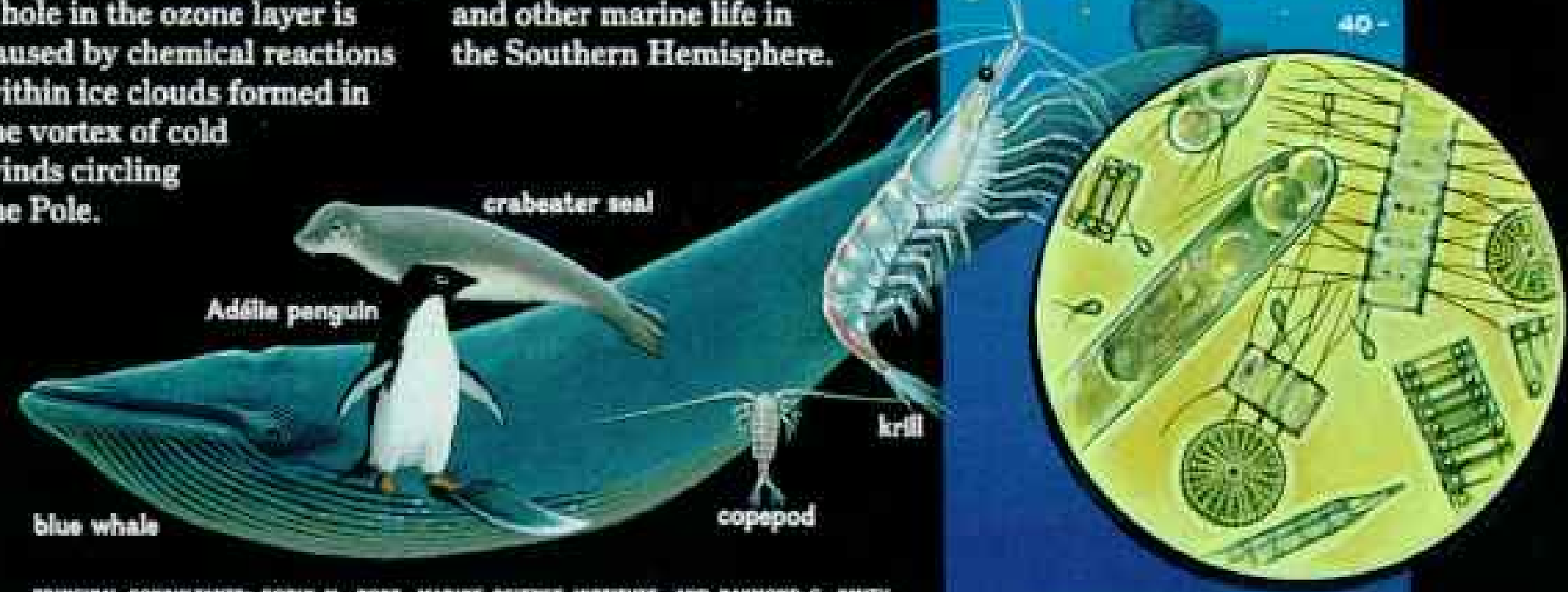
Ozone hole may threaten marine life

PRINCIPAL CONSULTANT: MARK R. SCHOEBERL, NASA, GODDARD SPACE FLIGHT CENTER

THE SKIES over Antarctica may hold ominous clues to the future of life on this planet. There scientists have discovered the most dramatic evidence yet that our atmosphere's ozone layer (diagram above), which protects earth from damaging ultraviolet radiation, is being depleted—partly through chemical reactions with gases released by man-made chemicals. The most severe depletion—about 50 percent of normal levels—occurs in spring over Antarctica, where a hole in the ozone layer is caused by chemical reactions within ice clouds formed in the vortex of cold winds circling the Pole.

Research is just beginning to measure the effects from the subsequent increase in UV radiation. While scientists disagree, some warn that higher levels of harmful UV (besides causing higher rates of skin cancer in humans) can penetrate water to impair or destroy phytoplankton (below right), the microscopic plants that form the foundation of the food chain. A decrease of phytoplankton could in turn endanger copepods and krill, the crustaceans that sustain fish, whales, seals, penguins, and other marine life in the Southern Hemisphere.





PRINCIPAL CONSULTANTS: ROBIN M. ROSS, MARINE SCIENCE INSTITUTE, AND RAYMOND C. SMITH, UNIVERSITY OF CALIFORNIA, SANTA BARBARA

PAINTING BY WILLIAM H. BOND

warmer between 5,000 and 8,000 years ago? There's no answer. And if you can't model the past, you can't model the future."

On Darwin Glacier, 180 miles south of McMurdo, I find the field camp of Donald DePaolo and Scott Borg of the University of California at Berkeley, who are studying the geology of the Transantarctic Mountains to piece together the most ancient history of all.

"We are trying to reconstruct the continents as they were between 750 and 500 million years ago," Dr. DePaolo tells me. "We have been able to establish that the Beardmore terrane—the land underlying the Beardmore Glacier region—was separated from East Antarctica by an ocean some 750 million years ago. We have found rocks of different ages that we think represent the 'docking' of two continental masses."

I fly with Scott Borg by helicopter to Darnell Nunatak, a rock pinnacle that juts above the Byrd Glacier to the south of the camp. Borg gathers several chunks of granite and metamorphic rock, and I ask if he's found any sign of gold.

"This stuff is gold to me," he says. "By analyzing isotopes of lead and other elements, we can learn how and when the rocks were formed. I think this granite will be 500 million years, plus or minus 20 million."

THE BEARDMORE GLACIER descends from the polar plateau for more than a hundred miles, and it was the principal obstacle for explorers climbing from the Ross Ice Shelf toward the South Pole. In privileged comfort I flew up the glacier in a ski-equipped Hercules from McMurdo and landed on the snow runway at the U. S. Amundsen-Scott Station. Its 165-foot-wide dome looks like a prototype for a space station but is actually an aluminum shell, sheltering within it a small village of insulated buildings.

I'm met by station manager Bill Coughran of Bayview, Idaho, in his fourth season at the Pole. He was working as a plumber in Alaska until he answered a classified advertisement placed by ITT Antarctic Services, Inc., which has operated U. S. stations under contract since 1980.

"They look for people from rural or frontier areas, because they tend to be more practical and self-sufficient," he tells me. "Romantic ideas don't make it here. This is not a place to come to escape from something. It is a place to learn new lessons about yourself."

He shows me through a long arched warehouse filled with fuel bladders containing almost a quarter of a million gallons of diesel, flown in at an estimated cost of $12 a gallon.

"In January," he says, "the South Pole is one of the sunniest places on earth. We could save a lot of energy by using solar panels, with possibly a four-year payback."

The first U. S. station, built for the International Geophysical Year of 1957-58, lies buried almost a mile away, carried away from the geographic South Pole by the constantly moving ice sheet. Now the dome of the present facility, completed in 1975, is being slowly buried by snow as well, according to Wayne Tobiasson of the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL), headquartered in Hanover, New Hampshire .

"A large snowdrift has formed on the downwind part of the dome, and its weight has depressed and torn portions of the dome's base. First we've got to remove the snow and jack up and repair the base. After that, we're considering building an artificial snowdrift using lightweight polystyrene foam, shaped aerodynamically to allow real snow to be blown away. That would extend use of the dome for about six more years. Beyond that time, the entire dome would have to be jacked up about 15 feet.

"Instead of placing buildings on the surface of the ice sheet and having them become buried in snow, I favor elevating them on stilts, then lifting or moving them periodically. This system isn't so pretty, but it works."

Transporting materials for a new station would place a great burden on an already strained logistics system that depends on seven aging Hercules LC-130 transports whose heavy skis reduce carrying capacity and aerodynamic efficiency.

Under another ongoing CRREL study, the National Science Foundation is investigating

FOLLOWING PAGES

Gracefully nosing the water, a Bryde's whale prepares to surface for air before diving again. Before all commercial whaling was banned in these waters, more than a million whales were killed.

MOTOI ICHIHARA

the possibility of landing wheeled transports able to carry bigger payloads on areas of relatively smooth snow-free ice near the Pole. From there a tractor train would haul supplies to the station. Test landings using lighter planes have already been made at a site 185 miles away.

As many as a hundred scientists and support workers occupy the South Pole station during summer months. During winter only 20 people inhabit the end of the earth. Among them was Betsy Crozer of Boulder, Colorado, who was operating the station's Clean Air Facility for the National Oceanic and Atmospheric Administration. Its purpose: to monitor the planet's air quality.

"The South Pole has the cleanest air on earth," she told me. "Prevailing winds blow 98 percent of the time from the so-called Clean Air Sector—between 20 degrees west and 110 degrees east—and by the time air reaches us it is well mixed, and we're sure that we're not getting distorted measurements caused by local sources of pollution."

Air-quality monitoring has been going on since 1957 and has found constantly increasing carbon dioxide levels. Recently, a new sophisticated laser device has been installed by the University of Rome to measure the height and thickness of polar stratospheric clouds, which form during winter darkness over Antarctica.

In 1986 scientists discovered that molecules of chlorine compounds adhere to ice crystals in the clouds. This makes possible a catalytic reaction, triggered by the sun's first springtime rays, in which chlorine atoms destroy as much as half the ozone over Antarctica between September and November.

Scientists believe most of the destructive chlorine comes from chlorofluorocarbons, or

Peering from a catcher boat, Japanese crewmen watch for pods of minke whales, which can be legally taken only for research purposes. After a strike, blood stains the water as a whale is drawn in and secured (above right). While the boat moves amid floes of pancake ice (right), three freshly killed minkes await processing by a factory ship. Although the minke remains relatively numerous, most whale species have been seriously depleted.

ALL BY MOTOI ICHIYAMA

RÜDIGER SCHMIDT (TOP); DOUG ALLAN, OXFORD SCIENTIFIC FILMS (ABOVE); STEPHEN A. SMITH (RIGHT)

Doing a slow shuffle, male emperor penguins incubate eggs during the bitter austral winter (top). Nestling a single egg between their feet and bellies, the birds gently jockey for position in the group to keep warm. Emperors are unique among Antarctic penguins, breeding in winter while others breed in spring. After fasting for as long as two months during courtship, the male takes custody of the egg from the female, which must often trek more than 100 miles to find open water to feed.

Sustained for another two months by only its body fat, the male stands vigil until his mate returns at hatching time, ready to feed the chick with regurgitated seafood. The male then leaves, returns with more food, and the shuttle continues. From beneath its parent's skin fold, a two-week-old peers out at its new world (above). Two adults bow over a chick (right), which they recognized was not theirs. The hungry bird continued a raucous search for its parents.

Poised for takeoff, giant petrels prepare to leave their nesting site to scavenge for food. To warn off intruders, the birds can eject their stomach contents several feet. With a history of fouling their own nest, humans could well heed such warnings in Antarctica, where they are still aliens in an often hostile land.

CFCs, which find their way from the industrial areas of the world to the stratosphere and are then carried south over Antarctica, there to be trapped by an annual atmospheric phenomenon called the polar vortex.

While chlorine in the atmosphere was found to have increased by about 10 percent in three years, some scientists thought the change so dramatic that they wondered if other factors might be involved.

One of the scientists is Ray Chuan, of Hanalei, Hawaii, who has been studying the chemical content of particles emitted by Mount Erebus since 1983. In eruptions that year, emissions of hydrogen chloride were calculated to be as great as 1,000 tons a day.

I meet Ray as I board the Hercules for the return flight from the South Pole to McMurdo. He is fitting a specially designed sensor in the emergency hatch over the cockpit. His research method is to have the Herc fly through the Erebus plume several times, a turbulent experience I would rather not repeat.

"This is the first time we've found chlorate particles in the air near Erebus. We want to find out how the hydrogen chloride gas at the crater of the volcano converts to particle form in the chlorate droplets. One object is to see what role the chlorine compounds may play in the ozone question."

One way of tracing emissions from Mount Erebus is through the presence of minute particles of elemental crystalline gold. "This makes Mount Erebus unique," Ray says. "In ten years of studying volcanoes from Alaska to South America, I have never before found gold."

Near McMurdo another search for chemicals is going on in a 16-foot-deep snow pit on the Ross Ice Shelf at Windless Bight. Gisela

JIM SNYDER

Dreschhoff, Edward Zeller, and Claude Laird of the University of Kansas Space Technology Center are analyzing ice cores for nitrates, which are produced largely by solar ionization of upper-atmosphere nitrogen.

The nitrates fall with snow and ice crystals and remain present as snow is compressed year after year to form the Antarctic ice sheet. After studying ice cores taken at the South Pole and the Soviet Union's Vostok base, the researchers were convinced that higher-than-average nitrate levels were indications of episodes of strong solar activity.

To demonstrate the theory, they needed precise correlations of recent nitrate levels with well-known solar flares.

"We chose Windless Bight because it really does have little wind, and snowfalls are less disturbed," Dr. Zeller said. "Our core cuts through snowfalls dating from the late 1920s, averaging about half a meter per year. The annual separations are very clear.

"Now we believe we have established strong nitrate correlations for three known solar events in 1928, 1946, and 1972. This reinforces our belief that there were great solar events at the end of the last ice age, because in the Vostok ice cores we see a substantial nitrate increase during the period when the ice age was ending. Clearly this has implications for climate studies, but the extent to which climate is influenced by solar activity is the subject of great debate."

The importance of nitrates is summarily dismissed by French scientists, who believe that high levels of carbon dioxide found in 180,000-year-old Vostok ice demonstrate that this so-called greenhouse gas trapped solar heat within the atmosphere and helped end the ice age.

I wondered why so much of Antarctic science seemed to produce controversy.

"Well," said Dr. Zeller, "you have to remember that science is done by human beings."

I TAKE THAT THOUGHT with me on a last stroll around the industrial sprawl of McMurdo. I avoid the large junkyard and fuming trash dump, which will soon be gone as part of a new ten-million-dollar cleanup program. The chapel offers cleanup programs of a different sort: a Bible class and an Alcoholics Anonymous session. The noncommissioned officers club has reached a level of activity that might generate candidates for both.

Returning to my borrowed desk in the McMurdo biology lab, I pondered again the meaning of a poster I'd found on the wall: "GREAT GOD—WHAT AN AWFUL RACE," it proclaimed. The sign bore the insignia of an organization campaigning to make Antarctica a world park. Would the authors ban humans, I wondered? Their slogan parodied the bitter words that Robert Falcon Scott scrawled in his journal after reaching the South Pole. "Great God! this is an awful place" he wrote, after finding the footprints of humans who had gone before.

To me Antarctica had become a very human place, whose citizens—scientists and seamen and laborers alike—viewed it not as an icy abstraction but as a fascinating world of living creatures and scientific mysteries. If those citizens were leaving footprints on the path to knowledge, it still seemed possible to believe that the continent might prosper in their hands. □

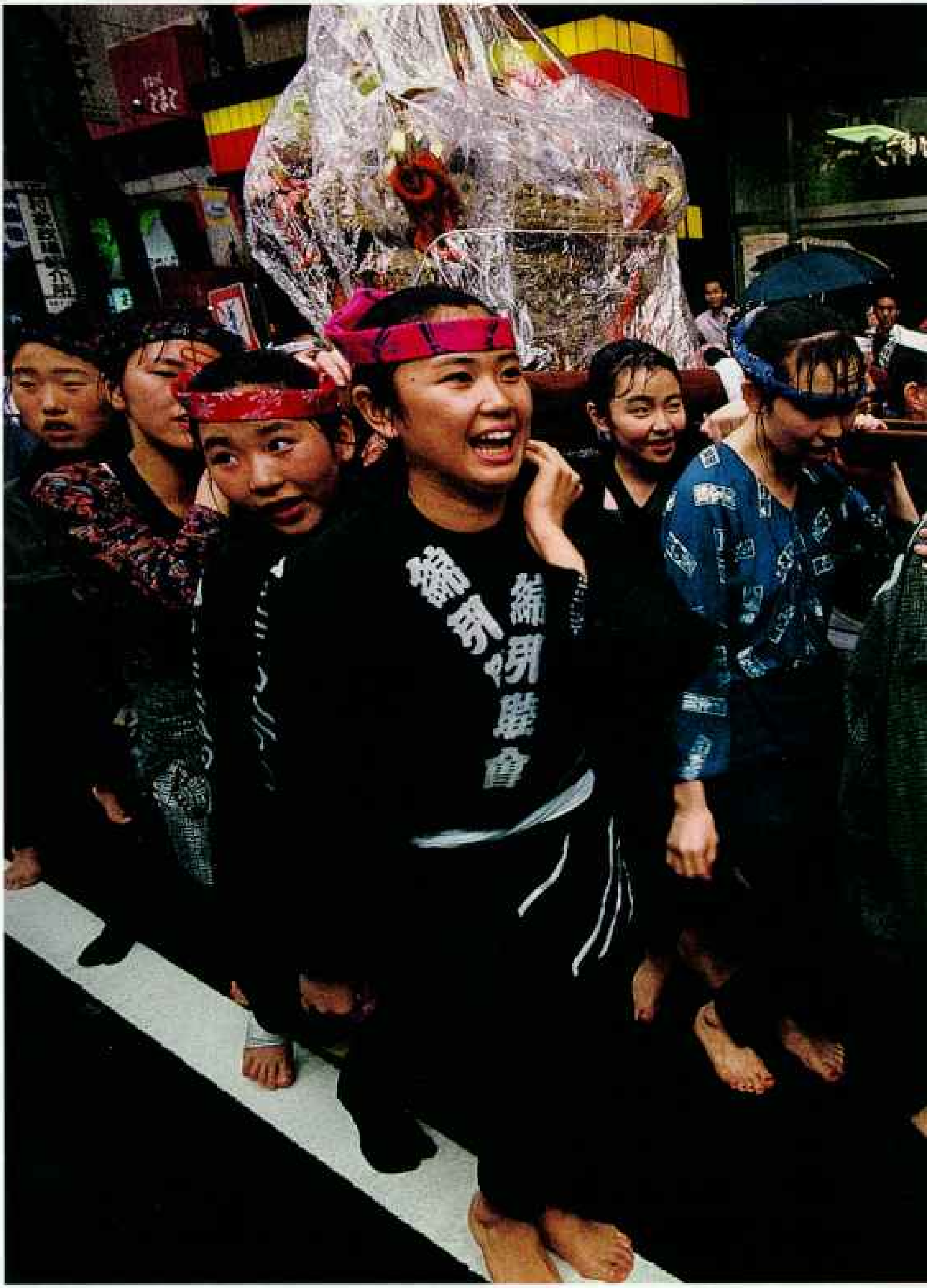
By DEBORAH FALLOWS

Photographs by
KAREN KASMAUSKI

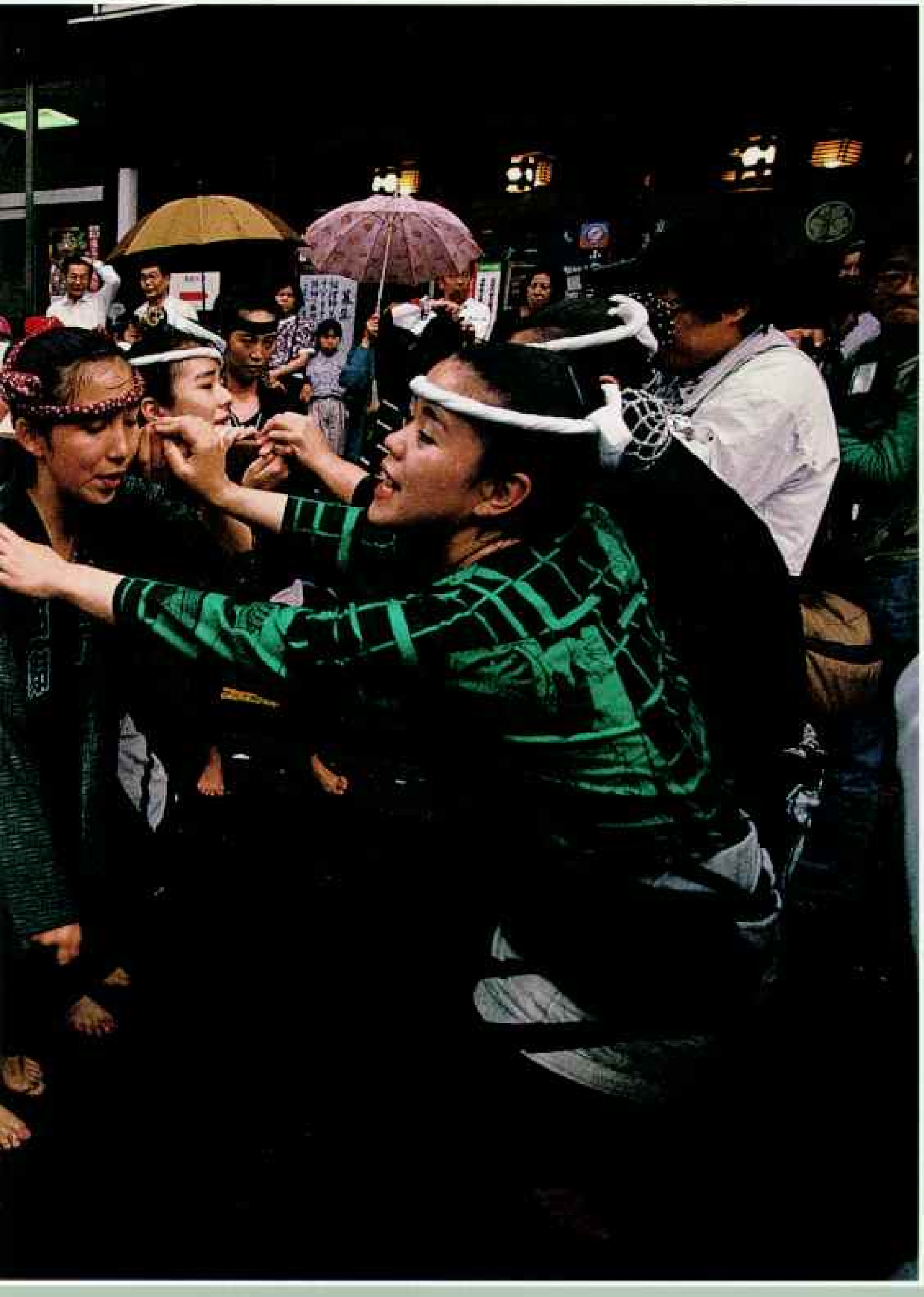
Wrapped in a shimmering white kimono on her wedding day, Tazuko Kojima sits serenely while neighbors take a look at the bride—a custom still honored in rural Japan. In a few minutes she will leave her parents' home for a wedding hall in Kyoto. Though she plans to stay at home as a housewife, some Japanese women are beginning to challenge tradition by taking advantage of opportunities unheard of a generation ago.

