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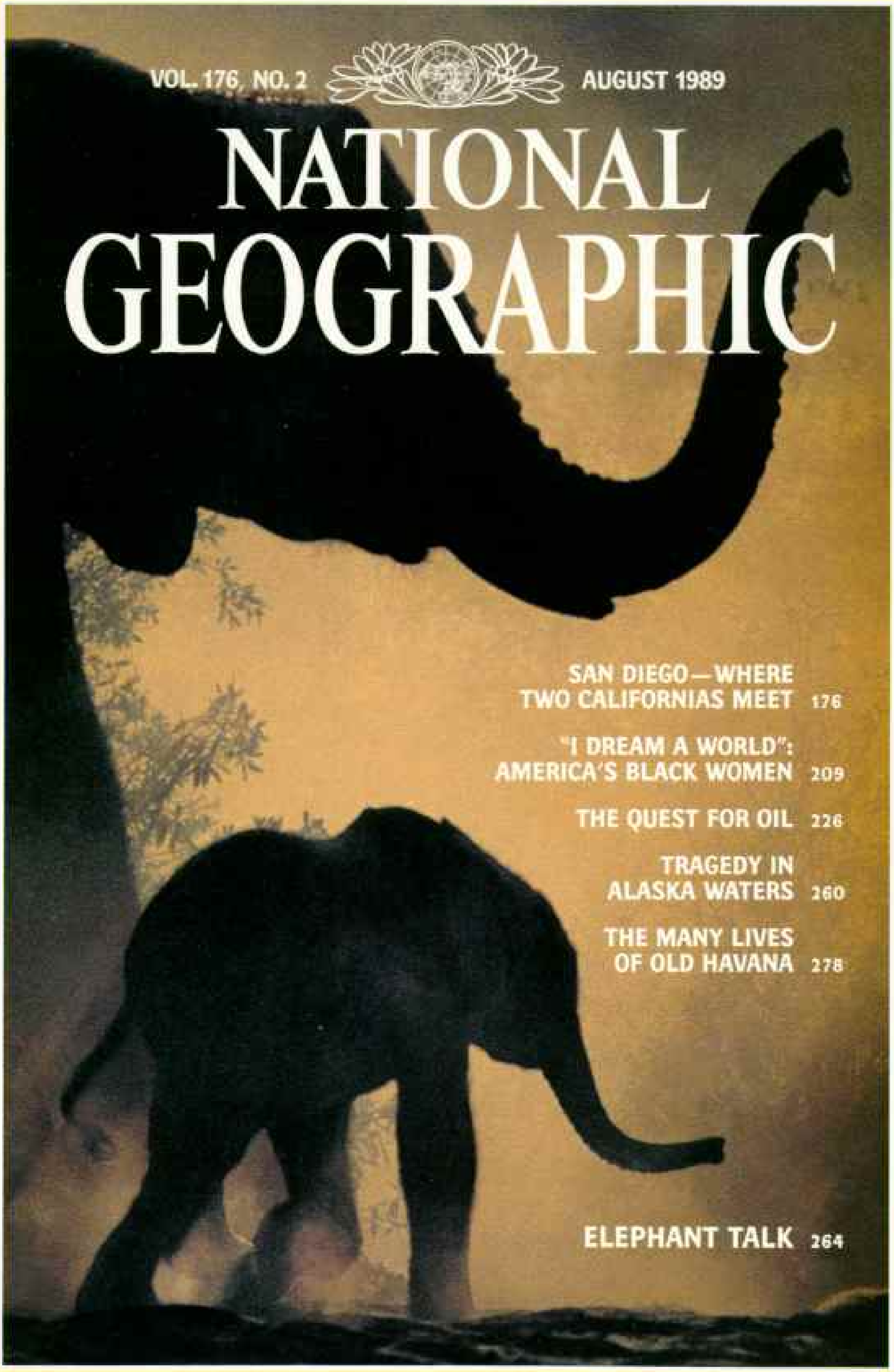
NATIONAL GEOGRAPHIC



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NATIONAL GEOGRAPHIC

AUGUST 1989

LASER ART AT UNION BANK BUILDING

BARBARA JORDAN

GAS FLARES AS A NEW WELL IS TESTED

OIL-COATED SEABIRD

ELEPHANTS DRINKING

YOUNG RESIDENTS IN OLD HAVANA

COVER: *Closely protected by an adult female, a baby elephant heads for water in Botswana's Chobe River. Photograph by Frans Lanting.*

As irrepressible as his adopted hometown, Shamu the killer whale trades laughs

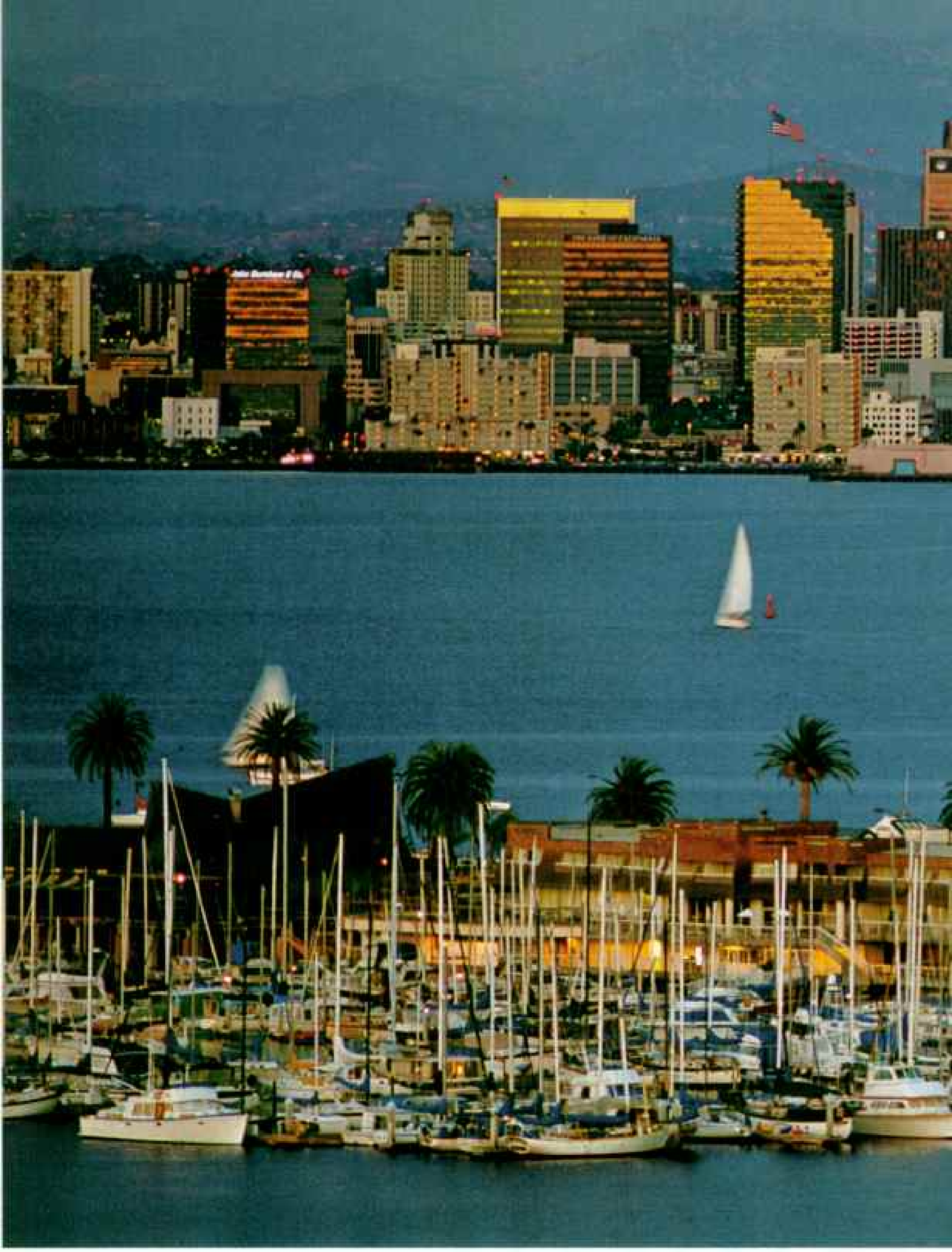
Where Two Californias Meet SAN

with trainers at Sea World, one of the world's largest marine-life parks.

DIEGO

By NEIL MORGAN

Photographs by
KAREN KASMAUSKI



HIGH, WIDE, AND HANDSOME, California's second largest city is riding a crest. With a population increase of more than 20 percent since 1980, San Diego ranks as the fastest growing city in the nation with a million or more people. Still a big military center,

KEVIN S. SCHUMACHER

the city has come a long way from the sleepy Navy town it was during the 1950s. Its economy today is dominated by aerospace, electronics, medical research, and other industries that pose little threat to the city's celebrated quality of life.

IT IS MIDNIGHT, moonless and surreal, at the busiest border crossing in the world. On scarred hillsides and riverbanks that are studded with U. S. Border Patrol sensors and prowled by bandits and rapists, hundreds of Mexicans huddle for the run of their lives. Their eyes shimmer with dread and hope, here at the sagging south fence of my hometown, rich and beautiful San Diego.

La Linea, they call our nation's 1,950-mile southern border. It is a line etched by crumbling barriers and lives, by ironies of geography and history. Desperate millions have come from Mexico's interior, hoping to cross over La Linea for the same reasons that ancestors of other Americans left Ireland or Norway or China. Their families are hungry, and there are no jobs. The largest throngs seek out Tijuana, a city of more than a million in Baja California, in Mexico's northwest corner.

In blackness now beside the putrid Tijuana River, the migrants stand along a mile of levee, watching three border patrolmen in steel-screened jeeps the agents call war wagons. For each lawman there are perhaps a hundred Mexicans. Overhead, an agent shuttles in a helicopter, his searchlight cutting a white swath along the border. The migrants await a quieter moment to start their dash across field and freeway to the fabled land of El Norte—the North.

"When they run, we grab as many as we can," an agent says. "We take them back to the border, and they try again. Eventually most of them get through. They can't get jobs without papers, but we can't expect employers to tell if work cards are counterfeit."

Alone, I scramble down the levee. In the flicker of a dying campfire, three figures cling to one another. The small one has brown saucer eyes. He stands between a young man and woman who clutch plastic sacks, the only luggage of this migration. I crouch near the child. "*Buenas tardes,*" I say. "Good evening." "*¿Cómo se llama?*—What is your name?"

He looks up at his mother. "Carlitos," he whispers.

I ask where he comes from. His mother's face softens in a small, puzzled smile. "Michoacán," she prompts. It is more than 1,200 miles to the southeast.

"*Vaya con Dios, Carlitos,*" I say. "Go with God." His parents' wary eyes follow me as I rejoin the Border Patrol.

An hour later the levee erupts in a frenzy of

CALLOW CREW of recruits line up for their first swim at the San Diego Naval Training Center, boot camp for 33,000 new sailors a year. Out on the open sea, a Navy pilot takes an F-14 Tomcat up for night landing practice on an aircraft carrier. With the heaviest concentration of naval bases in the United States, San Diego County is home to 140,000 active-duty military personnel, including 30,000 at San Diego Naval Station, 28,000 at Miramar and North Island Naval Air Stations, and 36,000 at Camp Pendleton Marine Corps Base. An estimated 40,000 military retirees also reside in the county.

movement. I sit behind a helicopter pilot as he broadcasts to agents in the war wagons below: "About 200 people are running toward the freeway. Lots more slanting west toward the beach. Your best chance is in the field."

Spotlights whirl as the agents seize migrants nearest to them. Our searchlight plays on a swelling group of migrants not yet handcuffed. They squat, in the way of peasant farmers, their hands in the air. In the glare of headlights nearby, migrants vault freeway divider walls and flee through eight lanes of speeding traffic. About 30 migrants died this way last year in San Diego.

Suddenly that skirmish ends. But over our helicopter radio come shrill Border Patrol voices: "Lisa! You got people coming up behind you!" Agents riding all-terrain vehicles along dark trails a mile to our east have intercepted a column of migrants trudging north through the chaparral of Deadman's Canyon. Another little border incident begins.

Hours later I walk through holding cells among hundreds of Mexican men and women, looking for a child with brown saucer eyes. Carlitos is not there. The agent at my side wonders why I am smiling.

SAN DIEGANS never expected to be in the maelstrom of social change. Still predominantly white and middle-class, they have cherished their cul-de-sac in the southwest corner of the country, walled in by sea and mountains, by Los Angeles to their north and the Mexican desert to their south. Now Mexico spills over. Some of its best and brightest are moving to Tijuana, anxious to prosper in trade between El Norte and Pacific nations.

More than three million Mexicans and Americans live in these contiguous metropolitan areas, sharing a sunny seaside littoral and its amiable climate. They also share the psychic kinship of migrants. Many on both sides have moved from elsewhere within their own countries; they have placed San Diego and Tijuana high among the fastest growing cities of their respective nations. Both are young cities, late bloomers that thrive on new ideas, new faces, perpetual evolution.

Academic visionaries believe these cities, the largest along La Línea, could become a transborder megalopolis, a blend of cultures, of Yankee capital and Latin labor. But their mutual size, clout, and goals are matched by awkward contrasts in heritage, custom, and governance. Few neighbor nations share so many common interests and collide over such irreversible differences. Nowhere else is there so lengthy an open border between Third World and First. It is said in the streets that the

PLAY IS HEALTHY for any young primate. Gordie the gorilla enjoys a vigorous swing by Joann Thomas during his checkup at the world-famous San Diego Zoo in Balboa Park. Many of the zoo's gorillas, including Gordie, roam the expansive Wild Animal Park north of the city. Aided by reproductive research, the zoo and park have enjoyed notable success in encouraging gorillas and other endangered species to propagate.

two cities are married but have not made love.

San Diego is a filigree of neighborhoods and subcities that sprawls 50 miles northward from the Mexican border, linked by canyons, bays, hills, parks, and freeways. At its north is the 17-mile cushion of Camp Pendleton Marine Corps Base, a welcome barrier to urbanization spreading from Los Angeles and Orange Counties. San Diego County, about the size of Delaware and Rhode Island combined, has 2.3 million residents, half of them within the city. Like San Diego City, the county's coastal towns face bays or sea. Four out of five county residents live within 15 miles of the coast. Settlement thins in the brittle forests of its arid hills and almost disappears in the desert, where the Anza-Borrego Desert State Park stretches 54 miles along the county's eastern side. In between rises San Diego's own great divide—6,000-foot mountains of the coastal ranges, dotted with oaks, cedars, pines, and red-barked manzanitas.

For years this confining geography isolated San Diego and shaped its history. The first European to see California was the Portuguese explorer Juan Rodríguez Cabrillo, who sailed into the bay in 1542. Sebastián Vizcaíno made his landfall in 1602, naming the harbor San Diego to honor the Spanish Saint Didacus. No European appeared for the next 167 years. San Diego became the first permanent California community in 1769, when a fearless Franciscan priest, Junípero Serra, journeyed from Mexico with Spanish soldiers to build his mission on Presidio Hill. But Spain yielded California to newly independent Mexico in 1822.

In 1848 San Diego became a border town through the Treaty of Guadalupe Hidalgo, which ended the war between Mexico and the United States. That treaty set the international boundary one marine league south of San Diego Harbor, a valuable prize for the U. S.

Transcontinental railroads were built into San Francisco and Los Angeles, forever branding San Diego as a spur-track city. Even San Diego's hope of maritime dominance was dashed when Los Angeles completed an artificial harbor in 1911. That fueled San Diegans' hostility toward the metropolis at their north.

Instead of wooing factories and tankers, San Diego established itself as a preeminent residential city. There is no oil to be pumped in San Diego. Its dwindling farmland requires intense irrigation. Most of its water and power come from far away. But San Diego air and bays and parks remain relatively unsullied, its trolleys purr along, and its freeways usually work. It is rich in space and parkland and health care and unmatched in climate. Its schools rank above the California average, and its university and research campuses are acclaimed. Almost 50,000 pleasure boats throng its marinas and bays. There are 70 miles of public beaches, 70 golf courses, 38,000 hotel rooms, an array of health spas and resorts. Such amenities attract some 30 million visitors a year; tourism spurs the economy.

So does high-tech industry, which produces goods delivered not by rail or sea but air. The bills of lading list excimer lasers, cancer-imaging devices, pregnancy test kits, monoclonal antibodies, plastic-bomb detectors, neural-network computers, and a thousand other products, all part of the harvest from San Diego's hybrid of science and commerce.

"Intelligence," Gail Stoorza Gill assured me, "has become the economic engine of San Diego." It is a reassuring declaration from the chairman of the Chamber of Commerce.

Among the ten most populous U. S. cities, San Diego has the highest proportion of college graduates, about one in four. "The kind of San Diegan we hire," says Tim Wollaeger, an executive in a biotechnology firm, "is a Ph.D. microbiologist, three years out of school, starting at $55,000. Or an M.B.A. from Harvard or Stanford, starting at $70,000. And they're likely to be married to each other."

I HURRIED TO KEEP PACE as 80-year-old Roger Revelle strode across the campus of the University of California, San Diego (UCSD). While director of Scripps Institution of Oceanography, he helped found this university in 1960 by recruiting faculty members whom he considered academic rebels.

"There was nothing here but all this beauty," Revelle said softly. We stood on a scenic cliffside knoll near the Institute of the Americas. "I was called chief campus officer, but of course there was no campus at that time. I brought about 20 great scientists to this hill, and most of them joined our faculty. They gave us a yeasty, innovative university that

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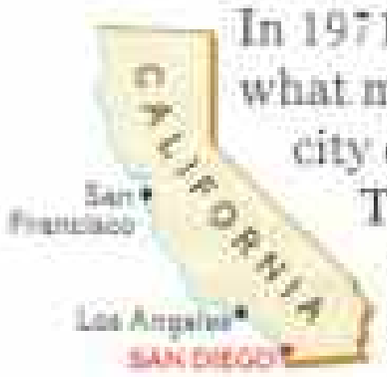
NEIL MORGAN is the editor of the Pulitzer Prize-winning San Diego *Tribune*, serving a city he adopted 40 years ago. This marks his sixth GEOGRAPHIC article. KAREN KASMAUSKI's photographs most recently appeared in our April 1989 article on radiation.

GREATER SAN DIEGO
The Booming Shore

Bypassed during the gold-rush days that brought fame and fortune to San Francisco, sidetracked by the railroads that helped transform Los Angeles into a megacity, San Diego has pursued a slow and steady path to success. In 1971 it overtook San Francisco in population. Blessed with what many consider the nation's most delightful weather, the city continues to draw migrants at a rate of more than 40 a day. Though laws have been passed to curb this growth, the city has plenty of elbowroom. Incorporating 330 square miles, it is larger in area than New York City.



Built-up area
Military base
Parkland
Military airfield
Civilian airfield

SCALE VARIES IN THIS COMPUTER-GENERATED PERSPECTIVE

NGS CARTOGRAPHIC DIVISION
DESIGN: SALLY SUDWORTH-SUMMERALL
RESEARCH: ROSS H. EMERSON
PRODUCTION: BARBARA CARRIGAN, LAURA J. S. KRAUSMANN, RAMSEY MURRAY
MAP EDITOR: JOHN T. BLOZIS

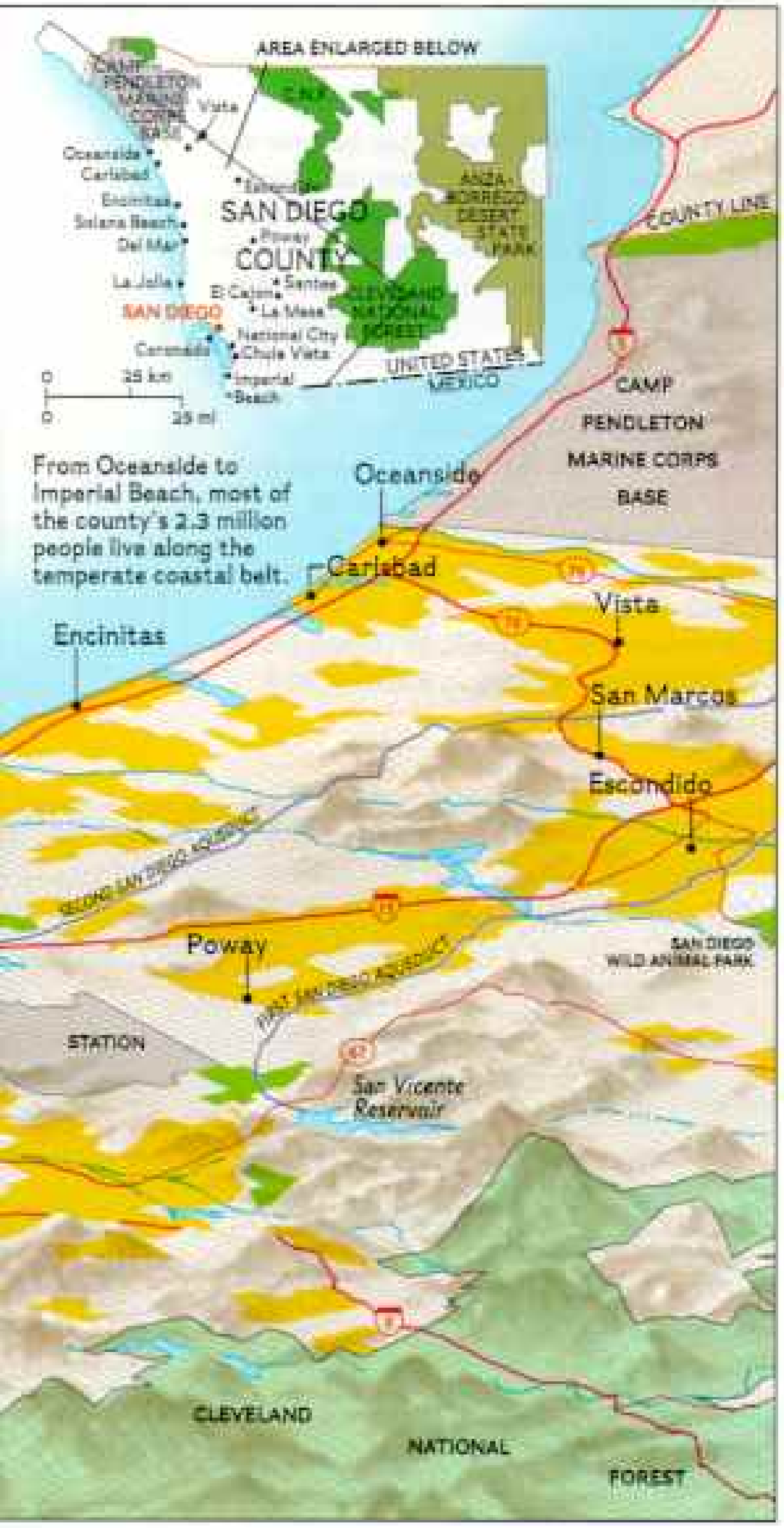
Sailing under the flag of Spain in 1542, Portuguese explorer Juan Rodríguez Cabrillo was the first European to sight these shores. Millions have visited his memorial atop Point Loma.

Balboa Park covers 1,400 acres, including the zoo, museums, and the renowned Old Globe Theatre, a launchpad for Broadway shows.

Mission Bay, with 27 miles of shoreline, is the city's prime recreation area and home of Sea World.

Miramar, training ground for the Navy's "top gun" fighter pilots and a score of other defense installations make the military the county's largest single employer.

Once only a fraction of its neighbor's size, Tijuana now harbors roughly the same number of people. Many are newcomers, drawn from Mexico's interior by jobs along the border.



was distinguished from its birth." The school staked out science and technology as its preeminent role, but early in its development it began to diversify.

We watched a distant aircraft carrier inch across an empty gunmetal sea toward port. The cliffs to the south, shaggy with eucalyptus and palm, curled out into the sea to enclose the suburb of La Jolla. To the east, along terraces that rise to the mountains, new buildings glittered for miles; they are the core of a modern San Diego built on the business of technology.

To this same cliffside Revelle enticed Jonas Salk, a national hero after he developed a polio vaccine. The Salk Institute, opened in 1963, has provided laboratories and sanctuary for reflection to men like Francis Crick, who shared a Nobel Prize for describing the structure of the DNA molecule, and mathematician Jacob Bronowski, the host of public television's *The Ascent of Man*. Salk, 75, works high above the sea in an airy office.

"Something in San Diego is attracting the right people," he said. "It's not climate alone. A critical mass of talent is developing. San Diego's future lies in science serving humanity."

Salk's institute and Revelle's university grew side by side. With 16,000 students in 1988, it ranked first among public universities in percentage of graduates enrolling in medical schools and first in those going on to Ph.D. degrees. Its faculty includes five Nobel laureates. Fifth in the nation in federal research funding, UCSD is a major factor in the estimated one billion dollars in research money that flows into San Diego County each year.

Through the prestige of its medical school and its early emphasis on biology and genetics, UCSD has become a center for the young biotech industry, which has perfected techniques for altering minute parts of living organisms and cloning them for medical use. In 1976 the Scripps Clinic and Research Foundation moved from downtown La Jolla to a campus beside UCSD. Scripps has since grown into the largest private biomedical research institute in the world.

WITHIN SIGHT of winter's gray whale migrations, Tom and Sandy Henry entertain above La Jolla Bay. La Jolla has become a respected center of education. Says the author, a longtime resident: "This area used to be known for its old money. Now it's known for its young brains."

LATE ONE FRIDAY AFTERNOON I joined its research director, Richard Lerner, 51. Many of his unconventional staff of about 500 M.D.'s and Ph.D.'s, some dressed in jeans, T-shirts, and running shoes, were milling about during their week's end social hour. At the center of the hall, with glowing red panels like a surreal jukebox, was a Cray supercomputer, ringed by the labs of biologists and chemists.

"Biotech is the future of medicine and health care," Lerner said. "Because of it diagnosis and treatment will become more computational, more mathematical. Computer and laboratory are its twin arms. Scripps already receives millions of dollars a year

URBAN SPRAWL California style: Row upon row of terraced housing crowds the steep hillsides (below right) of San Diego's northern suburbs. Near La Jolla, beams from a laser show highlight one of many gleaming office buildings that form a new "downtown," 12 miles north of the old. On a roll for three decades, San Diego has matched the growth of its population with an equally robust economic expansion.

For many San Diegans, drawn here by clean air and open roads, such growth threatens to bring with it the pollution and congestion of Los Angeles, which is often evoked as the ultimate bad example. Thanks to a coalition of environmental groups—one of which is called Prevent Los Angelization Now—growth has become the hottest issue in town. Two years ago the City Council adopted temporary measures to restrain housing starts, though voters rejected four ballot proposals last November that would have curbed new development.

Today much of the energy that was once spent on suburban development is being concentrated in the long-neglected city center. A powerful catalyst for change in one of downtown's most dilapidated districts has been Horton Plaza (below left), a "wonder mall" occupying six and a half blocks. Much praised for its fanciful architecture and open air, the plaza boasts two legitimate theaters in addition to a multiscreen cinema.

from discoveries made by this faculty."

Lerner, whose institute receives more research funds from the National Institutes of Health than any other private organization, believes this cliffside has become a sort of shrine to research: "Here are the results of three separate visions: Revelle's, Salk's, and ours. You could hardly put three such institutions in sight of each other and lose the game."

One big winner was Hybritech, a biotech firm begun in 1978, just across the avenue. It was the first drug company to market monoclonal-antibody technology, developed to treat certain forms of cancer. As chief executive, Ted Greene, 46, negotiated Hybritech's sale in 1986 to the pharmaceutical giant Eli Lilly for 480 million dollars. When 800 employees divided 80 million dollars of the sales price, San Diegans grew curious about biotech. So far the city's 70 commercial biotech firms employ only about 2,700 people. Those attached to Scripps and smaller research groups double the number.

"San Diego has this appetite for risk taking," Greene said, guiding me among white-coated scientists in their labs. "Even the city's lack of social roots is productive. People are used to trying new things. In biotech this is like the Texas Panhandle in the 1920s and '30s. We are the wildcatters, waiting for the corporate giants to step in when scientists hit it big."

RAY DITTAMORE, 46, a native San Diegan, returned in 1982 after five years in Europe and noticed how the city's pace had changed.

"I found a different breed of young people," he told me. "If I wanted to see them, it wouldn't be over some long lunch. It was for breakfast or a quick sandwich at the office or racquetball after work. A new work ethic, a new commitment had swept the city."

Newcomers have accelerated cultural change. William Jovanovich, one of the more innovative New York book publishers, startled competitors by moving five book divisions to San Diego in 1980 and establishing his own home here. "I came out of sentiment," he told me. "I love this city." At offices in downtown San Diego, 400 of his employees edit and publish all the books of Academic Press, the largest U. S.-based scientific publishing firm, along with 95 science journals.

Even the San Diego Zoo and the Wild Animal Park are frontiers for science. Deep in Balboa Park, near its theaters, museums, gardens, and galleries, are the laboratories of CRES, the Center for Reproduction of Endangered Species. Research Director Werner Heuschele and his colleagues use their findings to help troubled species such as cheetahs, gorillas, Chinese monal pheasants, and white rhinos. The Wild Animal Park hatched the first California condor chick in captivity. "There are only 30 of these great birds left," Dr. Heuschele said. "But now two others may be on the way. Some of the birds raised here will be released in the wild."

Other nations turn to CRES. It has helped breed Przewalski's horses, which had disappeared from their habitat in the Gobi desert.

TWICE WINNER of the America's Cup for the San Diego Yacht Club, Dennis Conner may yet witness the forfeiture of sailing's most prestigious prize if courts ultimately rule that his catamaran, Stars & Stripes, gave him an unfair advantage in the 1988 races. Also at stake: the estimated 1.4 billion dollars San Diego stands to gain for hosting the next regatta. Many San Diegans are happy to pursue their own competitions. Racing off Point Loma, a mischievous crew launches water balloons at foes.

