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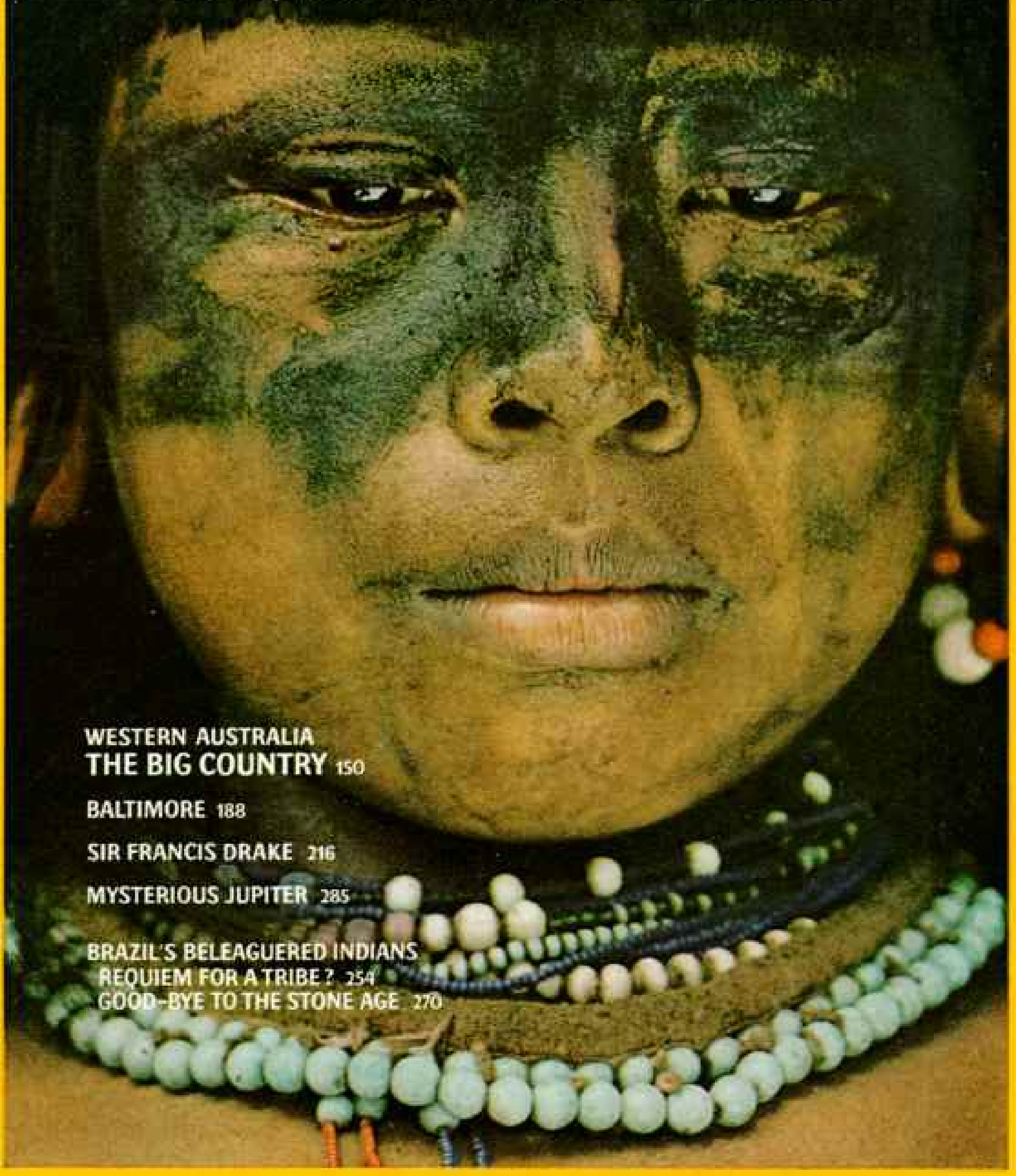
NATIONAL GEOGRAPHIC



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NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 147 NO. 2

February 1975

WHEN WE DECIDED to recount the saga of that famous freebooter Sir Francis Drake, there was never a moment's doubt as to who could best tell the tale—Capt. Alan Villiers, of course. The celebrated chronicler of the sea first sailed into our pages 44 years ago with a still-vivid account of a long and calamitous voyage around Cape Horn in a windjammer, the grain-filled *Grace Harwar* (**below**). As he related then: "... one of us was killed; a second went out of his mind; a third went overboard. ... We might have known these things would happen. We had thirteen in our crew. ..."

AS CAPTAIN OF *MAYFLOWER II*, ALAN VILLIERS WORE PILGRIM GARB

The elements that came to typify the Villiers style were present in that first story: a high sense of adventure and daring, an expert's knowledge of ships and the sea, and, under it all, a deeply felt love for a romantic way of life that was passing.

In the years that followed, words flowed from his pen like the racing gray-green seas off the pitch of the Horn—words based on deeds. He was among the last to circumnavigate the globe in a square-rigged ship, the *Joseph Conrad*, and he commanded little *Mayflower II* when she crossed the Atlantic (**above**). Through 28 GEOGRAPHIC articles, Villiers has taken us on many an epic voyage, on Arab dhows and square-riggers, under canvas and aboard the nuclear ship *Savannah*. He circled the world in the wake of Charles Darwin's *Beagle*, and most recently ranked high on our annual popularity poll with an account of the life of Capt. James Cook, written by one sailor in admiration of another.

FURLING SAIL ON "GRACE HARWAR"

Two of the ships he sailed on ended up as he knew they would—as floating museum exhibits. From the beginning of his career, he was aware that he was documenting the end of an era, that the beautiful sailing ships he knew and loved would vanish from the seas in his own lifetime.

The story he tells us in this issue in its own way represents a benchmark of change. Drake's humbling of Spain made possible the growth of English sea power and the birth of a great empire; three and a half centuries later we have watched that empire ebb. Much of modern history represents a picking up of the pieces from the collapse of what Elizabeth, Drake, and the other striking figures of that age initiated.

It is, as Captain Villiers would say, a very good yarn.

Editor

COVER: *The face paint of Txukahamei tradition and the porcelain beads of a menacing outside world symbolize the dilemma faced by a dwindling handful of Amazonian Indians (pages 254-83). Photograph by W. Jesco von Puttkamer.*

By KENNETH MacLEISH
SENIOR ASSISTANT EDITOR

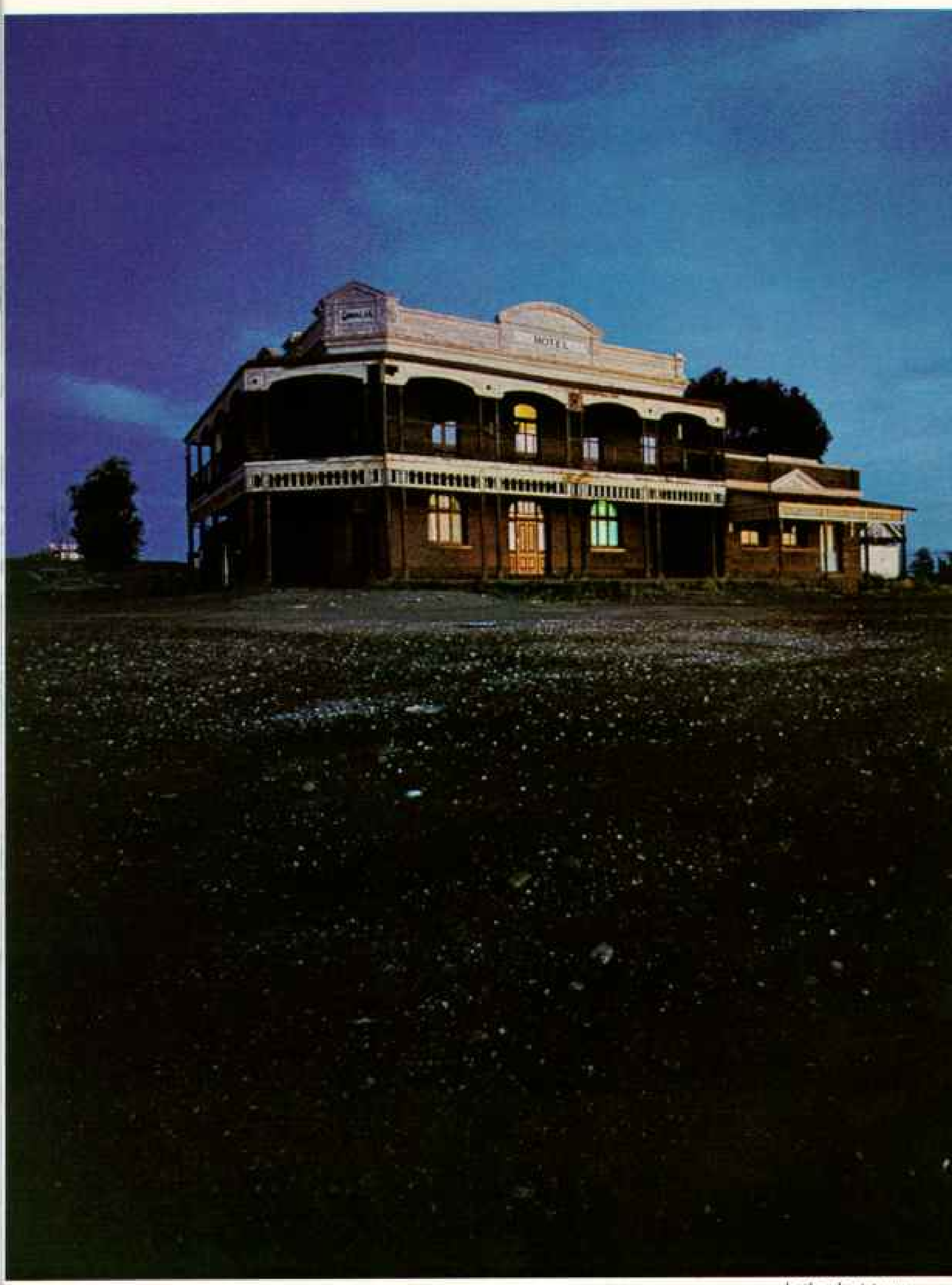
Photographs by
JAMES L. STANFIELD
NATIONAL GEOGRAPHIC PHOTOGRAPHER

WESTERN AUSTRALIA

The Big Country

...where strong men
wrestle a raw land veined
with mineral riches—
a land so dry that
"crows fly backward
to keep the red dust
from their eyes,"
so vast that cattle
must often be hunted
down like wild beasts

Manager Les Brown musters a steer at Ivanhoe Station in the Kimberley region.

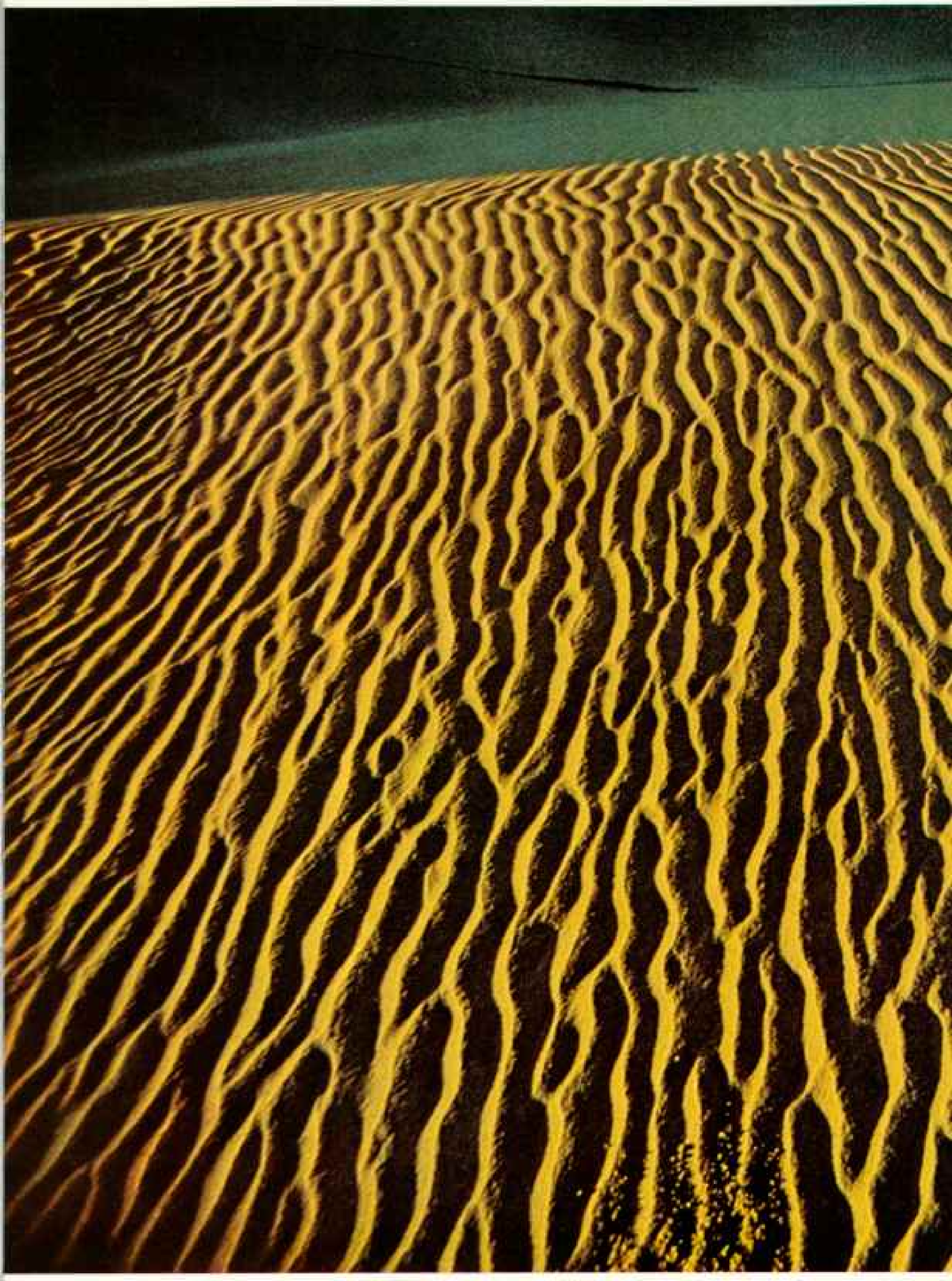


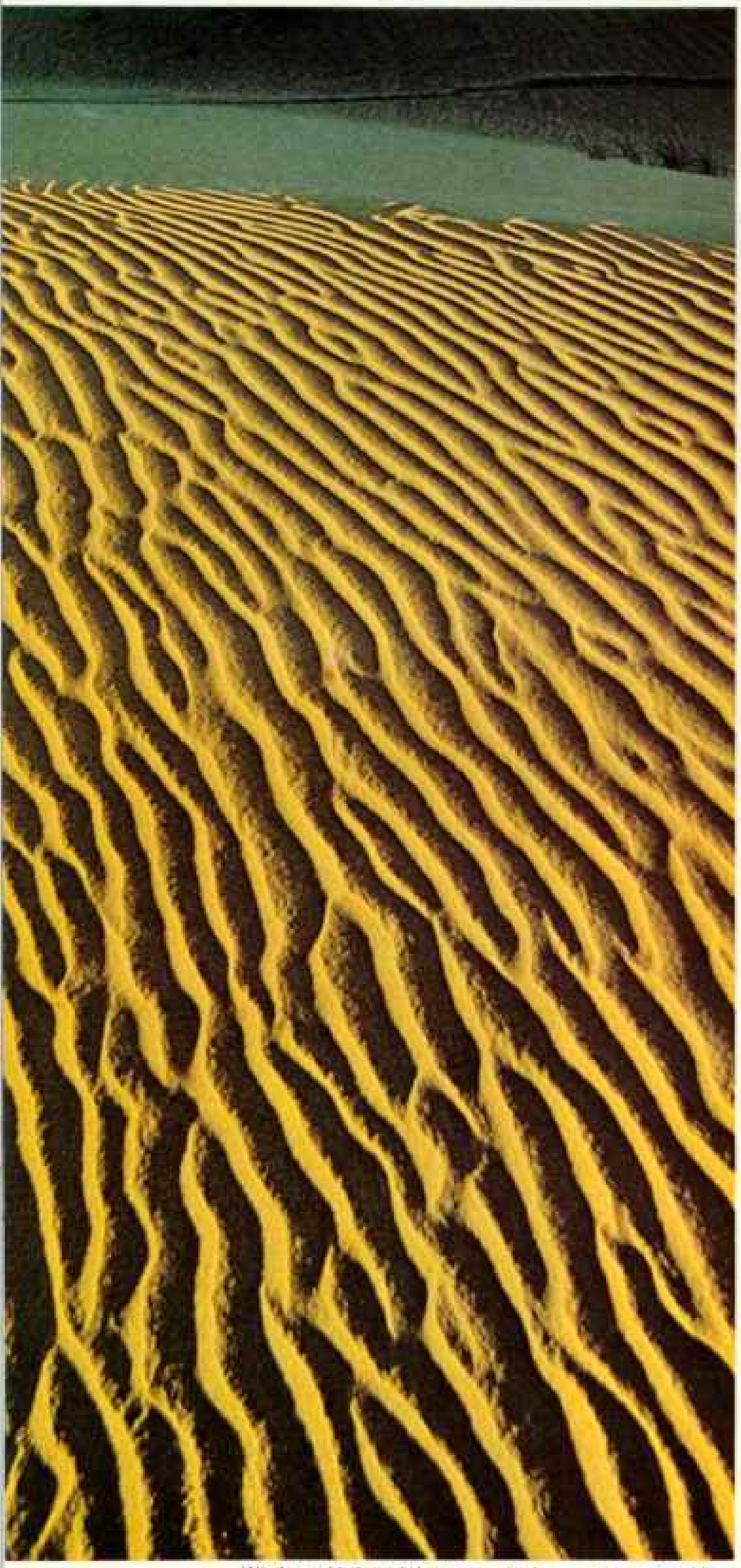
In the ghost town

Seduced by gold, waves of "diggers" awakened the dormant west. Some found fortunes, but many—jilted by the fickle lode—left their dreams and boomtowns to the wind

Family portraits of Italian miners stare from the corrugated iron walls of an abandoned shanty in Gwalia.

of Gwalia, lights again brighten the old State Hotel, restored as a mining office.





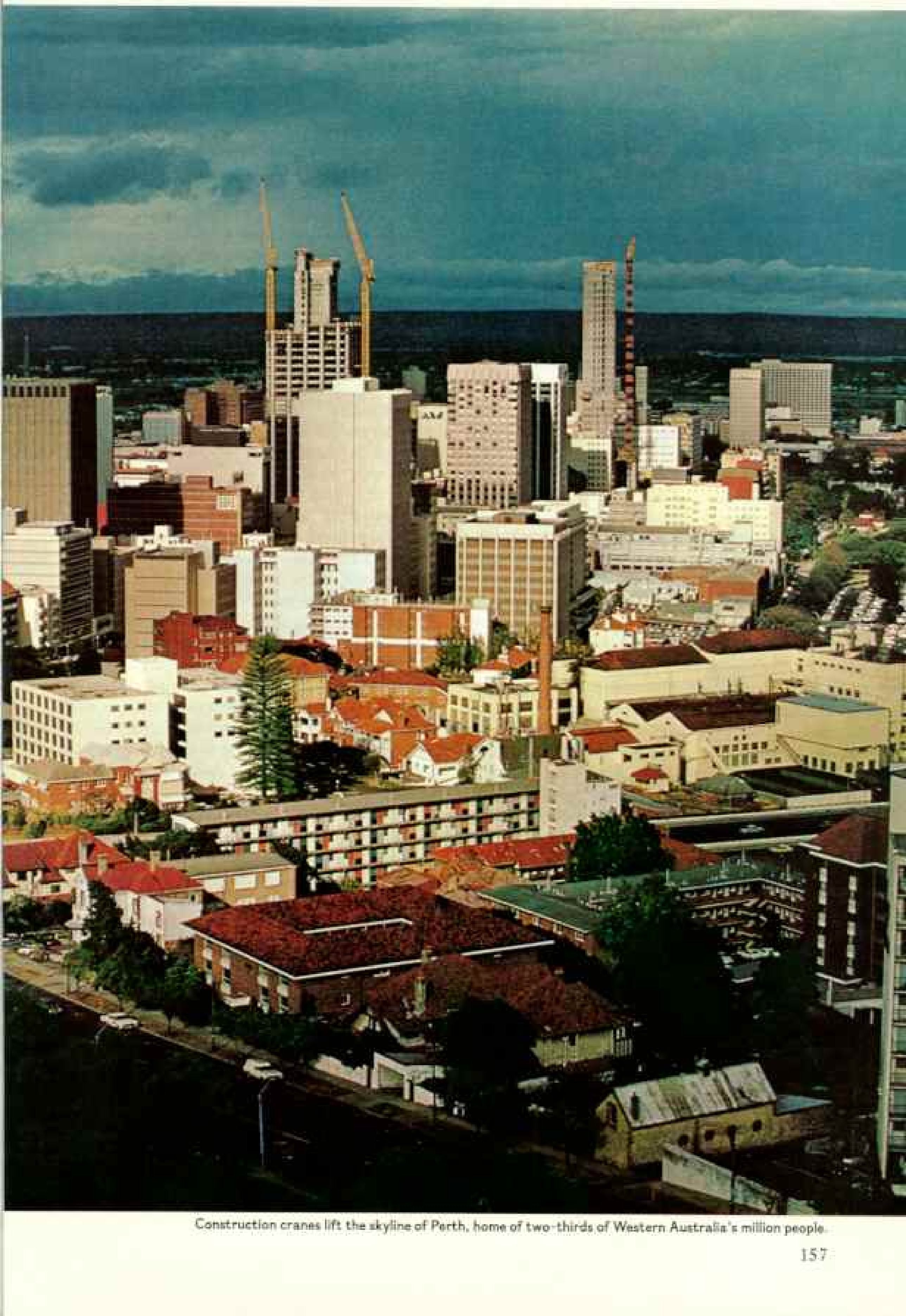
Wind-wrinkled sand dunes mantle the coast near Geraldton.

Boots and an empty beer bottle mark a grave near Marble Bar, a town in the Pilbara.

"You can't scare me with hellfire, mate," a dying bloke told the devil. "I'm from Marble Bar."

Perth beauty Jill Barber hurries through the busy shopping district.

Oasis of glamour and urbanity in a shirt-sleeves state, the capital city of Perth flexes its adolescent muscles on the fertile southwest coast



Construction cranes lift the skyline of Perth, home of two-thirds of Western Australia's million people.

Western Australia, The Big Country

BIGNESS IS THE THEME, a theme with endless variations. Bigness in area: a million square miles awakening under the sun. Bigness in ideas and risks, in money lost and won.

Western Australia is a third of a continent, an immensity of beauty and dreariness, richness and worthlessness in which a million people are creating a region to be reckoned with. Someone coined the phrase "A State of Excitement." Forgive the pun and accept the premise. The excitement is contagious.

Gold was the catalyst that created the late-blooming phenomenon of Western Australia. People by the tens of thousands came into the Eastern Goldfields at the end of the 1800's. Mining centered on Kalgoorlie, near which a "decent, bearded little man" named Paddy Hannan found gold in 1893. Here was surface gold, easy to get hold of once you'd found it. In 1894 Leslie Robert Menzies jumped off his camel into a heap of nuggets and gathered £750,000 worth in two hours. He "shouted" champagne for all comers in local pubs, then took six tons of gold to a bank by wheelbarrow.

Surface gold soon ran out. But Kalgoorlie and its contiguous town of Boulder lie along the famed "Golden Mile," bands of rich ore now worked down to 4,000 feet. Population of the two towns still tops 20,000. The main streets, wide enough to turn long teams of donkeys or camels, are lined with red-and-white Victoriana and small modern stores.

The deep gold lasted, and lasts still. The remaining big companies have amalgamated in an effort to make gold mining a paying proposition in a time of tough taxes, severe labor shortages, and galloping inflation.

Said Dick Hooker, operations manager of the newly merged Gold Mines of Kalgoorlie and Lake View and Star properties, "Gold mining is marginal right now. These companies were ready to go under. Then the price of gold rose. We're holding on."

But some "backblock battlers"—individual prospectors—are still hopeful. Jack Green is one. "A lot of blokes reckon the labor that goes into prospecting isn't worth what comes out. One bloke says to me, 'Show me a reef where I can cut gold off with a tommyhawk and I'll take it. Otherwise not.' But there's still money to be made."

He took me out to his boyhood town, Waterfall, and pointed out places in the rank, pale grass where houses had stood: "Our place was there, and my uncle's there, and the school yonder. And over by that pepper tree an Eyetalian bloke dropped his water bag, and where it fell, the water poured out of it and exposed gold. That battler went to work, and in a week or so he had a few thousand quid."

I went underground with old Jack, down a shaft more than fifty feet deep that he'd dug himself, and along narrow tunnels following a slender vein of quartz.

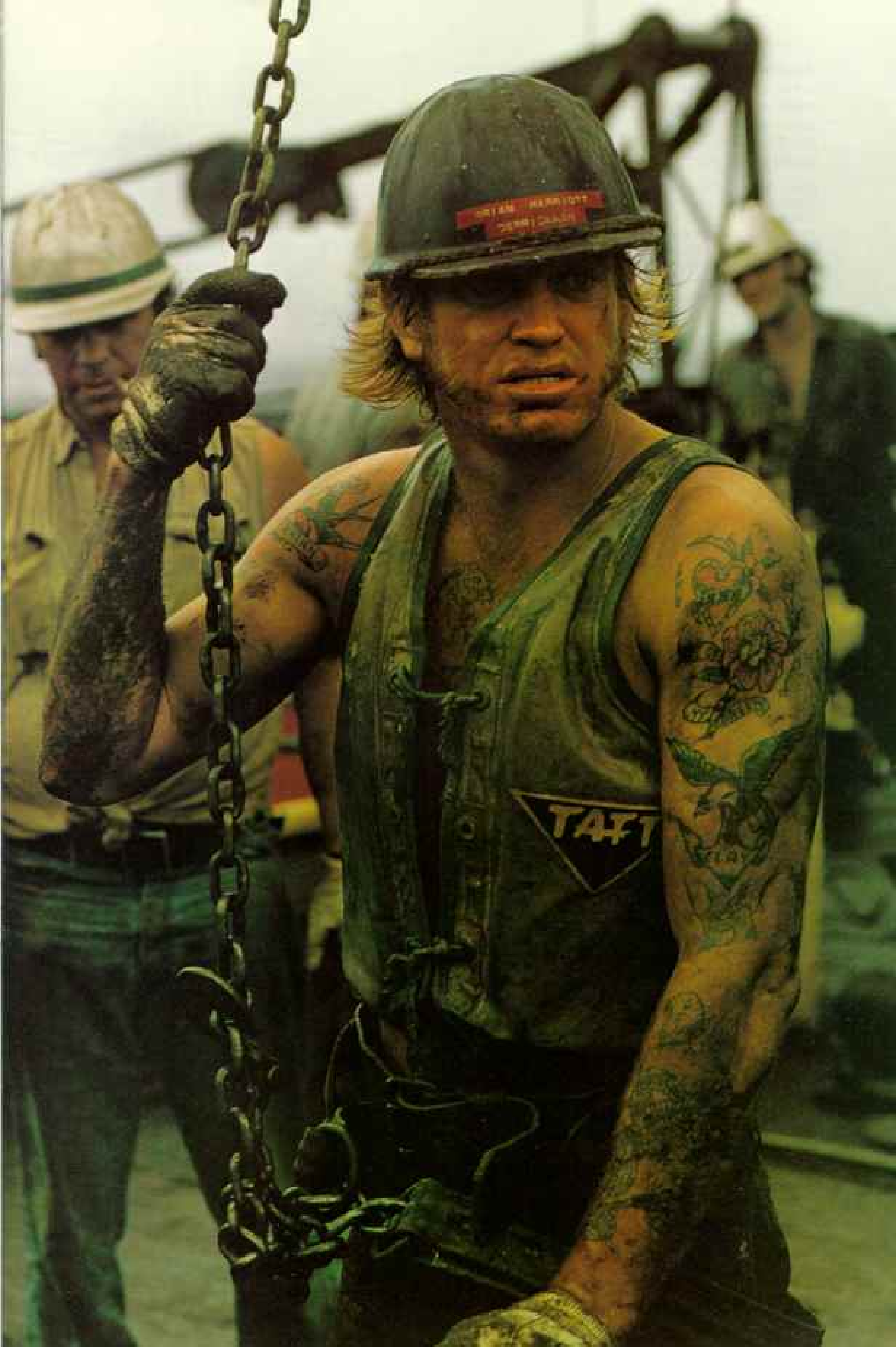
"I can get an ounce a ton out of that there reef, which is a bloody sight more than the big mines along the Mile get. And I will, too, soon as I find a good mate."

The gold rush drew people to the goldfields; the nickel rush is keeping them there. When a gold mine closes, its dependents move immediately. I'd seen the results at Gwalia, near Leonora, whose mine, once run by a young American engineer named Herbert Hoover, closed in 1963. Everyone left. Gwalia today is all but a ghost town (pages 152-3); empty iron houses rattling in the wind, desiccated arbors framing the doors, avian architecture—pigeon houses, chicken coops—rusting in each weed-choked garden, citizenship papers stuck to whitewashed walls, Italian picture books mouldering on rickety tables.

But, displaced though they were, many of the people stayed in the general area. Nickel had taken the place of gold as the major source of revenue. The new mines needed men. An official of Western Mining Corporation told me about the nickel boom.

"Nickel is saving the situation here. It gives us balanced mineral reserves and a pretty stable population. Kalgoorlie won't become another Gwalia. And our new towns here at

Burly, beer-drinking roughnecks shoulder the demands of a breakneck economy, probing coastal waters near Dampier for precious oil. Alerted by a cyclone warning, this derrickman prepares to uncouple the drill shaft, allowing the rig, a converted tanker, to float freely in the rough seas ahead.


TAFT

Australia's golden west, one of the great boom areas of the world, still needs people. Ripe for trade expansion with nearby Asia, the frontier state offers hard work but vast opportunities for the young man who wants to go west.

AREA: 975,920 sq. miles. **POPULATION** (1973 est.): 1,084,400. **CHIEF CITY:** Perth, 752,800. **CLIMATE:** Mostly hot and arid, except in southwest. **CURRENCY:** $1.00 equals $1.30 U. S.

Pearling luggers gather live shell for cultured-pearl farms along the coast near Broome's Roebuck Bay.

Offshore rigs search for oil and natural gas near Dampier to fuel growing industry.

Joseph Bonaparte Gulf

Kimberley Research Station

Wyndham

Ivanhoe Station

Durack Range

Kununurra

Ord River Dam

KIMBERLEY

Derby

Mowanjum Mission

Broome

Cambalin

Roebuck Bay

Great Sandy Desert

East Intercourse Island

Port Hedland

Goldsworthy

Cossack

Karratha

Dampier

Barrow Island

Marble Bar

PILBARA

Massive machinery scoops high-grade iron ore from the Hamersley Range, one of the world's richest beds.

Hamersley Range

Millstream

Fortescue River

Tom Price

Mount Tom Price

Paraburdoo

Mount Newman

Newman

Lake Disappointment (dry)

TROPIC OF CAPRICORN

Lake McLeod (dry)

Gibson Desert

Sasecone Agricultural Research Station

Mount Sandiman

Gascoyne Junction

Meeka

Carnarvon

Gascoyne River

Lake Carnegie (dry)

WESTERN AUSTRALIA

Meekatharra

Murchison River

Nickel mining soared in 1968, converting the state's mineral fields from a gold to a nickel economy.

Williamson farms

Malarang Park

Geraldton

Mullewa

Leonora

Gwalia

EASTERN GOLDFIELDS

Great Victoria Desert

Indian Ocean

Kalgoorlie

Golden Mile

Boulder

Waterfall

Kambalda

Karonie

Kalgoorlie boasts the richest square mile of rock ever known. It has yielded more than a billion dollars in gold since 1893.

To Port Augusta 490 Miles

Nullarbor Plain

Merredin

Perth

Fremantle

Cockburn Sound

Three-quarters of the state's population live in the southwest corner, blessed with reliable rainfall for forests and farmlands.

Bunbury

Esperance

Ormond Farms

Manjimup

Albany

Sperm-lipped whalers bring in about 800 sperm whales a year from the edge of the southern continental shelf.

Mine

Oil field; gas field

Ghost town

Homestead

Elevations in feet

STATUTE MILES

DRAWN BY JAMES SOUTHERD
COMPILED BY HAROLD A. HANSON

NORTHERN TERRITORY

SOUTH AUSTRALIA

Kambalda are flourishing. This 'land of sand, sorrow, and sore eyes' has a new lease on life.

"We've found big, proven ore bodies bearing as much as 8 percent nickel, which is bloody good. Nothing here for the small man; he can't go out and leap off his camel into a heap of pure nickel, and if he did it wouldn't make him rich. It takes a big operation to get nickel out of the ground."

This is done in two ways: by the standard shaft method in which tunnels branch off at regular intervals; and by the decline system, in which diesel-driven vehicles zigzag up and down a one-in-nine slope. The solid geometry of such a mine is impossible to perceive from a personnel carrier jolting down in semidarkness past roaring, lumbering vehicles. The impression is that of an immense multistory car park full of prime movers driven by men in a hell of a hurry. Still, the ore gets out, and the mine workers, when they surface, go home to houses as comfortable as most in the great metropolitan suburbs.

THE POPULATED PORTION of Western Australia, except for the Eastern Goldfields, tends to lie along the 4,350-mile coast, extending only occasionally toward the eastern deserts that isolate it from the rest of Australia. That isolation has led to a feeling of separateness from "T'otherside"—the long established and once far wealthier eastern states. But when you go up to the tropic top (as photographer Jim Stanfield and I now did to start our long southward journey through the state), you find people who feel cut off from the whole world.

Wyndham and Kununurra, in the east Kimberley area, are as far north as civilization extends. Wyndham is a Faulknerian port on a sultry backwater of Joseph Bonaparte Gulf, where flower-fringed iron buildings creak in the heat and a slaughterhouse reduces raw-boned cattle to useful substances, wasting nothing. Kununurra is a new town built to house people who came up to the deep north to work the land made irrigable by the damming of the Ord River.

Many comforts and conveniences are far away. So are some essentials.

"There's no choice. We live as we must, take what we can get."

"We bring up our high-school-age kids by airmail."

"We pay two prices for everything; one for the thing, one to get it here."

So say the settlers, sipping costly cold beer (I said life was hard, not intolerable) in houses where stilt construction, ceiling fans, and louvered shutters make the year-long summer bearable—just.

Still, the impounded waters of the Ord do produce splendid crops: cotton, sorghum, and rice now, sugar in the foreseeable future. And even though the High Cost of Everything makes Kununurra farmers gross rich and net poor, the potential for vast development is there. "It better be," says Ian Oliver, who owns two Ord farms of 640 acres each. "It's all there is. Look: I've been here ten years, and it's mostly been frustration, trying to find out what you could do with the land once it was irrigated. *(Continued on page 166)*

Drinking partners, a carpenter and his son quench their thirst near Cossack, once a thriving port for the Pilbara region. After the searing midday, the father returns to work, building company housing for salt and iron-ore industries in nearby Dampier.

"**Not fit for a dog to live in,**" said 17th-century buccaneer William Dampier, perhaps the first Englishman to penetrate the forbidding plateau of Western Australia. Only scrub brush, dust, and road scars add texture to the bleak outback where tough, stringy steers huddle by a windmill, its tanks, and overflow puddle. A "road train" loaded with cattle churns across the countryside toward Inkata Feed Yard at Camballin. Fifteen

years ago, northern stock was suitable only for ground beef, most of it shipped to the United States. Today the American-owned Australian Land and Cattle Company in Camballin diverts the nearby Fitzroy River and taps subterranean water to irrigate 7,000 acres of fodder. Fattened at the rate of 2½ to 3 pounds a day, the beef leaves the port of Broome as frozen steaks as well as ground meat for hamburgers half a world away.

Pesky as a giant fly, a bush helicopter rounds up steers in the Kimberley (**left**). At nearby Ivanhoe Station, which has 1,000 square miles of range and too few hands, only the chopper can scare up enough cattle to make the yearly muster pay.

A sky of baked enamel and 120° F. heat bear down on Aboriginal stockman Ken McEvoy (**below**), hitching a ride to the coast after a season of mustering cattle. Other than his boots and a jug of water, all he owns is rolled into the "swag" resting on his knee. A drifter, like many cattlemen, he may find summer work on a prawn trawler sailing out of Carnarvon.

"Right now cotton's come good. But we have wog [bug] trouble here you wouldn't believe. We need insecticides. If DDT is banned, there goes the cotton crop. Then we'll try rice or sugar. That ruddy great potential's here somewhere. We've only got to find it. Meantime we've got to make $20,000 [U. S. $26,000] a year to live like a day laborer in a city."

From the air, these rich and risky rectangles of brown, green, and gold look miraculously lush, ringed as they are by some of Australia's most forbidding rangeland. Raw-boned ridges lie lifeless under the relentless sun. But not these 30 new farms; not the 400 irrigated acres of the Kimberley Research Station.

"This is the first irrigation scheme to be attempted in Australia's tropic northwest," said Dr. A. J. Millington, the officer in charge.

"First we built the diversion dam, which can water 10,000 acres. The new big dam is farther upstream. When it's full, it'll allow us to cultivate 178,000 acres. Meanwhile we don't grow enough to offer much competition. We live here where few others would live, in the hottest part of Australia. There are 225 days a year in which you're entitled to feel uncomfortable at 3:30 p.m."

We drove off, sweating the sweat of the justly entitled, with Frank Grime of the Office of the North West. The surfaced road had holes in it. ("There are bacteria here that eat bitumen, would you mind," someone had said.) As the day waned, thousands of magpie geese landed in the rice and sorghum fields of

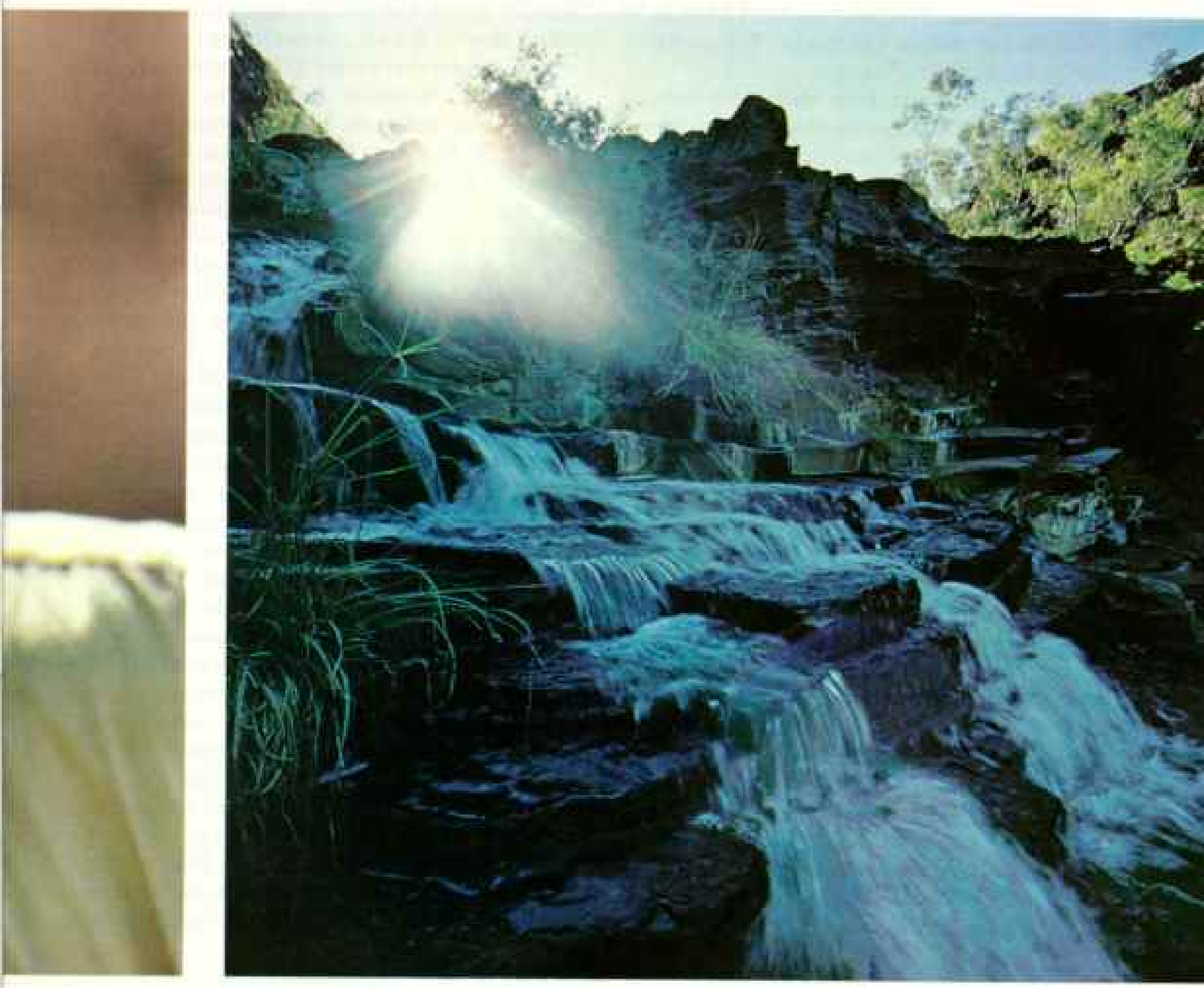
Paddy Blair's no Irishman, but an Aborigine from Marble Bar. Accustomed to a simple life, only a few native Australians prospect; their women often earn money by "yandying" —winnowing by tossing panfuls of ore into the wind to separate dirt from tin or gold.

the experimental station. "Another problem of the far north," said Frank mildly. "We had to move back the landing time of the evening jet an hour because of them. One good thing, though; they don't eat cotton."

IN CONTRAST to the Ord's modern farming methods, the cattle industry of the far north is run along old-fashioned lines. Flies in his eyes, sweat streaking his dust-reddened shirt, Les Brown battles a recalcitrant bull with his four-wheeler, forcing him along with the mustered mob. He spits grit.

Les and his wife, Glennis, run Ivanhoe Station for Hooker Pastoral Company. He looks after 1,000 square miles, a fifth fenced. "That's most of what's worth fencing. The rest is ridges, hills, and gullies. The fact is, Ivanhoe isn't profitable. We turn off 1,000 to 1,200 steers to the company feedlot for fattening, a lot of them cleanskins—wild, unbranded cattle [page 151]. But to help muster those beasts, we have to hire helicopters at $70 an hour. That wouldn't be necessary if we could get enough good men. We can't, so this is one of the worst stations in the region."

Dee and Jeanette Bostock reckon theirs is one of the best. They're T'othersiders, like most cattlemen here. Said Dee, "We've got 1,100 square miles with 30 wells and enough fencing to control the cattle for upgrading. For labor we use blackfellows. There'll be about 70 here, right after mustering, counting wives and kids. They're all right if you don't



Weekend washbasin for dusty iron miners, Fortescue Falls spills into a popular swimming hole at Dales Gorge. In new towns built for employees of ore complexes in the Hamersley Range, air conditioning and refrigeration help tame the oppressive heat.

treat them with familiarity, and treat them all alike. They'll laugh when you tell jokes, but that doesn't mean they're laughing at the joke; they may be laughing at you."