JAPANESE

WOMEN



Bent under a burden shouldered only by males until recently, a female festival group parades a *mikoshi*, or sacred palanquin, near



Tokyo's Yushima Tenjin Shrine. The symbolic passenger, a Shinto deity, bestows his blessing as he rides through the neighborhood.

Toeing the line, saleswomen listen to a supervisor's instructions before this Tokyo department store opens in the morning.

The young women probably will quit when they marry. Many older clerks have returned to work after raising their children.

FOR MORE THAN A YEAR I lived with my husband and our two young sons in a neighborhood in Yokohama called Utsukushigaoka, literally "beautiful hills." Our rented house was small but cheerful, with a backyard so tiny our sons trimmed the grass with scissors. Wind gusted up the hills, swirling the leaves off our front walkway. A well-swept walk is a must in suburban Japan, and the wind was a wonderful convenience.

Or so I thought, until the day my kindly neighbor, Mrs. Kamimura, came over to present yet another elaborate dish she'd cooked for us Americans. She casually mentioned that in our absence she had swept the walk. I looked outside—the walk looked the same as usual—and realized with embarrassment that she, not the wind, had been sweeping away the leaves all along.

My neighbor let me know gently and indirectly that she'd been sweeping up after me, but that it was now high time I assumed this chore myself. Because I was a foreigner who could not be expected to know what was expected of me, Kamimura-san had taken it on herself to keep up the standards of the street and also to save face for me. The longer I lived in Japan, the more I realized that Kamimura-san's good deed illustrated a basic truth about Japanese life: the unquestioned and unquestionable duty to do what is expected of you and do it properly.

Foreigners stumble over many mysterious customs in Japan. What is an appropriate gift to present to your new neighbors when you move into the neighborhood? (A small towel.) How do you fill your cup of sake? (Pour the other person's and hope he fills yours.)

These enduring customs are an important reason why postwar Japan runs so smoothly and successfully despite profound political, economic, and social change. Customs also play a fundamental role in binding Japanese women, the sector of society least affected by these changes, to their traditional role as mother-housekeeper-wife. Training for that complex and demanding role begins early.

My best Japanese friend, Keiko Wada, and I took our 12-year-olds, Sachiko and Tommy, shopping for gym clothes at the start of the school year. Tommy went into the changing room, leaving his shoes outside the curtain. When he stepped out and walked over to me to show off his selection, Keiko whispered into Sachiko's ear. Sachiko discreetly retrieved Tommy's shoes and knelt to place them beside him. What was embarrassing for Tommy and surprising to me was perfectly natural for our Japanese friends—Sachiko was a well-brought-up Japanese girl doing the expected thing.

Some Japanese women still help dress their husbands in the morning and routinely serve them the choicest morsels from the family rice pot. And once, on a crowded bullet train out of Yokohama, I watched a harried woman in her 50s rush onto the train weighted down with suitcases, shopping bags, and various parcels. She scrambled to claim the last free

With a good grip on her fork, a woman warrior eats lunch during field training. Female soldiers also learn flower arranging, a traditional bridal skill. Able to enlist as nurses since 1954 and as soldiers since 1967, women account for almost 2 percent of military personnel.

seat. A moment later her husband strolled onto the train, cool and collected, and slipped into the seat his wife had saved for him. While he read the newspaper, she stood in the aisle, bags and purse still dangling, all the way to Kyoto, a two-and-a-half-hour trip.

Like the self-sacrificing wife on the train, Japanese women are expected to do all that they do with patience, selflessness—and, above all, without complaining. Linda Matsui, an American who grew up in Illinois, married a Japanese salaryman (white-collar worker), and has lived in Japan for ten years, told me about her experience of childbirth in a Japanese hospital. "The labor was difficult, and after 12 hours I asked for an anesthetic," Linda said. But her doctor, a man, gave her a scolding instead. "Be quiet and persevere!" he said. In other words, be a woman.

QUIET PERSEVERANCE seems to describe the life of Shizuko Go, author of *Requiem*, a moving and realistic novel based on her experiences as a teenager during wartime incendiary raids on Yokohama. She published her book in 1972, nearly 30 years after the war. A biographical note states, "Marriage and raising two sons postponed her writing debut."

Popular Japanese literature abounds with stories about lengthy, solitary vigils by Japanese women performing their duty of caring for the young, the family, the elderly. Akiko,

Making up 40 percent of the labor force, women work at every corporate level. The unskilled do tedious tasks like processing fish at an Obama factory (right). Planning to get ahead, a woman holds her own during management training near Fujinomiya (above). Junko Yoda, a vice president, has a word with one of her salesmen in the Tokyo office of an American-owned investment bank. Women executives are few but have doubled in number in a decade.

in *The Twilight Years*, by Sawako Ariyoshi, takes care of her aging father-in-law through his senility and physical degeneration while her husband, the old man's son, simply looks on. A character named Tomo, in *The Waiting Years*, by Fumiko Enchi, endures a lifetime of unfaithfulness by her husband, shocking him on her deathbed by demanding that her scorned body be dumped into the sea.

Times are changing for women in Japan, but change is slow. Most Japanese women I know say that they are raising their daughters and sons by the same rules and standards, yet I never saw a Japanese boy do for anyone what Sachiko did for Tommy in that clothing store. In the summer elections of 1989 a record number of women (143) ran for public office, greater numbers of women (65 percent of them) voted than men, and there were more women's issues at the forefront than ever before.

But Hisao Horinouchi, minister of agriculture, forestry, and fisheries in Prime Minister Sousuke Uno's government, seized the occasion to remark that Japan Socialist Party leader Takako Doi (following page) was unfit to lead because she had never been married. In a sign of the times Horinouchi had to

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Popular and powerful as head of the Japan Socialist Party, Takako Doi confers with a colleague in her Tokyo office. A stuffed panda won in a singing contest sits beside her. Doi plays pachinko, *a kind of pinball, with a passion; others among the wealthy and powerful play golf. At a club in Kagawa prefecture, radio-controlled carts on monorails ease the load of caddies, many of whom are farmers' wives.*

apologize. But when Japan's first silver medalist in the 1988 Olympics, a young policewoman who competed in marksmanship, returned in triumph from Seoul, every interview I heard began with the same question: "Now that you've won your medal, when do you think you'll be getting married?"

It was a friendly question. Today as in the past, marriage is the only truly acceptable state of being for any Japanese woman—or man. As a woman approaches *tekireiki,* the "suitable age" to marry (traditionally 23 to 25, now closer to 27), all Japan will help her find the right mate. Large companies often have marriage bureaus to facilitate introductions between single employees. Matchmakers, sometimes professional, often a friend of the family, suggest suitable mates. Parents hire detectives to check out each other's families—they look for assurances of mental and physical well-being, and for signs of shady ancestors.

The Japanese aren't as superstitious as some other Asians, but even for them 1966, the Year of the Fiery Horse in the 60-year Chinese calendar, was considered bad luck. Females born in that year are called man-eating women, *hino-e uma,* literally "fiery horses." So many couples feared bearing a girl in 1966 that the official birthrate plummeted by more than 25 percent.

Many young women enroll in bridal training courses; they work on the tea ceremony or flower arranging—or if they're very modern, driver's education or even word processing. Buffing oneself up to become the ideal *oku-san,* literally "Mrs. Interior," can be, and often is, a full-time job. Fumiyo Arai, a 23-year-old woman who lived around the corner from us, showed up regularly at our door to practice her English on our sons; she loved to play board games with our eight-year-old and would do so by the hour when most Japanese were at work. I asked Fumiyo what she did with her time since quitting her part-time job as a receptionist. She answered, "I'm helping my mother." I was puzzled until I learned that Fumiyo was a *kaji tetsudai,* or "household helper," spending a few quiet years training to be a full-time housewife.

I don't know whether Fumiyo had undertaken any *omiai*—the formal meetings between virtual strangers that precede arranged marriages—but many Japanese marriages are the result of such encounters. Some go through 10 or 12 or 15 omiai without embarrassment. If either party has any objections to the other as a potential spouse, he or she is supposed to speak up quickly. No second date is assumed, but if three or four meetings take place, the couple will likely begin making wedding arrangements.

One woman I met, an English interpreter in her mid-20s who was sophisticated by any standard, called off a courtship after the third meeting. "My suitor was surprised," she told me. "By then he had assumed we'd keep meeting and eventually make it a formal engagement." She was obliged to apologize to the mediator, who had a difficult time convincing the young man's family that it was really over.

SPINSTERHOOD remains a dreaded fate. (An only slightly outdated slang term for an unmarried woman over 25 is "Christmas cake," because the latter drops sharply in value after December 25.) For wedding halls and hotels the Japanese wedding spells big business, as I saw when I visited the Tokyo Hilton's spring wedding show one Sunday afternoon. Engaged couples and their eager mothers turned out by the hundreds in their best clothes, sampling food trays and studying pricey menus. Bedazzled brides-to-be tried on the different costumes that every Japanese bride rents or buys for the greatest occasion of her life. The basic three are the age-old white kimono, the multicolored kimono, and—the favorite of all—the elaborate Western-style dress. This year's in color: fire-engine red.

Western concepts of romance play little or no part in Japanese marriage. An appropriate match of family standing and education comes first, love second. If love develops and grows, that's a bonus. But the life-style of Japanese families hardly encourages love—or even companionship. Men are out on the job from early morning till late at night, and most fathers in our neighborhood were so tired from their weekly schedules that they slept all day Sunday, their only day off.

During our year in Japan I met the husbands of only two of my friends and caught a fleeting glimpse of a third. When my English class, which met in my home, first saw my husband, a writer who often works at home, come downstairs on a Friday morning, they were dumbstruck. What was *he* doing there?

Elaborately choreographed and expensive, a fancy wedding shows off the bride in several sets of finery. Wearing one of five costumes, Tomoko Hashimoto joins her husband, Masahito Tanaka, by the champagne fountain (above) at their wedding in Fukui prefecture.

Tazuko Kojima (pages 52-3) wore her white kimono to the Shinto ceremony. Dressed in a young girl's kimono afterward, she gazes shyly at the groom, Toshikazu Enda (right). In Western dress at the end of the reception, the couple share an emotional moment with their parents.

Although female salespersons sell condoms door-to-door in the most respectable Japanese neighborhoods, my women friends were puzzled when I suggested that more modern methods of family planning existed. Birth-control pills are banned in Japan except for strict medicinal purposes—and my friends didn't know anyone who used them. The youngest and liveliest wife in the group provided a telling insight into the pressures of urban life and the general lack of interest in improved methods of contraception. "After all," she shrugged, "there's so little chance. . . ." It is estimated that there is an abortion for every live birth in this country, and one of the most moving sights in all Japan is the "abortion cemetery," where rows of little stone figures, often dressed in knitted caps and bibs, commemorate infants who were never born.

As an American raised to regard marriage as a union of interests, I was constantly surprised at the way wives led lives separate from their husbands'. One worldly and well-traveled friend whose husband worked in another city for months at a time (a situation so common that there's a special word for it —*tanshin-funin*) claimed she and most others in the same boat didn't really mind. "It's just one less person to arrange my life around," she said.

The baby-sitter is practically unknown in Japan—couples simply don't go out together. Women do. The mothers of my older son's class got together at least four or five times during the school year for potluck dinners,

restaurant lunches, afternoon picnics (with kids)—and even pub crawling. "We went to two or three little places around the neighborhood," a demure mother told me, "and finally sent Nakagawa-sensei [their children's young male teacher] off on the last train out!"

IT IS A COMMONPLACE statement in Japan that the nation's hardworking housewives are its secret weapon, the unrecognized segment of the work force that makes the country so successful, the backbone of the nation that enables its men to perform their economic miracle, and the insurance that the next generation of Japanese will behave in the same hardworking way.

Like women elsewhere, Japanese women clean house, fix meals, do the laundry, shop, and take care of their children. But household help is even rarer in Japan than in the U. S., and for these First World women, in one of the world's richest countries, daily life is laborious. The reason? Customs—again.

The school lunch, *obento*—literally "honorable lunch box"—is extremely important in the lives of most Japanese women. To take a lunch box to school is to take a little bit of mother with you. The standard tricolor obento is packed in a rectangular plastic box about the size of a book. One section may consist of bright, round, firm, fresh peas. Next to the peas rests minced chicken in soy sauce with a tad of sugar. The indispensable ingredient is a field of pure, bright, white rice with a plump, red, pickled plum set in the middle—the inspirational rising sun of Japan.

Our boys attended the public schools, and when Tommy began junior high, the one question posed to me by his homeroom teacher was, "How are you doing with obento, Mrs. Fallows?" Fine, I thought. But my best efforts were apparently not up to par. My friend Keiko gave me illustrated books entitled *Speed Bento,* Volumes I and II. She took me shopping for proper ingredients, and we practiced in my kitchen. When even then Keiko doubted I could pull it off, 12-year-old Sachiko showed up before school at the front door with a sample obento for Tommy.

The ritual of doing laundry is as important as the ritual of making lunches. First thing every morning, clothing flutters like family standards from balconies and windows; I could look outside and see who was out of town, who had slept late, or who was simply lazy that morning and hadn't gotten to the dirty clothes. On sunny days every *futon* is draped over a railing, a fence, or even the family car.

The mythological mother of Japan, the

Like an exquisite antique, a geisha in training poses for tourists in a Kyoto hotel. Skilled in age-old arts, geisha sell their image now that few men can afford to hire them for parties. In Hiroshima a bar hostess loosens up businessmen over drinks.

Shinto sun goddess Amaterasu, is said to frown on clothes not dried in the sun, and I didn't meet anyone who owned a dryer. On rainy days everyone resorts to hanging damp laundry inside, all around the tiny living quarters, in doorways, from jury-rigged laundry lines, from ceiling hooks.

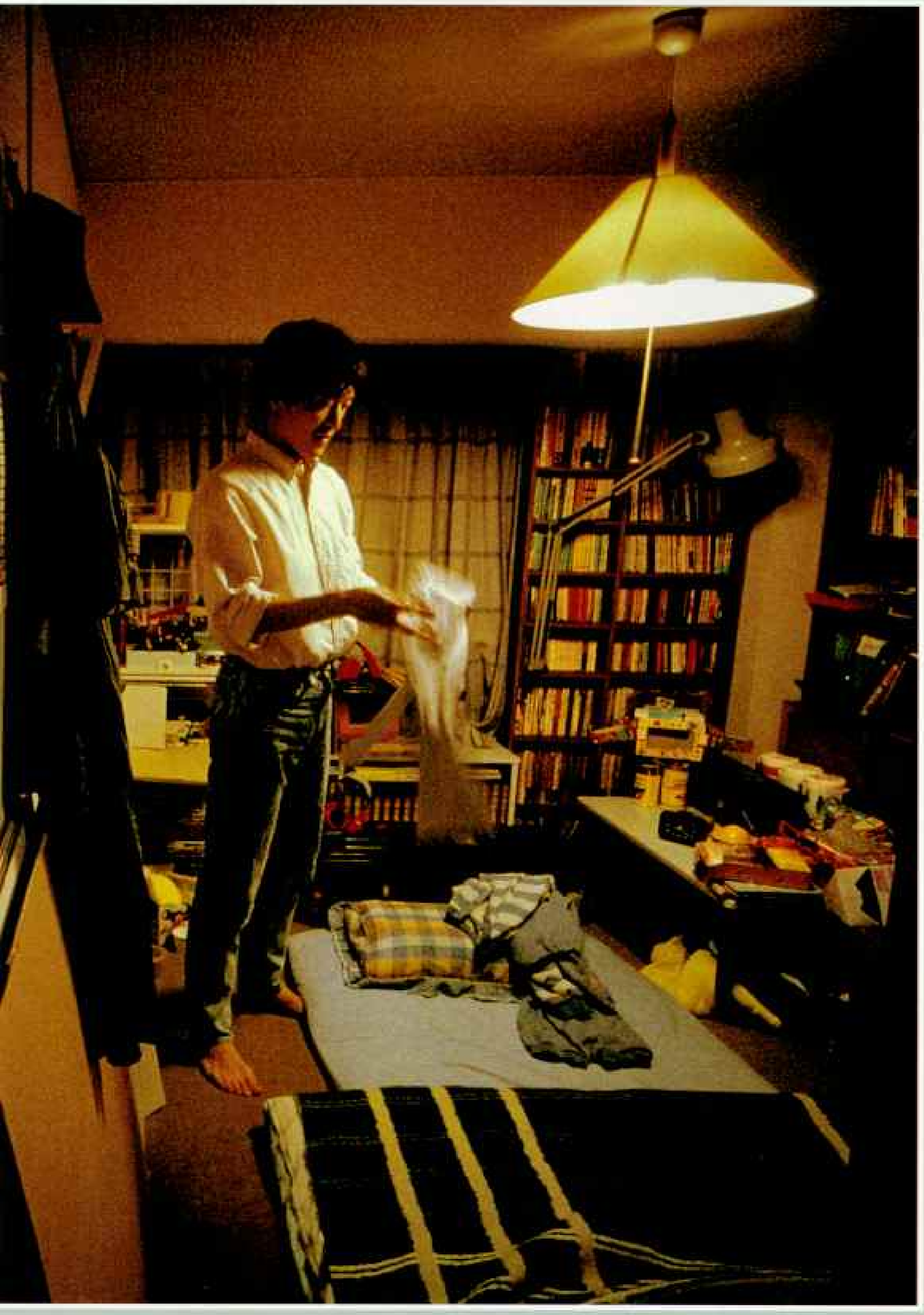
Many women do their grocery shopping daily because it has to be done on foot, and most kitchens are too small to store much. At first I resisted this Japanese way of doing things. We bought an old car, mostly so I could shop. But then I discovered that the only store with an adequate parking lot had put it on the roof, and the only way to the roof was an awkward combination of escalators and stairs, bags in hand.

I gave up and slowly grew accustomed to joining my neighbors in the daily search for that extra-fresh vegetable, or perhaps a packet of tofu or a bit of fresh squid or salmon at an end-of-the-day sale. I knew that every Thursday at five o'clock I'd meet the woman with the new baby waiting for the drive-by fishmonger, or every Sunday between nine and ten I'd be ready like the rest of our block to trade my old newspapers for rolls of toilet paper from the man in the pickup truck.

And I looked forward to the spirited music issuing from the loudspeakers of the trash trucks late mornings three times a week, confident that my trash was as neatly bagged and tied as any other housewife's. As I set about my last task of the night, preparing the next morning's rice in the automatic cooker, I thought of the millions of women around Japan doing exactly the same thing.

JAPANESE MOTHERS are devoted companions to their babies. When I walked my boys to school in the mornings, I would see legions of young mothers hanging laundry on their balconies or bent over their kitchen sinks, always with babies bound to their backs. They never left them and would even lie down and nap next to them during the day. Not until Japanese children start school do they move out of their parents' bedrooms.

A later and *(Continued on page 74)*



Three small rooms house Noriko's family. A teacher like her husband, she has her hands full at home with two sons, six-month-old Daisuke and five-year-old Kota (below). While she serves dinner, Takashi minds the baby (above). Noriko will sleep with the boys until they are older.

A wife works to have it all

Home on maternity leave, Noriko Shoji hangs up the wash on the balcony of her seventh-floor Tokyo flat. She is luckier than most working wives and mothers. When she returns to work, her husband, Takashi, will take over this chore. His job as a high school math teacher, half an hour away by car, gets him home by 7 p.m., so he can see more of his family. Most businessmen routinely work late hours and have long commutes. Noriko believes that young men are trying to do more than their fathers did around the house, but finding the time is difficult.

Music makes the front row mischievous in Noriko's kindergarten class. Noriko's interest in early childhood development led her to this traditional women's career. When school lets out a little after 4 p.m., she picks up her sons from a day-care center. Putting the baby on her back (right), she takes the boys on her errands. Like almost all Japanese housewives, she buys fresh groceries every day (bottom right). Home by 5:30, she does housework, plays with the children, and has dinner ready by the time Takashi walks in the door.