Eleven horses have been returned to northwest China. The zoo has helped reintroduce the almost extinct Arabian oryx in the deserts of Oman, Jordan, Israel, and Saudi Arabia.

"Much of our work is in enhancing fertility," Heuschele said. "We do DNA fingerprinting, studying the structure of genes to learn how closely individual animals are related. That helps us manage their mating by avoiding the adverse effects of inbreeding."

Heuschele, who began his career at the zoo in 1947 as a tour-bus driver, led me to an upstairs laboratory, where a chilled tank is labeled "FROZEN ZOO—20TH CENTURY ARK." It is the zoo's insurance against doomsday in the animal kingdom. Stored at 315°F below zero, living skin cells represent about 275 species. Sperm samples from 2,000 animals represent 156 species.

"We can maintain the viability of cells and sperm indefinitely," he said.

High technology helps farmers too. Near

HIGH ON HEALTH, many San Diegans have made fitness a goal in their relentless pursuit of the perfect body. At Jazzercize, one of the largest nationwide aerobic organizations, with headquarters in northern San Diego County, patrons and instructors mix it up for an instructional video, used later to polish their form.

the coastal town of Encinitas, Paul Ecke, Jr., led me through 35 acres of greenhouses specked with the fire-engine red of blooming poinsettias. He originates 90 percent of the mother plants from which growers around the world produce the familiar Christmas flowers.

In the 1960s, when land and water prices rose, Ecke's family moved their business inside. "Poinsettias are photoperiodic," Ecke said. "They respond to a day-and-night cycle. To keep the mother plants from blooming, we

CONTAMINATED
WITH SEWAGE
KEEP OUT

AVOID ALL CONTACT
NO SWIMMING, WADING, SURFING OR WATER SKIING
COUNTY OF SAN DIEGO DEPT. OF HEALTH SERVICES

MANTENGASE FUERA
EL MAR ESTA CONTAMINADO
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EVITE TODA CLASE DE CONTACTO
NO NADE, NO ANDE DESCALZO, NO SE META AL
MAR CON LA TABLA O EL ESQUI ACUATICO
CONDADO DE SAN DIEGO
DEPARTAMENTO DE SERVICIOS DE SALUBRIDAD

QUARANTINED
DO NOT EAT MUSSELS
FROM THESE WATERS
FROM MAY 1 TO OCT. 31
THE DARK MEAT FROM CLAMS SHOULD
BE DISCARDED AND NOT EATEN.
MEAT COULD BE POISONOUS

fool them by turning on special greenhouse lights for 15 minutes an hour during the middle of each night from September to May. They need a longer night to bud and flower."

LIKE THOUSANDS of adopted San Diegans, I was in Navy uniform when I first saw the city. It was 1944, and camouflage covered the Consolidated-Vultee Aircraft Company, where B-24 Liberator bombers rolled off assembly lines. San Diego was a city of fewer than 300,000 then, swollen by the coming and going of what seemed like a million sailors and marines.

"San Diego has never been afraid to be called a Navy town," says Rear Adm. John W. Adams, who oversees San Diego's vast complex of Navy and Marine Corps bases. The military is a mainstay of the economy.

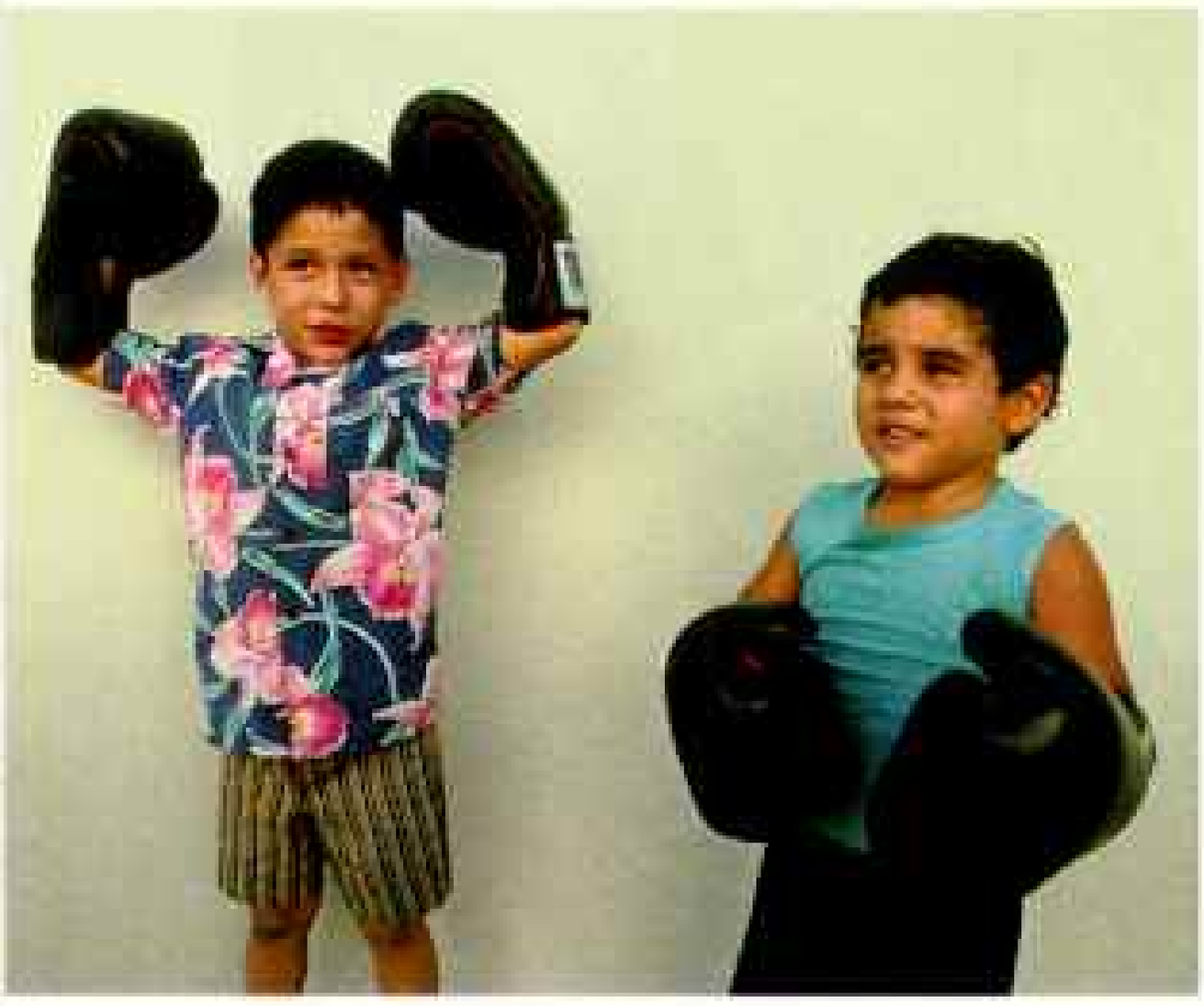
Some 140,000 military people are on active duty in San Diego, and about 40,000 have retired here. They receive close to four billion dollars in pay and retirement benefits each year. San Diego is home port for a hundred Navy vessels—among them cruisers, nuclear submarines, and the aircraft carriers *Ranger*, *Constellation*, and *Independence*, each a waterborne community of 5,000 people. These ships patrol waters as distant as the Indian Ocean off eastern Africa.

In addition some 700 military aircraft are based in San Diego. One night I watched young Navy pilots practice landings on the

MARRIAGE OF CONVENIENCE, the relationship between the two largest cities on the U. S.-Mexico border is nurtured by meetings between San Diego Mayor Maureen O'Connor and Federico Valdes Martinez, her Tijuana counterpart. About half of Tijuana's 450 or so maquiladoras—foreign-owned factories, like Sanyo's TV assembly plant (top)—have offices in San Diego County. Disparities in wealth between the two cities can hardly fail to create tensions. For years now, raw sewage from Tijuana has been polluting the waters off Imperial Beach.

FIRST TOEHOLD in El Norte for illegal immigrants, a makeshift camp in northern San Diego County is inspected by the U. S. Border Patrol early one morning. While some of the estimated 450,000 Mexicans who successfully bolted across the border last year sought work harvesting the county's fruit and vegetables, most headed north to the barrios of Los Angeles or beyond.

Mexican Americans, on the other hand, make up about 17 percent of San Diego's population and occupy all rungs of the economic ladder. At the Barrio Youth Center, youngsters (below) are dissuaded early on from joining the street gangs that often terrorize their neighborhoods. In a more affluent neighborhood Jacoba Ponce, at right, and a friend prepare for her sister Susie's upcoming quinceañera, the traditional celebration of a girl's 15th birthday.



Ranger, 60 miles southwest of San Diego. The deck lights went bright and a loudspeaker erupted with orders as, one after another, the 24-ton F-14 Tomcats slammed down on the deck at full power—125 to 135 knots.

On a platform at the stern I joined officers who were grading pilots on their landings. We were at eye level with the flight deck and its arresting cables, spaced 40 feet apart. If the approach is a few feet too high, the pilot could miss them all. "This next pilot is fighting to keep his wings," an officer said. "He's been brought back from the western Pacific. He's having trouble with night landings."

Down from the black sky he sped, his wing lights mere specks. Electronics monitored his approach. His nosewheel lights flashed red (too fast), then green (too slow), and back to amber. His lights grew suddenly larger, and the Tomcat screamed in just above us. Jet blast and pellets of debris struck our faces. The plane roared out of sight. An officer muttered, "He makes a perfect approach and then starts wrestling with snakes in his cockpit."

The pilot tried twice more to get his plane down. Both times he failed. Low on fuel, he radioed his good-night and flew back to shore. He was almost certain to lose his wings.

My heart went with him. I had washed out of Navy pilot training.

SAN DIEGO has been a boom city since its last major recession in 1962. Its gross annual product is about 47 billion dollars, larger than the gross national product of Greece, and its growth rate exceeds those of California and the nation.

But growth brings problems. As freeways become crowded, voters rail at developers of the housing communities that march across the mesas. The pace of growth has become the primary political issue. Ernie Hahn, 69, hopes to attack the problem of urban sprawl by rebuilding the city from within. His shopping village, Horton Plaza, has helped rejuvenate a dying downtown. "I don't know a city in the United States that has the assets and opportunities of San Diego," he says. "But it's somewhat provincial. There's not enough visionary leadership, not much sense of urgency. I hate to see a great resource waste away. We need a strong regional plan for these 18 cities that we call San Diego."

Mayor Maureen O'Connor, 43, a native in a city of migrants, remembers when foreigners were rare in San Diego. "Now we hear three and four languages in a neighborhood," she says. She has helped revive and extend San Diego's trolleys, pushing for a 16-mile route linking the downtown to Tijuana. She has fostered an effective civic alliance with San Diego's two most powerful businesswomen: Helen K. Copley, chairman of Copley Newspapers, and Joan Kroc, the McDonald's heiress and owner of the Padres baseball franchise. They have supported causes ranging from housing the homeless to sponsoring a Soviet arts festival in San Diego.

"But our drug problems are worse because of the border," the mayor says. "So are our sewage problems." She is alert to border sensitivities. She has convened the San Diego City Council at Tijuana's Palacio Municipal in joint session with Tijuana's own *regidores*, and the Mexican group has met at San Diego's city hall. She has set up an emergency radio link between police of the two cities.

Still, nothing seems to stem the flow of drugs. At the primary border crossing from Tijuana into San Diego, immigration and customs agents operate checkpoints in 24 lanes of traffic. One night I watched as a woman in a red dress was asked to open her trunk. The sweet stench of marijuana—a hundred pounds of it, with a street value of $80,000 to $100,000—overwhelmed the acrid fumes of a thousand idling engines. She stared wildly at the agent as terror and tears welled up in her eyes, and he snapped handcuffs around her wrists.

Drugs have made street gangs a major crime problem. To see them in action, I rode on patrol with San Diego Police Sergeant Ted

RETURNING from an inner journey, guests at the Golden Door in Escondido employ meditative breathing techniques. The most exclusive of San Diego's many health resorts, the spa charges $3,500 a week, providing personal instructors to guide each client through programs of physical and mental fitness.

Mims. His detail seeks to control an estimated 5,000 youths whom police call gangbangers. Territorial battles between two drug-dealing groups, the Crips and Pirus, have sent the San Diego homicide rate soaring, with 24 deaths in 1988. Before ten o'clock that night we had been to the scenes of two drive-by shootings and seen the bloody victims carried off to hospitals.

As we pulled up at 30th and Imperial, where bullet holes riddle storefronts, several dealers hawked drugs. They darted into the darkness at our approach. Skeletal prostitutes strutted in the glare of traffic signals. "They're crack hookers," Mims said. "Addicts of rock cocaine. Crack addicts never seem to eat, never sleep. Our work used to end when the bars closed. This stuff goes on to daybreak."

At Azalea Park, a tidy green enclave in middle-class City Heights, Mims and his men interrogated 18 Hispanic children who stood cheerfully with their hands against the wall of a park building. Mims had interrupted 14- and 15-year-old boys and girls being initiated into the East San Diego Gang. Their nicknames were sprayed on walls in an elaborate script.

Detectives were filling out interrogation forms and photographing each youth. "Nice-looking children," Mims said. "This is a junior gang, sort of a Cub Scout pack. But someday we'll pick up one of them on a homicide by knowing his gang name. Now

IN THE RAIN SHADOW of the coastal ranges elaborate irrigation systems allow a few citrus growers to wrest profits from the Anza-Borrego Desert. A wilderness of desert, chaparral, and mountains, much of the eastern two-thirds of San Diego County is

unpopulated and unfarmed. Though only 3 percent of the county's 4,255 square miles is cultivated and 15 percent grazed, together they produce more than half a billion dollars in agricultural products, including the nation's largest avocado crop.

CALIFORNIA'S fastest growing minority, Asian Americans account for 9 percent of San Diego's population. Cambodian Pha Mann and his family (above) live in Golden Hill, where many Southeast Asian immigrants have settled. The city's homeless (right) are cared for at shelters supported by civic leaders like McDonald's heiress Joan Kroc.

we'll just send them home and hope they go."

Near midnight, the detectives gathered in the canteen of the Southeast Area Police Station to share information. In their ragged street clothing they were a motley group. But they are eloquent and zealous to head off a deadly crisis in street crime.

As Mims finished a take-out barbecue meal, his radio blared with a hospital report. "Tonight's score," he said, "is one Crip who's good only for organ transplants and a 17-year-old Piru who'll never walk again."

By day this violent southeast neighborhood is brushed with the same benign sheen as the rest of San Diego: Poinsettia trees and jade bushes bloom in front of cottages with picket fences. "In San Diego," says Tom Payzant, the superintendent of city schools, "it's harder to see the poverty."

THE RACIAL BALANCE of San Diego is in flux, with the population of Hispanics and Asians increasing. Hispanics make up about 17 percent of the county total of 2.3 million; 9 percent are Asians, 5 percent blacks. In the center city and in city schools, minorities become the majority. In contrast to many cities, nine of ten school-age children are in public schools; there has been relatively little white flight. About one-fourth of San Diego city school pupils attend 45 magnet schools and programs, many through interneighborhood busing. The Reverend George Walker Smith, whose weekly Catfish Club luncheons are a popular interracial forum, told me that "two things people in San Diego can't complain about are their schools and parks. This is still the most livable city of its size in the nation."

Yet, many San Diegans don't realize that their city has swung rapidly away from its provincial Anglo tradition. "But for me," says Superintendent Payzant, "its diversity is one of San Diego's blessings. But we have not learned to cherish it and make diversity a foundation of our civic life."

Deep in a tough Hispanic residential area, an iron-willed San Diegan, Rachael Ortiz, developed her Barrio Station as an oasis of youth facilities. After serving four prison terms for heroin-related crimes, she turned to community service. As she led me through

gym and game rooms, Hispanic youngsters called, "Hey, Rachael, Rachael!"

Like many other resident Hispanic Americans, she is critical of the flow of undocumented migrants from Mexico. "Some of them want to make a life here, but many others are just people running through," she said. "They are temporary people. It shows in the way they live."

Some of that hostility exists because desperate migrants seem to threaten the job security of established Hispanic residents on both sides of the border. About 7,000 Tijuanans cross legally into San Diego every day to work at steady jobs.

I talked to some of them at American Fashion, a men's clothing factory in Chula Vista, six miles north of the border. About 60 percent of its 450 employees are of Hispanic extraction, but many have become U. S. citizens. As sewing-machine operators they receive $6.30 an hour, about five times what Tijuanans are paid in Mexican assembly plants. There are other benefits. Many parents from Tijuana drop their children off at San Diego public schools on their way to work.

Victor Carrasco, 52, born in Tijuana, told me that he commutes to his American Fashion job from a three-bedroom house in a middle-class neighborhood near the Tijuana racetrack. "It cost my wife and me about $12,000 a dozen years ago," he said. "With so much devaluation of the peso now it would cost at least five, six times that much. But it is cheaper for me to live in Tijuana and work in San Diego. In Tijuana you must work day and night to earn enough for your family. Still, life is good because there is less pressure. Tijuana is about to become the best city in Mexico."

Downtown Tijuana is separated from the Pacific by rolling hills that have become busy *colonias,* neighborhoods of dusty streets and cluttered housing that Americans often dismiss as substandard. The sudden contrasts

ACADEMIC PIED PIPER, Roger Revelle (right, with students) recruited some of the nation's greatest scientific minds to the University of California, San Diego, which he helped found in 1960. Buttressed by the Salk Institute and the Scripps Clinic and Research Foundation, UCSD has made San Diego a boomtown for biotech and medical research. Cancer researcher Ivor Royston (bottom right, at left) uses ultraviolet light to study DNA. Not far from the campus the Alzheimer's Family Day Care Center (left) is directed by Dr. George Glenner, one of UCSD's authorities on the disease.

etched by La Línea overwhelm many visitors and make them apprehensive. Yet the voices of Tijuana seem softer than in El Norte, the smiles broader, the pace more languorous; the smells are different too, of charcoal smoke, corn tortillas, and roasting meat.

In Tijuana's new central enclave of Zona Rio, fashionable shops and restaurants mirror those of southern California. It becomes hard to follow the path of La Línea on Otay Mesa, where low, flat-roofed factories and warehouses multiply on both sides of the border. Yet to many San Diegans, Tijuana seems as remote as Istanbul. "Have you noticed," a Tijuanan asks me, "all the weather forecasts in San Diego stop at the border?" Such Mexicans seek understanding from the fair-haired Californians across La Línea.

The isolation of Tijuana from the Mexican heartland and its remoteness from the federal government at Mexico City, 1,400 miles away, link it ever more closely to San Diego. While migrants slip across by night, the people of Tijuana's burgeoning middle class flash their crossing cards by day and night to trade with San Diego merchants, cheer the Padres, and lament the NFL Chargers. San Diego's best restaurants woo Tijuanans; their mealtimes begin when San Diegans' end.

AS HISPANIC INFLUENCE soars in southern California, schooling, speech, and mores grow more latinized. Bilingual school programs are crowded, and many adults sign up for Spanish classes. Mexican holidays are celebrated in El Norte. The airwaves are thronged with Spanish-language stations. Mexican music, food, and crafts gain wide popularity.

In Tijuana 45,000 semiskilled Mexicans labor in the *maquiladoras*, assembly plants owned by companies based in the United States, Asia, and Europe. (They are named for the fee, called *maquila*, that was levied for milling grain in colonial Mexico.) The current wage of $1.00 to $1.50 an hour ranks among the lowest in the world, but is regarded as a bonanza by thousands who vie for jobs building televisions and recorders, health-care supplies, computer parts, rechargeable batteries, furniture, and opticals.

Most products are sold in the U. S. Some companies set up related office buildings and warehouses on the American side, and prosperity spirals. In 1988, 1,450 maquiladoras employed 390,000 Mexicans and generated 1.7 billion dollars of income, replacing tourism as Mexico's largest industry other than oil. Some 450 of the plants are in Tijuana.

Along one assembly line in the Hitachi television factory I talked to a dozen men and women who had come to Tijuana from farms

WATERING HOLE for 12 U. S. Presidents and a cavalcade of Hollywood celebrities, the Hotel del Coronado celebrated its 100th year in 1988 with a star-studded gala. A star itself in the Billy Wilder movie Some Like It Hot, *the hotel is the centerpiece of an exclusive beach community and the embodiment of old San Diego: a city that keeps improving with age.*

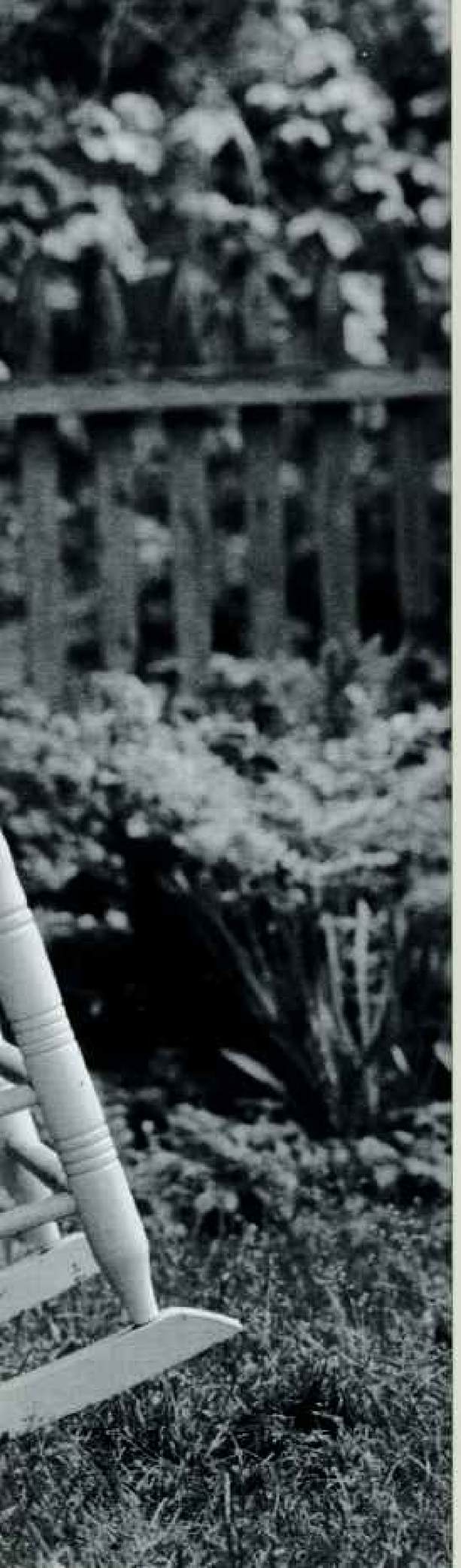
and villages in Oaxaca, Jalisco, Michoacán, and Chihuahua. Most of them also held second jobs. "Back home there is no work, no money," a 28-year-old man said. "Here it is more expensive, but at least there are jobs." My interpreter was Ignacio Villafan, one of the trilingual specialists whose skills are pivotal in the foreign-owned maquiladoras. Born in nearby Mexicali, he studied Japanese at a Kyoto university and married a Japanese girl. He spends his day translating the thoughts of

his Japanese boss, Shigemasa Ito, to Mexican workers and American customers.

High in one of Tijuana's landmark twin towers I met Gonzalo Gomez-Mont, a 33-year-old attorney who was directing the new Tijuana office of Baker & McKenzie, the world's largest law firm. He and seven Mexican colleagues, none older than 35, were representing 20 of 23 Japanese firms that operate maquiladoras in Tijuana.

He also spoke for bright and hopeful people on both sides of La Línea who long for closer understanding and more rewarding lives.

"San Diegans look north, historically apprehensive of Los Angeles," Gomez-Mont told me. His voice was gentle, but his eyes flashed. "Most of you don't yet realize that a giant has been born here in Tijuana, behind the fence at your back. You have not yet sensed that your future lies not with Los Angeles but with Tijuana. That is the way it will be, all along La Línea." □



Marian Wright Edelman

In 1965 Edelman (left) became the first black woman admitted to the Mississippi bar. She is founder and president of the Children's Defense Fund.

"We lose about 10,000 children every year to poverty. But where is the outrage?

"Children cannot eat rhetoric. What I want to do is see that this country feeds hungry kids. The legacy I want to leave is a child-care system that says no kid is going to be left alone or left unsafe.

"Ordinary women of grace are, in a sense, my real role models. They had the capacity to keep struggling. I think that is a message that this quick-fix culture needs."

Leontyne Price

"Prima donna assoluta" Price (page 209) is the first black woman to achieve this worldwide status. Her 1961 debut at the Metropolitan Opera won her a 42-minute ovation.

"The way I was taught, being black was a plus, always. Being a human being, being in America, and being black, all three were the greatest things that could happen to you. The combination was unbeatable.

"In some of my operatic roles—maybe the strength of my portrayal of Aïda—I reveal the wonderful thing that it is to be a black princess."

THEY CAME TO STAY

BY MAYA ANGELOU

Black women whose ancestors were brought to the United States beginning in 1619 have lived through conditions of cruelties so horrible, so bizarre, the women had to reinvent themselves. They had to find safety and sanctity inside themselves or they would not have been able to tolerate those torturous lives. They had to learn to be self-forgiving quickly, for often their exterior exploits were at odds with their interior beliefs. Still they had to survive as wholly and healthily as possible in an infectious and sick climate.

Lives lived in such caldrons are either obliterated or forged into impenetrable alloys. Thus, early on and consciously, black women as reality became possibilities only to themselves. To others they were mostly seen and described in the abstract, concrete in their labor but surreal in their humanness.

They knew the burden of feminine sensibilities suffocated by masculine responsibilities.

They wrestled with the inescapable horror of bearing pregnancies that could result only in issuing more chattels into the rapacious maw of slavery.

They knew the grief of enforced separations from mates who were not theirs to claim, for the men themselves did not have legal possession of their own bodies.

And men, whose sole crime was their hue,
The impress of their Maker's hand,
And frail and shrinking children too,
Were gathered in that mournful band.

—from "The Slave Auction,"
Frances Ellen Watkins Harper

The larger society, observing the women's outrageous persistence in holding on, staying alive, thought it had no choice save to dissolve the perversity of the black woman's life into a fabulous fiction of multiple personalities. They were seen as acquiescent, submissive Aunt Jemimas who showed grinning faces, plump laps, fat embracing arms, and brown jaws pouched in laughter. They were described as leering buxom wenches with round heels, open thighs, and insatiable sexual appetites. They were accused of being marauding matriarchs of stern demeanor, battering hands, unforgiving faces, and castrating behavior.

When we imagine women inhabited by all those apparitions, it becomes obvious that the women themselves did not hallucinate, but rather that they were national, racial, and historical hallucinations. Those contradictions stump even the most fertile imagination, for they could not have existed despite the romantic racism that introduced them into the American psyche. Surprisingly, above all, many women did survive as themselves. [In these photographs] we meet them, undeniably strong, unapologetically direct.

The photographer, Brian Lanker, possesses an acute eye and a brave heart. He has discovered women whose images show us the high cost of living and the rich reward of thriving. Lanker intends to capture the viewer with the twin magic of his camera and the women's faces. These women regard us, understand us, gaze through us into a beyond, alien to our most common view. Each seems to know something we have not known. The sameness of their gaze informs us that they will not be removed, that indeed although they are shaken, bruised, and uprooted, they are determined to remain.

This foreword does not mean to be an explanation of the black woman's stamina. Rather, it is a salute to her as an outstanding representative of the human race. Here educators, athletes, dancers, judges, politicians, artists, actresses, writers, singers, poets, and social activists dare to look at life with humor, determination, and respect. Their visages do not entertain hypocrisy. To those who would desire chicanery, the honesty of these women is terrifying.

The heartbreaking tenderness of black women *and* their majestic strength speak of the heroic survival of a people who were stolen into subjugation, denied chastity, and refused innocence.

These women have descended from grandmothers and great-grandmothers who knew the lash firsthand and to whom protection was a phantom known of but seldom experienced. Their faces are captured here for the ages to regard and wonder, but they are whole women. Their hands have brought children through blood to life, nursed the sick, and folded the winding cloths. Their wombs have held the promise of a race that has proved in each challenging century that despite threat and mayhem it has come to stay. Their feet have trod the shifting swampland of insecurity, yet they have tried to step neatly onto the footprints of mothers who went before. They are not apparitions; they are not superwomen. Despite their majestic struggle they are not larger than life. Their humanness is evident in their accessibility. We are able to enter the photographs and enter into the spirit of these women and rejoice in their courage and nearness.

Precious jewels all. Thanks to their persistence, art, sublime laughter, and love we may all yet survive our grotesque history.

LEONTYNE PRICE

I DREAM A WORLD

My life for the past two years has been spent in the living rooms, offices, kitchens, and backyards of some of the finest people it has ever been my privilege to encounter. I have often been asked, Why this project? Why document the lives of 75 black women? It is the result of my own growing awareness of the vast contribution black women have made to this country and society, a contribution that still seems to have gone largely unnoticed. All the women have dreamed of a world—to borrow from the Langston Hughes poem—not only better for themselves but for generations to come, a world where character and ability matter, not color or gender. As they dreamed that world, they acted on those dreams, and they changed America.

PHOTOGRAPHS AND INTERVIEWS BY
BRIAN LANKER

FROM HIS COPYRIGHTED BOOK *I DREAM A WORLD* (NEW YORK: STEWART, TABORI, & CHANG, INC., 1989).

Barbara Jordan

In 1966 Jordan became the first black elected to the Texas Senate since 1882. Elected to the U. S. Congress in 1972, she served three terms and now teaches at the University of Texas in Austin.

"There seems to be a chilling of opportunity rather than an enlivening and enhancing of opportunity. But to me, that should just be the spark that energizes you to get out there and do things.

"I get from the soil and spirit of Texas the feeling that I, as an individual, can accomplish whatever I want to, and that there are no limits, that you can just keep going, just keep soaring. I like that spirit."