The problem of dealing with the native population is more intense in the port of Derby, where half the pupils in the combined primary and secondary schools are Aborigines. Mowanjum Mission, a native settlement run by the Presbyterians, is just outside town. Said an outspoken administrator:

"Education doesn't cause all the problems, and it won't solve them all, either. Our teachers are sympathetic to the black children's difficulties. The teachers themselves are on their first job away from home. They find life in Derby culturally depriving, like living in a hole. The only comforts are drinking and philosophizing. You see, you don't have to be good to succeed in the north. You're white, you're here, you're 'right.

"We teach white kids their own culture. But the black kids are on the apron strings of that culture. There's no going back to the old nomadic ways and skills. The natives have to be drawn along into our way of life.

"But there are important values in the old culture. An old man, one of the elders at Mowanjum, told us: 'You clever people. You know much. You teach our children many good things. But the Aboriginal knows things you don't know. He listens to the wind, and he knows the earth and the sky.'

"There's nothing stupid about these people. They simply don't think as we do."

WHERE the Fitzroy River separates the southern edge of the Kimberley from the Great Sandy Desert, there is a magnificent example of what can be done with lean and stubborn country and cattle, given money enough to plan big projects and water enough to carry them out. Here the American-owned Australian Land and Cattle Company has drilled wells and diverted the Fitzroy River to irrigate 7,000 acres near Camballin on which to grow fodder for a great Texas-style feedlot called Inkata, where cattle from nearby stations are fattened.

"These Kimberley cattle come along fine once they're quiet and well fed," said Wes Roddy, the Texas-bred feedlot boss. "They've survived on poor country for so long, they've got to be tough. We take 'em off the stations at around 600 pounds. In about 180 days they're up to 1,100 pounds.

"This is our second year, and we turned off about 5,800 fat cattle. But the stations we own aren't carrying near what they could if their pasture were improved—and we're improving it. This country's going to need a lot of developing, but that shouldn't be hard."

ALMOST DUE WEST of Camballin and about 150 miles from it lies the Kimberley's southern port and most exotic town: Broome. The first settlers landed in 1865 with the idea of establishing a pastoral paradise. Poor pastures and hostile natives almost literally drove the settlers into the sea, from which they've drawn a better living ever since.

At one time there were 350 pearling luggers in Broome's Roebuck Bay. Three thousand men served the fleet, some belonging to the handsome Eurasian group known locally as "Broome Creamies." Pearls as such were few, but the iridescent shell of the pearl oyster sold well on the world market until plastics displaced it. Then luggers lay rotting in the mangrove swamps. The pearlers drifted away, leaving only a few to man the dozen or so remaining boats, and a lot of friends and relatives beneath the Japanese, Malay, Chinese, and Indonesian gravestones in the town's wonderfully interracial cemetery.

Yet Broome still lives and pearling continues in a different form. Three companies send out luggers to collect live shell for the pearl farms up and down the coast, in which bigger cultured pearls are grown than are produced in Japanese waters. Jim Stanfield and I went out on one of the boats.

The divers were Japanese. They live in their own building, maintain their own temple, play Japanese records, and, in most cases, speak no English. We left their rickety pier in a mangrove thicket when the tide (28 feet along this part of the coast) floated our lugger free, and went to sea under diesel power with jib and jigger steadying us in a fresh wind. Several miles out we cut engine and drifted broadside to the breeze as the two divers

Sunburst of dance, created by a zoom lens, abstracts the Perth City Ballet. With its new concert hall, wealth of international artists who perform there on tour, and annual arts festival, Perth injects culture into a state more inclined toward outdoor sports.

Baked by the sun's furnace, seawater evaporates to salt. At the Dampier saltworks (**below**), the crystals tumble from a harvesting machine.

At Lake McLeod, a dry basin near Carnarvon, Texada Mines pumps natural underground brine, ten times as saline as the sea, into a grid of mile-long pans (**right**). Stage by stage, the sun steadily concentrates it further. After removal of ordinary salt, the remainder is processed into potash. A region of constant sunshine, the Western Australian coast has catapulted to world prominence in salt export in just five years.

suited up in old-fashioned diving rigs, identical from bronze helmet to iron-soled shoes to those used early in the century. The slender, gracile Japanese lads became hulking monsters who would trudge with slow and heavy tread upon the seafloor.

Here that floor was about fifty feet down, and I made my way to it with a plastic hose from a little deck compressor as my only source of air and connection with the ship. It wasn't a good idea. Visibility was about three feet, and the lugger was drifting as fast as I could swim. I couldn't find the diver. He couldn't find any shell. We surfaced separately, sailed on, and dived again.

This time I followed down his lifeline and ended up peering into his faceplate upside down. He came as close to jumping as a fully

suited diver can, then staggered on searching the murky bottom. Still nothing. The deck crew hauled us in together.

No one seemed surprised. Bad days are common. We sailed back in and came ashore, wading through mangrove muck to the pier now deserted by the fallen tide.

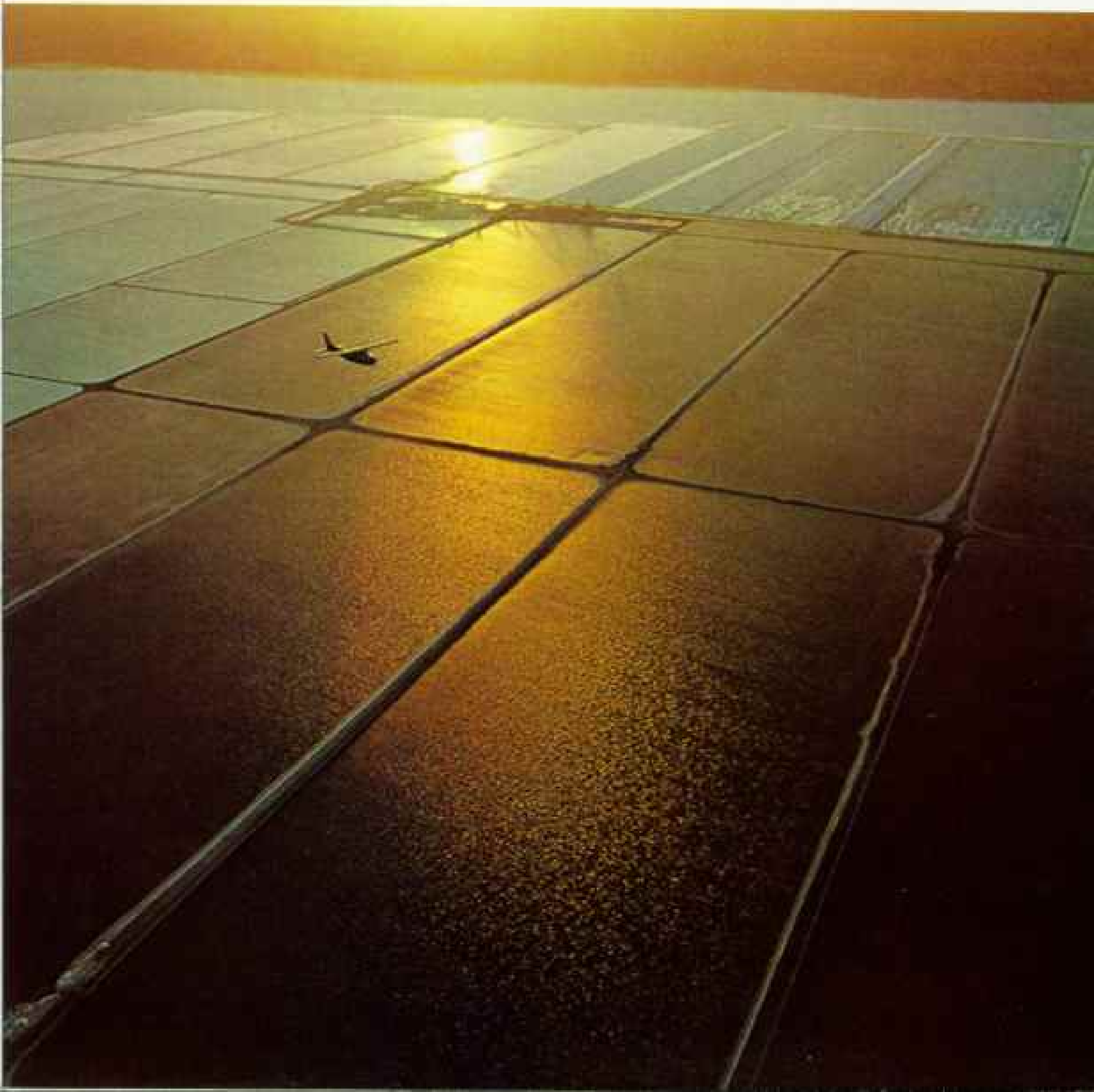
THE 350-MILE STRETCH from Broome to the Pilbara is thoroughly forgettable. Here the Great Sandy Desert extends almost to the sea (map, page 160). The road is unpaved, a scar across the naked skin of earth. Where land gives way to sea are beaches that must be the world's emptiest, and beyond them the restless Indian Ocean.

The Pilbara is a region of 171,462 square miles that extends as a broad stripe across Western Australia from the coast to the Northern Territory border. Its eastern half is desert wasteland—for the moment at least—but its western segment, from the rust-red mountains to reef-fringed sea, is the booming site of great new iron-mining operations that are among the world's most productive.

Like other Western Australian regions, this one was settled in the mid-19th century by pastoralists. A few decades later, mineral discoveries brought new pioneers with new dreams. Gold was their goal. And gold built towns before it gave out.

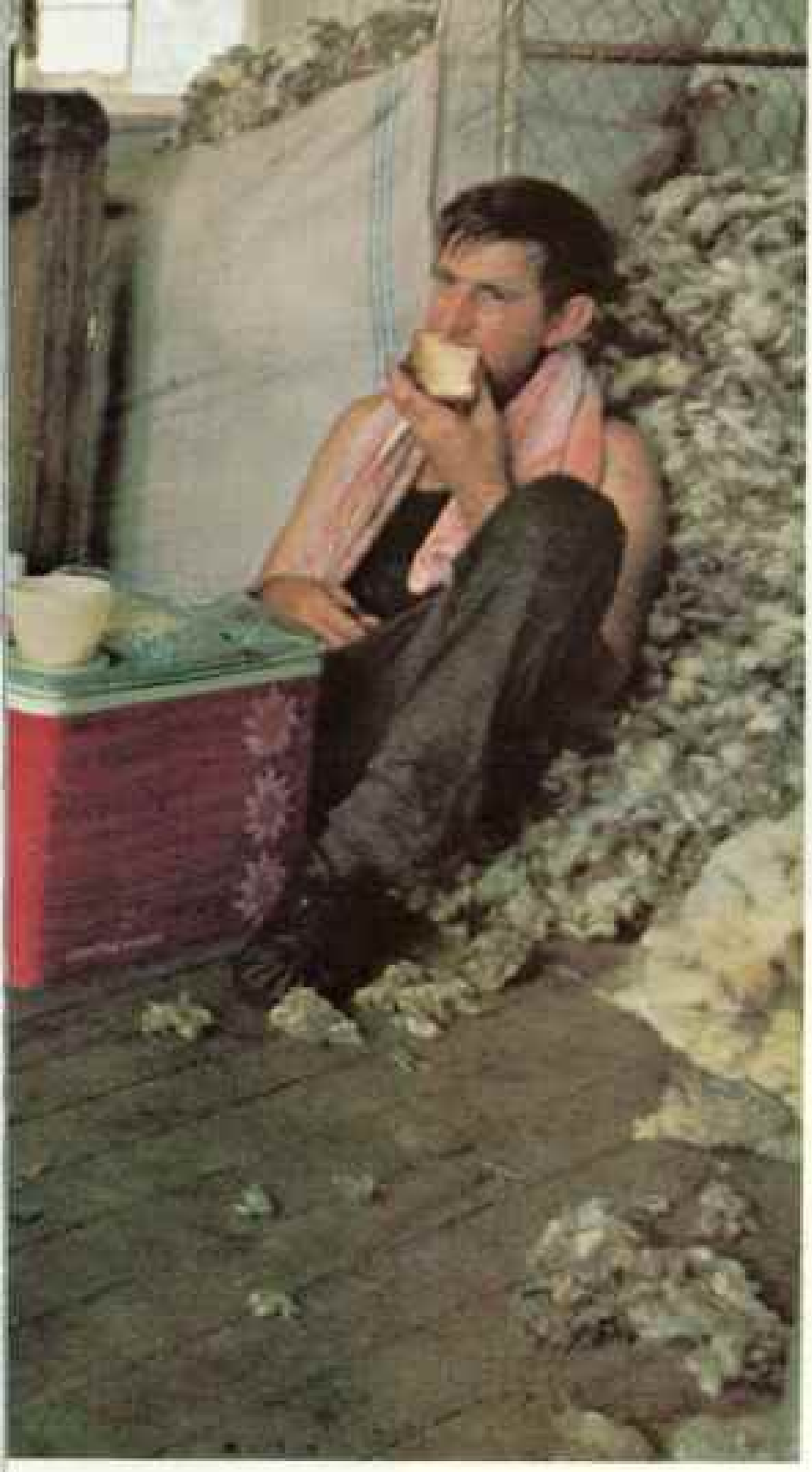
Port Hedland is one of these, and there I stopped for a talk with the shire clerk.

"This place has grown from 800 to 8,000 in the years between 1965 and 1972," Lance Rogers told me, "and it's still growing. Iron is



"Shear" exhaustion overcomes Paul Johnson, left, and Archie Ovens, taking a "smoko" break at the Malarang Park sheep station near Geraldton. Despite 115° F. heat in the iron shed, each man shears some 145 sheep a day, gulping as much as two gallons of water and juice as he goes.

There's a roo in the bucket at Mooka station near Gascoyne Junction—a pet "joey" that gobbles grain with the station horses. Wild kangaroos often share pasture with sheep, but according to one station manager they're not as hardy. "They've got to hop," he says, "which is a bloody silly way to go 'round the country."



its lifeblood. The old townsite is full, so a new town, South Hedland, is under way, and we reckon that'll take 40,000 more. There's no bloody knowing where it will end. Some reckon there'll be 130,000 people in the Pilbara by the year 2000, if all goes well. But will the Pilbara be 'right for years to come? It's full of fine, high-grade iron ore, but it takes millions to work it. The money, most of it, has to come from overseas. And the market has to be Japan. There's iron everywhere. All we are is an iron-rich region handy to Japan.

"The interests of the two countries are interwoven. Japan is small, and has a pollution problem, so why couldn't they shift their bloody steelmaking here and pollute us? That'd cut the cost of transportation. All we need is cheap power. So far, no one's figured out how we'll get it, but it's not beyond us."

The search for sources of power—oil and natural gas—is pursued off the coast as ardently as that for mineral bonanzas in the Pilbara hills. Oil in commercial quantities has been found on Barrow Island west of Dampier, and great reserves of gas have been proven northeast of there. Drilling rigs are making hopeful exploratory holes in the ocean bottom all over the nearby continental shelf. I went out by helicopter to visit one called *Ocean Digger,* on lease to Australia's Woodside-Burmah Oil.

Ocean Digger is a floating rig held by ten groups of anchors. She "makes hole" wherever the company geologist tells her to, for $33,000 a day. She was 11,000 feet down in her thirtieth dry hole (as it proved to be). No one seemed discouraged. They would go down another couple of thousand feet, then "kelly up" and away to another likely undersea formation. Perhaps next time. . . .

THERE ARE FOUR iron-ore complexes in the Pilbara, an area said to be capable of meeting the iron needs of the world for at least a century. They are Mount Newman, Goldsworthy, Robe River, and Hamersley. We picked Hamersley Iron for a close look, and went along to Dampier, a town Hamersley built, to learn something about iron mining on a gigantic scale (next pages).

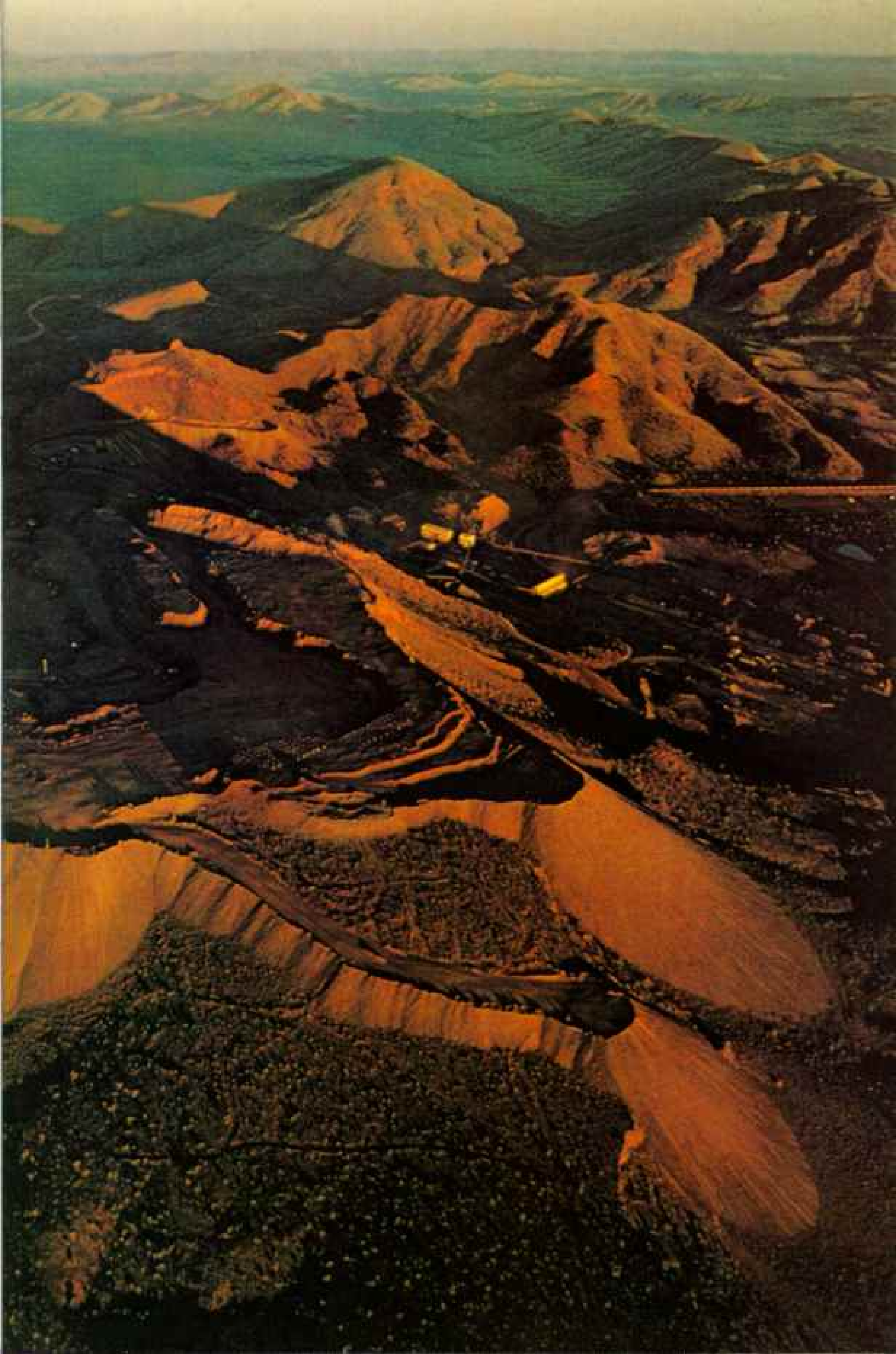
The Pilbara deposits are two-billion-year-old sediments standing now as high plateaus cut by deep gorges. Almost all contain iron, but certain formations run as high as 68 percent. Hamersley began to work ore of this quality at Mount Tom Price in 1966. In 1974 capital investment exceeded 700 million dollars—and those are Australian dollars, worth a third more than our own. Export earnings should be even greater.

Swift as has been this megamillion flow out of the Pilbara's harsh mountains, there is nothing boom-and-bust about Hamersley's plans for the future. It and the other iron empires are there to stay.

Hamersley has built three company towns; one each near (but not too near) the open-pit mines of Mount Tom Price and Paraburdoo, and, to handle coastal shiploading facilities, Dampier itself. It has also built hundreds of houses at Karratha, a town 14 miles from Dampier. In all four communities the company homes are brick built, air conditioned, furnished, and arranged more in the manner of Western Australia's pleasanter suburbs than as mine workers' quarters in a hostile

"**How much iron ore is there?** How do you measure the air?" The buoyant report in 1962 of newly found iron ore in the Hamersley Range by U. S. engineer Tom Price launched a new economic era for Western Australia. Hamersley Iron's open-pit mine at Mount Tom Price (**right**), literally a four-mile-long mountain of iron ore, now yields 130,000 tons a day. Ore moves by railroad to freighters at Dampier, where most is shipped to Japan. Particles too small for blast furnaces are shaped into pellets at Dampier (**above**), where a workman scrapes the steaming machinery.

As immense capital investments and giant bulldozers move mountains, individual gold miners like plaid-shirted Jack Green (**below**) and son Peter, far right, still earn enough on their claims to keep going as old-style "diggers." But will it last? "I'm not getting any younger," says Jack, "and mates that'll work this hard are hard to find."



environment. There are lawns, trees, well-tended gardens, grassy sports ovals, pools, theaters, hospitals.

Says Klaus Jurat, the town administrator of Dampier, "A man gets a house to fit his family, not his salary. They all rent for the same low figure.

"About 70 percent of our people are married; married people are more stable. As to where they come from, we don't care. Most are of non-Australian birth—like me, 17 years in this country but born German. We're a melting pot, and that's good."

The iron mines do their best not to damage their own rugged environments. In general they succeed. If a minor mountain of metal is removed and the site recovered and replanted, the scenery will not have suffered much of a setback. So said Carl Bickendorf, a liaison and security man at Hamersley's Mount Tom Price, as he showed me the shelf-like benches of the open-cut mine. Here drills, shovels, and trucks went about their business. They differed in detail, but they had two things in common: immense size and immense cost.

"With these giants we dig about 130,000 tons a day. The dump trucks are 120-tonners, diesel electric. The shovels can fill them in four or five bites. Over there is a diesel-electric drill; it cost $350,000.

"This particular ore body is one of the richest in the world. It's four miles long,

Civilization drops by once a week at isolated depots of the Trans-Australian Railway. At Karonie, west of the Nullarbor Plain, Ron Mathews and his wife gather together the week's groceries purchased from the "Tea and Sugar." A shopping center on rails, the train serves railroad employees along the 1,050-mile stretch from Port Augusta to Kalgoorlie.

4,000 feet wide, and 500 deep. And when it's used up, there are others. One of them is being worked now at Paraburdoo."

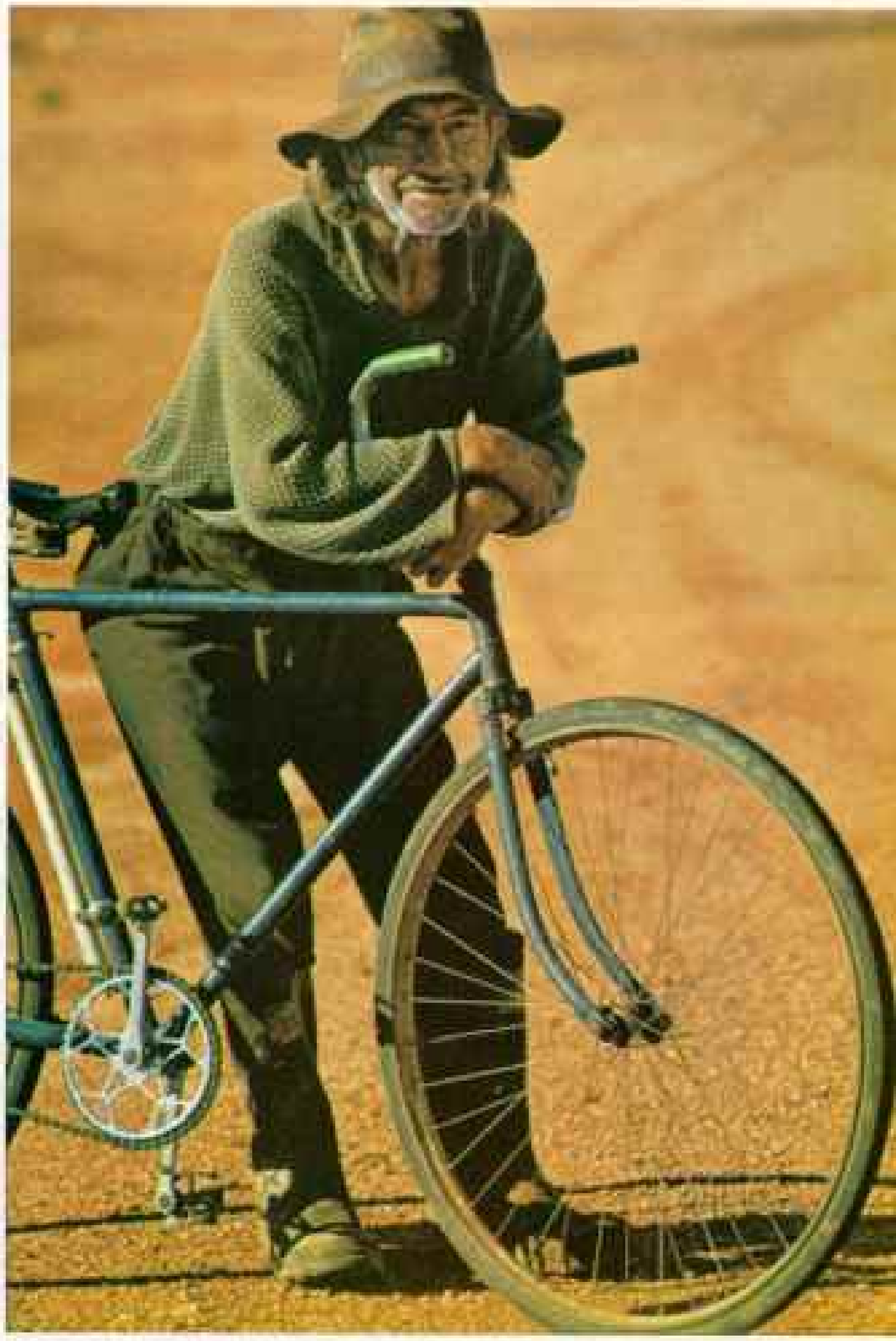
A railroad carries the crushed ore to the coast, to Dampier and nearby East Intercourse Island. At the shiploading facilities, red dust sometimes fills the air. People say that white is an unknown color there. "There are no white cats or black-and-white cats, only pink and pink-and-black ones." My own white beard turned Pilbara pink after a few days in the area.

"It's a good thing the dust is no worse," said Neville Bayley, a Hamersley liaison officer. "If I want to get a suit cleaned, I send it 1,000 miles to Perth."

SO OPEN AND EMPTY is the Nor'west below the Pilbara that you have to drive more than 400 miles down the coast from Dampier to strike the next town, Carnarvon. It's not much to look at. If you weren't careful, you could "shoot through." But if you do stop to take a careful look around, you'll find enough to hold you for a while.

Carnarvon is curiously sited on the edge of the Indian Ocean beside a river that usually isn't there. When it is, it sometimes floods the main street which, incidentally, is 44 yards wide, and therefore big enough to turn a camel train in. Backed by stretches of semi-desert flats and ridges, where a million acres is no more than an ambitious sheepman

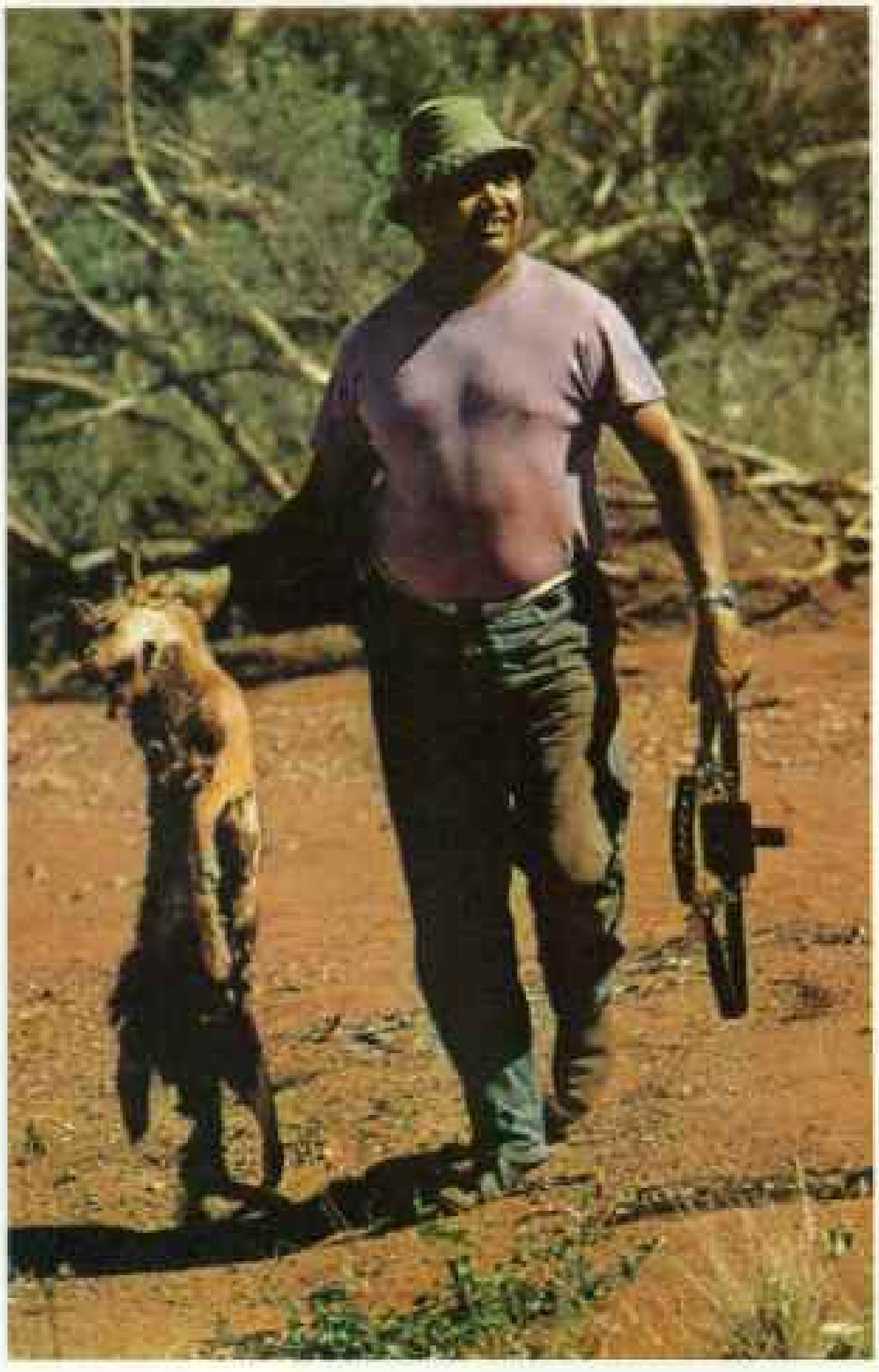
a dismal, practically uninhabited expanse with few roads. Refrigerator cars bring fresh food, a theater car shows movies, infant-welfare nurses treat the young, and traveling ministers tend the soul.



Grizzled Bo-Peep has lost his sheep—nine of them—somewhere between Kalgoorlie and Boulder. Former gold miner Stan Blackmore, now a shepherd, stopped to query photographer Stanfield, then wheeled off down the lonely road into empty country to find them.

Sheep killer pays the price. Horace Curley (**right**), "regional dogger" employed by the state government to control dingoes, or wild dogs, emerges from the bush with his trap and its grisly prize. Strychnine in the trap ensured a quick death. Fence-post signs (**below**) mark the dogger's 1,000-mile trapline east of Carnarvon. Camping with his van and his swag near Mount Sandiman (**below**), "Horry" cleaves mutton chops with an ax.

Apparently brought to Australia as pets and hunting partners by Asian ancestors of the Aborigines, dingoes are condemned by sheepmen as a major menace to their flocks.



wants, Carnarvon's immediate area holds three green and prolific square miles that produce more than four million Australian dollars' worth of fruit and vegetables a year. What keeps it green? The river that isn't there: an upside-down river, the Gascoyne.

When I saw it, in November, the Gascoyne was a sandy highway wandering between fringes of graceful gums. But water lies beneath that sand, only a few feet down. Hence the "upside-down" appellation: sand on top, water underneath. It is pumped to the fields on a strictly rationed basis; overpumping could bring up salt to ruin the soil.

Said Dave Thomas, manager of the Gascoyne Agricultural Research Station: "We can't depend on rain. The average is only nine inches a year. So we use water carefully, pumping flat out when the river runs—which isn't often—and taking enough for three acres of bananas per man the rest of the time.

"People here are mostly Europeans used to small holdings. We've got about 150 farmers, 50 percent Yugoslav, 25 percent Italian, 13 percent Portuguese, and the rest odds and bods, including a few Australians. The Australians stick to bananas, our oldest and still major crop. They're not all that interested in the 14-hour days and seven-day weeks you've got to put in to grow 'vegies.' And bananas are money-makers, if the weather treats you right. Some blokes are making their water ration go farther by using trickle irrigation, piping dribbles directly to the plants instead of flooding the whole area."

Ken Sheridan was doing just that when I found him, bearded and be-shorted, setting out a new patch. A literate, thoughtful young man, he plans his work carefully. "You have to, when labor is almost impossible to get. Two brothers and I work this land our father took up years ago. We're not terribly interested in vegies. They make you a slave to your crops. That's not for us. I mean—if you pick a bean, what have you got? One bean. You pick one stem of bananas and what have you got? One carton, maybe two.

"I'm a farmer. My ancestors were all farmers. I reckon if I had to have a transfusion you'd have to put a shovel of dirt in it, I'm that close to the soil. But I want to do a job, not put in hours."

Farther up the river I talked to David Correia, the other kind of Carnarvon farmer. He has brothers, too, and with them owns several farms and two prawn trawlers. He's a Portuguese from Madeira, and he gets labor from there—small farmers who've grown vegetables all their lives.

"They call us foreigners, these Aussies. The only one who isn't a foreigner here is the blackfellow. The Aussies don't like us because we work too hard growing vegetables—tomatoes, green peppers, all kinds. We know how. We like to work. I sent out 1,100 cases of tomatoes this morning."

Carnarvon's population of 6,500 looks beyond rich farmland for its living. Now the output of the Texada saltworks at Lake McLeod exceeds Carnarvon's agriculture in value of harvest. And from the sea, more than a million dollars' worth of prawns a year are harvested by the Nor'-West Whaling Company's 18 trawlers for export to Japan.

Carnarvon has even looked out into space. Antennas of a U. S. tracking station on a low ridge east of town stared up at satellites and spacecraft until the end of 1974. And, away out back, the pastoral country turns off sheep in their tens of thousands, as it has done for most of a century.

BEFORE GOING INLAND to see one of the sheep stations, I looked up a man whose curious profession helps sheep stations to exist. His official title is Vermin Control Officer, but he's called the "regional dogger." From the moment I learned there are men who bear this marvelous label, I longed to meet one. I was lucky. I met Horry Curley, who hunts dogs—that is, dingoes—east and north of Carnarvon (facing page).

Dingoes are wise and clever beasts, true dogs brought from Southeast Asia into Australia millenniums ago. They're middle-size, usually tawny, and unusually dangerous to sheep and even calves. Sheepmen say they kill for the sake of killing (as do a few other clever animals, notably man).

"A dog'll run sheep just for the joy of it," Horry told me. "He'll give a worn-out old ewe or roo a pass, then run down a little mob of young wethers. The faster they go, the more the dog likes it. In the end he might kill eight or ten, and never eat one of them.

"If he's hunting for food, like when his girl friend has pups in the nest, then he'll kill a sheep, eat until he can't hold any more, carry off a quarter in his mouth, and deliver all of it, vomiting what he's eaten, to feed his family.

"Dingoes mate for life, and they're territorial. So we study their comings and goings,

find the sandy playgrounds where they leave their pups, and maybe even backtrack them to their dens. Then we set out our traps."

Said Sandy McTaggart, manager of the million-acre Bidgemia sheep station, near Gascoyne Junction, "If we had 20 dogs on this station we'd be in deep trouble. They could run us off the land." We were flying over the station in his two-seater Cessna. There were signs of erosion on some slopes.

"We'll keep the sheep off those for a while. We don't want the land ruined, it's our livelihood. My family's been pastoralists for more than a hundred years. Right now we run 37,000 sheep and 800 cattle on these million acres. We've got five outstations, 40 paddocks, 800 miles of fencing, and 68 windmills. So you see we aren't just squeezing the country dry. We're putting a lot into it."

That evening we dined in a proper dining room at a well-set table in the agreeable company of Sandy's English wife.

"I rather like this arid country," Carol told me. "Arid!" said Sandy indignantly. "You call this arid?"

Cockatoos woke me at five, crows at six. As I started my 110-mile trip back to Carnarvon, green-crested pigeons flared from the cool dust of the roadside. Regal black "cockies" screamed from the meager bush. A wedge-tailed eagle circled, searching out quarry that would soon take shelter from the risen sun. And a dingo crossed the road, looked at me, grinned, and trotted away.

WHEN YOU LEAVE Carnarvon, on the southern edge of the great red reaches of the northwest, you leave pioneer country and cross 26 degrees south to enter the domain of the farmer, the businessman, the industrialist, the orchardist, the forester, the grower of grapes and tender crops. Nine-tenths of the state's population lives here in the southwest.

It is best to fly from Carnarvon to Geraldton, from one world to another. You can see the change. Prelude to the new environment are rectangles of wheat, at first in a narrow band close to the coast, then widening inland in the region of reliable rainfall. The rolling

The Great Australian Dream came true for the Gibaud brothers, Paul, Georges, and Pierre (**facing page**). Emigrating from France in 1949, and unable to speak English, the Gibauds first found jobs in the karri eucalyptus forests near Bunbury. Accustomed to immigrants, their foreman put them to work by simply drawing three pictures—a tree, an ax, and a tree crashing to the ground.

In 1953 the brothers bought land near Geraldton with their savings and planted wheat. Operating a combine (**right**), Georges wears one of his wife's petticoats to keep wheat chaff from irritating his bare legs. After 21 years of dedicated labor they sold their 31,000-acre farm last year for nearly two million Australian dollars.

plains back of Geraldton are reckoned as some of Australia's best wheatlands. Last year they produced close to a million tons of wheat, barley, and other grains. The city itself, even seen from a distance, is identified as a grain center, one of the biggest in Australia, by the massive silos of the Co-operative Bulk Handling terminal.

Grain isn't the only resource for this thriving town of 19,000. Geraldton's port is home base for the largest single fishery in Australia, the rock lobster, or crayfish, industry. After grain and "crays" come meat and wool. Sheep are part of the wheat operation, grazing on stubble or on fallow land to bring a farmer maximum returns from his acres.

And then there's tourism. Geraldton calls itself the "Sun City" and boasts of an average eight hours of sunshine a day all year long. Up north they don't boast about the sun; they just endure it. But here in the cooler south it's considered a blessing.

In the port area, early and late, boats of many shapes and sizes bustled about, piled high with lobster pots. The cray season had just begun, and brought with it an aura of bonanza and rancid bait. At the grain terminal the first truckloads of wheat were rolling in from the farms where oversize combines had started a harvest that would last through January.

I drove out to the Williamson farms to have a look at the production end of the wheat business, and talked to Danny, one of three sons who now run the place.

"We've got 54,000 acres here, all owned by the family, but with several homesteads on it. My grandfather started all this, and my Dad, that's O. J., well, he built it up. He cleared 20,000 acres in 20 years. The wheat area's defined by the rainfall. You ought to have at least 11 inches, which you won't get much farther east. Government Rabbit Proof Fences also help set the boundary. One runs 1,140 miles from north of Port Hedland to the southern coast."

Danny poured a steaming cup from an insulated jug. He looked dubiously at me. I nodded. He poured another.

"Didn't know Yanks drank tea," he said.

"Bickies?" He held out a tin of biscuits (i.e., a can of cookies). I took some.

"This Yank likes both. Thanks."

"Besides rainfall," Danny said, "we've got to worry about this business of quotas. We're not always allowed to produce all we can."

The quota problem has forced farmers to look for other crops that aren't subject to restrictions. Some have found one that seems to have exciting possibilities. By pure luck I met along the road the man who has done most to produce and promote it in the Geraldton region: Stanley Peck, first president of the Uni-Growers Association.

"That's white lupin," he said, pointing at an area of unfamiliar herbage. "Also called sweet lupin. Costs less to plant than wheat and brings more per acre. It's 31 percent protein, edible as a vegetable or in concentrates. It's a legume, so it doesn't need nitrogen; it puts nitrogen into the soil. And its stubble carries more sheep than that of wheat."

"Sounds almost too good to be true," I said. "Why is anyone growing anything else?"

"Ah, well, you see, this is new. We only started with it a few years ago, we being mostly English farmers—'Pommies,' they call us—in this area. The fact is we Poms aren't as conservative as the Aussies. And lupin does have a few minor drawbacks. You can't just keep planting it, or disease will develop. You rotate it with other crops. Also, your harvesting has to be spot-on or you'll lose the lot: The seed pods tend to ripen and open all at once. Production is still small, so marketing isn't what it should be."

There's no marketing problem for Geraldton's marine harvest. Its crays—or rather, their tails—go mostly to the United States.

"They're too pricey for Australia," said Dick Matthews, manager of the Golden Gleam fish company. "The whole catch here is brought in by 385 boats. There won't be more. The licenses are all taken. If you want to fish, you've got to buy a boat that's already licensed.

"Take an ordinary bloke with one ordinary boat, say a 25-footer. He can get hold of 20,000 pounds of live crays, and we'll give him $1.20 a pound. Even after taxes and expenses he's got to net $8,000 a season.

"And it's not a bad life. The boys use fast boats, 18 to 60 feet, and they're up before dawn and home for lunch. We take their catch, process it, deep-freeze it, and send it south by refrigerated truck."

SOUTH IS THE DIRECTION in which commerce flows, and Perth is the magnet. The Western Australian capital—pretty, fresh, affluent—need no longer feel neglected by the eastern states; it has arrived with a bang that has jolted the continent. If it is distant from the eastern cities, it is by the same token closer to new markets in Asia. It is the lucky capital of the luckiest state in one of the world's luckiest nations. Once poor but proper, Perth is rich and getting richer fast.

Yet it has known how to use its wealth wisely. Instead of becoming a tinseled, unharmonious urban center of conspicuous consumption, the city has expanded according to a master plan. At its heart, mini-skyscrapers of handsome design tower above bits of gingerbread Victoriana in a manner that somehow shows off both to best advantage.

Beyond the gleaming headquarters of industry, old Perth spreads away into the distance, a red-roofed expanse of suburbia. In this, Perth is typically Australian: Australia, for all its vastness, must be the most suburbanized country in the world. Every man has his own home, however modest his means, however pinched his plot.

Looking confidently toward a brilliant future, Perth builds and plans throughways to handle expanding traffic, and keeps its foreshores clear to display its wonderful Swan River for the benefit of all its citizens. The Swan is one of Perth's great blessings, and its way of using it (rather than abusing it) says a lot about the city. Although industry has propelled the capital into world prominence, it is kept well out of town, where it cannot pollute Perth's water or air.