500

Bowed in prayer, a Buddhist priest in Kyoto conducts a service for mizugo*—aborted, miscarried, or stillborn infants. Bright pinwheels offer comfort to their spirits. Statues donated by women after an abortion assuage their sorrow. In Kamakura (below) women have outfitted the statues as children.*

(Continued from page 67)

inspiring stage of attentive mother is the *kyoiku mama*, or education mama. Mothers consider their children's studies so important—every opportunity in Japan depends on education and exams—that they'll do anything to encourage them. At a Yokohama department store I inspected the ultimate in student desks that kyoiku mamas can buy for their children. Its most noticeable feature is a call button connected to the kitchen. A hungry—and spoiled—student can buzz his mom to bring him a snack or some sharpened pencils.

Japanese women are quick to point out that they do far more than sweep, scrub, cook, and tend their children. They also manage family finances, make housing and schooling decisions, and handle almost all major household purchases. Half the women I met admitted (with a trace of condescension that creeps into many discussions about their husbands or men in general) that their grip on the family purse strings included doling out a strictly controlled allowance to their salarymen for walking-around money.

The force behind the women's movement in the West—the search for self-expression and satisfaction—doesn't appeal much to Japanese women; in their country every man, woman, and child is expected to consider the well-being of the group before his or her own self-interest. This custom may be the most important and pervasive one in Japanese life.

Keiko introduced me to a friend of hers, Takako Hasegawa, who, along with three other middle-aged mothers, had started a very successful company called MaMa. MaMa trains older women to work as mother's helpers for the new generation of

mothers. Nowadays many young couples move away from their hometowns for career reasons, and grandmothers are no longer able to help out when new babies come, so the idea caught on.

"What about the satisfaction of starting a successful company?" I asked Hasegawa-san. "Do you feel proud of what you've achieved?" She hesitated, then replied shyly and politely, "Yes, we are quite proud of what we have done." But she was clearly puzzled by this strange turn in the conversation. Later Keiko explained why. "Japanese women consider Western women and their search for self-fulfillment to be rather *wagamama*," she said. "Selfish."

Women have always worked in Japan, many of them at hard manual labor—in rice fields, farms, and fisheries—and others in the same few occupations, on factory lines or as nurses or teachers. Now some women are venturing out in new directions: Housewives are taking part-time jobs; university graduates are breaking into fast-track lanes. Individualists, always rare in Japan regardless of gender, are becoming "firsts"—first woman skipper, soldier, bank manager.

Tsuneko Ikeda, 47, falls into the traditional mold of Japanese working women. She has worked in her family's tea-processing business in Shizuoka, southwest of Tokyo, for 26 years—ever since she married her husband, Seiji, at 21 and moved in with his family, as is the custom. The small family shop was a bit chilly on the rainy April day when I visited her. Like many encounters in Japan, this one started rather formally. Ikeda-san offered green tea while her husband stood by, a little nervous but eager to answer questions for his wife or to speak up for himself.

Ikeda-san and her mother-in-law shared the work of raising the couple's three children, tending the home, and running the business. Over the years, as her husband's parents grew older, the burden of responsibility shifted increasingly to Ikeda-san. She does all the bookkeeping, using a traditional abacus or a simple electric adding machine. During tea season she rises at 4 a.m. to boil water for the buyers who drive down early from Tokyo to sample tea and place their orders. She works throughout the day, running upstairs during lulls to clean the rooms or prepare the family's meals. Her husband calls her "*arumaiti*—almighty."

Ikeda-san's sense of self-confidence surely comes from all she has accomplished. "I felt I could do it, and I did it," she says.

Women in managerial positions still number only 160,000, about one percent of all working women. Those few women who have "made it" tend to be feminine—that is, humble—about their success. They resist calling themselves role models and offer little encouragement to young women starting out. Patience is still the key word.

Sadae Ishida is one of the real success stories at the Matsushita (Panasonic) plant outside Osaka. She came looking for a job in 1965, a fresh junior high school graduate—"golden eggs" as they were called—because her parents couldn't afford the school fees for her to continue. Today, at 39, she is the first woman subsection chief, or *kancho*, in the factory, a position she said she resisted accepting for a while. "I felt I would rather train men to be hanchos than be one myself," Ishida-san explained.

Ishida-san is a model Japanese worker. She's up at 5 a.m., arrives at the plant at 6:30, reads in her car while waiting for the plant gate to open at 7. Then, like all Matsushita employees, many managers included, she changes into her company uniform of blue overalls. After most of her co-workers leave at 5 p.m., Ishida-san stays on to wind down her day with cleaning, reviewing the day's work, and sometimes meeting with her work group. She finally heads home about 7:30.

Ishida-san—unmarried, with a 25-year career, self-made—is an exception to the usual profile of women factory workers. Typically they are high school graduates who work for five or six years until they leave to marry. Nowadays more are middle-aged housewives returning to temporary and part-time work.

The new part-time workers, like those at Matsushita, have become part of the largest group of working women in Japan. But, for most, jobs are as low paying and unpromising as the ones they held before they quit to have their children—frying burgers at McDonald's, ringing up groceries at supermarkets, or marching door-to-door selling cosmetics. Yet when the Isetan department store advertised for 300 *paato*, or part-timers, 2,000 hopeful women turned up.

Often these women work as many as 40

hours a week, alongside full-time workers of equal experience and training but for wages that average 30 percent less, and with fewer fringe benefits such as health insurance, paid vacations, retirement plans, bonuses, and job security. Because they are repeatedly hired and fired, the slang word for part-timers is "throwaways."

Until a few years ago the largest group of working women in Japan was the young army of office ladies, "OLs," who serve tea, mop up spills, hold doors, handle phone calls, and generally provide a soft, feminine presence for the big companies. Modern pressures have made some companies and some women edgy about the title if not the role of office ladies, and my requests to Mitsui, one of Japan's largest trading companies, to talk with some were met with the explanation that the company no longer employs office ladies. "Women in Japan have more responsibilities now," a Mitsui spokesman explained.

Instead, I interviewed two women in their 20s who were "clerk-secretaries" for the staff of men who deal in fertilizer trading. They weren't serving tea (companies like Mitsui now contract with professional caterers). And they weren't wearing uniforms.

Sachiko Maeda is 26, perky and attractive, well-mannered and sweet. She graduated from Rikkyo Junior College and wrote an essay called "My Dream" to get her position at Mitsui. "I wrote about my wishes to lead a fulfilled life," she said. "I don't want to look back and feel disappointed."

After work Maeda-san often goes to the

This year's fresh faces, future pop stars barely in their teens learn the right moves for a dance routine. Mitsuyo Obara (left, at center), Juri Toyoda, at left, and Tomomi Hoshino were discovered in a national contest sponsored by the Tokyo-based talent agency that will market them. Tomomi takes a voice lesson from Michio Kono (above), one of the teachers grooming the girls to be idoru kashu, or idol singers. Naomi Hosokawa, the agency's debutante last year, performs for fans at a radio station in Niigata (below). Cuter than they are talented, most of Japan's several hundred idol singers fade in a few years.

Rows of solemn faces reflect the importance of the first day of kindergarten. As part of the welcoming ceremonies, these Tokyo students and their mothers sit for a photograph. Mothers participate in many school activities, taking time off work if necessary. Yoshiko Hayakawa, a cultural-events producer for a television network, reassures her son, Shin'ichiro, on his first day of first grade in a Tokyo suburb. Unlike many men, her husband attends most school programs, since she usually cannot.

movies or dinner with friends before heading home to her parents' apartment—unmarried female Mitsui employees are required to live with their parents. When I asked her about her dream for the future, Maeda-san shyly demurred with a typical Japanese response, "*Wakaranai*—I don't know." But then she revealed the homely truth: "I see myself married, at home, with children."

COMBINING A CAREER with marriage is an idea whose time has not quite come in Japan. Few have struck the right combination of family circumstances and professional zeal to "have it all." Sachiyo Suzuki, in her 20s, is a buyer of women's golfwear for the big Mitsukoshi department store, and she's optimistic about her chances. "My future husband is happy I'm working and has said he'd help at home," she told me. "My parents are supportive, and my mother-in-law even offered to cook dinner for us."

My friend Setsuko Yamamoto, the mother of a nine-year-old, is less upbeat. "What happens when a mother-in-law gets tired of cooking, when the husband gets longer working hours, when she gets more responsibility at her job, when they have children?" she asks. "I thought very hard about this myself, but I realized it just wouldn't work."

Some women try nearly a lifetime to make a career work. Keiko Atsumi, who started a successful international financial newsletter five years ago, said it took her three times the effort of any man, plus 20 years of trying, to be accepted by the virtually all-male financial community. Many young women are not willing to wait. They flock instead to American or European companies operating in Japan, which eagerly welcome them. Others gravitate to newer, more flexible specialities—software, consulting, interpreting, the media.

From big companies come many stories about problems professional women still face. Bylines are erased and replaced with names of male colleagues. Meetings are held, but women don't know about them or are not invited to attend; if they do go, they can't speak up. After-hours socializing, when many decisions are made, usually excludes women. Shizu Munekata, a graduate of Georgetown and Stanford Universities who has one foot in Japan and the other in the West, says male colleagues routinely stacked papers on her desk to copy, and if she complained, they complained right back, "You're forgetting your place as a Japanese woman."

And yet when I asked these women if they were angry or resentful about their working climate, Munekata, Atsumi, and others seemed surprised at my question. "I'm grateful that certain jobs are now open to me," said Munekata-san. "I was happy to learn patience and tolerance and a sense of priorities from this," adds Atsumi-san. Munekata-san, like many other hard-driving Japanese women, is more impatient with her own gender than with the system: "Most women have a fantasy about their ambitions," she says. "Everyone I know has ulcers, and most non-working women have no idea about those

realities. It's a lot easier to catch a big fish and stay home all day."

ONE OF THE OLDEST, and certainly the most famous, of female workers in Japan is the geisha. I met Yayoi, an 18-year-old *maiko*, or trainee, in Kyoto, traditional home of the most elegant and talented members of the craft. Yayoi, like many of this vanishing breed, comes from a rural family.

"I dreamed of life as a geisha, but my parents were against it," she told me. But after her parents contacted the local kimono maker, who contacted a kimono maker he knew in Kyoto, who found a teahouse proprietress, or *okami-san*, willing to take Yayoi in and train her, they relented.

On the day I saw Yayoi in the downstairs receiving rooms of the okami-san's elegant house, she was marking the end of two years' training by being fitted with a new kimono. In ordinary clothes she looked and behaved like a tired, grouchy adolescent from any place on earth. The dresser, a seedy gap-toothed man, was there to tighten Yayoi's wide red-and-white-cloth sash, or obi. He teased her, gave her a playful spank, and pulled on the obi with all his might.

The okami-san pinned a new silver hairpin and some bright plastic flowers into Yayoi's lacquered hair. The effect was stunning—white powdered face, rosebud lips, glistening elaborate coiffure, bright kimono. Yayoi was transformed into an elegant figure from another time, another Japan.

Rie Nakano took another path. Now about 40, she grew up on the Izu Peninsula. She liked school and was a good student. Because her parents couldn't afford it, she put herself through college. Nakano-san wanted to go into journalism, but when the newspaper she wanted to work for wasn't hiring that year, she joined a big company instead. Later she switched to a smaller firm, and eventually she decided to try her luck at starting her own film-distribution and publishing company. This made the difference. "Once you're off the beaten path," Nakano-san says, "you can do anything you want."

Nakano-san's office bears the mark of her individuality. It is cluttered and homemade looking, like the office of a small magazine or radio station in the West. All the employees are women, dressed according to all manner of individual taste, rather than in the usual conservative, tailored uniforms. She offers crackers and tea, served in unmatched mugs. In the background a humidifier buzzes on, out of water—forgotten in a society where women never forget such things.

Nakano-san's goal was lofty from the start: to raise consciousness about women's issues. Her self-help books show women how to think about jobs, find vocational schools, locate child care, understand birth control, plan for the elderly, choose recreation, solve legal problems—even challenge pornography, which is everywhere in Japan. On crowded trains, salarymen casually read "sports papers" with blatantly pornographic pictures in them. Even a popular comic book for adolescent boys, *Young Jump*, contains explicit sexual illustrations.

Nakano-san's success has been modest, her best-selling book having sold 10,000 copies since 1986. But she is surviving. And when she digs her fat address book out of her purse and begins jotting down names of friends, you think Japan is fairly bursting with fascinating, strong, independent women.

One is Mariko Nakano, who lives in Kamagasaki, one of Japan's two major slums, with her husband and two children. The slum, outside Osaka, is less shocking than those in most other countries. There's a park with some homeless men, many broken bottles, and the stink of urine. "This is where you feel the real humanity," says Nakano-san. She spends winter nights roaming the streets, carting homeless people to shelters.

Nakano-san lived in the smallest quarters I visited in Japan—three tiny rooms, stacked from floor to ceiling with pots, pans, dishes, books, records, clothes, toys, and a caged rabbit. The only place to sit was on three small cushions around a coffee table. In the bedroom a child played on his bunk bed. There was floor space for an additional mattress. The house has no bathroom; the family uses the public bath down the street.

SOME OF JAPAN'S most interesting women are hidden in the nation's far corners. Makku Uchima, a *noro*, or priestess, of a traditional religion, lives in a wind-swept village on the small island of Kudaka, off the southeast coast of Okinawa.

Tenderly bathing her ailing mother-in-law, 48-year-old Machie Takenaga fulfills her duty as the wife of an oldest son. During a day that stretches from 5 a.m. to after 11 p.m., she looks after a three-generation household—which includes her own oldest son, still unmarried at 28—and works on the family's plum and rice farm in Fukui prefecture. At night she checks on her mother-in-law every two hours. Machie says that she hopes no daughter-in-law will have to care for her when she herself grows old.

Instead of a family, a doll keeps an old woman company at a home for atom bomb survivors in Hiroshima. How to care for the elderly increasingly concerns the world's most rapidly aging country. In 1970 more than 75 percent of older Japanese lived with adult children; today just over 60 percent do. Growing numbers move to retirement and nursing homes.

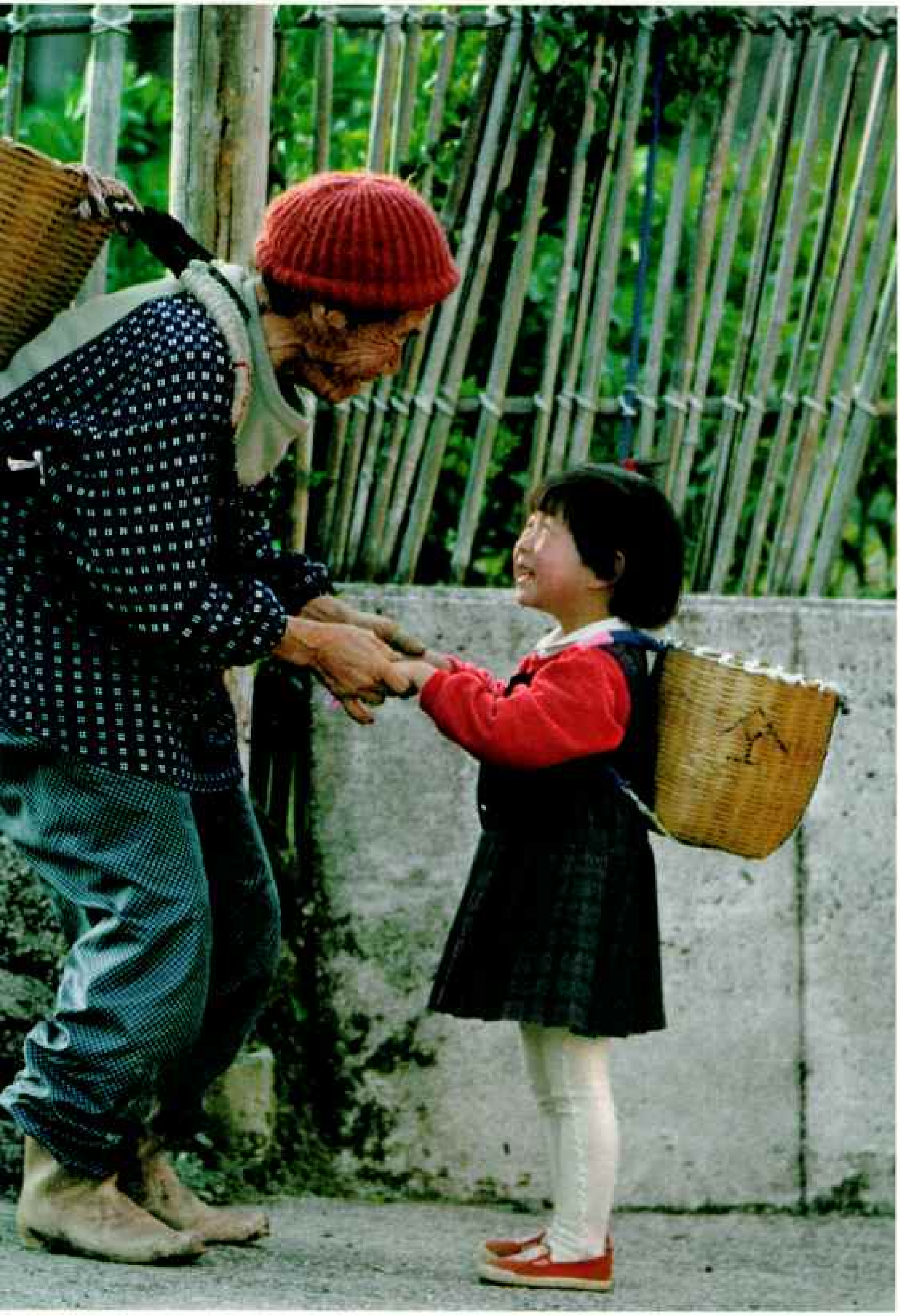
Just for fun Aiya Okada carries a copy of her grandmother's harvest basket. She lives with her brothers, parents, and grandparents on a farm in Chiba prefecture. As an adult she probably will not have this kind of close-knit extended family. Changes in Japanese society and the roles women play promise to make her life different from anything she can yet imagine.

Uchima-san looks every bit the priestess, with filmy gray hair flying about her head and age spots on her fragile-boned face. She has been a priestess since she was 42, she said, when she received a calling. At that time she had been sick, but no doctor could explain her illness. So she went to consult a *yuta*, or shaman, who told her that her ailment must be a sign that she should be a priestess.

Now, several decades later, Uchima-san prays for people, helps with spiritual healing of the sick, and twice a year climbs before daylight to an island hilltop to pray to the goddess of the sea. Fishermen often call on her to guide them on safe and successful ventures. Uchima-san's house is in the elegant traditional Japanese style, with wooden and tatami floors, an ancestral altar, and family treasures. But in the background are her Western-size kitchen appliances in matching shades of avocado.

ONE OF THE LAST WOMEN I met during my year in Japan embodied many of the contradictory elements in the lives of her countrywomen. Nobuko Kayo is a 36-year-old mother of three; we met on Okinawa. She had just been admitted to medical school. As a result, she quickly became a phenomenon, celebrated in the local newspapers.

When I asked her about the response to the articles about her, she admitted modestly that there had been quite a lot. Only that morning she had received five telephone calls from women asking how she did it, how she managed to get into medical school. I took this for a positive sign and wondered if she felt like a role model for women to follow. "Oh no," she said, laughing at my naïveté, "the women weren't calling about themselves, they were calling on behalf of their sons!" □



A Personal Vision of
VANISHING WILDLIFE

One of the cherished illusions of our culture is that animals will always live contentedly in idyllic wilderness. Through television, magazines, books, and calendars we continually feed ourselves scenes of wildlife surrounded by glorious vistas, exquisite plant life, and Technicolor sunsets. Such romantic imagery creates a sense that all is right with the world, that Eden is still out there, that the idyll will exist forever.

As a photographer I am no stranger to that illusion. The reality, in fact, is far different. The shapes and colors of animals' surroundings distract our attention from the beauty of the creatures themselves. I decided to strip away the visual encumbrances that keep us from seeing the full beauty of the animals' form, line, color, and texture. This kind of rendering forces us to confront the animals directly, to see their extraordinary aesthetic properties, and to answer a key question: Are these "objects" of exquisite formal beauty, such as the zoo chimpanzee at right caught in a striking but natural pose, worth saving?

In many cases it is already too late. Humans have actually destroyed much of the world's natural landscape in our relentless search for farmland, living space, wood, and minerals. As a result the age of truly wild animals is nearly over. Unprecedented numbers of mammals, birds, reptiles, and amphibians are facing extinction; more than a thousand species and subspecies are presently considered threatened, and hundreds more are under enough pressure that they need considerable protection. Such animals are the subject of the photographs that follow.

Many of the species that survive this wave of extinction will be quasi-domesticated residents of wildlife preserves, where the

PAN TROGLODYTES

ecosystem will be controlled by humans rather than by the traditional interaction among animals, plants, and earth. Others will be captives, living in the artificial twilight zone of zoos. Their original wildernesses will be reproduced as tiny enclaves landscaped by foam rocks and bounded by walls of iron. Their "home range" will be surrounded by human dwellings or fast-food franchises. Their mates will be chosen by computer selection, and their reproductive acts will take place in petri dishes.

Recognizing this, I have no desire to perpetuate the romantic mirages of traditional wildlife photography. Instead, I have created images of animals in exile from that lost Eden, adrift in the ether of a planet now alien to them. It is a new kind of landscape, one largely devoid of the familiar topography. But it is the place they must now call home.