Alice Walker

A gifted, prolific writer, Walker has called herself a "womanist." Her novel The Color Purple *won a Pulitzer Prize for fiction in 1983.*

"I love this land. I'm not crazy about the nation. There's a real inability on the part of the white males that we have elected to understand any kind of interrelatedness. And that's fatal.

"I've met Rosa Parks and Fannie Lou Hamer. They have been tempered in the fire of experience, and they have come through whole and shining. That's what I get from these older black women, that sense that every soul is to be cherished, that every flower is to bloom. We're rich because we have those women."

Gloria Dean Randle Scott

Elected first black president of the Girl Scouts in 1975, Scott is now president of Bennett College in Greensboro, North Carolina.

"Every black person who had some measure of achievement and visibility was my hero.

"To get through, you have to have a base. I see on whose shoulders we stand. Some of us got through only because they *didn't. And that's a critical responsibility for the generation you're in, to help provide the shoulders, the direction, and the support for those generations who come behind.*

"I think white children ought to have healthy exposure to black people in leadership and adult roles too."

Willie Mae Ford Smith

Known as the mother of gospel music, Smith has sung and preached throughout the country. In 1988 the National Endowment for the Arts recognized her as an outstanding American folk artist.

"When I would go to their meetings, the preachers would say, 'You can sit down there, you don't need to come up here. Don't get in my program. You a woman, didn't you realize?' No respect at all. Well it don't make no difference to me. So I turn around in my pew and sing to that audience. Next thing I know, 'Come on up here, get up and let all of them see you.' "

Wilma Rudolph

Overcoming polio as a child, Rudolph in 1960 became the first American woman to win three gold medals in track and field in a single Olympiad. She is currently a special consultant on minority affairs at DePauw University in Indiana.

"Around nine the braces came off, and now I can't remember which leg I wore my braces on. Once I discovered I could run, I spent all of my extra time running. When I got back from the Olympics, my hometown [Clarksville, Tennessee], which had never been integrated, decided to have a parade for me. I told them I could not come to a parade that would be segregated. So, I sort of broke that barrier in my hometown. I probably did everything I wasn't supposed to do, but it was to pave the way for other blacks in the town.

"When I was going through my transition of being famous, I used to ask God: Why was I here? What was my purpose? Surely it wasn't just to win three gold medals.

"The challenge is still there."

Angela Yvonne Davis

Political activist Davis lost her teaching position at UCLA after she joined the Communist Party. Implicated in a 1970 shoot-out, she was sought nationwide, imprisoned, tried, and acquitted. She now teaches philosophy and women's studies at San Francisco State University.

"It didn't occur to me when I was fired from my position that I would not fight. That just was not a possibility.

"I never really sought to be a public figure. But that was my historical fate, that was a challenge.

"Black women have had the burden or the privilege of being spokespersons for all the oppressed in this society. And sometimes, of course, black women have just argued for the right to be tired."

Sherian Grace Cadoria

Promoted to brigadier general in 1985, Cadoria is the highest ranking black woman in the United States armed forces.

"In Vietnam I interviewed for a protocol job. The colonel told me I couldn't do the job, 'You can't travel, you can't carry luggage, it's too heavy. Women can't do this.' And I said, 'Nobody said I couldn't carry those hundred-pound bags of cotton when I was just a little child.'

"By act of Congress, male officers are gentlemen, but by act of God, we are ladies. We don't have to be little mini-men and try to be masculine and use obscene language to come across. I can take you and flip you on the floor and put your arms behind your back and you'll never move again, without your ever knowing that I can do it."

Katherine Dunham

A pioneer of modern dance, Dunham, now 80, redesigned the art by introducing elements of African and Caribbean folk culture. She founded and leads the Katherine Dunham Museum and the Katherine Dunham Children's Workshop in East St. Louis, Illinois, where she lives. She also has a home in Haiti.

"It was in me to dance, and I had to do it to be satisfied. [Once] I constructed a ballet around the small village I had lived in in Martinique. Our production portrayed a part of black people that had not been seen on the stage or in theater.

"Why East St. Louis and why Haiti? They have so much in common. I still love Haiti. It has problems, and East St. Louis has problems. But both places have their structure. The family is very strong. I like that because it's probably the only salvation for young people. Our program is socialization through the arts. I see it as taking the rough edges off their lives and trying to channel them into ways of thinking and behaving that will help them in other parts of the world."

Clara McBride Hale

At age 63 Mother Hale turned her Harlem apartment into a home for the care of babies of drug-addicted mothers. She has returned hundreds to health.

"My husband died when my daughter, Lorraine, was five and Nathan was six. There was no way under the sun that they would give you any other job except domestic jobs. And that meant being away all day from those poor little children who had nobody. So I decided to take in other people's children. I raised 40. Every one of them went to college.

"In 1969 my daughter sent me a girl with an addict baby. Inside of two months I had 22 babies living in a five-room apartment. We hold them and rock them. They love you to tell them how great they are. They're happy, and they turn out well."

Faye Wattleton

Since 1978 Wattleton—here with daughter Felicia Gordon—has headed Planned Parenthood Federation of America, the nation's major family-planning agency.

"Although I came from a poor and humble background, I did not come from a family of people who had a poverty view of the world. I came from people who viewed the world as attainable. My mother felt that I should be a missionary nurse [and] go abroad to Africa and other parts of the world to serve the suffering. I have been something of a disappointment to her ideal, but I think I have done missionary work nonetheless.

"I want the same things for blacks, Hispanics, and whites that I want for myself and my child. And that is the ability to take charge of our lives and not be victimized by reproduction."

Althea Gibson

Breaking the color barrier in women's tennis, Gibson first played in the U. S. National Championships at age 23 in 1950 and at Wimbledon, England, in 1951, winning prestigious championships at both in 1957 and '58. She has taught, been a tennis pro, and served on recreational councils in New York and New Jersey.

"When I was younger, all I did was ride the subways and walk various sections of New York. They called me a wayward child. I knew what to expect when my father came home. Not a spankin', a whippin'. My parents were doing their best to raise me, but I just didn't let 'em.

"I learned paddle tennis with a friend of mine on 143rd Street. The young boys who played on another court up the block heard about me and challenged me. And I accepted. I played it all—basketball, shuffleboard, badminton, volleyball. I played and practiced most of my life in Harlem on boards, on wood. Fastest court surface in the world.

"I knew that I was an unusual, talented girl through the grace of God. I didn't need to prove that to myself. I only wanted to prove it to my opponents."

Leontine T.C. Kelly

Elected a bishop of the United Methodist Church in 1984, Kelly has retired to a professorship at the Pacific School of Religion in California.

"I believe God called me to the ordained ministry. I was willing to go that journey, and it has been sustained.

"For me, the crux of the gospel message is the way we share power. One of the things women bring to the situation is a new style of leadership. I am no less the bishop. I know where the buck stops, and who is responsible. But that doesn't mean I have to exert power in such a way that other people feel they are less than who they are because of who I am."

Alexa Canady

In 1981 Dr. Canady—at age 30—became the first black female neurosurgeon in the U. S. She now directs neurosurgery at Children's Hospital of Michigan in Detroit.

"I think the decision about what you do for a living is not an intellectual one. It's really a visceral decision. Some places you feel at home, and I felt at home in neurosurgery.

"I used to tease my parents by saying, 'You're raising me to be the person you don't want my brothers to marry.' People are just not very ambitious for women still. Your son you want to be the best he can be. Your daughter you want to be happy."

Unita Blackwell

Blackwell helped organize the challenge to Mississippi's all-white delegation at the Democratic National Convention in 1964. Twelve years later she was the first black woman to be elected mayor in that state.

"This very place [Mayersville] where I am now the mayor, the people used to arrest me every day and harass me every day. I was involved in the voter registration drives, trying to get people down to the courthouse. If you did that, you took your own life in hand. [Now] I am the law. I am over the slave owners that used to be over me. I am their mayor. I'm the judge."

Gwendolyn Brooks

Pulitzer Prize winner for poetry in 1950, Brooks has served as poetry consultant to the Library of Congress.

"When I was 15, I began writing to people like James Weldon Johnson. He sent back my manuscripts with marginal notes, little assistances. He thought I was talented and hoped that I would keep writing. My parents were delighted with all of this attention. But I would have gone on writing.

"In writing poetry, you're interested in condensation, so you don't try to put all of a particular impression or inspiration on a single page. You distill. Poetry is life distilled."

Eva Jessye

Composer, conductor, arranger, and actress, 94-year-old Jessye achieved world fame leading her choral group in the first production of the Gershwin opera Porgy and Bess.

"I could read music so easily. It came naturally to me, not second nature but first nature. George Gershwin knew a great deal, he studied a great deal, but I've been black longer than he has. I made a lot of changes when we did Porgy and Bess. *The producers would ask me, 'Do you think it should be this way or that way?' I'd have to go through the score and point out where I thought they went a little astray. But, of course, his stuff sounds quite white.*

"I traveled and made money, and I wouldn't let anybody get between me and my music. Any woman of that time would have had the same trouble I had. They never thought a woman could be as devoted to one idea as a man.

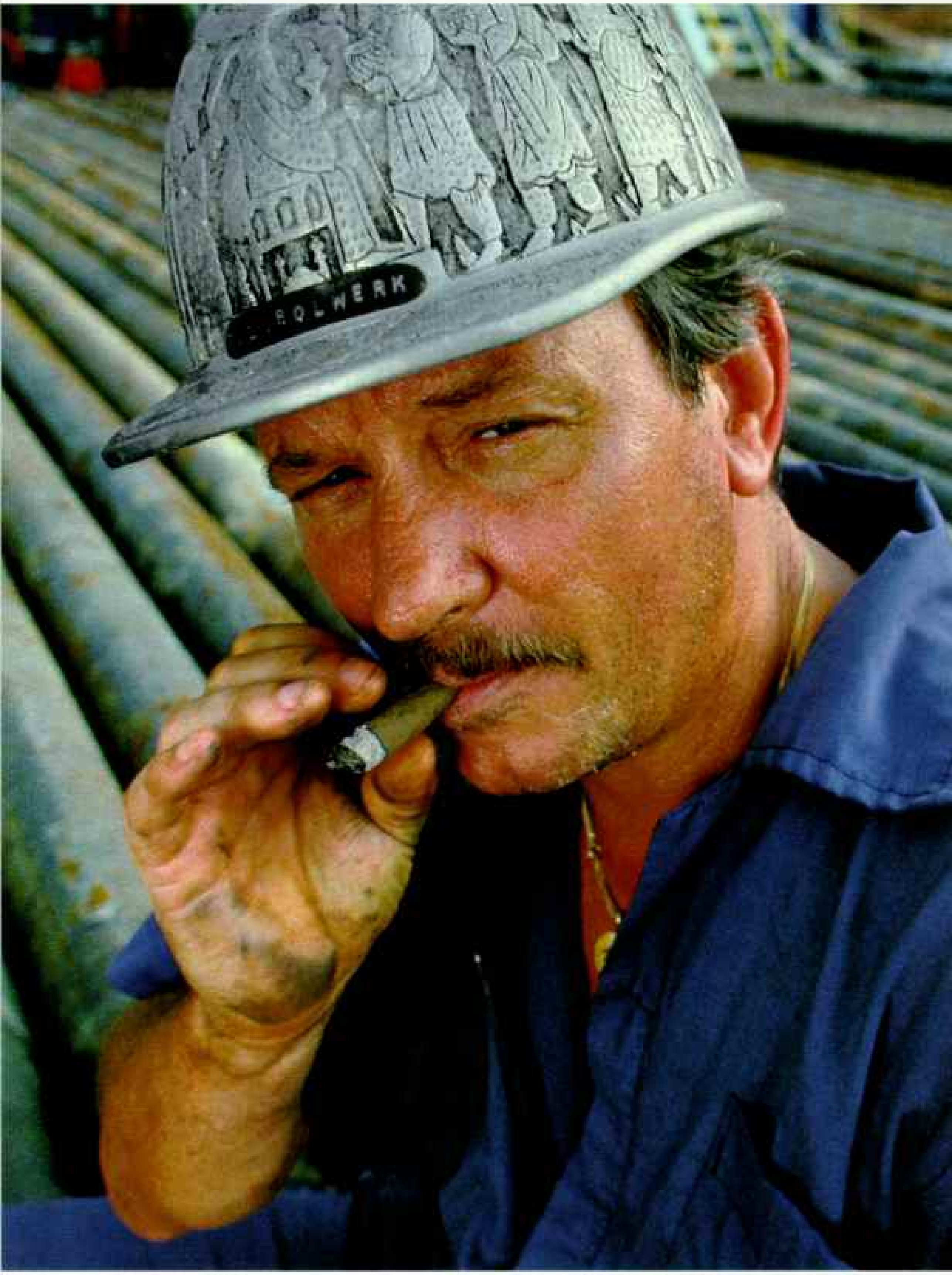
"They say you should not suffer through the past. You should be able to wear it like a loose garment, take it off and let it drop." □

A traveling exhibition launched at the Corcoran Gallery of Art in Washington, D. C., in February 1989 is scheduled to open at the International Center of Photography in New York City on September 8. The project was made possible by a grant from the Professional Photography Division, Eastman Kodak Company, and the exhibition was funded by a grant from USWest, Inc.

THE QUEST FOR OIL

By FRED HAPGOOD Photographs by GEORGE STEINMETZ

Fired with success, an offshore rig tests the flow of oil—and associated natural gas—it has just tapped. Nine out of ten wells come up dry in the gamble of oil exploration. This one paid off as one of the largest North Sea finds in a decade.


SOLWERK

THE RUGGED HIGHLANDS of Papua New Guinea are a land of footpaths. For the most part these are unmapped—even, to a stranger, invisible—for in the jungle a well-traveled path can be fainter than a scratch. Such trails exist more in the memory than in the terrain, as patterns of accommodation to the landscape, discovered over millennia and passed down through the generations like folklore.

A trekker from abroad walks them by watching the back of a local guide: first a snakelike passageway running 30 feet along the face of a steep cliff, perhaps, then three quick bounds down the rocky slope, then a vertical scramble.

But there are other paths that are as conspicuous as a city street. It was one of those that Roger Brash and I set out on the day he took me looking for five-billion dollars.

I had come to Papua New Guinea following the trek of the oil finders—people who range the earth in search of petroleum, voyaging into the most extreme climates and unpromising political situations, looking thousands of feet under the surface of the earth, beneath oceans, ice caps, and mountains, to map those layers of rock with enough oil in them to interest the front office.

"Whatever happens here is my responsibility," says Dutchman Cees Bolwerk, drilling supervisor for a rig off the Sumatran coast. A veteran explorer—his hard hat was decorated by an Iranian artist while he was working in the Persian Gulf—he bosses a multinational crew gathered to kick around ideas.

Struggling with their burden, exploration crew members scramble over a ladder of

saplings as they haul a water pump up a hill in the Sumatran rain forest.

I knew almost nothing about the work done by these people, about where they looked and what made them look and where the future was taking them. Given how much the world depends on their successes, wherever they were going, I knew I was probably bound in the same direction.

By the time I arrived in Papua New Guinea, I knew this much: Oil explorers first began opening doors for modern civilization 130 years ago, when a railroad man named "Colonel" Edwin Drake drilled the first commercial oil well near Titusville, Pennsylvania.

Drake was in fact no colonel. What he was was a retired conductor in need of a little prestige, and new to the fledgling oil business. He had been hired by a small-time oil company based in Connecticut to survey the area and get more out of an oil spring it already owned.

The human race had known about oil long before Drake drilled his well. In Greek mythology Medea set her rival on fire with naphtha. The Mesopotamians used asphalt as a building material 5,000 years ago. The walls of Jericho were bound with pitch. In Nero's time the people of Sicily burned petroleum in their lamps instead of olive oil.

But as valuable a product as petroleum had already become (when Drake struck oil, the price was $20 a barrel, equivalent to about $260 in 1988 dollars), gods and mortals alike until the 19th century took oil as the earth gave it to them, from seeps and springs.

WHAT DEFINES an oil explorer is not that he looks for oil, exactly, but that he looks underground, that he casts his mind into the earth. What inspiration made Edwin Drake the first to act on impulse and actually drill into the ground we have no idea. Like prospectors before and since, he died without confiding in anyone. The site is now memorialized by the Drake Well Museum.

All we know is that one day he walked into a forest, thought his way down through the layers of rock, bought an eight-horsepower Liddel & Hershey steam engine, hired a blacksmith to forge a drill, built this granddaddy of oil rigs out in the forest, and commenced driving sections of six-inch cast-iron pipe into the ground.

For weeks Drake found nothing, but whatever he had "seen" beneath his feet drew him on and down, until on August 27, 1859, the first successful well stained the sands black—the color of raw profit. News of the new technique spread rapidly, creating in its wake, to name only one effect, the abundant supply of cheap, high-quality lubricants that greased the way for the industrial age.

The earliest oil explorers did not depend on science to select their drill sites. Some invoked divining rods or guides from the spirit world. Certain prospectors claimed to have "oil bones" that twinged whenever the explorer passed over an economically viable deposit. As more discoveries were made, the success rate of oil bones and voices from beyond began to decline. Almost certainly alarmist speculation was heard, even then, that the world was running out of oil.

Then, toward the end of the century, a new science called petroleum geology developed the basic theory of petroleum formation. It was already known that the geologic forces at play around the margins of continents can cause depressions in the earth's crust, like huge underwater basins. Inorganic sediments, often carried by rivers, tended to flow into and fill the depression. As the basin filled, those sediments would automatically mix with plant material and the cadavers of myriad microscopic marine animals raining down from the seawater overhead.

As this compound accumulated, its lower layers naturally became more dense and were pressed more deeply into the earth's crust, where the temperature of the mixture rose. When it reached the temperature of a good cup of coffee, the compound began to turn, laboratory experiments suggest, into one or another type of petroleum.

Oil is naturally buoyant. As soon as it is

One neat stroke of a geologist's pen on a map in the office sends the same Sumatran crew up a cliff. Conducting a seismic survey, they plant special microphones—called geophones—then set off dynamite charges and record the shock waves that bounce off the layers of rock below. Fed into a computer, the data show likely spots to sink a well. The company hopes to find an extension of a major gas field discovered in 1971.

Free-lance writer FRED HAPGOOD described the many uses of the soybean in the July 1987 GEOGRAPHIC. GEORGE STEINMETZ, a former geophysicist, has photographed oil operations all over the world.

formed, it starts a slow migration toward the surface, squeezing upward through microscopic pores and cracks in the rock. Most of the oil made by the earth has probably succeeded over the eons in escaping out onto the surface, where it was destroyed by sunlight, bacteria, and oxygen.

Sometimes, though, ascending oil ran into a tight, impermeable layer of rock such as shale, shaped like an inverted bowl. These dome-shaped caprocks, or traps, prevented the oil from rising farther. If there was a large formation of porous rock, like an old coral reef, just under the trap, the rising oil accumulated in a network of tiny pores—not in vast underground pools. Those mineral sponges are known as reservoir rocks.

That is what oil explorers look for: places with some indication that source rocks (in which oil was formed), caprocks, and reservoir rocks exist and are arranged in a plausible relationship to one another. Over the first 60 years of this century teams of explorers, using increasingly sophisticated geologic techniques, spread out over the globe looking for such subterranean clues.

DAVE KINGSTON, now retired and living in Houston, Texas, was a member of this small army of explorers. Kingston is built like a lumberjack, which he was, and he has an air of personal force, of command, of an aggressive, driving curiosity that makes him easy to remember. I asked for an example of what his life in the field was like.

"Once in the fifties," he said, "we were in Paris, writing up the reports of some exploration we had conducted in the Middle East. We got a telegram from the company back in New York that said, 'Do Niger Republic.' "

That was the entire order from headquarters. On arrival in Niger, Kingston found that there were no geologic maps of the areas of interest, which forced his team to select the locations they wanted to study from aerial photographs. Setting off across the Sahara in jeeps, the geologists could ask for directions only by imagining how a feature they knew from the air might look to an observer on the surface and then trying to describe it to local guides.

"We drove from Timbuktu eastward across

The search for subterranean clues

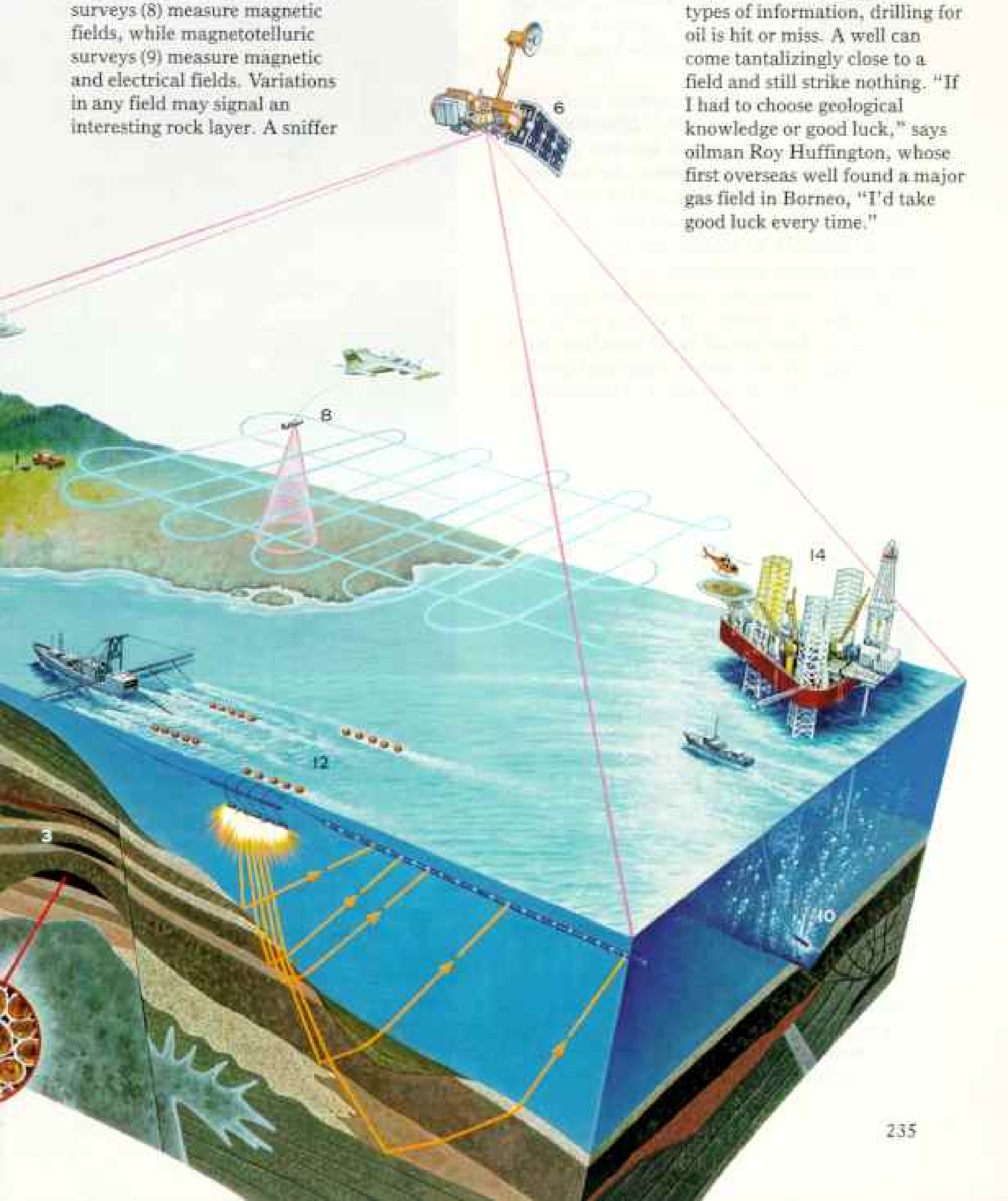
MANY MILLIONS of years ago the remains of marine plants and animals turned to oil in sedimentary rocks deep in the earth. As pockets of oil slowly percolated upward, they hit impervious caprocks that kept them from rising farther. To be commercially exploitable today, that trapped oil must rest in the pores of a permeable reservoir rock (1).

Like detectives, petroleum explorers look for formations that trap oil. The depositional process itself may have buried a sandbar (2). The deformation of a rock layer may have trapped oil in a fold (3) or alongside a salt dome (4) or fault (5).

Satellite images (6) and airborne radar (7) help geologists map the earth's surface. Aerial surveys (8) measure magnetic fields, while magnetotelluric surveys (9) measure magnetic and electrical fields. Variations in any field may signal an interesting rock layer. A sniffer (10) detects traces of gaseous hydrocarbons, here bubbling upward from an oil reservoir. Seismic surveys carried out on land (11) and water (12) record differences in how rocks reflect shock waves. They give the clearest geologic picture.

Drilling an exploratory well—on land (13) or offshore (14)—is the only way to find out exactly what lies underground. As it bores, the bit chips off rock, which drilling fluid carries to the surface for analysis. And, in a process called down-hole logging, a probe lowered into the well detects various properties of the rocks it passes through (15).

Even with these different types of information, drilling for oil is hit or miss. A well can come tantalizingly close to a field and still strike nothing. "If I had to choose geological knowledge or good luck," says oilman Roy Huffington, whose first overseas well found a major gas field in Borneo, "I'd take good luck every time."



Niger to Sudan. From In Azaoua all the way south to the Ubangi River," Kingston recalled. "Eventually we began to see some telltale rock outcrops."

Even though the structures Kingston's team was looking for were often many thousands of feet deep, the heaving and thrusting of the earth's crust over geologic time can force edges and fragments of even deeply buried structures to the surface. Erosion begins to plane these features down as soon as they are exposed. But a trained eye can pick up their traces by noting the angles of the strata visible in outcrops.

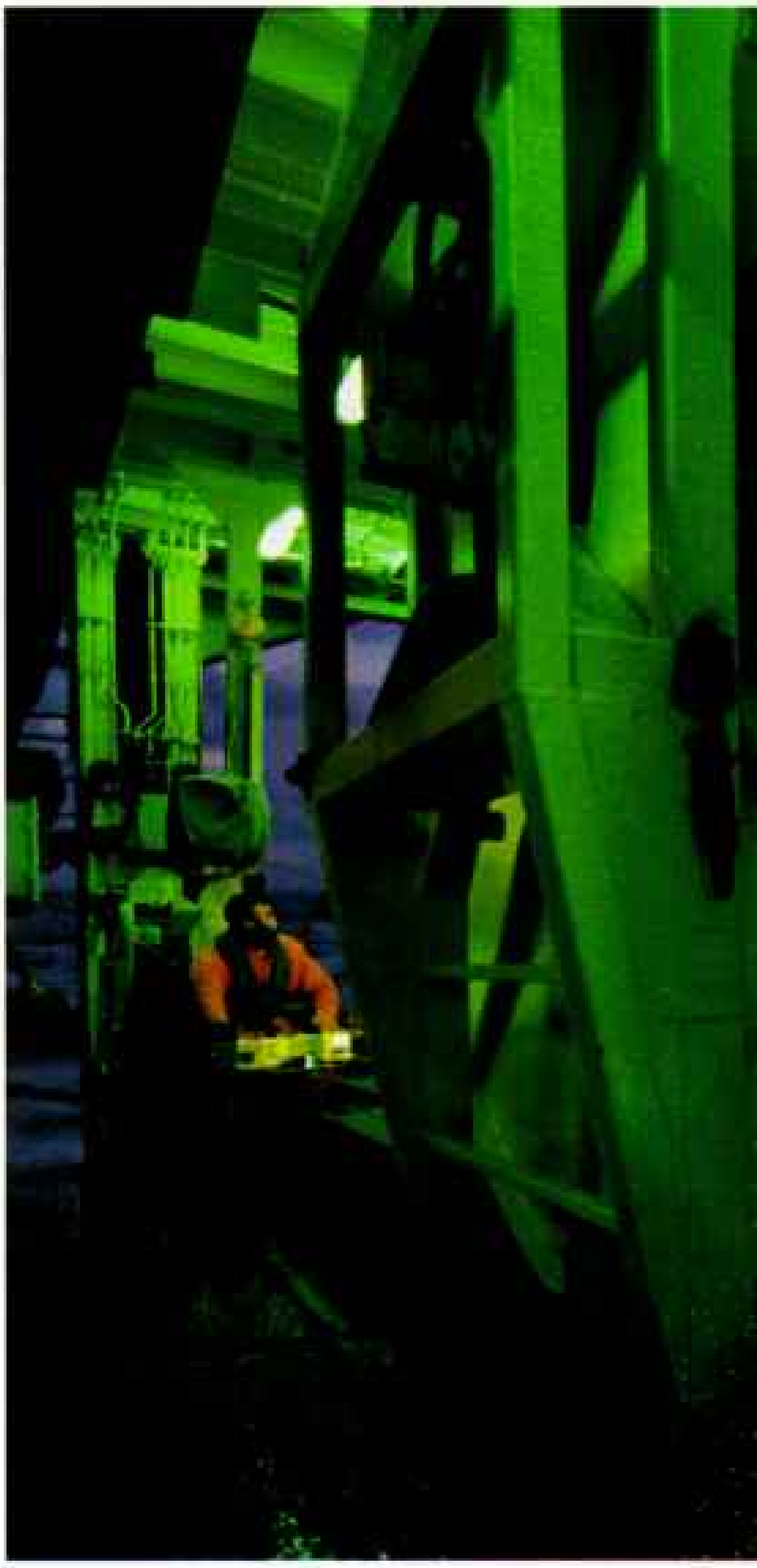
"It was like reading a mystery book with most of the pages torn out," Kingston said. "You have to read what's left and guess at what was lost. Take a basin, for example. Lakes are often associated with basins, so if you find the sign of an ancient lake, there may also be evidence for a basin. Now I've paddled my canoe across many lakes. A fisherman gets a feel for where lake bottoms are hard and where they're muddy. So once I had a few hints about how the old lakes were laid out, I could begin to reconstruct them and predict what was under the ground. But basically the rocks tell you their story."