Industry, which seemed to grow heavier and headier even as I observed it, strives and thrives and soils and stinks down at Kwinana, on Cockburn Sound; commerce bustles profitably about the port of Fremantle. But Perth stays bright and clean, its image reflected and redoubled in the shining Swan.

The very southwesternmost corner of the continent, with Perth itself and its ancillary cities, contains three-quarters of Western Australia's million souls. That pattern, so far as the cities themselves are concerned, is typically Australian and demographically deplorable. In Western Australia it will soon change, as the Pilbara becomes a great industrial center, and keep on changing as, in time, the Kimberley comes into its own.

Still, there are good and evident reasons for the relatively dense population of this southwestern land. It has good soil, reliable rainfall, and a proximity to consumers that the northwest must envy. It is pleasant, productive, and pretty rather than remote, empty, and overwhelming.

Yet there is a segment of this area that must impress any visitor from anywhere: the kingdom of the karri. The karri is a eucalypt of staggering size. It may reach 250 or even 285 feet in height. More striking than its height, though, is the unbroken sweep of its silver-gray trunk, which often rises to more than 150 feet before the first branch breaks its perfect symmetry.

Said Jock Smart, senior forest officer at Manjimup, "The karri is a fine tree, a forester's tree. There are some 172,800 acres in karri right now. Last year we took out 9.77 million cubic feet of karri wood, leaving seed trees to keep the forest self-perpetuating."

Jock eased his four-wheeler along logging trails through the green-shadowed woodland. "Here's the one they're felling this morning."

The tree was a fine straight one, perhaps 100 feet to the first limb and six feet or so in diameter. It would be about 300 years old. One lean and leathery lad with a 31-inch chain saw brought it down in less than half an hour. He cut a six-inch section out of the trunk on the fall side, then sliced across the back. The great tree moaned, trembled, shrieked, and slowly leaned into an inexorable earthward arc. The forest floor shuddered when it struck. Then, as broken branches came to rest, the whining chain saw sputtered out into ringing silence. Sun streamed through the gaping rent in the leafy canopy where hidden birds began again to call.

WESTERN AUSTRALIA'S south coast is washed by a clean, cold sea where seals bask and fairy penguins perch on ancient rocks worn smooth by waves. Farther out, along the continental shelf, sperm whales cruise and catcher boats from the last of the nation's shore-based whaling stations pursue them. I had a date to join Ches Stubbs, master of a Cheynes Beach Whaling Company boat (following pages), at quarter to four in the morning for a day of chasing.

The whaling vessels—three of them—berth at the town jetty in Albany, the main port of the southern coast and the southernmost community in Western Australia. Whaling is an old industry in Albany: 150-odd years old.

Ches was still asleep in the master's cabin when his Dutch mate, Case (Kees) Van der Gang, took the 438-ton ship out of Albany's splendid natural harbor.

"We usually go out to the edge of the continental shelf," Case told me, "and then steam east. The whales tend to swim toward the west. This way we meet as many of them as possible."

Dawn found us on the edge of the shelf, as did the company's spotter plane. Ches came up and took over the ship. Both captain and

Future secure in his arms, escapades of the past tattooed on his back, a westerner nuzzles his children at Vintage '74, a wine festival at Caversham, in the Swan River Valley near Perth. With its mild Mediterranean climate, the area supports 90 percent of the state's vineyards. Very little of the full-bodied local wine is exported.

The sea runs red with the blood of a 50-foot sperm whale, harpooned off the southwest coast near Albany (**left**). Peg-legged skipper and master gunner Cheslyn Stubbs (**right**) fires the second, or killer, harpoon, which usually ends the animal's life with an explosive charge.

Last of the once-widespread whaling operations in Australia, the Cheynes Beach company captures only sperm whales, using three chaser ships, a spotter plane, even radar and sonar to track down the canny mammals on their westerly treks along the edge of the continental shelf. The sperm whale is hunted mainly for oil; its tough, strong-tasting meat is unpalatable to humans but provides protein-rich meal for animal feed.

Tethered giants, a day's catch of five sperm whales flanks the ship; a boat tows two away to the processing plant. Australia takes some 800 sperms a year, well within International Whaling Commission quotas. Many experts think sperms are less imperiled than most species. Even so, the sperm remains on the endangered list of the United States. The U.S. urges a ten-year moratorium on all commercial whaling —a stand the National Geographic Society strongly supports.

Exiled from the wind, an injured sea gull finds compassion at Perth's City Beach. In the Australian west, a pioneer generation struggles to wrest the goodness from an ornery land. But another generation already rises to decorate, to befriend the small and weak, to write the gentle poetry, and soothe the callused hands.

gunner—one of the best, I'd heard—he would make every kill himself, first conning the ship into position for a shot, then hurrying forward along a narrow catwalk to take over the stubby cannon and fire an explosive-headed harpoon into the quarry. I wouldn't have known, if I hadn't been told, that Ches made his surefooted way around the rolling ship on an artificial leg. I asked one of the men how Ches lost the original.

"He shot it off. Stepped into a loop of the harpoon line, then fired. Off it came. Ches said, 'Well, there goes a bloody good bit of crayfish bait.' They offered him a shore job after that, but he wouldn't have it. You'll notice he never gets excited while we're chasing. But he still does when he gets hold of the gun."

I noticed it as we came up on our first whale, a 50-foot bull, about 50 tons. Ches gave quiet orders and sat expressionless on the bridge deck until we were within little more than 100 feet of the whale. Then he made his way to the gun and began hollering commands. He gestured to the right, then to the left, crouched, yelled "slow," aimed, and fired. The shot shook the whole ship. The whale rolled, veered away. A muffled thump sounded as the harpoon head detonated deep inside him.

"Full astern!" Ches shouted over the clatter of a steam winch heaving in line. He glanced at me. "Gives them a bloody hell of a shatter, poor devils. It's the excitement of the flamin' chase I like, not this."

We took five bulls that day. It was midnight when Ches berthed us at Albany.

In the morning I went out to the shore station to have a look at the processing and to talk with manager Jock Murray. The flensing, cooking, and separation into oil and meat-and-bone meal didn't take long to see. I was more interested in what Jock had to say:

"Until 1963 baleen whales—humpbacks and blues—were being slaughtered by whalers in Antarctic waters. Their numbers fell off, and now they're protected. But the sperms aren't considered an endangered species by the International Whaling Commission. Under its quotas, we're allowed 900 males and 505 females a year. We take them only over 30 feet in length."

When I asked about the pressure from conservationists to ban commercial whaling entirely, Jock replied thoughtfully, "I can see clear reasons why whales whose stocks are

endangered shouldn't be killed. But where there is a natural resource that can be used without being diminished, I think it ought to be used for the benefit of mankind."

HAVING NOW TRAVELED from Wyndham, the northernmost town in Western Australia, to Albany, the southernmost, with a few thousand miles of side excursions, I was left with one further foray to complete my sampling of the state. I headed east to Esperance.

The name means "hope," and for years it was bitterly appropriate. A few decades ago hope was all that the 57,458-square-mile Esperance region could offer its settlers. Many of these were out-of-luck miners from the goldfields to the north who found that they had exchanged one sad situation for another. The pretty little town on its delicious seashore served a dismal hinterland in which fields cleared out of the sparse bush yielded niggardly crops. Defeated, most farmers moved on. The dreary plain lay dormant until this century was half done.

Then Esperance came alive. Today 800 farmers work two million acres in a region that has become one of Australia's greatest potential sources of beef, fat lambs, wool, and grain. By the 1980's, planners say, the Esperance area should earn 55 million Australian dollars a year with 20,000 people using four million acres to produce 300,000 cattle, three million sheep, 30 million pounds of wool, and 20 million bushels of cereal.

This staggering bonanza, unwittingly presaged by the very name "Esperance," lay hidden in the region's sullen earth since man first trod it. The key that released it into human hands was a modest one composed of copper and zinc and a little molybdenum. Who found that key? Australian scientists, who learned that a few pounds of these metals could turn an acre of wasteland into one of lush pasture or heavy-headed grain; and American financiers, who made it possible to discover just how and when and where to apply the magic key to the land.

U. S. banker Allen Chase, who founded the Esperance Plains company, was first to invest. He risked and lost, but he induced another group to risk again, and it won. Well-known Americans—Art Linkletter, Rhonda Fleming, Robert Cummings, Henry Luce III—followed his lead. Orleans Farms, a fine property out east of town, is owned by David Rockefeller and Benno Schmidt, a partner in the Jock Whitney empire. An efficient and engaging Australian manager named Tony Moore runs the farm for them.

"The land company bought one and a half million acres," Tony told me, "with the proviso that they must develop it to a certain point and then sell half of it in 2,000-acre lots. That's been done. This farm is ten years old and has 16,000 acres of developed land, 15,200 of which is in pasture. We run 42,000 head of sheep, 2,000 of cattle. We could run cows at one and a half an acre, which isn't bad for land that was once considered useless."

Profit isn't the only driving force at Orleans Farms, however. Benno Schmidt has amassed a magnificent collection of Australian art, all to be kept in Australia. The paintings hang in the several rooms of Tony's house, to the delight of the Moore family, not as a gallery but as ordinary pictures would hang in an ordinary house. One, Drysdale's "The Drover's Wife," has a visual eloquence that hit me hard at first glance. All the strength, simplicity, and sadness of the pioneer woman is reflected in her austere face. That woman never knew tamed land and quiet cattle. She lived in the back of beyond. She coped.

AS PERTH is the point of entry to Western Australia, so is it the point of departure; and there I went to begin my long voyage home. A glance at a map raised for a moment the specter of isolation: Perth remains desert-bound to the east, sea-rimmed to the west, the only city in the entire western part of the continent.

But what if the distances are great? Their importance has all but vanished. The state capital—and through it, all Western Australia—has joined the world, not as a shy countryman in a community of condescending sophisticates, but as a full partner bringing extant and potential means wherewith to make his presence known and welcome.

In a flower-edged pond at the airport swims the black swan, symbol of the state. As I hurried by it, grips in my grasp and ticket in my teeth, it struck me that the symbolism was profoundly apt. All swan and all black, the lovely bird proclaims its irrevocable kinship with swans of the northern and parent hemisphere, and, through its opposite coloration, its distinct and special identity. Western Australia, that proud newcomer to the power centers of the world, does the same. □

Baltimore: The Hidden

By FRED KLINE NATIONAL GEOGRAPHIC STAFF

City

Photographs by MARTIN ROGERS

I WAS DRIVING from Washington, D. C., to New York City when I glanced to my left and saw Baltimore for the first time. My impressions: bleak, run-down, 19th-century industrial—in a word, ugly. I saw Factory Town, a chuckhole in the eastern megalopolis that fortunately I could drive around, under, and away from via the Baltimore Harbor Tunnel. And so it has been for years: an undiscovered city, prejudged by motorists passing its industrial outskirts at 50 miles an hour.

But now I've *been* to Baltimore—246-year-old Baltimore by the Chesapeake—and what surprises greeted me! Having wandered her neighborhoods and met her people, having been touched by the doughty spirit of the city, I know that what I first saw was just a tattered overcoat—only one aspect of a city whose singular character, charm, and yes, even beauty, have made those early impressions fade like a mirage.

Second impressions: mellow, antique, friendly. Riding the gentle slopes of the land, waves of row houses—neighborly, Victorian, of enduring brick—line the streets in subtly changing patterns. Church steeples punctuate the cityscape like the masts of giant ships. Islandlike parks offer sanctuary, trees offer shade. Relaxed old buildings speak of things past; tense new buildings listen.

Is this the same place others have called Mob Town, Nickle Town, a Loser's Town?

"Nicknamers be damned," said Sweeney the cabbie. "Save me from 'em. Friends I grew up wit still call me 'Beano.' Ain't that a pip!"

You sense right away Baltimore's cosmopolitan flavor. South Broadway neighborhoods celebrate ethnic diversity in the dialects and customs, names and faces of Italy, Russia, Greece, Poland. All about the city you discover the food of Germany, the wit of Ireland, the vitality of Africa. Around the inner-city harbor, exotic wafts of clove, nutmeg, cinnamon drift by on the wind—whatever McCormick & Co. is processing that day.

Lexington Market, since 1782 a labyrinth

As if waiting for a table, Roman emperors survey the lunch-hour scene at Haussner's. Fruits of the palette as well as pleasures of the palate lure 10,000 diners a week to the famed East Baltimore restaurant. As diverse as Haussner's art and menu, Baltimoreans take pride in their heritage of commerce, culture, and—above all else—individuality.

full of tempting foods, still invites you to have a picnic every time you pass. Peppery steamed crabs, freshly baked bread. . . .

Listen to "Rawlmerese," the language of the city: a unique mixture, to my ears, of Pennsylvania Dutch, West Virginia Southern, Brooklynese, and a pinch of Cockney. Store is *stewer*, child is *chahld*, boil is *ball*.

One morning in a Highlandtown neighborhood, I saw a hefty woman sweeping her white marble front steps and I asked her why everyone for blocks around had white steps.

"They ain't so waht," she said. "Ya oughter see 'em scrubbed."

"Really, do you know why everyone has them?" I persisted.

She leaned her ample frame on the broom and regarded me with a no-nonsense look. "Cause they're *purrdy!* Why else wooed people have 'em?" She couldn't hold back a smile, and countless generations of Eastern European housewives smiled with her.

Hometown of "The Star-Spangled Banner"

As you learn the city's lore, you sense more of her personality. You think about a boisterous Babe Ruth playing sandlot ball at St. Mary's Industrial School; a sick and gloomy Edgar Allan Poe writing his first successful tales in a row house on Amity Street; an ambitious young Spiro Agnew presiding over a suburban PTA. You think about an enchantress, Wallis Warfield—destined to become the Duchess of Windsor—being presented to Baltimore society at the bachelors' cotillion.

Baltimore is the birthplace of "The Star-Spangled Banner," and when you sing it here—as I did at a baseball game—you sing it with fresh pride, a special poignancy.

The Battle of Baltimore, which the national anthem commemorates, was one of the most decisive in the War of 1812—the nation's "Second War of Independence." And when you think of Baltimore's feisty sons facing down those British regulars who had just burned Washington, you know that Baltimore's patriotism runs deep.

Orderly ranks of row houses, fronted by the city's famed marble steps, march toward the downtown skyline. Inspired by European architecture, row-type design has been the mainstay of Baltimore housing for two centuries. Row-house residents have included Edgar Allan Poe, H. L. Mencken, and Babe Ruth.

City of many nations, Baltimore treasures her ethnic variety. In proud tribute she stages weekend festivals to celebrate the customs of 26 distinctive groups.

Pioneer settlers created a colonial waterfront at Fells Point (**left**), where browsers now quench their thirst while searching for flea-market bargains at the annual Fun Festival. Preservationists initiated the fair in 1966 to protect the neighborhood and its 18th-century architecture from a new highway. Politicians take advantage of the event for speechmaking.

For the Greek Festival by the Inner Harbor, Koula Giacoumakis (**below**) wears a

colorful 1890's wedding dress from the isle of Rhodes.

Lithuanian teenagers (**upper right**) whirl around Hopkins Plaza, high-stepping their forefathers' national dance.

City Council President Walter S. Orlinsky (**right**) waves from an antique-car parade through the streets of Hampden, where cotton mills burgeoned in the 19th century. Factory owners here built workers' homes of local stone; many of them survive.

BIANCA LAVIES, NATIONAL GEOGRAPHIC STAFF (ABOVE AND FACING PAGE)

Yesterday in the bay, tonight on a restaurant table, an 87-pound black drum is hefted to a cleaning table at Baltimore's Wholesale Fish Market. Here last year some twenty dealers sold 22,000,000 pounds of Atlantic Coast seafood, including Chesapeake Bay specialties—succulent oysters and hard- and soft-shell crabs.

Lending a helping hand, poultryman George Hummel (**right**) sells peaches at a friend's produce stall, one of a hundred family-owned stands in Lexington Market.

Bold ventures in medicine and the humanities have long been part of the city's rhythm. At Johns Hopkins Hospital, the blue-baby operation and the technique of closed-chest heart massage were developed. At Johns Hopkins University, philosophers Josiah Royce and John Dewey earned their Ph.D.'s. Here literary experimenter Gertrude Stein studied the brain, and novelist John Barth teaches in the Writing Seminars.

Listening to Baltimore's musical children, you sense other rhythms: the blues by Billie Holiday, arias by Metropolitan diva Rosa Ponselle, rock creations performed by Frank Zappa and the Mothers of Invention.

To see their city as Baltimoreans do, I kept

posing the question: What's Baltimore like?

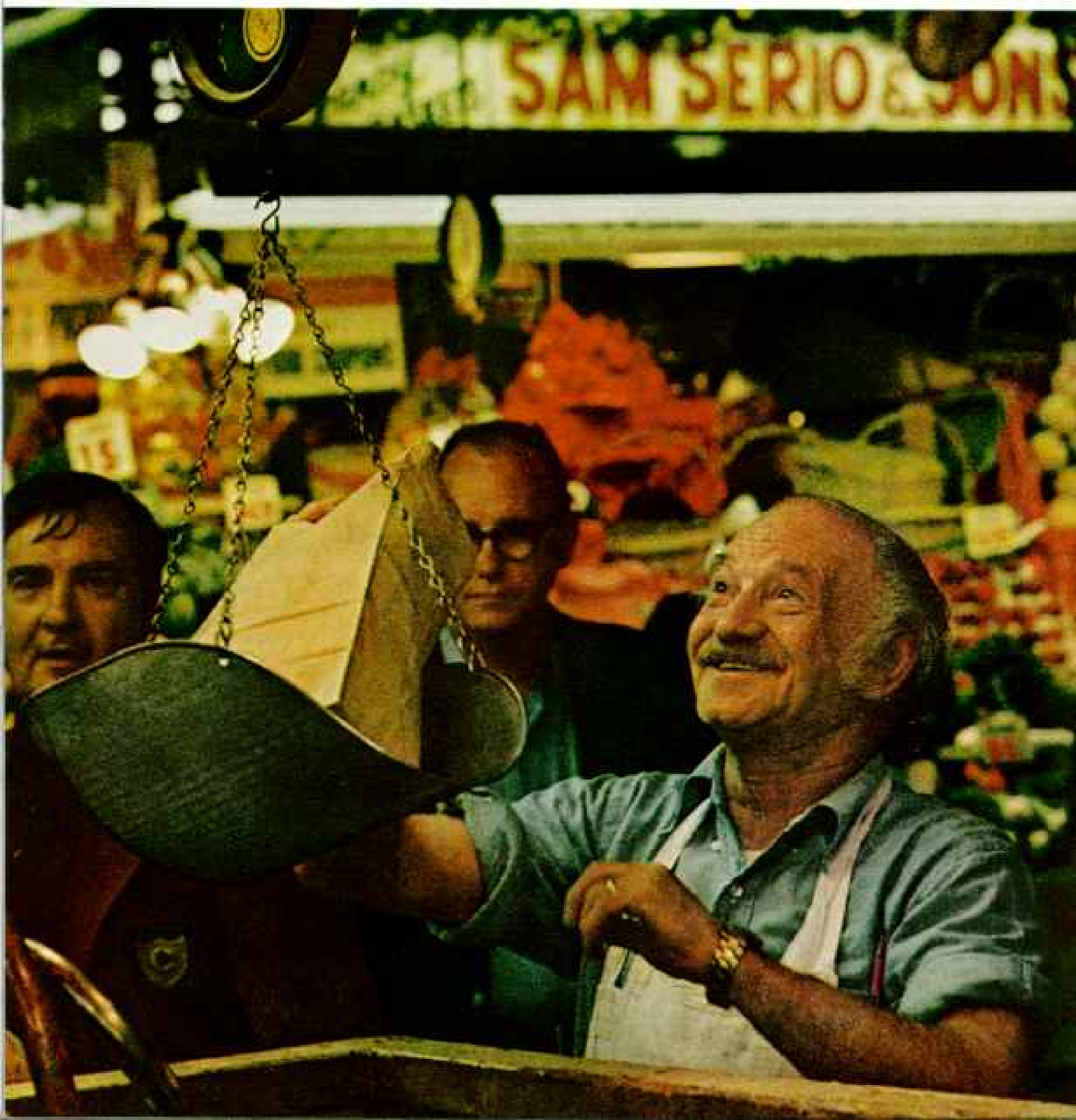
"Earthy, way out, funky like San Francisco," said a young filmmaker. "Clubby like London," said a college professor. "Wild like New Orleans," said a ship's carpenter.

"Baltimore's a Capricorn," an astrologer told me. "It combines a certain impetuosity—leaping into venturesome projects—with conservative traditions and a love of the material."

You keep hearing about the material pleasures of Haussner's, a Baltimore institution that features wall-to-wall, ceiling-to-floor *objets d'art*, as well as a menu of mouth-watering diversity. One evening at our table my gaze took in a little girl with a St. Bernard dog, the ocean crashing on a beach, women gossiping at a village well, mounted men doing battle, naked nymphs—a hundred scenes and statues. My attention was diverted by the steaming dish of baked rabbit and spaetzles set before me. "Take your time," the waitress told us as our party relaxed an hour after dessert, feasted in eye and palate.

The city endures: its pleasures, its problems, its past. The haunted faces from hell along the Pratt Street skid row; the charms of bucolic Dickeyville—an intact 19th-century mill-town-become-neighborhood.

Going north out Charles Street, toward the Hopkins Homewood Campus, I found another world emerging—of large, well-crafted homes and green lawns. I kept going, beyond




HAMBURGERS

the city limits, and before long I was in the Maryland countryside of fox hunts and fine horses, of elite Goucher College. Returning into the city, I passed by Bryn Mawr School, where headmistress Edith Hamilton steeped a generation of young girls in the glories of ancient Greece and Rome.

"Bawlmer's got sex appeal," said Sweeney the cabdriver. "It's real, the people act natch'l, ya know what I mean?"

Victorian Acropolis Preserves the Past

The city's name comes from Gaelic words meaning "place of the great house." It harks back to the Ireland of the Lords Baltimore, whose ruling baron was proprietor of Maryland when the town was founded in 1729.

The lords left not only their name, but also their gold-and-black livery. It seems that the Baltimore oriole, a spring and summer visitor to the city, was so named because his plumage resembled his landlords' colors.

Today's Baltimore has many great houses, most numerous in Roland Park, Guilford, Homeland, and other garden enclaves favored by Baltimore society.

Most elegant vision of the gilt-edged 19th century is Mount Vernon Place. Recently designated a national historic landmark, this block of four park squares and splendid town houses stands aloof on a downtown hill, like a Victorian acropolis. Two of Baltimore's venerable temples of the arts give the area its continuing vitality. The Walters Art Gallery, where I saw exquisite Coptic jewelry, houses treasures that range back to civilization's dawn. Across the street the Peabody Conservatory of Music has sent sweet sounds out into the world for more than a century.

In a changing section of the city once compared to Mount Vernon Place stands a well-shaded 21-room brick mansion, the home of a lady whom Rembrandt would have painted in a golden light. Patroness of the arts and active citizen, daughter of a leading Baltimore merchant and wife of an esteemed Johns Hopkins physician, Florence Hochschild Austrian has, for 60 of her 80-some years, lived and raised a family here on Eutaw Place. While many of the city's gentry have moved to the suburbs, Mrs. Austrian has stayed put while noise, debris, and problems beset her once tranquil neighborhood.

Nearby stand two of her favorite places—the Maryland Institute, where she studied painting, and the Lyric Theatre, home of the Baltimore Symphony Orchestra and the Baltimore Opera Company. Over the years Mrs. Austrian has helped keep them all in good health.

Sitting in the shade of her veranda, I asked about her role in sustaining Baltimore's cultural life over the past half a century. She genially put the question aside.

"What I'm really interested in is urban renewal—being a kind of guardian to the neighborhood and stopping them from tearing everything down. I guess you might call me a preservationist.

"Who would go to Paris, Munich, London if the hearts of those cities were destroyed? The real goal is to renew Baltimore so people will want to continue to live here and come here to *our* museums and *our* symphony."

Downtown renaissance: Spacious Charles Center Plaza (**left**) frames "Energy," a 33-foot free-form bronze by Italian sculptor Francesco Somaini. Hamburgers, a clothing store, occupies one corner of the showcase, built to rejuvenate the decaying inner city. Christened Baltimore Town in 1729 in honor of Charles Calvert, fifth Lord Baltimore, the 78-square-mile city of 905,000 sprawls along the Patapsco River, which gives it easy access to Chesapeake Bay shipping lanes (**right**). The 310-square-mile area of greater Baltimore is home to 1,600,000.

ROBERT S. PATTON, NATIONAL GEOGRAPHIC STAFF

This is a workingman's city, a beehive of makers. Silversmiths and masons have long excelled here. Men toil around the water: refining steel and copper, making paint and soap, loading and unloading ships, building and repairing ships.

The city's economic hub, and Maryland's single most important economic asset, the port of Baltimore each year handles some 4,500 ships and more than two billion dollars' worth of cargo. In tonnage of foreign commerce it ranks fourth in the nation, after New York, Philadelphia, and Norfolk. In a city of half a million jobs, much of the day's labor is done by blue-collar workers along 45 miles of industrialized waterfront.

Still gracing the waterfront neighborhood of Fells Point, 18th-century houses speak of a time of master shipbuilders. From here swift Baltimore clippers carried flour and tobacco across the seas, and returned with various cargoes—Brazil's coffee, West Indian molasses, sugar, and fruit.

Sounds and scenes of construction pervade the inner city. "Hey, where ya been all m'life?" yells a hard hat straddling a lofty girder to a miniskirted beauty below. At the end of the day, in one of the city's many corner bars, she will compete as a topic of conversation with whether the Orioles can win another pennant or whether the Colts will ever again see the likes of legendary quarterback Johnny Unitas.

Quaint traditions are part of the city's heart —and part of her work force as well. San Francisco has her cable cars, London her

Tinkling bells accent traffic's roar when Duke, a dapple-gray pony, makes his rounds. His master, "Khaki," one of Baltimore's 175 "Arabs"—nomadic fruit and vegetable hucksters—rents Duke and the wagon for $5 a day; the vehicles must be licensed. "I got me a good pony," Khaki says, "and no bosses. I go where I please and quit when I'm tired. Money's good, and so's the work."

double-decker buses, Baltimore her street Arabs—pony-and-wagon hucksters of fruits and vegetables *with soul.*

Gertrude Stein remembered them in the "Baltimore, sunny Baltimore" she knew nearly a century ago. They are still some 175 strong, a corps of "A-rabbers" who not only offer "the best peach in the city" but also give you the opportunity of calling someone by a nickname of rare originality.

"Hey, Mooseface!" "Say hey, Ratpea!" "Jackpot Crapper," "Heavy Mose," "Man-boy," "Aunt Sam Cootsie."

"Got me gooood grapes today, juuuicy pears 'n peaches, what'cha need?" I walked on the sidewalk alongside "Bunkey's" wagon as it squeaked through heavy downtown traffic, pulled by his faithful pony of six years, Buck. Sitting beside him was his 10-year-old helper who jumped off here and there to deliver orders to regular customers.

A man came up and said he was buying a peach. He split one and dropped it into the gutter. Then another.

"Some's ain't juicy, mister, not all's," said Bunkey. The man bit into a third and what seemed like a glassful of juice cascaded down his clothing and left a tiny puddle on the sidewalk. Undeterred, the man finished his peach.

"Tha'sa mighty good one," said Bunkey. The man agreed, and paid for it.

"Some peoples say we cause traffic jams and treat the ponies bad," Bunkey told me. "We had us a demonstration 'while back, dressed the ponies all up. You should'a seen all the peoples feedin' 'em an' pettin' 'em. Naw, thems I talk to say they wants us to stay. I been doin' this 20 years. And my fatha 'fo me. The work ain't bad."

With that he began to drive off. "Sho' co'n, Sho' co'n. . . ." Naturally his corn is from Maryland's Eastern Shore—that's the best.

Remembering the "Great Debunker"

One of the city's most famous sons, critic and journalist H. L. Mencken, worked in New York as an editor during the twenties, but he commuted back to Baltimore, to his German neighborhood, to his Hollins Street row house, whenever his job allowed. He likened his return to "coming out of a football crowd into quiet communion with a fair one who is also amiable, and has the gift of consolation for hard-beset and despairing men."

His irreverent wit was more characteristic: "An idealist is one who, on noticing that a rose smells better than a cabbage, concludes that it will also make better soup."

Recently friends and the faithful gathered at the Enoch Pratt Free Library—perhaps Baltimore's true cultural center—to honor Mencken's birthday. Had he lived, the "Great Debunker" would now be 94.

Mencken's gadfly barbs, sent forth with typical Baltimore directness, stung those perpetrating what seemed to him the excesses of post-World War I America: puritanism, philistinism, and supersalesmanship. Friends saw another side: his blue eyes sparkling, his whimsical smile, his jokes, his stories.

"Henry loved music in the best sense of the amateur," Peabody composer Louis Cheslock recalled. "He played *secundo* piano in the orchestra of our Saturday Night Club with the same facility he had at the typewriter."

To the Silent Screen Via Baltimore

The festivities included a film called *Mencken's America.* Next to me sat Paul S. Lake, a dapper hotelier in his eighties who knew Mencken in his heyday. A photograph flashed on the screen: Mencken gleefully toasting the end of Prohibition in 1933.

Mr. Lake nudged me. "I had just handed him that glass of beer," he said.

"A typical Baltimore experience," my friend Joe Raymond commented when I told that bit about Mr. Lake. "This is a city with a thousand footnotes."

Joe's wife, Betsy, who was lunching with us at Marconi's, couldn't resist giving one of her own about the great lover of the silent screen, Rudolph Valentino. "He once worked here as a waiter and lived upstairs."

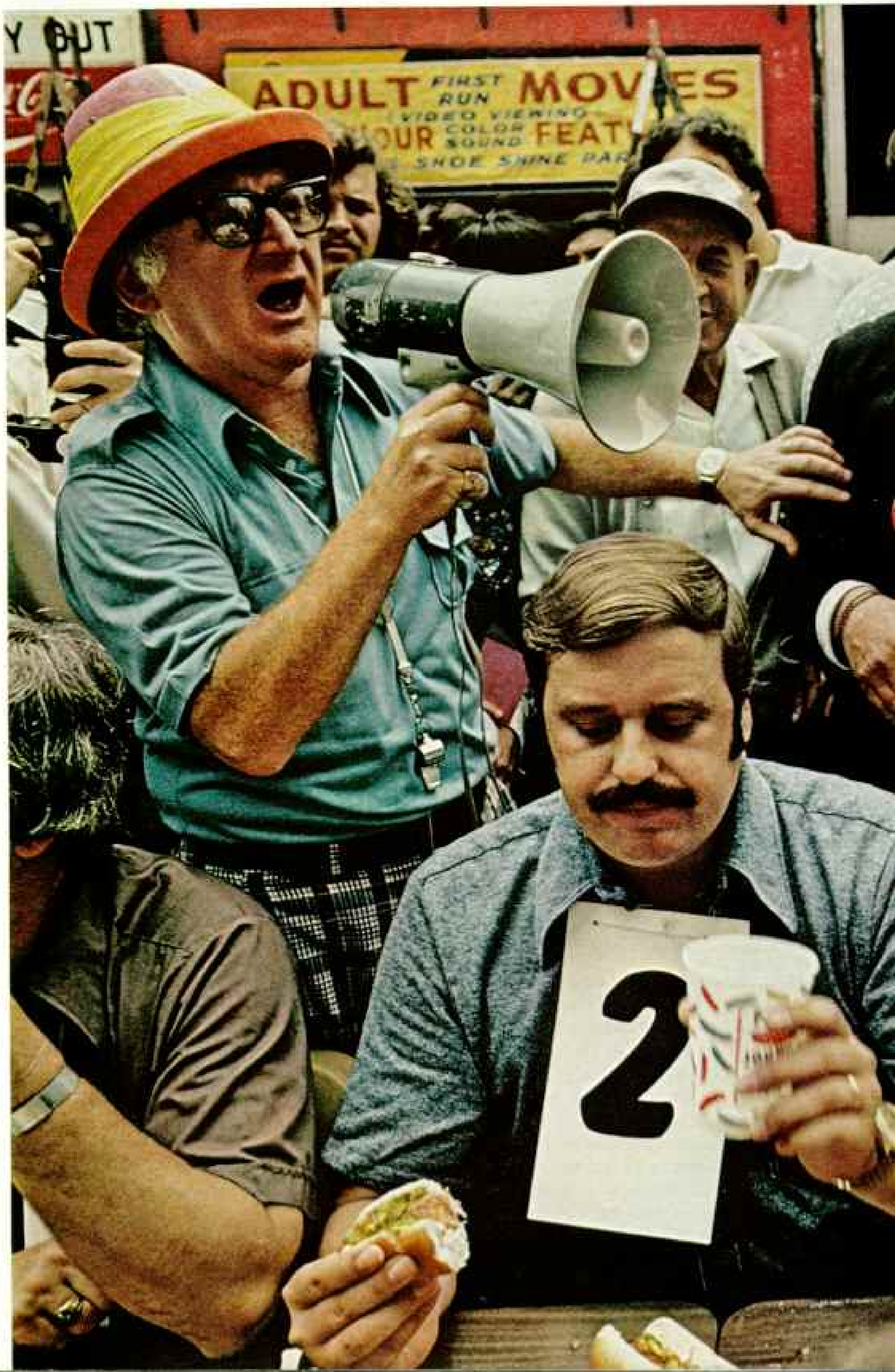
"A thousand and *one* footnotes," Joe said.

That quality of nostalgia in the very air of the city affected novelist F. Scott Fitzgerald —actually Francis Scott Key Fitzgerald, after his great-uncle. The creator of *The Great Gatsby* lived in the Bolton Hill neighborhood during the 1930's while finishing *Tender Is the Night*—just a block from the Raymonds' three-story town house.

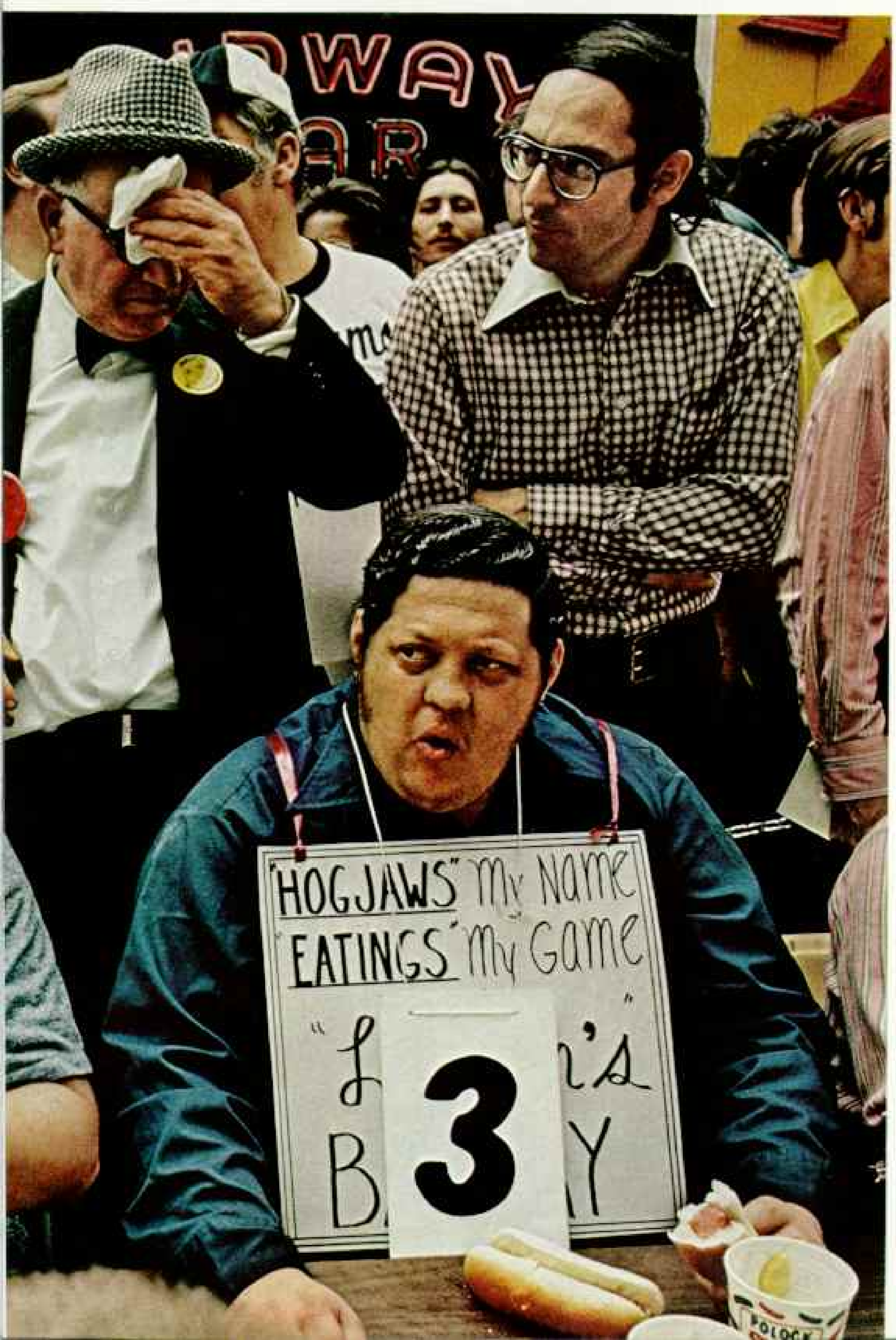
"Baltimore . . . is so rich with memories," Fitzgerald wrote; "it is nice to look up the street and see the statue of my great uncle and to know Poe is buried here and that many ancestors of mine have walked in the old town by the bay. I belong here, where everything is civilized and gay and rotted and polite."

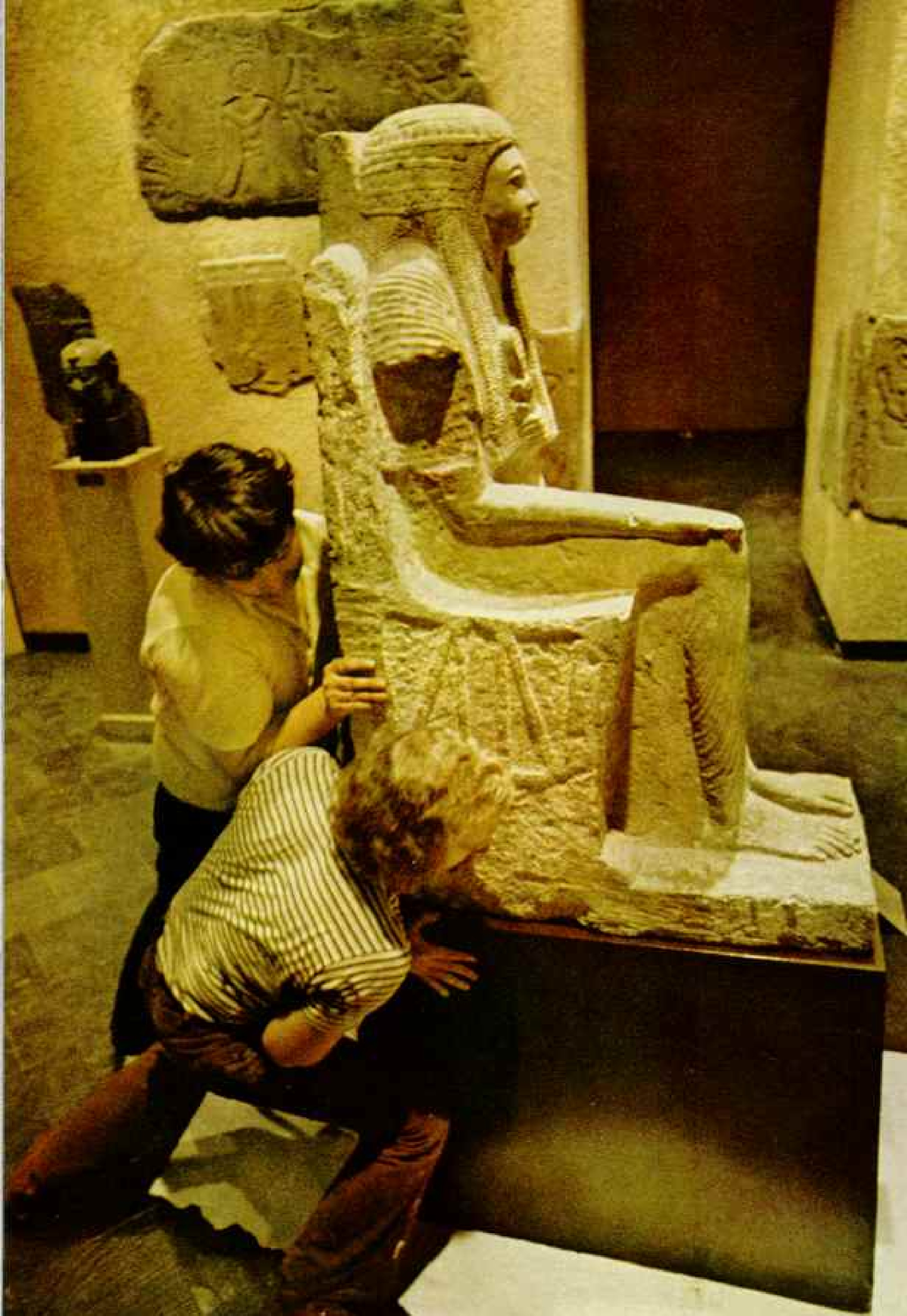
The "civilized" tradition also includes fine

Ate too much, ate too fast: Nearly sated, contestants prepare to bite the dust in the Seventh Annual Polish Sausage Derby as honorary chairman Frank Rosenfeld, Baltimore's tireless booster known as "Mr. Diz," mops his brow. Sponsored by Polock



Johnny's Joint, a gastronomical landmark in the "Block" of striptease bars and adult-movie houses, the eat-off raised $1,474 for charity. The winner took an hour to wash down 21 of Johnny's famed "unburgers" with black coffee—and later, four soothing seltzers.





horses. In posh Worthington Valley—northwest of the city—fence-jumping equestrians vie every spring for the Maryland Hunt Cup. The valley's horse-breeding fame rides on the Vanderbilt-owned Sagamore Farm, home of Native Dancer and Discovery.

At Pimlico Race Course on Preakness Day, the city's sports event of the year, I saw an all-day rite of spring animate the infield. A mostly young crowd picnicked mostly on beer, while Frisbees and footballs contested for the airspace above them. One man pitched a large blue tent for a reunion with friends from college days. Several streakers raced around until they were tired. A rock band laid down a barrage of cacophony.

Late in the afternoon, the playing of "Maryland, My Maryland" announced the running for the Baltimore tiara in the Triple Crown (Kentucky Derby, Preakness, and Belmont Stakes). People in box seats put down vodka-and-rum-laced "black-eyed susans" and picked up binoculars. Thousands in the infield hugged the fence line, hoping for a glimpse of the elite Thoroughbreds as they vibrated past.

Then they were off and running for the 99th Preakness Stakes, worth $209,000. Less than two minutes later, amid shouting, hand wringing, and jumping up and down, Little Current came home first. My 30-to-1 shot, Jolly Johu, placed fourth. Win-Place-Show, nothing for fourth but the thrill of it all.

I asked Nathan Cohen, a Pimlico owner, if he had bet on the race. He smiled. "I don't know how to pick a winner. But a lot of people here do. Baltimore's a horseplayer's town."