Some of the photographic techniques I used to symbolize that new landscape were borrowed from contemporary advertising photography, whose contrived "look" is aimed at creating a desire for superfluous goods such as cosmetics, liquor, jewelry, and high-fashion clothing. In a sense the use of those techniques is an ironic commentary on our society, which is so adept at turning the meaningless into the priceless. These photographs thus challenge us to revise our perceptions enough to separate the truly priceless from the meaningless.

The series of photographs took more than two years to make and involved nearly 80,000 miles of travel. Altogether I photographed 233 individual animals representing 96 species. In every case success or failure hung on a single basic question: What photograph was the animal willing to make *with* me? The best images grew out of an emotional exchange between the animal and me, and I often thought of the sessions as collaborative performances.

That is hardly surprising, for humankind does not stand removed from animals and nature—we are an integral part of the vast network of life forces. Because of certain aspects of our cultural heritage we have exiled ourselves mentally from that network at a terrible cost to the animals and to ourselves. Their endangerment and their alienation from their habitat mirror our own; we too are adrift in the ether of alienation.

We are, after all, the descendants of animals, and our identity stems not from our experience *with* animals, but rather from our experience *as* animals. When we look at the images on these pages, we rediscover the fact that animal powers still speak to us. The language is often subtle and varied: Even now, many months after some of these photographs were made, I am not certain exactly what they mean. The giant panda seated center stage in his theater, the elephant drifting through a veil of gauze—each time I look at them they speak to me anew.

Perhaps these images can play a small part in helping us find our way home out of that long exile from nature. But until we become much more skilled at listening to the voices of nature in and around us, all animals—including the one we call human—are in jeopardy. The unspeakable tragedy is that our learning process will be too slow to prevent some of the extraordinary animals on these pages from being among the last survivors of their species.

JAMES BALOG
BLACK STAR

James Balog is an award-winning photographer whose work has been published worldwide. His book, Survivors: A New Vision of Endangered Wildlife, *will be published in September by Harry N. Abrams of New York, and a traveling exhibit will tour the country.*

FLORIDA PANTHER

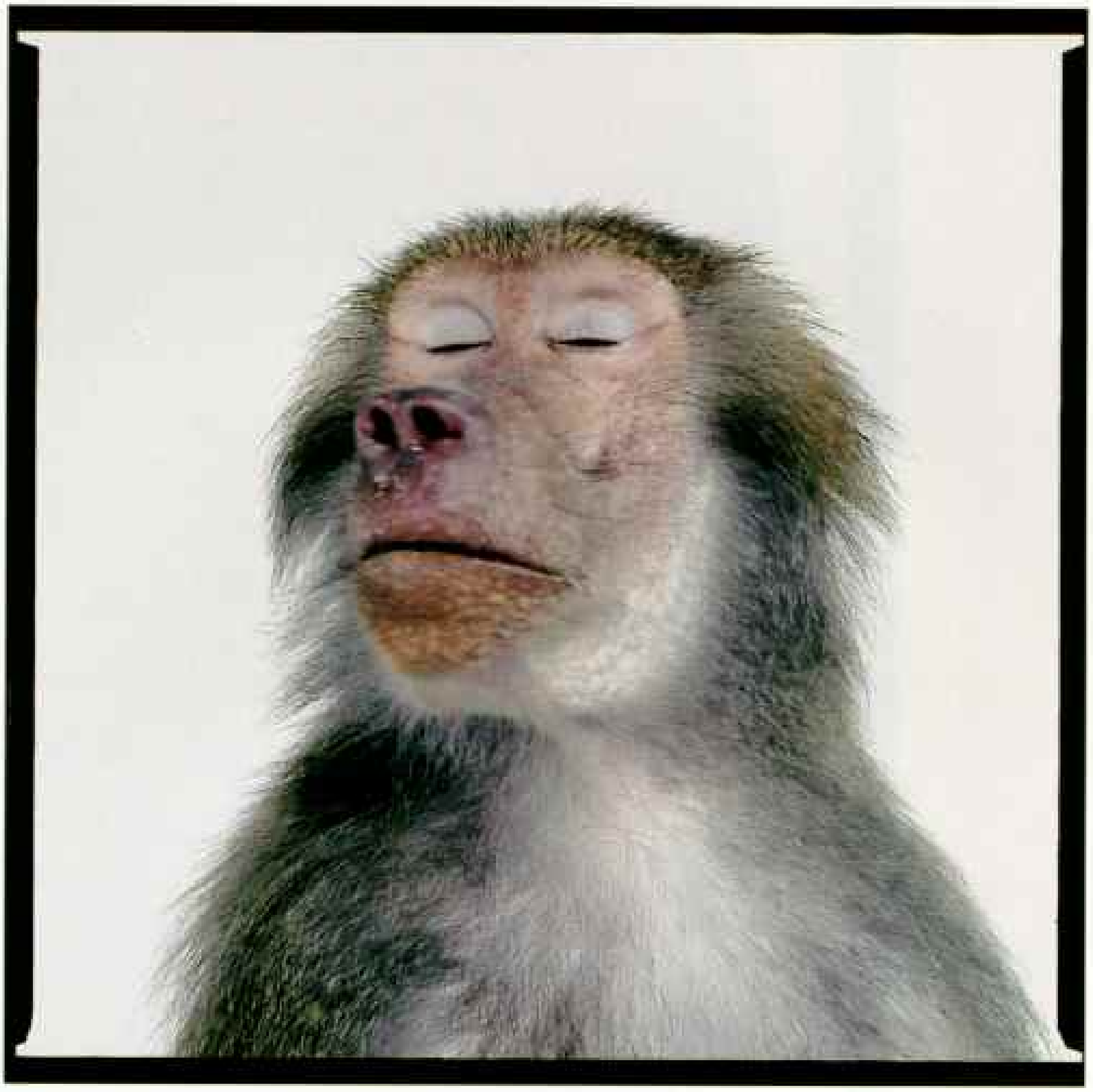
FELIS CONCOLOR CORYI

Biologists believe that only 30 to 50 pure-blooded Florida panthers remain alive in the wild today. I photographed this three-year-old mixed-breed male, descended from wild Florida panthers with an admixture of mountain lion blood, at a private wildlife sanctuary in Tampa, Florida. He napped off and on throughout the session until a noise offstage caught his attention. Then he gave me this piercing, haunted look.

WEST INDIAN MANATEE

TRICHECHUS MANATUS

A native of the Caribbean and the Atlantic from Florida to Brazil, the West Indian manatee has long been slaughtered for its meat and hide. In Florida motorboats now take an increasing toll. I photographed this seven-year-old female at Sea World in Orlando. She was placid and gentle, lolling poolside and allowing me to scratch her skin, talk to her, and shake her blubber. Her snout was soft as deerskin, but the rest of her hide had the rough tautness of a football made of sandpaper.



HAMADRYAS BABOON

PAPIO HAMADRYAS

Ancient Egyptians regarded the hamadryas baboon as sacred and associated it with their god of wisdom. Today the species is extinct in Egypt and rare in Ethiopia, where most of the remaining stock lives. I photographed four-year-old Marlena at a Florida circus where she performs. Marlena considers her owner, Lee Stevens, to be her mate, and I had to be careful of any gesture I made toward him to avoid upsetting her.

GRIZZLY BEAR

URSUS ARCTOS HORRIBILIS

Grizzlies once roamed North America by the tens of thousands. Today the animals are listed as threatened in the lower 48 states, and truly thriving populations exist only in Alaska and Canada.

I photographed ten-year-old Bailey at a small zoo in Grand Prairie, Texas. It is stunning to have Bailey walk into a small room. His claws, elongated from lack of use, click on the white linoleum floor as he tours around in that way animals have—sniffing, looking, touching with his nose. And then he comes to me.

I crouch on my haunches at eye level with him. He gets bigger. And bigger. And bigger. I feel his hot breath—not breath exactly, more akin to wind. Here is Bear incarnate. Though he can wreak total destruction anytime he likes, he chooses to act gently, with delicacy, and the photographic session goes smoothly.

Yet even now, many months later, I can still feel that breath.

ASIATIC BLACK BEAR

SELENARCTOS THIBETANUS

Scientific names are not known for their poetry, but Selenarctos thibetanus, *meaning "moon bear of Tibet," has magic and refers to the animal's crescent-shaped white chest marking. Widely distributed in the forests and mountains of Asia, the bear is in danger from overhunting and loss of habitat. I photographed 11-year-old Bruiser at a small performance arena in Texas. When I hung the white gauze from a bar overhead, the wind blew it around Bruiser: He did not seem to mind, and it added a dimension of mystery to the image.*

BLACK RHINOCEROS

DICEROS BICORNIS

Among African animals the black rhino is one of those most threatened with extinction. The primary reason is poaching: A black rhino's two horns bring as much as $50,000 on the black market for use as Arab dagger handles or Oriental medicines. I photographed Clyde, a 37-year-old male, at the Columbus Zoo in Powell, Ohio. His personality is far from that of the stereotyped "awesome rhino." With a tender pink upper lip he gently plucked McIntosh apples from my hand, and his only vocalization was a small squeak, much like a puppy's.

ASIAN ELEPHANT

ELEPHAS MAXIMUS

Some 40,000 Asian elephants remain in the wild, mostly in small islands of habitat surrounded by expanding oceans of human settlement. Listed as endangered, Asian elephants are trapped in a downward spiral that many experts believe will result in their extinction in the wild. I photographed Calcutta, a 39-year-old female, in Rochester, New York, at the Ringling Bros. and Barnum & Bailey Circus. I used the curtain technique hoping to capture some of the mystery and power of these almost supernatural creatures.

BACTRIAN CAMEL

CAMELUS BACTRIANUS

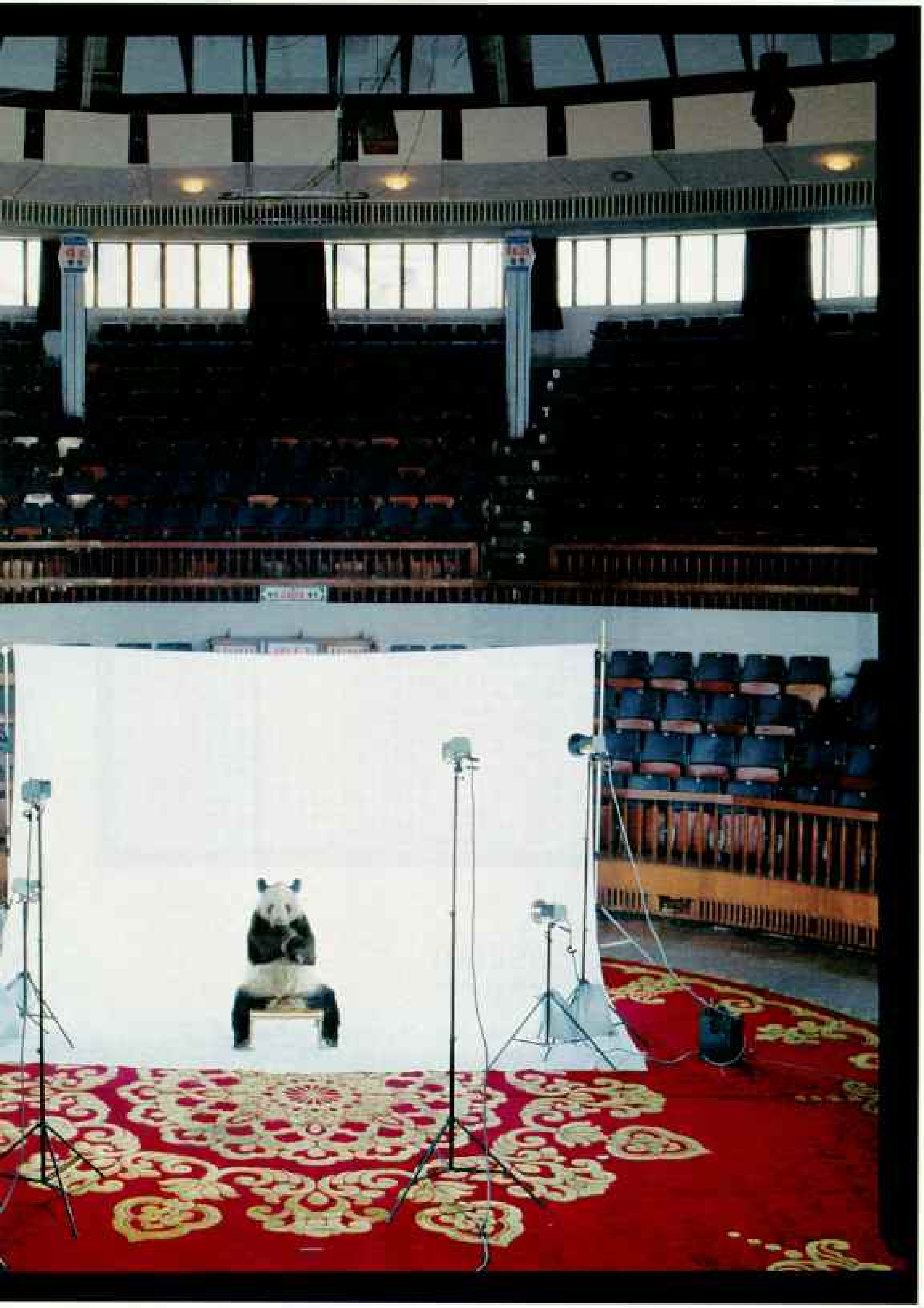
I am in awe of the Bactrian camel's mechanisms for survival in the Gobi desert of China and Mongolia: An extra eyelid wipes sand off the eye; nostrils narrow to tiny slits in a sandstorm; a thirsty camel is able to drink 25 to 30 gallons of water at a time. But because the wild Bactrian is endangered and probably will not survive, these attributes will soon have meaning only for those that trek the desert as domesticated pack animals. The humps on this camel at a Florida zoo seemed invested with a life and personality separate from the whole animal.

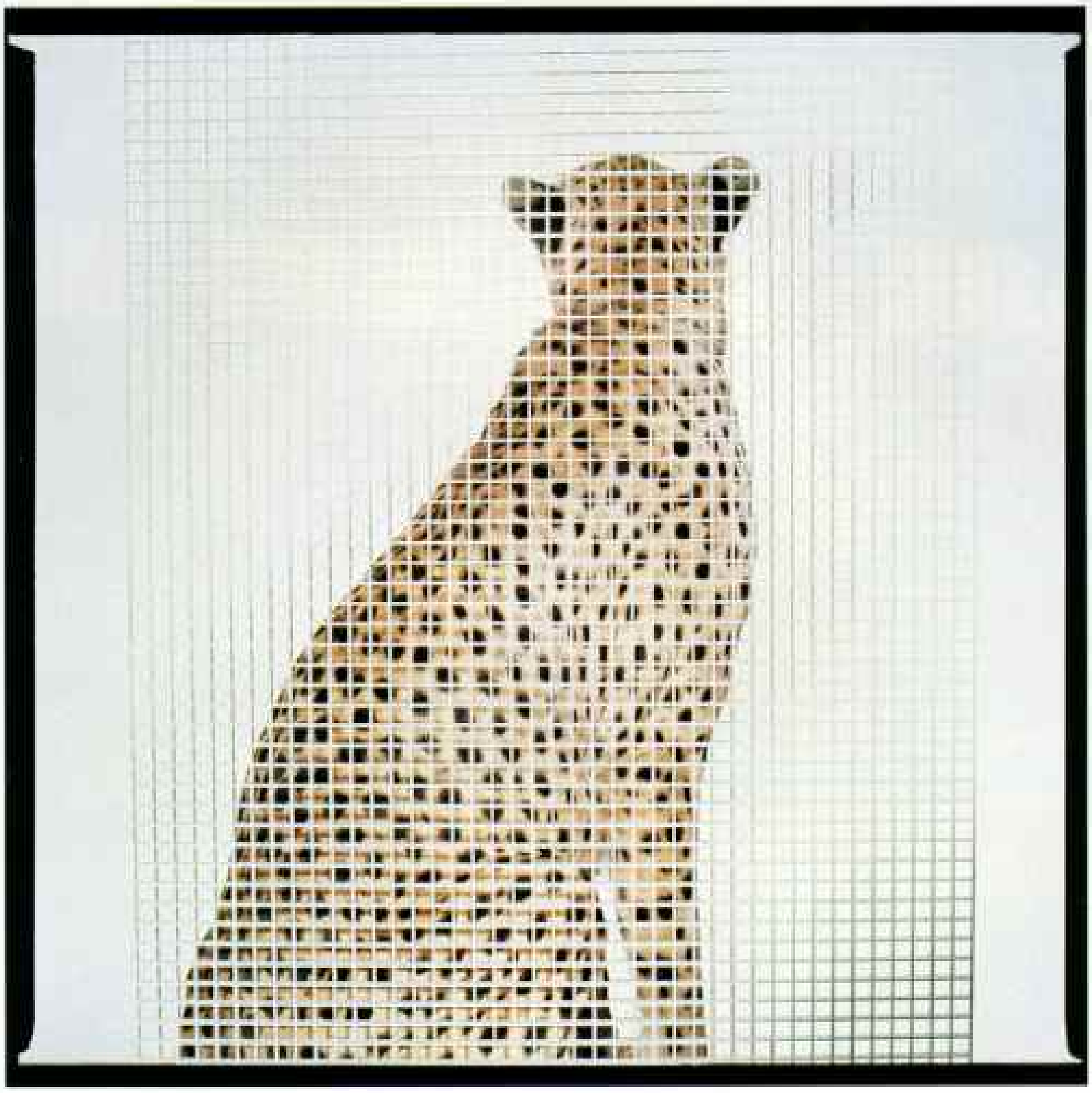
GIANT PANDA

AILUROPODA MELANOLEUCA

In developed countries, popular interest in conservation is often governed by what some call the "cult of cuteness." Pandas have been primary recipients of this kind of adoration, but their survival is nonetheless in jeopardy: Last estimated at a thousand, the wild population in China has been declining, and reproduction in captivity has been disappointing. Meanwhile panda pelts sell on the black market for as much as $20,000 each, mainly in Japan.

Wei-Wei, a 16-year-old male with the Shanghai Acrobatic Theater, performs a nightly act involving pushing a toy wheelbarrow and having dinner with his trainer—routines that struck me as ineffably cute. I thought it appropriate to photograph Wei-Wei on location. Given that setting, I could not help but make this image: It is a statement about how we project our illusions onto pandas. Though Wei-Wei is a flesh-and-blood animal, he is as visually surreal as any creature on earth.





CHEETAH

ACINONYX JUBATUS

Speed is no match for modern technology. The world's fastest land animal has been decimated in Africa by poachers driving all-terrain vehicles and armed with rapid-fire weapons. Now expansion of farms also contributes to the decline of the species. I photographed three-year-old Tumba, owned by the San Diego Zoo, through a light-diffusion panel, such as those used in offices, to comment on our culture's obsession with reducing a complex world to numerical fragments.

GREAT INDIAN RHINOCEROS

RHINOCEROS UNICORNIS

At Lowry Park Zoo in Tampa, Florida, I photographed six-year-old Jordy, who is related to about half the Indian rhinos now in North American zoos. Whether we are looking at animals or other visual forms, our tendency is to see them in stereotyped perspectives. To me this image reveals the most beautiful facet of any of the world's five rhino species, and I hope that it challenges conventional perceptions.

ATLANTIC GREEN TURTLE

CHELONIA MYDAS MYDAS

The systematic exploitation of the Atlantic green turtle for meat, eggs, and oil has led to drastic population reduction, if not to eradication, in much of its range. I photographed this 15-month-old individual at South Padre Island, Texas, in the backyard of Ila Loetscher, an 85-year-old environmentalist known nationwide as the Turtle Lady. Ila assured me that the turtle was comfortable upside down on the cushion. I am continually mesmerized by this image of delicate vulnerability.

ASIAN SMALL-CLAWED OTTER

ADNYX CINEREA

The size of the wild population of these animals is unknown, but scientists fear that loss of habitat and environmental pollution have taken a heavy toll. I photographed this adult male at Sea World in San Antonio, Texas. He was in the whirl of activity that typifies otters' lives: into the water, out of the water, back into the water, then under, around and around in dizzying circles. I sought an image that would momentarily freeze him in the midst of that perpetual motion.

LEOPARD

PANTHERA PARDUS

The fashion industry—which transforms unusual animal fur into expensive coats—has been the nemesis of many of the world's great cats. Leopards are no exception; they were once slaughtered by the tens of thousands to supply the fashion salons of the world. Moreover, wild leopards living close to human settlements often develop a taste for cattle, sheep, goats, and dogs. As a result, leopards have disappeared from much of their former range in Asia and North Africa, although they remain widespread south of the Sahara.

I photographed this trained six-year-old male black leopard in a mobile studio near Malibu, California. Most of his work consists of acting in feature films or television commercials.

Rarely in the course of photographing this series did I have such a sense of malevolence and danger from an animal; those yellow eyes glaring from that dark feline face seemed to embody hostility. After seeing him jump from one platform to another, I made this picture. Do we actually see a leopard, a shadow, or perhaps a symbol flashing through our minds? I cannot say.

I believe the function of art is to ask questions as much as to provide answers. Perhaps the leopard and other animals in this portfolio will move us to ask the crucial question: How can we help the animals, and ourselves, survive? □

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INFO
BER

DAVID ALAN HARVEY

Berlin's ODE TO JOY

In tears and triumph the people of East Berlin surge through the fresh cut in the Berlin Wall at Potsdamer Platz on a cold morning in November 1989, free at last. They clutch flowers and special-edition Western newspapers that celebrate a Berlin reunited after 28 years of separation. Within weeks the brush fires of reform burned across Eastern Europe, Stalinist regimes collapsed, and the Iron Curtain melted into history.