By the 1960s the number of places where the rocks talked clearly enough to be heard, even by a mind as tuned in as Kingston's, was decreasing, and a new era, based on increasing use of technology and offshore activities, was opening up.

IN PORT MORESBY, Papua New Guinea, I was briefed by Jan Smith, a lanky, balding geologist working for Niugini Gulf. Not long before, Smith said, an exciting discovery had been made in the highlands. Unfortunately the cost of the pipeline needed to carry the oil from the point of discovery to the sea was prohibitively high.

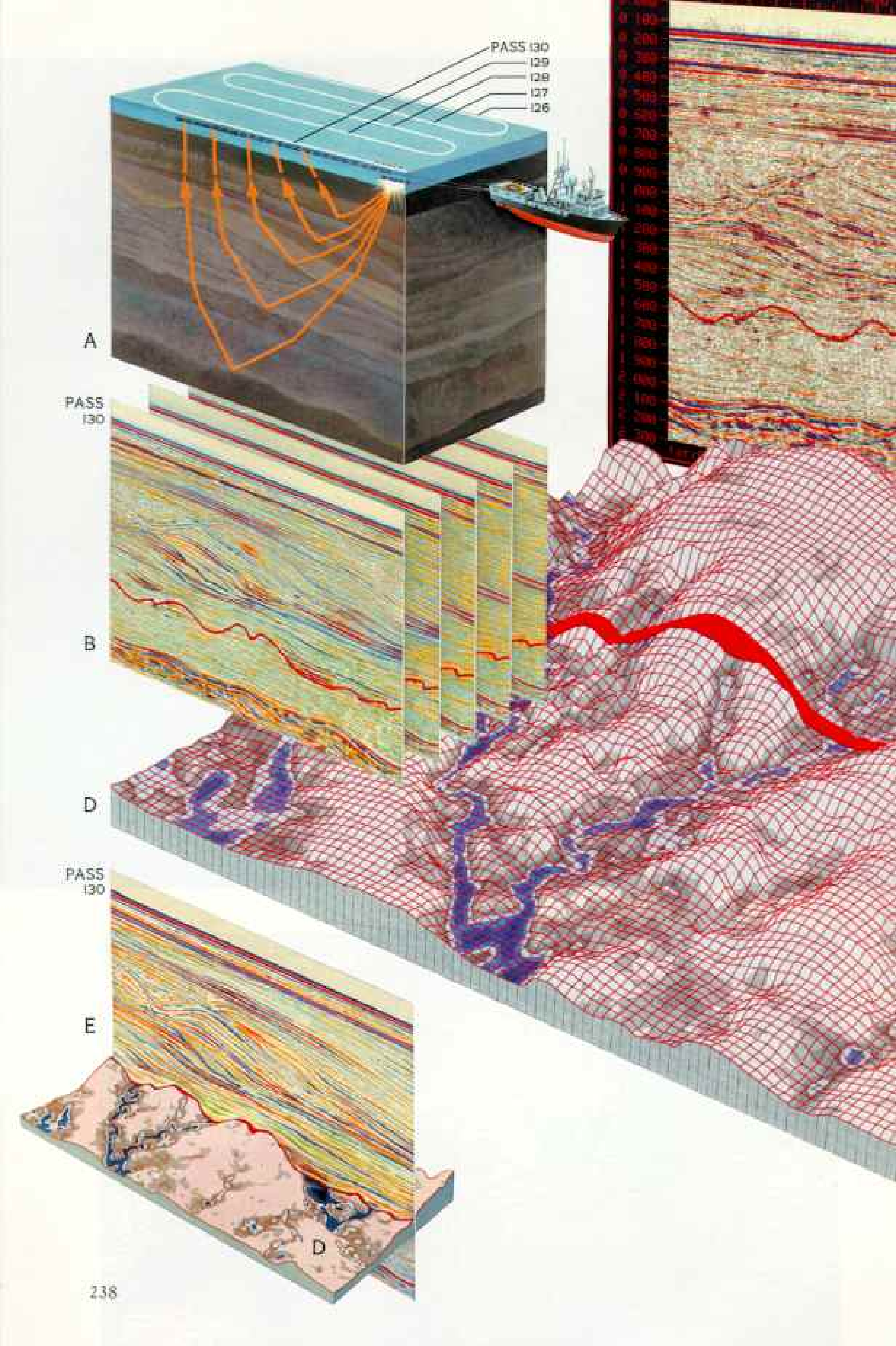
So, at the moment of my visit, the company was engaged in an energetic search for a second deposit that could help pay the bill for the pipeline. A major problem facing the company was that the geology of the highlands was unusually tortured and difficult, riddled with fractures and folds.

The highlands are capped by a thick layer of limestone, and that rock has the unusual property of dissolving in water. Some parts of the highlands get as much as 400 or 500 inches of rainfall a year. The consequence is a landscape



Adding more cable to miles already on the spool, chief navigator Malcolm Metcalfe prepares for another round of seismic surveys on a ship in the North Sea. The cable contains hydrophones, or listening devices used at sea. When towed behind the ship, they record echoes from blasts of air released underwater. Seismic observer Paul Taylor, behind the spool, will oversee recording.

In Houston, geophysicists John Minor and Scott MacKay (right, at right) study a cross section of data from an offshore seismic survey that helped determine the site of the Alaska well on pages 256-7.


PASS 130
129
128
127
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A
PASS 130
B
D
PASS 130
E
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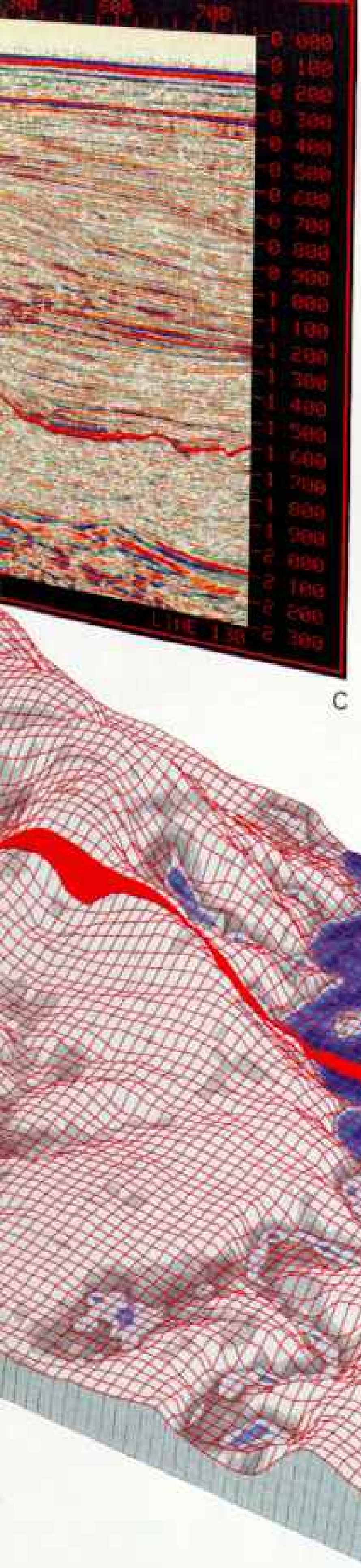
Using computers to peer below the seafloor

WITH EVERY PASS precisely calculated, a survey ship sails back and forth to collect seismic data (A). The ship's navigator monitors the location of the hydrophone cable, which stretches as much as two miles astern, to within 30 feet.

A computer turns the data from each pass (B), or seismic survey line, into an image that shows rock strata like a slice of layer cake. Distance across the image represents surface position; the vertical scale is the time it takes sound to echo from different strata.

Geophysicists analyzing the image from pass 130 of a survey off Barcelona, Spain (C), find an interesting flat echo between two strata of strong contrast. They ask the computer to combine that horizon, marked in red, with corresponding levels from nearby passes. The result is a three-dimensional picture of what earth's surface there looked like some six million years ago (D). The hills and valleys of the red line in the cross section (E) correspond to ancient topographical features.

The flat area represents a prehistoric riverbed, sometimes a good reservoir for oil. But this time, the prospecting company does not see enough potential and decides not to drill a well.



BLOCK DIAGRAMS (LEFT) PAINTED BY DAVID MEITZER; NATIONAL GEOGRAPHIC PHOTOGRAPHER JOSEPH D. LAVENBURG (TOP); COMPUTER PRINTOUT COURTESY EMILE C. A. GEVERS, ROYAL DUTCH/SHELL; DATA PROVIDED BY SHELL ESPAÑA

as pitted and cratered as any on the globe.

Ordinarily pipeline construction companies work from specially built access roads, but up in the mountains the broken terrain would force the contractors to work from the air, with helicopters. And the first discovery, as promising as it had been, didn't look large enough to pay for such a massive undertaking.

Smith slid a pair of images of the area under a stereo viewer. "They were shot with radar," he said. "There's too much cloud cover to depend on ordinary photography." Through the viewer the southern highlands rose and rolled over the tabletop, their slopes as densely pitted as the surface of the moon.

"Here's Masaka," Smith said, pointing with a pencil to the top of a fold.

Masaka turned out to be an oil explorers' camp built just two weeks before—a couple of cleared acres, six prefabricated one-man billy huts, a mess hall, a generator, a shower, and a large laboratory built of saplings and brightly colored plastic tarpaulins. There I met Roger Brash, a young geologist from New Zealand.

Every nail had been carried in by chopper. Brash was working over a binocular microscope and invited me to look. To my eye the contents of the slide looked like the magnified sweepings of a little girl's closet: ornamented slippers, sequins, chambered spheres, bits of costume jewelry, all bathed in a pale gold light. These objects were in fact the fossilized remains of a community of tiny creatures, lying as they had fallen 20 million years ago, entombed in paper-thin limestone.

Roger Brash (upper right) is not only a geologist but also a paleontologist, and he is on close terms with many of the species of marine organisms that lived when the highlands lay at the bottom of a shallow sea some 5 to 30 million years ago.

Folded rocks in a road cut in Oman form a classroom, as British geologist Michael Hughes Clarke trains graduate students for key roles in oil exploration (opposite). Near Muscat, the capital, a warehouse shelters a 30-year library of well cores (bottom). Fieldwork takes New Zealand geologist Roger Brash to the rain forests of Papua New Guinea, where he examines an outcrop.

Few species had lasted through that whole span; some had become extinct only one or two million years after they had first appeared. Knowing when each species had lived, Brash could date each layer presented in an outcrop; this sequence of dates identified the formation, in effect fingerprinting it.

With these fingerprints Brash and other company geologists in Port Moresby might be able to connect one bit of outcrop to a second one ten miles away, no matter how geologic forces had twisted the layers.

A HELICOPTER dropped Brash and me off at a landing site hacked into the side of a steep hill in the wilderness somewhere west of Mount Murray and east of the Mubi River. A battery-powered computer the size of a suitcase had already been working for 24 hours, calculating our exact position from data supplied by satellites orbiting overhead. Brash reviewed the computer printout as to our whereabouts and then set out into the bush. I followed.

Our route lay up, down, around, and across a universe of sinkholes, many of which were at least partly covered by undergrowth. The holes came in all sizes, though few were so small that I felt comfortable about stepping over them.

A team of villagers had gone over the ground a few days before and marked the trail. Trail marking is not one of the traditional arts in the highlands, where everyone knows the paths from childhood, but the team, leaning over backward for the newcomers, had gone over the trail like a lawnmower.

This proved to be an education in the superiority of tradition, since many of the saplings that might have been used as handholds had been cut on the bias, leaving sharp stubble like punji sticks sticking up all along the trail. There were sharp rocks as well, spires poking up through the undergrowth, for not every bit of limestone dissolves at the same rate, and sometimes a pinnacle is left standing in the open air after its matrix erodes.

It had rained, naturally, and the ground was slippery with mud and rotten leaf mold. "Sometimes the ground gets really bad here," Brash said, moving up and down the slopes as if floating on a column of compressed air.

It looked so easy. I remembered a question I had asked before we came up here. "Do you people have many industrial accidents? I

Descending a dune in Oman, a team of vibrator trucks heads for camp at the end of the day. Instead of dynamite blasts, a seismic crew uses these trucks, which send low-intensity vibrations to bounce off the underlying rock strata. All four start a ten-second vibration at the same time, move 40 feet, vibrate, and move again, at an eight-miles-a-day clip.

mean like falling on sticks or down holes?"

"That almost never happens, although one fellow did sit on a sharpened stick a while back," Jan Smith had replied. "The real risk is helicopter accidents. Last year another company lost a pilot and two geologists."

Every minute or so Brash would pause, measure the strike and dip, or orientation and inclination, of the layers of rock composing the exposed ledges we passed, and chip off a sample. At one point I was laboring up a slope and saw Brash, several feet above, stop and look over my head into the forest. I turned to follow his gaze.

The canopy of the rain forest was relatively loose, and enough sunlight had penetrated it to support a luxuriant plant life at every height off the floor. The sun was brilliant—we were near the Equator and at some altitude—and it seemed that a tapestry, gold and green and

A makeshift shower washes the day's dust from an Omani jug hustler—member of a seismic crew who handles geophones, or "jugs." Taking a break, juggies nap in the shade, while up the line a vibrator truck operator reads the Koran. Salt domes, often associated with oil deposits, lie under Oman's Rub al Khali desert.

velvet, was being woven around us in all three dimensions, out of the very air.

Though it had not rained for hours, the forest canopy was still shedding water, and from everywhere came the popping and ticking of waterdrops working their way to the ground, leaf by leaf. Whenever a drop of water fell through a ray of that intense sun, it would explode into a tiny flare. Sometimes this happened only inches from my eyes.

Brash and I looked on together in silence for a minute or two. "It's not that bad, out here in the bush," he murmured. Then he turned, picked up his sample bag, and floated on up the hill.

AS I TRAVELED through the fraternity of oil finders, certain observations kept coming up, almost like proverbs. The most common was: "All the easy oil has been found." I heard this again and again, from drillers in Bangkok and vice presidents in Houston alike.

I never heard this observation without wondering exactly when finding oil had been easy—it certainly hadn't been easy for Colonel Drake himself. But without doubt the industry is convinced that their great scavenger hunt is carrying them right to the limits of what they know and what is economically feasible.

Take Bob Laing, whom I encountered in the oil camp at Rumbai, near Pekanbaru in central Sumatra in Indonesia. Laing, who is the chief geophysicist for Caltex Pacific Indonesia, is a Canadian in his early 40s, a little nervous and shy, a bit rumpled, and meticulous as to how he lays out his speaking points. He is an expert in the science of sending sound down into the earth and then inferring the shape and depth of subterranean structures from the echoes returned to the surface. I asked him to tell me how the process works.

Developed in the middle of the 19th century to study earthquakes and used by the Germans during World War I as a technique for locating

enemy artillery batteries, seismology is today the most important tool employed by the oil explorers, barring actual drilling.

The heart of seismic prospecting, Laing explained, is comparing the time it takes man-made shock waves, such as those from an explosion of dynamite, to show up at different locations on the surface.

Not so very long ago seismologists made their surveys by comparing data from just a handful of locations. These days, though, to repeat, the easy oil has been found. Almost all the fields that remain are offshore, or thought to be small, or deep, or small *and* deep, or hidden under complicated geologic features that play games with seismologists.

Certain rock formations can bounce a shock wave back and forth within themselves, like dice shaken in a cup, before releasing it to the surface. A geophysicist listening to the echoes might infer a deep structure, while the wily culprit was in fact lying right under his feet.

For a demonstration of the uses of advanced seismology in oil exploration, Laing passed me on to Bob Briant, a manager for Halliburton Geophysical Services, Inc. Briant was at the moment conducting a "shoot" in east-central Sumatra, in about 40 square miles of swampy floodplain surrounded by thick, second-growth, lowland rain forest.

Years ago, Briant told me, an oil explorer curious about the same territory would have

"This is the most remote spot I've ever worked in," says Canadian pilot Marko Grubac, flying his helicopter over a waterfall on Papua New Guinea's Mubi River. He carries personnel, equipment, and supplies to wells where no roads exist. A Huli tribesman atop a barrel of aviation fuel hiked to a site at 9,000 feet and, with some 60 others, cleared space for a helicopter to land.

With an empty explosives box for a pillow, a Papua New Guinea highlander plays his harmonica on a break from clearing a well site. After local laborers cut down the trees, a level area is blasted in the rugged terrain. Bulldozers flown in piece by piece move the debris. Helicopters make more than a hundred trips to deliver a drilling rig. Such preparation takes about eight weeks and costs $600,000 or more.

As the last equipment arrives for their rig, John Rawls and Mike Woodman (below, at right) grab a cup of coffee. Drilling specialists, they work 12-hour shifts in the round-the-clock operation.

Wells here have found plenty of gas, which may be used locally. So far oil reserves have not proved large enough to justify building a pipeline.

just bushwhacked right in. But lugging the tons of equipment required by a modern seismic operation over such difficult terrain is out of the question, and buying helicopter time or building access roads is very expensive.

The solution has been to build dozens of miles of narrow wooden footpaths through the target area, break the exploration process down into stages, and then send separate teams, each with its own assignment and equipment, out over the pathways to set off explosions and measure their echoes.

On their backs and shoulders, the members of these teams carry a week's supplies at a time—drilling pipe, explosives, 50-pound sacks of rice, rope, dried fish, toolboxes, fuel drums, bags of nails, tents, fiber-optic cables, geophones, coffee, first-aid gear, compressors, kitchen gear, generators. Sitting next to the bridge-like wooden paths, watching this prodigious traffic, I felt that the whole of a modern exploration expedition was passing by me unpacked, as if for inspection.

First over was the survey crew, responsible for measuring and marking the route with great precision. A few days later the pilot crew filed out to drill test holes and lay charges for a preliminary seismic survey that would determine where the charges for the main survey should be placed. Following the pilot crew came the drilling crew, who both drilled and then maintained the 70- to 150-foot holes in

which the charges would be placed. With only a handful of exceptions, the members of these crews, including management and technical personnel, are Indonesian.

And finally, the recording crew, 240 strong, strung the fiber-optic cables, planted the hundreds of geophones like great metal seedpods, and set off the charges. When this happened, a great yodel spread down into the crust and was reflected back to the geophones, to be transmitted to recording devices and eventually to sophisticated computers.

Two months later, the fecundity of the jungle being what it is, little evidence that anyone had been there at all will exist except in the memories of those machines.

ONE OF THE FEATURES of contemporary exploration is the separation between data acquisition and analysis. "In the old days people used to roll plotter paper right out on the hood of a truck," Laing said. Nowadays a geophysicist seldom even sees the information after it has been processed, much less draws conclusions. The work from this job will be analyzed at Rumbai. But sometimes it will be sent to even more powerful computers back in the United States.

The graphics displays on these very large machines, one of which I saw in Sydney at Esso Australia Ltd., gave me the sensation of passing, wraithlike, through the earth.

Push a key, *(Continued on page 254)*

250 *A tangle of trees is what remains of a section of rain forest that was blasted off a Papua*

New Guinea mountaintop so an exploratory well could spud in, or begin drilling.

Idled by the slump that hit the oil industry in the 1980s, offshore drilling rigs sit at anchor in the Sabine River between Texas (above, at left) and Louisiana. As they waited for work, some rusted past the point of recovery and had to be sold for scrap by bankrupt owners. Many of those that remain are jack-up rigs, named for their retractable legs, which can work in water as deep as 450 feet. Jobs, when they come, will likely take these rigs to the nearby Gulf of Mexico.

On a jack-up rig in the Gulf of Suez (right) exploration has finished, and production is about to begin. Perched above the waves, an Egyptian roustabout (left) attaches cables to lower a steel framework through 80 feet of water. Divers guide the 45-ton structure onto three delineation wells, each drilled at an angle to determine the limits of a field. This framework was designed to accommodate six more wells and a production platform. Bunching wells saves money because a single platform can service the whole group.

Dressed for temperatures that plunge below minus 40°F, a jug hustler collects his geophones near the Beaufort Sea in Alaska. Working only while ice and snow protect the fragile tundra, seismic survey crews labor as long as 18 hours a day to finish their tasks before the spring thaw. Their vibrator trucks run on rolling tracks that exert little more pressure per square inch than a human foot.

and you dive down a fault for thousands of feet, like skydiving down an elevator shaft—only this "shaft" is solid rock. Tap a few more keys, and you soar up the hulking flanks of a buried range like a hawk floating on a thermal, or circle around the tongue of a magma intrusion, or sink, layer by layer, through millions of years of fractured strata.

It was becoming clear to me by the time I got to Sydney that the oil-exploration industry is passing through a historic transition. When I began my trip, I had the misapprehension that oil came in bonanza discoveries or not at all. In fact, the formations that trap oil come in all sizes, and so therefore do oil fields. For years now the average size of new fields has been trending steadily downward.

"We're looking for gnats where we used to look for elephants," Laing had said in Sumatra, and I heard similar comparisons almost everywhere I went. Dave Kingston says that when he was in the field in the 1950s and '60s, his instructions were to look only for fields that contained a billion barrels of recoverable oil or more. Nowadays such big plays are few and far between, and with the possible exception of the explorers in Papua New Guinea, where the geology gives hope of enormous discoveries, almost no one I met expected ever again to stumble onto such a bonanza.

The disadvantage of small fields is, of course, that the oil recovered from any one

of them is less likely to pay the up-front costs, primarily the exorbitant expense of pipeline construction. (For some reason the word "recovery" is used, as though the oil had originally belonged to the industry but had through some strange accident been lost.)

The compensating virtue of small fields is that there are lots of them. This gives oil seekers the option of exploring at home, on land that is already producing and is close to a pipeline or a road. Without those advantages the economics of recovery from small fields would be forbidding.

I was shown an excellent example of this trend in Moomba, an oil and gas field in the southeastern region of the great Australian desert. Ed Tadiar, a geologist for SANTOS, one of the companies exploring from Moomba, sketched in the background for me in his map-festooned office in Adelaide.

The first discoveries made there in the mid-sixties, he said, were large gas deposits. These finds brought the first pipeline and the associated processing plants. Then a second round of discoveries, including oil, paid for more pipelines, laying an even finer mesh under the desert. (Because of environmental and security concerns, and also because the sand helps hold the pipes in place, all the networks have been laid beneath the surface.)

Now there is so much equipment in place that a field one-tenth of one percent the size of the original can be a paying proposition.

One day my guide at Moomba, Maurice Watson, set out to illustrate Tadiar's point. He took me far out in the desert. We rode for miles among low combers of parallel dunes created by winds blowing from the south.

Though the rains had put in a rare visit just a month before, the widely spaced bushes and grasses were already turning tan and gray. The topsoil was as fine as dust; as our truck passed, clouds would leap up out of the road, as though startled from sleep, and hang behind us in the air.

Our truck and the road aside, there were no signs of civilization. Then, off in the dunes, I saw the flash of sun on steel. A pipe had appeared out of nowhere, breaking right up through the sand. Watson explained that three vast networks of pipelines ran under the desert all around Moomba: one for water, one for gas, and one for oil. What I had seen were sections left on the surface for reasons of maintenance and control. Resting on their supports, they looked like giant underground centipedes that had stumbled out onto the surface and been stunned by the sun.

But they made Tadiar's point. As desolate as the outback there might seem on the surface, the subsurface was as organized as the streets of Adelaide.

FOR ALL THESE CHANGES, the exploration business retains its own feel. The level of courtesy among oil finders was everywhere extraordinary. Over and over again I listened to groups of men talking among themselves for hours without hearing a voice raised or a speaker interrupted. Even the worst jokes were laughed at. Evidently living and working with the same few people for months at a time in conditions of isolation is a powerful teacher of social graces.

If finding oil was easy for the previous generation and hard for this one, some future generation may find it impossible. The most common opinion among the analysts I spoke to is that somewhere around 500 billion barrels of oil recoverable using conventional methods remain undiscovered—perhaps half of that beneath the oceans.

In recent years it appears that discovery rates have been lower than world consumption of some 20 billion barrels a year. Proven reserves are estimated at 900 billion barrels. These figures, taken together with the increase in reserves to be expected from future exploration, suggest that at current consumption levels, conventional oil resources would last for about 70 years. However, the play of world politics could throw this figure off widely in either direction.

Running-out-of-oil predictions have a long history, and many geologists would not be surprised if the latest were no more accurate than those in the past. In particular, there might be whole new categories of oil traps undetectable by current technology.

The targets of most contemporary exploration efforts are folds or warps in the strata that in theory, if not always in practice, can be picked out by seismic probes. But oil can also be trapped when it rises through rocks that lose their permeability, perhaps only because the pores of the rock become just a tiny bit too small for the oil to navigate.

Michel T. Halbouty, a legendary oil explorer, calls these "subtle" traps and has been arguing for years that their potential is

enormous. Some of the largest fields in exploration history, he points out, were found when somebody happened to poke a drill into one of these subtle traps by accident—for example, the great East Texas field discovered in 1930.

"Ask yourself: Am I a real oil finder?" he said in a speech at an explorers convention. "If your answer is yes, then go out and find a subtle trap."

Finally, since large amounts of carbon were present in the materials that formed the earth, one highly controversial theory suggests that nonbiological hydrocarbons could have formed at great depths and migrated upward into the crust. If so, some sort of exploration might continue forever.

MY LAST STOP was a trade show at the Houston Astrodome, where I wandered through acres of new oil-finding tricks. I saw devices that could map an area in 3-D using the radiation from just about any point in the spectrum—radio, infrared, or ultraviolet—or as a chart of variations in gravitational or magnetic character. Other instruments surveyed changes in the electrical, radioactive, and chemical characteristics of rocks. There were computers that could probably eat the Library of Congress at eight o'clock and be hungry again by nine.

I watched demonstrations of portable, automated laboratories that could turn a small sample of rock into an advanced seminar on the petroleum geology of the region it came from. I saw extraordinary instruments, looking like huge metal crayfish, that were designed to be lowered into boreholes to sniff and taste and nibble at the walls. All this highly technical apparatus was presented with the excitement and glitter of a huge party, so that once an order had been placed, the canny buyer could begin immediately to celebrate his inevitable riches.

Eventually I ran into Roger N. Anderson, director of borehole research at Columbia University's Lamont-Doherty Geological Observatory. The hot concept in exploration was not on display here, he said; it was still too new. This was the "integrated expert system"—a network of computer programs that would sweep together all the information gathered by all known sensing methods and devices into a single set of terms, and then represent those terms in a common display.

Standing guard against polar bears, Alaska native Lonnie Solomon covers engineers gauging ice thickness and movement on the Beaufort Sea. Their base is a ship specially outfitted for exploratory drilling in the Arctic. Frozen in for the winter, the ship rests on a steel platform on the ocean floor. The platform can withstand a season's growth of ice, which can reach six feet by mid-May. Below deck Kirk Newbigging steam cleans a well casing. The casing passes through one of four openings, called moon pools, in the bottom of the ship.

Moving at two miles an hour, the parts of a drilling rig take the haul road back to Prudhoe Bay, Alaska. The crew has just completed an exploration well some 40 miles to the south. Results are top secret, but if the prospecting company hits a field worth producing, wells will be sending oil along the pipeline to Valdez. If not, the company will continue its quest as long as the money holds out and the geology of the site hints of a payoff at the bottom of the next well.

At an extreme of effectiveness, such a system might allow a person to look down into the earth and see deposits of oil as distinctly as clouds against a summer sky. Such a program would be almost unimaginably complex and would require the most powerful computers under development. Nonetheless, Anderson said, lots of companies have integrated expert-system projects under way.

After Anderson and I had wandered around the showroom floor, he took me aside and began to discuss his own research, which has to do with the role of subterranean heat flow—differences in the rate at which areas lose heat to the surface. When fluids like oil, gas, and

water move up in the earth, he told me, they carry heat from those deeper levels. That higher heat flow shows up as an anomaly on a map of the rate at which different areas lose heat. He had a map of heat-flow readings from the Gulf of Mexico. Different temperatures appeared in different colors; the more yellow the area, the stronger the heat loss. Most of the gulf was a mottled red.

Then Anderson brought out another map of the gulf and laid it over his heat-flow chart. This one showed which sections of the bottom were leased for exploration purposes and by whom. In most cases, though not in all, areas already producing oil or gas were associated with yellow colors, showing high heat flow.

This is just what the theory would have predicted. "That's interesting," I said.

"Look a little closer," Anderson suggested.

I began picking over the lease map square by square. Most squares were leased, but here was one that no one seemed to have chosen. Oh, oh! A glorious bright yellow was blossoming right in the center of the unleased square. Some plume of hot fluid was down there, fighting its way up to the surface.

Oil? I had the feeling it was calling directly to me, right from the bottom of the gulf. Anderson and I looked at each other and saw we were both grinning wildly. □

Tragedy in Alaska Waters

By DOUGLAS B. LEE NATIONAL GEOGRAPHIC SENIOR STAFF

Photographs by NATALIE FOBES

IT WAS virtually impossible, they said. No major spill could take place in Prince William Sound. But should the impossible happen, emergency procedures would quickly minimize any damage—so claimed the companies and agencies responsible for ships carrying oil through Alaska's unspoiled waters.

That was before the tanker *Exxon Valdez* ripped open its bottom on Bligh Reef. Oil fountained out of its hull as 10.9 million gallons of North Slope crude poured into the sound.

Offloading the remaining 42 million gallons began almost immediately. But two days after the accident deployment of containment booms was pitifully ineffectual (above).

Workers tried to protect the shoreline (opposite), but equipment that was supposed to be on hand was in short supply. When winds spread the slick, it became inevitable that shellfish and thousands of sea otters and seabirds such as a common murre (right) would die. The catastrophe that couldn't happen became a nightmarish reality.

FEW REGIONS of North America's coast have more to lose from such a devastating environmental blow. And few would be more difficult to clean up. The gantlet of islands that forms Prince William Sound (map, left) slows the natural cleansing process that takes place on beaches exposed to heavy surf. Alaska's frigid water keeps oil from breaking down as quickly as it would in warmer seas. Gravel beaches along the rocky shoreline absorb oil, which then leaks out for months or years.