One horseplayer told me that he had missed a friend's wedding for the Preakness. "Listen, the bum let me down," he protested. "We planned a year ago to be here today."

Curious about Baltimore's notorious "Block," I sat at the bar of the 2 O'Clock Club waiting to talk to Blaze Starr, the city's famed queen of burlesque.

Her club seemed a touch of glamour in an otherwise tawdry Casbah of striptease bars, flophouses, restaurants, peep shows, and X-rated bookstores, which, since World War II, has been flashing like a garish neon sign in the nightlife of this worldly port city.

Sitting next to me at the bar was a dour, gaunt man in his fifties, a John Carradine-like character who was grumbling at his beer.

Blaze appeared, resplendent in a green sequined gown that accented her red hair and her famous charms.

"Here!" The gaunt man reached past me

Still pampered after 3,000 years, an Egyptian priestess (**left**) moves to a new display wing in the Walters Art Gallery. The museum's vast collection, representing nearly every age of history, was willed to the city in 1931 by railroad magnate Henry Walters, a native Baltimorean.

The city's rich cultural life provides a medley for ear and eye alike. During a performance of the Baltimore Symphony, 34-year-old Associate Conductor Andrew Schenck (**right**) cautions *pianissimo*. The regularly scheduled concert series, special shows for children, and free concerts for area schools keep the orchestra's musicians busy.

and banged down some cash in front of her. "I'm repaying my debt, with interest." He put a pack of cigarettes and a pack of gum beside the money, and smiled. "She ain't afraid to lend an old friend a few bucks."

Blaze doesn't talk much about her civic work, but the people of Baltimore do. She has given Christmas and Thanksgiving fetes for the children of a local orphanage, and has performed in special programs for hospitalized servicemen.

Down the street, old buildings have been marked for destruction as part of urban renewal, a bad word along the Block. "Oh, there will always be a Block in Baltimore," Blaze said. "If not here, somewhere else. But I guess I'll retire when this goes. Maybe they'll make my autobiography into a movie."

Minutes later she was on stage, bumping and grinding through her famous routine. In her hand she held a rose, and she tossed and blew the red petals to willing catchers.

Everyone seemed to be dancing at a folk festival of the Lithuanian community in Hopkins Plaza. When the music paused, I walked over to a booth serving liquid refreshment.

Splashy finish churns a quagmire track at Pimlico (**right**), in a race preceding the famed Preakness. Fans follow the action from the vantage point of the open boxes (**above**). This spring the race course will host the 100th running of the Preakness, main event in a week-long, city-wide festival that features a regatta, a frog hop, and "The Great Baltimore Balloon Race" across Chesapeake Bay.

"Try the Lithuanian national drink," said Mrs. Zita Saurusaitis, handing me a jigger of amber-colored liquid. "It's called *viritas*."

"*Veritas*, as in *truth*?" I asked her. "So this is truth!"

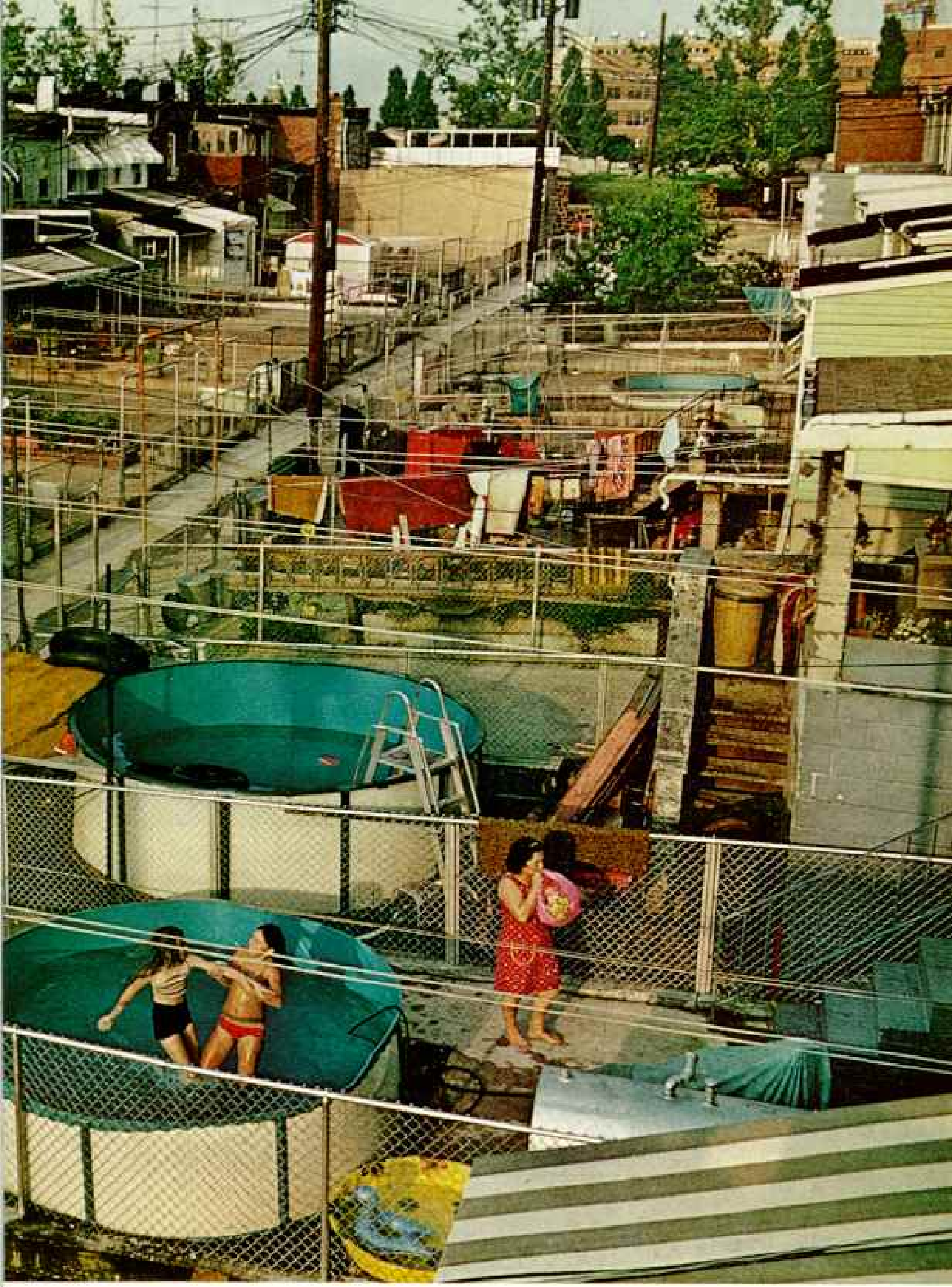
"*Sveiks!*" she gestured. "Your health!" I downed the "truth serum" and asked for the recipe. "Maryland rye, 100-proof—that's important," she said as she poured more "truth." "And just experiment with clove, orange, honey, cinnamon. . . .

"Drink up," Mrs. Saurusaitis said. "The money's going to a good cause, the Lithuanian Saturday School—where the children learn about their heritage: history, literature, our language. Did you know that the Lithuanian spoken today is virtually the same as it was in the Middle Ages?"

The Reverend Casimir Pugevičius—Father Cas to everyone—moved through the crowd carrying a microphone, followed by two young men toting a videotape outfit.

"I run the documentation center for the Lithuanian community," Father Cas told me. "We're collecting memories of the old country, and Baltimore too. Our people have been in

Life between the roofs adds neighborly intimacy to Highlandtown, a



community in East Baltimore where backyards serve as summer playrooms.

the city at least a hundred years. We started out as a community of tailors. See that man over there?" A short, intense man looked at us and smiled. "He fought in the underground against the Russian occupation. A desperate struggle. . . ."

We went over to a regal old gentleman in a black cape. "This is Nadas Rastenis," Father Cas said into the microphone, "our community's venerable poet laureate."

The octogenarian poet told of his translating Lithuanian writers into English and Shakespeare into Lithuanian, of his years as a Baltimore attorney. With a flourish of his cape he raised his hand and recited in Lithuanian from "our greatest poet, Donelaitis."

Later I mentioned to Mr. Rastenis that two of my grandparents were Lithuanian, but they became Americanized and never talked about their homeland. "Today, for the first time, it means something to me," I said.

"We share a glorious heritage, my friend," he said. We had a hearty handshake. "*Landsman!*" he said, and we gripped harder.

Mad Scheme Creates the B & O

Baltimoreans have always been house proud, neighborhood proud, proud of their heritage, a heritage ultimately shaped by this city's regional personality, once alluded to by Baltimore poet Ogden Nash:

The tip of the South and the toe of
the North,
It constantly teeters back and forth.

Another peculiarly Baltimorean mix: that of the South's social traditions and the North's economic dynamism.

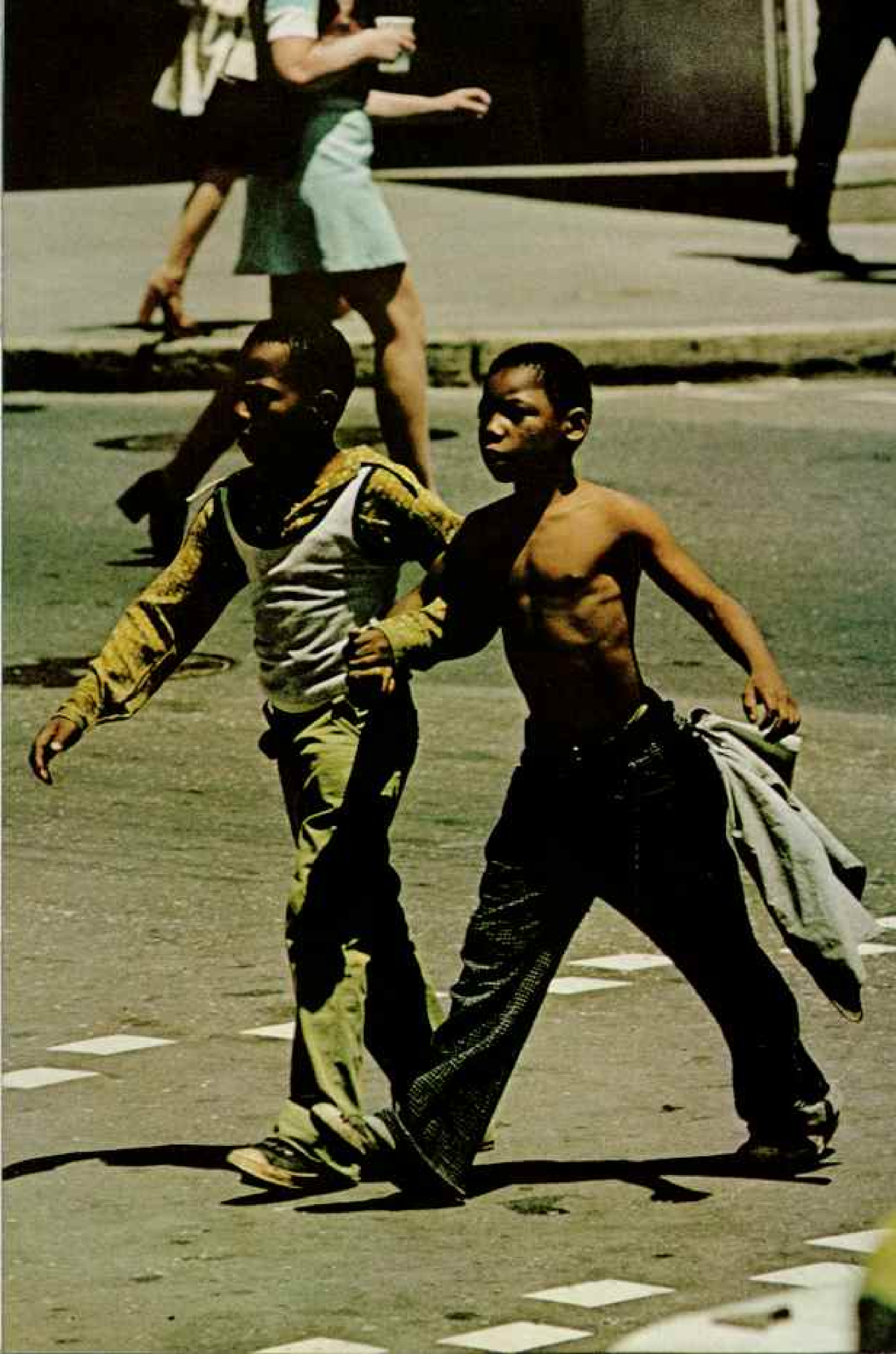
By 1830 this ambitious port on the Eastern Seaboard had passed Philadelphia to become the nation's second largest city. The threat, a few years earlier, of the Erie Canal diverting valuable western trade to New York only made Baltimore try harder.

In the uncertain dawn of rail transit, building the Baltimore and Ohio seemed a mad scheme. Baltimore succeeded then as now because of her fast and flexible enterprise. She has long held her status as one of the largest U. S. cities—currently No. 7.

But in this city, bigness doesn't have to mean bustle. "Baltimore fits like a comfortable old shoe," said Richard Hart, an "upper-bohemian" Baltimorean—which in his case means an unconventional man of letters who also served as a Pratt librarian for 40 years.

He bid on Baltimore. Stockbroker George King, seated at his desk (**above**), left New York to settle in "Bawlmer," as the natives call their town. He and his wife, Paula, are among the first "homesteaders" in a city-funded project to renovate derelict houses. For a nominal dollar and a commitment to refurbish in two years, the Kings bought a vacant row house near Lafayette Square. Enthusiastically they wielded hammers, saws, and paintbrushes to help make their new home pleasingly livable.

Pride showing in their stride, two youngsters (**right**) hurry to a mid-city rendezvous.



Two roads to recovery: the bunny trail and the red line. At Johns Hopkins Hospital a young patient meets a rabbit named Pumpkin, with the introductions made by teacher Janet Stophel (**left**) of the institution's Child Life Department. Children play and learn while they heal; parents visit anytime and can even room here, and the therapeutic sound of laughter floats through the corridors. At the Maryland Institute for Emergency Medicine, a medical team (**below**) ministers to a patient helicoptered in from a rural area. Swift treatment for grave injuries or illness has boosted the statewide survival rate for such patients to 80 percent.

"Southern, traditional, perhaps. But I see it, most of all, as a high-minded place rather than an exclusive place."

High-minded Baltimore is a city for getting on with her dreams. You see a metropolis in the midst of a great reconstruction, one that has begun cosmetically with her appearance and hopes to include her spirit as well. The rebuilt heart of downtown—the Charles Center-Inner Harbor Project—with its gleaming towers and elegant plazas, seems to say: Look and take inspiration.

In the mid-1950's Baltimore was dying. Its downtown was near bankruptcy, its white population was moving to the suburbs, there was a shortage of decent low-cost housing, and it had thousands of abandoned homes and blocks of heavily populated urban blight. Now there are many beacons of a new Baltimore, some already shining, others shining as dreams that men are making come true.

"The new Baltimore began here," Executive Director William Boucher III told me, "at the Greater Baltimore Committee, with the business leaders of the community. This is where the imagination and daring were, and it was a big gamble—one billion dollars. From the start all you heard was 'Never happen in Baltimore.'"

But the dream of a better city was entrusted to men who said it *could* happen, men like Walter Sondheim, J. Jefferson Miller,

and Martin Millspaugh. With the drive of Baltimore businessmen of 1827, when the epoch-making B & O Railroad was begun, civic leaders, working hand in hand with city government, have carried the Charles Center-Inner Harbor Project from vision to reality.

Turning the Exodus Around

The city official most directly involved in Baltimore's reconstruction is Robert C. Embry, Jr., a 37-year-old Harvard lawyer now serving as Commissioner of Housing and Community Development.

On a tour with Mayor William Donald Schaefer and Maryland Governor Marvin Mandel, Commissioner Embry stopped to point out a beauty spot in a redeveloping East Baltimore neighborhood. "The thing of greatest value is the small contribution," he said. "You see that uniquely painted house over there or that vacant lot planted with flowers, and you say 'This block's alive.'"

He told me later: "One of Baltimore's great extras is that it has a lot of preservable housing. We can rejuvenate in many cases, rather than tear down buildings and uproot people."

Urban-renewal projects have included the rehabilitation of 1,500 of Baltimore's ubiquitous row houses and an experiment called urban homesteading that offers vacant city-owned houses for a dollar each to buyers who agree to rehabilitate them within two years. And work will soon begin on an ambitious "new-town-in-town" called Coldspring—4,000 dwellings on a hilly wooded site conceived to entice middle-income families from suburbia to a well-planned, architecturally exciting city neighborhood.

I talked to one of the homesteaders as he put a new floor in his one-dollar house. "This

is going to be a lot of fun fixing up," he said, "thanks to the loan the city helped me get. I may live in it or just sell it and make a nice profit. Help the city, and help myself too."

A young black man, lunching with me beside the fountain in Charles Center's Hopkins Plaza, took another view. He gestured to the new office buildings, the new high-rise apartments, the striking new Morris A. Mechanic Theatre looking like a monumental sculpture of gigantic concrete cubes.

"It's nice, you know, everybody's gung ho. But man, I ain't got a job. You dig? This is all a waste of money to me. Where am I in this here new city? We need jobs, not a bunch of ten-million-dollar buildings."

While the city continues to develop programs aimed at creating economic independence among its poorest residents, minority-group jobs remain a stubborn problem. A

Sweeping the bases for the Baltimore Orioles at Memorial Stadium is a real "groove" for Donna Parker (**above**), a junior-high-school student hired as a broom girl. The city's rabid sports fans follow the ups and downs of five professional teams—the Orioles, football's Colts, hockey's Clippers, soccer's Comets, and the Banners of team tennis.

Swiping the ball, University of Maryland's lacrosse goalie Jake Reed eludes the jabs of Johns Hopkins' Franz Wittelsberger (**left**). Art Seekamp, No. 16, joins the action at Johns Hopkins' Homewood Field. Known for its winning lacrosse teams as well as for its medical school, Johns Hopkins won the national collegiate championship in 1974.

recent study commented: "Opportunities for employment in Baltimore are . . . too sharply limited for satisfaction. There are not enough jobs . . . good jobs . . . secure jobs; and there are not enough trained people for the highly technical positions that have gone unfilled."

Blacks Begin to Win Key Public Offices

A voice often heard speaking out for the concerns of the black community—50 percent of Baltimore's population—is Dr. Homer E. Favor, Dean of the Center for Urban Affairs at Morgan State College.

The center—in its fifth year—is a tool for change that he conceived and implemented with the aid of the Ford Foundation and the State of Maryland. I asked Dr. Favor what changes the center has helped to bring about.

"We worked to get Parren J. Mitchell elected to the U. S. Congress and Joseph C. Howard elected as judge of the Supreme Bench of Baltimore—two of the city's outstanding men, who just happen to be black," Dr. Favor told me. "Baltimore is now considered a prime example of the success of black determination to advance through the elective process.

"In many ways Baltimoreans are fair-minded people. I think one of the problems in the past has been not having the best men running for office.

"But big problems still face us. Our neighborhoods remain decaying next to viable white ones. And when black areas *are* reclaimed, where will our people go? Baltimore County is still a stronghold of segregation.

"Neither we nor the city can claim real progress when the mass of black people continue to be poor and opportunities dwindle."

Searching for a hopeful note, I cited a book, *The Death and Life of Great American Cities*, in which city theorist Jane Jacobs concludes:

"Dull, inert cities . . . contain the seeds of their own destruction and little else. But lively, diverse, intense cities contain the seeds of their own regeneration, with energy enough to carry over for problems and needs outside themselves."

Dr. Favor praised her view, but with a qualification. "One can only hope that Baltimore's regeneration has enough stamina to

City of the "rockets' red glare" finds a modern echo in light-blazing skyscrapers. Waters that held British gunboats in 1814—when "The Star-Spangled Banner" was

succeed on a human scale as well as it is succeeding architecturally."

I pondered those words one summer Sunday afternoon as I sat near the statue of a contemplative George Peabody. I was in the Mount Vernon Place park near the conservatory, staying cool watching the play of an old fountain's waters. Then, through the trees, a flute song came drifting and magically touched the mood of my silent wondering. . . .

I remembered something Hopkins President Steven Muller had told me. "What I like most about Baltimore is that it hasn't been ruined by modernity. Here, there's still time for an intelligently planned city."

Finding Baltimore's Front Door

Aboard the *Port Welcome*, the port of Baltimore's excursion boat, I stood on deck savoring the salty breezes off Chesapeake Bay. I was on my way back to Baltimore from nearby Annapolis, Maryland's capital and showplace of colonial times.

Coming into Baltimore harbor, you realize, as if a great truth had found you, that this is how you should first approach the salty old queen—by water. She wants you to glide up her dusky Patapsco River courtyard, to get close and recognize first her reason for being. She wants you to feel the generative strength emanating from her industrial bulwarks, to see ships flying the world's flags.

"If you haven't sailed in, you've missed the city's gates," I imagined the old queen saying. "Now you can come in. Have a beer! Bring your friends too; we like parties."

What a gathering it would be! Mrs. Austrian, Bunkey the street Arab, Blaze Starr, the old poet Nadas Rastenis, Sweeney the cabdriver, Father Cas, the ghost of Mencken—and we would gather at a fine waterfront bar and meeting place, "The Horse You Came In On," and sit outside talking and laughing under the trees and the stars.

We would toast Baltimore—an old-fashioned city with gumption, persevering with style, like a small traveling circus in a modernizing world. A city that doesn't mind at all if you become sentimental about her. In fact, I'd say that's the secret of her charm. □

composed here—now welcome ships of many nations. Baltimore's port processes 50 million tons of cargo a year, an important source of energy for the city's thrust forward.

TED SPIEGEL, BLACK STAR

QUEEN ELIZABETH'S FAVORITE SEA DOG

Sir FRANCIS DRAKE

By ALAN VILLIERS

Photographs by GORDON W. GAHAN

NATIONAL GEOGRAPHIC PHOTOGRAPHER

I HAD NEVER SEEN A COAST that looked so much like southern England's. The white cliffs rose abruptly from the cold sea and the green moors rolled away inland, just like so much of the coasts of Dorset and Dover.

Almost four centuries before—in 1579—Francis Drake had known the same sensation as he touched the coast of California. Drake's nephew recorded that "the white bancks and cliffes, which lie toward the sea" suggested that the land should be called Albion, the White Land, an old Roman name for England derived from the chalky cliffs that look over the Channel. Drake himself called the place Nova Albion—in effect, New England—as he staked the claim of his sovereign, Queen Elizabeth I, by nailing to a post an engraved metal plate.

That morning as I stood on Point Reyes, 38 miles north of San Francisco's Golden Gate, I felt a special affinity for that fiery little mariner, plunderer of the Spanish Main, humbler of the Spanish Armada, and the first Englishman to circumnavigate the globe. Perhaps his adventures speak so eloquently to me because I too have sailed a wooden galleon like his, small and engineless, across an ocean. That vessel was the *Mayflower II*, which I commanded on a 54-day voyage from England to Massachusetts in 1957, the 337th anniversary of the Pilgrims' landing at the place they called New Plymouth.*

The first *Mayflower* reached America 42 years after Drake's *Golden Hind* intruded into the Pacific. No detailed descriptions exist of either vessel, but they must have been much alike: three-masted, about a hundred feet long, with high aftercastles that made them look rather like old shoes. Such ships changed little in those days.

Three months before he put in at what is now California, Drake had been gathering booty along the Pacific coast of the Americas—which had been, until his sudden appearance, a peaceful Spanish enclave.

"But he wasn't coming from the south when he saw this place," commented Raymond Aker as we walked along the firm sands that fringe Drakes Bay at Point Reyes. Ray is president of the Drake Navigators Guild, a group devoted to the study of Drake's circumnavigation and his North American contacts. "He was coming from the north, where he had hoped to find a way back to the Atlantic. His ship was leaky. He had to repair her. He needed a safe place to careen her. The estuary of Drakes Bay fit the bill."

Not everyone agrees that this is the site he chose; some think he was more likely to have sailed into San Francisco Bay. An archeologist excavating an *(Continued on page 223)*

*An account of the *Mayflower II* voyage appeared in the November 1957 GEOGRAPHIC. Editor Gilbert M. Grosvenor recalls Captain Villiers' long association with the magazine on page 149 of this issue.

KUNSTHISTORISCHES MUSEUM, VIENNA

"WELL FAVOURED FAYRE and of a cheerefull countenance," Drake harbored a ramrod will and gunpowder daring. When this portrait was painted, he had already plundered the Spanish Main and circumnavigated the earth in the Golden Hind. *Pirate and patriot, he "singed the King of Spain's beard" by raiding Cádiz and helping to defeat the mighty Spanish Armada, thereby heralding England's rise to world power.*

Running before the wind, a reproduction of Drake's *Golden Hind* (**left**) foots toward London on a trial voyage from Appledore, England, in August 1973; a diesel engine supplements her sail power. Devon-born and ruddy-bearded like Drake, mate Jan Pearce squints to windward to check the rigging (**below**).

The ship's American owners are sailing her through the Panama Canal, rather than along Drake's route through the Strait of Magellan, to Fisherman's Wharf in San Francisco where she will become a tourist attraction.

When Queen Elizabeth I officially recognized Drake's circumnavigation in 1581, she ordered *Golden Hind* into dry dock at Deptford near London in "perpetual memory" of the great voyage. Thousands of Englishmen and foreigners flocked aboard. But by 1618 the ship looked "exactly like the bleached ribs and bare skull of a dead horse," an observer wrote. Yet famous as she was, no precise plans or drawings survive. Based on drawings of other ships of the time, the new vessel was built 102 feet overall, with a 20-foot beam and a 13-foot draft.

Almost 400 years ago Drake

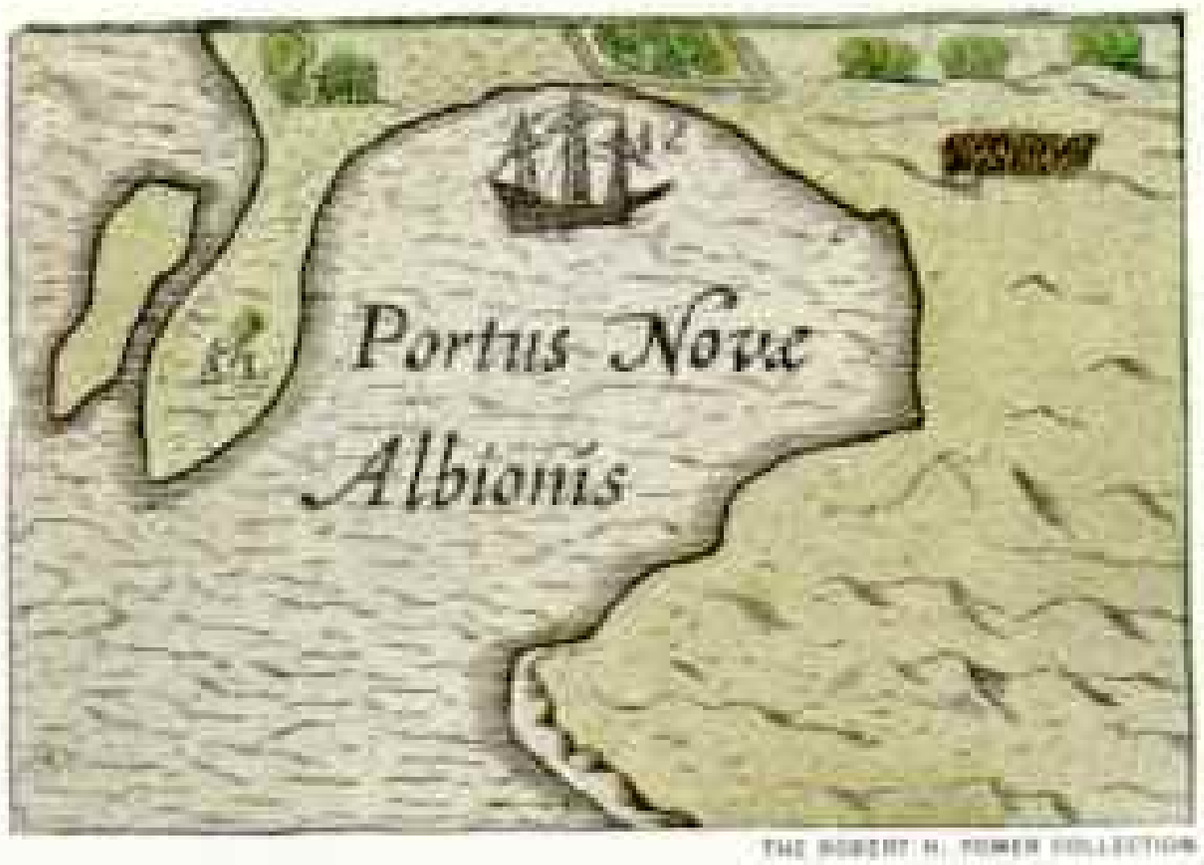
DRAKE THREW THE WEST COAST of the Spanish Americas into turmoil on his round-the-world voyage. But when he reached a "faire and good Baye" in California on June 17, 1579, he set the stage for a historical dispute that still rages. Where did he land?

Drake had first sailed north in search of a passage to the Atlantic. Some say he went as far as Vancouver Island. Nearly everyone agrees that he coasted along present-day Oregon before returning to northern California at about latitude 38° N. *Golden Hind* was leaking, and Drake needed a protected anchorage for repairs.

Foremost candidates for the correct bay, beginning with the northernmost, are Drakes (**above right**), Bolinas, and San Francisco (**above**). Proponents argued their cases in 70 pages of the fall 1974 issue of *California Historical Quarterly*.

Even later in 1974, archeologist Charles Slaymaker announced he had discovered at an Indian site excavation near the northern end of San Francisco Bay an English coin dating from 1567 and a glass bead probably of the same era.

Scrutiny of Drake's own logs might have resolved the dispute. Upon returning to England, though, Drake gave them to Queen Elizabeth. They have not been seen since. Maps and available accounts were either produced after the fact or based on secondhand information. A case in point: An inset from the rare Judocus Hondius world map of 1589, tracing Drake's circumnavigation (**left**), shows the anchorage. The tantalizing



THE ROBERT H. FISHER COLLECTION

landed in California—but where?

map has been used by each side trying to prove the case for its favored site. Undisputed, however, is the name. Drake claimed the territory for Elizabeth as Nova Albion, in essence New England, in a grand but futile gesture.

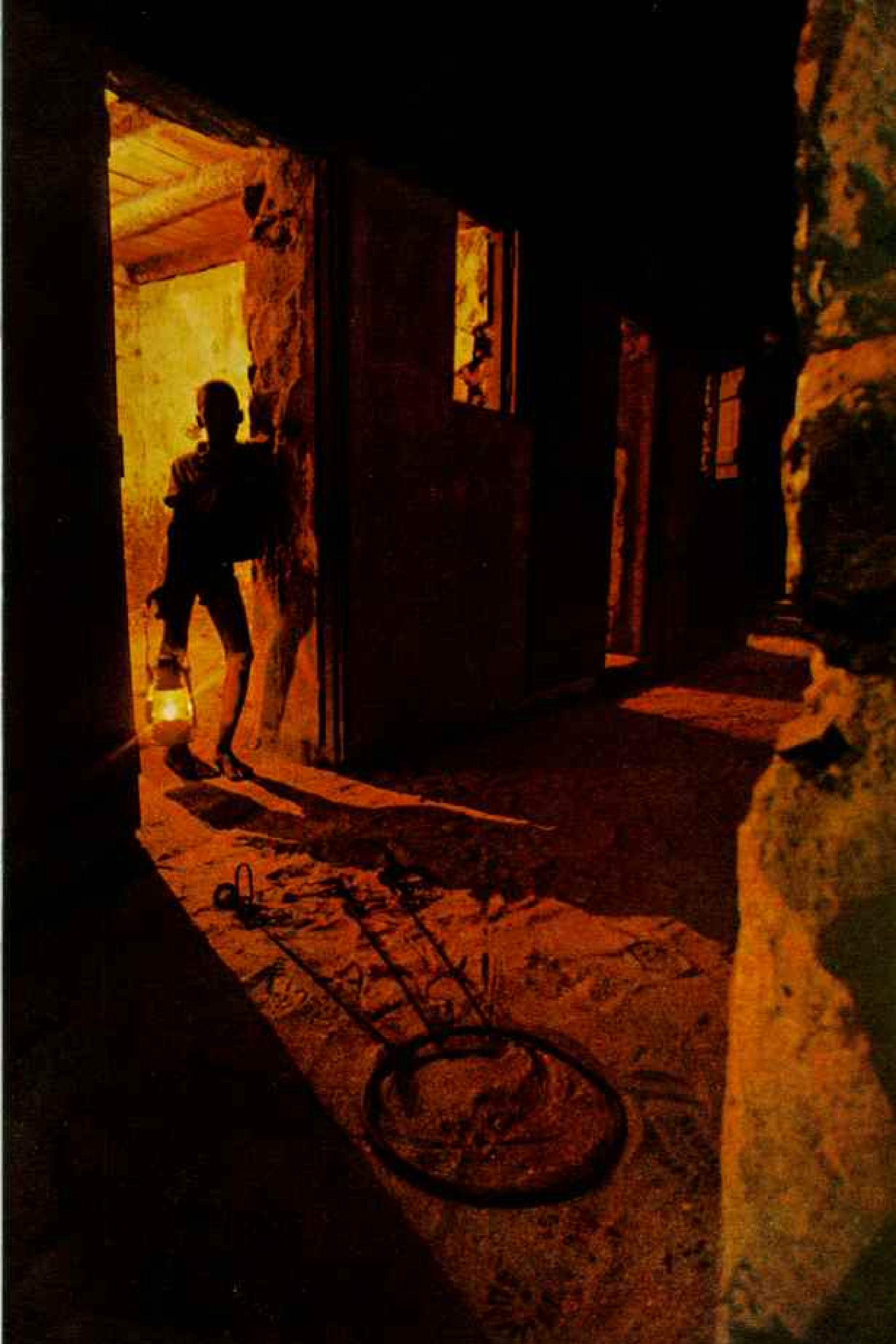
To commemorate the event, Drake had affixed to a post a plate of either brass or lead, which was eventually to add still more layers to the onion of controversy. In 1936 a man on a stroll near San Francisco Bay picked up what was undoubtedly a plate of brass (**right**), whose message, signed "Francis Drake," claimed Nova Albion for Elizabeth. The 8-by-5½-inch plaque has an opening in one corner that tallies with one journal's description, "a piece of sixpence [bearing Elizabeth's visage] . . . shewing itselfe by a hole made of purpose through the plate."

When the find was announced, yet another man claimed he had been first to find the plate, near Drakes Bay, but later chucked it from an open touring car near where it was discovered—or rediscovered.

The question of the plate's authenticity has yet to be resolved, despite extensive metallurgical, microscopic, and textual analyses. Some researchers feel the case is already proved; others are just as adamant that the plate is a hoax. Meanwhile, the controversial artifact rests in the Bancroft Library of the University of California at Berkeley.

After 37 days in Nova Albion, Drake put to sea from his still-unidentified harbor and its friendly Coast Miwok Indians and headed for home.

BY PERMISSION OF THE DIRECTOR, BANCROFT LIBRARY



Indian site near there reported only a few months ago the discovery of an Elizabethan sixpence apparently coined 12 years before Drake's visit, as well as a glass bead of the type used by Englishmen for trade with the Indians. Many seafarers, however, still favor the estuary at Drakes Bay, for they know (and I know) that the Golden Gate could be a difficult spot to find and enter in the days of sail.

Taking in the extraordinary "Englishness" of those white cliffs and thinking back into the mind of an old-time shipmaster groping along the shoreline, desperately in search of a safe careening berth, I know I would have been very interested as my ship rounded Point Reyes and the lonely inlet—easily visible from the open sea—came into view.

I'd round to, bring her up to the wind, ghost in, sound, and examine. And thank God.

I looked at the possible drying-out places with Ray, thinking of the shape of the bottom of *Mayflower II*. Yes, we could have careened her at several places, heaving her over when moored to a couple of anchors dug into the sand. A lot of work, yes, but no real trouble. The *Golden Hind* remained in California for 37 days.

WHO WAS THIS SEAMAN I was chasing to the ends of the earth, from the Strait of Magellan to Point Reyes, from the Cape Verde Islands to Java, from Spain to the Caribbean, Panama, and Chile?

To Spaniards, he was the pirate *El Draque*, and if they had captured him, he would have met a pirate's fate. But there were pirates and pirates in those days. Long engaged in a cold war with Spain (and finally a hot one), Queen Elizabeth had in Drake a freebooter who brought home loot, confounded Spanish forces, kept the enemy off balance, and taught him painful lessons. And since Drake was a private adventurer, Elizabeth could respond to outraged Spanish authorities that Drake had no license from her—though there is evidence that she backed him financially. No other single captain did more to humble the Spanish Empire and lay the foundation for England's mastery of the high seas.

From the few surviving paintings of Drake, a chubby-faced little man with pointed red whiskers stares out benignly. We know he was Devon-born in England about 1540, at Crowndale Farm near Tavistock, the oldest of 12 children fathered by a Protestant lay preacher. Those were times of unrest and religious persecution. His father had to flee his piece of land, finding a hard living as part-time minister to sailors on the River Medway in Kent. The family lived there in a hulk—a leaky, smelly, cut-down ship.

By age 12, Francis was at sea, learning that dangerous business in the tricky tidal waters of the Thames and Medway estuaries and the English Channel. He did well in this hard school—one of the toughest there was or is—so much so that the good old sea dog he was apprenticed to willed Drake his ship when he died. In her he acquired knowledge

Dark chapter in man's and Drake's history, the slave trade leaves an iron footnote: a ring and shackles (**left**) on Gorée Island off Senegal. On the nearby mainland, a farm couple now lives in simple freedom (**right**). Briefly party to this grim traffic, Drake sailed with a slaving fleet in 1566, its cargo an affront not to Spanish morality but to Spanish monopoly.

England's time had not yet come. Elizabeth sat on the shaky throne of a minor insular power. The English Navy was in a deplorable state. But the buccaneer Drake was abroad, and Spain would never again rest secure.

of those swift waters around southeast England—knowledge that served England well when the Spanish Armada came in 1588. A seaman of those days carried his sea lore in his head; it was stored from childhood and retained for life.

SOON DRAKE JOINED UP with his kinsmen the Hawkinses of Plymouth, shipowners and seamen. In the late 1560's Drake accompanied John Hawkins as he ranged the West African coast gathering slaves to take across the Atlantic. The Spanish monopoly closed the Caribbean and mainland America to English traders, but trade was possible with the connivance of local officials—if one dared to take the risks.

Hawkins sailed with a fleet of six ships, including a vessel under young Drake's command. They risked more than they bargained for in 1568 at San Juan de Ulúa, off Veracruz on the coast of Mexico.

As the bus from the Veracruz airport sped along beside the sea, I looked across the bay at a fortress of gray stone sitting upon a small island like a warship aground.

"It was here 40 years before Drake came," said the guide when I took a tour of the city. "We were constantly plagued by pirates. But Drake was thrown out of here, don't forget that!" The thought seemed to please him. But I was aware from other sources that there were two sides to the matter.

When Hawkins and Drake put in, they had storm damage and were short of food. They needed shelter to put their ships right. They wanted no trouble and said so. But while their battered vessels rode at anchor in this important Spanish port, a fleet of "thirteene great shippes," as Hawkins wrote later, arrived from Spain with a new viceroy.

Hawkins claimed his men could have kept those ships out of the harbor if he had wanted to. But he parleyed instead. It was agreed under flags of truce that the Spaniards would come in peacefully and that the English would sail as soon as they were seaworthy.

But not long after the Spaniards got in, they opened fire. The Englishmen fought back, losing all but two of their vessels. Drake and Hawkins were lucky to get out at all.

I went to sleep in a hotel overlooking the city square as great bells tolled the hours and mariachi music rose ceaselessly from the pavement cafés. I thought of Drake with his kinsman Hawkins fighting their way to the open sea from the harbor below that square—driven out by a fleet that they had allowed in by gentlemen's agreement.

After San Juan de Ulúa, there were no more deals with Spanish officials for Drake—ever. Limping back to England, he knew it was open war with Spain, declared or undeclared, personal if necessary.

Soon he was again in Spanish waters—this time as a spy. He gathered knowledge of Panama, the great funnel through which passed the gold of Peru and the silver of fabulous Potosí in Bolivia. The treasure was hauled in galleons to the city of Panamá on the Pacific, carried across the isthmus on muleback or ferried down the Chagres River, and loaded in galleons bound for Spain at Nombre de Dios on the Caribbean (map, pages 230-31). By the end of his second journey to Panama, Drake even possessed a map of Nombre de Dios.

IN 1572 he sailed from England again with 73 men and two small barks. Aboard were the frames and planks for three pinnaces—small oar-equipped sailboats. They would enable the freebooters to move about at night, when the wind was often still.

"He had his nerve," said Dean Edwin C. Webster of the Cathedral of St. Luke at Ancon in the Canal Zone, for many years a student of Drake's exploits. "Across the North Atlantic with a handful of men and a couple of tubs not the size of many yachts around here, to take on the whole Western Hemisphere."

Drake set up a base on a small island he called Port Pheasant, off the San Blas coast near Cape Tiburón, 160 miles from Nombre de Dios. Cimarrons—escaped slaves—brought intelligence and reinforcements; like Drake, they had no love for Spain.

Landing in the now-assembled pinnaces, Drake's assault force got into Nombre de Dios all right—61 men armed with bows and muskets. Some carried flaming pikes that, by one participant's account, lit the town "as if it were neere day" while "our Drums and Trumpets sounding in so sundry places" gave the impression that a large force was attacking. Even so, the inhabitants fought back with "a jolly hot volley of shot."

Drake entered the governor's house and saw a stack of silver ingots. He knew that even more valuable loot—gold or jewels—was to be had elsewhere in the town. But

a sudden squall damped the invaders' powder, put out their matches, and slacked their bowstrings. Then Drake fainted. His men saw that the earth where he had been standing was soaked with blood from a leg wound. They staggered away empty-handed.

RECOVERING, Drake drifted along the coast to Cartagena in Colombia, seizing small frigates for their victuals and even stealing one good-size ship.

For the big haul, though, the men would have to wait until the treasure trains moved across the isthmus again. Drake planned an ambush along their route.

Dean Webster and I drove the excellent highway to Panamá Vieja, or Old Panama, the Pacific treasure port on the outskirts of the present capital of the republic. "Quite a lot of the old treasure road has been uncovered lately because of unusually dry weather," he said. We stopped to see short stretches. They were laid with small flat stones, with two other rows of stones placed vertically to keep the lot in place.

Along that old road, Drake at last got news of a mule train approaching. Ambush was set near Venta Cruz. Drake and his men waited, silent and tense.

The sound of the mule bells! On they came. Drake heard the leather thongs creaking and the voices of the muleteers.

At this moment a young freebooter, "having drunken too much *aqua vitae* without water," stood up, at the ready. A Cimarron jumped on him, but too late. The alarm was given. Not a gold-laden mule was taken.

Drake extricated his force—the fate of the drunk is not recorded—and got back to his base. He was a good man in tight corners. He had been severely wounded and had lost many men in battle and to sickness. One of his brothers, John, had been killed in a futile action against a coasting vessel, and another, Joseph, had died of a tropical fever. At this point many a freebooter probably would have given up and sailed for home. But patience, patience; third time lucky.