By PRIIT J. VESILIND
NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by
DAVID ALAN HARVEY
and
ANTHONY SUAU
BLACK STAR

Gaining the high ground, West Germans on November 10 revel for the second night on the Wall near the Brandenburg Gate, potent symbol of the German nation, as nervous East

ANTHONY SUAU

German troops prevent further encroachment. Weeks of protest in East Germany had broken the communist regime, and East Berliners were free to go; the Wall had lost its terror.

BOTH BY ANTHONY SUAU

The hammer of history slams into the graffiti-covered barrier, only to be met by an East Berlin water-cannon blast. After the Wall was erected in 1961, 80 people died attempting to escape across it. For emboldened West Berliners, angry graffiti no longer seemed an adequate protest. By afternoon the water cannon was gone, and the realization dawned that East German border guards would no longer defend the Wall with force; the battle was won. Soon the western side of the Wall rang with dozens of victorious hammers and chisels, but the ultrahard concrete yielded only fragments. In the East, as public pressure mounted on the government to speed reform, army crews moved in quickly to bulldoze more than a dozen new openings.

Inspecting the unthinkable, an East German officer in great-coat arrives in the early hours of November 12 to oversee the removal of Wall panels at Potsdamer Platz, one of the

busiest intersections of prewar Europe, now a wasteland. A West German policeman guards the gap against a restive and expectant gathering of journalists and West Berliners.

Potsdamer Platz bursts at daybreak, and crowds of Westerners spill through the gap into East Berlin territory, ecstatic with the historic moment. Joining forces, East

DAVID ALAN HARVEY

German border guards, at front, and West Berlin police, in green uniforms, link together to form a path for East Berliners to walk the final yards from East to West.

"We are the people," they shouted in protest, and now East Berliners stride through Potsdamer Platz into West Berlin, many for the first time. An East German soldier, right, already softened by gifts of flowers, signs his name to a portion of the wall rubble. Among the arrivals were 50-year-old Monica Gosszens and her pregnant daughter-in-law, Katy. "I am torn between joy and sadness," Monica told the author. "My life would have been completely different without the Wall." Katy patted her stomach: "At least my baby won't have to experience what we've gone through."

BOTH BY ANTHONY SUAU

IN EAST BERLIN the people heard it first on television, as an item on the evening news. You are free to go, the government announced. They could travel to the West. For any reason. For no reason. After 28 years of virtual imprisonment, the cage was open. The Berlin Wall had collapsed.

On that surreal, sleepless, Thursday night, November 9, 1989, joyous West Berliners popped champagne bottles and lit candles atop the despised Wall by the towering Brandenburg Gate, symbol of the German nation. It took East German water cannons to dislodge the celebrators in the early hours of the morning.

By the time I arrived at noon the next day, Berlin was awash in triumph and singing its ode to joy. East Germans poured through the gates by the thousands, looking stunned.

"The border police over there didn't know what to do," one East Berliner told me as he came through. "They had learned in school to be frightened of this day, and they just didn't know what to do. So they did nothing."

Mothers pushed baby carriages, families held hands. Many, overwhelmed by the moment, wept as they stumbled through the cordon of police and a welcoming funnel of West Germans, who threw flowers and shouted, *"Herzlich willkommen! Herzlich willkommen!*—A heartfelt welcome!"

On Friday night the heart of West Berlin's dazzling shopping street, the Kurfürstendamm, throbbed with adrenaline. It was the biggest block party, the sweetest family reunion in German history. The church bells that lay silent in 1945 now pealed unashamed victory. At a rally on the central square, politicians already clamored for a "unified Berlin!" Masses moved boisterously up and down the Kurfürstendamm, emptying bottles, embracing strangers, singing "Glory, glory hallelujah! The Wall is kaput."

Most stores on the "Ku'damm" were closed, but Lutz Jöstingmeier kept the Hein Gericke Speedware leather shop open in celebration. "I have a good friend from the East who has not been allowed to come here. Well, we opened the shop at ten o'clock this morning, and there he was, standing at the door. It was the greatest moment of my life."

There would be no return to normal; normal had passed on. "I'm ecstatic—with a touch of sadness," said West Berlin student Ulrike Brödermann. "Our Berlin is gone, and it will never be the same."

Saturday morning rang with the sound of hammers and chisels, souvenir hunters chipping away at the western side of the Wall. On the eastern side, construction crews torched and hacked at the steel-tough concrete to open more than a dozen new crossings in the city.

At the Brandenburg Gate, which has moldered in East Berlin, a protective line of East German border guards now stood astride the Wall and stared down at a Western media circus. All Berlin had come hoping to witness a symbolic breakthrough—businessmen in camel-hair overcoats, punkers in chains and leather, vendors of wurst sandwiches, a hurdy-gurdy man, television anchormen in pasty makeup and trench coats.

Almost lost in the confusion were Stephen Rompf and his girlfriend, Katrin Schöne, who stood somberly together without speaking. They had just walked over from the East.

"The Wall doesn't have the same force any more," Katrin finally said softly. "It's incredible. For years it has defined our limits, our thoughts as well."

Stephen looked up. "I worked here as a border guard," he said, "on this spot. I don't know . . . for years you get educated one way, and all of a sudden that is not right." He shook his head. "Slowly, slowly, please," he pleaded to no one in particular.

"Is the tension gone for you?" I asked.

"*Ja*. . . . The situation a few weeks ago, when people were escaping through Czechoslovakia—that was much more tense. I was on the border, and we should have stopped them; that was our job. On the other hand, we wanted them to go. And yet we had sworn to the flag, to the party. That was our struggle—between our allegiance and our hearts."

THE POSTWAR ERA of Europe was over, and for me the end stirred dark images of the beginning, in that summer of grief and exultation, 1945.

When the Allied invasion of Europe reached Beilngries, a modest town in Bavaria, I was very young. But I remember American tanks rumbling down the cobbled main street, as I peered from the second-floor window of the Gasthof Wagner Bräu, an inn where my family had sought shelter.

We had reached Beilngries from the lost nation of Estonia—four among the hundreds

Pent-up emotions explode at Berlin's Invalidenstrasse crossing, as East Germans reunite with family and friends from West Berlin. At Potsdamer Platz, West German women in folk dress offer bouquets to arrivals. All along the 860-mile German-German border, tension melted. At a pedestrian crossing in Braunlage, in the Hartz Mountains, East German guard Lieutenant Balke escorts 86-year-old Lissi Wolff and her purse to the western side. "Things are much more relaxed now," said Lieutenant Balke. "Before we didn't speak to each other about our feelings." And the snowman near the customs gate? "We built that when we were bored."

ANTHONY SUAU (TOP); PHILIP J. GRIFFITHS (LEFT); DAVID ALAN HARVEY

The barrier between the Berlins began in 1961 as brick and barbed wire. It further isolated West Berlin as a West German island surrounded by a hostile German Democratic Republic (GDR), a nation created from the Soviet Union's zone of occupied Germany after World War II. As the wire went up, a child cried to get back home across the border. The GDR guard, despite orders not to let anyone pass, lifted the wire. He was caught in the act, and not heard from again.

of thousands of refugees wandering a charred and rotting German landscape in the final days of the Second World War. Forty million Europeans were dead, and a sickness of spirit numbed the living.

Weeks before, as my father pushed a wheelbarrow of our belongings along a railroad line near the town of Landshut, Allied bombers had descended to systematically destroy the rails. He shoved the three of us into a bomb crater that had not been there ten seconds earlier, and with his broad back he sheltered us for hours from the hurtling stones and stinging earth. For eight days we hid in the hayloft of a kind German farmer, along with 20 Hungarians, as the front passed.

While we struggled with our personal losses that summer, the nation-states of Europe lay exhausted to the marrow. The winners redrew the map. Czechoslovakia, Austria, Poland, and Yugoslavia reappeared as whole nations. Estonia, Latvia, and Lithuania disappeared, absorbed into the Soviet Union. (Foldout map, pages 120-23.)

Occupied Germany was divided into four zones—United States, British, French, and Soviet. By 1949 the three Western zones had joined to form the Federal Republic of Germany. But the Soviets refused to relinquish their gains and created the German Democratic Republic (GDR), or East Germany, splitting Germany as they had split all Europe.

Once proud Berlin, capital of Hitler's Reich, lay deep within the Soviet zone and became a special case. It also was divided into four sectors. But the Soviets made East Berlin the capital of the GDR. So the three other sectors combined as West Berlin, a remnant capitalist island in a Marxist sea.

From the Baltic to the Mediterranean, an Iron Curtain descended. In the displaced-persons camp in Geislingen, West Germany, where 4,000 Estonian refugees huddled, no one believed this would last: Stalinism was too alien a concept for Europeans to swallow; we would all go home to a free Estonia. But we underestimated the power of fear, and our disbelief dulled with time. Unreason became reality.

West Berlin, dangling in the East, became a magnet for new refugees. On August 13, 1961, a tight-lipped, hemorrhaging GDR put the final ugly touch on the division of Europe. They walled off West Berlin.

My family reached the United States in 1949 to start a new life. When I returned to Beilngries last November, hard times were but a memory; West Germany had built itself into Europe's leading financial and economic power. Ironically, immigrants again crowded the land—this time other Germans. At the guesthouse where we had lived, you could still

get a good Bavarian draft beer from Frau Wagner, who remembered my family from those sad days long ago.

THE BERLIN BREAKTHROUGH, swift and unforeseen, sent tremors through the rest of Eastern Europe. With this most trusted Warsaw Pact stalwart in disarray, the unreasonable had become the unbearable. Hungary and Poland had already launched courageous programs of reform away from communism, encouraged by Soviet President Mikhail Gorbachev's decision to let satellite nations go their own way.

Now Czechs took to the streets in Prague, ousting their hard-line leadership and forcing elections in a matter of weeks. In Bulgaria longtime party chief Todor Zhivkov was muscled out, and candlelight vigils haunted party remnants in their chambers. In Romania a time bomb was ticking under the heavy-handed Premier Nicolae Ceauşescu, and the people stirred, provoking bloody repression, followed by his overthrow and execution.

In East Berlin and Leipzig, demonstrations organized by the prime opposition group, New Forum, kept pressure on the faltering communist leadership. By edict of the people, in an almost pure street democracy, the ruling institutions of the GDR were forced out. The entire Politburo resigned, including party leader Egon Krenz. The dreaded secret police, the Stasi, was defanged. Deposed party chief Erich Honecker, the nation's grandfather for 18 years, was arrested for corruption and abuse of power. Like battery acid, ugly revelations seeped to the surface: The party elite had lived in secret luxury, indulging in private villas, swimming pools, and designer clothes.

"Germany lost the war," a young East German refugee told me, "and the East has had to pay for it. We have been second-class citizens and second-class Germans."

At a New Forum rally in East Berlin a casket painted with "Stasi-ism 1949-1989" was carried by mock pallbearers and laid on the doorstep of the Volkskammer, the GDR parliament. But for others, talk about the death of the totalitarian state was premature.

In a cafeteria beside the square of demonstrators a pensioner biting into a sausage noticed me. "Forty years of history," he groused. "Why should we give it away? A capitalist society couldn't happen here, because capitalism, in history, has always brought

DAVID ALAN HARVEY

Not waiting for history to unfold, one of the last East Germans to die while attempting to escape across the Wall was shot on February 6, 1989. Scribbles on his memorial damn former GDR leader Erich Honecker.

pain to the people." He chewed angrily.

"Many who have been working within this system are quiet and puzzled right now," offered Peter Gabriel, one of the demonstrators. "And schizophrenic. Don't think that all these people will welcome change. You can't just go into the school and get all the teachers to admit they were wrong.

"Quite honestly, socialist ideals are still alive here. But socialism itself has failed, totally. And we have no successful example to show our children anywhere in the world. And without socialism the GDR won't be able to stand alone. We are so dependent on the West."

The German-German border had separated brothers and sisters, villages and neighborhoods, brass bands and soccer teams. When the gates opened, both governments were astonished to find a German nation intact.

From the border zone, where neighbors again met face-to-face, a network of connections spread inland, like needles pulling thread. By the time the obvious message had reached Bonn, capital of West Germany, politicians could only issue lame warnings against too much, too fast. Within three weeks West German Chancellor Helmut Kohl set out a ten-point plan for reunification. Considered reactionary only weeks before, the potent idea gathered legitimacy with a rush.

(Continued on page 128)

EASTERN EUROPE TODAY

A time of triumph and peril

TO A WORLD accustomed to the Cold War, the changes that have swept across Eastern Europe during the past few months have seemed almost unreal. Who could have imagined a year ago that the sad, stolid, gray nations of Eastern Europe—oppressed for four decades by their communist governments—would burst into the light of democracy? Then again, who could have predicted that Soviet leader Mikhail Gorbachev would have allowed such change? Or even openly encouraged it, sparking a wildfire of reform from the Baltic to Bulgaria?

It began peacefully in Poland, where the Solidarity trade union, underground for eight years, swept the nation's first democratic election since World War II. Independent political parties also appeared in Hungary. Then with ever increasing speed, hard-line governments in East Germany, Bulgaria, and Czechoslovakia fell as demonstrators demanded free speech and an end to the Communist Party's monopoly on power. Events turned bloody in Romania when secret police killed thousands of protestors, triggering a revolt that resulted in the execution of dictator Nicolae Ceauşescu and his wife, Elena.

Democracy in Eastern Europe had been a dream deferred since 1948, when the Soviet Union established a buffer of puppet governments from Poland to the edge of Greece. Communists snuffed out free speech, arrested dissidents, and turned the press into a purveyor of party propaganda. In Romania, where authorities registered typewriters, words were most feared. Even bebop was too much for the Czechoslovak government, which jailed jazz musicians for trumpeting freedom of expression. There was little hope for reform. In 1956 Soviet tanks ended an uprising in Hungary; 12 years later Warsaw Pact troops squashed the flowering of a democratic-socialist government in Czechoslovakia.

What provoked the rebellions of the past few months? Largely it was the economic failure of communism—crumbling living standards and crippled economies. Poland suffered from a 40-billion-dollar debt, high inflation, and chronic food shortages. Romania exported its agricultural bounty, leaving pig's feet and potatoes for its people. East Germans boasted the highest living standard in the communist world, but glitzy West German television commercials whetted appetites for VCRs and BMWs.

The hard days, however, are far from over. As these fledgling democracies rebuild their societies, they may well face high inflation, unemployment, and new social tensions—conditions that can ignite extremist political movements. They must also put behind them ethnic rivalries and border disputes, which have turned them against one another in the past.

The future of Eastern Europe is uncertain, but one thing is clear: The once impenetrable Iron Curtain is now a tattered veil.


NORWAY
SWEDEN
FINLAND
DENMARK
WEST GERMANY
EAST GERMANY
POLAND
CZECHOSLOVAKIA
AUSTRIA
HUNGARY
ROMANIA
YUGOSLAVIA
BULGARIA
ALBANIA
ITALY
GREECE
TURKEY
MOLDAVIA
UKRAINE
BYELORUSSIA
ESTONIA
LATVIA
LITHUANIA
U. S. S. R.
RUSSIAN S.F.S.R.
BALTIC SEA
GULF OF FINLAND
Gulf of Riga
Gulf of Gdańsk
ADRIATIC SEA
BLACK SEA
Oslo
Helsinki
Vienna
Rome
Under Russian rule since the 18th century, Estonia, Latvia, and Lithuania began 20 years of stormy independence after World War I. Their autonomy ended in 1940, when they were forcibly annexed by the Soviet Union.
ESTONIAN S.S.R.
Engineering and oil shale production dominate the economy of the U.S.S.R.'s least populous republic.
Area: 17,413 sq mi
Pop.: 1,566,000
Capital: Tallinn
Language: Estonian
Religion: Lutheran
Ethnic groups: Estonian 65%, Russian 30%
LATVIAN S.S.R.
Despite a large Russian minority, this urban, industrialized republic pushes for autonomy.
Area: 24,595 sq mi
Pop.: 2,667,000
Capital: Riga
Language: Latvian
Religion: Lutheran
Ethnic groups: Latvian 54%, Russian 33%
LITHUANIAN S.S.R.
First Soviet republic to challenge monopoly of Communist Party.
Area: 25,170 sq mi
Pop.: 3,673,000
Capital: Vilnius
Language: Lithuanian
Religion: Roman Catholic, Lutheran
Ethnic groups: Lithuanian 80%
Kaliningrad Oblast is part of the Russian Republic
EAST GERMANY
16.5
12.5
The Soviet Union's largest trading partner suffers from aging factories and labor shortages.
Area: 41,828 sq mi
Capital: East Berlin
Language: German
Religion: Protestant, Roman Catholic
Ethnic groups: German 99.7%
POLAND
38.1
7.2
High inflation and unemployment could threaten support for the reformist government.
Area: 120,725 sq mi
Capital: Warsaw
Language: Polish
Religion: Roman Catholic
Ethnic groups: Poles 99%
CZECHOSLOVAKIA
15.6
10.1
Cut short by Soviet invasion in 1968, economic and democratic reforms are again being tried in this heavily industrialized nation.
Area: 49,371 sq mi
Capital: Prague
Language: Czech, Slovak
Religion: Roman Catholic
Ethnic groups: Czech 64%, Slovak 31%
HUNGARY
10.5
8.6
The most liberal Warsaw Pact nation seeks to embrace the free market.
Area: 35,919 sq mi
Capital: Budapest
Language: Hungarian
Religion: Roman Catholic, Calvinist
Ethnic groups: Hungarian 97%
YUGOSLAVIA
23.7
6.5
Regional rivalries and ethnic loyalties hamper democratic change.
Area: 98,766 sq mi
Capital: Belgrade
Language: Serbo-Croatian, Slovene, Macedonian
Religion: Eastern Orthodox, Roman Catholic, Muslim
Ethnic groups: Serb 36%, Croat 20%, many others
BULGARIA
8.9
7.5
Discrimination against Turkish minority continues despite moves toward democracy.
Area: 42,823 sq mi
Capital: Sofia
Language: Bulgarian
Religion: Eastern Orthodox, Muslim
Ethnic groups: Bulgarian 85%, Turk 9%
ALBANIA
3.2
.9
Europe's poorest, most politically isolated nation.
Area: 11,100 sq mi
Capital: Tirana
Language: Albanian
Religion: Constitutionally atheistic
Ethnic groups: Albanian 96%
ROMANIA
23.1
6.5
Freed from years of want and repression, Romanians struggle to forge democratic institutions.
Area: 91,699 sq mi
Capital: Bucharest
Language: Romanian
Religion: Romanian Orthodox
Ethnic groups: Romanian 89%
U.S.S.R
286.7
8.7
Ethnic strife and political turmoil weaken the unity of the Soviet state.
Area: 8,649,538 sq mi
Capital: Moscow
Language: Russian, many others
Religion: Russian Orthodox, Muslim
Ethnic groups: Russian 52%, Ukrainian 16%, many others
In recent decades the nations of Western Europe have achieved high levels of prosperity (right). By the end of 1992 the 12 members of the European Community plan to establish a single internal market allowing freer movement of services, capital, people, and products. No one knows how changes in Eastern Europe may affect these developments.
FRANCE
55.9
16.8
ITALY
57.5
14.2
UNITED KINGDOM
57.0
13.3
WEST GERMANY
60.9
18.3
KEY TO GRAPHS
Population in millions
30
10
Gross national product per capita in thousands of U. S. dollars
Pie chart shows percentage of labor force
Industry
Agriculture
Other activities
Site of recent popular demonstration
SLOVAKS Significant ethnic concentrations
0 150 km
0 150 mi
NGS CARTOGRAPHIC DIVISION
DESIGN: ALLEN CARROLL, SALLY S. SUMMERALL
RESEARCH: ANDREW J. WAHLL
PRODUCTION: RAMSEY MURRAY, JAMES E. MCCLELLAND, BARBARA CARRIGAN, NEAL J. EDWARDS
MAP EDITOR: GUS PLATIS
CONSULTANT FOR ETHNIC INFORMATION: GEORGE W. HOFFMAN

DAVID C. TURNLEY, BLACK STAR

Czechoslovakia

Inspired by the German upheaval and memories of 1968, when reform was squashed by Soviet tanks, the people of Prague staged massive protests in November to force out the Stalinist political system.

PIERRE PERRIN, SYGMA

Hungary

Hungarians, who ripped the first hole in the Iron Curtain last May, were still dismantling barbed wire on their Austrian border in July. In February 1989 the first independent daily newspaper in decades, the Mai Nap, hit Budapest streets (above).

BERNHARD J. HOLZNER, SYGMA

DAVID C. TURNLEY

Bulgaria

A woman in Sofia accosts a policeman by the state-run television station, demanding an independent press and free speech. Hard-liners have been ousted, but Bulgarian-Turkish tension remains.

Romania

The end of Nicolae Ceausescu's brutal regime came with stunning swiftness but not without bloodshed. In the dictator's office two reformist militiamen view the televised face of Ceausescu himself, executed on Christmas Day.

East Germany

A once obedient nation turns defiant during demonstrations in East Berlin, pushing the nervous communist government, no longer propped up by Moscow, into compromises and finally into opening the Wall.

FRANCO ZECCHIN, MAGNUM

DAVID ALAN HARVEY (BELOW); DAVID C. TURNLEY

Poland

The Eastern bloc's first non-communist, multiparty parliament sits in Warsaw, including representatives of the Solidarity movement, whose activism goaded the nation to reform. Its goal: to breathe new life into a stagnant economy.