The sound is home to whales, porpoises, seals, sea lions, and one of North America's greatest concentrations of sea otters—an estimated 10,000 before the spill. Some 400,000 resident birds are joined in spring by a million migrating seabirds and ten million waterfowl and shorebirds. Brown bears, Sitka black-tailed deer, and thousands of bald eagles live along the forested shores. Five species of Pacific salmon spawn in hatcheries or in streams that empty into the sound, also a prime area for herring, shrimp, and bottom fish. Fishermen who had expected a 1989 harvest of 120 million dollars faced an uncertain future.

A harvest of death awaited fishermen who were among the first on the scene to pull dead and dying animals from the water. Soaked in oil, a pigeon guillemot crouching among coated rocks (left) died soon after it was found. Hardest hit of marine mammals were sea otters (right), poisoned by oil or killed by hypothermia as their oil-soaked fur lost its insulating properties. Veterinarians, technicians, and volunteers at rescue centers funded by Exxon treated otters and birds brought in by boats, planes, and helicopters.

No phase of the sad event has been without controversy. Contingency plans for dealing with a spill have been on file since the 1970s, when Congress gave the go-ahead for the trans-Alaska pipeline from Prudhoe Bay to Valdez. But after 12 years of relatively trouble-free operations these plans proved to be a paper reality only. Round-the-clock response teams had been demobilized, and equipment that should have been ready was far away or nonexistent. Faced with the worst oil spill in U. S. history, corporations and state

and federal agencies responsible seemed uncertain about who should take command, and critical time was lost.

Left untreated and uncontained, the oil combined with water to form a floating "mousse," deadly and uncontrollable. A large part of the gooey mat eventually oozed through straits and channels to open water, spreading tendrils of pollution to Kodiak Island and beyond. Where it landed on beaches, the danger remained that high tides or storm winds would refloat the oil to coat new areas. While lighter elements of the oil quickly evaporated, some poisonous compounds may have entered the water column, with unknown consequences for fish and bottom life.

Never before has such a sensitive natural showcase been so massively and suddenly violated. The victimized sound has become an unfortunate laboratory for scientific research. Studies now under way will help authorities understand the impact of oil upon the biological galaxy of creatures in coastal waters. Public outcry has focused scrutiny on industry's invasion of wilderness.

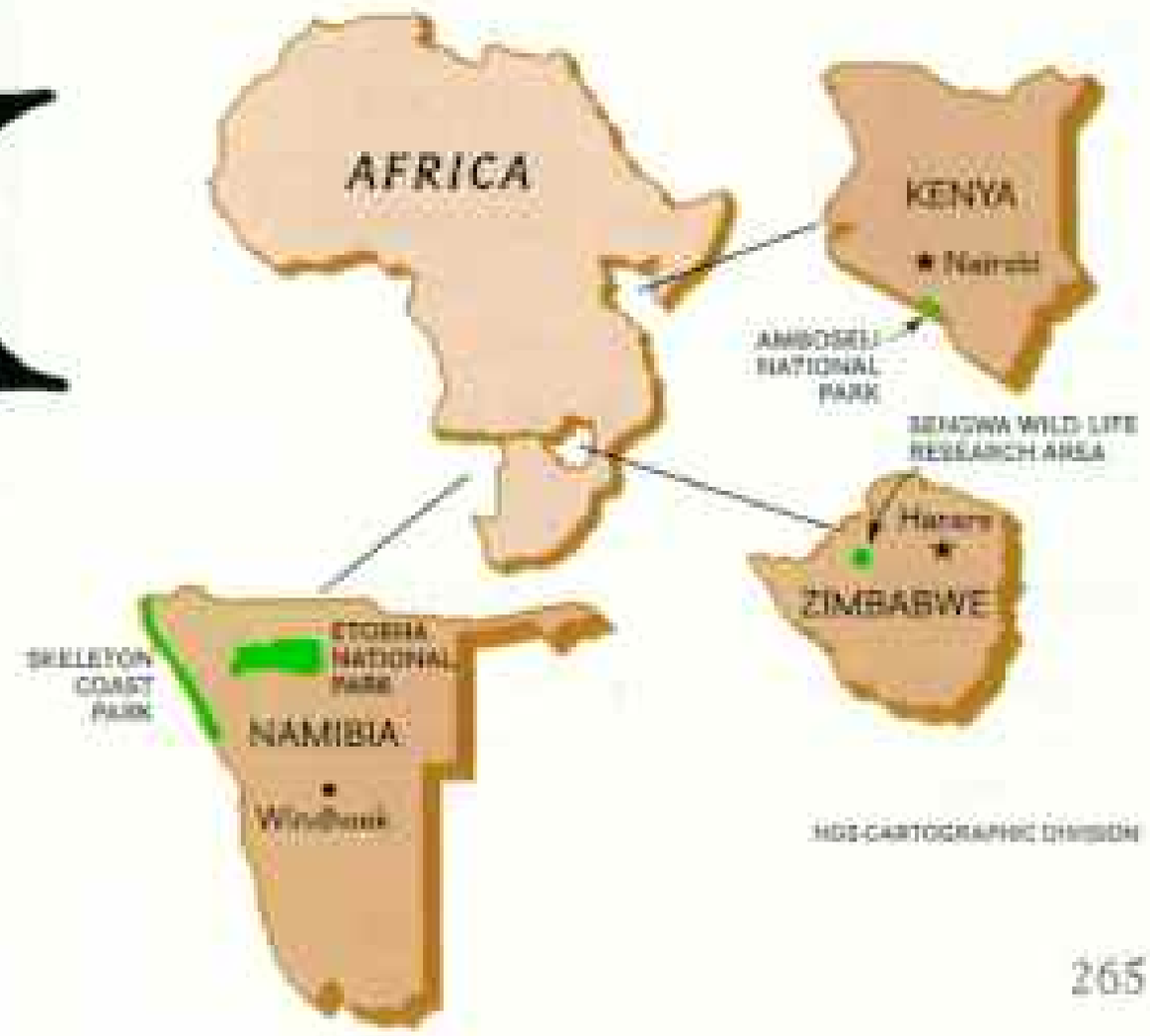
A NATIONAL GEOGRAPHIC team, arriving the day after the spill, continues to monitor events and will present a complete report on the accident and its aftermath in an upcoming issue. One lesson is frighteningly clear: Current equipment and techniques are hopelessly inadequate to master so rapid and large a spill. And well-laid plans too easily become unkept promises. □

ELEPHANT

All is quiet to the human ear as a stately procession of elephants wends its way past Kilimanjaro. And yet the air is filled with the sound of elephant calls, resonating from near and far just below the pitch audible to humans. Research in Kenya, Namibia, and Zimbabwe indicates that elephants—perhaps alone among land mammals—use infrasound to communicate across distances of several miles.

TALK

Article and photographs by
KATHARINE PAYNE



VOICEPRINTS OF CALLS BETWEEN ASIAN ELEPHANTS AT THE ZOO IN PORTLAND, OREGON. THESE WERE AMONG THE FIRST RECORDINGS OF INFRASONIC VOCALIZATIONS

SPEND A DAY AMONG ELEPHANTS, and you will come away mystified. Sudden, silent, synchronous activities—a herd taking flight for no apparent or audible reason, a mass of scattered animals simultaneously raising ears and freezing in their tracks—such events demand explanation, but none is forthcoming.

Some capacity beyond memory and the five senses seems to inform elephants, silently and from a distance, of the whereabouts and activities of other elephants.

I stumbled on a possible clue to these mysteries during a visit to the Metro Washington Park Zoo in Portland, Oregon, in May 1984. While observing three Asian elephant mothers and their new calves, I repeatedly noticed a palpable throbbing in the air like distant thunder, yet all around me was silent.

Only later did a thought occur to me: As a young choir girl in Ithaca, New York, I used to stand next to the largest, deepest organ pipe in the church. When the organ blasted out the bass line in a Bach chorale, the whole chapel would throb, just as the elephant room did at the zoo. Suppose the elephants, like the organ pipe, were the source of the throbbing? Suppose elephants communicate with one another by means of calls too low-pitched for human beings to hear?

Half a year later the World Wildlife Fund, the Cornell Laboratory of Ornithology, and friends in the Cornell biology department helped me, Bill Langbauer, and Liz Thomas return to the zoo to test this idea. We recorded near the elephants for a month. Then we made electronic printouts like the one above and saw that we had recorded 400 calls—three times as many as we'd heard.

Elephant sounds include barks, snorts, trumpets, roars, growls, and rumbles.* The rumbles are the key to our story, for although elephants can hear them well, human beings cannot. Many are below our range of hearing, in what is known as infrasound.

The universe is full of infrasound: It is generated by earthquakes, wind, thunder,

*Zoologist Judith Kay Berg of the San Diego Wild Animal Park reported similar categories of elephant vocalizations, some at very low frequencies, in a 1983 scientific paper.

Fluttering and vibrating as air passes through the nasal passage, the skin on an elephant's forehead (in shadow, above) signals that infrasonic vocalizations are taking place. This behavior was noticed at a zoo in Oregon, as Asian elephants exchanged calls through a thick concrete wall. The acoustic spectrum below shows the range of sounds—about ten octaves—audible to an average 15-year-old human at the loudness and proximity of normal conversation.

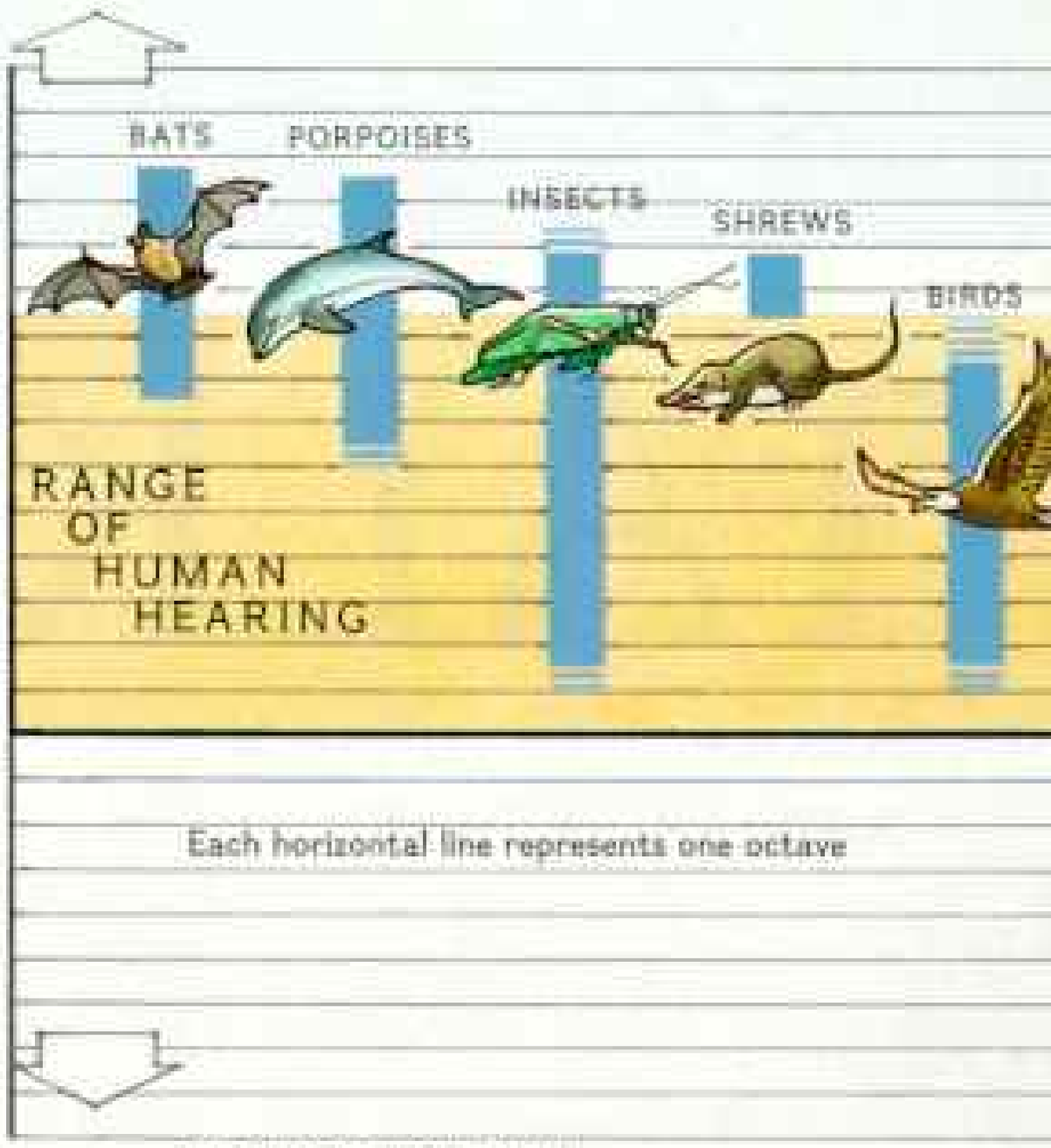


DIAGRAM BY PIERRE MION

volcanoes, and ocean storms—massive movements of earth, air, fire, and water. But very low frequency sound has not been thought to play much of a role in animals' lives. Intense infrasonic calls have been recorded from finback whales, but whether the calls are used in communication is not known.

Why would elephants use infrasound? It turns out that sound at the lowest frequencies of elephant rumbles (14 to 35 hertz, or cycles per second) has remarkable properties—it is little affected by passage through forests and grasslands. Does infrasound, then, let elephants communicate over long distances?

Suddenly we realized that if wild elephants use infrasound, this could explain some extraordinary observations on record about the social lives of these much loved, much studied animals. Iain and Oria Douglas-Hamilton, Cynthia Moss, and Joyce Poole, in their long-term studies of elephants in Tanzania and Kenya, had reported many examples of behavior coordinated by some unknown means over distances of two miles or more.

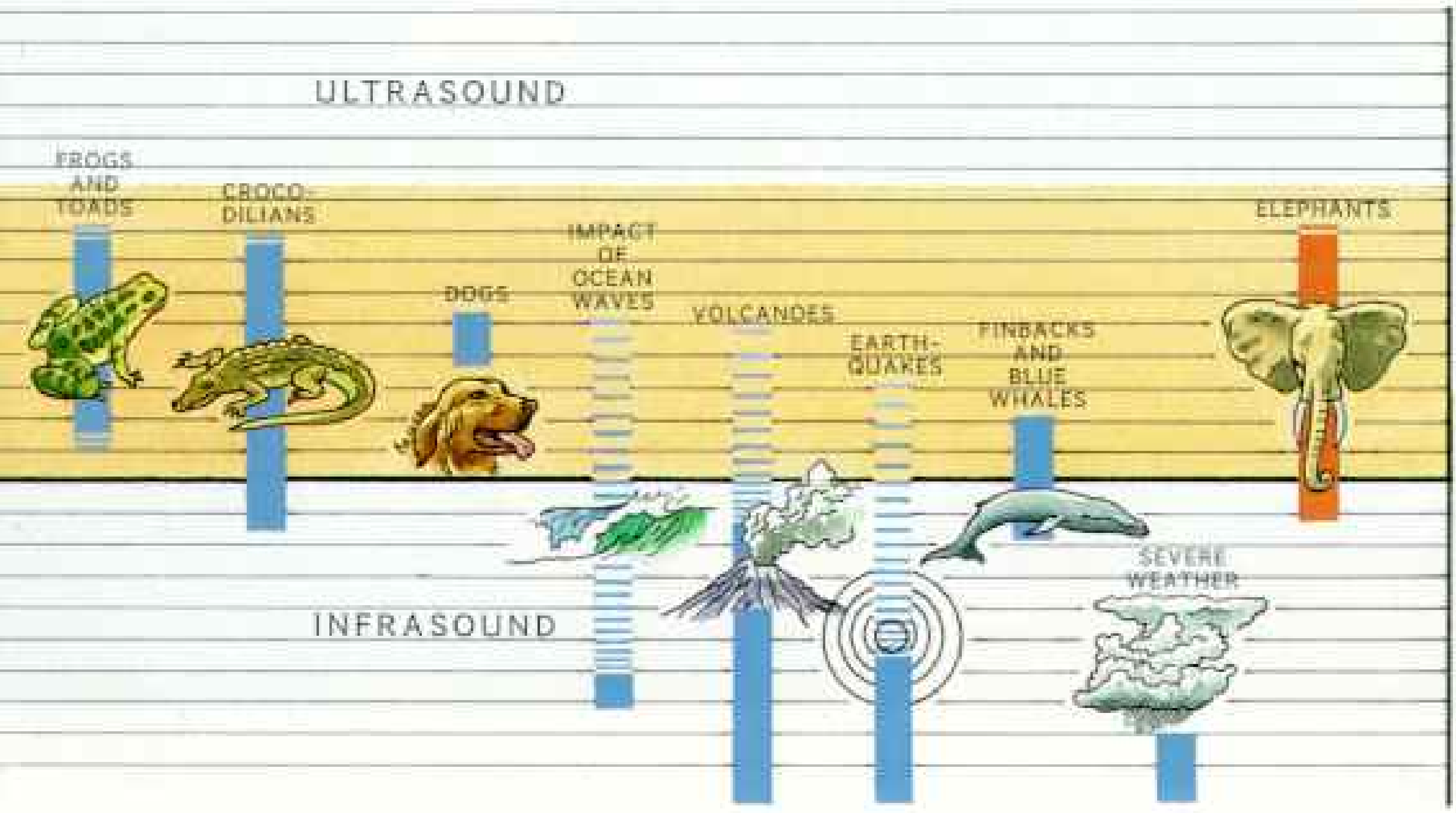
For instance, how do male and female elephants find one another for reproduction? This was a question raised by Joyce's doctoral research on the lives of males. Adult males and females live independently from one another, moving unpredictably over a great territory, with no fixed breeding season. A male elephant spends part of each year in a condition called musth, when he crisscrosses large areas in an endless, irritable search for females in breeding condition. Well may he feel irritable, for receptive females are a truly scarce resource. With two years of gestation followed by two more of nursing, a female is receptive only a few days every four or five years.

But they do find one another. In fact, as Joyce observed, the amazing thing is that the female is no sooner in estrus than she is surrounded by males that gather from all directions, some from far away. The dominant musth male then guards the female and mates with her every few hours until her period of receptivity ends.

A RESEARCH PROJECT SUPPORTED IN PART BY YOUR SOCIETY

How has the estrous female informed males from far and wide of her condition? The answer may lie in a unique sequence of intense, low-frequency calls that a receptive female makes during her estrus. This sequence always has the same form and thus technically may be called a song.

Slow, deep rumbles, rising gently, become stronger and higher in pitch, then sink down



again to silence at the end. The performance may continue for half an hour, and before the day is out the singing elephant will be surrounded by male elephants.

I FIRST SAW AND HEARD these things as a guest of Joyce Poole in Kenya's Amboseli National Park in 1985 and 1986. In two and a half months we recorded more than a thousand calls from the elephants that Joyce and Cynthia Moss know so well. The calls that seemed likely to interest distant elephants were rich in infrasound and powerful enough to travel a mile or more.

But how were we to prove that elephants responded across such distances? How could we study communication when we couldn't perceive most of the calls? Bill Langbauer figured out a way to solve these problems.

ESTROUS SONG OF ZITA, A FEMALE IN AMBOSELI NATIONAL PARK IN KENYA

His preparations led us to two four-month expeditions in southwestern Africa. Bill, Liz, and my daughter Holly and I were the team in 1986. Bill, Russ Charif, Lisa Rapaport, Loki Osborn, Liz, and I were the team in 1987. The National Geographic Society sponsored both expeditions. Needing a work site with long visibility, we chose a vast, semidesert park in Namibia called Etosha.* The dry season in Etosha is desperately dry; the only surface water lies in a few dozen widely spaced water holes. Nothing is green: It is hard to see how the thousands and thousands of herbivores such as springbok, wildebeests, hartebeests, kudu, zebras, giraffes—and elephants—manage to survive.

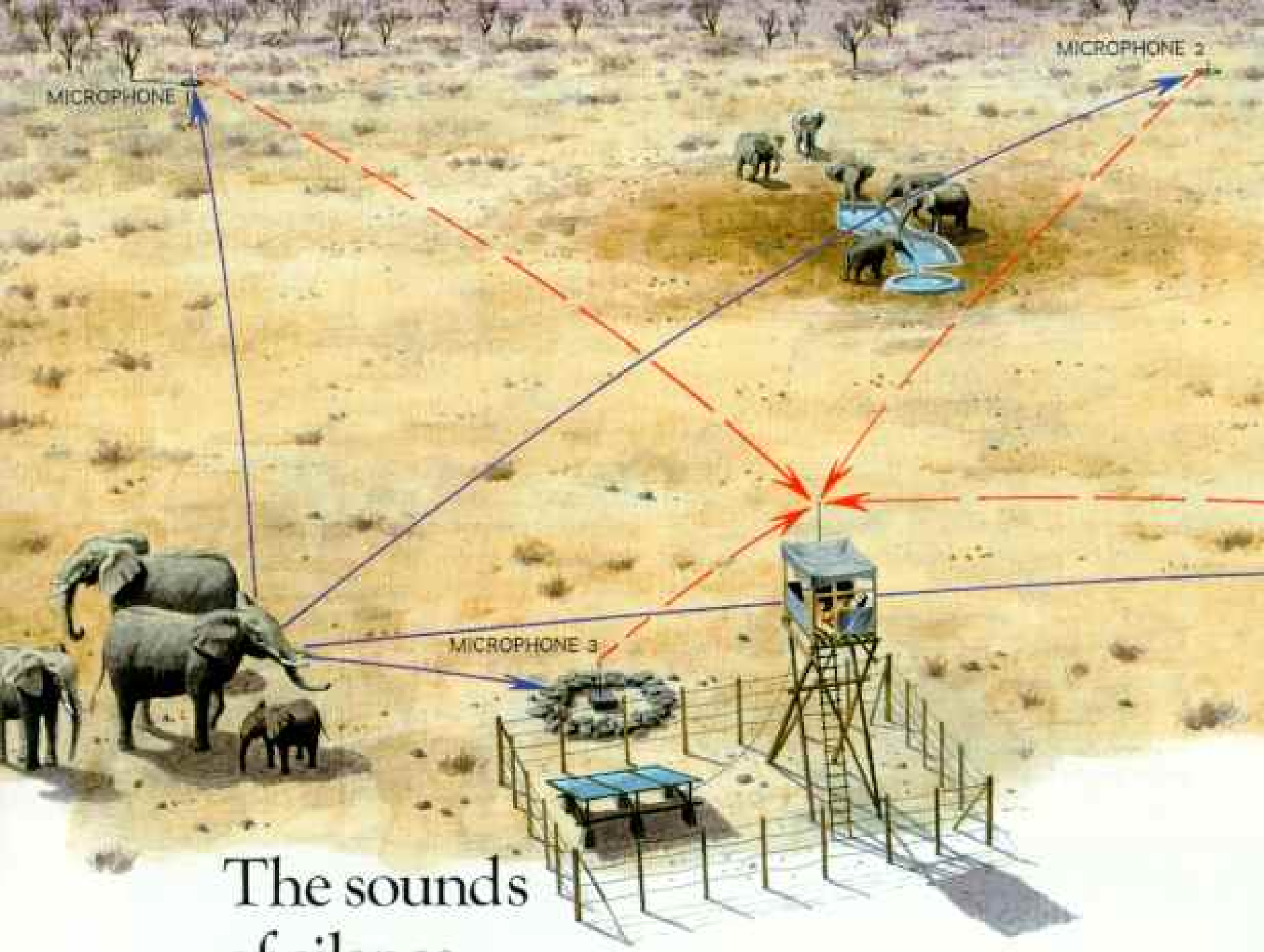
The answer, for elephants, seems to lie in lives of perpetual motion. Elephants coming to a water hole often arrive at a dead run, not because anything scary is behind them, but simply because water is, at last, in front.

Etosha elephants are leaner than the elephants in East Africa, there is more competition at water holes, and calf mortality is higher, probably because of the distances between water and food. We figured that if elephants had the ability to communicate over long distances, they would be particularly likely to use it in places like Etosha, where news about how distant elephants were faring might reduce the likelihood of bad decisions and death from exhaustion, predation, or dehydration.

From the platform of our observation tower 20 feet above ground (following pages) we had a good view of an area of roughly half a

*See "Etosha: Namibia's Kingdom of Animals," in the March 1983 GEOGRAPHIC.

Fierce and furious combat can ensue when well-matched males are drawn to the same estrous female. In Amboseli National Park in Kenya, Thor stirs up a dust cloud before locking tusks with Pablo (left, at left). Both males are in musth, an annual condition of heightened aggressiveness and sexual activity. Although Pablo won this three-hour fight, he lost the next one to Masaku, a larger, one-tusked male; Masaku was in turn displaced twice but eventually mated with Zita (above).



The sounds of silence

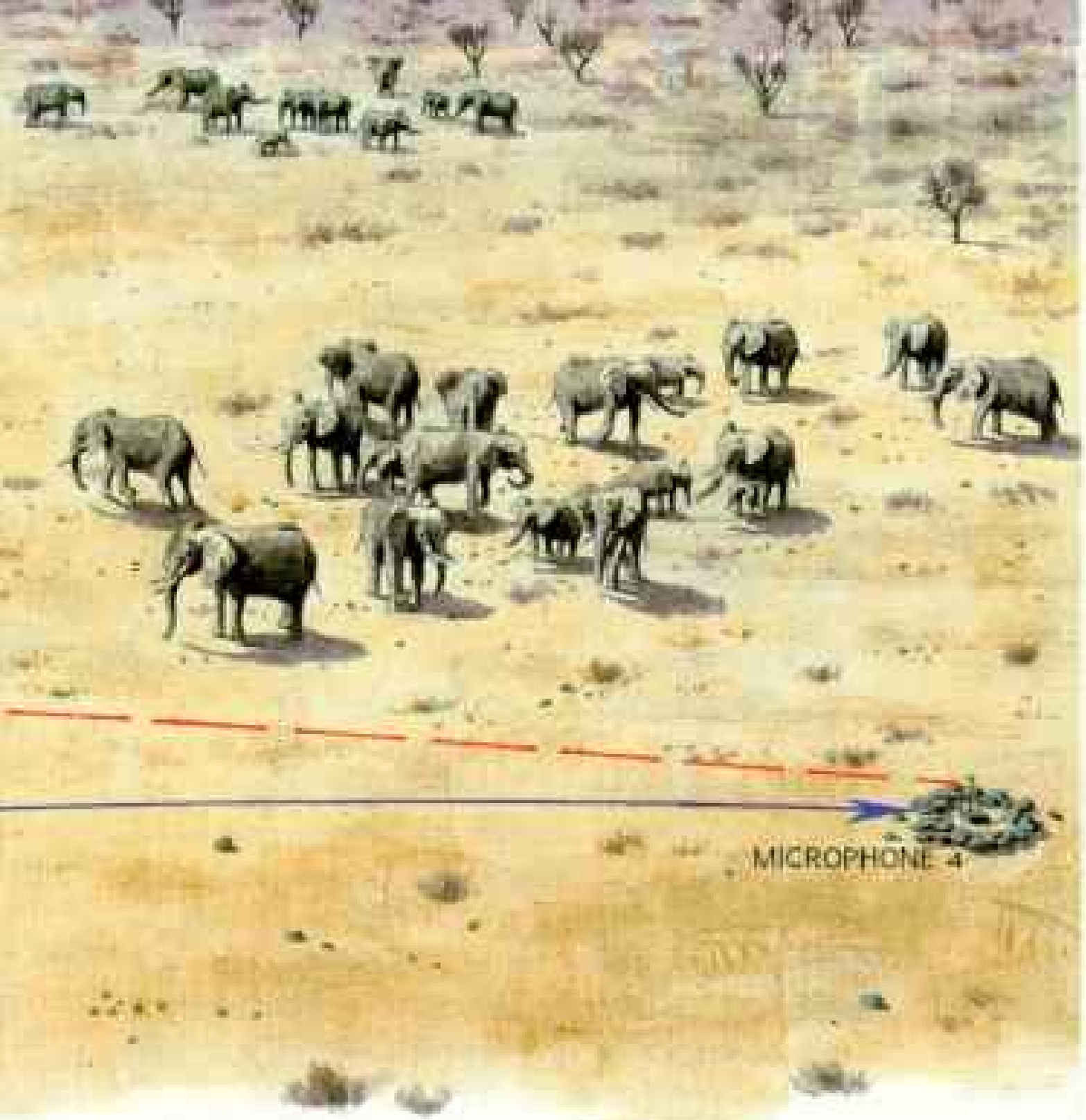
square mile. An array of four widely spaced microphones enabled us to pinpoint elephant calls, whether or not we ourselves could hear them. Video recordings revealed which elephants were in the correct places to have made the sounds and documented the subtle interactions of elephants at a watering area.

ONCE AGAIN we marveled at elephants' "silent" mass coordination. Often it took the form of simultaneous arrival of several groups from different directions, after days in which we had seen no elephants at all. Sometimes it took the form of sudden group flights, when a moment before all had seemed peaceful and individuals had appeared relaxed. Sometimes we observed sudden synchronous freezing—two to a hundred individuals suddenly holding still in their tracks, as if a motion-picture frame had stuck in the projector. Other times there was sudden simultaneous calling by several adult females, which we would understand only later when a new group arrived and was greeted with excitement by others already present at the water.

Although males came to the water as often as females, the great majority of our recorded calls were made by females. A picture began to form in my mind of a communication system in which males and females played quite different roles.

Female behavior is richly illustrated by their calls—mothers, calves, and baby-sitting sisters settling questions of when to nurse or how far to wander, of family groups keeping track of one another, and so forth. Yet females also respond to distant happenings. How do they achieve the silence necessary for hearing faint, distant signals? "Freezing," which insures synchronous periods of listening, seems to solve this problem.