In 1573 Capt. Guillaume Le Testu, a Frenchman, arrived. Like Drake, he sought Spanish booty. They joined forces and set an ambush for another mule train close by the gates of Nombre de Dios.

Surprise was complete. Le Testu, wounded, was captured and executed. The rest of the men, though, got away with a great haul of

THE ARMADA PORTRAIT, COURTESY THE DUKE OF BEDFORD, WOBURN ABBEY

The flood tide of success for Elizabeth came as Drake filled her coffers with Spanish wealth and opened the oceans to English ships.

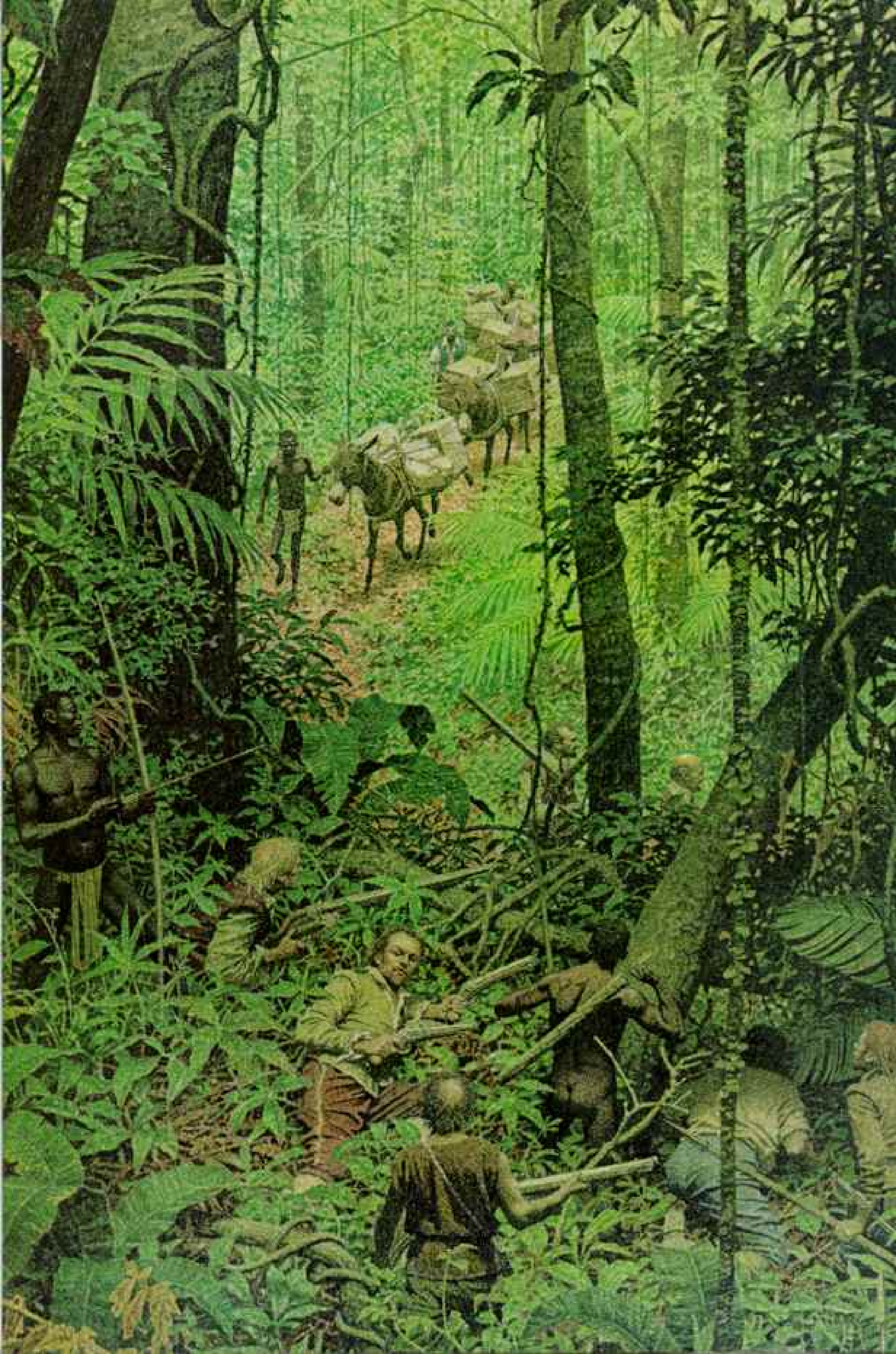
silver and gold. Back in England the poor-born Drake was a wealthy man.

But he was only beginning, and now he had a marvelous idea. Why not attack Spanish ships in the Pacific? Cimarrons had told him of this traffic, and even taken him across the isthmus for his first view of that great ocean. South American treasure came to Panamá by slow galleons that the Spanish built on that side of the continent. The lightly armed ships were thought to be so safe from attack that they were rarely even convoyed.

IN 1520 the Portuguese navigator Ferdinand Magellan had found a way around the Americas, through the strait that now bears his name at the bottom of South America. He had died in the Pacific, but one of his ships managed to complete the first circumnavigation of the earth. Others had followed Magellan's wake through the strait, but it was considered too difficult for common use.

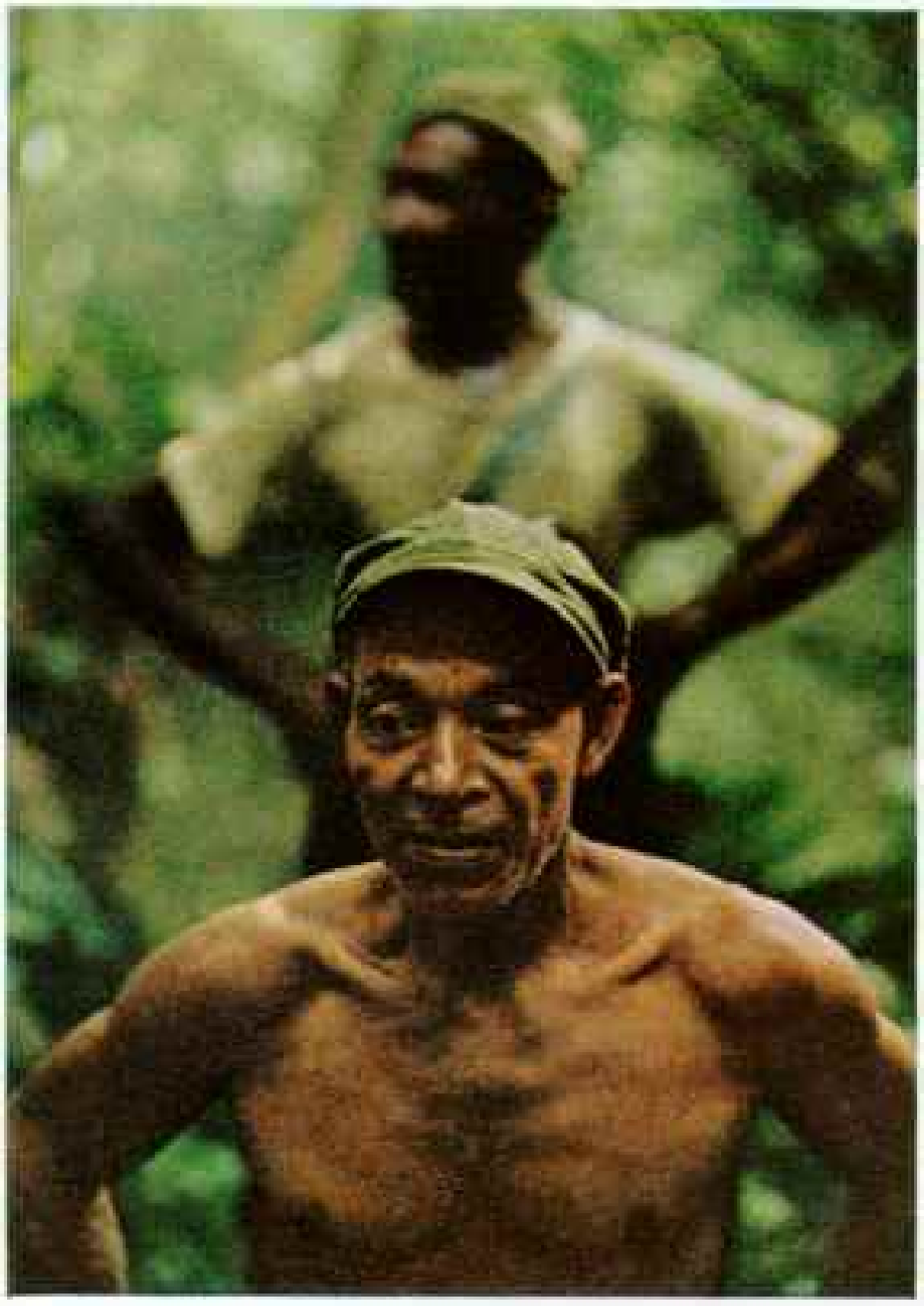
It was just the thing for Francis Drake. But not with a couple of cockleshells that could hide among the trees of Port Pheasant. It was one thing to cross the Atlantic. Even the clumsiest of square-riggers could blow westward in the northeast trade wind and return farther north in the Gulf Stream's east-flowing current. To get down to latitude 50° S. and north again on the Pacific side, Drake needed a seaworthy fleet. He put together a squadron of five ships. He took as a flagship the *Pelican*, a vessel armed (as a Portuguese taken prisoner later reported) with 18 guns.

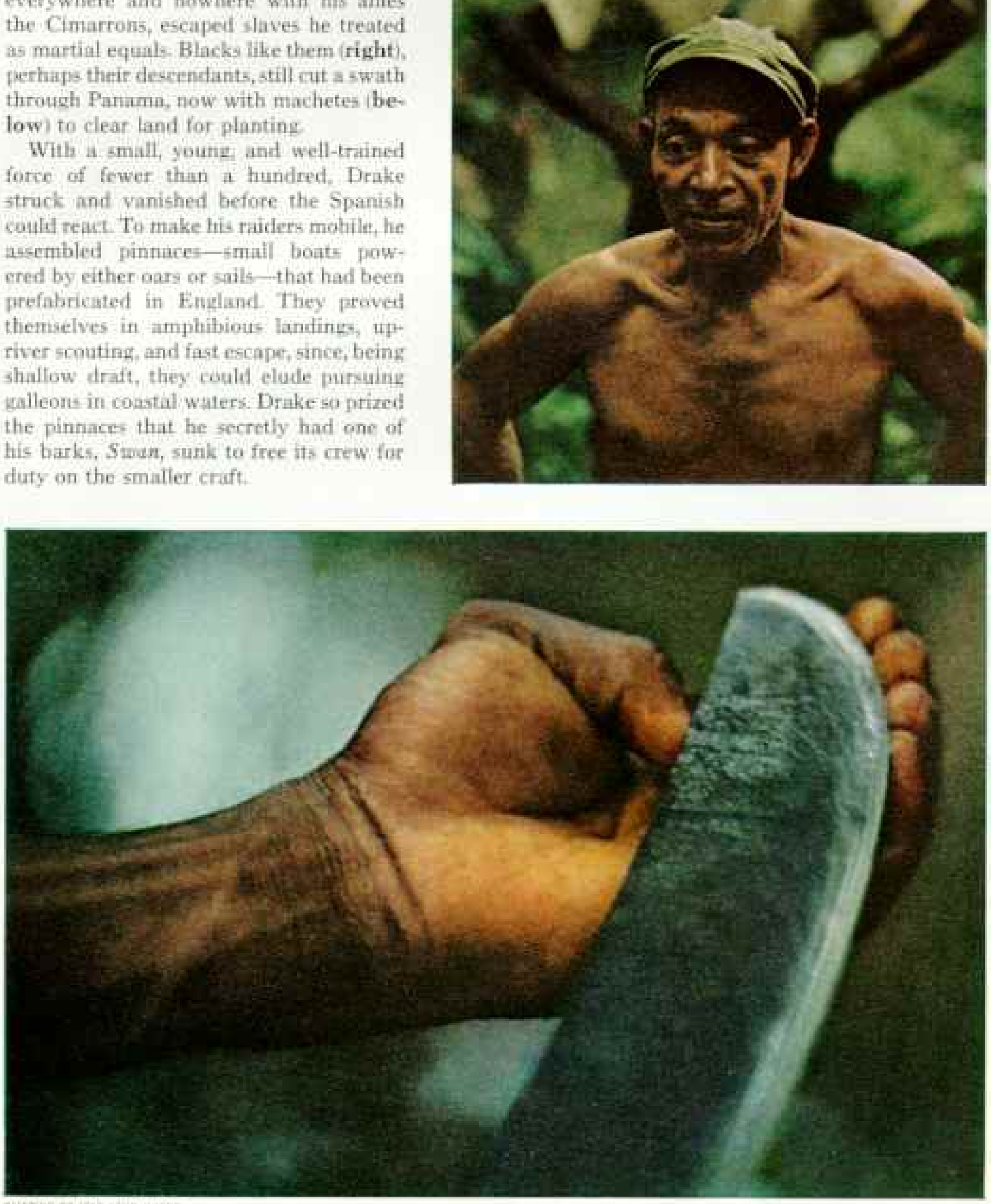
Drake seems to have had Elizabeth's covert support in *(Continued on page 232)*



Drake's commando tactics, such as his ambush of a mule train (**left**) bearing treasure across Panama in 1573, ended the tranquillity of Spain's rich colonial empire in the Americas. Drake seemed to be everywhere and nowhere with his allies the Cimarrons, escaped slaves he treated as martial equals. Blacks like them (**right**), perhaps their descendants, still cut a swath through Panama, now with machetes (**below**) to clear land for planting.

With a small, young, and well-trained force of fewer than a hundred, Drake struck and vanished before the Spanish could react. To make his raiders mobile, he assembled pinnaces—small boats powered by either oars or sails—that had been prefabricated in England. They proved themselves in amphibious landings, up-river scouting, and fast escape, since, being shallow draft, they could elude pursuing galleons in coastal waters. Drake so prized the pinnaces that he secretly had one of his barks, *Swan*, sunk to free its crew for duty on the smaller craft.





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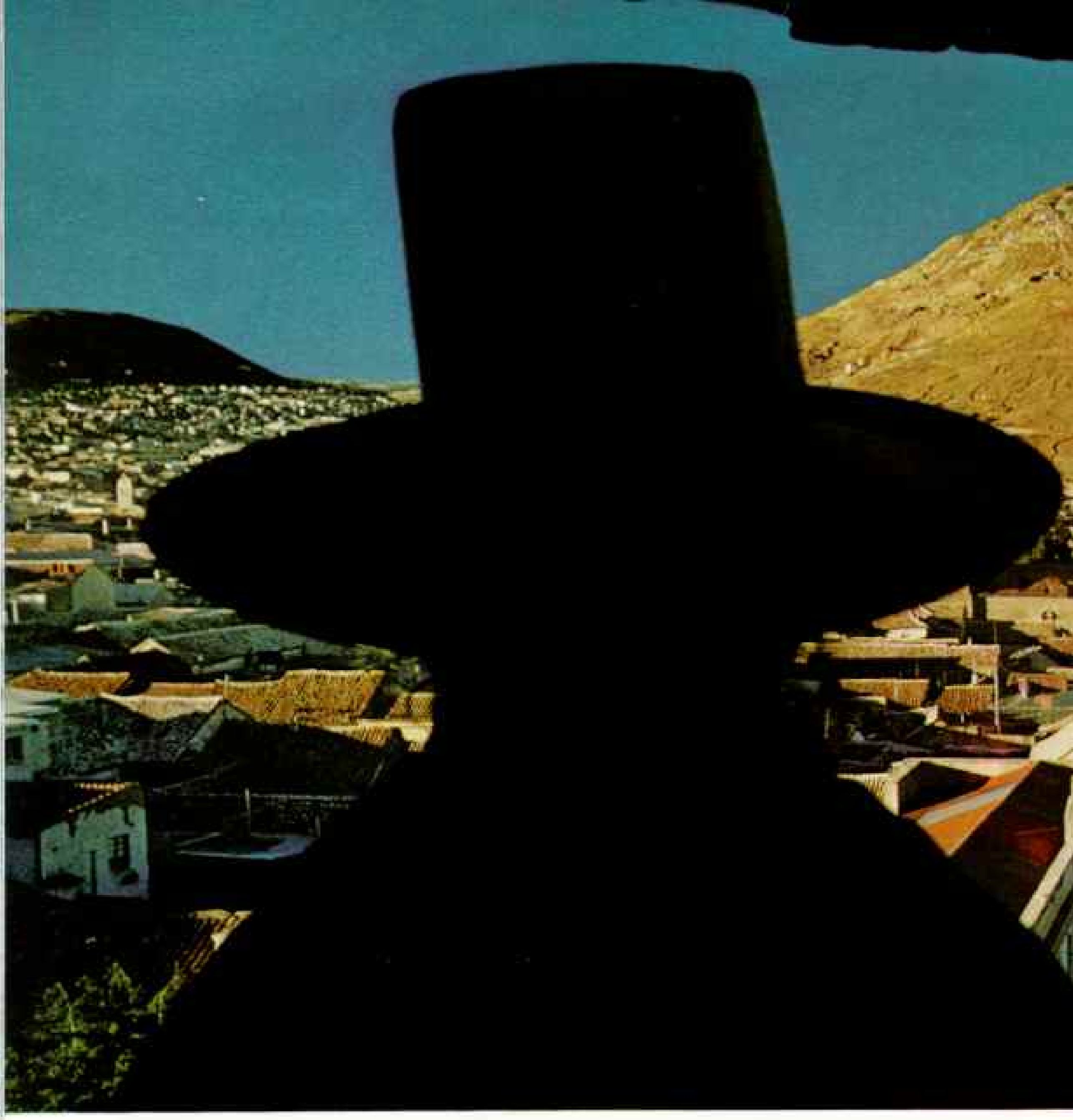
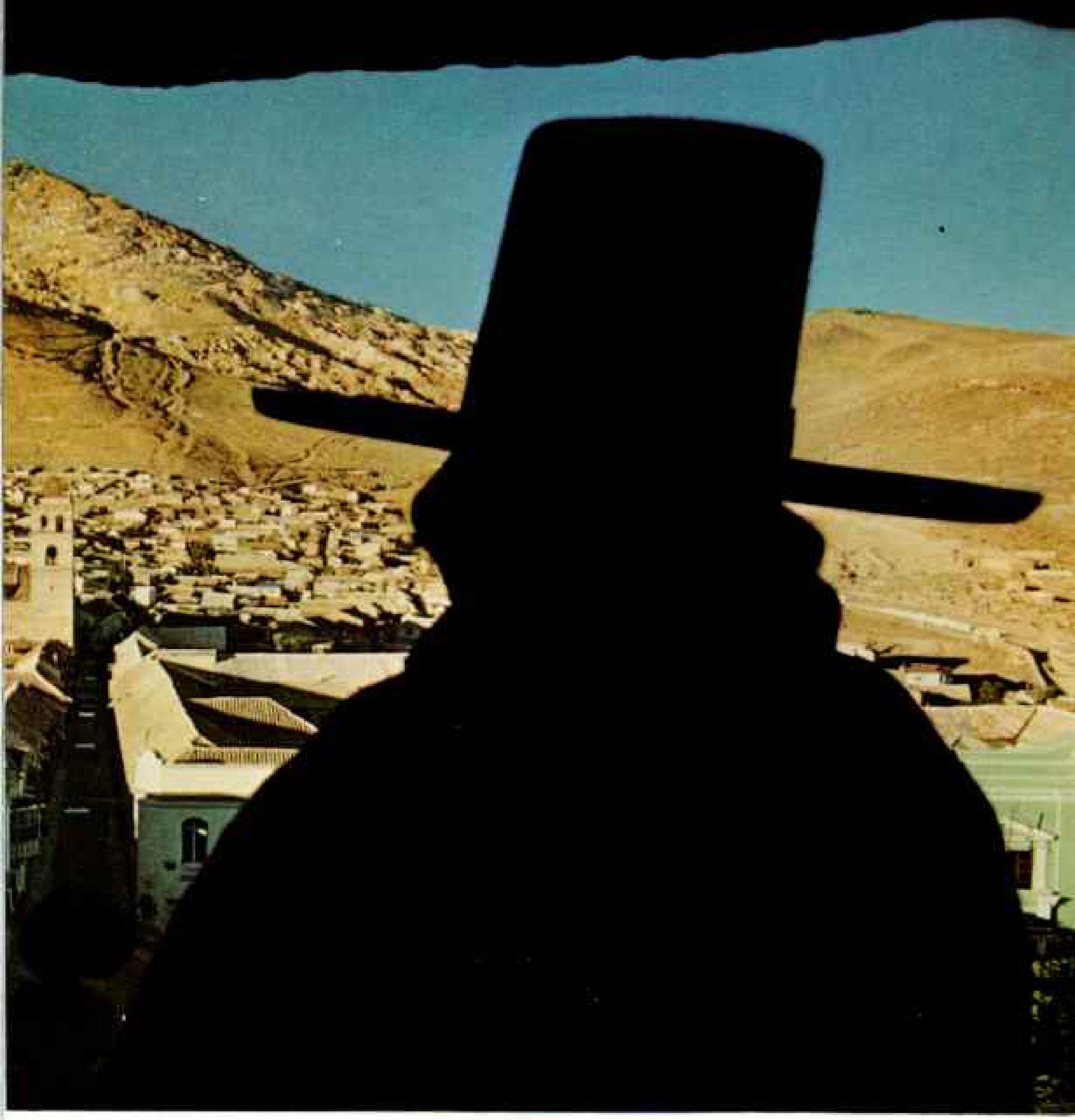


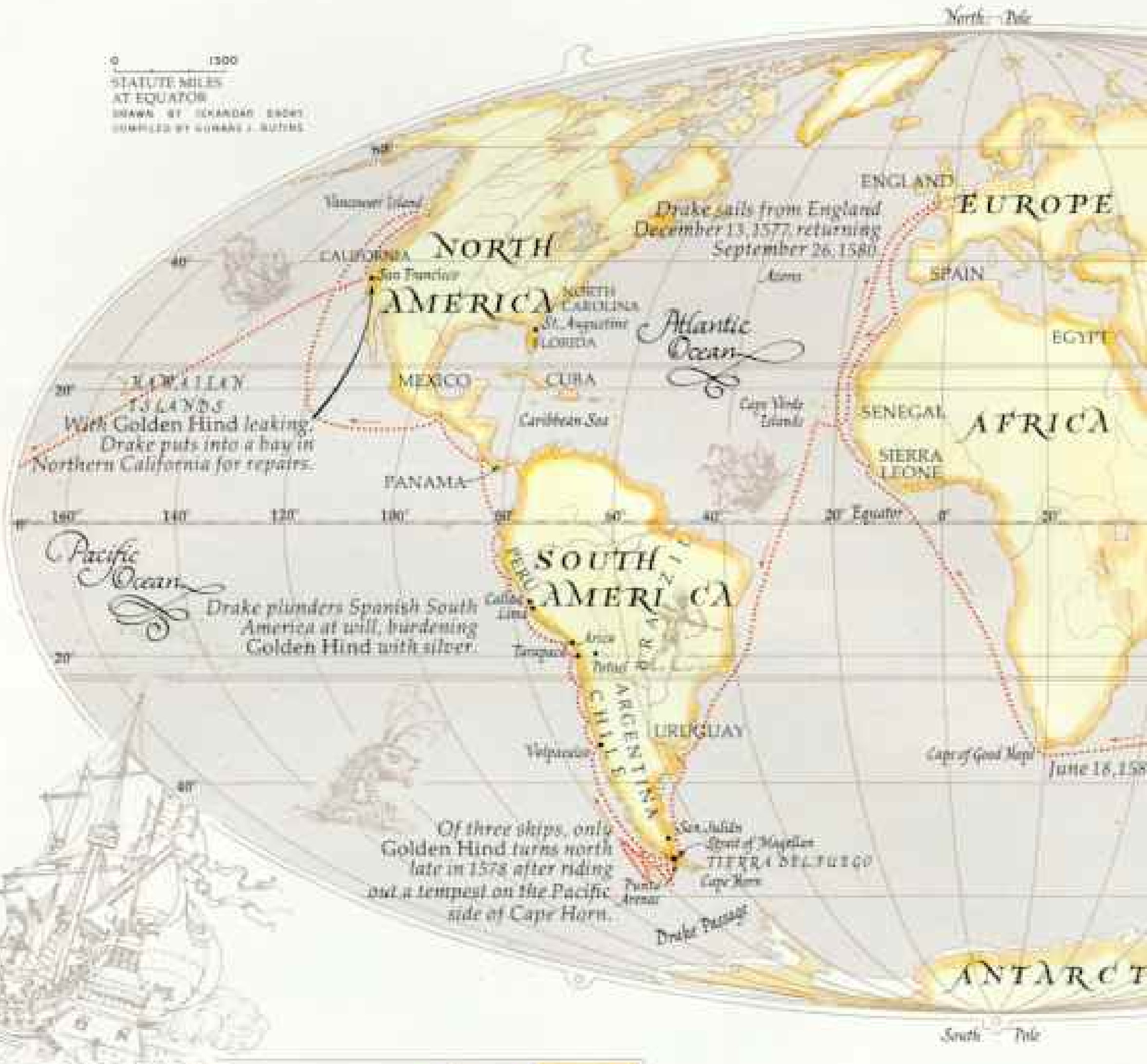
Literally stumbling over a fortune, the story goes, an Indian in the service of a Spaniard in 1545 kicked up a clump of grass with silver clinging to its roots. He had discovered a billion-dollar mountain of silver at Potosí (**above**) in what is now Bolivia. To haul the silver down to the port of Arica required a descent of more than 13,000 feet, using llamas for pack animals. In one chronicle of Drake's plundering voyage, the unusual animals were described as "sheepe [with] neckes like camels . . . they serve to carry over the mountaines marvellous loades . . . where no other carriage can be made. . . ."

In a 1579 raid at Callao, Lima's port on the Pacific, Drake relieved a Spanish ship of its silver. Peru remains an exporter of silver, such as this Japan-bound bullion from Cerro de Pasco (**right**).

Spain's New World colonies were unprepared for the English forays. Wasn't this a Spanish ocean? What need to arm ships or settlements? So in the Pacific Drake took what he chose. *Golden Hind* rode lower and lower as her hold filled with treasure that had been earmarked for the coffers of Spain.



The World Encompassed, and *Divers* other



Like a bank of clouds they came, sails of the Spanish Armada swelling in arrogant ranks. Past England's southern tip, into the Channel (**left**) sailed one of the greatest fleets ever assembled, more than a hundred ships, with orders to land thousands of troops on English soil.

But standing out from Plymouth, the heart of the English fleet got to windward, where it could outmaneuver the cumbersome floating castles of the Spaniards. Skirmishes up the Channel (shown by stars on the map) proved inconclusive. English fire ships sent the enemy vessels into disarray, and a storm forced them to head north around the British Isles. Scarcely half made it back to Spain.

Heroical Sailings of *Sir* Francis Drake

INTRIGUE UPON INTRIGUE upon intrigue attended Drake's plans and departure on December 13, 1577, in the *Pelican* (later to be renamed *Golden Hind*) with four other ships. The public reason, the only one the seamen knew, was that they were to sail to Alexandria, Egypt, to engage in the Turkish trade. The gentlemen adventurers aboard may have thought they were on a voyage of discovery to *Terra Australis Incognita*, believed to lie south of the Strait of Magellan. Perhaps Drake and Elizabeth alone knew the real mission—an attack on the rich Spanish outposts of South America.

Drake may or may not have planned to circumnavigate the world, for his orders—perhaps deliberately misleading—were to "returne . . . the same way . . . whome wardes, as he went owt . . ." One of his five original ships did return that way, one sank, and two were destroyed. Yet, with his windfalls in South America and his landfall in California behind him, Drake sailed west with the aid of captured Spanish charts, making for the Moluccas and the riches of the spice trade. After 68 days he reached an island, possibly in the Palaus, which, for the cunning of the populace, the crew named the Island of Thieves. *Golden Hind* sailed on, loading a cargo of cloves bartered from the Sultan of Ternate.

Lumbering heavily under her freight, *Golden Hind* ran aground "upon a desperate shoale." Cannons and some cargo were jettisoned; it was not enough. Finally wind and tide changed and the ship was freed. While the vessel was aground, the chaplain had given a sermon that angered Drake, who thereupon marked him with a sign reading "Frances Fletcher, ye falsest knave that liveth." Drake finally relented and released Fletcher from his irons. Ahead lay the long passage home and, for Drake, fame, wealth, position, and title.

More important to England than Drake's circumnavigation of the world may have been his exploits in Mexico's gulf and the Caribbean (**map, left**). Here he had seen Spanish treachery at San Juan de Ulúa, off Veracruz, in 1568, when the English fleet he served in was attacked under a truce. Here he had plundered the Spanish Main. Here he would die in 1596. And here was Panama, where Spain's golden cornucopia was transported from Pacific to Atlantic, a slender, vulnerable neck that Drake was forever keen to throttle.

Supping together, gauchos conclude a day of tending sheep near old Port St. Julian, Argentina. Here Drake tried one of his officers, Thomas Doughty, for inciting mutiny. Sentenced to die, the prisoner confessed and took Communion. Then he dined and drank cheerfully with the commander before losing his head. At Cabo Blanco (**right**) surf pounds the skull of a sheep. While sounding a nearby bay in a small boat, Drake was threatened by a squall. Braving fog and weather, one of his captains daringly sailed into the untested anchorage to rescue the commander.

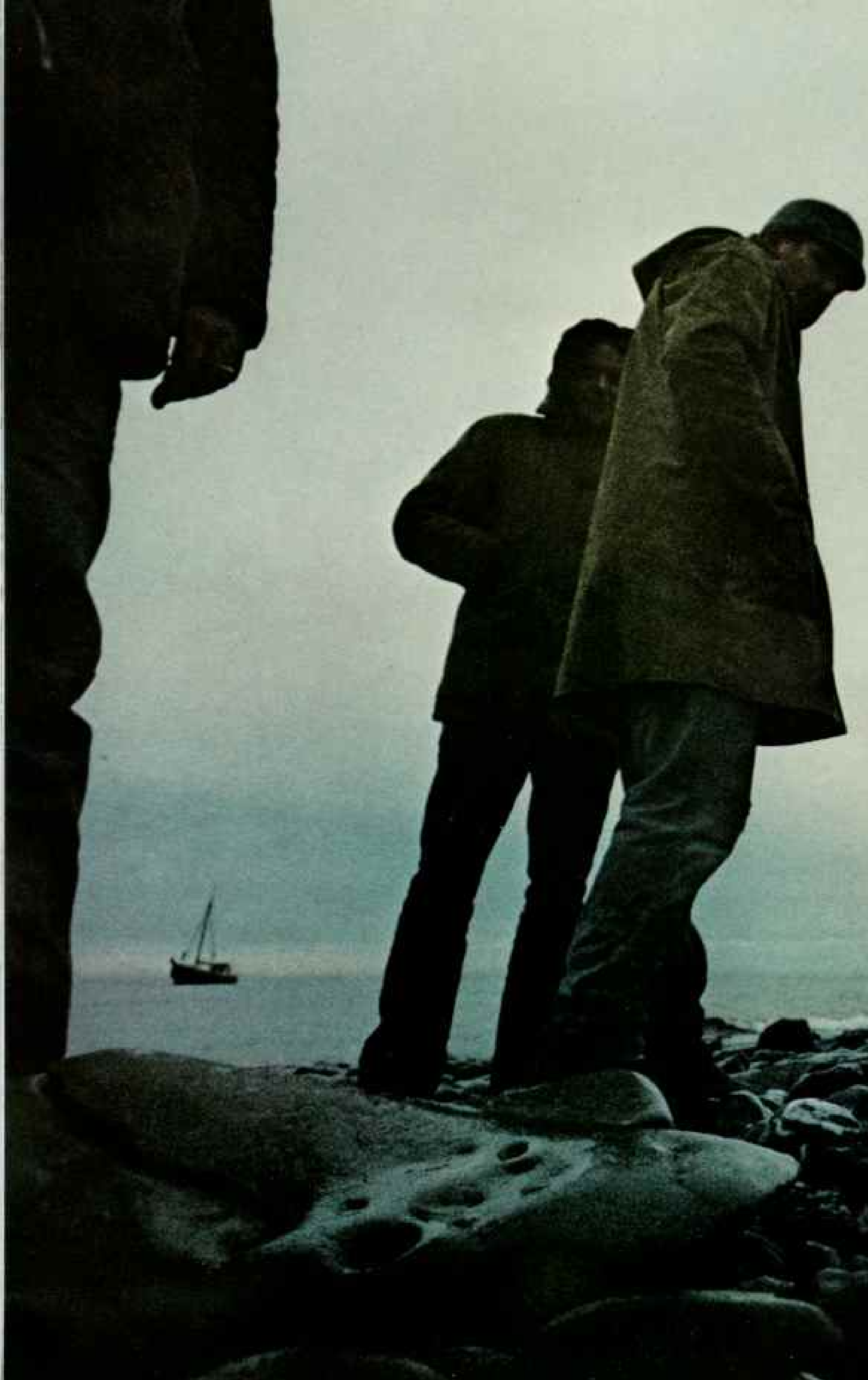
(Continued from page 225) undertaking a raid on Spanish shipping in the Pacific; the evidence even indicates that she was one of several financers of the expedition. But what else did he intend to accomplish when he sailed out of Plymouth on December 13, 1577? Had he already planned a globe-girdling voyage?

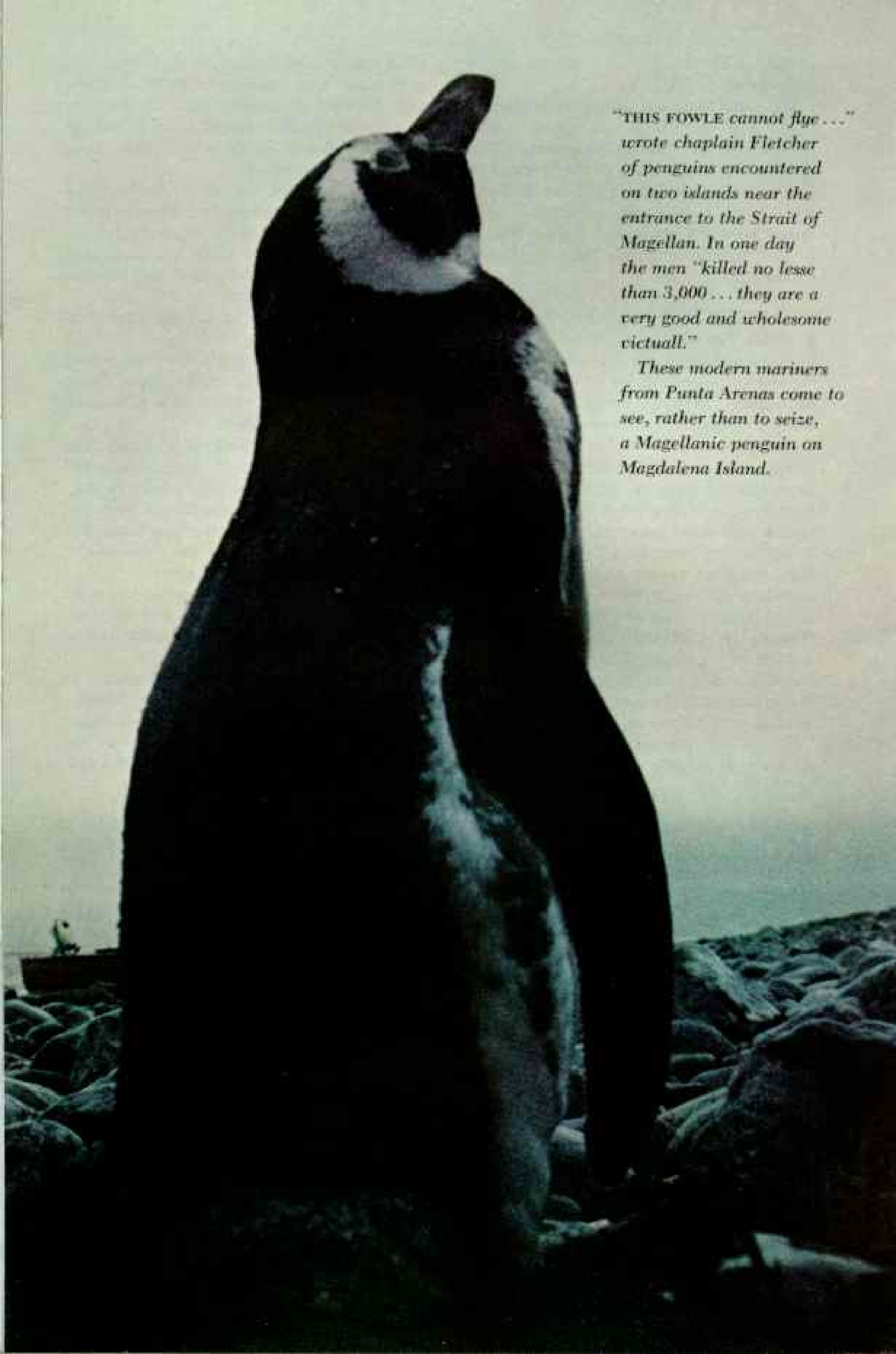
No one knows, although some students of Drake's exploits believe this exciting possibility was in his mind. Perhaps his backers also instructed him to try to establish trade in the Pacific and to look for a northern passage around the Americas from the Pacific to the Atlantic. To mask his intentions, a story was purposely leaked that he was sailing for Alexandria, Egypt.

By air I followed Drake's course from Devon to the Cape Verde Islands, where he took captive a Portuguese pilot, Nuño da Silva, who knew the South Atlantic and may also have known something of the Pacific as well; then across to Brazil and Uruguay.

In a bay in Argentina occurred an episode that was to cloud Drake's reputation for life. Friction had gradually built between Drake and Thomas Doughty, an adventuresome, well-connected gentleman with whom Drake had established a friendship in Ireland. The record of what happened is not clear, but Drake claimed to believe that Doughty was conspiring to sabotage the voyage. He had Doughty arrested and tried, winning from him, as some accounts said, a confession. As if still friends, the two men dined together the night before Doughty's head was severed from his body by an executioner's ax. Was his death really necessary? We do not know.

Curiously enough, Magellan also had dealt with a mutiny on the Argentine coast, and seemingly at the same place, Port St. Julian.





"THIS FOWLE *cannot flye . . .*" *wrote chaplain Fletcher of penguins encountered on two islands near the entrance to the Strait of Magellan. In one day the men "killed no lesse than 3,000 . . . they are a very good and wholesome victuall."*

These modern mariners from Punta Arenas come to see, rather than to seize, a Magellanic penguin on Magdalena Island.

Drake's men found there a gibbet and human bones.

Having beheaded a gentleman of influence, Drake may have been attempting to flatter an ally in court—always important in Elizabethan England—when, in the Strait of Magellan, he rechristened the *Pelican* the *Golden Hind*. Such a deer was emblazoned on the family crest of Christopher Hatton, a backer of the expedition and a man high in the Queen's favor.

I FLEW INTO PUNTA ARENAS on the strait. The sun shone and the strait looked like a pleasant cruising ground—briefly. In the afternoon a strong westerly gale whipped up, sullen, cold, and nasty. It came up in about five minutes, without warning.

Along the road that skirts the north side of the passage, I saw children carrying the large eggs of seabirds, probably still warm from the nest. I recalled that Drake got provisions near here: penguins, good water, firewood. His men were crowded into three ships now; the other vessels had been abandoned to streamline the squadron.

The prudent mariner may find his way through the strait without too much trouble —if the wind permits. The chief difficulty for a westbound ship like the *Golden Hind* is that the wind usually blows from the west, often howling at great strength.

Toward the midpoint of the strait I stood on a rough hillside. The bleak face of the strait trended away toward the Pacific. The cold water was lashed to a froth of whitecaps between mountains that funneled the gale. Snow squalls screamed by on the savage wind, the flakes flying horizontally above the churning water.

It's easy to think that these storms at the hostile bottom of the world must howl around forever, with nothing in the way but this iron-tipped southern end of Chile, the mountains of Patagonia, and the storm-trap islands around Tierra del Fuego.

Ugh! What a place! Drake got through in 16 days.

Weeks later, driven south from the jagged rocks and islands off the Pacific side of Tierra del Fuego, Drake found himself near latitude 57° S.—below Cape Horn.

Armchair geographers had drawn the edge of a huge continent there, attached to Tierra del Fuego. They called it *Terra Australis Incognita* and supposed that it stretched toward New Guinea. Drake may have had instructions to investigate this "continent."

But the land mass wasn't there.

What was there was wild ocean swept by wilder storms. He lost contact with his other two ships. One sank; the second made its way back to England.

I have sailed through Drake Passage, as the route around the Horn is called, in ships of 3,000 tons and also in the square-rigger *Joseph Conrad*, not much longer than the *Golden Hind*. I had good charts and I also

had a chronometer, ample means for fixing my position whenever observations of sun or stars were possible. In those waters Drake could not find his longitude at all; he guessed wildly at his latitude in bad conditions with an eye-burning, bouncing thing called an astrolabe, had no charts, saw no lights. And he was alone. But he was in the Pacific, through the back door, come silently and unseen.

AT QUILPUÉ, near Valparaíso in Chile, I talked with then 95-year-old Capt. Robert Miethe Kriews, one of the last of the great windship seamen. "What Drake did was incredible," said the captain, who had consistently driven square-riggers past Cape Horn. "But don't mention his name too loudly round Valparaíso! Or Arica, or Callao, or Cartagena, or Santo Domingo, either.

"He came to Valparaíso. The Spaniards didn't realize that the Magellan Strait made them vulnerable. So when Drake showed up one morning, he was welcomed as a Spaniard."

Drake wasn't looking for welcome. He sacked the settlement, collected all the wine, bread, and bacon he could find, took about $40,000 worth of gold from a ship in the harbor, and was off.

"No one could overtake him," the old sailor continued. "He was then in the Peru Current that sets north, and good sailing conditions took him to every port he wanted to raid. None had so much as a single cannon."

At Tarapacá in Chile, Drake's men found a Spaniard asleep beside 13 bars of silver and made off with the ingots. Landing again for water, the freebooters came upon a Spaniard and an Indian boy driving eight llamas loaded with 800 pounds of silver. Recollected one of Drake's men, with tongue in cheek: "... we offered our service and became drovers, onely his directions were not so perfect that we could keepe the way. ..."

Near Callao, the port of Lima, the captain picked up tantalizing news. The galleon *Nuestra Señora de la Concepción* was at sea, bound for Panama, jammed with gold, silver, and jewels.

The Spanish vessel had a two-week start. Drake drove his *Golden Hind* under every stitch of sail, the seamen wetting the bellying courses to make them draw better. But the South American coast seemed to drag by with exasperating slowness.

Past Peru sailed the *Golden Hind*, pushing a roll of foam at her bow, the guns on her deck still housed.

At last, abeam of Cabo de San Francisco on the northwest coast of Ecuador, a sail! A big sail—lots of canvas, slowly pulling a laden ship. Approaching too rapidly could arouse suspicion, so Drake put out large wine jugs that dragged in the water as drogues.

All day the little *Golden Hind* crept toward her galleon prey, unobtrusively gaining. The sun set and the tropic night fell on the sea like a blackout curtain. Quiet commands: "Haul in the drogues! Guns at the ready!