SUKHOVSKY-ZUMA PICTURES, GAMMA LIAISON

Latvia

Demonstrators light candles in Riga to denounce the revelation of the Hitler-Stalin secret protocols of 1939 that allowed the Soviet Union to annex Estonia, Latvia, and Lithuania the following year. They now lobby for full independence.

"A hundred percent of the people want reunification!" insisted Hartwig Blunck, a 50-year-old West German businessman. "I'm not a nationalist, but. . . ."

"But, why not?" asked the older Hans-Joachim Ulbrich, who had overheard our conversation. Ulbrich had pinned down the core of German anxiety: nationalism versus guilt. "Every Frenchman, every Pole, is proud of his fatherland. I know what they say about a united Germany, that it would again pose a danger for Europe. But look: World War I and World War II developed out of a monarchy and out of Hitler. Out of a democratic system nothing comparable could come."

Others were less sure. "For me," one West German woman had told me in the first few days, "the GDR is a country like Austria or Switzerland where they speak German. We're happy for them and want them to live as well as we do—but in their own country. And Berlin the capital of the new Germany? That makes me think of the darkest moments of our history. That would be horrible."

In Berlin the four occupying military powers called a hasty meeting to reaffirm their legitimate role in the future of both Berlin and Germany. Because of Cold War tensions no peace treaty had been signed to end World War II. What would happen to the Warsaw Pact and the North Atlantic Treaty Organization (NATO), the power packs of Cold War ideology, if the Germanys merged? A neutral Germany? A resurgent, belligerent Germany? The world reeled.

PHOTS 2, 3(BELOW LARGE), ANTHONY SUAU

"We feel as if we have walked into our television sets," said one East Berliner on the glitzy West Berlin shopping street, the Kurfürstendamm. With little hard currency East Berliners can only covet a motorcycle or the latest TVs, tuned to protests back home in the East. At a fruit stand near Ratzeburg, West Germany (facing page), a GDR family savors a banana, symbol of all that has been unavailable.

THE GERMANYS began to merge almost as we watched. On the tip of what used to be the Iron Curtain, on the Baltic Sea, I followed a group of elderly West Germans bundled in overcoats as they made their way along the beach to stand and look at the East German guard tower in the distance.

"I think there's nobody up in that tower," observed one. "Nobody."

They peered into the fog, over the wild rose bushes. "Since yesterday the glass windows of this tower are gone," said another. "Always two military constables were watching us—but they are gone. They are gone."

"The East guards began to speak to us last week," said a man who lives in one of the beach cottages next to the fence. "Before, they would never even look at you. We started to say *'Guten Tag'* to each other. And we even smiled. And they asked whether they could come and see us. They thought the houses here were so charming."

Indeed most East Germans had wanted just to take a look at what they had been denied. Of the millions who clogged West German highways on that first weekend, most returned to work Monday. They came to the West as to a shopping mall. Home? That was something else again.

In 1989 each incoming East German was entitled to a hundred free deutsche marks (DM), about 60 dollars, by West German law. At banks in West German border cities the queues looped for blocks.

For the East Germans who descended on the city of Hamburg in the north of West Germany, the hundred DMs proved paltry, and

DAVID ALAN HARVEY

the gap between their material lives and this affluent city was jarring. There was no hiding their origin, their clothes, their cars, their wide eyes. I saw a woman stop on the sidewalk in amazement as a sliding glass door opened in front of her. Magic.

Even for the seasoned Western consumer, Hamburg before Christmas is an overload of wealth—the flash of lights, streets crowded with sleek Mercedes-Benzes and shoppers smug in fur, outdoor shops with fruits and fresh gingerbread.

Not all Hamburgers were overjoyed at the invasion from the East. They complained when sympathetic police looked the other way at illegally parked GDR Trabants (Trabis) but gave tickets to BMWs beside them. The cheap eateries were mobbed, bus seats were hard to find. Some Hamburgers simply stayed home, appalled at the spectacle.

"But as for us common people—we accept them," said taxi driver Hans Brüchmann. "Nobody complains, yet. These people are from Mecklenburg, our natural suburbs. Our mentality is the same. We fit together. Now, if they had been Saxons. . . ."

Those who plan to stay discomfit Hamburg more. At the city's social-services office, spokesperson Brigitte Eberle lives on the thin edge of coping. More than 6,400 East European refugees are already housed in apartments, trailer homes, ships in the harbor, even in a former "eros center" on the famous street of sin, the Reeperbahn.

"But I'm afraid of a backlash. We have 80,000 unemployed in Hamburg," she said. "Now, if there is a choice, the employers will take the fresh, new guys from the GDR, and the long-term unemployed of Hamburg will be set back. Drug addicts have no place to go because of the new influx. Our own homeless people get pushed down again.

"We cannot say hello to everyone. We cannot accept 15 million people. In the GDR there are no more political refugees, but our law says they all have the right to live here too. These laws were made in the 1950s, when everybody was sure no one would come."

On the outskirts of Hamburg two young refugees from East Germany, Steffan and Christian, shared a small trailer furnished by the city. They had arrived in the first wave of East Germans, through Hungary, before the gates were thrown open.

Rail workers in the GDR, they have applied to work for the West German railroad, which has offered them a flat if hired. Prospects are good, and their two weeks in the West have been a revelation. "For most of our lives," said Steffan, "we've been more workers than human beings. Now we have to learn to be human beings again. I ate my way through Hamburg in three days. I was fascinated by all this food. I couldn't help myself. The first snack bar . . . the second."

Inspired, we left the trailer for a steak dinner at a restaurant. But even as the conversation warmed, they would not tell me their last names. Old fears haunted them. "I don't want any more black points," said Steffan by reflex. "Whenever things are published, as soon as people have names, our families . . . perhaps they can't travel. I'm the class enemy now; I'm the capitalist, and my parents are 'the society.' I don't think the state will give up this distinction so easily."

We ate dessert. "I wonder," said Steffan, "what the waitress would say if I told her I was eating chocolate ice cream for the first time? In the GDR we have brown ice cream, but there is no chocolate in it."

"I had a dream when I was a child," mused Christian, "to see the most important streets in the world—the Kurfürstendamm, the Champs-Élysées, the Reeperbahn, Broadway—even if I had to go by foot." A fire burned in his eyes, at comic odds with his thin leather tie and droopy blond mustache.

"I will live to be 101!" he blurted suddenly. "The hope is so strong right now. Every day is wonderful! I'm not a *kaputnik!*"

"A kaputnik?"

"Oh, that's from the Russian—someone who's a pessimist, who shoots himself in the head and his legs fall off."

ON THE PLAINS of northern Germany, where the ranks of trees slant like sailors in the headwind off the Baltic, the border slices south from Lübeck through a chain of lakes where middle-class Hamburgers holiday.

On November 12 an entrepreneur named Michael Kühn set up a stand in an empty field outside the town of Ratzeburg and sold one ton of bananas in two hours to the lines of East Germans spewing from the recently opened gate near the village of Mustin.

"More than 3,000 Trabis were in this field last Saturday," he told me. "They had bus service into Ratzeburg. The banana is the most important fruit they cannot get. And the Sony Walkman? They are sold out, all over Germany. All the stereo/electronic things under a hundred marks—completely gone! I faxed to Hong Kong asking for more."

At Boizenburg the German-German border turns southeast along the Elbe River, where Allied Commander Dwight D. Eisenhower stopped the advance of the U. S. Ninth Army, allowing the U.S.S.R. to liberate Berlin from the East, and thus to stake Prussia as its own.

Near here the border splits a tiny village—called Zicherie in the West and Böckwitz in the East. But a boulder had been placed into the soil by the wall that separates them, with the inscription: "Germany Is Inseparable."

Fifty-seven-year-old Heinz Ritzmann of Zicherie had come to stand by the newly opened gate to watch history pass. "We were not even allowed to wave to our neighbors. There were harsh penalties for them."

In border areas of the GDR, movement was severely restricted; even close relatives from neighboring villages needed written permission from the police just to come for tea. Family from the West could come only for funerals.

For the residents of this frontier zone, change came like a thunderbolt. When photographer Dave Harvey and I walked across the border from Zicherie, we became the first Americans in Böckwitz since World War II.

That afternoon, in a dimly lit community center, Elfriede Guhl was celebrating her 60th birthday with cake, coffee, and schnapps with her colleagues in the farm cooperative. Around a long table sat 40 milkmaids, swine tenders, and beet pickers.

"You are welcome," said a flushed and beaming Frau Guhl, as years of apprehension melted in her eyes. "We can have guests again." And they folded us into their warmth.

"Within 15 minutes of the news," said a woman across the table, "we were on the other side. Our friends were there. But we were all children when the separation happened—so we hardly recognized each other."

"One day last week," burst in another, "I took my bike and . . . just went over. I had to stop and laugh! I felt so strange. For 40 years we couldn't do something so simple. I just had to stop and laugh."

"Enough of that," said Frau Guhl. The toasts were starting, and there were songs to

Gone for good

It tears the heart to leave home, as East Berliners Hans and Andrea Zacher and their four children discover, even if home has been dispiriting and drab. Hans (left, at right) says good-bye to his best friend and packs the car for the journey, joining an emigration of nearly 350,000 East Germans in 1989. At their new home near Bremen, West Germany, Andrea strolls with baby Paula and their sponsor, Claudia Möllenkamp. Immigrants from the GDR receive automatic citizenship. From overloaded Berlin, arrivals are now sent to other parts of West Germany, where they will challenge the nation's economy and test the resilience of its people.

ALL BY DAVID ALAN HARVEY

ANTHONY SUAU

A modern Stonehenge forms near Potsdamer Platz as slabs of the Wall are carted away. But these monuments will not be timeless: East Berlin, newly attuned to the marketplace, has sold such slabs to Western merchants to be broken into Cold War mementos. So be it. Free enterprise may heal more wounds than politics as Germany celebrates its hard-won family reunion.

sing. So we linked arms around the table and sang, Dave and I and 40 East German farm women on parole, swaying back and forth to the tune "*Es gibt kein Bier auf Hawaii*—There is no beer in Hawaii, there's no beer. There is no beer in Hawaii, so we'll stay here!"

A few of them even walked us back to the once dreaded border down the street. They joked with the guards and hugged two Americans good-night—scenes from a dream for them, so astonishing and giddy that surely morning would come to spoil it all.

BY THE TIME I got back to East Berlin, representatives of Volkswagen were already in the GDR cutting a deal to make cars with Trabant, idle West German physicians were considering East German posts, and three street urchins in the district of Pankow had painted the first graffiti on the eastern side of the Wall. One was in English: "Gorbi we like you."

"Our youth newspaper, *Junge Welt*, said that it was all right now," explained 12-year-old Kai Sieber.

The wounds have begun to heal. But I can't forget Gertrud Scholze, a grandmother who came with her husband, Johannes, through the gap at Potsdamer Platz on November 11. As retired people they could visit West Berlin often, but they savored this symbolic moment. Frau Scholze gave a rose to my interpreter, Uli, and told us this story:

"A few weeks ago our guards arrested me because I had 30 West German marks in my purse when I tried to cross the border. They put me into a room and questioned me. I was crying. I only wanted to get some fresh fruit, because my husband was in the hospital. After an hour I fainted, and they let me out. But . . . other people have had bigger problems."

She pulled herself erect, eyes shining, and said, "Remember, a heart that has never suffered is a heart that will never sing."

All over Eastern Europe there are more songs to come and verses to be written. □

We'd like to recycle the thinking

Before.

Contrary to public opinion, plastics are among the easiest materials to recycle.

In South Carolina, one company is recycling 100 million pounds of used plastic soft drink bottles a year into carpet yarn, flower pots, toys, and fiberfill for ski parkas.

In Chicago, another company is recycling 2 million plastic milk jugs a year into "plastic lumber" for decks.

In Tennessee, another company is recycling plastic beverage containers into bathtubs and shower stalls.

The recycling of plastics is rapidly catching on. Recycling is transforming used plastics into a "natural resource" that can be used to produce many new products. Recycling is a critical issue as America grapples with its growing solid waste problem.

Our landfills are filling up.

We dispose of 160 million tons of garbage a year. In the past 10 years, our landfills have decreased from about 18,500 to 6,000. Within 5 years 2,000 more will close.

In their haste to find solutions, some policymakers propose to ban plastics. The fact is, according to a recent study, plastics make up about 18% of the volume of solid waste in our landfills; paper and paperboard, about 38%; metals, 14%; glass, 2%; and other wastes, 28%.

If plastic packaging is banned, the need for packaging won't go away. The idea is to replace plastic with biodegradable materials. Studies show, however, that degradation is so slow in today's landfills so as to almost not exist.

that plastics can't be recycled.

After.

How Amoco Chemical is helping.

At Amoco Chemical, we believe all recyclable materials should be recycled—glass, metals, paper and plastics—in addition to integrating source reduction, waste-to-energy incineration and landfilling when appropriate.

Amoco Chemical is sponsoring a recycling program in New York demonstrating that used, polystyrene foam food service containers from schools and restaurants can be recycled into insulation board for commercial construction, cafeteria trays and home and office products.

We're participating in a consortium with other major plastics manufacturers involved in the construction of regional polystyrene recycling plants.

We're encouraging the start-up of new recycling efforts, helping to find better ways to collect and sort recyclables, and helping to create markets for recycled plastics products.

At Amoco Chemical, we believe the more we recycle, the more we'll bring a huge problem down to size.

For a free copy of "Recycling: Do It Today For Tomorrow," write Amoco Chemical, Recycling MG, 200 East Randolph Drive, Chicago, IL 60601.

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The Outdoors—Something to Celebrate

THE NATIONAL GEOGRAPHIC SOCIETY

TOM BEAN

Pedaling past field and farm, participants in the Des Moines Register's Annual Great Bicycle Ride Across Iowa explore the outdoors.

As I traveled across the country a few years ago for the President's Commission on Americans Outdoors, I discovered a reassuring fact: Americans care passionately about their outdoors and are willing to take action to preserve it.

Our open spaces, fellow citizens told me, are great soothers of our souls. They recharge our creative batteries, toning our minds as well as our bodies.

We Americans, however, have gradually come to realize that our outdoors—like so many of the things we cherish most—is a finite resource that deserves wise use rather than careless exploitation. And we are slowly discovering that decades of mismanagement and neglect have taken their toll.

Every year, reports the National Recreation and Park Association, urban and rural development in this country gobbles up nearly half a million acres of wetlands—habitat for countless bird species—and three-quarters of a million acres of farms and forests.

Because of such losses the top recommendation of the President's commission three years ago was a call for a "prairie fire" of local action, spreading from community to community to preserve what we have left. Fortunately there now is a major effort helping to light that fire. It's called the National Celebration of the Outdoors.

The core of this effort is a broad coalition of more than 50 national conservation-minded groups, and the National Geographic Society is one of them. During the week beginning April 22—the 20th anniversary of Earth Day—thousands of communities in all 50 states will celebrate the outdoors in their own way.

How does a community go about celebrating its outdoors? With a project as simple as cleaning up a park or planting trees or as far-reaching as forming a land trust to acquire title to threatened open spaces, perhaps to turn them into the recreation corridors known as greenways.

"The idea of the celebration carries on two strong American traditions—concern for the land and a belief that local action can determine quality of life," says Henry Diamond, a longtime conservationist who has spearheaded the celebration as its chairman.

The success of the celebration will rest on each individual's realization that a small voice, if it's strong and clear, can be more powerful than a large group of people who are silent. The celebration's planners fervently hope that the individual voices will also ring in our halls of government. Clear thinking and action are urgently needed to reinvigorate the Land and Water Conservation Fund, enacted in 1964 to acquire and protect remaining open spaces. The fund has experienced severe budget cutbacks in the past decade.

The overriding conclusion of the President's commission seems more imperative today than ever before. "The next five to fifteen years," the commission reported, "will be a critical period for Outdoor America. Decisions made between now and the year 2000 will determine the fate of America's remaining land and water resources."

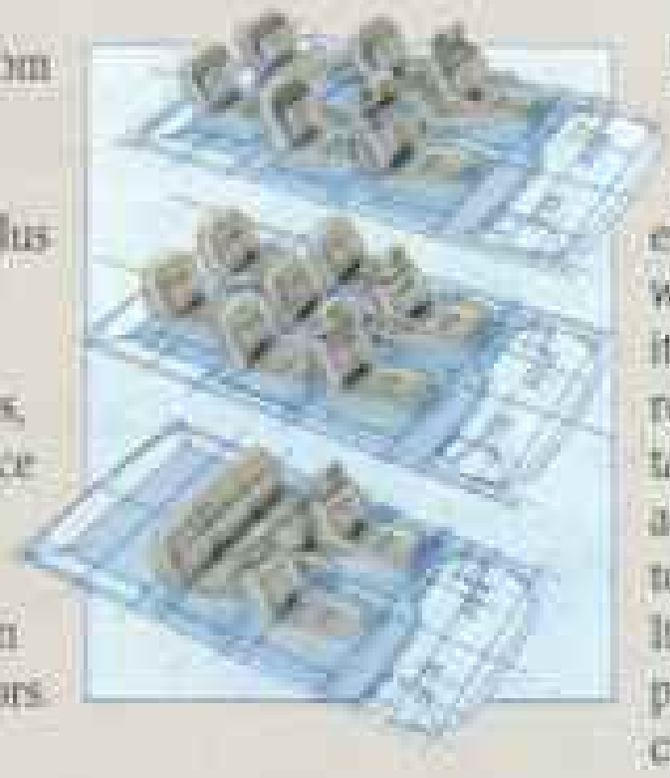
That means now is the time to start thinking big—as big as all outdoors. And, to start celebrating.

Gilbert M. Grosvenor

INFORMATION ON THE NATIONAL CELEBRATION OF THE OUTDOORS IS AVAILABLE BY CALLING 1-800-628-LAND.

Trans Sport. The Pontiac of Minivans!

It's the space vehicle of the '90s from the people who build Excitement. Depending on the model, there's cabin space for five, six or seven plus launch equipment like a specially cammed 3.1L V6 and front-wheel drive. And speaking of aeronautics, Trans Sport's sleek shape lets it slice through the atmosphere with a lower coefficient of drag than any other minivan made or sold in America by any of GM's competitors. What's more, Trans Sport's body panels are made of a composite material that resists impacts and never rusts. Inside, there's an ergonomically sculpted steering wheel and analog gauges. Also, its modular seats can be easily rearranged, their backs folded for a table-like surface, tipped up for added floor area, or removed entirely to produce 112.6 cu ft of cargo space. It all helps make Trans Sport* the perfect vehicle to take you and the crew where no van has gone before.



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Members Forum

Advanced Materials

Thomas Canby's article (December 1989) captures the enthusiasm and excitement of materials science and engineering and will contribute greatly to a general awareness of this discipline. Young people with a bent toward engineering are, in general, unaware that such a career option exists. Henceforth this article will be required reading in our introductory materials courses.

PATRICK P. PIZZO
School of Engineering
San Jose State University
California

There was no mention of new forms of synthetic diamond made possible through advances in chemical vapor deposition technology. We all know that diamond is the hardest substance. But it has other properties—for example, it is the best known conductor of heat at room temperature and an excellent electrical insulator. The new availability of diamond in thin film form makes possible X-ray transmission windows that extend the detection range of X-ray spectrometers. As the technology advances, we may expect diamond-based electronics, bioimplant materials, and perhaps large, low-cost, gem-quality diamonds.

J. MICHAEL PINNEO
LINDA S. PLANO
Crystallume
Menlo Park, California

I was surprised not to find a photograph of Montreal's Olympic Stadium as a perfect example of the strength and flexibility of Kevlar. The stadium roof may have cost us a fortune, and we're still paying for it, but at least we can boast an arena that is sniper proof.

LUIGI PALAZZINI
St. Leonard, Quebec

As a dentist I was distracted by your misplacement of an upper denture on the lower jaw in the composite (page 754). The patient would probably notice too.

DAVID SCHOOLEY
Kanata, Ontario

Paper's recyclability, not degradability, ought to be highlighted. This year more than 20 million tons of waste paper will be recycled domestically, providing one-fourth of the raw material for the nation's paper and paperboard industries. One hopes that today's engineers and materials scientists will emphasize recycling in their innovative designs for tomorrow. If not, we may end up with enormous amounts of high-tech waste with no place to go but to landfills or incinerators.

ROBERT J. GARINO
Institute of Scrap Recycling Industries, Washington, D.C.

Technological progress does not include glitzy, magnetically levitated trains (page 748). They can't do anything that can't be done cheaper, faster, and better by conventional trains and trolleys. Europe and Japan experiment with maglevs, but they build conventional railroads. The beauty of the French TGV train is its compatibility with Europe's electrified rail network.

WILLIAM R. WRIGHT
Cranford, New Jersey

Sistine Chapel

To see the ceiling restored to its original beauty and brilliance was a feast for the eye and a balm for the soul. I take heart when I see technology and art united to such a radiant effect.

MARK RICHARDSON
Halifax, Nova Scotia

Horrible, absolutely awful! A world treasure lost for all time, at least our time. The patina of time removed, the beauty and mystery cleaned away, and a room full of chromos left. What man can do in the name of improvement.

LOIS G. ANDERSON
Clifton Springs, New York

In 1988 I was fortunate to be a frequent visitor to the Vatican and its museums over a five-week period. The work that was completed by that time was truly remarkable, and your article certainly captures the spirit and atmosphere of the project.