Adult males are less vocal than females, yet very responsive to female activities. Probably the noisiness of female groups enables males



PAINTING BY PIERRE MION; DES AND JEN BARTLETT

How can one locate sounds that one cannot hear? A system composed of four microphones and transmitters placed near an observation tower and protected from curious elephants by piles of rocks provided an elegant solution. At the tower the calls transmitted from the microphones were recorded and the elephants' behavior simultaneously videotaped by the author (above, with binoculars) and her colleagues. The origin of the calls was determined by comparison of their arrival times.

to learn much about the latter's location and sexual state simply by listening.

Our preliminary findings about the vocal behavior of females were interesting in the light of a long-term study by Rowan Martin in southern Africa. Martin put radio collars on adult females in different family groups in the Sengwa Wild Life Research Area in Zimbabwe. He tracked the females for long periods—up to ten years—and found that the apparently haphazard wanderings of family groups were not random but were coordinated with one another for weeks at a time, even when the groups were rather far apart.

Sometimes two or three or four of the groups Martin is studying would follow parallel courses, keeping a mile or more between them and changing directions simultaneously. Sometimes groups would converge from spots three miles or more apart to arrive at a source of water within minutes of each other. Out of sight and ordinary acoustic range, separated elephants synchronized their behavior uncannily, even when the wind direction prevented their using the sense of smell to keep track of one another.

To find out whether elephants actually perceive and respond to distant calls, Bill designed playback experiments to be conducted at the water hole in Etosha. While the rest of us were filming the behavior of elephants near the tower, Russ and Loki would broadcast a few seconds of prerecorded elephant rumbles from a van stationed at one of several distant locations. When we later studied our video and audio tapes, we would compare the activities of the elephants immediately before the playback with their activities just afterward, to see whether the playbacks had measurably changed their behavior.

Experiment 16

Loki and Russ are in the van a mile to the southwest of us in the tower. Two huge male elephants, Mohammed and Hannibal, have been drinking and bathing at the water hole

OVERLAPPING CALLS BETWEEN ELEPHANTS GATHERED IN AMBOSELI NATIONAL PARK; FAINT CALLS ARE PROBABLY FROM DISTANT ELEPHANTS

for some time. By walkie-talkie we have notified Loki so that he and Russ can choose a playback stimulus not previously played to either of these bulls. At some point they will play the tape at a known volume. We are purposely not informed about the exact timing, so that our observations will not be biased.

We hear nothing, but suddenly both elephants lift their heads, stiffen, spread their ears, and hold still. Slowly Mohammed swings his head to the left, back to center front, to the right, and back to center again. Now Hannibal is doing the same. By now the recording must have finished, for none of our playback tapes last longer than 40 seconds.

Mohammed has made a decision. He swings around 180 degrees to face southwest, where the van is, far out of sight. Then the two males set off in that direction. Neither stops to touch the water as they pass it—unheard of! From time to time one stops to scan and listen again; the other stops; both freeze for 30 seconds. Then, swinging their trunks a little, they resume their march.

Five minutes later they are still on course. Ten minutes later they pass the van and keep right on moving. In the van Russ and Loki heave great sighs of relief as the swaying backs of the gigantic bulls disappear into the scrub forest beyond the van, still heading southwest. The recording they had played for Mohammed and Hannibal was the estrous song of Zita, one of Amboseli's females.

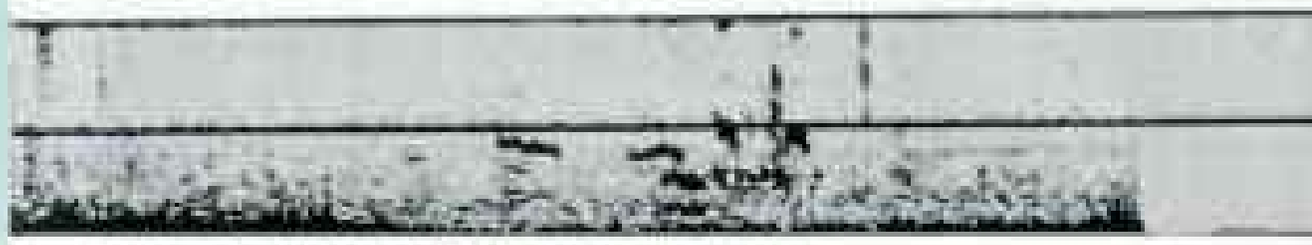
IN REPEATED EXPERIMENTS elephants at the water hole changed their behavior markedly just at the instant of playback. Males and females lifted their ears and listened, scanning to locate the source of the call. Males often made long treks toward the loudspeaker. Females often gave loud, instantaneous calls of their own. Both males and females responded to calls from as far away as two and a half miles, the longest distance we tested.

Are infrasonic calls, then, one of the means by which elephants normally coordinate their behavior over long distances? With Rowan Martin we plan next year to attach microphones to the radio collars of the same elephants he has been tracking in Zimbabwe, so that we can continuously monitor not only

Trunks held high in sniffing posture, an elephant family in Etosha National Park in Namibia inhale the intriguing smell of human observers. Elephants use their sense of smell constantly. When wind direction interferes with picking up scents, infrasonic communication becomes vital, especially for musth males faced with finding a mate that may be in estrus as few as two days every four years.

A remarkable sight, groups of as many as a hundred females and calves periodically freeze at the same moment, apparently to catch faint, distant calls. They will remain motionless, with raised, spread ears (below), for as long as a minute.

DICK AND JEN BARTLETT



TWO ADULT RUMBLES AND TWO CALF SUCKLE CALLS IN AMBOSELI NATIONAL PARK

A tiny growl known as a suckle protest issues from a hungry calf. Mother responds with soft calls, followed by immediate gratification. Highly protective of their young, female elephants make model mothers, sisters, aunts, grandmothers, and cousins. A roar and a scream from a distressed baby calf creates havoc as all available relatives rush to the rescue (below). Their rumbles of panic—presumably intended to summon even more help—were among the strongest infrasonic calls recorded.

Led by the matriarch, females and their calves eat, drink, sleep, and travel together in sociable cooperation. Different family units (each consisting typically of about ten animals) will often join forces with each other; known as bond groups, they are thought to be related. Males tend to be loners, avoiding one another particularly when in musth.

ADULT ALARM CALLS IN RESPONSE TO A DISTRESSED CALF IN ETOSHA NATIONAL PARK

their movements but also their vocalizations.

The evidence that infrasound plays a crucial role in the lives of elephants is building up. Our experiments suggest that each elephant lives in a network of communication in which the animal-to-animal distance is potentially at least two and a half miles. It seems likely that this network has something to do with the ability of elephants to maintain an elaborate hierarchical society even in an environment as sparse as Etosha.

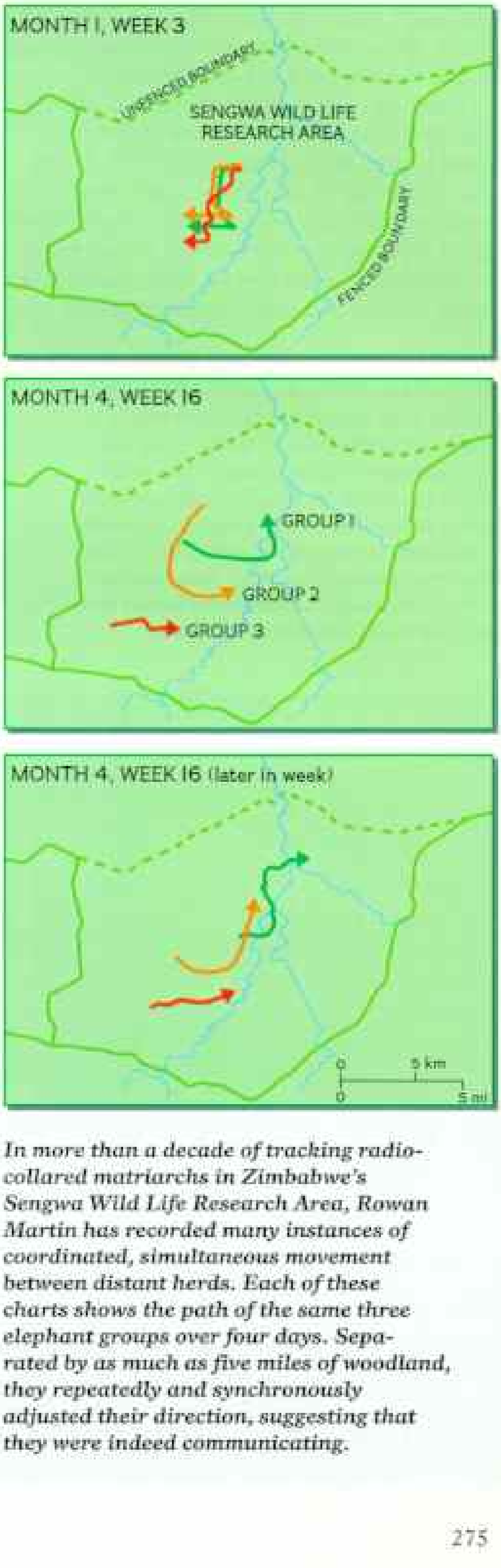
What would happen to a population too dispersed to use the long-distance communicative abilities that elephants appear to be endowed with? This question was in my mind two years ago when, as a guest of friends from the World Wildlife Fund, I was able to go into one of the sparsest environments in the world and see elephants living there.

A hundred miles west of Etosha along the South Atlantic is a strip of shifting sand dunes and gravel plains called the Skeleton Coast Park. My old friends, filmmakers Des and Jen Bartlett, have lived, filmed, and studied animal life there for the past five years. Amazingly, they told me, elephants inhabit the area, although rain almost never falls and there is little surface water except during the rare occasions when water from rain in the mountains far inland bursts through the dunes and creates a river flowing toward the sea.

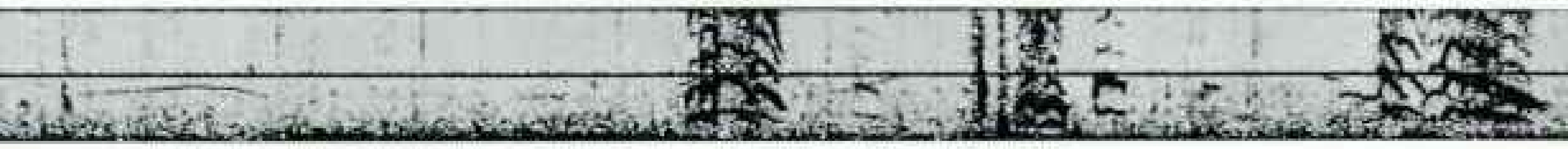
However, succulent bushes in dry riverbeds reveal that water is not far beneath the surface. The desert elephants eat leaves and branches from these bushes. To get from browsing areas to drinkable water, they may walk as far as 30 miles in a stretch. They sometimes go four days between drinks.

Pioneer conservationist Garth Owen-Smith took us to see some of the elephants' sources of drinking water. Words fail to describe those barren, empty distances, the intense heat, the unquenchable thirst, or the longing I felt for signs of life. Each time we reached water, I wondered how any animal that had found it could ever leave. But there was not enough vegetation near water to feed a herd of elephants for more than a few hours.

In a dry riverbed just outside the park we came to a dozen or so wells dug by the



In more than a decade of tracking radio-collared matriarchs in Zimbabwe's Sengwa Wild Life Research Area, Rowan Martin has recorded many instances of coordinated, simultaneous movement between distant herds. Each of these charts shows the path of the same three elephant groups over four days. Separated by as much as five miles of woodland, they repeatedly and synchronously adjusted their direction, suggesting that they were indeed communicating.



OVERLAPPING GREETING CALLS BY GROUPS OF ELEPHANTS AT A WATERING HOLE IN AMBOSELI NATIONAL PARK

elephants, each just wider than an elephant's trunk. Reflections showed water about a foot down. All around were animal tracks.

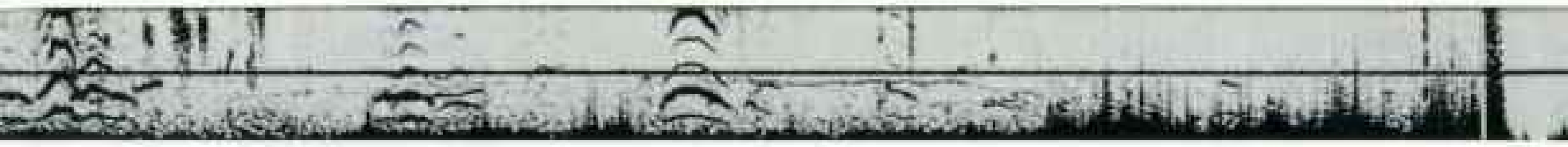
Years ago, we learned, the largest population of elephants in the coastal desert had lived nearby in the Hoarusib Valley. There too, in the bed of a tributary, were wells that supplied not only the elephants but also many other wild animals with water. When water in the wells was too low for little elephants to reach, adults would fill their trunks and pour the contents into the calves' mouths.

But by 1982 the elephants had all but vanished. Many left when a drought harsh even for the Skeleton Coast struck the region, but piles of bones revealed that poachers also took a toll. With the elephants disappeared all traces of their wells.

So it had been a wonderful surprise for Garth when, one day four years later, he happened upon a family of ten elephants in the Hoarusib area. They walked up the valley where the old wells had been, dug new holes in the same place, drank, and left. After this, footprints of other animals leading from all directions to the wells revealed that it had again become a place of life.

These were the sort of tales we heard about the desert elephants. We heard no tales of magically synchronized movements among separated groups. I believe, in fact, that the distances between groups are usually too great for their calls to reach.

Companionable but apart, two families reveal their separate recent travels by the color of their dusty hides. They are probably not a bond group. Even after short separations, bond-group members greet each other with intense excitement: rumbling, urinating, whirling in circles, and trumpeting. Constant communication helps reinforce the social bonds that are key to the elephants' survival.



The remarkable—almost unbelievable—thing about the desert elephants is their endurance through the dry months. They must be guided not by the voices of distant relatives but by their own heritage, which we may think of as the voices of their ancestors. The experience of many generations is what leads these elephants over gravel plains and rocky mountains, across dunes and down dry riverbeds to the few sources of life-giving water in a vast and hostile desert.

IF THE SKELETON COAST lineage dies out, it seems unlikely that other elephants lacking this heritage could ever repopulate the area. I suspect, rather, that the present elephants' tracks and their wells would be filled in with windblown sand, and that would be that.

Thus it is terrible to learn that in the past two decades the desert elephant population has declined from several hundred to a few dozen, badly reduced by ivory poachers. The elephants' tusks were torn out, sold to middlemen, and illegally shipped to Japan, China, Europe, and America.

By the time the tusks reached their final destinations, all the experience of the living elephants had gone out of them—the dust and the musth, the smells and sounds of fighting and mating, the long, urgent songs of fertile females, and the stillness of the night as elephants froze in their tracks to listen.

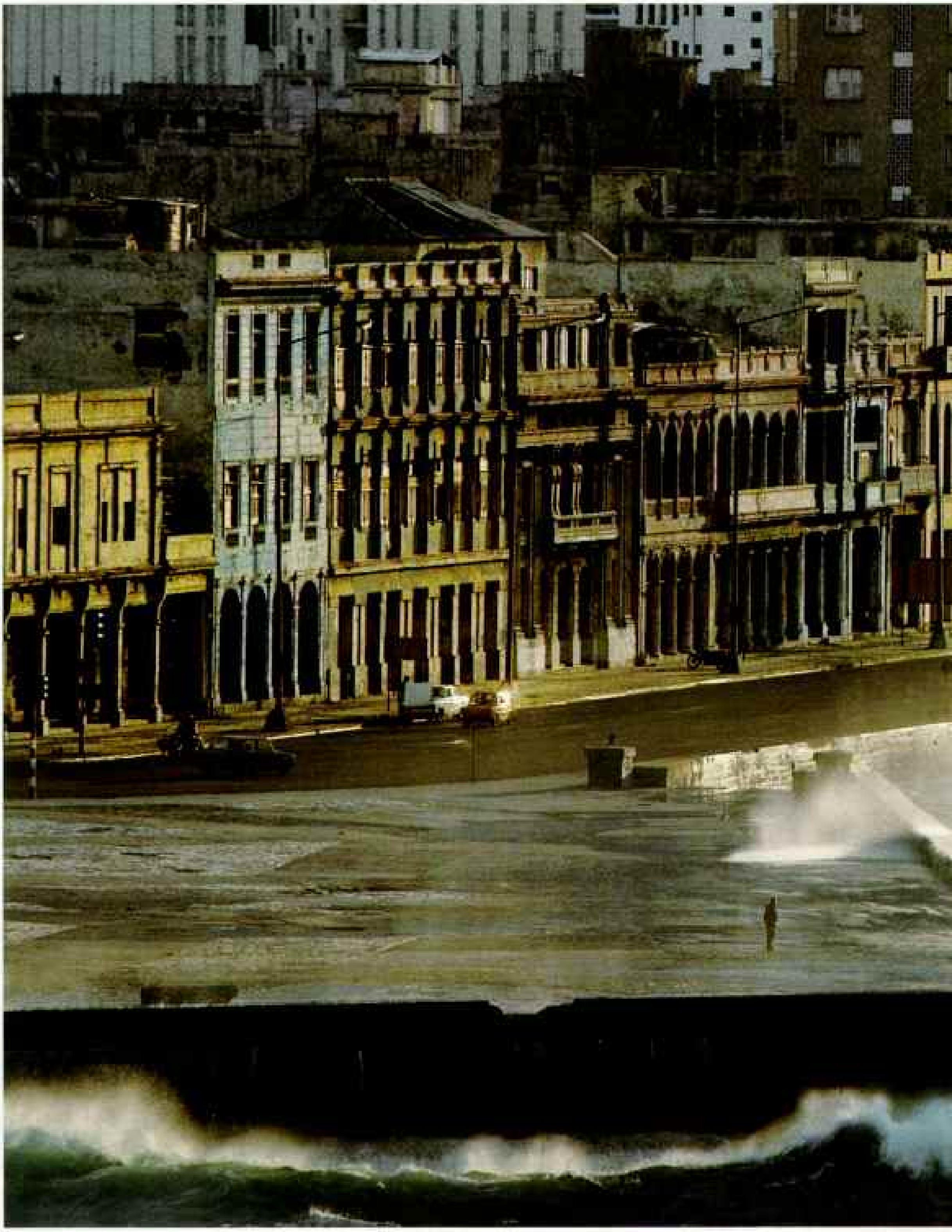
Gone, too, the long dry treks over dunes and gravel plains, guided by matriarchs with generations of memory in their heads. Gone the finding, the digging, the drinking from their own fresh wells. Gone the memories of heat and the vastness of the barren land—the patience. And the river breaking through.

All of this vanished with several hundred desert elephants. Nothing is left of them but little white carvings in ladies' jewel boxes, smelling faintly of French perfume. □

DEE AND JEN BARTLETT

Like a reef built on Havana's shore over the centuries, decaying facades along the Malecón await the restoration that is transforming the colonial heart of Cuba's capital.

The Many Lives of OLD



HAVANA

By JOSEPH JUDGE
SENIOR ASSOCIATE EDITOR

Photographs by
JAMES L. STANFIELD
NATIONAL GEOGRAPHIC PHOTOGRAPHER

"YOU KNOW HOW IT IS there early in the morning in Havana with the bums still asleep against the walls? . . . Well, we came across the square from the dock to the Pearl of San Francisco Café. . . ."

Thus Hemingway begins his novel *To Have and Have Not*. As they say in Havana, Ernest, a lot of rain has fallen since then.

For the past 30 years we have had only the occasional look at the capital city of this Marxist island nation off the Florida coast. No matter—time has stood so still along Old Havana's narrow streets that Hemingway would be instantly at home; even Hernando de Soto might not feel lost.

Through neglect by both capitalist and communist, the Old City within the former walls has remained essentially unchanged for centuries, a collection of colonial buildings—palaces, churches, mansions, and humble dwellings—so extraordinary that UNESCO has classified it as a world heritage site.

More than 900 of the area's buildings are of historical importance; only 101 date from our own century. There are 463 from the last century, 200 from the 18th century, and, amazingly, 144 from the 16th and 17th centuries. The Old City is four hundred years deep.

In the past decade the Cuban government has been making earnest efforts to restore this patrimony; 68 buildings in the historic center have been completed. The results are often dazzling, offering spacious views of colonial life filled with sunlit patios, wide stairs, magnificent rooms, and beflowered balconies overlooking cobbled streets.

The Plaza de Armas, the zero milestone of Havana history, is still the loveliest place in town, shaded by royal palms, with open vistas past the Castillo de la Real Fuerza, oldest (begun 1558) of the four forts that guarded the glinting waters of one of the New World's best harbors. Atop La Fuerza's tower stands a bronze figure, La Giraldilla de La Habana, symbol of the city. Legend says she is Soto's wife, scanning the horizon for his return.

In her day Cuba was Spain, and America was Spain, and Havana's waters sheltered the caravels of explorers and conquistadores and, beginning in the 16th century, what they found—the silver and gold of Mexico and Peru packed aboard treasure fleets bound each summer for Spain. Here too came enemies, French pirates and Dutch men-of-war, and here lay the hulk of the exploded U.S.S. *Maine*—symbol of *norteamericano* interference in Cuban affairs—until 1912, when it was raised, dragged to sea, and sunk again.

On this bright day the most recent visitors, Soviet tankers and freighters, will parade through the narrow entrance, proceed to the huge docks of the inner harbor, and leave behind a grime that coats the harbor margin like a greasy bathtub ring, making it now one of the most polluted harbors in the world.

THE PLAZA serves as the front porch of the magnificent Palacio de los Capitanes Generales, its cool loggia shadowed behind nine great arches, its courtyard vivid with the splashing red of bougainvillea and a heroic marble Columbus, sternly refusing to believe he is anywhere but the East Indies.

Cuba was long ruled from the palace, including a stint by the American military. In more democratic days it became the city hall. After Fidel Castro's revolution ended the dictatorship of Fulgencio Batista in 1959, it was turned into the city museum—the hive from which the restoration is directed by Eusebio Leal Spengler, historian of Havana, friend of Fidel Castro, energizer, manipulator, doer of difficult deeds (opposite). The architects and craftsmen who work for him call it "trying not to fall down in front of the locomotive."

"History cannot be unmade," he told me. "We can only understand and justify the present by the past. We have an obligation to the past, especially when we are custodians of such a great survival as Old Havana."

The restoration plans stretch to the year 2000 and include major renovation of the most important buildings and at least a

face-lift for the others—all of which requires something always in short supply, money. The project has a budget of six million pesos ($7,800,000 U. S.) a year, twice what it was before 1986, and employs more than 800 people. Private individuals, commercial firms, and the governments of other countries have contributed. Major help comes from the Cuban military—a million pesos a year for work on the forts.

"We have captured the hearts of the people," Leal says, "by providing housing for doctors and old people."

The restored blocks, in fact, represent only a fraction of an ancient town that is in terrible decay, neglect, and decline. It was estimated ten years ago that of the 3,157 buildings within the perimeter of the old walls, only 500 or so were in good condition.

Even though the bums are gone, and many of the bars, cafés, and restaurants, the streets are lively with Latin life—what else, with 60,000 people (170 an acre) living there? The scene is animated by the passage of 1950s-vintage Chevrolets and Pontiacs. In its material culture Cuba is 90 miles away and 30 years ago.

The streets echo in the imagination with the boot tread of men like Soto, and Angel de Villafañe, who went to settle Carolina in 1561 and failed, and Pedro Menéndez de Avilés, who built a town named St. Augustine in the pine scrub of a land named Florida in 1565.

At the heart of the restoration plans are the Old City's five squares. Two are truly handsome European spaces in the Americas—the Plaza de Armas and the Plaza de la Catedral, fronted by the magnificent baroque facade of the former Jesuit church where the bones of Columbus, who "discovered" Cuba in 1492, are said to have been kept for a century. Plaza Vieja, the Old Square, is undergoing restoration. The other two, Plaza de San Francisco and Plaza del Cristo, are pretty much where history threw them.

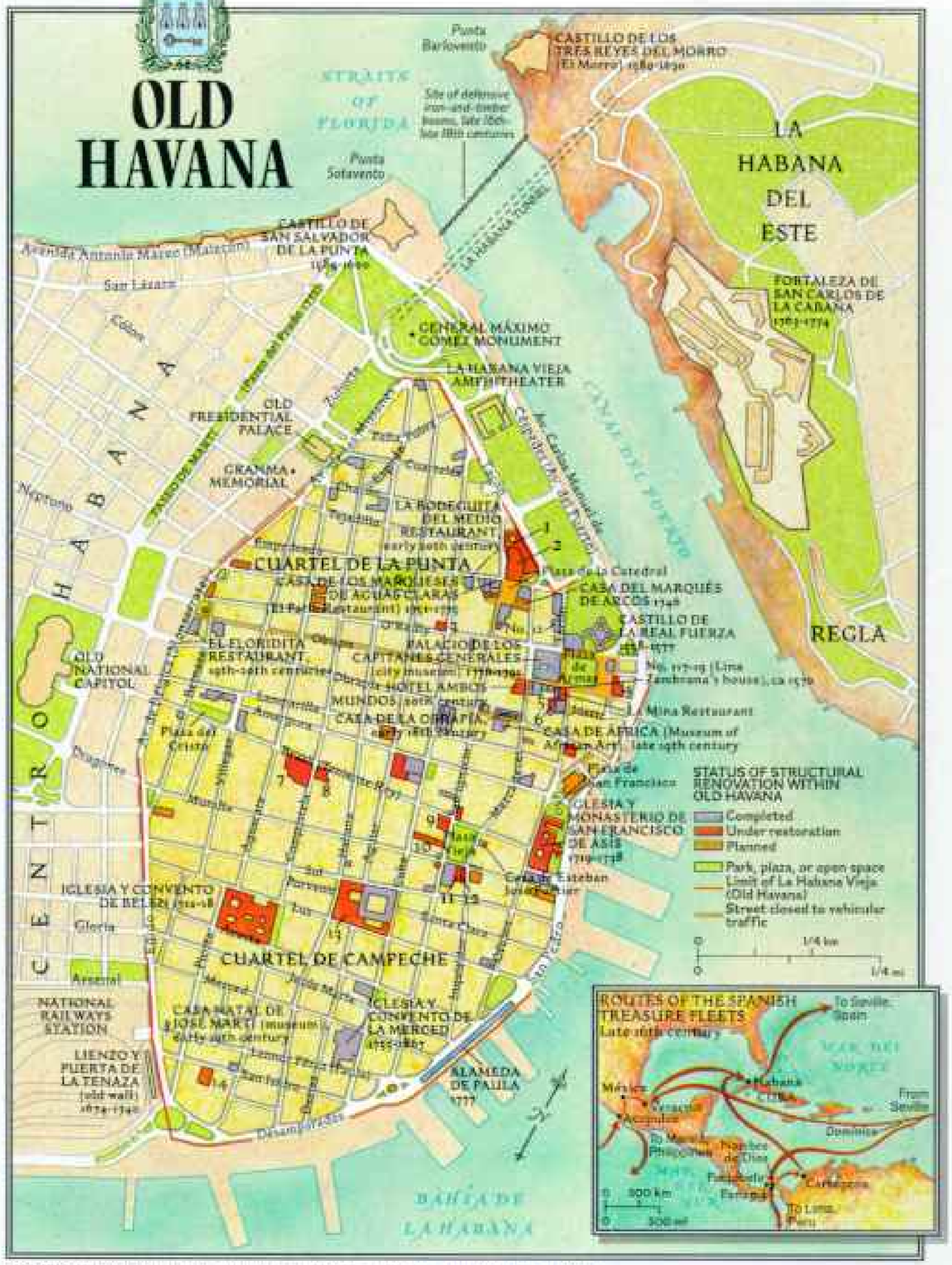
The Old Square is most revealing of the problems and possibilities. An underground parking lot from the Batista years is being gouged out of its center, not a hundred feet from two of Havana's oldest buildings. Nearby is the 18th-century house once lived in by the sisters Cárdenas, half-hidden in billowing dust from work in progress. From a marvelous old stone balcony next door hung washing and a banner reminding the party faithful of an upcoming "balance" meeting—a self-criticism session.

I visited the restored house of a colonial Cuban, Esteban *(Continued on page 290)*

MAN OF ACTION as well as words, city historian and popular TV personality Eusebio Leal Spengler briefs journalists as they cruise past the fortress of El Morro, begun by the Spanish in 1589. Leal directs a regiment of architects, historians, and craftsmen in an ambitious project to reclaim the old walled city and its fortifications.

"MUSIC TURNED TO STONE," uttered Cuban novelist Alejo Carpentier of the baroque facade of the Havana cathedral (above). Begun by the Jesuits in 1748, the cathedral reigns over a small square embraced by former noblemen's palaces.