Iron-ribbed skeleton of an abandoned ship (**left**) stands near San Gregorio in the Strait of Magellan, where treacherous winds still challenge mariners. Magellan took 39 days for the passage. Drake was lucky. With good weather he made it in 16.

Near Cabo Pilar a Chilean coastal steamer of today (**right**) grapples with storm-tossed waves.

Prepare to board! Not a sound, my lads! We have her now!"

The *Hind* slipped on faster, faster. Suddenly a shout across the sea to the galleon's captain: "Strike sail, Señor San Juan de Anton! Strike, or to the bottom!"

"What Englishman orders me to strike?" shouts San Juan de Anton. "Come on board to strike sails yourself!"

The answer was a well-aimed chain shot (two cannonballs chained together). The galleon's mizzenmast was knocked into the sea. Boarders climbed over the side from a pinnace. The capture was effected in a trice.

"Have patience, for such is the usage of war," said Drake to the Spanish captain, almost gently.

The loot included 26 tons of silver, 80 pounds of gold, 13 chests of valuable plate, and several more jammed with jewels. All prior takings were now a mere bonus.

FROM REPORTS of a Spanish captain and the Portuguese pilot da Silva, both taken prisoner by Drake, a picture can be pieced together of life aboard the *Golden Hind* in the Pacific. Don Francisco de Zarate, captured off El Salvador, wrote his viceroy that "Francisco Drak . . . is a man about 35 years of age, low of stature, with a fair beard, and is one of the greatest mariners that sails the seas, both as a navigator and a commander." His men were young, well disciplined, and as practiced in warfare "as old soldiers . . . could be." Before making decisions, Drake convened a council of nine or ten gentlemen, "although he takes advice from no one."

He ate from "silver dishes with gold borders and gilded garlands," and enjoyed "all possible dainties and perfumed waters." Viols played as he took his meals.

The captain held a daily prayer service and sometimes offered a sermon to the crew.

Francisco de Zarate wrote that Drake had aboard "painters who paint the landscape in its proper colors," apparently making a kind of picture-book cartographic record that Drake or other mariners could follow around South America.

An "intollerable tempest" buffets the *Golden Hind* on her second day in the Pacific after passing through the Strait of Magellan. The storm howled for nearly two months. "The winds were such as if the bowels of the earth had set all at libertie," tossing ship and men "like a ball in a racket."

Drake lost his two remaining consorts. The *Elizabeth* limped home. The *Marigold* was never heard from again.

Alone, the *Hind* reeled southward with the punch of the storm. Here the mainland of South America dissolves into a scattering of islands. Beyond them "the Atlanticke Oceane and the South Sea, meete in a most large and free scope."

An unwitting discovery, but a discovery indeed: Drake had demolished a favorite 16th-century fiction—that Tierra del Fuego was the northern tip of a southern continent.

But Drake had come for gold, not geography. When the weather turned fair, he sailed north, up the western coast of South America, the treasure font of the Spanish Empire.

Beware, Valparaiso and Callao. Beware, gold-laden galleons. *El Draque* is loose!

PAINTING BY JEAN-LOUP HUNG

Drake himself sometimes embellished his log with pictures of sea lions, birds, and trees.

San Juan de Anton sailed his galleon slowly to Panama, where his arrival—empty!—was met with astonishment. El Draque in the Pacific! Who was safe there now?

Drake had, however, no intention of lingering in those waters. But how should he return to England? Not, if he could help it, around the stormy extremity of Tierra del Fuego. And now the Strait of Magellan might be guarded.

Shore-based theorists and some optimistic seamen believed there was a passage around North America. Searches had been conducted from the Atlantic. Now perhaps Drake could have a look from the Pacific.

HOW FAR NORTH Drake sailed one does not know; some say as far as 48°, almost to the latitude of Vancouver Island, British Columbia. Then he turned south. Under the weight of the tons of plunder, the *Golden Hind* was literally coming apart at the seams.

On the California coast the treasure was stored and a stockade built while repairs were made. But Drake had no need to protect his crew from the California Indians, who, a journal records, worshiped the commander as if he were a god, the local chieftain insisting that Drake don a headdress, the symbol of kingship.

When the *Golden Hind* had captured another Spanish vessel off Costa Rica, Drake had confiscated Pacific charts, which he consulted as he set course from Nova Albion. His men had been away from England for 19 months; another 14 months would pass before they reached home.

The *Golden Hind* sailed southwest, then west in the trade winds, sighting land—probably the Palau Islands—after 68 days. The ship ventured on to the Philippines. At Ternate in the Moluccas, now part of Indonesia, Drake took on sugarcane and rice, and bargained with the sultan for cloves, loading six tons into the groaning *Golden Hind*. The spice would bring a fortune in England—if he could get it there.

He very nearly did not. Studded with coral reefs, the waters around the Indonesian islands are among the most treacherous in the world. Sailing the *Joseph Conrad* there in 1935, I knew many perilous moments, even though I had charts and could depend upon navigation lights ashore to guide me.

Somewhere east of Celebes, running at night before a strong wind, the *Golden Hind* struck a reef. The crew worked into the next morning to try to free her, but the wind held her on the coral. To lighten ship, Drake jettisoned eight cannons and supplies—even half the precious spice cargo. Still the *Golden Hind* was held fast. The ship's chaplain administered the Sacrament to all hands. Finally, in the afternoon, the wind died and the ship slipped free. The *Golden Hind* stayed in one piece.

I picked up Drake's trail at a port in Java called Tjilatjap. Here Drake had tarried for more than two weeks in March 1580, entertaining and being entertained by the "just dealing people" while his men "traffiqued with them for hens, goats, cocoes, plantons, and other kinds of victuals."

He then set a course around the Cape of Good Hope to West Africa. By the time he stopped for water and provisions in Sierra Leone, he had voyaged nonstop for 118 days and sailed 9,700 miles, the longest unbroken passage made to that time. When the vessel sighted England in September, fevers, skirmishes, and ship losses had taken their toll; Drake returned with only a third of the men who had set out in the squadron.

At first the official reception was cool. Queen Elizabeth had continued to play a duplicitous game with Spain; when news of the capture of the treasure galleon had reached London, she had assured the Spanish Ambassador that Drake was an independent adventurer. Now the Ambassador demanded the return of the booty.

DRAKE LAY LOW. But presently the official ice melted. Drake was summoned before his Queen, who wished to see some of the curiosities collected on his voyage. Soon the loot was in safekeeping in the Tower of London.

Visiting the *Golden Hind*, the Queen commanded Drake to kneel. Would she offend Spain by knighting this sea dog who had caused the Spaniards so much woe? She gave the sword to a French envoy and asked him to bestow the title in her behalf.

From his share of the booty, Sir Francis bought a fine great house near Plymouth, called Buckland Abbey—now a memorial to him—and served a term as the town's mayor. But he was not at peace for long.

Pomp and glory gild the *Golden Hind*, as Queen Elizabeth in 1581 creates a knight and stokes the wrath of the King of Spain.

Drake had returned to England with the richest store of loot ever taken on the high seas. His hoard of gold, silver, and gems rivaled, if it did not exceed, a year's revenue to the Crown. A fuming Spanish Ambassador demanded restitution.

Elizabeth faced a hard choice. Should she publicly acknowledge Drake as her own highly successful pirate and goad the Spanish into war? Or disavow him and return the booty to Spain?

After nine months of delay, she decided to knight the seagoing adventurer. Though she handed the sword to a French envoy and asked him to deliver the accolade to the kneeling Drake (**left**), the act was a slap in the face to Philip II of Spain and intensified the growing hostility between the two nations.

By 1584 plans were afoot for the Armada, the "invincible" fleet Philip believed could conquer England and end such impudence.

PAINTING BY JEAN-LEON HUENS

Spain and England were drifting toward open war, due to begin the moment King Philip II felt ready. In 1585 English vessels were seized in Spanish ports; a Catholic plot to assassinate Elizabeth was discovered. Another lesson by Drake was needed.

This time he took a small navy of 29 ships and 2,300 men. No more the private operator who could succeed or fail and be written off, this time he was officially in the Queen's service. She donated two of her own vessels.

Drake had hopes of capturing the whole homeward-bound treasure fleet. Missing it, he took on Santo Domingo, now the capital of the Dominican Republic, then administrative headquarters of the Spanish Caribbean.

The city supposedly was impregnable. Drake landed his troops on a beach, then arrayed his fleet before the harbor and commenced a bombardment of its fortress. While the Spaniards concentrated on repelling a frontal assault, Drake's soldiers marched ten miles overland and fell upon the city's rear. The defenders fled in confusion.

MY WIFE, NANCIE, AND I visited Santo Domingo and found that Drake was far from forgotten. In fact, the guide who drove us about the city hated him. "His men assaulted nuns," Juan Felipe said. "He cut our bishop's right hand off. He slung his own hammock right in the cathedral. I will show you the marks where he drove his hammock hooks."

Juan Felipe never could find the marks of those hooks. But in other ways Santo Domingo suffered. Drake sent messages to the governor, hiding in the country, demanding ransom for the city. When the governor procrastinated, Drake ordered his men to begin putting the torch to houses.

He collected a ransom worth only about $16,500, some eighty cannons, and such booty as his men could find. But in holding Spain's Caribbean capital for a month, Drake had delivered a stinging insult to Philip.

Nine days later Drake's fleet stood off Cartagena, near where he had brazenly stolen an anchored ship between forays in Panama. This time at Cartagena he repeated his Santo Domingo tactic: an amphibious assault where the defenders least expected it.

I passed a pleasant afternoon in the town of Boca Chica, beside the entrance to Cartagena's bay. As I sat in the shade at a charming café, eating a large fried flying fish with

Bow high to the surf, fishermen launch their boat at Peniche, Portugal. Drake

landed troops here for a planned attack on Lisbon in 1589. Spanish strength and a lack of Portuguese support, though, forced the English to abandon the mission.

Wires web balconies in the sleepy Old Town of Cartagena, Colombia, once the gem of the Spanish Main. During his foray of 1585-86, Drake took the town by daring amphibious assault.

Yet no sooner did he show his sails off Cartagena than most of the citizenry showed their heels, taking treasure that probably included emeralds from the Chivor mine, like these cut and uncut specimens (**below**). The disappointed Drake settled for ransom and cannons, then sallied north for a raid on St. Augustine, Florida.

Compared with the *Golden Hind* voyage, the financial returns were meager, but the military success was huge. Drake had plundered at will the very heart of Spain's Caribbean domain. Returning to England, he reported, "... there is now a very great gap opened, very little to the liking of the King of Spain."

Sir Francis Drake

yams and salad, small two-masted sailing vessels, schooner rigged, glided slowly past on the water. Drake would have been familiar with them; he'd pressed many such into his service round these waters.

When he attacked Cartagena, however, Drake overestimated the wealth of the city; he collected a modest ransom of 110,000 ducats—about $73,000. But when he departed, his ships were loaded with 60 more captured cannons, many of which would be turned against the Spanish Armada.

SAILING NORTHWARD along Florida, he set fire to the town of St. Augustine, and seized 14 more cannons.

He continued up the coast to visit the 103 English colonists planted only ten months before in a new land named Virginia, honoring their Virgin Queen, Elizabeth. They dwelt on an island they called Roanoac, off what is now North Carolina. Drake offered them a ship filled with a month's rations, but the vessel foundered in a storm and the colonists returned with him to England. Two years later another colony occupied Roanoke Island, only to vanish mysteriously; not until 1607 did the English establish a permanent settlement in North America.

King Philip, meanwhile, had determined to invade England. His shipyards resounded to the rasp of sawyers' blades and the thump of caulking hammers—especially in the Bay of Cádiz, on Spain's southwestern coast.

So Drake went there. Wooden ships and shipyards burn well. He burned them in 1587.

I had a look at Cádiz for myself. Beside the bay, a peninsula hooks toward the north, and the modern city shines in the sun. From a high building I looked over the narrow channel leading into the harbor.

When Drake appeared, the harbor was occupied by 12 galleys—shallow-draft ships that could set a couple of sails but relied mainly on oars rowed by slaves. Each was armed with a single huge gun that could be trained only by maneuvering the ship.

An enemy was supposed to be afraid of a line of galleys, drawn up in confined waters, ready to belch enormous iron balls. In came Drake and his fleet, sailing swiftly and boldly, headed right for those galleys but yawing and swinging, never quite in the Spanish line of fire. Now backing his spritsail to throw his ship broadside, Drake hurled red-hot balls. The Spanish vessels could neither answer in time nor swing out of the way, no matter how furiously the whips cracked about the shoulders of the galley slaves.

One broadside, then swing and fire the other! Soon the surviving galleys were running for the shelter of sandbanks—outmoded, clumsy ships of war put out of business by one man that sunny afternoon.

I marveled at his nerve as I surveyed sunlit Cádiz bay. Two Scandinavian cruise liners disgorged the new invaders—nice old ladies with pale-blue hair, come to see the sights.

Drake's force looted and burned thirty to forty vessels and vast quantities of supplies, and also took away six laden merchantmen. This 36-hour commando raid was referred to as "the singeing of the King's beard."

Drake was slow to put down the match. Sailing west to Cabo São Vincente, at the tip of Portugal, he personally led troops who compelled the surrender of the fortress of Sagres on the steep heights, commanding Spain's northern trade route.

And Drake gained a priceless piece of information: A treasure ship was eastbound from the Azores. He set out to meet her, and she sailed practically into his arms. She was the *São Felipe*, private property of King Philip, a huge vessel laden not only with bullion but also with silks, spices, exquisite Chinese porcelains, pearls, gems, and other Oriental treasures. In value, her cargo exceeded that of any other ship Drake ever looted.

"It was easily the greatest prize ever taken by Drake," said George Naish, secretary of the Society for Nautical Research at Greenwich in England. "It paid for Elizabeth's campaign against Santo Domingo and Cartagena, and the loss of all that wealth compelled Spain to postpone the sailing of the Armada until the next year."

ENGLAND WAITED. At last the lumbering might of martial Spain—more than a hundred ships—showed up in colossal and glorious array off The Lizard at the southwestern tip of England on July 29, 1588 (July 19 by the old Julian calendar, which England still used then).

Legend says Drake, newly commissioned a vice admiral, was playing bowls on Plymouth Hoe, a promontory overlooking Plymouth Sound. "Let them wait their turn; there's time for this and to beat the Spaniard afterwards," he said—typical of the man, and good listening for the populace.

Time, in fact, was terribly short. Neither Drake nor his commander, the Lord High Admiral, nor anyone else in England knew where the invaders would strike. Plymouth?

On the Armada came across the western horizon, glorious with sun tint on golden sails, ablaze with standards, banners, and flags, bristling with guns, nobly beautiful as it moved on with vast spectacle and stately grace, to deal at last with England!

The defenders were ready to put to sea, but the wind that brought the Spaniards was against the English. It is a tribute to English seamanship that 54 ships were able to get out of Plymouth harbor July 29-30.

The mighty Armada dominated the English Channel. Drake, in the *Revenge*, fell in behind while the galleons lumbered on, for the time being of unchallengeable might.

The Spanish ships were packed into a tight crescent for mutual protection. Their commander, the Duke of Medina Sidonia, occupied a position in the vanguard, his galleon a rainbow of flags, with other men-of-war strung out on the rim of the crescent. The formation was magnificently kept, as if the ships were all on strings.

Nearing the Armada, Drake saw that half the vessels were storeships and troop transports. In addition to the soldiers aboard these vessels, an invasion force of 17,000 under the Duke of Parma waited across the Channel in Flanders. If Medina Sidonia could effect a rendezvous, his fleet would convoy these legions to England's shores.

THE ENGLISH SHIPS WAITED. They could not break that tight formation or take on the firepower of the whole Armada. They needed wind! Strong, blustery wind to fill the English sails, letting them dart into the ominous crescent, fire broadsides, pick off stragglers, and weaken the fighting force. Though several long running fights developed as the Spaniards continued up-channel, they hardly weakened the awesome power of the Armada. The English were only nipping at its heels.

The Channel waters narrowed as the Armada approached the Strait of Dover. The Spanish ships stopped off Calais not far from the beaches of Dunkirk, where England was again to avert disaster more than three and a half centuries later. The Armada was very near its destination.

The English had a plan for getting at those Spanish ships, anchored near sandbanks and a dangerous lee shore with England's fleet on the other side. Fire ships were the thing—sacrificial vessels specially covered

Bowlers on Plymouth Hoe enjoy a game where, legend has it, England's officers were playing when the Spanish Armada was sighted. Everyone looked to Drake. With his customary coolness, he insisted on finishing the game before setting forth to do battle.

"**What is that devil** preparing now?" Spanish captains asked themselves as Drake and the English fleet lay to windward of the Armada, anchored off Calais.

Night fell dark and ominous. At midnight Spanish lookouts saw fires rise in the distance. Two. Six. Then eight. *Fire ships!*

Borne by wind and tide, the blazing unmanned ships approached, "spurting fire and their ordnance shooting, which was a horror to see in the night." Terror seized the Spanish. Captains ordered anchor cables cut. Ship ground against ship, fighting for sailing room. By morning the Armada lay in disorder and confusion.

with pitch so they would burn readily. But none were near enough at hand.

Drake offered one of his personal ships, the *Thomas*, setting an example for other captains to follow. In the night hours of August 7, eight vessels were stuffed with flammables. Their loaded guns and barrels of gunpowder were left aboard as a further diabolical embellishment. Now to wait for the right conditions to set them adrift among the tightly packed ships of the Spanish fleet.

In the dead of night, a goodly tide was running toward the Armada and a fair wind was up. Suddenly the Spaniards saw the sea ablaze with the vessels that came on with

PAINTING BY JEAN-LEON HUENS

what seemed to be the speed of demons. Now the fire ships were among the fleet, exploding and throwing off showers of sparks and salvos of burning debris.

THE ARMADA was in panic. Anchor cables were hastily cut—with a loss of valuable ground tackle—as the heavy galleons, troop transports, and storeships tried to maneuver.

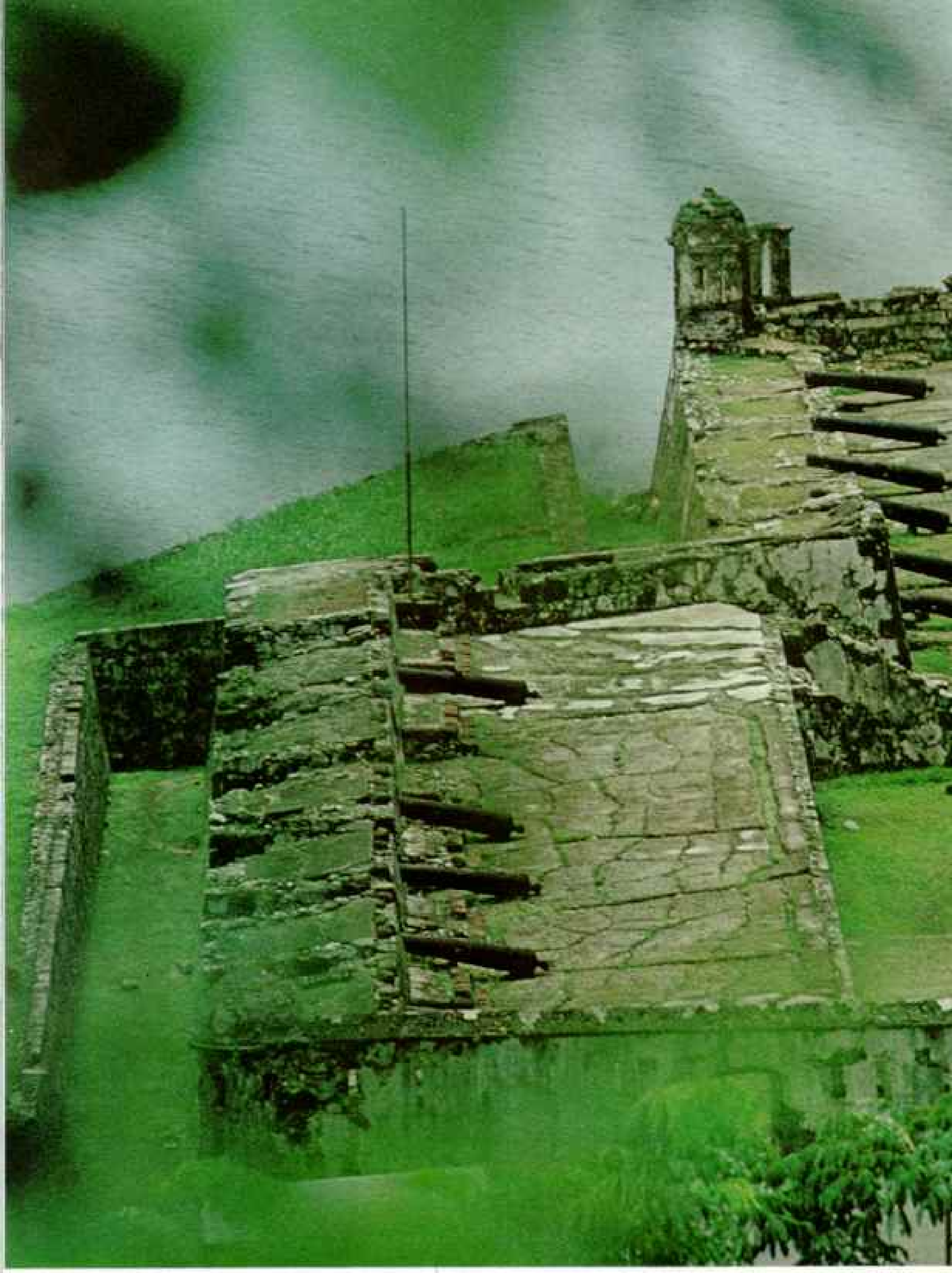
Not a single vessel, as it happened, was set ablaze. But some collided and others went aground, and that magnificent protective formation was shattered.

Dawn brought battle with the Spanish strung out over miles. Swifter, more maneuverable, and sailed by men with abundant knowledge of the Channel waters, the English ships went to work.*

Medina Sidonia managed to get a dozen or more of his vessels together. They fought back bravely and with skill. Meanwhile, the Spaniards were being forced toward the banks and shoals of the Netherlands coast.

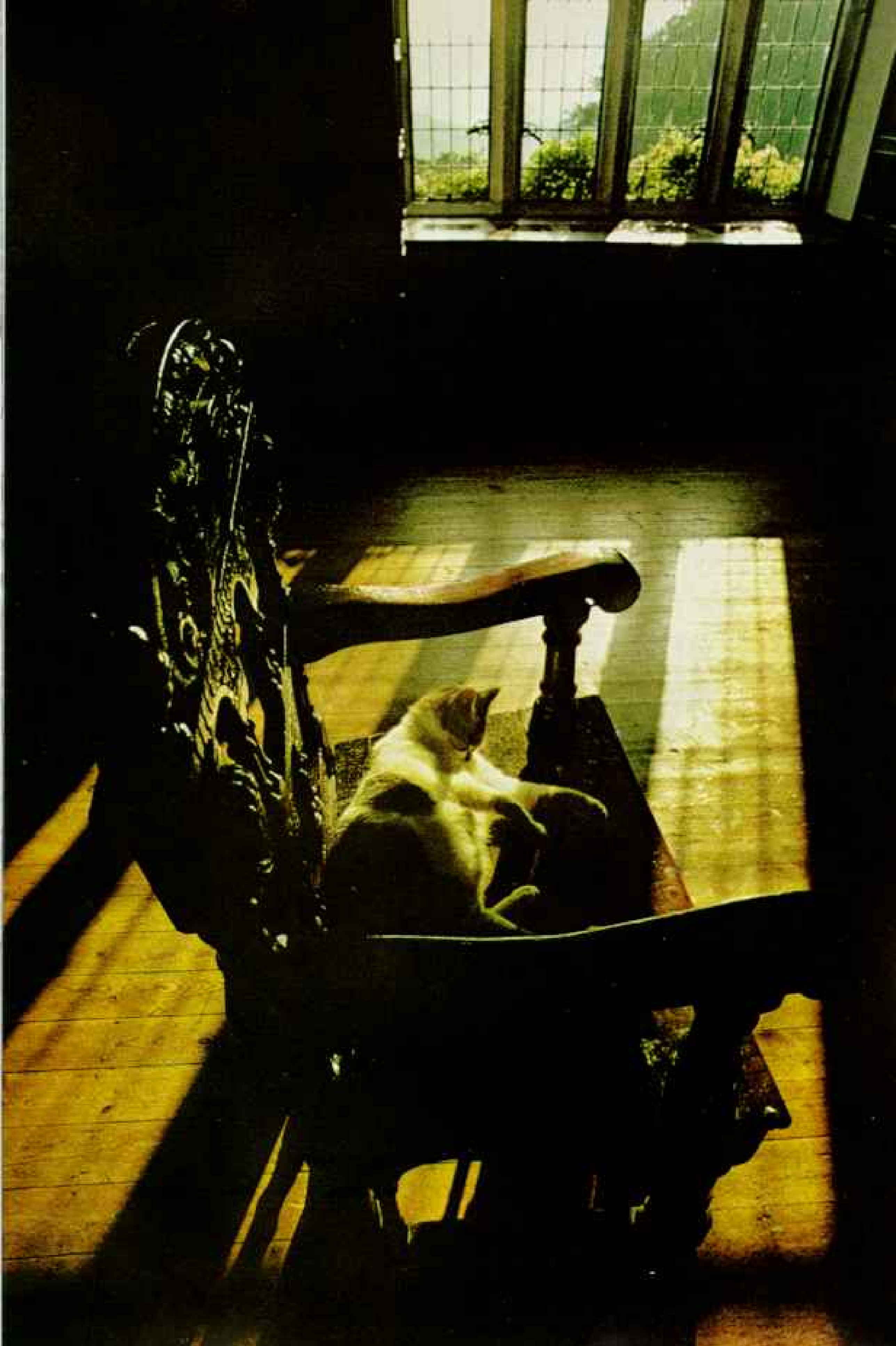
A sudden wind from the southwest saved them from immediate wreck. But the same

*The Spanish Armada's fate was described by Dr. Louis B. Wright in the November 1968 NATIONAL GEOGRAPHIC article "The World of Elizabeth I," and by Robert Sténuit in "Priceless Relics of the Spanish Armada," June 1969.



The guns of Portobelo, Panama, point seaward where Drake prowled—and died. Returning to the isthmus for another rendezvous with riches, Drake was finally

repulsed by Spanish arms, then fatally stricken with fever. Off this coast his crew witnessed "the solemne buriall of our Generall sir Francis in the sea," January 28, 1596.



Timber from the *Golden Hind* provided wood for a chair (**left**) at Buckland Abbey, the West Country manor Drake paid for from his share of the *Hind's* plunder. As a New Year's gift in 1582, Queen Elizabeth gave him a gilded cup, its cover ornamented with a map (**above**).

"Excelling all those that excelled before," as a balladeer sang, Francis Drake rallied a hesitant English nation with his imagination, zeal, and effrontery. Bold privateer, daring tactician, admiral of genius, he more than any other man of the time set Britannia on her course of greatness on the seas.

wind gave no alternative but to run before it —and run and run and run, along England and Scotland, then around the north of Scotland, and on to western Ireland.

Many were shot-damaged and leaky. A dozen or more crashed on the dangerous Irish coast. Others foundered. Only half the Armada saw Spain again.

AFTER THE VICTORY Drake went back to Buckland Abbey to live out his days quietly. But peace and day-to-day pursuits were not for him, and he was only 50 or so. He had no pension, and he had always been generous. So in 1595 the old partners Drake and Hawkins were off to the Caribbean and Spanish Main again. There was news of a damaged galleon, full of gold, that had put back to Puerto Rico. The Englishmen arrived with thirty ships, but the gold had already been stored on the island. The English were driven off by the guns of a fortress.

Drake sailed for Panama. He took Nombre de Dios with ease, but the 750-man force he sent to seize the city of Panamá was ambushed and defeated. Leaving Nombre de Dios in ruins, Drake sailed west along the coast, then doubled back.

Drake himself became ill with a fever, and soon was too sick to remain on deck. In his delirium, he struggled from bed on the night of January 27, 1596, insisting that he should don his armor and die like a warrior. He died before dawn the next day.

His body was placed in a lead coffin and dropped into the sea off Portobelo.

The stone shells of the big gray forts that ring Portobelo's lovely bay lie silent now, their iron guns rusting. Inside the roofless ruins of the old treasure-house, small descendants of the Cimarrons play noisily at some game. A mule-train track of long ago leads into the bush; it crosses a small bridge and is lost, going nowhere. The coastal hills wait to burst the rain clouds blowing in before the easterly winds that once brought Drake.

A furious squall breaks. It rains and rains, as if the Lord were trying to wash the ruins of Portobelo into the sea.

But the memories live on. At the bay's mouth I catch in the pattern of sun-broken cloud a vision of a small sailing ship—swift, romantic. On the quarterdeck stands a little man with a jutting beard and a voice like thunder. An instant, and he is gone. And the thunder and the mirage with him. □

BRAZIL'S KREEN-AKARORES

Requiem for a Tribe?

ARTICLE AND PHOTOGRAPHS BY
W. JESCO VON PUTTKAMER

Question: How should a Space Age nation deal with Indians so innocent of the outside world that many have never in their lives used a piece of metal? In this and the following article, explorer von Puttkamer documents the work of the Brazilian Government's National Foundation for the Indian (FUNAI) as it tries to answer that question in its dealings with the Kreen-Akarores and their old enemies, the Txukahameis.

FUNAI's successes are legion: Under its sympathetic guidance, tribe after Stone Age tribe has been introduced to the modern world, and at the same time has been shielded from its inevitable dangers. Each mission is a gamble, though, and sometimes—despite every precaution—there are losers. So it is with the Kreen-Akarores, whose first extended contact with non-Indians is described here. Sadly, we learn as this issue of the magazine goes to press that FUNAI's greatest fear has been realized: Influenza is sweeping the tribe. Of the estimated 130 Kreen-Akarores, a score are reported dead, and the fate of the others remains in doubt. Thus yet another of a dwindling handful of Indian tribes may succumb—not only to disease but to change, to civilization, to the relentless juggernaut called progress.

—THE EDITOR

IN THE STEAMING JUNGLE I sat and watched the myth of their inhumanity fade in the dancing light of welcoming cook fires.

For what was probably the first time in the hundreds of years since Europeans first glimpsed Brazil's wild and mysterious Mato Grosso State, the legendary "giant" Indians of Amazonia had peacefully led strangers into the sanctuary of one of their villages.

We were only six—two white *civilizados*, four "tame" Indians of another tribe. It would have been easy for the *gigantes*, now called Kreen-Akarores, to slaughter us with

their huge war clubs, as they have slain other intruders. Instead, they gave us food and water, touched us gently, tried to speak with us. They accepted the bewildering medicines, even painful injections, that only we—not they—knew would give them at least a chance to survive in a world that progressively threatens their wild kind.

In so doing, they justified our belief that they were as human as we, not untamable beasts, like the spotted jaguars. Savages they may be, but when we gave them our trust and love, they returned both in full measure.

Now my beloved native country has a grave

"**Stay away from the road!**" comes the warning to women and children of the Kreen-Akarores, until recently one of Brazil's most hostile tribes. But fateful curiosity draws the Indians into the camp of army engineers building a highway across Mato Grosso State.

responsibility. While developing the riches of the Amazon Basin, one of earth's last refuges for Stone Age peoples, Brazil must also somehow find a place for human beings whose ancient ways of life she cannot help but disrupt forever.

When, early in the 16th century, the Portuguese began colonizing Brazil, four million Indians stood in their way. The newcomers showed them scant mercy, brushing them aside by any means they could. Even in modern times, certain greedy civilizados have machine-gunned them, dynamited them from the air, and given them poisoned food.

Today Brazil can identify only about 200,000 pureblood Indians. Some of these—the Kreen-Akarores are among them—live in forests only now being penetrated by pioneer rubber tappers, loggers, missionaries, and, above all, the road builders who are opening Amazonia with a network of highways.

Sertanistas Form Vanguard of Change

To overcome the savage hostility of these innocents, Brazil formed the National Foundation for the Indian, called FUNAI for short. Its spearhead is the small body of *sertanistas*, "men wise in jungle ways," possessed of almost mystic love for the people they must both protect and render harmless to civilizados.

As photographer and diarist, I go often with FUNAI "pacification" expeditions. I watched the sertanistas make the first contacts with the dreaded Txikaos and Cinta Largas.* I went with the Villas Boas brothers, Orlando and Claudio, candidates for the Nobel Peace Prize, to cover the first tense overtures to the Kreen-Akarores in 1968. Five years later, when the young sertanista Apoena Meirelles took over from the exhausted Villas Boas brothers, I returned to join him at FUNAI's advance Kreen-Akarore pacification camp.

Now Apoena and I sit in our hammocks as night falls. I savor the familiar jungle noises—the cough of a prowling jaguar, the rustling of sleepy monkeys in the forest canopy, the bellow of a lovesick caiman in the nearby Peixoto de Azevedo River, and the cry of the *curiango*, a night bird.

"Listen," says Apoena, and at last I hear what he hears: the distant booming of dynamite, the rumble of road-building machinery.

*See: "Saving Brazil's Stone Age Tribes From Extinction," by Orlando and Claudio Villas Boas, September 1968; and "Brazil Protects Her Cinta Larga Indians," by W. Jesco von Puttkamer, September 1971.

One with her wildwood home, an Indian girl beholds outsiders covered with something unknown—cloth. Her decorative stripes, made with the juice of genipap

fruit, double as camouflage. Ever since FUNAI's first attempt at contact in 1968, the Kreen-Akarores had evaded outsiders by burning their own villages and moving on. To gain their trust, FUNAI expedition members daily placed presents on jungle trails. Finally the Indians responded, leaving war clubs in return for the gifts.

"They work even at night," Apoena says. "Soon they will have pushed their road to the Kreen-Akarore village we have seen from the air. You know as well as I do that these city people carry the seeds of death to the Indians. Germs against which the jungle people have no immunities. *Cachaça* [rum]. Vice.

"Jesco," he continues, pausing to swat at the mosquitoes that in the night forest replace *barrachudos*, the biting flies of the day, "we must take dreadful chances and hurry this pacification."

I know what he means by "dreadful chances." The skilled sertanista does not press hostile Indians, but only leaves gifts for them, an act that seems to disrupt their normal reflex to kill intruders.

Then one day, often only after months or years, the Indians will themselves make the overtures of friendship. But the Kreen-Akarores have not yet made these overtures —and time is growing short.

So we press the Kreen-Akarores. Each day we sally from the post in search of them. We know they are all around us, watching us. Our Xavante Indians, the people of Apoena's godfather, tell us so.

"Sometimes we see them, but not clearly," the Xavantes tell us. There is a curious quality to jungle sunlight. Sifting through the great trees, it blinds as it is reflected from wind-stirred leaves. Rather than illuminating living things fully, it blurs and camouflages them.

Songs and Gifts Pave Path to Peace

Every day or so we go in an outboard-powered dugout to a riverbank *tapiri*, a rude shelter where we have been leaving gifts of pots, pans, steel machetes, and the like. One day we see three Kreen-Akarores, faces smeared with black dye of genipap juice, standing on the bank as we pass on the river. They are not the giants of legend, but they are hostile. To bows taller than themselves they fit long feathered arrows.

We do the only thing possible for sertanistas in a hurry. Singing, laughing, shouting at full voice, we move toward them. In the jungle, the man who comes with noise cannot be an enemy.

On my accordion I play polkas and Viennese waltzes. Trembling fingers hit wrong keys, but I play loudly.

The technique works! The three warriors take the arrows from the bows. We step onto the riverbank slowly, carefully. Now we see six more warriors, two women, and a small boy peering from the forest.

It is still a dangerous moment, for the Indians are anything but relaxed. But we push nevertheless, as we must. We make signs for them to board our canoe and come to the post.

They do! The trip up the piranha-infested river in an overloaded boat goes well, and so do things at camp. We talk in sign language; the Kreen-Akarores accept our food.

When night begins to lower, we take the Indians back to the tapiri, whence they vanish on the trail to their village.

Jungle Meals Ease the Pain of Waiting

Now many frustrating days of waiting begin. The Indians do not show themselves. Have they abandoned us? We do not know. It is difficult for a civilizado to fathom the minds of people who have little concept of time.

Our Xavantes hunt to augment our meager supplies. They shoot monkeys, but I can eat them only when I am almost starving. They look too human.

I like tapir, though, especially its roasted liver. Rank as it is, I enjoy the tail meat of the crocodilian caiman. *Mutum*, or curassow, the size of a wild turkey, is very good. So is armadillo cooked in its shell.

We break the monotony with daily trips to the tapiri. One day, finally, we see an Indian youth on the riverbank. We pull to the shore, and although he trembles with fright, he stands his ground mutely and we have a pleasant visit.

After this, trade picks up at the tapiri. But there are no contacts.

"Whatever they have been doing, the Kreen-Akarores now have finished with it and are watching us again," the Xavantes say.

Twice young warriors visit the post. One even spends the night.

"They are testing us," says Apoena. "I will test them in return."

We leave him all alone at the tapiri. When we return for him, he is grinning.

"I climbed on the roof where I could be seen," he relates. "I played a mouth organ. Nothing. Then I whistled. From the forest came answering whistles and a shout: '*Hoo!*' I turned slowly around to find five Indians, three warriors and two small boys, standing beneath my perch. We had a nice meeting. Then they went away."

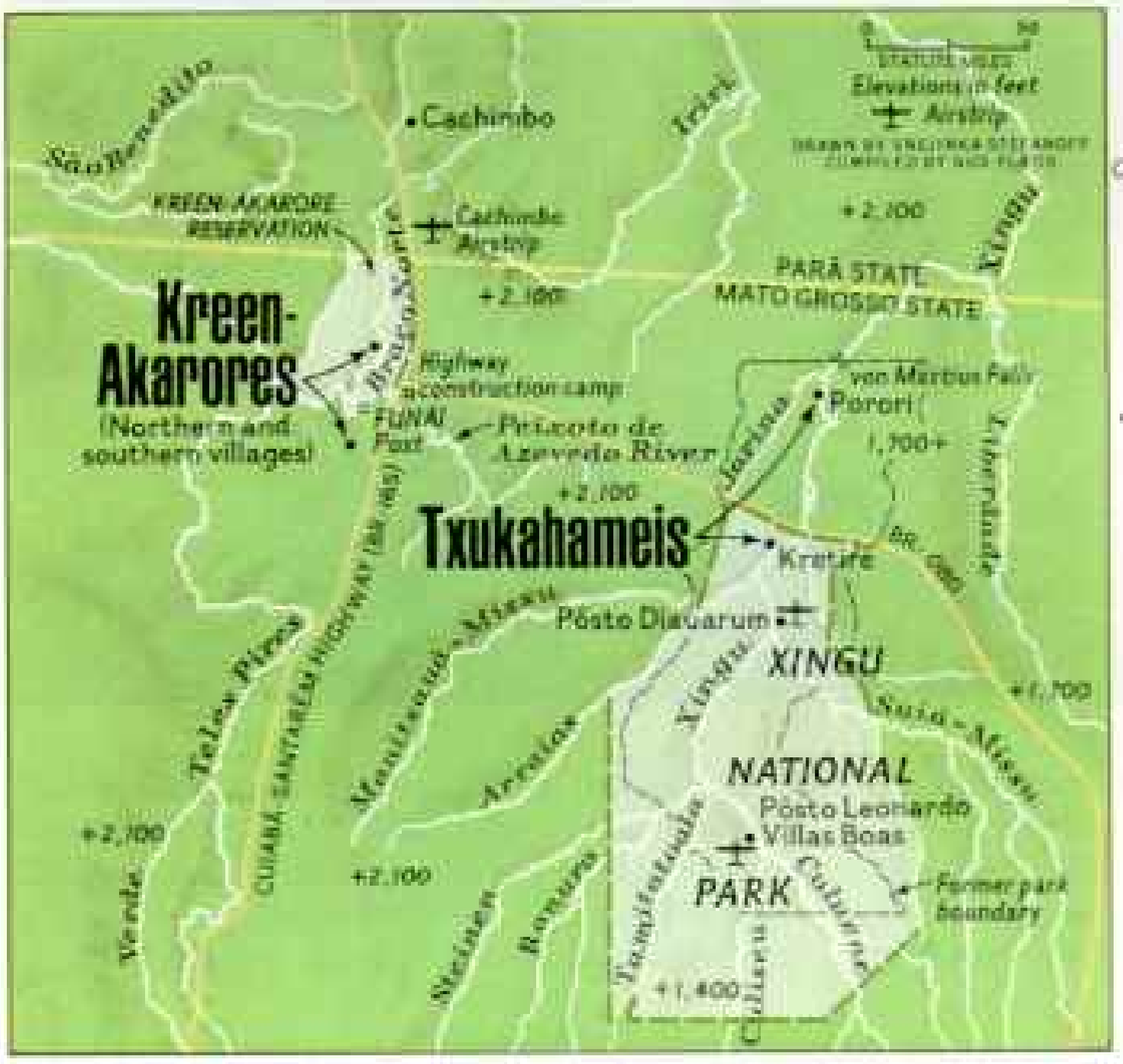
The wild ones vanish again for a week. Then a large band of Kreen-Akarores shout

Face-to-face with the future: Warriors in black war paint—and one, mysteriously, wearing a store-bought hat—meet FUNAI members on a sunlit riverbank in the expedition's first contact. Controlling his tension, for a single wrong move could mean disaster, expedition leader Apoena Meirelles steps forward to offer a gift. To make this contact in the shortest time possible, the FUNAI team disregarded its own rule—"Let them come to you"—and rushed forward at the risk of their lives.

Acceptance comes slowly. A young envoy (**above**) arrives with Apoena by canoe—a craft he has never been in before—for a night in the FUNAI camp. Only after he returns safely are expedition members invited to spend a night in the village.

Chief Krekon (**right**) leads the way as the first Kreen-Akarore to receive a penicillin shot—but only after his tough skin had broken two needles.

Hoping to shield forest innocents from the modern world, Brazil in 1973 set aside a temporary refuge for the Kreen-Akarores. In 1961, the nation had established the 8,500-square-mile Xingu National Park, now home to 16 tribes. Among them are the Kreen-Akarores' traditional enemies, the Txukahameis (pages 270-83). After highway BR-080 cut through the park, boundaries were shifted to make the road the northernmost limit.



Down the road together: A member of FUNAI and a Kreen-Akarore walk highway BR-165. To the right lies land open to prospectors and ranchers, against whom Indians must be safeguarded; to the left is the Kreen-Akarore reservation, legally off limits to *civilizados*.

from the jungle across the river and signal for us to ferry them to our camp.

We do as they ask. Apoena invites the leader of the party to sit with him in his hammock. The chief sits down, the hammock breaks. The two men tumble to the ground.

Shocked, for these people understand hammocks not at all, the warriors seize their clubs. We could be in peril. We are only nine.

Apoena breaks the tension. He roars with laughter. Rubbing his backside where he hit the hard earth, the chief also laughs. The bodyguard joins in the merriment. I breathe freely again.

When the Indians leave for the night, Apoena comes to me.

"Did you feel the same thing I did? These Kreen-Akarores are surrendering! Each time there was a dynamite blast, they looked at us with fear and pleading in their eyes. They know they cannot overcome men who can make the very earth shake. They are begging for our protection.

"Tomorrow we will go to the village. I cannot tell you how I know this, but they will be waiting for us in the morning, and they will lead us to their homes."

Dawn. Shouts through the fog that shrouds the river.