DAVID A. KEITHLEY, JR.
Littlefield, Texas

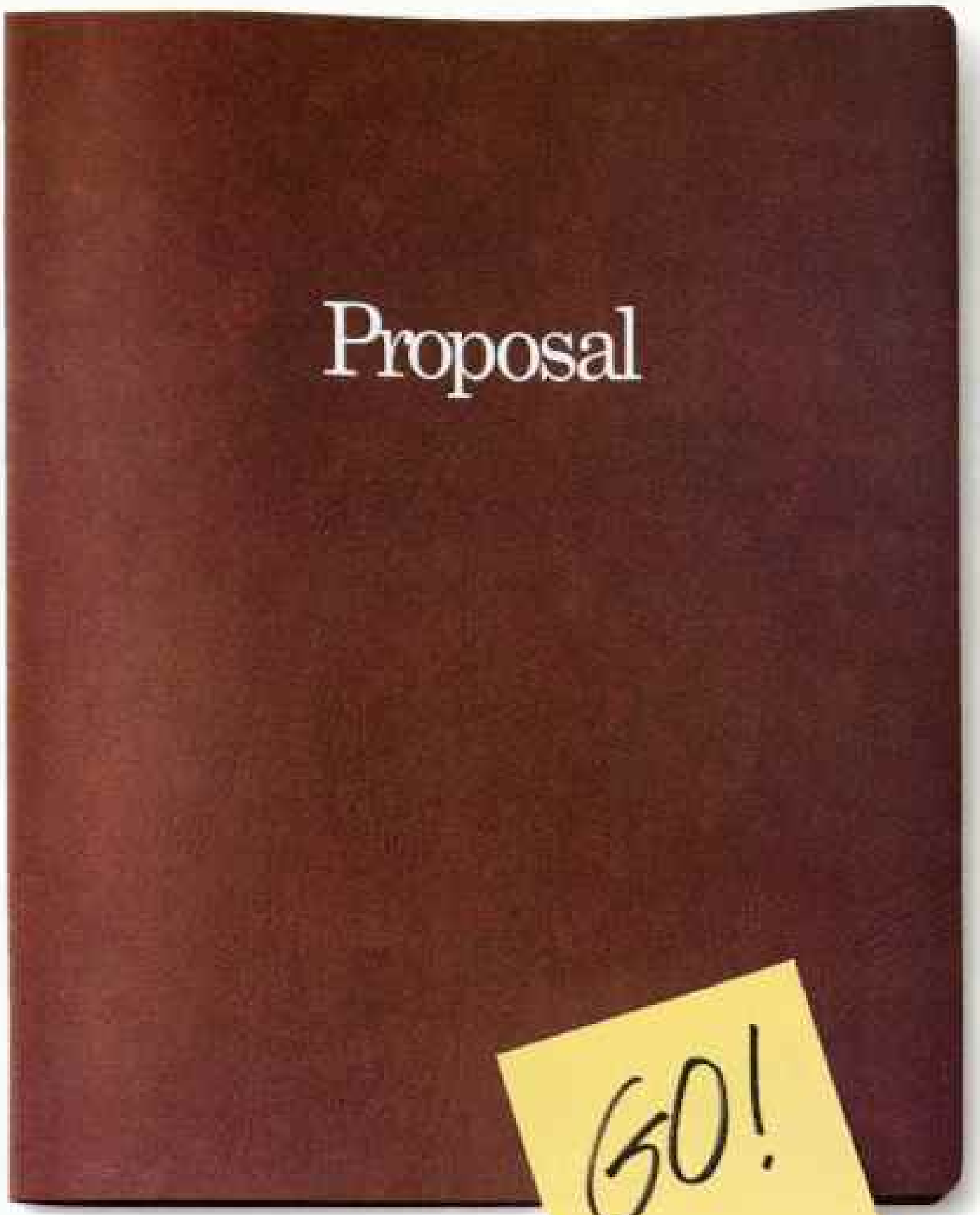
Baja California

I learned more about my home state, Baja, during the 15 minutes it took me to read your article than in the ten years I studied in Tijuana.

EDMUNDO ANGEL OROZCO
Tijuana, Mexico

You use the simple adjective "legendary" to describe off-road racing that is destructive of this fragile environment, so much so that the organized *ejidatarios* (farmers and fishermen) have done their best to ban such races across their lands. The 1989 race finally took place because the lure of gringo dollars opened some of the *ejidos*. And then one small Mixtec boy was killed by a racer who failed to stop.

PAGE GILMAN
Roseburg, Oregon



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I visited "Los Cabos" for the first time last year and fell in love with the countryside and people. The Mexicans have maintained, in spite of the onslaught of tourism, a combination of warmth, charm, and dignity that is irresistible. There is a sign at the Cabo San Lucas market: No handouts to children, please. We want them at school.

JANA KREJCOVA
Oakville, Ontario

Washington State

Thank you for showing readers a typical view of the pathetic remnants of their Western national forests. Skinned-off hillsides extend to the property lines of national parks. Animals needing the big trees, dead trees, fallen logs, and other amenities of virgin forest are being squeezed out. Many Northwesterners are alarmed at the present rate of deforestation, reportedly greater than that of the Amazonian rain forest.

JANET AND JAMES STRONG
McCleary, Washington

Here in British Columbia there are also people ready to follow the perceived lead of your preservationists. I would appreciate your having forest scientists explain the rationale of logging old-growth forests based on facts and experience, not emotion. Old-growth forests are bank accounts that pay no interest, whereas the allowable cut is based on the potential of the site, which is the

interest rate. To preserve old-growth will inevitably lead to a decline of productivity and to the same bricked-up trees one can see in Europe. For that we have the parks.

G. H. EICHEL
Forestry Manager
Pope & Talbot Ltd.
Midway, British Columbia

Enough. We need more national media attention like we need another highway from California. The next time the GEOGRAPHIC feels compelled to feature a beautiful state with water, trees, and economic ties to the Pacific Rim—try Michigan.

MIKE AND DEBBIE LIBBEE
Cle Elum, Washington

Holy Land Map

Congratulations on the informative map. I especially appreciate the fact that you translated the call of the minaret correctly. Everyone should realize that Muslims, Christians, and Jews worship the same God, and "Allah" is simply the Arabic word for God.

THE REVEREND JOHN A. ZUNES
Chapel Hill, North Carolina

Geography test: Where are the international headquarters and holy shrines of the Baha'i faith, which has five million followers in 166

countries? Answer: Haifa and Acre, Israel. I hope to see this missing information on future editions of the Holy Land map. Israel has four world faiths.

ROBERT STAUFFER
Bainbridge Island, Washington

Saying that the Dead Sea "has such a high concentration of minerals that it cannot sustain life" is incorrect. Microbiologists have known for more than two decades that, although it presents a hostile environment to many life-forms, it is home to very successful microbes that find its high mineral content to their liking.

JORDAN KONISKY
Professor of Microbiology
University of Illinois at Urbana-Champaign

Geography Education

I commend the National Geographic's efforts to encourage learning. However, glancing at the Gallup survey raises some concerns. Although there may be an awareness problem surrounding geography and other areas of study, that people are unable to locate a place on a map is no reason for panic—yet. A more revealing survey would ask: "If you don't know the answer, how would you go about finding it?" Knowing how and where to look for answers is much more important than having them on the tip of your tongue. The first is a skill indicating resourcefulness and an ability to think; the other might be the echo from a powerful memory. I surprised myself by identifying 12 of 16 locations, but it was much more satisfying to consult my National Geographic maps and rediscover those places that slipped my mind.

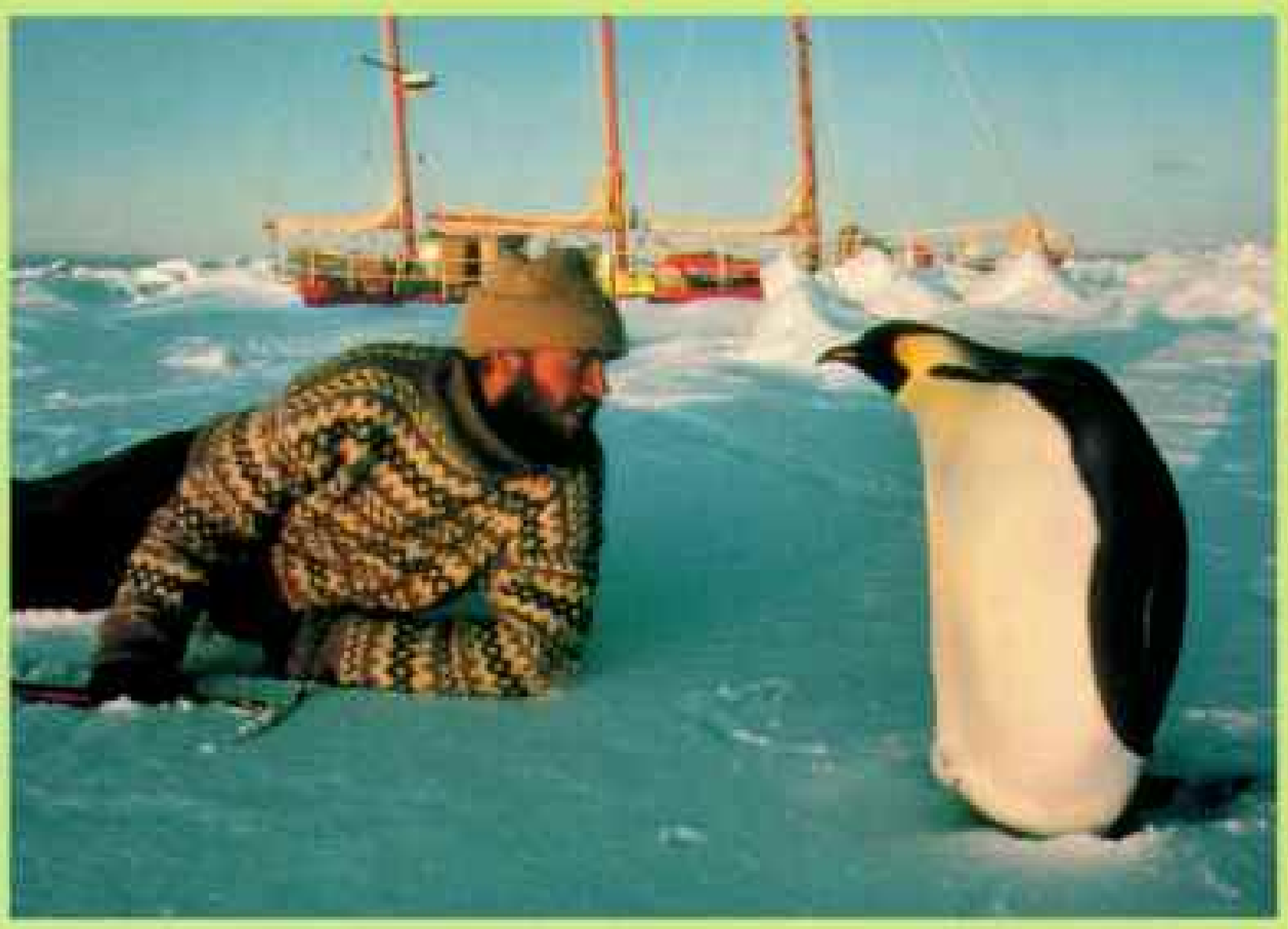
CHARLES E. HUNT III
Buffalo, New York

As tour escorts our work takes us to Russia, and we take as gifts for our Intourist guides a North American road atlas, assuming it will help them understand and locate places their charges came from. Recently a sparkling woman in her middle years with a superb command of English and her nation's history admitted privately that maps were illegible to her. Her generation had never been taught to "read" them. We are heartened to read that younger people there are now beginning to learn about the world "outside."

CHARLES B. HAYWARD
Springfield, Massachusetts

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

National Geographic, April 1990



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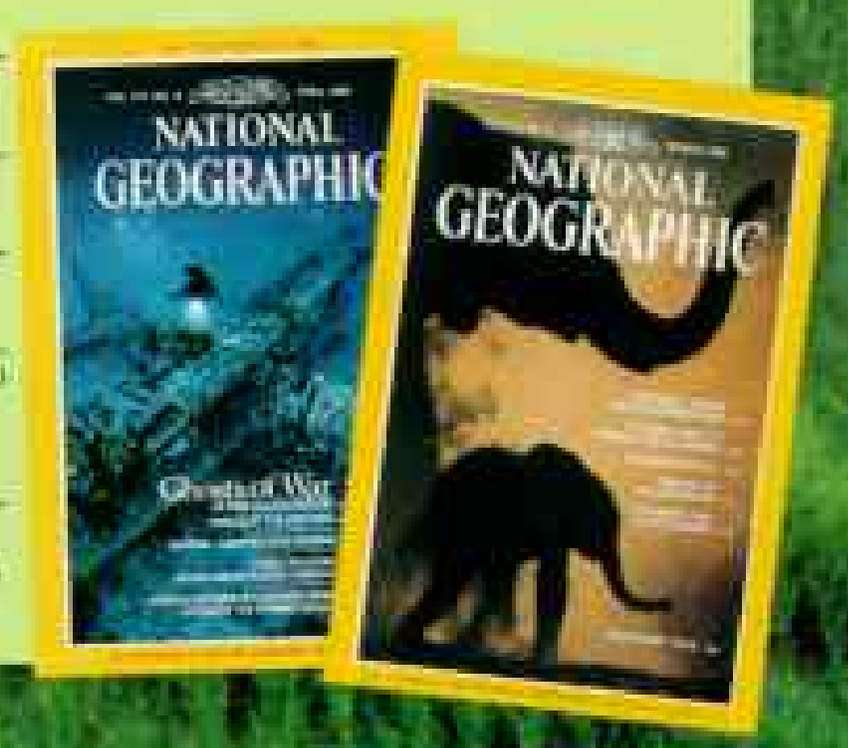


APRIL 1990

GEOGRAPHICA

NATIONAL GEOGRAPHIC MAGAZINE

Granny Is Reburied, This Time With Dignity

After 368 years Granny has been given a decent and proper burial.

Granny is the name archaeologists gave to a woman whose skeleton they found in a rubbish pit while excavating the remains of Wolstenholme Towne (NATIONAL GEOGRAPHIC, January 1982). This site on Virginia's James River is the oldest British-American town plan yet found. Granny—so named because she had lost all her lower molars, though she was only about 40 years old—was one of some 60 English settlers killed there on March 22, 1622, during a colony-wide Indian attack by the Powhatan Confederacy.

When a Colonial Williamsburg team removed Granny's skeleton for study, a court order required them to return it eventually to the site where it was found. "We couldn't put her back in the trash pit where we found her," says Ivor Noël Hume, retired Colonial Williamsburg archaeologist (above right). "So we decided to put her back in a proper grave." Services were held, and Granny was reburied in a gabled colonial-style coffin. A sealed tube containing a copy of the January 1982 GEOGRAPHIC was buried with her.

In the meantime, researchers have changed their original idea of who Granny was. They now think she was a maid, not the wife of a prominent settler. That might explain why survivors of the Indian attack did not rebury her body. In any event, says Noël Hume, she remains the earliest female Virginia colonist found so far.

RAYMOND GOODEN

How War Stimulated Geographic Knowledge

When the U. S. Civil War broke out in 1861, few field maps were available to either the Union or the Confederate Army.

By the end of the war four years later, each had mobilized an array of skilled mapmakers to guide its forces. At the same time, commercial mapmakers seized upon cartographic techniques, such as panoramic "bird's-eye views," to explain the course of the war to an avid public. And newspapers started to publish battle maps routinely.

The result was an explosion of interest and geographic knowledge among Americans, both North and South. Richard W. Stephenson, a historian of cartography at the Library of Congress, tells of this explosion in his introduction to a newly published, annotated compilation of more than 2,300 Civil War maps, charts, and atlases in the library's collections.

"A wide interest in maps was beginning to develop just before the war," Stephenson says. "But the war itself added to the growth of the map industry. Maps became essential because so many people were fighting in areas they had never heard of. It wasn't just military maps. Maps were being produced for the general public too."

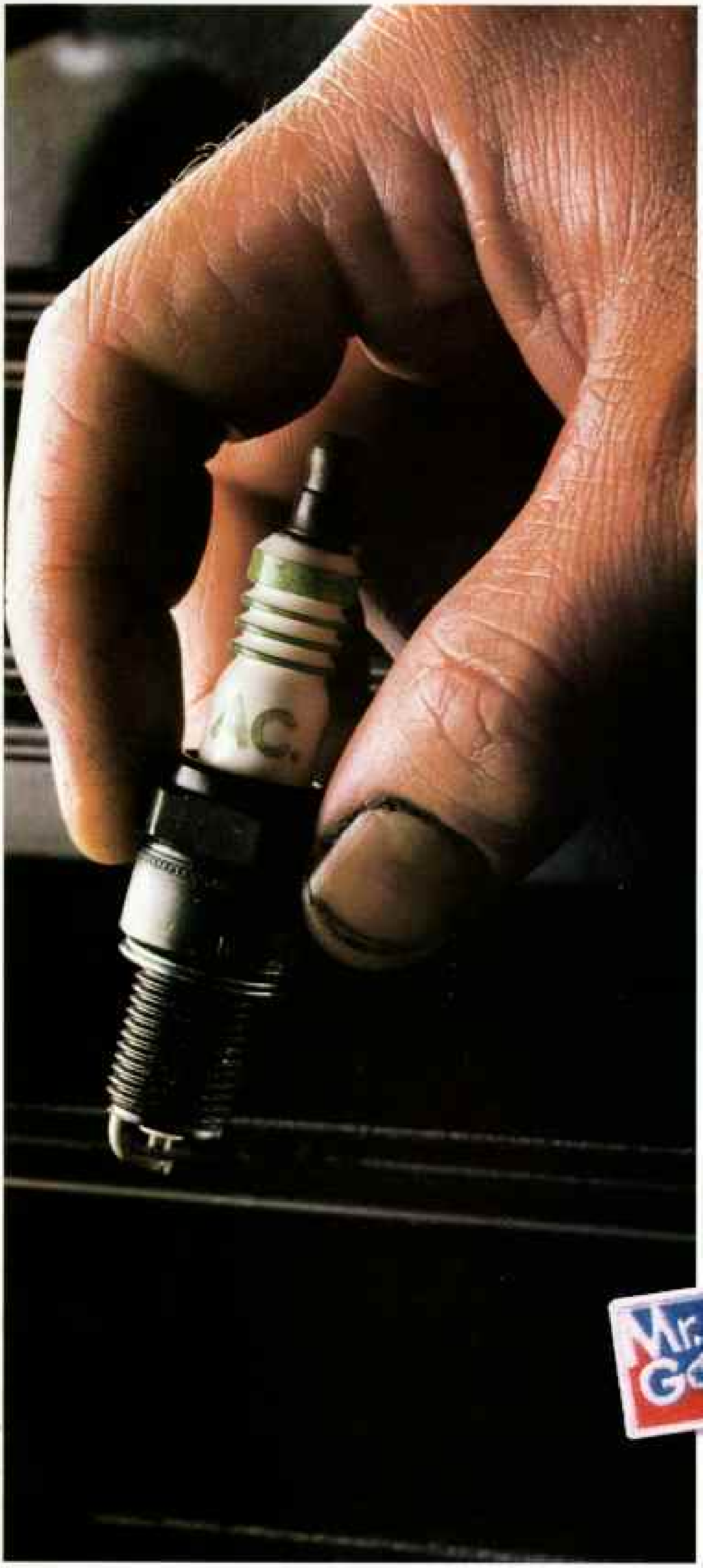
Three-quarters of the maps contained in the book were produced during the war. But there are also many produced later, including several created in the 1960s to illustrate GEOGRAPHIC articles for the Civil War centennial period.

PANORAMIC VIEW OF FORTRESS MONROE, VIRGINIA, PHOTOGRAPHED BY VICTOR R. BOSWELL, JR., NGS

Across Bering Strait, an International Park

Wags are calling it "Glasnost and Glaciers" park.

It's a plan to link parts of Siberia's Chukotskiy Peninsula and Alaska's Seward Peninsula, which face each other across the Bering Strait, as an international park. Such a park has been proposed since the 1960s, but it has gained impetus with the loosening of the U.S.-U.S.S.R. border that brought such results as the Friendship Flight (GEOGRAPHIC, October 1988).



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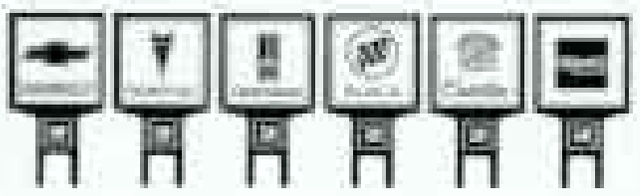

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Last fall National Park Service officials and their Soviet counterparts spent a month studying sites and preparing a report. They propose designating "protected areas" in both nations—the Bering Land Bridge Natural Preserve in Alaska and a Siberian site yet to be chosen. The report also urges establishing a joint facility to study the region's cultural and natural heritage and creating cooperative agreements to allow designated people, from ivory carvers to geologists, to cross the border with ease. It may be 1992 or later before both nations approve the necessary legislation.

Taking Coelacanths out of the Marketplace

The Convention on International Trade in Endangered Species has outlawed international trade in the coelacanth, the "living fossil" fish known to exist only in the Indian Ocean off the Comoro Islands. CITES shifted the fish from its Appendix II, which permits limited trade if the species' survival is not threatened, to Appendix I, barring any trade.