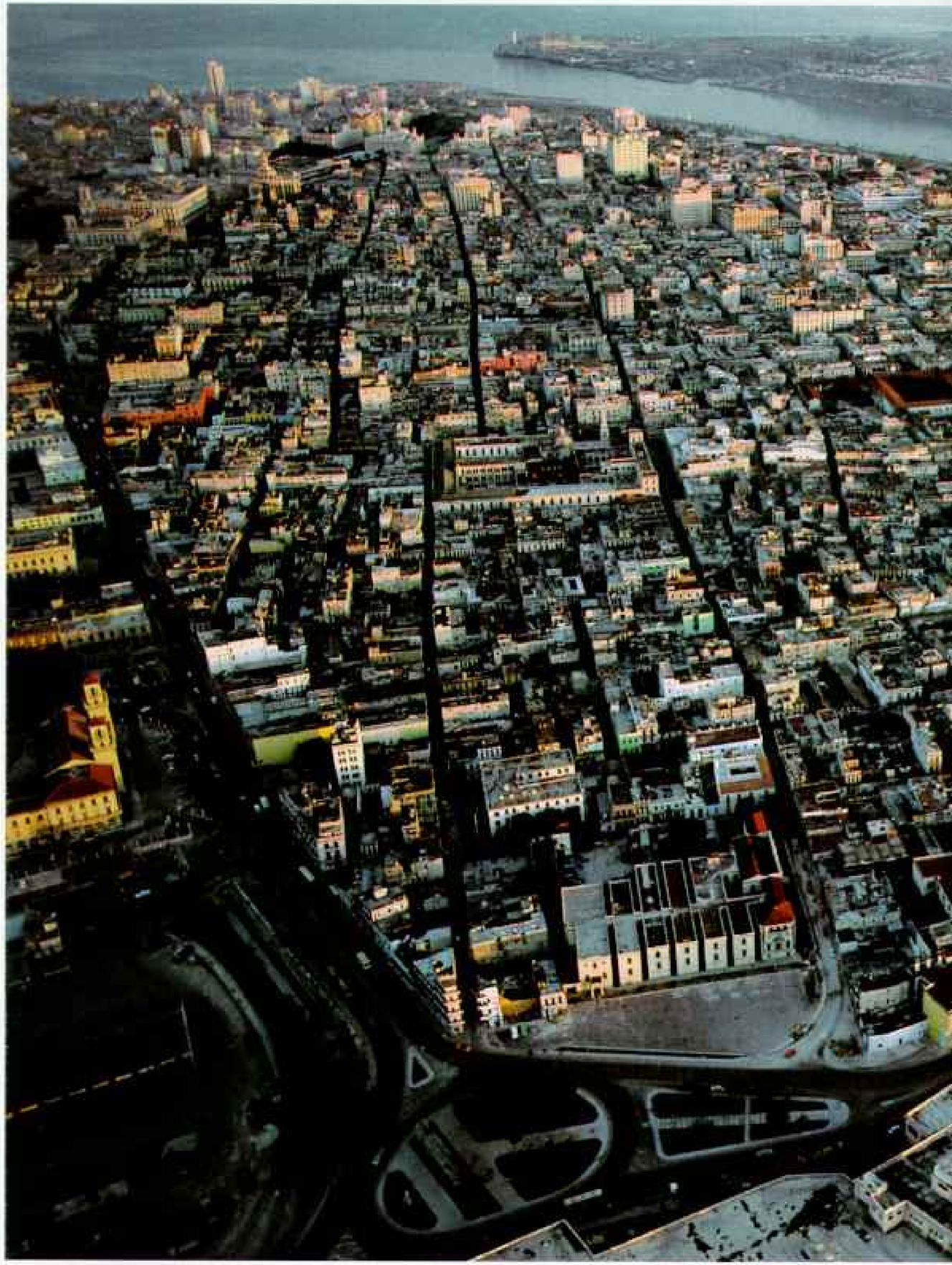
Once the site of religious festivals, the square, here enlarged by a panoramic camera, sways to the beat of Silvio Rodríguez and the AfroCuba jazz orchestra. Closed to traffic, a single stretch of Obispo Street spans 400 years of architecture (below). The colonial building in the middle—oldest house in Havana—with its low tiled roof and wooden balconies, recalls Moorish influence from southern Spain. Turrets on the adjacent tower also point to the Moors. To the left, stained glass graces neoclassical window designs, a signature of the Cuban style that flowered in the 19th century.



MGS CARTOGRAPHIC DIVISION RESEARCH: JUAN J. VALDÉS; PRODUCTION: VICTORIA A. McMULLEN, MARTIN J. GOLDEN; MAP EDITOR: JOHN T. WOOD; DESIGN AND PAINTING BY LISA ROSAZZA

STRUCTURES UNDER RESTORATION 1989–1990 (Dates indicate period of construction)

1. SEMINARIO DE SAN CARLOS Y SAN AMBROSIO, 1773, seminary
2. CATEDRAL DE LA HABANA (LA SANTA IGLESIA CATEDRAL DE SAN CRISTÓBAL), 1748-1787, cathedral
3. VIVIENDA, late 18th century, residence
4. CASA DE LOS CONDES DE SANTOVENIA, 18th century, residence
5. COLEGIO SAN FRANCISCO DE SALES, 17th century, school
6. CASA DEL OBISPO, 17th-18th centuries, bishop's residence
7. CONVENTO E IGLESIA DE SANTA TERESA, 1705, convent and church
8. DROGUERÍA SARRÁ, 19th century, drugstore
9. CASA DE LAS HERMANAS CÁRDENAS, 18th century, residence
10. CASA DEL CONDE DE LOMBILLO, 18th century, residence
11. CASA DE PEDRO ALEGRE, late 17th century, residence
12. CASA DEL HISTORIADOR JOSÉ MARTÍN FÉLIX DE ARRATE Y ACOSTA, 1687-1766, residence
13. IGLESIA Y CONVENTO DE SANTA CLARA DE ASÍS, 1638-1643, church and convent
14. HOSPICIO SAN ISIDRO, 1700, religious hospice



ONCE A STRONGHOLD for treasure collected from Mexico and Peru, Old Havana itself has become the prize. Narrow streets lead to plazas bordered by colonial mansions. Of some 900 historic structures that remain in the Old City's 350 acres (map), 344 were completed before 1800. Girded by walls begun in 1674, the town stood invincible until 1762, when the British briefly held it. Spain relinquished control of the colony in

1899, after the sinking of the battleship U.S.S. Maine just off the docks sparked the Spanish-American War.

Cane sugar, which attracted nearly a thousand ships a year in the early 19th century, still draws traffic—mostly freighters from East Germany and the Soviet Union, which unload consumer goods and oil. A modern threat to the port comes from ship bilge and nearby industries, which have left the harbor heavily polluted.

FRESH FLOWERS add passing beauty to a timeworn street in Old Havana, where 60,000 of the city's two million residents live. The area languished earlier in this century, even as Mafia-controlled casinos and brothels turned Havana into a notorious playground.

After Fidel Castro toppled the U. S.-supported Batista regime in 1959, land speculation and demolitions for high rises ceased, but the decay of existing structures continued; rural development, not urban restoration, was his top priority.

A HELPING HAND from a neighbor eases life for an elderly woman on Luz Street, who stayed when others moved out for the restoration. Those who remain endure leaking ceilings and overcrowding; extended families often share the same flat. Some couples buy privacy by the hour at state-run posadas.

(Continued from page 281) José Portier. It is an example and not a model of available units.

Eutimia Castillo Soria, a friend of Leal's, was living alone in the well-furnished living room with a dining alcove, where we sat at the table and drank good Cuban coffee, black and sweet.

"I'm lucky, to have a home and be retired," she said. "These days mothers drop their children off at a day-care center or at a free school and go to work. Everyone in Cuba is assigned to a work station, where lunch is provided for 50 centavos. That's what I did. I cooked for a work station near the cathedral. Rents in Havana are set at 10 percent of a person's income. For this I pay 13 pesos a month, but it should be only 11."

She showed me photographs of her family—a daughter and grandson. A handsome devil, he was dressed in a blue tuxedo for prom night of his high school in New Jersey.

"What would I do in New Jersey?" Eutimia asked herself, in the tone of one who has landed on her feet.

THE SOUTH END of the Old City, the Campeche quarter, was always the poorest and most crowded and presents today the most stubborn problems of restoration.

In this section is the restored but still humble house, a few rooms in two stories, in which Fidel Castro's hero, José Martí, was born in 1853. Poet, novelist, journalist, revolutionary, Martí thought of himself as a citizen of the Americas; his dream was of a unified Latin America that would be able to thwart 19th-century North American imperialism.

Martí served months in prison for his support of the 1868 uprising (fought in vain for independence from Spain, it was no trivial affair; an estimated 250,000 people were killed)—as did Fidel Castro in a later century. Exiled from Cuba, Martí refined his plans for a revolution—as did Fidel. In 1895 he landed with an armed force in Oriente Province—as did Fidel. But whereas Fidel lay in a sugarcane field and miraculously

escaped death from strafing planes, Martí was shot dead in a skirmish at Dos Ríos on May 19, 1895.

It is a short stroll from Martí's birthplace to the reason for Havana, the deep, flask-shaped harbor that opens out to the Straits of Florida. The waters beyond are a wide blue canvas on which history painted many a picture—treasure-laden fleets that numbered dozens of vessels and covered the altars of Spain in silver; returning ships with tattered sails that had seen new horizons and brought back strange Indian captives from a new continent; buccaneers of the French pirate Jacques de Sores, whose torches set aflame Havana and Soto's first fort in 1555; the massive power of the British men-of-war that took the city in 1762.

As the conduit of the wealth of a hemisphere, the harbor was one of the most fortified in the New World. La Fuerza was joined on the western bank by the Castillo de San Salvador de la Punta, completed in 1600. On the opposite point rose another fort (both were designed by an Italian engineer, Juan Bautista Antonelli) that would become the visual trademark of the city—Castillo de los Tres Reyes del Morro—and below that, on the hill east of the harbor, the huge Fortaleza de San Carlos de la Cabaña, which looms over passing ships.

I went up there one night with a small contingent of citizens led by Leal for the ceremonial discharge of the nine o'clock nightly cannon. Under restoration by the army (as all Cuban forts will be), La Cabaña shines with fresh paint and newly pointed brick and stone, but almost no outside lighting. We made our way in the dark to a gun position overlooking the harbor and all Havana beyond. A small unit dressed in 18th-century costume and led by fife and drum marched up and at the appointed hour lit the fuse to an old smoothbore piece and BAM! The single round of sound ripped into the night air and vanished, and not a single dog barked nor dove rose.

Havana at deep of dark resembles a campfire—it's a 40-watt town. The low lights smoldered in the mist, the little string of orange pearls of the Malecón, the boulevard that separates the city from the sea, marking out the seawall where young couples would be gathering, arm in arm, oblivious to the headlights of passing cars.

El Morro, an even more spectacular fort, is smaller, but it looks out over the blue straits. The architect in charge of the restoration, José "Pepe" Capelo, took me through the mahogany doors with huge brass bucklers into the compound, where the British had built a hospital and barracks after they succeeded in capturing El Morro.

"Strange to say," Pepe said, "while British occupation of Havana lasted only 11 months, they changed it forever with one act of policy; they dropped the trade restrictions, and when Havana came back to Spain in exchange for Florida, the local merchants and politicians lobbied against the old ways of privilege, and the island began to prosper."

From the battlements we looked out to the wide streaming currents off the coast where the great marlin run, where Hemingway in *Pilar* thundered out to wrestle with them.

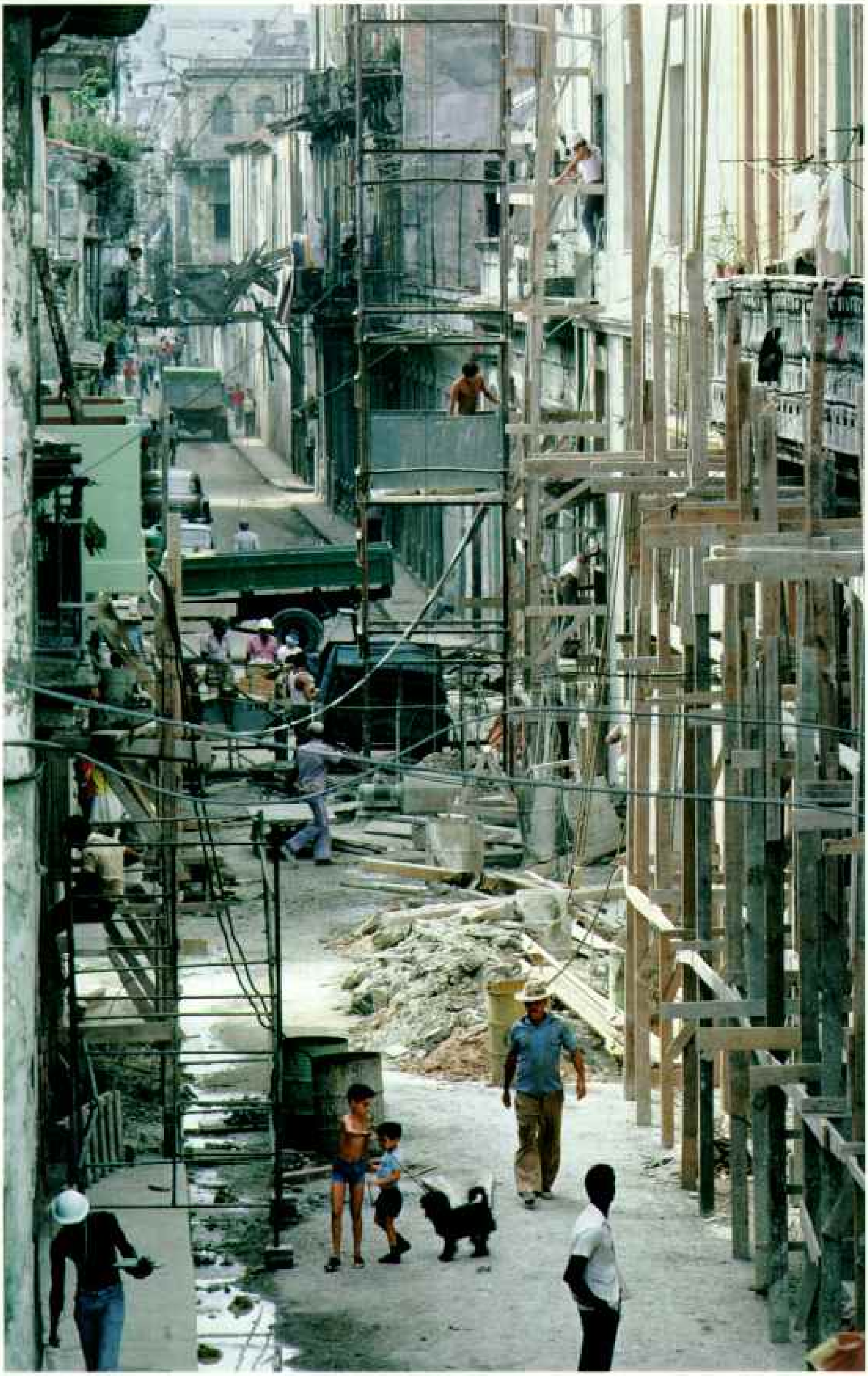
Hemingway first hunted marlin here in April 1932, aboard Joe Russell's boat *Anita* out of Key West. The men checked into the five-story, redbrick Ambos Mundos Hotel, an undistinguished 20th-century structure now being restored by Leal's team, next to the palace. Hemingway would do so many more times, as the hotel became a set for some of his best later years. In 1939 he moved in to work on a manuscript the world would know as *For Whom the Bell Tolls*. No wonder he thought of his fifth-floor room on the northeast corner as a good place to write. The Nobel laureate Gabriel García Márquez recalls it as "a gloomy room, 16 square meters, with a double bed made of ordinary wood, two night tables and a writing table with a chair."

After the revolution Ambos Mundos was taken over by the state to house the Ministry of Education's employees—all except Hemingway's room, which was untouched, including the old Spanish edition of *Don Quixote* he had left on one of the night tables.

Hemingway remains a cultural hero to the Cuban people, in part because of his belief in the necessity of revolution there. Fidel himself once remarked that he had devised tactics against Batista from reading Hemingway.

Nearby, in the oldest known house in the city, lives a lady, 80-year-old Lina Zambrana, who remembers Ernest.

Two orange canaries sent up a melodious cascade of song from their cages, and rain



BUILDING A FUTURE out of the past, workmen renovate structures along Luz Street (left). Interior work includes the removal of murals to the early 18th-century Casa de la Obrapía, where specialists led by Angel Bello Romero (below, at right) rescue the paintings from centuries of neglect.

In 1977, the year after Cuba named Old Havana a national monument, officials formalized a restoration plan. UNESCO offered assistance and declared the area a world heritage site in 1982. Today the project's annual budget of 7.8 million dollars supports more than 800 workers.

Castro has made tourism a top economic goal, and the restored Old City is proving a strong drawing card for visitors. Last year tourists, mostly Canadians, Mexicans, and Europeans, added significantly to Cuba's supply of hard currency. Visits by Americans are severely restricted under an embargo imposed by the U. S. in 1962.

So far workers have completed 68 structures; plans call for renovating at least a hundred more by the year 2000. With limited resources and such obstacles as a cumbersome electrical system (right), the project focuses on rescue of the most important historic structures, a mere fraction of the area's 3,157 buildings.

BEING RESTORED FROM THE GROUND UP, this palace discloses the colonial splendor hidden by centuries of decay. Once home to a conquistador's widow and later to orphaned girls, the building now houses La Mina, one of the few restaurants in Old

Havana. Folding louvered doors framed by imposing columns offer more than decoration; they block tropical rains and glare while admitting sea breezes. The arched fans of tinted glass send sunlight dancing about the rooms.

began to thunder on the roof and splash onto the patio below her second-floor door.

"He was always around," she said. "The first time I saw him, I asked him, 'Are you Hemingway?' He said, 'Sure, let's have a drink.' The Ambos Mundos in those years I remember for luxurious weddings in rose gardens and elegant employees."

Her house, or something like it on the site, was built in 1570 and appears on maps from that period. Against that long reign her own 50-year occupancy seems fleeting. Downstairs, embedded in the stone walls, are iron rings where slaves were once chained. Are those not chilling artifacts to live with?

"No," she smiled. "I am not afraid of the dead, only the living."

Her husband died when their son was two, so she became a domestic and later a travel agent. Then came the revolution, and she went to El Encanto department store to sell embroidery, but the store was burned down—"by counterrevolutionaries."

As I left, she said a simple good-bye: "To remember is to live again."

HEMINGWAY would surely have gone up the street for a drink, and his old haunts are today prime destinations (mostly for Canadians, Mexicans, and Europeans). La Bodeguita del Medio, a few steps from the cathedral, serves the best food in Old Havana in its three cramped rooms whose walls are covered with thousands of signatures.

The bar Papa preferred, El Floridita, also looks much as he left it, with its brown pillars and banquettes where Spencer Tracy and Marlene Dietrich once came to rest. It still serves, whether you ask for one or not, the rum drink made famous there by Constante Ribailagua, the daiquiri.

Honest Lil and the Worst Politician and other of Hemingway's real-life characters have been replaced by tourists who pay $20 in advance at their hotel for a dinner reservation, like the stout Brazilian doctor on an inexpensive vacation who could not resist accosting this American:

"Tell me, how can it be that in the early days, a lot of you Americans supported Castro and this poor old waiter here supported Batista? Politics!" he roared.

"Now," he went on, "economics! America, despite what you say, is a socialist country, and everyone in your socialist country has everything. Brazil is a capitalist country, and we haven't got a dime!"

A trio came to play—a violin, a guitar, and maracas. I asked them to play something from the past, like "Begin the Beguine."

"I have not played that in many, many years," said the violinist in halting English, then struck up the song.

"You remembered it well."

"For that, thank you."

I gave them a small tip in dollars.

"For that, God bless you."

"If you have dollars," roared my Brazilian friend, "you can buy the biggest hotel in Havana. That's communism!"

AROUND THE CORNER from La Bodeguita, near the end of Tacón Street, an 18th-century seawall has been found under the modern pavement with a row of cannon still emplaced. An unmistakable blue hue of doors and balconies marks the old residence, number 12, that houses Leal's archaeological unit under Leandro Romero.

"We call it Havana blue," Leandro said as he greeted me. "We find it everywhere under the old layers of paint."

The house had been owned by a scholar who had adorned an airy upstairs room with murals on each wall. Carefully revealed under 27 layers of paint, the charming naive scenes show noble life in the Havana of 200 years ago. In an estate setting, men are attired in knee-breeches and stockings, waistcoat and long coat, with their hair in a bun. The city's steeples rise in the distance. A proud horse romps under a proud rider. A shipowner with a long spyglass examines an arriving vessel, a beautifully detailed square-rigger of the 18th century. Some of the gentlemen in the painting are well-to-do mulattoes.

In the half century following 1521, when the conquest of Mexico was virtually complete, about 35,000 slaves arrived in the Indies at the rate of at least 500 a year. They were West Africans from what are now Senegal, Gambia, and Guinea; later they came from Nigeria and the Congo. By 1570, according to one estimate, of the 17,550 people in Cuba, 1,200 were European, an equal number were Indian, and the rest were black and mixed.

If ever a pot melted, it was Old Havana. Spanish and Indian—before their rapid extermination—produced mestizos; Spanish and black, mulattoes; and Indian and black, zambos. The laws posed no objection as long as both parties were Christian. Today in Cuba the term mestizo has come to refer to any ethnic mix, but mostly black and Spanish.

The casual and open life of a port city gave Havana a reputation for the high life of dancing under the palms, rum drinks and casino wheels, and the low life of prostitution and smuggling. Books like Graham Greene's *Our Man in Havana* reflect that tropical glamour, excitement, and melancholy.

In our time, Cuba's ethnic history gave Fidel an African card to play.

Fidel himself made a triumphant tour through Africa in 1977 and brought back a great number of zebra skins, chief's chairs, and other ceremonial gifts. The embassies of the 17 African countries represented in Cuba contributed more, and this collection is now housed in the Casa de África, a museum of African art, in a splendidly restored Spanish colonial building on Obrapía Street.

The museum's director, Claudia Mola Fernández, had visited Benin and Nigeria, perhaps the home of her ancestors, where she had a confusing experience.

"I met with traditional chiefs, saw ceremonies in each region, was shown everything. They knew everything I wanted to see. They said they knew I was looking for my roots."

"Like Alex Haley," I ventured.

"Who?"

"You know—*Roots?*"

"I'm sorry, I don't."

I was led through the museum by curator Raisa Fornaguera, who paused only momentarily at a painting at the entrance depicting a blood-dripping skeleton wrapped in an American flag. On the third floor is a fabulous collection of paraphernalia used in the rituals of the African religions that came with the slaves and never died.

"It is known in Cuba as *santería*, or saint worship," Raisa told me. "In Haiti, as voodoo, after the Fon word for "spirit," *vodun*. It reflects the native religions of people like the Yoruba of Nigeria but has a lot of Roman Catholic liturgy and sacramentals."

Catholic figures like Sts. Barbara and Lazarus—even Our Lady of Charity—are avatars of the Yoruban *orishas*, or divine beings of African animism. The central ritual of santería is possession by such divinity under the influence of the pounding drums and ecstatic dancing.

Statues of four of the leading divinities in the Yoruban pantheon—Elegguá, Changó, Yemaya, and Ochún—have been set up in the museum, surrounded by objects associated with them. Many of the things in the museum are handsome, like the dancing costumes of the Abakuá. Others seem brutish, such as the *otanes*, stones in which the orishas reside. They fill an iron pot swathed in chains, along with offerings of animal horns and daggers and iron spikes, a white crucifix.

"In the rituals, animals are killed—goats and pigs. Pigeons and ducks. For Elegguá a rooster or a white chicken. . . ."

Does this really go on in Cuba today?

SAMPLING HER HANDIWORK, Hilda Hernández takes a puff on a cigar as she sorts leaves in the Miguel Fernández Roig factory. Rules permit unlimited smoking on the job, one cigar for take-home. Hand-rolled Havanas, considered by many the world's best, remain an important export.

POWDERED with bread flour, Estanislao Pita (above, at left) and Ramón Pérez Llama unload sacks at Almacenes Latinoamericanos. To ease traffic in Old Havana, several industrial warehouses, or almacenes, were moved out and bus lines rerouted. Printing houses and government offices have proliferated. Sandwiched between remaining warehouses, auto shops use ingenuity and dent filler to maintain classics like this 1951 Chevy, ubiquitous relics of prerevolutionary days.

"Many believe. Not nearly so few as you might think."

It has been said that if you scratch a Cuban Catholic, you find a santería believer. The huge edifices that occupy grand spaces in the Old City display a vaunted power that has receded—the huge Convento de Santa Clara de Asís, begun in 1638; the fortress-like Convento de Belén, which housed a Jesuit school, the successor to which moved uptown and educated young Fidel Castro (who later found the church on the wrong side of his revolution); and the cathedral itself.

On the Plaza de la Catedral are a restaurant, El Patio, and an atelier, selling modern artworks to the casual tourist. I remarked to artist Rafael Paneca that I found the works a relief from the incessant propagandistic realism of the socialist world.

"Lenin once was asked if he liked Gorky, modern art and writing," he said. "He replied that he liked Pushkin, traditional art—but Gorky was not stopped from writing."

"So Cuba's policy is more like Lenin's and less like Stalin's?"

"Let me tell you the situation. After the revolution Fidel called the artists and writers and intellectuals together and told them to keep on, do what you want, as long as it does not result in counterrevolutionary activity. They agreed. Last year he called them again to thank them for keeping their word."

The cathedral's interior conveys a certain feeling of emptiness; the bones revered as those of Columbus are gone (taken to Spain after the Spanish-American War), and the once flourishing parish life seems to have declined. A few dogs, their tongues wagging from the heat, cooled their bellies under the pews. Near the altar I met a man still devout.

He said there were too few priests to go around. At many churches one cannot attend daily Mass.

I asked him if the church was not dying.

"No, not dying, but in crisis, as always," he said.

"The church has existed before in Marxist states."

"We are willing to live within the political system. We have asked to join. But until recently they did not want us."

"Can a person be a good Catholic and a good socialist?"

"Of course. What was Jesus? The Sandinistas have taken the lead away from Fidel. Nuns and priests are being martyred in Latin America. They are as dead as Che Guevara, and for the same reasons."

Recently Pope John Paul II accepted an invitation to visit Cuba, and I heard they were shooing the dogs out of the church.

THE FORMIDABLE TASK faced by the restoration crew is as much social as architectural, for the spaces of the Old City are crammed with people long in residence. In the foyer of the once grand house of the Marqués de Arcos, built in 1746, I found what looked like a large

packing crate with a wooden door. As soon as the door opened, the smell of coffee rising from a portable heating coil greeted me.

So did pandemonium. It was moving day, I learned, for Lourdes Torres and her family—five people who had lived in the crate, subdivided by cardboard walls, for years.

The family belongings had been packed into boxes; one truck would convey it all to a new apartment near the airport, a long way away but larger and better and near her husband's workplace. Fortunately he was a truck driver for a fruit distributor.

Lourdes said that 40 families had lived in the building soon to be restored, but 32 were already gone. I wondered how 40 families could have fitted into the place, despite the best crate engineering.

"In some places, there are 90," she said. She was happy to be going.

I climbed the wide marble stairs to the two-room home of gentle 74-year-old Escolástica Ramos, who had been defending herself from the torrential rains that had come through the roof and washed under the doors from the second-floor veranda.

"I stand in the corner and wait for the rain to stop," she told me. "I put the girls on the bed." The girls, three in number, were her son's daughters.

Escolástica left her home in rural Matanzas to work as a maid in a big house in Havana where lived the heirs to the H. Upmann cigar fortune. She stayed for 28 years. With the revolution her employers went to California.

The man she married lived here, in the subdivided house of the marquess, for 56 years, first in "that shell downstairs" and later in the three upper rooms, where she had now lived for 40 years.

A friend had come to visit, Mercedes Cuzco, and the two women sat in the damp and exchanged a muted gossip.

"All Havana cannot be a museum," said Mercedes, "a well-decorated store." Escolástica arranged herself so as not to see the holes in the roof.

As I took my leave, I looked over the balustrade into the former grand patio, where a tin-roofed shack stood. Well, as Hemingway might have said, what good was it with only a marquess to look at it. □

FRIENDSHIP FOUND in a familiar face, Iván Pimentel and playmate Sheila Ponce share a stairway at No. 609 Aguiar Street against a backdrop of 19th-century azulejos, glazed tiles. With many challenges yet to meet, restoration holds promise that Old Havana may again reach full flower.

Car and Driver Magazine puts Mazda MPV at the top of the category for 1989.

The verdict was overwhelming. *Car and Driver* editors rated Mazda MPV and its competitors in ten separate categories—and MPV claimed victory by winning nearly every one.

Pitted against competitors including Dodge Caravan and Ford Aerostar, Mazda MPV was rated number one in eight out of ten categories including handling, ride, styling, comfort and value.

In selecting MPV, *Car and Driver* stated: "Winner, winner, winner...phenomenally good road dynamics...a *most* carlike feel...great layout ...delivers more fun per mile than we thought possible from a utility-minded vehicle."

And now MPV will offer a whole new choice in four-wheel-drive versatility with the introduction of MPV 4WD. It's designed to combine all-weather four-wheel-drive capabilities with the exceptional performance, room, and comfort that has put MPV in a class by itself.

Mazda MPV. The reviews are in and the consensus is clear: it is the "'Best in Class' with the emphasis on class."

Right before our eyes

THE NATIONAL GEOGRAPHIC SOCIETY

Katharine Payne records the sounds of elephants in Namibia's Etosha Park. PHOTOGRAPH BY HOLLY PAYNE

HOW MANY MILLIONS OF US have spent time watching elephants amble about at a zoo? How many millions—and how many noticed what Katy Payne noticed?

She was visiting the Metro Washington Park Zoo in Portland, Oregon, in 1984, taking a break from researching the songs of whales. As she was quietly observing Asian elephants, she sensed a throbbing in the air like that from thunder. It was barely perceptible, but tantalizing enough to lead her and colleagues to a remarkable conclusion: Elephants talk to one another in a range of sound below that of human hearing (page 264).

How did Katy manage to pick up on what the rest of us had missed when it was there all the time?

"All my work follows from the sort of observations that children make every day," she says. "Children are such wonderful observers. But as you get older, your expectations fill your mind, and then you stop trusting what you see. The fun I've had has been to trust what I see or hear and give it another chance."