"Now," says Apoena.

We toss our gear into a canoe and cross the stream toward the waiting Kreen-Akarores. They point downriver, toward the tapiri and the head of the trail to the village.

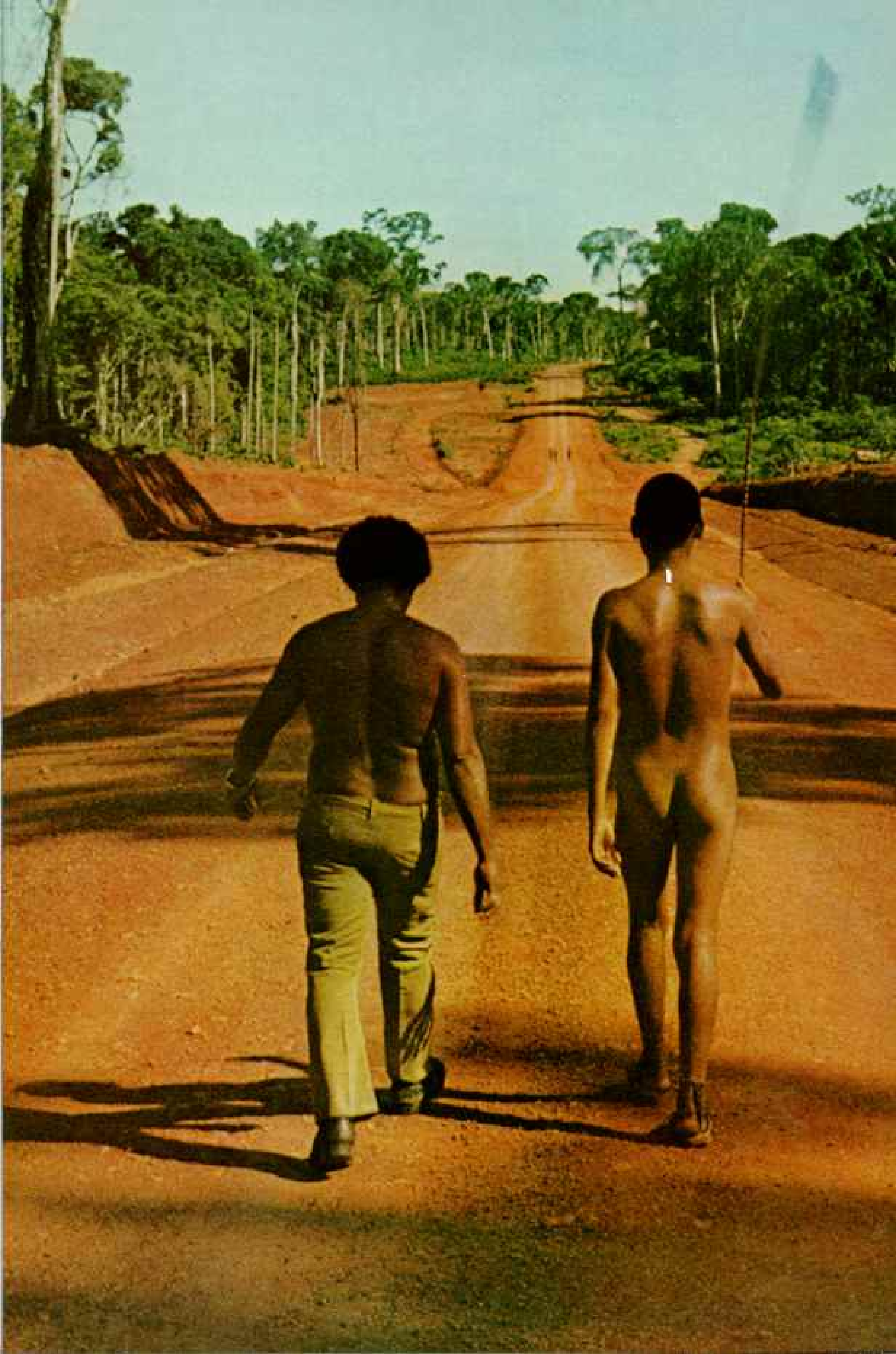
Tears Mark Welcome for Unarmed Guests

We land at the tapiri. Apoena does not hesitate. He takes a burden of water-filled gourds from an Indian woman and adds it to his own. A frowning warrior points to our firearms. We leave them in the hut.

The Kreen-Akarores fear pistols and rifles; several bear scars of gunshot wounds.

We are six from the post. Apoena. Four Xavantes. And I, Jesco, or as other Indians named me, Borbula, "man with the great moon face." With the dual handicap of heavy cameras and a large belly, I fall behind. The Kreen-Akarores give me bananas.

We march almost 24 miles, then we come



upon neat plantations and a collection of huts covered with banana leaves.

Women and children scamper screaming out of the village into the jungle. For a few seconds, we see only bare brown backs. Our escorts laugh and call to the hidden ones. They return one at a time.

Now what we take to be welcoming ceremonies begin. A medicine man blows his breath upon us. To rid us of the civilizados' diseases? The savages may be more prescient than we think.

Warriors deliver orations that sound like prayers. And they weep great tears!

A giggling woman paints Apoena's countenance black. My "great moon face" she decorates with the brilliant red juice of urucú plants. The solvent: spit.

At dusk women stir the cook fires into leaping life. They wrap bananas and manioc cakes in wild banana leaves and put them among fire-heated stones.

The Kreen-Akarores eye the food hungrily. They are undernourished. We think they have not planted all the sweet potatoes, squashes, peanuts, cassavas, and corn they need because their routine has been disrupted by the presence of so many outsiders.

Pantomime Helps Chase a Devil Away

Almost all the Indians have skin infections. Several are too sick with fever to walk. After much palaver in sign language, we are allowed to treat the infections with sulfanilamide powder. But when we approach the seriously ill with penicillin needles, we meet frightened resistance.

I try a trick that we have used with other tribes. I squeeze first the head of a sick man, then the whole body down to the feet. I make

motions of throwing away the sickness devil.

The patient smiles. I jab him with the needle. He grimaces, but the smile remains.

In World War II Germany, where I was educated, the Gestapo lamed my left leg. I feel a sting in its calf. The medicine man is giving me shots—with tiny arrows fired from a little bow. (And next day my leg feels better than usual!)

We eat. Now, by the light of the cook fires, the dreaded Kreen-Akarores, faces wreathed in beatific smiles, sing for us—strange chants, simple lines each ending in a shouted "*Ahow!*"

Then they dance.

"Join in," says Apoena. "It is the Indian way of relieving tension."

I wish someone had troubled to photograph Borbula, urucú-dyed face and all, stomping about a jungle clearing with the very same tribe that, 12 years earlier, had

"**They've burned their village** and run again," guessed the author when he saw charred huts amid unharvested sweet-potato fields. When he flew over several days later, however, rebuilding had started and the Indians came out to wave (**below left**). Expedition members learned that the holocaust was due not to fear of the civilizados, but resulted from an intratribal blood feud that orphaned two children (**below**). FUNAI personnel thwarted a subsequent attempt to drown the siblings, then sent them to Cuiabá, where the organization has assumed responsibility for their upbringing.

Stone for steel: The Kreen-Akarores exchanged Stone Age axes (**below**) for machetes, which one warrior (**lower**), completely covered with war paint, adds to his bow-and-arrow arsenal. Two chiefs—one 6½ feet tall—and a boy (**facing page**) marvel at the strange outsiders who gave the youngster the fishline he holds and must yet learn to use.

Once known as the "giant" Indians of the Amazon, the Kreen-Akarore tribe today counts only a few taller-than-normal individuals.

murdered the English explorer Richard Mason near Cachimbo.

The party ends in moonlight. We lie down, but we get no sleep. Warriors watch us all night, and every few minutes they pound the earth with enormous war clubs.

Why? Are they telling us they are still a free, strong people? Are they showing us that they, too, can make the earth tremble?

In our remaining time in Kreen-Akarore territory, we made several visits to this village of about 85 people to inoculate all of them against tuberculosis, smallpox, measles, and other diseases of civilization. FUNAI was later to inoculate the rest of the known Kreen-Akarores; they live in a village of roughly half that size some 30 miles to the south. We knew, despite the injections we administered, that continuing contact with civilizados could expose the Indians to illnesses impossible to guard against—especially influenza. The Indians have built up no natural immunity to flu, and no medicine offers protection against all the strains of the virulent disease. An influenza outbreak here, so far from medical facilities, could be disastrous. At FUNAI's request, the government declared most of the Kreen-Akarore territory off limits to outsiders.

Giants in Deed Only?

We learned much, meanwhile, about the gigantes—including the fact that they are not giants at all. If very tall warriors were ever common among these Indians, most are dead now. Only a few Kreen-Akarores today are of imposing height.

We found they speak a Ge tongue, one of the four main language groups of Brazil's Indians. Another Ge tribe, the big-lipped Txukahamei of Xingu (pages 270-83), were their worst tribal enemies in the mystic, ritualistic wars of the Amazon.

For centuries the Kreen-Akarores and the Txukahameis fought standoff battles. Then in 1967 the Txukahameis fell upon a Kreen-Akarore village with shotguns stolen or traded from pioneers. Some thirty villagers died.

In our brief visits to their village, I developed a quick and lasting affection for the Kreen-Akarores—and I retain many vivid, random impressions of their ways.

The Kreen-Akarores cut their hair short with knives of split bamboo; indeed, the name means "men who cut their hair short" in the Txukahamei tongue.

Taut as his bowstring, Chief Krekon aims a six-foot arrow (**left**) at a fish gliding through the shallows. Then he beaches his prey and kills it with a stick (**below**). The Indians sometimes use the poisonous bark of a vine called timbo to capture fish. Crushed and spread in shallow water, it stuns the prey, making them easy to gather when they float to the surface. The toxin is harmless to humans. Fishline and hooks now often replace both arrows and poison.

In addition to fishing, Kreen-Akarore warriors may roam for weeks on hunting trips that take them hundreds of miles from their villages. While men provide game, women cultivate sweet potatoes, cassavas, and corn.

Carrying her weight in food, a maiden in shell earrings (**right**) totes a backpack of bananas and sweet potatoes. Genipap fruit, gourds, and a land turtle fill her hands. At 13 she assists older women with the chores, leaving the men free for hunting and fighting. The girl's short hair, cut with a blade fashioned from split bamboo, signals her arrival at the threshold of womanhood.

They neither make nor use pottery; at first they would not accept our aluminum pots. And, unlike other Amazon tribes, they would not take our mirrors, matches, or dolls.

They once feared and hated aircraft; from the air I have seen them shoot arrows at us. Now they wave at passing airplanes.

The Kreen-Akarores once hunted fish only with arrows or poison. Now increasingly they use our more efficient fishhooks. They eat earth and clay—perhaps instinctively for minerals, perhaps to fill empty bellies.

Unlike the irrepressible Cinta Largas, who made off with everything they could carry, the Kreen-Akarores never stole from us, although they accepted gifts and traded freely.

They play a game, like some other Amazon tribes, in which relay teams of warriors race with hundred-pound logs on their shoulders. They also fight stylized duels with heavy war clubs, taking care not to strike an opponent on the head. (We did set one broken arm.)

Children and grown-ups alike were fascinated by a special talent of mine: I can wiggle my ears and nose and wildly roll my eyes.

When it came time for Borbula, wiggler of nose and ears, to leave them, they cried unashamedly until tears rolled off their chins.

Facing Sad but Certain Change

And what of the future for the Kreen-Akarores? There are dangers.

FUNAI has learned through bitter experience that goodwill alone does not guarantee success. When it brought the Nambikuaras to their new reservation, many of the insufficiently immunized Indians died of respiratory diseases. Apoena inoculated the Kreen-Akarores as his first responsibility. Still, not all diseases respond to such measures.

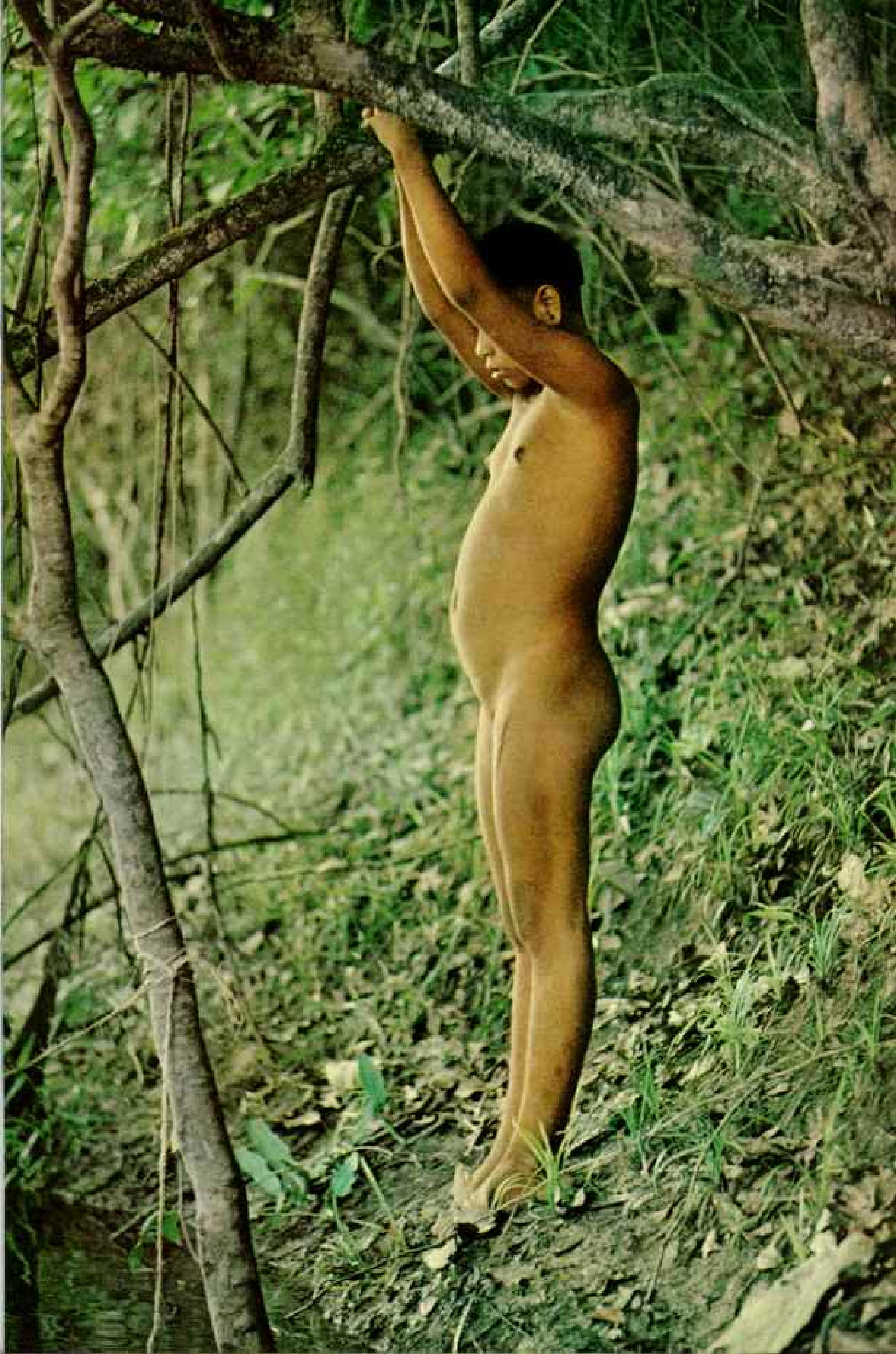
After pacifying the large Cinta Larga tribe, FUNAI, plagued with budget problems, left the pacification post too thinly manned and inadequately supplied. When medicine ran out and the Cinta Largas started dying, they attacked the camp, killing two sertanistas. A large band of the Indians vanished into the jungle. It will be difficult to pacify them a second time.

The road that borders the Kreen-Akarore territory is FUNAI's great fear, for it exposes them, too much and too fast, to civilizados whose diseases they are not equipped to resist. In time FUNAI hopes it can persuade all the Kreen-Akarores to go willingly to Xingu National Park, a large reservation set aside for wild tribes.

There, we hope, they will live with other tribes, including the Txukahamei, in peace and safety until the day comes when they can enter fully into the life of modern Brazil. No sertanista views such assimilation without sadness, of course, for it means the destruction of a beautiful and distinctive culture.

But I believe it is the best solution in the long run. Until they adapt to each other's lifeways, a black-dyed Kreen-Akarore warrior and my neighbor up the street in Goiânia cannot dwell under the same roof, be it made of wild banana leaves or ceramic tiles. □

A new life begins as a 15-year-old mother (**above**) gently bathes her two-day-old baby. The child's survival—indeed the survival of all Kreen-Akarores—remains in doubt because of the influenza epidemic that swept the tribe after this article was written. FUNAI's field staff, working desperately to save the remaining Kreen-Akarores, continued its frustrating efforts to convince the Indians to join other tribes in Xingu National Park. There they could receive better medical care, and adjust gradually to the culture they have just met. Enjoying a moment of the jungle's dwindling solitude, a girl (**right**) perhaps was contemplating her uncertain and bewildering future.



BRAZIL'S TXUKAHAMEIS

Good-bye to the Stone Age

PHOTOGRAPHS BY
W. JESCO VON PUTTKAMER

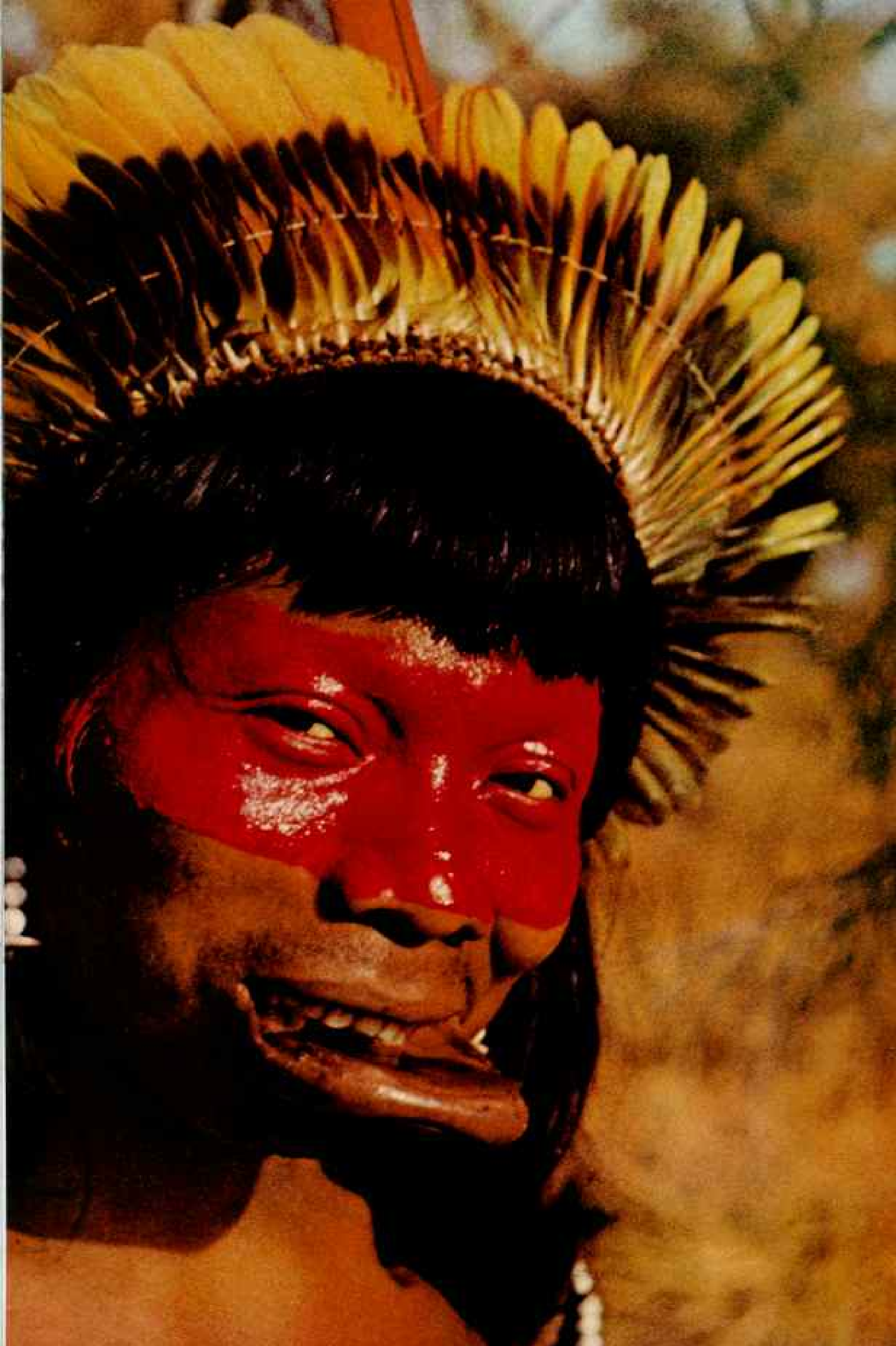
"I AM a mighty warrior. Different from other men. To be respected. To be feared!"

That was the message once broadcast by the flat wooden disk worn in a slit lip, by the flaming red face paint, by the feathered dance headdress. Wearing such decorations like a badge, the Txukahamei warrior was a scourge to his Kreen-Akarore cousins. He also terrorized rubber tappers, road builders, and other *civilizados* encountered along the banks of northward-flowing Amazon tributaries or in the jungles and grasslands of Brazil's States of Mato Grosso and Pará. Today only a few of the older Txukahameis (Choo-kah-HAHM-eyes) wear the lip disk and revere old-time ways. But, in varying degrees, all join in the struggle to cope with invading modern influences.

Some two decades ago, Claudio and Orlando Villas Boas, longtime protectors of the nation's Stone Age Indian tribes, made civilization's first friendly contact with the Txukahameis, then living in a remote area west of the upper Xingu River. For the Indians' protection, the brothers persuaded a large group, perhaps as many as 400, to resettle near the river within the Xingu National Park and to establish Porori village (map, page 260).

Setting out for Porori ten years ago, Jesco von Puttkamer determined to capture on film a way of life then already threatened by the encroaching 20th century. For more than two months he lived with the Txukahameis, sharing the feasts as well as the famines of village existence, learning the language, joining the hunts, and suffering from bites of mosquitoes and bouts of malaria.

His rewards for that visit of a decade ago: lifetime friendships among the tribe and an invaluable collection of photographs of vanishing customs and ceremonials.



SCALY HAZARD of the Amazon Basin, this stream-dwelling anaconda no longer poses a threat to Txukahamei children. Palm-frond headbands of these young hunters honor a visiting Suyá Indian, second from right. A taboo bars killing of the giant reptiles by fathers of young children or husbands of expectant mothers, for fear their offspring may come to harm. Another river peril for the tribe: the piranha, a flesh-eating fish that sometimes attacks swimmers.

To the Txukahameis, however, the greatest danger is the human intruder.

Even Jesco, their friend of long-standing, had to re-establish his kindly intentions when he revisited the tribe last summer. To signal friendship, he employed a gesture he had used before, releasing big balloons behind his boat to bob on the river—dancing spheres of blue, red, orange, green, purple. Thus assured that he came bearing gifts and goodwill, the hidden Txukahameis came out of the forest and stood on the riverbank, waving a welcome.

HOLDING OBLIVION AT BAY, tradition wears "claws" (**left**) and masquerades in creations that represent anteaters (**below left**). To teach courage and inspire respect for tribal customs, older boys at Pororí slip on the costumes, perform a curiously silent dance, then chase smaller boys, using the arm openings to brandish clawlike sticks tipped with fish teeth. Adding to the excitement, the youngsters fight back with their version of bean shooters—bamboo tubes loaded with chewed-up leaves.

Though the costumes were artistic and worthy of preservation, Jesco could not save them. After three days of ceremonial use, they were thrown into the river at dawn as part of the ritual. If, as Jesco suspected, the masks had been made to honor the spirits of anteaters the Indians had killed for food, then their "burial" in the river seemed an appropriate act.

Destined for a tribal cooking fire after capture in the jungle, an 80-pound giant armadillo rides on the back of a lad (**below**), who uses a head sling to bear most of the weight.

Other trophies, such as a macaw (**below**), satisfy the desire to beautify. The hunter's shotgun, taken on a raid against rubber tappers, represents an important change from his traditional club and spear. The machete, too, is an introduced boon; metal was unknown to these Indians until a few decades ago.

THRONG OF EAGER GOURMETS prepares a turtle feast to celebrate the formal naming of village youngsters. During this ceremony the tribe confirmed the names borne from birth by two adolescent girls. The festival, held for both sexes and repeated as

needed, features a meal of turtle meat, baked on hot stones seen behind these juvenile helpers. The boys begin to untie the turtles, caught in the jungle; later the girls and women will cook them. The Indians blacken their bodies for ceremonies, hunts, and war parties.

MAKING MEN of Txukahamei boys involves many tests, considerable endurance, and sometimes years. Invited to live at the Porori boys' house, Jesco had a ringside seat during their initiation rites.

One manhood test, heroically endured by 12-year-old Tio (**left**), required that he hit a wasp nest with his fist and suffer the angry stings and fever. Warriors repeat the ordeal throughout their lives.

Another test saw bloody scarring of the boys' legs with razor-sharp fish teeth. More long-range "schooling" sent them off with warriors to hunt, fish, and raid the camps of rubber tappers, source of the kettle used as a water jug (**below**).

Finally "graduation" is at hand. Those who are ready partially shave their heads, stain bodies black with the juice of unripe genipap fruit, paint faces and feet red with dye from the urucú plant, and apply beeswax hats (**right**). Then begin days and nights of singing and dancing.

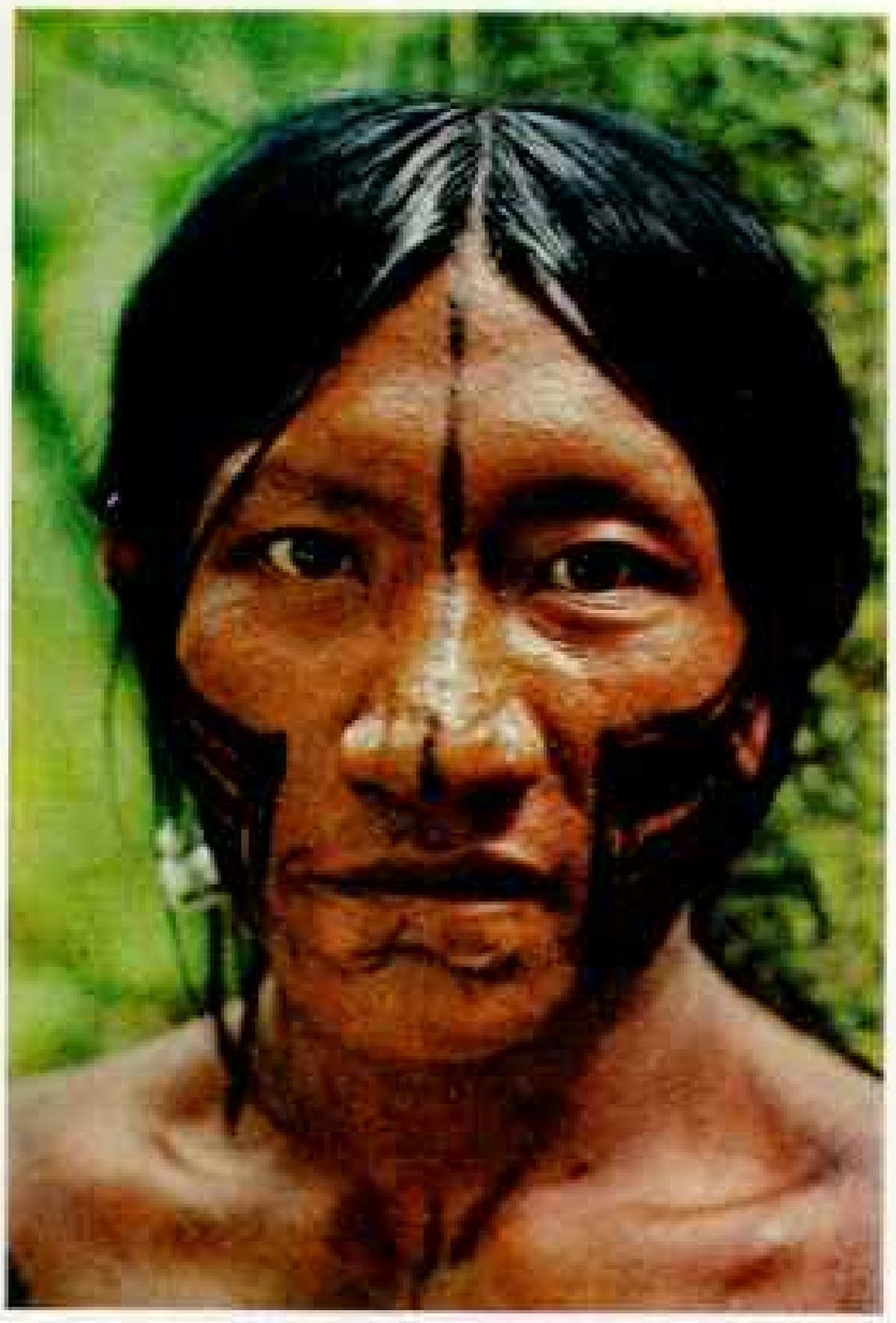
With the coming-of-age rites, young people are free to have sexual relations. Selected older women, all highly respected, instruct the young men.

There is no marriage ceremony; couples simply set up housekeeping. Until then, single men live in the boys' house, practicing hunter and warrior skills.

LIKE PARADING CORNSTALKS, betasseled dancers exhort young corn to yield a bountiful harvest. They wear "fig leaves" of yellow palm fronds and brandish guns seized in raids on rubber-tappers' camps. The Txukahameis depend increasingly on firearms for hunting and protection; in former times they used guns to gain victories over the Kreen-Akarores, their traditional foes, who had only clubs and bows.

The volatile character of the Txukahameis made their situation at Pororí precarious when park boundaries were redrawn after highway BR-080 cut through the territory (map, page 260). Half the tribe, led by Chief Rauni, resettled at Kretire. Others returned to a former village and fell upon bad times. Increased contacts with civilizados brought on a measles epidemic. Then came disillusionment with Indian values and a resort to alcohol provided by the road builders.

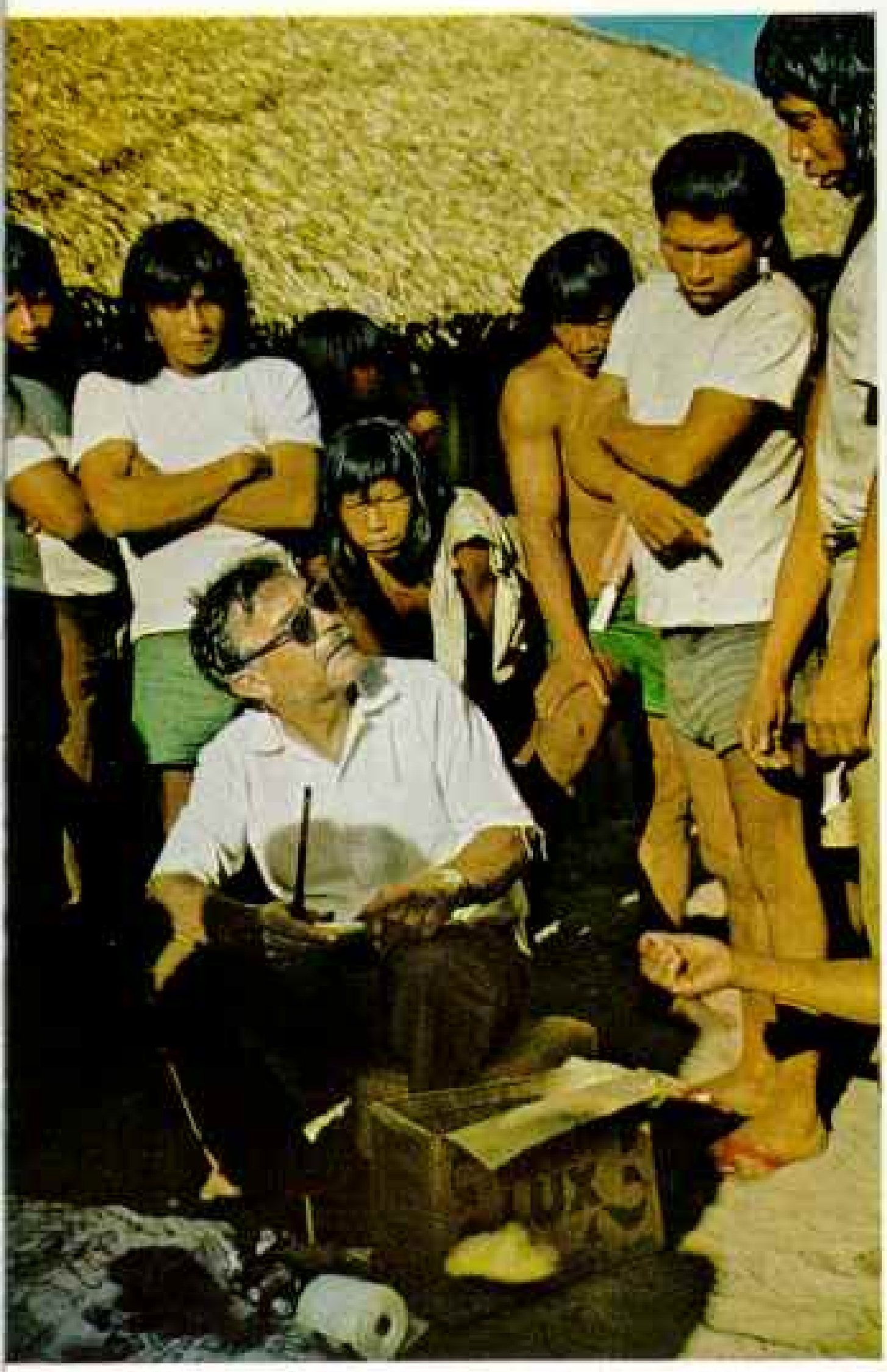
Now the Txukahameis outside the park and those at Kretire have become rivals in a situation so explosive that an eruption of fighting is feared.



HE SPEAKS to the spirits of animals and people. Cobroti, painted for a dance at Pororí, is credited with the power to summon snakes from the jungle and to commune with the dead. He also gives counsel to the tribe.

Hostile Kreen-Akarores ripped out Cobroti's lip disk in battle many years ago. The wound gives him added status among his people.

For the big corn festival, chiefs (**below**) put on their finest feathers of egret, oropendola, and parrot.



NO LONGER self-sufficient children of the jungle, many Txukahameis are becoming dependent on the white man's tools and ways, Jesco discovered during a recent revisit with his Indian friends. Metal hooks and nylon lines, here distributed by "Father Claudio" Villas Boas (**left**), gradually replace the bow and arrow used to shoot fish, or the poison from timbo vines used to paralyze them.

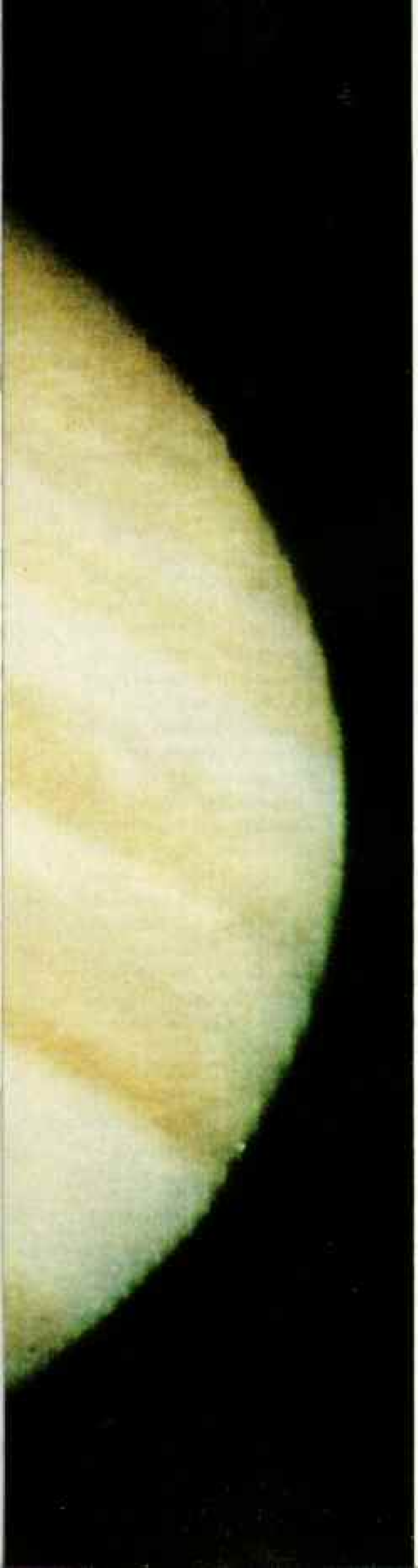
Other Villas Boas gifts: fruit trees, here being tended by youngsters (**below left**), and clothes for those who want them. More and more, the boys and men wear shorts while girls and women put on dresses for everyday, reserving painted nudity for festivals (**right**).

What will happen to the Txukahameis, caught between the past and present?

"Time," urges Claudio Villas Boas. "We need time." The Xingu National Park gives the Indian time to understand and accept what is right for him among civilization's gifts. But the park cannot shield him forever.

Yearly his needs grow—medicine, ammunition to hunt food for the tribe, hammocks and mosquito netting to avoid painful bites and disease. Today education is becoming a compelling drive for these intelligent and adaptable people.

Meanwhile, the Villas Boas brothers believe that Txukahamei values—self-sufficiency won from a harmony with nature, a sense of freedom and independence that makes a chief an adviser only—are traits that more civilized peoples would do well to emulate. □



Mystery Shrouds the Biggest Planet

By KENNETH F. WEAVER

ASSISTANT EDITOR

THE INHABITANTS OF JUPITER "must ...it would seem, be cartilaginous and glutinous masses....boneless, watery, pulpy creatures." Thus, 121 years ago, did the British philosopher William Whewell speculate on the kind of beings that might live in the powerful gravitation of the largest planet of the solar system.

Whewell's description may seem farfetched today, but not his suggestion that life could exist on Jupiter. Indeed, in recent years some scientists have suggested that conditions for the origin of life may be quite favorable on the huge planet, despite its seemingly hostile environment.

Interest in this possibility has heightened now that American space probes have begun exploration of Jupiter. Only a few weeks before you read this, a spidery spacecraft named Pioneer 11 will have raced swiftly through the frightful radiation belts of Jupiter, aiming its battery of 12 instruments at the strange Jovian environment. Almost exactly a year earlier, Pioneer 10 preceded it, sending back to earth remarkable images of the huge multicolored cloud bands that ring the planet, the swirling storms, and the enigmatic Great Red Spot.

Pioneer 10 could not see evidence of life from its closest distance of 82,000 miles above the cloud tops,

Seething clouds and the Great Red Spot mottle the face of Jupiter, as it was photographed by Pioneer 10 from 1,580,000 miles out. The planet's roiling atmosphere, many scientists believe, contains molecules basic to life. Io, the Jovian moon whose shadow lies near the picture's center, is blanketed by a sodium cloud and may be dusted with salts. Pioneer discovered an ionosphere and an extended hydrogen glow around Io.

NASA

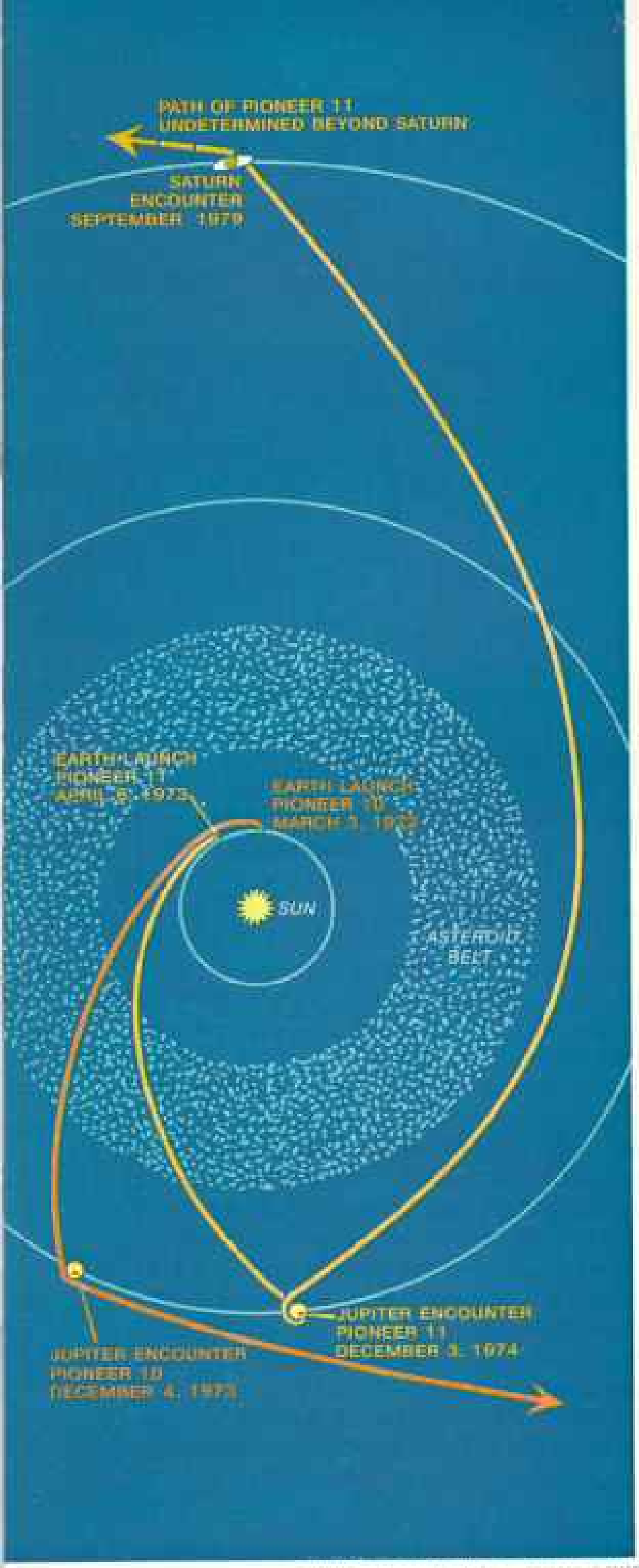


DIAGRAM BY ELIE SARKAR, NATIONAL GEOGRAPHIC STAFF

Rendezvous with the stars awaits Pioneer 10 after its 620-million-mile flight to within a celestial eyelash of Jupiter. Its near twin, Pioneer 11, is scheduled to boomerang toward a first flyby of Saturn. Both spacecraft passed unscathed through the asteroid belt.

nor was it designed to detect life. Neither could Pioneer 11, though it passed within 27,000 miles. But as scientists analyze the data transmitted by these spacecraft about atmosphere, temperatures, gravity, radiation, and magnetic fields, they are putting together new models of Jupiter that have implications about the possibilities of life.