The action was sought by West Germany, home of Hans Fricke, a scientist who used a submersible to observe the fish in its native habitat for the first time (GEOGRAPHIC, June 1988). Fricke and two scientific colleagues—Eugene Balon of Canada's University of

HANS FRICKE

Guelph and Michael Bruton of South Africa's J.L.B. Smith Institute of Ichthyology—had urged the change. They said that efforts by aquariums in the United States and Japan to capture a living specimen threaten the creature's survival. There is no reliable estimate of coelacanth population.

Coelacanths had been thought to be extinct for more than 70 million years until a South African fishing boat landed one in 1938. Fricke and his colleagues estimate that about 200 have since been accidentally captured. They believe Comoro Islands fishermen, recognizing that a commercial market exists for the fish, are employing more effective fishing techniques—such as using heavier lines—and seeking to catch it deliberately for the first time.

JOEL SARTORE

Rehabilitating Wildlife, and Prisoners Too

It started with a baby badger.

In 1984 a Kansas construction crew accidentally destroyed a badger den. Billy Cox, Butler County wildlife conservation officer, raised the surviving baby badger in his home until it grew too large. Cox gave the badger to the El Dorado Honor Camp, a nearby minimum-security prison. From that beginning came the El Dorado Wildlife Rehabilitation Center. There, inmates volunteer to care for animals that are injured, orphaned, or otherwise in need of help. Harold D. Samuels, director of Kansas honor camps, says the center has housed as many as 200 animals annually—deer, foxes, bobcats, even bald and golden eagles—until they are ready to be returned to the wild. Inmates feed the animals, tend their wounds, give them medication. Only when treatment requires surgery or the use of a needle are animals taken to the clinic of a local veterinarian, Dr. Davy Harkins. The center is supported entirely by donations.

Samuels says that there are always more inmate volunteers than the four or five who can work for the center at a time. He calls it "a really valuable inmate rehabilitation program."

Harkins, the veterinarian, is delighted to see animals nursed back to health and freedom. And at least one inmate, Paul Byrd (above), has been so moved that he hopes to become a veterinarian himself after his release.

Around the Nation in a 1940 Biplane

He had no electronic navigational equipment, only maps and a compass. He was flying an open cockpit Waco UPF-7 biplane built in 1940. But John T. Race—a professional pilot for 45 years—succeeded in duplicating Charles A. Lindbergh's 1927 tour of the United States (GEOGRAPHIC, March 1989). Lindbergh made his tour after his solo flight across the Atlantic Ocean. The tour took Lindbergh 95 days; Race made it in 89.

Race says his "marvelous journey" allowed him to appreciate the nation's beauty. "At the same time," he adds, "I was saddened by the harm I saw we are doing to the land: air and water pollution and whole mountains with all the trees cut down.

"The tour," he says, "was exciting and demanding—perhaps not my last fling at youth after all. Even though I will be 69 in May, I have 'miles to go before I sleep.'"

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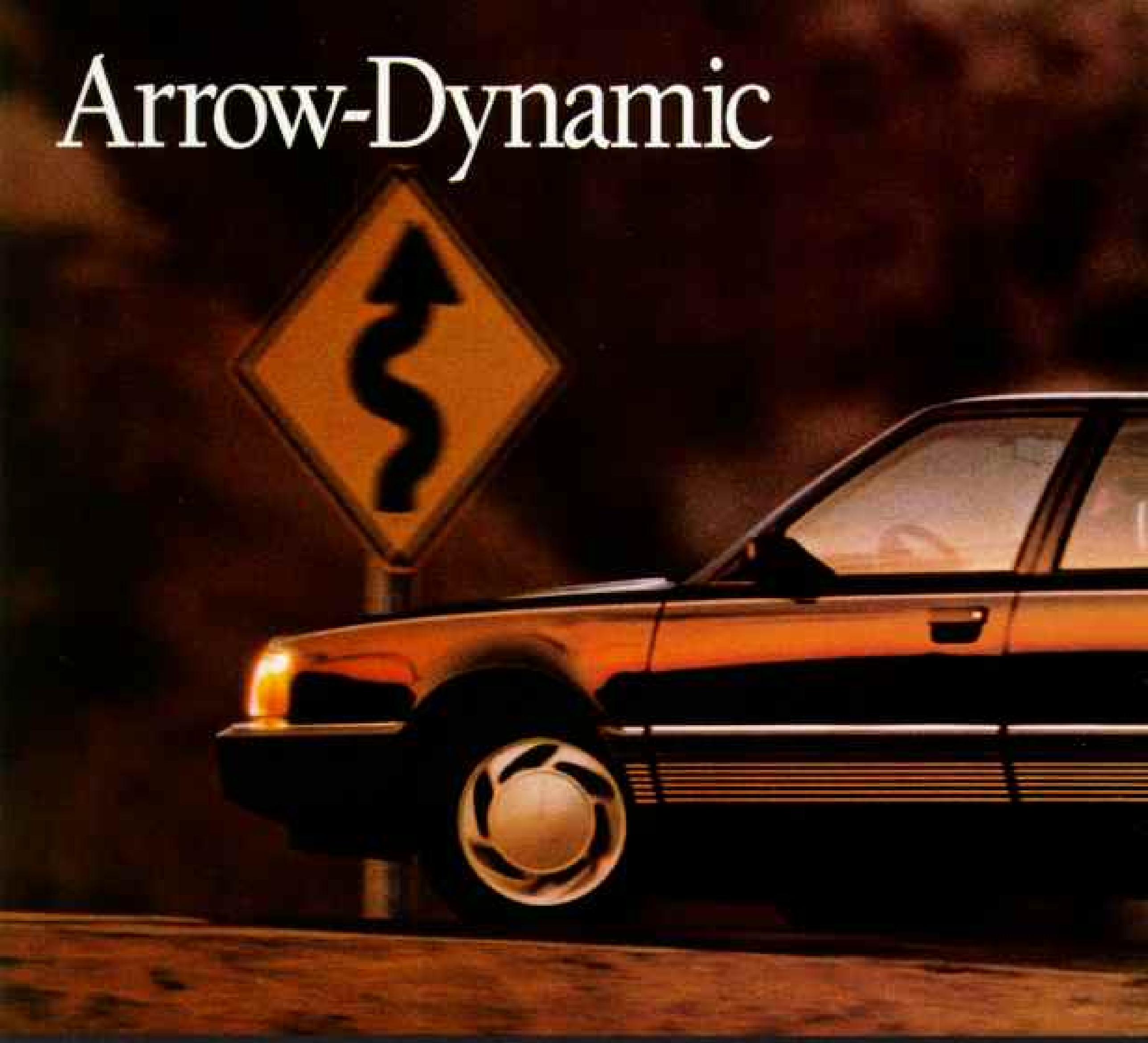

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A Snowmobile Trail: Wyoming Controversy

As part of centennial celebrations this year, Wyoming residents planned a snowmobile trail through some of the state's most spectacular regions. Environmental groups are raising questions about the plan.

Some 250 miles of the proposed Wyoming Continental Divide Snowmobile Trail were marked for use last winter, from Lander to the Togwotee area just outside Grand Teton National Park. The National Park Service is studying a request for a 30-mile-long corridor through the park so that the

route can link up with trails running over the unplowed winter roads of nearby Yellowstone National Park. Several environmental groups are asking the Park Service to consider the corridor's implications—whether, for example, it is needed or would endanger wildlife—in preparing a winter-use plan for Grand Teton and Yellowstone, to be presented this summer. Some also want the U. S. Forest Service to assess snowmobile impact on trail portions that are on its land.

Linda Hewitt, chairman of the trail association, says her group has worked with others to avoid causing environmental damage. Trail markers are put out in winter and taken down in spring, she says, leaving no sign of use.

Analyzing Old Air: Inconclusive Results

In 1935 the *Explorer II* balloon soared to 72,395 feet—a manned altitude record that lasted nearly 16 years—in a flight sponsored by the National Geographic Society and the Army Air Corps. Its two balloonists

JIM RICHARDSON, WEST LIGHT

collected air samples from the stratosphere, some of which were analyzed using the best equipment and techniques known at the time. The remaining air was stored in two glass flasks.

Equipment and techniques for analyzing air are now far more sophisticated. Could the "archived" air reveal more about what the stratosphere was like in 1935? Could it, for example, provide a benchmark for studying later increases in air pollution? The Society shipped one of the flasks to the National Oceanic and Atmospheric Administration's Environmental Research Laboratories in Boulder, Colorado, for testing (above).

NOAA scientists suspect that the unusually low levels of carbon dioxide and nitrous oxide were produced by a 1935 "drying" process that was supposed to remove only water vapor. Further contamination probably resulted from exposing the flasks to light. While meaningful comparisons were impossible, the effort taught them a lesson. "We have now become somewhat skeptical of finding reliable old air samples in places other than in gas bubbles trapped in ice cores," says team leader Pieter Tans.

Corn on the Cob, 2,200 Years Old

In science, as in most things, it pays to be lucky.

Stephen A. Hall, a University of Texas geologist, was in New Mexico to find out more about the early environment of today's Zuni Indian Reservation. He spotted some charcoal in deposits buried 23 feet deep but exposed in the wall of an arroyo. Hall and his colleagues with the Zuni archaeology program began to dig out the charcoal and found corncob fragments. The fragments proved to be about 2,200 years old—the oldest corn ever found on a Zuni site and among the oldest samples in the American Southwest.

Hall, whose work was supported by the National Geographic Society, says that the cultivation of corn began in Mesoamerica at least 5,000 years ago. Little is known about the path that corn followed northward into what is now the United States. The combination of charcoal, corncobs, and clumps of pollen grains suggests that what Hall found was a field site of some sort, perhaps one where harvested corn was roasted. The absence of any other artifacts indicates that the harvesters lived elsewhere, perhaps in caves or in the open not far away.

Decoding Mysteries of the "Slime Hag"

The hagfish has been around for at least 350 million years, but scientists don't know very much about its biology, its life-style, or its evolutionary history. They're learning, but it isn't easy—or even pleasant.

John B. Heiser, director of the Shoals Marine Laboratory, is leading a study of Atlantic hagfish in the Gulf of Maine. Last year he and members of his team sought out the fish with a manned NOAA submersible. At first they found few specimens. But when they set out bait—"If it's fish and it smells and it's rotten, it'll work," Heiser says—hagfish by the hundreds swarmed all over the sub.

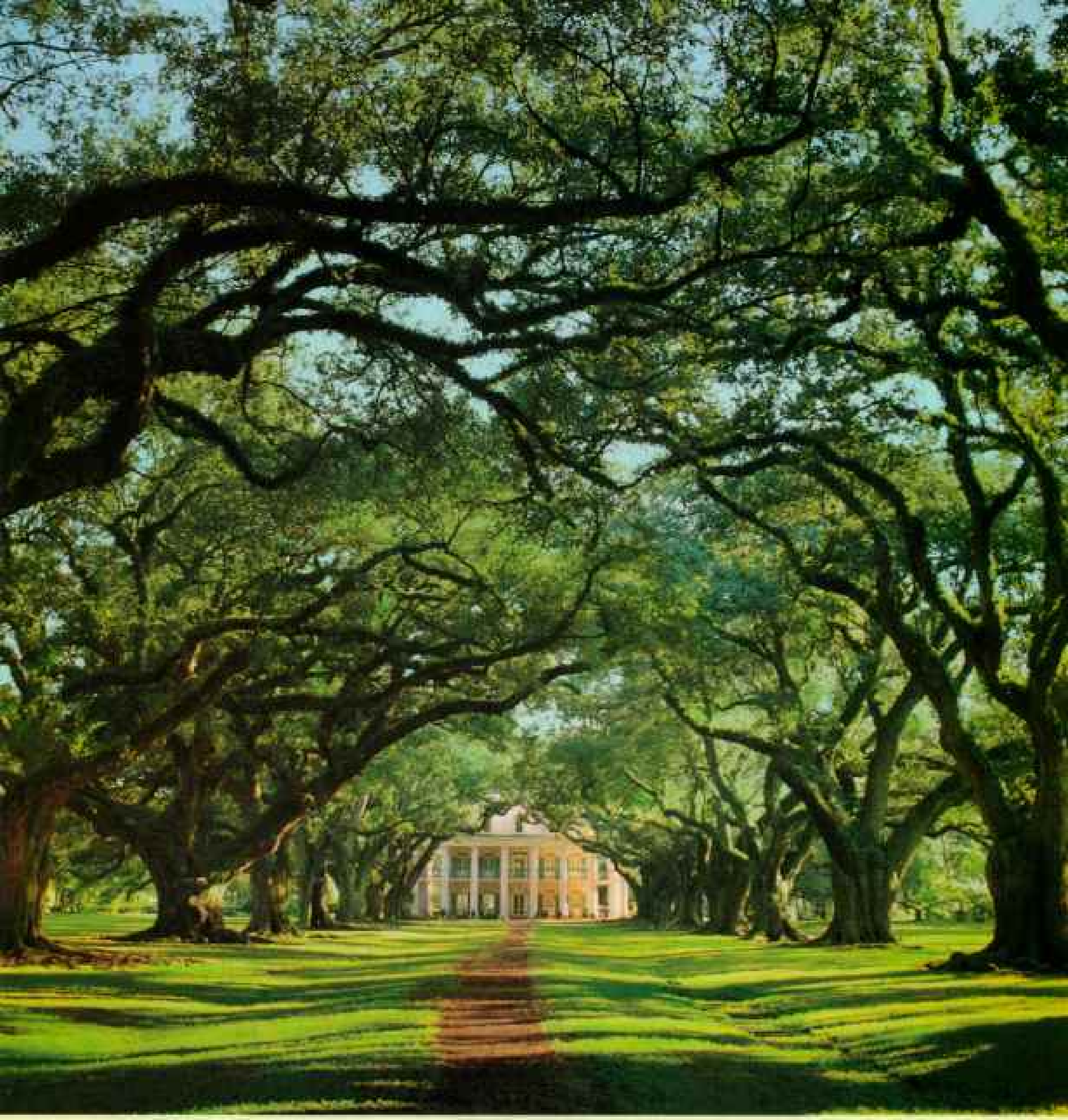
For the scientists, if not the fish, it was no picnic. The hagfish produces copious quantities of slime as a defense mechanism; New England fishermen call it the slime hag. "The term is usually preceded by several expletives," Heiser notes.

All the expletives may be justified, because hagfish strip the bait from lobster pots or prey on other fish trapped in nets. When the fishermen retrieve their nets, they find "an unmarketable bag of bones and skin," says Frederic Martini, co-leader of the team.

Some fishermen, however, are getting even. Korean tanners make wal-

TOM MCHUGH, PHOTO RESEARCHERS

lets and checkbook covers from hagfish skin, marketing it as eel skin. But because hagfish seem to live long lives and reproduce slowly—research suggests that they alternate periods of high activity with periods burrowed in the mud—they can quickly be overfished. Hagfish are now scarce in Asian waters, and Korean buyers are paying well for fish caught off U. S. shores.



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NATIONAL GEOGRAPHIC MAGAZINE

NATIONAL GEOGRAPHIC SOCIETY

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THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D. C., as a nonprofit scientific and educational organization. Since 1890 the Society has supported more than 4,000 explorations and research projects, adding to knowledge of earth, sea, and sky.

TO PUT WORDS where they don't belong, we can almost hear the orangutan in the cover picture asking "Why me?" Why through no fault of his own has he been added to the growing list of endangered species?

Because the world is ever changing. And some changes, mostly those caused by humans, are making survival increasingly difficult for thousands of species of plants and animals. While these really can't speak for themselves, James Balog, in words and pictures, is an eloquent spokesman on their behalf.

Japanese men, who can and do speak for themselves, must be asking "Why us?" as they watch their venerable, male-dominated society begin to disappear politely before the wave of changes in the role of the Japanese woman.

Until 169 years ago Antarctica was the only one of earth's seven continents never to feel human footsteps. Why not leave it alone? Because even this inhospitable and remote land is not immune to the forces of change. Hundreds of men and women from 23 nations are there now, punching, probing, and prying at its secrets to determine its new role in this changing world.

More so than is usual, this entire issue focuses on change, but nowhere more dramatically than in the report on the breaching of the Berlin Wall. For 28 years this most visible and despised link in the Iron Curtain stood as a modern icon to mankind's futile attempts to stop change by building walls or drawing lines. Whether it be the walls of biblical Jericho, China's Great Wall, or France's Maginot Line, no barrier, no matter how seemingly impregnable, has stood up against the trumpets of change. Incumbent dictators such as Romania's Nicolae Ceauşescu, who thought the Iron Curtain would protect them from change, might have asked "Why me?"—but only if they had forgotten that the one certainty in life is change.

As for the orangutan, if he can just hang on long enough, we can hope things will change in his favor before it's too late, because one thing that cannot change is the finality of extinction.

Wilbur E. Garrett

EDITOR

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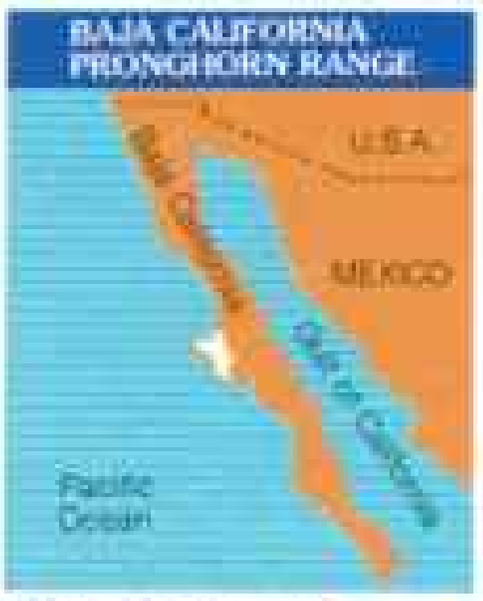

Baja California Pronghorn
Genus: *Antilocapra*
Species: *americana*
Subspecies: *peninsularis*
Adult size: 88-105cm at the shoulder
Adult weight: 37-70kg
Habitat: Vizcaino Desert in Baja California, Mexico
Surviving number: Less than 100
Photographed by Patricio Robles Gil

Shadowy images keep pace as Baja California pronghorns stride with the grace and speed for which these North American mammals are known. By 1920, pronghorns, which once numbered over 30 million, dwindled to less than 20,000 due to hunting and loss of open land. Pronghorns in the U.S. and Canada have recovered, but the Baja subspecies remains endangered. To save endangered species, it is essential to protect their habitats and understand the vital role of each species within the earth's ecosystems. Photography, both as a scientific research tool and as a means of communication, can help promote a greater awareness and understanding of the Baja California pronghorn and our entire wildlife heritage.

You have to kill a whole elephant to get a little ivory.

The road to extinction is paved with ivory bracelets, rings and carvings. All beautiful. All deadly.

Every day in Africa, 143 elephants are slaughtered. At this rate, they'll be wiped out in 25 years. Unless you help now. First, don't buy ivory, new or old. And alert everyone you know.

Then, support World Wildlife Fund's elephant action campaign. We are the only group actively working with local people across Africa to stop poaching and save elephant lands.

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Prepared as a public service by Ogilvy & Mather. Photo by Charles Gold.

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On Assignment

DAVID ALAN HARVEY (LEFT); KARL KONTUS

With good reason for glee, Senior Writer Priit Vesilind chiseled a chunk off the Berlin Wall last year. In 1944 he had left his native Estonia with his family, fleeing west as the Soviet Army advanced. Father Paul with Priit, mother Aino with brother Aarne, and cousin Salme Kontus faced a choice of destinations in Polička, Czechoslovakia (above right). After four years in a displaced-persons camp in West Germany, the family arrived in the small town of Beaver, Pennsylvania, to start anew. Priit graduated from Colgate University, served as an officer in the U. S. Navy, wrote a sports column for the *Atlanta Journal*, and earned an M.A. in photography at Syracuse University. He joined the Geographic staff in 1973. One of his most satisfying magazine assignments—"Return to Estonia" (April 1980)—gave him the chance to revisit and explain the painful dilemma of his homeland, which had been forcibly annexed by the Soviet Union.

When the news hit that the Berlin Wall, the Cold War's most despised symbol, would soon be history, Priit rushed off on two hours' notice to document the emotional events in a city he had once covered (January 1982). He found the experience so intense that "I couldn't hold back the tears. I could only scribble and weep, scribble and weep."

Looking for her own roots, photographer Karen Kasmauski received this family picture (below) from her Japanese uncle during her first trip back to Japan since infancy. She was traveling there to shoot pictures for our April 1989 article on radiation.

Karen was born on Yokosuka Naval Base to a Japanese mother and an American father; at age eight months she joined this family outing with her grandmother Kame and mother, Emiko, to Hakone, a lakeside resort near Mount Fuji. A year later she was in the United States, where she grew up as a typical American and typical "Navy brat." At the University of Michigan Karen pursued a double major in anthropology and religion "to learn more about how people live and why they do what they do." Working on oral-history projects, she realized photography could be a useful tool.

On the radiation story, her fifth for the Geographic, she met Japanese aunts and cousins; with them she cleaned her grandmother's shrine in a little fishing village and burned incense to her spirit. "I was immediately thrown into an unfamiliar culture. I realized Japanese women are mythologized in

STEVEN KASMAUSKI (LEFT); WILLIAM T. DOUTHITT, AIA

America, especially by men, as if they are all fragile little flowers or geisha. I could see that my own relatives, especially my strong-willed mother, were not like that." To explore what Japanese women are really like, Karen proposed the story in this issue.

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