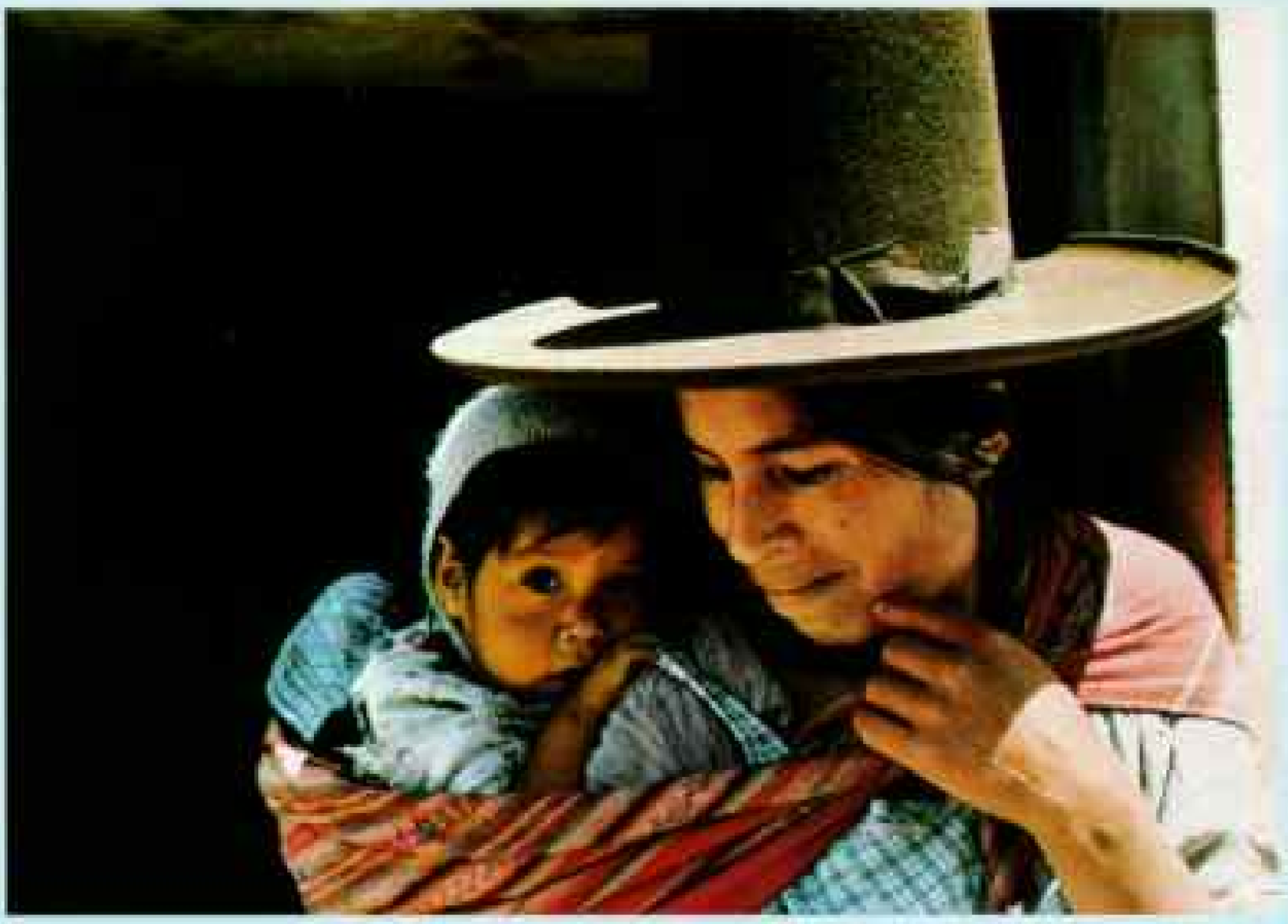
Childlike powers of concentration survive within us, she insists. To discover amazing things, all we need do is look and listen to what's around us. Her grandfather knew this well. A renowned painter of birds and mammals, Louis Agassiz Fuertes had a perfect eye for detail. His work enlivened our magazine from 1913 to 1920.

Katy's children knew it, too, during their years in Patagonia, where Katy and her then husband, Roger Payne, were studying the behavior of right whales. A photograph in our March 1976 issue shows the Payne youngsters—John, Holly, Laura, and Sam—gazing out into Argentina's Golfo San José, binoculars in hand.

"Our children made some important observations in those days," Katy recalls. "Once Holly said, 'Daddy, there are orcas!' Well, we hardly ever saw killer whales in that bay. 'They're probably dolphins,' we told her. But when we looked at the horizon, it could only be orcas. We just hadn't noticed them." Now in their mid-20s, the children still share an enthusiasm for the natural world, three as professional conservationists.

"Open your eyes," says Katy Payne. We could do worse than follow her example. It's all too easy in our complicated world, as each day grows more crowded with demands, to lose sight of what's important—even when it's right before our eyes.

Gilbert M. Grosvenor



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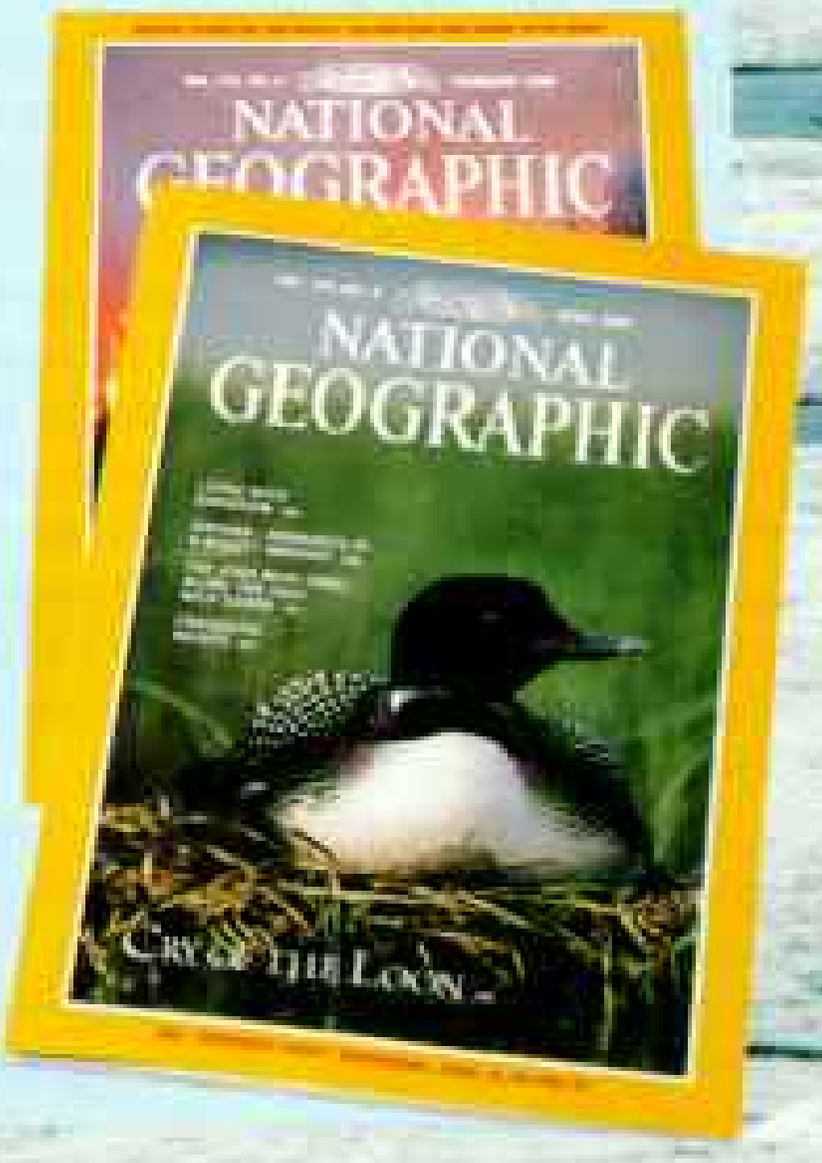

Members Forum

Radiation

I've been involved in teaching radiation safety at our medical school for 15 years and felt Charles Cobb did a splendid job covering the technical and real-life aspects (April 1989). Karen Kasmauski's photographs also brought forth a personal side to a very technical issue.

DEAN W. BROGA
Virginia Commonwealth University, Richmond

Nuclear power is a nonsensical way of converting water into steam. The alleged benefits are miniscule when compared with the risks. We must abandon nuclear technology and commit ourselves to devising ways to satisfy our human needs without compromising all existence in the process.

HARRIETT FELS
Montreal, Quebec

Thousands of Navy personnel have spent hundreds of man-years submerged beneath the oceans in symbiotic relationship with nuclear power plants. Their lives depend upon, and no one has been harmed by, these compact seagoing reactors.

DUDLEY G. MILLER
Schenectady, New York

The French respond to a potential nuclear accident by building a 3.5-million-dollar medical-aid railcar, capable of traversing Europe in 24 hours, while the U. S. and Canada merely pass laws disclaiming responsibility for cases involving national policy.

R. WEATHERILL
Winnipeg, Manitoba

One of the greatest benefits of radiation is detecting flaws in virtually every critical product manufactured today. Nondestructive radiographic testing identifies imperfections in components of jet engines, space vehicles, pipelines, ships, bridges, etc. That use has saved countless lives through the prevention of accidents and catastrophic failures.

CHARLES J. HELLIER
Niantic, Connecticut

You greatly overstated by saying "at the Idaho National Engineering Laboratory, radioactive waste has fouled the Snake River aquifer."

During the early decades of operation the INEL did put waste cooling water containing low levels of radionuclides into a waste-water injection well, a practice discontinued years ago. Most of the contamination was short-lived tritium, most of which has decayed away. None exceeds drinking water standards now, and none is detectable beyond the site boundaries.

PHILIP A. ANDERSON
Idaho Academy of Science
Boise, Idaho

Pending more detailed sampling, the Department of Energy ranks tritium in the aquifer at INEL as a potential environmental and public-health hazard.

The statement that "once inside today's energy-efficient houses [radon] does not escape" implies that energy-efficient houses are part of the problem. There is documented research indicating no correlation between house tightness and radon problems. As the Swedes decided—and they've dealt with this problem far longer than anyone else—the best way to treat the radon problem is to build tight, energy-efficient homes and install controlled ventilation systems.

STEVE ANDREWS
Denver, Colorado

You might mention the very successful nuclear facilities in Canada, where a major portion of our electrical needs are met through nuclear energy. Pickering in Toronto is one of the oldest, largest continuously operated nuclear plants in the world. Bruce, a second facility nearby, incorporates a heavy-water distillation plant and a huge experimental hydroponic complex (we dream of oranges and bananas in Ontario). Overall safety must conform to the superclean demands of our very active and powerful environmentalists.

JOSEPH N. SCHAUENBERG
Jarvis, Ontario

John Muir Trail

Galen Rowell's unsubtle criticism of the National Park Service wilderness access policy, compared with that of the Forest Service, doesn't square with his passionate lament about the evils of excessive tourism in such places as Nepal and the Himalaya (November 1988). As a world-famous mountaineer, Rowell knows very well about the long, bitter controversy between those who want unrestricted access for everybody and those who want wild areas reserved for the strong, determined, and skilled who can get there without a horse, vehicle, or other mechanical contraption. The choice should depend upon the circumstances of the individual site.

J. R. BRUMAN
Sherman Oaks, California

I submit that the first purpose of the national parks is to be used as widely and by as many people as possible. As with books, wear is inevitable but is proper and to be expected. Only the very rare and unique should be limited in access. For the rest, maintain by all means, but use, use, use. National Park Service action in needlessly excluding the public is a scandal.

JOSEPH J. DEVANEY
Los Alamos, New Mexico

We must face the fact that as population pressures increase, we cannot indulge in a laissez-faire philosophy *and* preserve our national environmental heritage. It is clear that pack animals in our wilderness ought to be severely regulated. And if we *must* have them, they should be kept apart from those who use their feet to experience the wilderness.

M. K. BRUSSEL
Urbana, Illinois

When Galen Rowell describes climbing to the top of the peak and placing a pile of stones on the summit, I can't help think that he has taken the opportunity to show his own self-importance and destroyed another's opportunity to feel the same "untouched by man" sensation.

K. MCNISH
Edinburgh, Scotland

The first climber to reach a summit traditionally leaves a cairn or other record.

The photograph on page 477 shows more than a beautiful moonrise. It shows a rarely recognized phenomenon: the earth's shadow. The dark blue band at center occurs directly opposite the sun, like the full moon in the picture, and is best seen when the sky is very clear.

DOUGLAS DUNCAN
The Space Telescope
Science Institute,
Baltimore, Maryland

Loons

The loon's cry is a symbol of peace and tranquility for millions of people, and they don't even know it. When producing sound for a wilderness night for TV, radio, or film, if it's ominous, in goes the owl; if it's peaceful, romantic, tranquil, in goes the loon. When Shirley MacLaine was camping in the Andes in her TV special, you heard the loons (even if real loons seldom get within 2,000 miles of Peru) to let us know all was right with the world. If we lose the loons in nature and have only digitally reproduced ones left, all is certainly *not* right with the world.

LEON MARTELL
Los Angeles, California

National Geographic, August 1989

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Loons may be nesting in Iowa again. For years we never saw any here on the lake, but last summer my wife and I saw a pair and their offspring frequently in a state park near our home. One possible reason: The quality of water is better now that a sanitary sewer system serves most homes.

JOHN E. VAN DER LINDEN
Spirit Lake, Iowa

In Alaska, where I have worked as a wildlife research biologist since 1972, I have witnessed the predation of common loon chicks by bald eagles, eliminating the productivity of three nesting pairs on Coyote Lake in the Kenai Peninsula for several years. The message is that we often inject our priorities for species into natural systems without knowing the impact. The loon predation problem may be compounded by persons feeding bald eagles with good intent but adding pressure on loons.

DR. ALBERT W. FRANZMANN
Soldotna, Alaska

The common loon is now firmly etched in the minds of Canadians—it is carried on the reverse side of the new 11-sided, bronze-coated dollar, which is commonly referred to as the loony.

ELIZABETH PREITZ
Edmonton, Alberta

Cartagena

Cartagena continues to play a very important

role as an oasis of hope and tranquillity for Colombia and a window of romance for the world.

ALBERTO CÓRDOBA-SALAZAR
Hyattsville, Maryland

Kronan

Your article by Franzén, Curtsinger, and Berkey on the Swedish warship was highly informative and shows some excellent work in marine archaeology. Nearly 400 artifacts are currently on display from *Kronan* here at the Vancouver Maritime Museum (until September 4). Your article plus the visual display makes me feel like taking a trip to Sweden to see the rest of this historic ship.

L. R. SOLKOSKI
Vancouver, British Columbia

John Berkey's painting vividly described one of the sailors' nightmares: trapped below in the phantasmagoria of a capsize, the light with its glimmer of hope streaming through the upside ports.

RUSSELL SANTORA
Guilford, Connecticut

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AUGUST 1989

GEOGRAPHICA

NATIONAL GEOGRAPHIC MAGAZINE

JAMIE BLANKENSHIP, THE GLOBE FILE

"Time Capsule" Floats from the Pole to Ireland

When Will Steger and his party reached the North Pole by dogsled in May 1986 (NATIONAL GEOGRAPHIC, September 1986), they placed a "time capsule" on the ice for the currents of the polar sea to carry away. It was a sealed piece of plastic tubing more than a foot long filled with mementos of their trip, including a Jim Brandenburg photograph of the team. "I really never thought we'd see it again," Steger says.

Last February 5, Peadar Gallagher (above), a 62-year-old carpenter who lives in County Donegal on Ireland's northwest coast, in an area called Bloody Foreland, was walking on the seaside rocks by his home when he spotted a plastic cylinder. "I tried to open it, but I couldn't, and I saw water dripping out," he recalls. "I took it home, pried it open, poured the water out, and things began to emerge."

Gallagher had never heard of the Steger expedition, but a photograph in the cylinder bore the name of the National Geographic Society. He wrote to the Society, asking help in explaining his find, and that is how Steger and his party learned what had happened to their time capsule.

Steger was surprised that the cylinder had floated some 2,400 miles to Ireland; he had thought that if it turned up anywhere, it would be Iceland. Gallagher returned the cylinder and its contents and received a $5,000 reward from Du Pont, an expedition sponsor.

EPA's Wetlands Goal: No Net Loss

The nation's wetlands—those bogs, swamps, marshes, prairie potholes, and riverine forests that nurture wildlife, offer protection from flooding and erosion, and produce organic material to support the food chain—have long been disappearing. Half of the lower 48 states' 200 million acres of wetlands have vanished as these precious areas were drained, excavated, and converted to agricultural or urban use. Each year 300,000 to 450,000 acres are lost.

Now the U. S. Environmental Protection Agency has adopted a plan to fight the decline. If its central goal is met, any newly converted wetlands must be offset by the creation or restoration of wetlands elsewhere.

The plan was EPA's response to a report of the National Wetlands Policy Forum, a 20-member group of state and local officials, environmental and business leaders, farmers, ranchers, and academic experts organized by the Conservation Foundation, an environmental group affiliated with World Wildlife Fund. The report listed numerous proposals for action by government and private groups, all based on the no-net-loss goal.

An EPA official says the plan calls for no new funds and is "a short-term response to get something started."

Nine Men's Morris in a Manhattan Cellar

By his own admission Donald DeFillo plays "a lot of somewhat obsolete games." So when DeFillo (below), supervisor of historic house restoration for the New York City Parks and Recreation Department, walked into the cellar of the city-owned Dyckman House at 204th Street and Broadway, he had no trouble identifying a pattern of lines that someone once carved into a rock outcropping there.

"I recognized it as a game board for nine men's morris," DeFillo said.

Nine men's morris, a checkers-like game, has been played for at least a thousand years and takes its name from the number of pieces, or "men," each player has.

The game had a brief moment in the literary sun: In *A Midsummer Night's Dream*, Titania tells Oberon that because they fought, nature wept, and

JOE MCNALLY

"the nine men's morris [board] is filled up with mud."

The house at 204th Street was built after the Revolution by William Dyckman, a prosperous farmer whose grandfather emigrated from Germany more than a century earlier. The rock outcropping on which the game board was carved is beneath the stairs, suggesting that it was there before the staircase. DeFillo is trying to find out when and how the board got there.

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1929 ROLLS-ROYCE PHANTOM I CABRIOLET DE VILLE

COURTESY SOTHEBY'S

A Treasure of a Map Barely Evades Auction

It is the only surviving map of its size from the late 13th century: a sheet of vellum 64 by 54 inches that depicts the world, real and mythical, as known or conceived by an English mapmaker. And it barely escaped being sold at auction.

Drawn by Richard of Haldingham and Lafford, a cleric at Hereford Cathedral, the "Mappa Mundi" (World Map) has hung there for 700 years. The cathedral desperately needs to raise seven million pounds (about 11 million dollars) to pay off debts, build a new library, and maintain existing properties. So the cathedral and Sotheby's tried to persuade the British government to acquire the map as a national treasure and let it remain in Hereford. When they had no success, Sotheby's announced plans to auction the map.

The plans caused a furor. The Royal Geographical Society's curator of maps called the Hereford map "a work of art from an age before anyone distinguished between art and science" and said the cathedral is "where it belongs and where it should stay." The uproar led to a number of new proposals to solve the cathedral's financial woes, including one from the National Heritage Memorial Fund. Delighted cathedral officials said they would study the proposals, proclaiming that "an ultimately satisfactory solution" would be reached, and canceled auction plans.

The Growing U. S.—Expanding the Limits

As one of his last official acts President Reagan extended U. S. territorial waters from three to twelve nautical miles from the coast. The three-mile limit had been in effect since 1793.

The United States is the 105th nation to adopt the 12-mile limit, a standard set by the United Nations Convention on the Law of the Sea. Reagan said the new limit "will advance the national security and other significant interests of the United States." A State Department official explained that it would keep "Soviet spy ships" farther off the U. S. coast. Ships that threaten national security are prohibited inside the 12-mile limit, but all other foreign vessels are allowed "the right of innocent passage" through such waters. So are aircraft flying over the area.

Wild Chimps' Status to Be Ruled Endangered

The U. S. Fish and Wildlife Service has proposed reclassifying wild chimpanzees from "threatened" to "endangered," a more protected category. Captive chimps, however, would remain under threatened status.

The Humane Society of the United States, the World Wildlife Fund, and the Jane Goodall Institute had asked that all chimps be reclassified as endangered, which would limit international traffic in chimpanzees.

A report compiled by Geza Teleki of the Committee for the Conservation and Care of Chimpanzees said the number of wild chimps in Africa has drastically declined, in part because they have been captured and sold for use in experiments. Teleki said his group was not "intrinsically opposed" to research on chimpanzees under humane conditions but feared wild animals would be sold through third countries and then imported into the United States.

Jane Goodall, whose research on chimp behavior has been chronicled in the GEOGRAPHIC since 1963, said she was "extremely pleased" by the action regarding wild chimps. "I think it will have a strong impact in some countries," she predicted.

The National Institutes of Health opposed reclassification, saying it would be premature without a survey proving a decline in wild chimp numbers. Dr. George Galasso of NIH said there are about 320 in U. S. zoos and some 1,300 in research facilities. "We have established a breeding program to meet the needs of biomedical research," he said. "We haven't imported chimps from the wild since the mid-seventies."

ROBERT MADDEN, PHOTOGRAPHERS

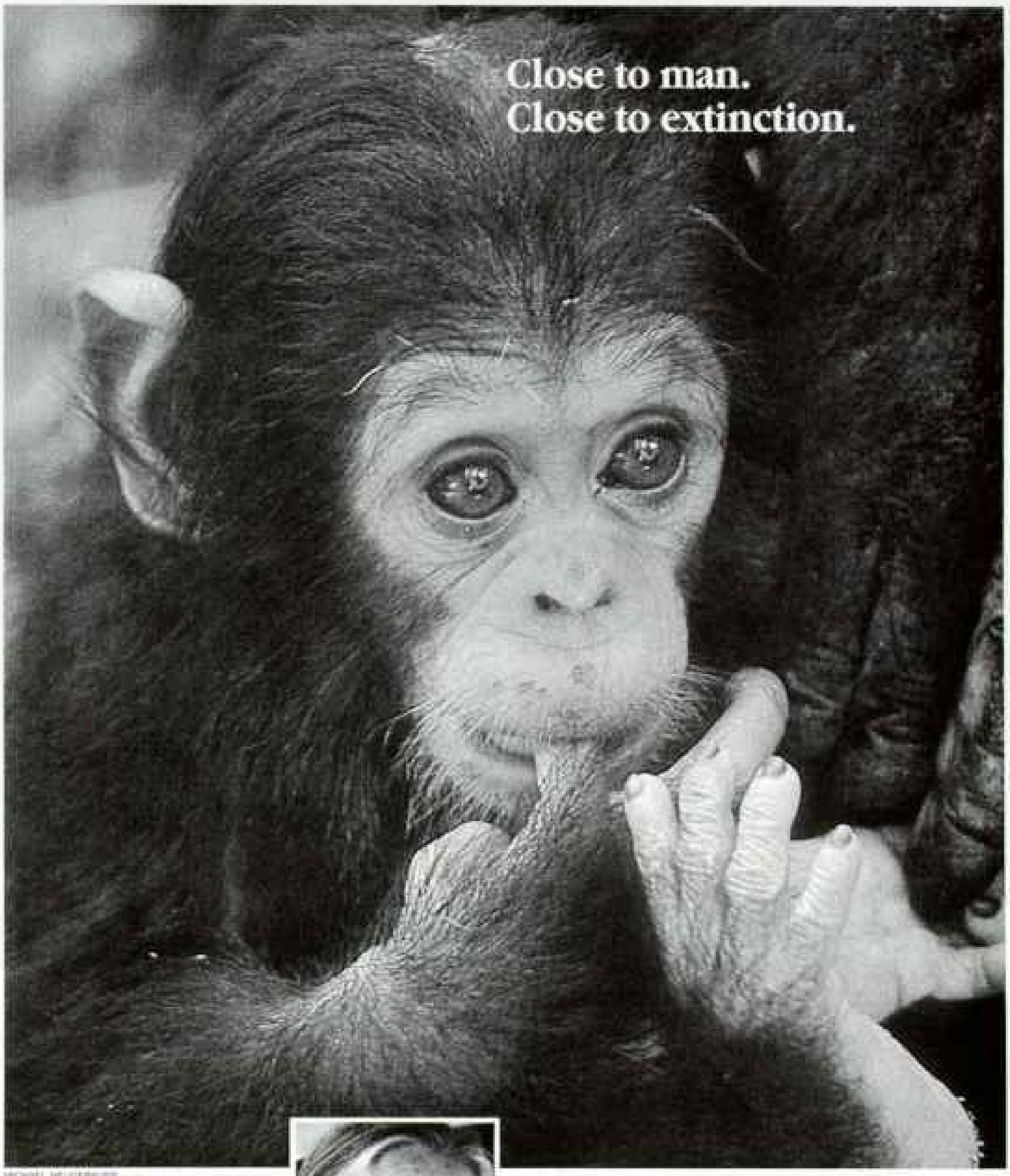
Hyacinth Macaw **Genus:** *Anodorhynchus* **Species:** *hyacinthinus*
Adult size: Length, 93-100cm (including tail, 55cm) **Adult weight:** Approx. 1.5kg
Habitat: Marshlands, forests and palm groves in Brazil and eastern border areas of Bolivia
Surviving number: Estimated at 2,500—5,000 Photographed by Luiz Claudio Marigo

Wildlife as Canon sees it

Majestic with their cobalt blue plumage, a pair of hyacinth macaws inspect a tree cavity for a possible nest site. Largest of all parrots, these macaws frequent palm groves to feed on palm nuts, their main food source. Sturdy legs and feet anchor the macaw while it hangs sideways or upside down in attempts to reach nuts with its powerful bill. As they fly, the colorful birds emit loud piercing cries, while their long tails stream gracefully behind them. In addition to a dwindling habitat, hyacinth macaws and other parrots are threatened by a continued demand in the pet trade. Over 200,000 South American parrots are exported annually, and tens of thousands more are smuggled out illegally, many dying in transit.

To save endangered species, it is vital to protect their habitats. Understanding the fragile balance of the earth's ecosystem holds the promise for the future. Photography, both as a scientific research tool and as a means of recording the world around us, can help promote a greater awareness and understanding of the hyacinth macaw and how it lives within its natural environment.

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



MICHAEL NICHOLS/NGP

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NATIONAL GEOGRAPHIC MAGAZINE

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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 3,700 explorations and research projects, adding to knowledge of earth, sea, and sky.

TO MY EYE as a first-time visitor, Cuba had a Rip Van Winkle quality—as if the entire country has been in hibernation. Cars pampered as antiques elsewhere move arthritically through streets that seem sets for a 1950s movie. Like fading dowagers, the old Chevys and Fords wear too many layers of paint poorly applied. Conversely, most of Havana needs a coat of paint.

The obvious poverty dulls the inherent charm of this time warp, with one elegant exception. The heart of the once walled city of Old Havana, founded in 1519, is being meticulously restored. In 1982 UNESCO named it a world heritage site. As a living museum, it will be Cuba's showcase for the celebration of the 500th anniversary of Columbus's arrival.

On my last night in Cuba I met Fidel Castro. His dogmatic Marxism, a stagnant sugar market, and the U. S. political and economic embargo keep Cuba strapped and dependent on Soviet aid, estimated at 15 million dollars a day. Except for his finely tailored military fatigues, Fidel was anything but nostalgic and seemed unfazed by the materialistic failure of the revolution. He exuded enthusiasm and curiosity. Even the costly restoration of prerevolution Havana enjoys his full support. For the first hour he asked as many questions as he answered. On Third World and social issues he's encyclopedic.

He's justly proud of Cuba's public-health services—especially their success in lowering the infant mortality rate, now among the lowest in the Americas. He spoke for an hour on the medical program, then jokingly blamed me for getting him started by asking a question on the subject.

Had it been hard to give up smoking cigars—with tobacco a major Cuban export?

"It was easy," Castro replied. "Smoking's not good for the people. It was a contribution I could make to public health. But the campaign against smoking hasn't been good for us economically."

We discussed the recent sighting of an ivory-billed woodpecker in Cuba—long thought to be extinct. Castro told me with a twinkle, "He's been a headache. I had to move a whole new highway so we wouldn't bother him."

Our meeting lasted a very fast three and a half hours. I left at 12:30 a.m., exhausted. Castro, still buoyant, seemed ready to tear into a night's work. Though accepted as a friend throughout the week's visit, I was reminded at a commemorative exhibit of the Cuban revolution that, officially, the U. S. remains the enemy. A guide lecturing young soldiers described Americans as Yankee imperialist dogs. Seeing I had heard, she seemed embarrassed.

Wilbur E. Garrett

EDITOR

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On Assignment

WHEN BRIAN LANKER set aside duties as contributing photographer for *Sports Illustrated* and *Life* to pursue his own dream of recording the achievements of black women, he could not foresee that he would become close friends with many of them.

Rosa L. Parks (right), whose defiance of segregation in Alabama sparked the civil rights movement, returned from her home in Detroit to Montgomery's Dexter Avenue Baptist Church, scene of bus-boycott planning. "It was very moving to be with her," Lanker says, "and to realize the far-reaching effects she had on all of us."

The Pulitzer Prize-winning photographer, a resident of Eugene, Oregon, had spent months drawing up lists of potential subjects. When he tried to research them in black studies sections of libraries, he found that "some of the women I knew to be notable had little representation. You soon realize who wrote the history books. It wasn't women."

PHOTOGRAPHS BY FRANK ATURA (ABOVE); BRIAN LANKER

Colleagues helped him scan newspapers and search files at the Schomberg Center for Research in Black Culture and at Time, Inc., in New York City. Many women recommended other individuals who might have been overlooked.

"I was interested in each person's childhood and family," he said, describing his approach to the interviews.

"I discovered a world of wit and wisdom and philosophies of work and life. Many of the women grew up in strong, supportive families with the black church playing a major role."

During his research he became familiar with Maya Angelou's many talents: author, actress, movie director, and Reynolds Professor of American Studies at Wake Forest University in Winston-Salem, North Carolina (left). Her autobiography, *I Know Why the Caged Bird Sings*, had been nominated for a National Book Award in 1971. Lanker was elated when she agreed to write the foreword for his book (page 208).

The outpouring of generosity from all the women was wonderful, Lanker recalls. "Their greatest lesson to me was this is not only black history, this is my history, this is American history."

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