What We Knew Before Pioneer

Scientists already knew a great deal, of course, about the king of the planets.* Systematic studies with ground-based and airborne instruments had told us that:

- Jupiter has 11 times the diameter, 318 times the mass, and 1,300 times the volume of earth, but only a fourth its density.
- Jupiter is so huge that it alone makes up nearly three-quarters of the entire mass of planets and moons in the solar system.
- Nearly 500 million miles from the sun (5.2 times as far away as earth), Jupiter receives only 1/27 as much sunlight per square mile as falls on earth. Yet, surprisingly, Jupiter radiates about two and a half times as much energy as it receives from the sun.
- To radio astronomers, Jupiter is the noisiest object in the solar system save for the sun itself. Its wild radio storms last for minutes at a time. By one calculation they equal the energy of megaton hydrogen bombs exploding at the rate of two every second.
- A year on Jupiter (one revolution about the sun) lasts nearly twelve earth years. But a day on Jupiter is less than ten hours because it rotates so swiftly.
- The whirling planet bulges at the equator 5,400 miles more than its polar diameter. The pull of gravity therefore is slightly lower at the equator because it is farther from the center of mass. Centrifugal force is also greater at the equator. As a result, a 150-pound man, if he could stand on Jupiter, would weigh 350 pounds at the equator but 425 pounds at either pole.

Astronauts will not likely put these figures to the test anytime in the foreseeable future, however. The difficulties and hazards of a manned voyage to Jupiter would defeat today's most advanced technology.

Few men would welcome the sheer duration of the trip—21 months for Pioneer 10—even if life-support equipment were devised

*The author described an evocative "Voyage to the Planets" in the August 1970 GEOGRAPHIC, and wrote "The Incredible Universe" in the May 1974 issue.

to last that long. Communications would be a problem, especially for a stricken spacecraft —some 45 minutes each way for messages flying at the speed of light.

But the chief peril comes from Jupiter's vicious radiation belts. Pioneer 10, in the few hours of its closest approach to the planet, received a massive and unexpectedly high dose of radiation, a thousand times the lethal amount for a human being. Although the spacecraft itself came through relatively unharmed, with few of its instruments more than temporarily affected, engineers believe it was at the very limits of its tolerance to damage from the high-energy electrons that fill the radiation belts.

Eventually scientists will send an unmanned space probe plunging into the Jovian atmosphere. What its sensors will detect, and what you might see if you were aboard, can be speculated about, thanks to the latest theories concerning the atmosphere and interior of Jupiter. Some of these new ideas were announced just as this article was written.

Temperature Rises as Spacecraft Drops

Imagine that you are an observer aboard the probe as it reaches the planet's equatorial region. Your vehicle is streaking at some 100,000 miles an hour. You pass through Jupiter's outer atmosphere, several hundred miles of very thin gas. The "air" pressure on the spacecraft, at first quite low, rises gradually. So does the temperature, which at one point registered 300° below zero Fahrenheit.

This atmosphere is not nitrogen and oxygen, as on earth, but hydrogen and helium, the two commonest and lightest of all chemical elements. Together they make up 99 percent of the entire universe, and they must also be the basic components of Jupiter to account for its low density. In addition, Jupiter's atmosphere contains small but extremely important amounts of methane and ammonia, and almost certainly water.

Long before we entered the atmosphere, we had seen the spectacle of a gigantic layer cake of alternate bands, some light, some dark, some narrow, some wide, circling the planet. These are the familiar whitish or yellowish "zones" and reddish-brown or grayish "belts" making up most of Jupiter's face (page 293).

As we approach, it becomes apparent that the light-colored zones are cloud bands standing miles above the darker surface of the belts. Their edges are sometimes marked by whorls and eddies and plumes. These clouds consist of crystals of frozen ammonia, riding in the hydrogen-helium atmosphere much like the cirrus clouds of water ice high above earth. At the top of Jupiter's cloud deck the temperature is minus 220° F.

Once inside the clouds, our spacecraft is buffeted by updrafts and jet streams. It is a region of turbulence. Outside temperature rises several degrees for every mile we drop.

Handsome Clouds With an Evil Smell

Plunging on through this clouded region, the spacecraft reaches clear atmosphere again. But below lies a second cloud deck—somber clouds of dark yellow and reddish orange and deep brown. This cloud deck is, in fact, part of the "surface" we saw earlier lying on either side of the white cloud zone. According to Dr. John S. Lewis of the Massachusetts Institute of Technology, whose concept of the Jovian atmosphere is widely accepted, this second cloud level consists of icy particles of ammonium hydrosulfide.

The clouds are spectacular to see, but it is fortunate that we are well protected from them. Says Dr. Lewis: "This ammonium hydrosulfide is ghastly stuff with a most noxious odor, somewhat like smelling salts. It reminds one of both ammonia and rotten eggs."

If ammonium hydrosulfide is made in a dark laboratory, it resembles ordinary table salt. But when sunlight reaches it, a photochemical reaction sets in. The substance turns yellow, then orange, then brown. Thus, Lewis believes, we may have a partial explanation for much of the color we see on Jupiter.

Below the colored clouds, temperatures rise steadily until they pass the freezing point of water. Now we have come to Jupiter's third cloud deck—a massive, thick stratum of liquid-water droplets suspended in the ever-present hydrogen-helium, with a layer of ice-crystal clouds on top. Ammonia—in gaseous form at these temperatures—dissolves readily in the water to make a solution much like household ammonia. The atmosphere is quieter here than at higher levels. Flashes of lightning occasionally relieve the gloom.

For those who look for life on Jupiter, the water clouds form the most important part of the planet. Here are found pressures and temperatures within the limits that terrestrial organisms tolerate. Here, according to Dr. Lewis, is abundant water, an invariable requirement for any forms of life we know. And

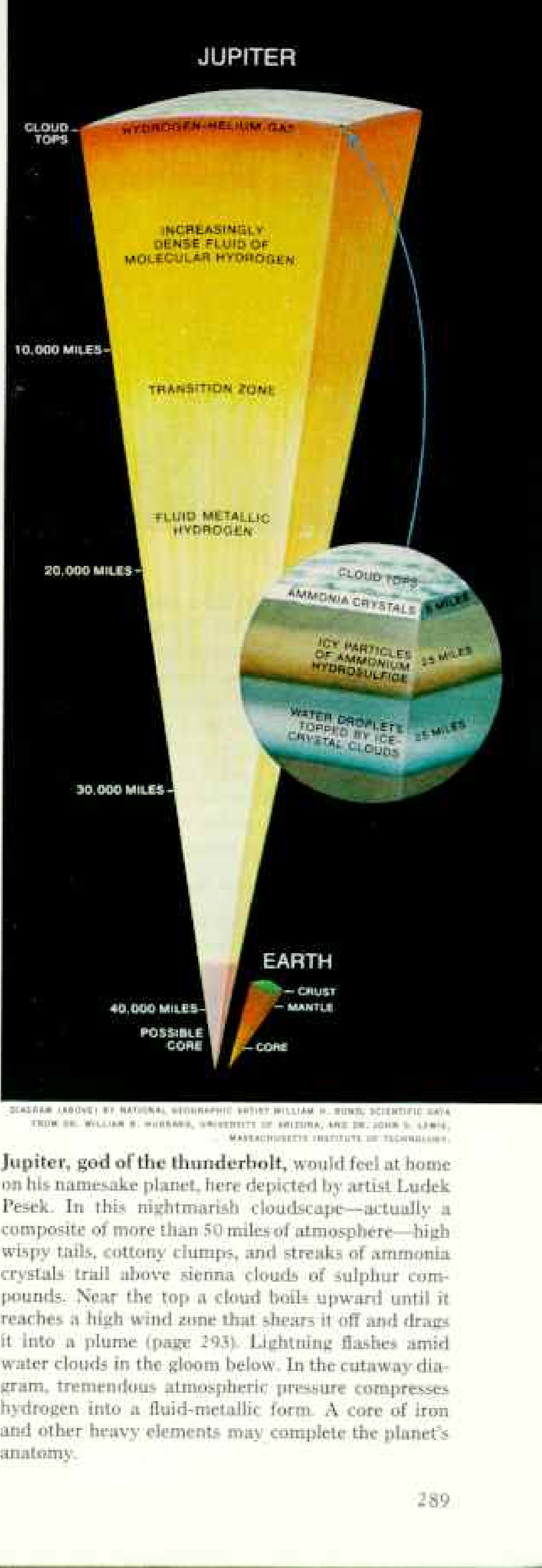


DIAGRAM (ABOVE) BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BOND; SCIENTIFIC DATA FROM DR. WILLIAM B. HUBBARD, UNIVERSITY OF ARIZONA, AND DR. JOHN S. LEWIS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Jupiter, god of the thunderbolt, would feel at home on his namesake planet, here depicted by artist Ludek Pesek. In this nightmarish cloudscape—actually a composite of more than 50 miles of atmosphere—high wispy tails, cottony clumps, and streaks of ammonia crystals trail above sienna clouds of sulphur compounds. Near the top a cloud boils upward until it reaches a high wind zone that shears it off and drags it into a plume (page 293). Lightning flashes amid water clouds in the gloom below. In the cutaway diagram, tremendous atmospheric pressure compresses hydrogen into a fluid-metallic form. A core of iron and other heavy elements may complete the planet's anatomy.

PAINTING BY LUBOS FEJER

Eyes and ears of Pioneer 10 scan Jupiter's cloud tops from 82,000 miles (**left**). Nuclear generators on the 10-foot booms at lower left power the 11 instruments of the TRW-built craft, at this point half a billion miles from our sun—too distant to tap enough solar energy. Below a slender mast that holds a device to measure the planet's magnetic field lies the puzzling Great Red Spot. The huge Jovian "eye," seen (**right**) obliquely across the top of Jupiter's cloud decks, may be an unthinkably vast and long-lived storm. With a surface area nearly as large as earth's, the spot differs from two smaller white cells flanking it, perhaps "thunderheads" of ammonia crystals.

here are hydrogen, methane, and ammonia—prime ingredients of the "primordial soup" in which, many scientists believe, life on earth originated billions of years ago.

Beneath this deep cloud deck, about 125 miles below the tops of the uppermost cloud layer, pressure approaches 100 atmospheres—that is, 100 times earth's atmospheric pressure at sea level. Here temperature reaches 800° F. Our space probe cannot penetrate much farther without being destroyed.

What Lies Below the Clouds?

What would we find below if we could reach it? Is there eventually a solid surface? Or an ocean? Or is Jupiter entirely gaseous? Scientists have long argued these questions, but work by Dr. William B. Hubbard of the University of Arizona, based in part on Pioneer 10, is now giving us a clearer picture.

Below the 125-mile depth, Hubbard and his colleagues believe, hydrogen is squeezed gradually into a dense, hot fluid under the increasingly high pressure. It is not a sudden change. There is no sharp division as between an atmosphere and an ocean. Instead, there is a zone with gradually increasing viscosity.

"It's not really a slush," says Dr. Hubbard. "I'd call it an exceptionally dense gas."

About 1,800 miles down, the pressure has reached a crushing 100,000 atmospheres, and the temperature registers more than 12,000° F., hotter than the surface of the sun. Now the hydrogen and helium become so dense that they behave like a liquid.

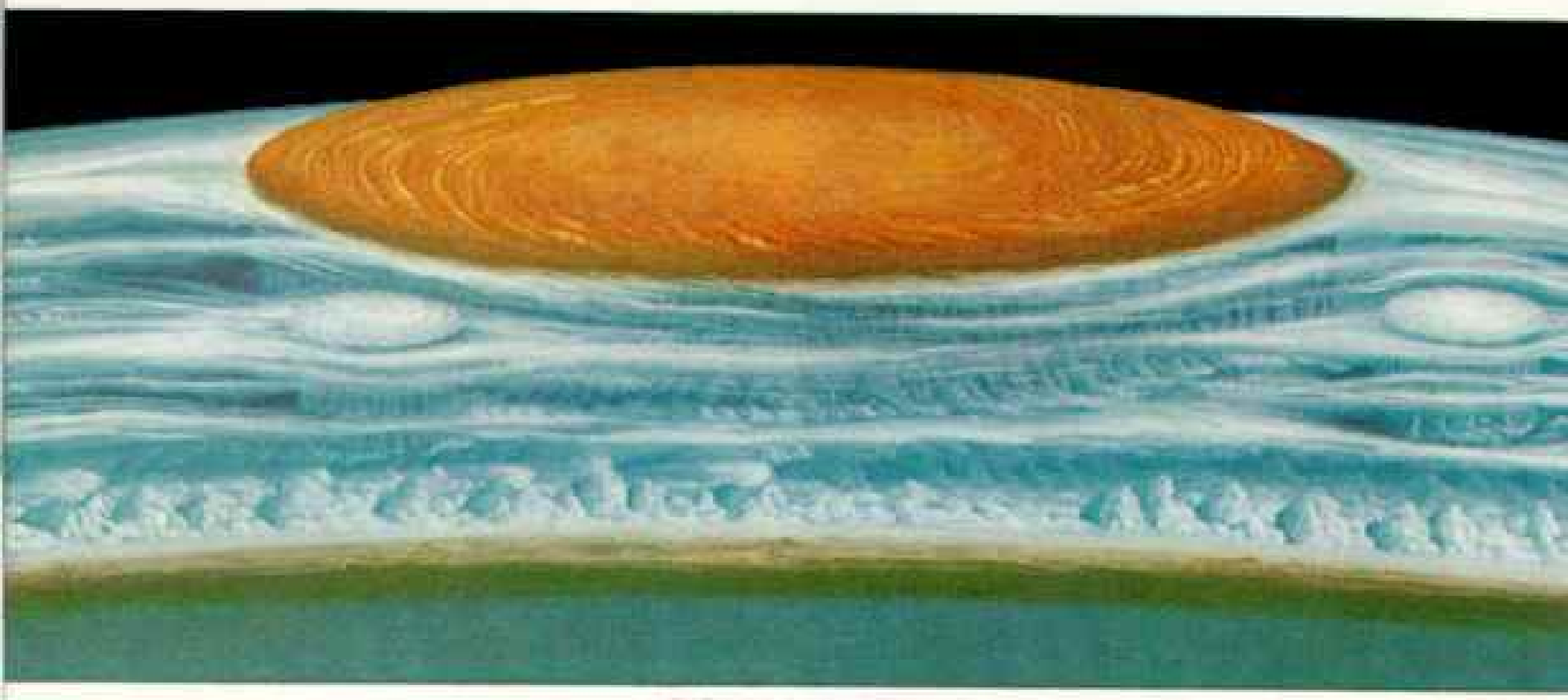
Dr. Hubbard's model shows Jupiter to be a "liquid" planet from this point virtually all the way down. At about 12,000 miles in depth, scientists believe, a change takes place in the molecular fluid hydrogen. Under a pressure of some three to five million atmospheres and a temperature of 18,000° F., the hydrogen becomes metallic—a form unfamiliar on earth. This hydrogen does not become solid, but it takes on such characteristics of a metal as the ability to conduct electricity.

Finally, Jupiter may have a small core, slightly larger than the earth, thought to contain iron and other heavy elements.

Because Jupiter pours out more energy than it receives from the sun, some writers have called it a "near star," or a "star that never got started." But the latest estimates show that, although Jupiter's central pressure is as much as forty million atmospheres, the temperature does not likely exceed 50,000° F. Since the thermonuclear reactions of a star require temperatures of millions of degrees, Jupiter is far from being a star. In fact, its mass would have to be at least thirty times greater to create sufficient pressure and temperature for a thermonuclear furnace.

No one is quite sure where Jupiter's excess heat comes from. Most scientists believe it is simply leftover primordial heat from gravitational contraction after Jupiter and the other planets condensed from the solar nebula some 4.6 billion years ago. This contraction—and heat output—still goes on.

In any case, the heat is enough to drive the



PAINTING BY NATIONAL GEOGRAPHIC ARTIST ROBERT C. MIKOS; VERTICAL SCALE GREATLY EXAGGERATED

interior of Jupiter into sluggish convection, like a kettle of taffy simmering on the stove. This same heat also keeps parts of the Jovian atmosphere constantly churning, with updrafts in the zones and downdrafts in the belts.

Despite the turbulence of Jupiter's visible atmosphere, one feature remains relatively constant—the mysterious Great Red Spot in the southern hemisphere (above). A sharply defined oval some 17,000 miles long by 8,500 miles wide, it could easily encompass two earths side by side.

For more than 300 years astronomers have observed this baleful Cyclopean eye, noting that it drifts slowly around the planet, always at about the same latitude. Its length fluctuates, and its color waxes and wanes. But even when the red has faded to gray, the oval spot is still visible.

Jovian Mystery May Be Solved

The riddle of the Great Red Spot may be close to solution. Observers note that it is a whirling column that towers some miles above the surrounding clouds. It rotates counterclockwise, once every 12 earth days. Thus some scientists believe it may well be a long-lived storm that will in time disappear.

Since Jupiter is now thought to have no solid surface, it becomes increasingly difficult to accept an older theory that the red spot is a stagnant column in the atmosphere caused by a bump or a hollow in the surface below.

Why is the red spot red? I found an answer to that question right here on earth, in the Laboratory of Chemical Evolution of the University of Maryland. Dr. Cyril Ponnamperuma, director of the laboratory, has for 13 years been experimentally reproducing the conditions believed to have existed on the primitive earth some four billion years ago. He and his colleagues seek to determine the steps by which organic molecules first evolved. From this point they hope to discover how life itself evolved on our home planet.

The experiment that Dr. Ponnamperuma showed me is basically simple. He filled a flask with methane, ammonia, and hydrogen, characteristic gases of earth's primordial atmosphere as well as of the Jovian atmosphere. Then he threw a switch, and sparks crackled between electrodes embedded in the glass wall.

As time passed, the clear walls of the globe became dirty and clouded. Color began to appear. Unmistakably, a reddish material was being deposited on the glass. With the passage of hours, the material thickened and the color deepened.

"There's your red spot," said Dr. Ponnamperuma. "We've taken the Jovian atmosphere and applied lightning to it. Other forms of energy such as ultraviolet radiation will work as well. The results you see on the walls of the flask are molecules of an organic polymer known as a nitrile. Now if we combine nitriles with water we get amino acids—the building blocks of proteins and thus of all life, from the smallest microbe to the largest mammal.

"Experiments like these convince me that

CHARLES O'REAR

NATHAN BEAN (ABOVE) AND NASA (FACING PAGE)

"**Primordial soup**" may make the red spot red, according to Dr. Cyril Ponnamperuma (**lower**) of the University of Maryland. He produces electric sparks in a flask of methane, ammonia, and hydrogen, all present in Jupiter's atmosphere, and brews precursors to amino acids, building blocks of life. The resulting reddish-orange mixture could explain the spot's color. Another pioneering scientist, Dr. Guido Münch (**top**) of Caltech, used an infrared radiometer aboard the spacecraft to create heat maps of the planet. They suggest that the wide, light "zones," seen in a Pioneer 10 photograph (**facing page**), rise miles above the warmer cinnamon-colored "belts."

life could evolve on Jupiter, and indeed probably already has done so. It is perhaps unreasonable to believe that life could exist only on one planet," he added.

Dr. Ponnamperuma thinks that Jovian life would be very small, something like the bacteria that are found in earth's atmosphere at altitudes as high as ten miles.

Rugged Germs or Giant Living Balloons?

He points out that bacteria can be extremely hardy. He has exposed common terrestrial microorganisms for a day to simulated Jovian atmosphere at pressures from 1/10 to 120 atmospheres and temperatures down to minus 325° F. In nearly all cases they survived. Similarly, bacteria have lived at 330° F. in carbon dioxide under high pressure.

Larger creatures on Jupiter would be out of the question, I assumed, until Dr. Bradford A. Smith at the University of Arizona noted the possibility of enormous organisms suspended from floating gas bags.

It is only fair to add that many other scientists see a major obstacle to life on Jupiter. Dr. Ichtiaque Rasool, chief scientist of NASA's Planetary Programs Office, points out that vertical currents in the atmosphere might quickly carry organisms down to lethal temperature levels. Yet, the life proponents reply, if there are quiet and stable areas in the atmosphere, life forms might find havens for survival.

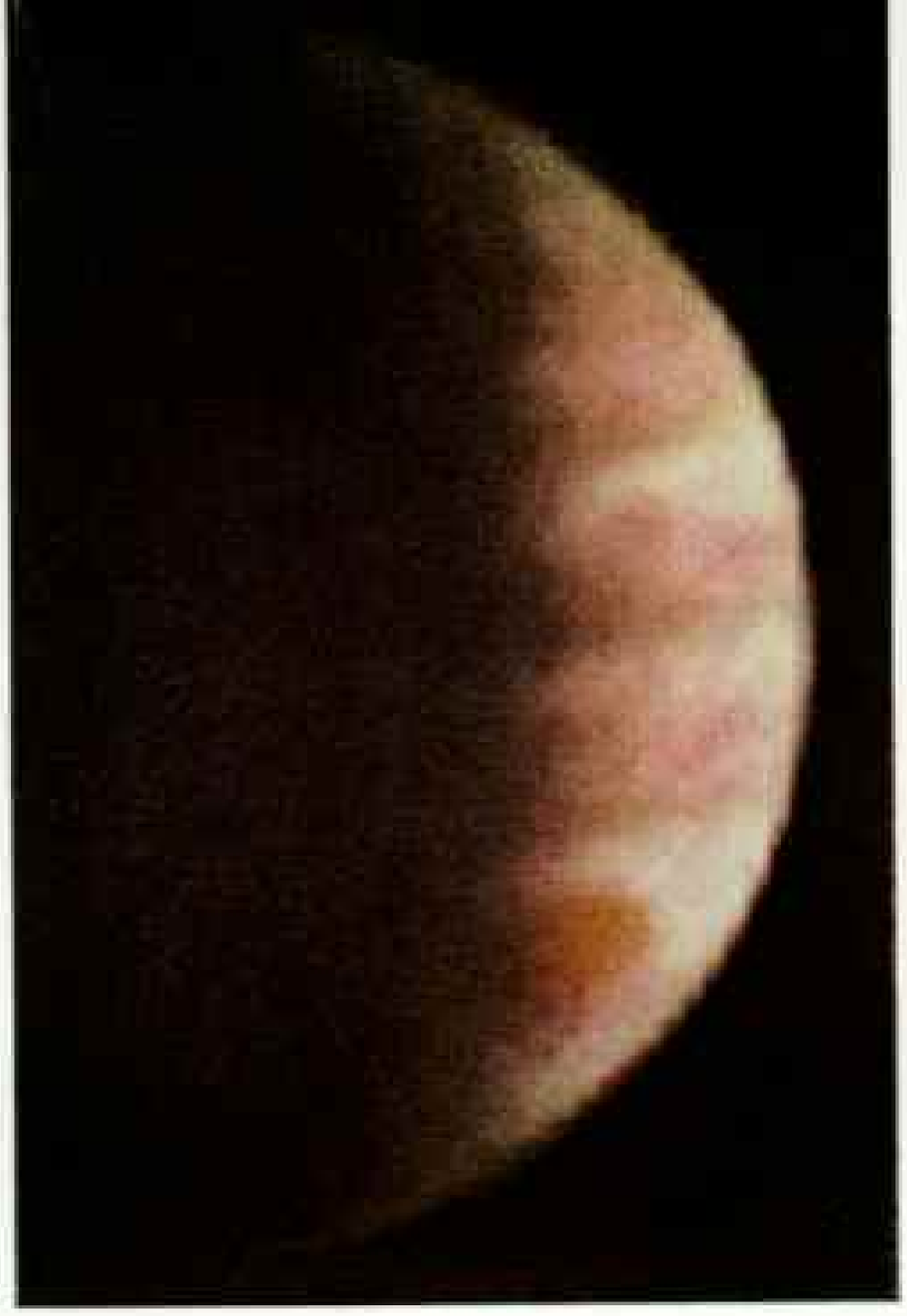
Man, of course, could not live on Jupiter, but he might investigate one of its 13 moons.* Io and Europa are nearly the size of earth's moon or larger; Callisto is the size of the planet Mercury, and Ganymede is even larger. However, only Callisto lies outside the most intense radiation zone.

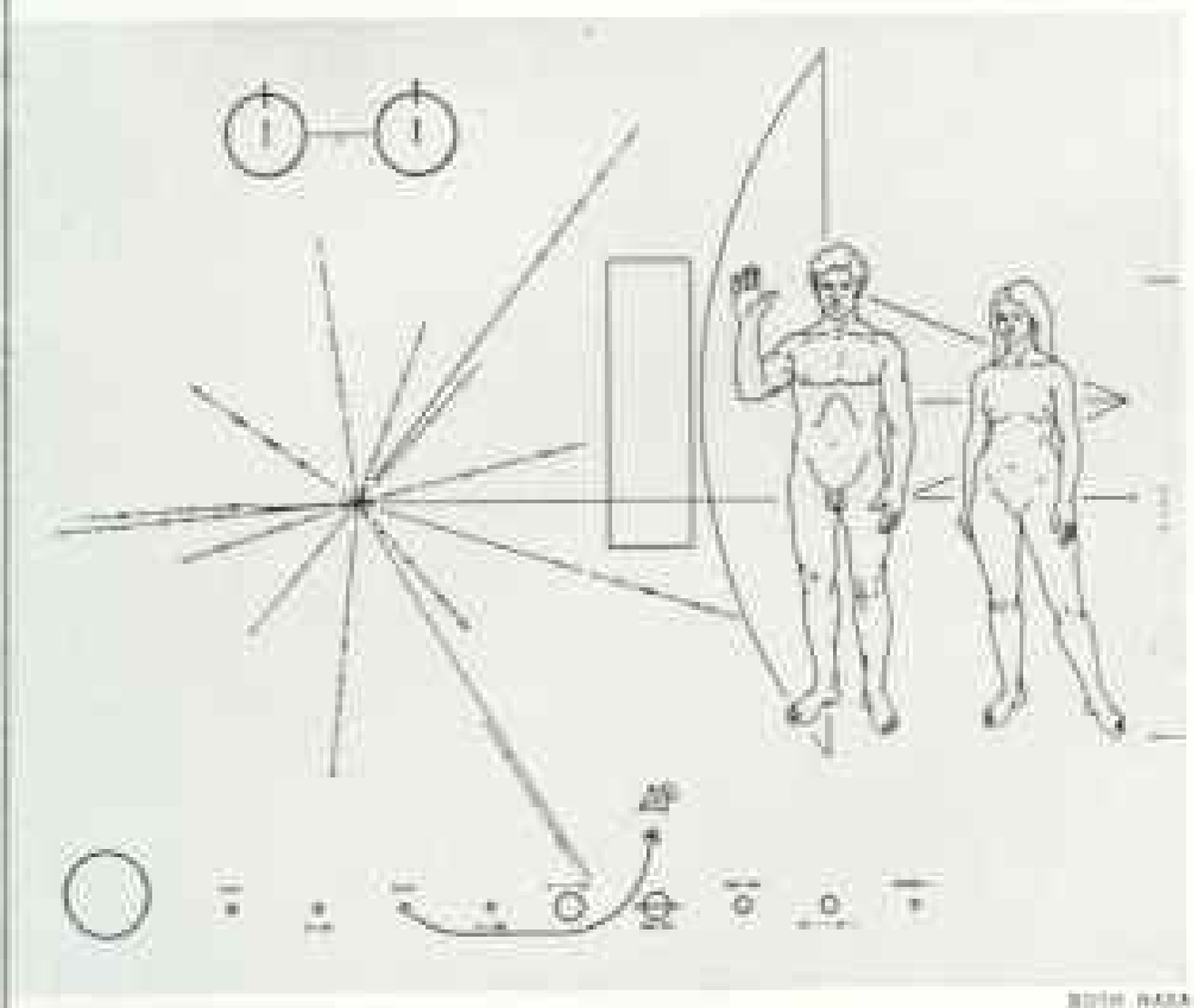
Io, closest in of the large moons and most reflective object in the solar system, is of special interest. Normally orange, it has been seen to brighten for about 15 minutes as it comes out from Jupiter's shadow. One explanation: A gas, possibly ammonia or methane, "snows" out of Io's atmosphere while in the frigid shadow, then swiftly evaporates in the sunlight.

Io arouses interest also because its orbital motion somehow modulates many of Jupiter's awesome bursts of radio energy.

The Pioneer spacecraft have not only thrown new light on our largest planet, but

*Jupiter's 13th moon, about five miles in diameter, was first seen last September in photographs made by astronomer Charles Kowal at Palomar Observatory.





BOTH: NASA

Jupiter glows in a crescent phase never seen from earth (**top**). Pioneer 10 sent this view as it sped away toward the distant red star Aldebaran.

The spacecraft bears a gold-anodized plaque bolted to its frame. A schematic hydrogen atom, at the upper left, represents the most common element in the universe. Radiating lines give bearings from our sun to 14 pulsars, cosmic radio sources. Humans in front of an outline of Pioneer show what we look like and how big we are. Our solar system, bottom, indicates Pioneer's track from earth out past Jupiter. It all adds up to a message to any intelligent beings: "You are not alone."

they have also laid to rest the bogey of the asteroid belt. This 150-million-mile-wide band of rock and dust and debris between the orbits of Mars and Jupiter was once feared as a hazard to space travel. What if a spacecraft were struck by one of the trillions of trillions of objects ranging from the asteroid Ceres, 640 miles in diameter, down to particles the size of a grain of sand? At 30,000 miles an hour, any such collision could be disastrous.

But both Pioneers sailed right through these uncharted dangers. Their detectors showed impacts of only about 100 microscopic dust particles, none damaging to the spacecraft.

Far Beyond Our Solar System

Today, more than a year beyond Jupiter, Pioneer 10 is in headlong flight toward the red star Aldebaran, which it should reach in 1,700,000 years. In 1987 it will cross the orbit of Pluto. Years later it will flash by the last of the comets, becoming the first man-made object to leave the solar system.

Until it reaches the orbit of Uranus in 1979, Pioneer 10 will be able to send intelligible information about interplanetary space. But this communications thread is incredibly slender. Even when Pioneer 10 was transmitting from Jupiter, the power of its messages reaching the huge 210-foot antenna at Goldstone, California, measured only a quintillionth of a watt. If this wattage were accumulated for the life of the solar system, it would light a single Christmas tree bulb for only a hundredth of a second!

Pioneer 11, meanwhile, has swung sharply around Jupiter and, accelerated by the great planet's gravitational kick, is headed for Saturn (diagram, page 286). If all goes well, in 1979 its instruments will make the first spacecraft observations of the ringed planet.

The Pioneers have only begun the exploration of Jupiter and the outer solar system. Congress has authorized a Mariner Jupiter-Saturn mission, with two launches in 1977, to make more-sophisticated observations and pictures than Pioneer could make. And NASA hopes to put two Mariner spacecraft into orbit around Jupiter in the early 1980's.

No man knows what these further researches will reveal. But, in the words of science writer Arthur C. Clarke, "What a shock it will be to our pride if the biological as well as the dynamical center of gravity of the planetary system turns out to be somewhere on the other side of the asteroids!" □

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WASHINGTON, D. C.

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Covering the Kurdish War

KURDISTAN's boundaries appear on few maps, but writer-photographer LeRoy Woodson, Jr., found his way to this invisible nation: A contact in Washington . . . hurried briefings in Lebanon . . . secret police in Iran . . . and, finally, the right connections for a perilous ride into the jagged mountains of northeastern Iraq.

In this corner of the "Land of the Kurds," two million iron-willed people remain deadlocked in civil war, battling the Iraqi Government for the right to rule themselves.

Donning the garb of the Kurdish guerrillas, Woodson (**top**, in sunglasses) spent nine rugged weeks last summer covering the conflict. He found the Kurds' resolute faith exemplified by wounded soldiers (**bottom**) who weathered a torturous 16-hour journey to a hospital.

"The refugees come over the mountains in an endless, dusty stream," an entry in Woodson's diary reads. "Yet their faces show incredible dignity and determination. They are willing to face any hardship to win their freedom."

Woodson's story will appear in next month's GEOGRAPHIC. You can share such dramas with friends by nominating them below as members.

LE ROY WOODSON, JR.

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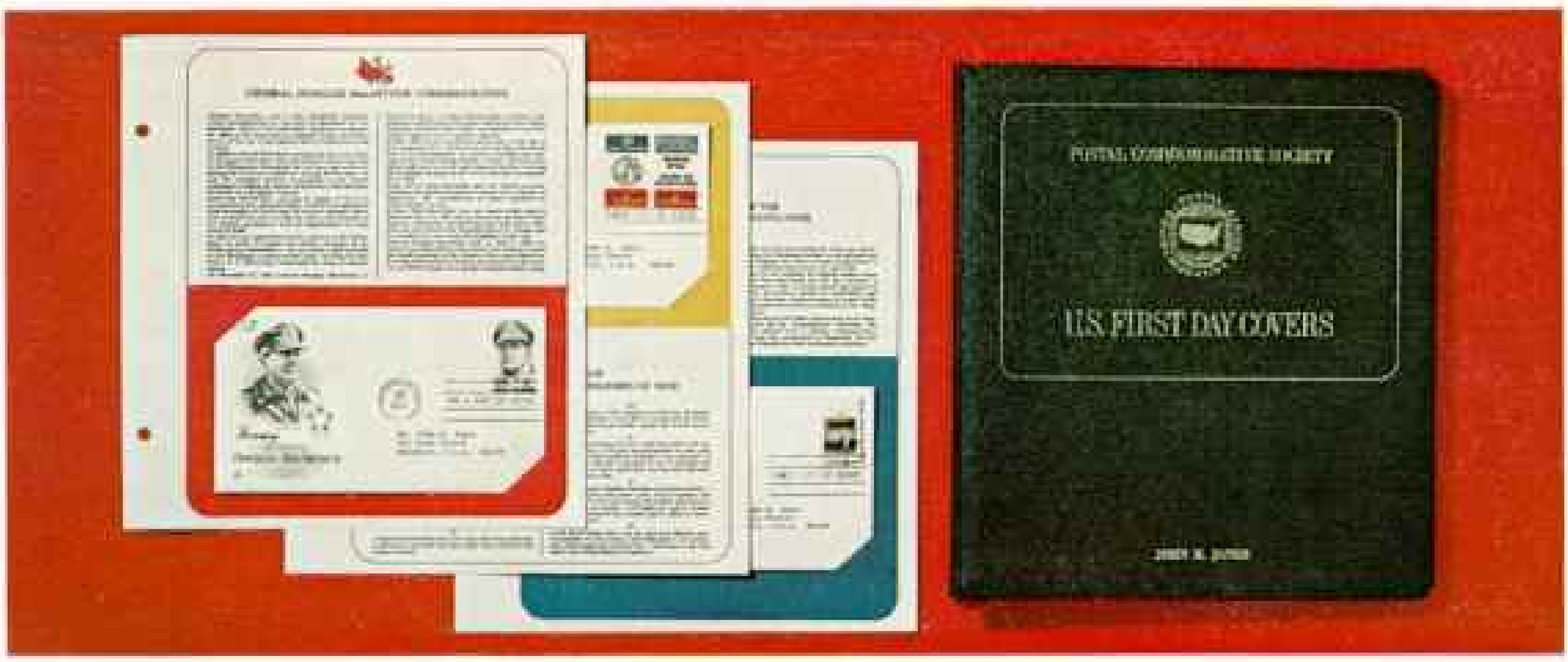

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This frail doll whispers of Peru's lost civilizations

Raggedy Andy of a forgotten time, he wears homespun cape and cap, with coarse wrappings for arms and legs. His rouged face is fashioned of wood, the hair of fiber.

Carved and clothed by a Peruvian craftsman, probably about 800 years ago, the 23-inch doll and his small puppetlike companion survived the years in a bone-dry grave. Now he is carefully preserved in the Smithsonian Institution. No mere curio of some ancient toyland, he probably served as an offering to the dead. The pair were unearthed in Peru's desert, a virtually rainless ribbon of land along the coast. Here colorful textiles entombed for thousands of years preserve their brilliance; objects as delicate as feathers weather the centuries intact. Time has not dulled the doll's black hair or frayed his garments. Even the red paint on his face has not paled. In such frail images Peru whispers of ancient civilizations.

Inland, Peru shouts of past glories. High in the Andes, on a mountain saddle above the twisting Urubamba River, sun-worshiping Incas built the temple city of Machu Picchu. Hand-hewn granite blocks of the citadel lay hidden under dense jungle growth until 1911, when Yale professor Hiram Bingham "rounded a knoll and suddenly faced tier upon tier of Inca terraces rising like giant stairs." Supported by the National Geographic Society, Bingham explored and cleared the site. In the GEOGRAPHIC for February 1915, he reported his discoveries in detail.

Readers have since returned many times to Peru. Lured by tiny doll or mammoth ruin, they find lost civilizations vividly unveiled in the pages of NATIONAL GEOGRAPHIC

"We went to Horseshoe Bay and it was almost like a honeymoon place."

Dinah Tarbell on the Tarbells' first visit to Bermuda.

"We'd walk into little coves and go exploring in the shady rocks...It was beautifully secluded."

"I think Bermuda is a place to just be yourself and enjoy beautiful thoughts."

"The pipers at Fort Hamilton are gorgeous. They are really a sight. And they do it just for fun. Just because they love the history and tradition of it."

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December 1, 1974 to March 15, 1975.

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Seafloor oil wells.

Exxon is developing a revolutionary system of underwater wells that may unlock oil and gas reserves deeper beneath the sea than ever before.

To boost America's energy production, Exxon is taking a giant step down.

Today, under the Gulf of Mexico, Exxon is testing the prototype of a system that may someday allow us to reach for oil and natural gas deeper beneath the sea than has ever been possible.

The prototype is called the Submerged Production System—or SPS. As the name indicates, it operates *underwater*.

Exxon saw the need for such a system in the mid-1960's—years before the term "energy crisis" entered our vocabulary. Now, after $30 million of design, engineering and construction, the first SPS unit is undergoing operational testing.

Why it's needed

Nearly all of today's offshore oil and gas is brought to the surface by wells drilled from production platforms. These platforms are huge steel towers that are anchored to the seafloor and rise above the water. Up on their decks many people live and work.

These platforms are practical for production in relatively shallow water. But in deep water costs and technological problems involved make them less attractive. This is where the SPS may take over.

We will soon be producing oil and gas from water depths that will require platforms nearly as tall as the Empire State Building. The SPS may permit production from even greater water depths.

The operation

Once the SPS has been lowered to the seafloor and anchored, a drilling ship will complete a number of wells through openings on the unit and then leave.

After production begins, the SPS will carry out the entire production operation. All SPS functions will be monitored and remotely controlled by an operator aboard a ship or in a control room on shore.

At the push of a button, the operator will start up or shut down parts of the SPS unit. The SPS is designed to pipe oil and gas to shore—or to a tanker overhead, as shown in the illustration on the right.

The handy Manipulator

A maintenance device called the Manipulator services and repairs the SPS once it's on the ocean floor.

If, for example, a valve should need to be replaced, the Manipulator will be lowered to a track which encircles the SPS unit. The Manipulator will move around the track until it reaches the faulty valve. It will then remove the old part, insert a replacement, and test to make sure everything's working right.

All the while, underwater television cameras on the Manipulator will enable an operator in a work boat to direct the progress below by remote control.

Environmentally safe

Besides having the potential to unlock billions of barrels of oil—and trillions of cubic feet of gas—the SPS also offers promising environmental innovations.

The SPS is designed with special features to prevent oil leaks. And even in the unlikely event that a leak does occur, oil-catching drip pans will collect the escaping oil and automatically shut down production until repairs are made.

Deeper beneath the sea than ever before—this is one of the places Exxon is going to bring you gas and oil.

1. Drilling ship anchors over Submerged Production System and drills a number of wells.

2. The drill is guided through pre-planned openings clustered on the SPS and into the rocks under the seafloor.

3. Oil and gas are directed through the SPS and channeled into pipelines which connect to a riser that leads to a moored storage tanker above.

4. Oil and gas are delivered to a tanker on the surface.

EXXON

Two points of view. Which is right? Obviously both are. Because both recognize fundamental truths about our quality of life.

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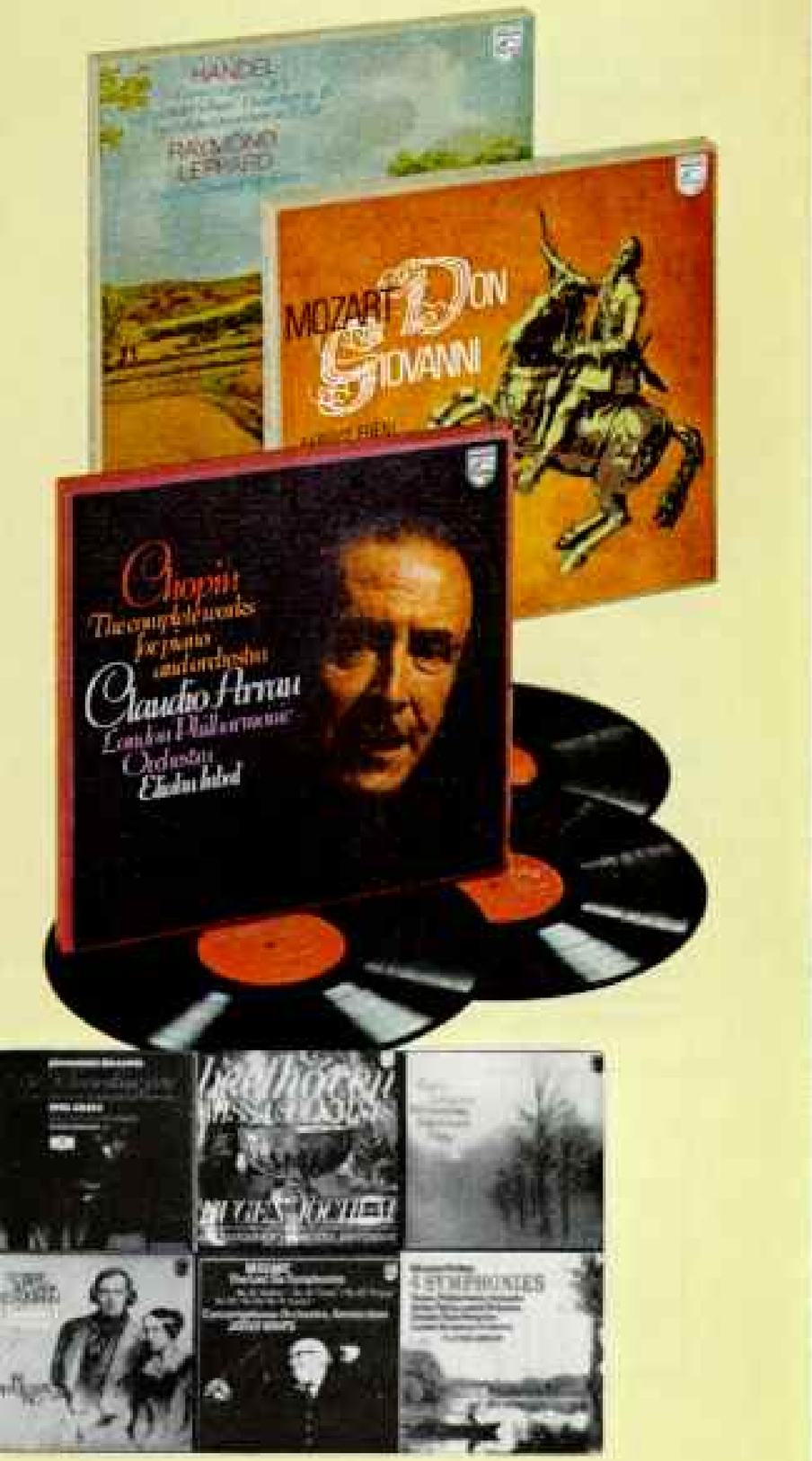

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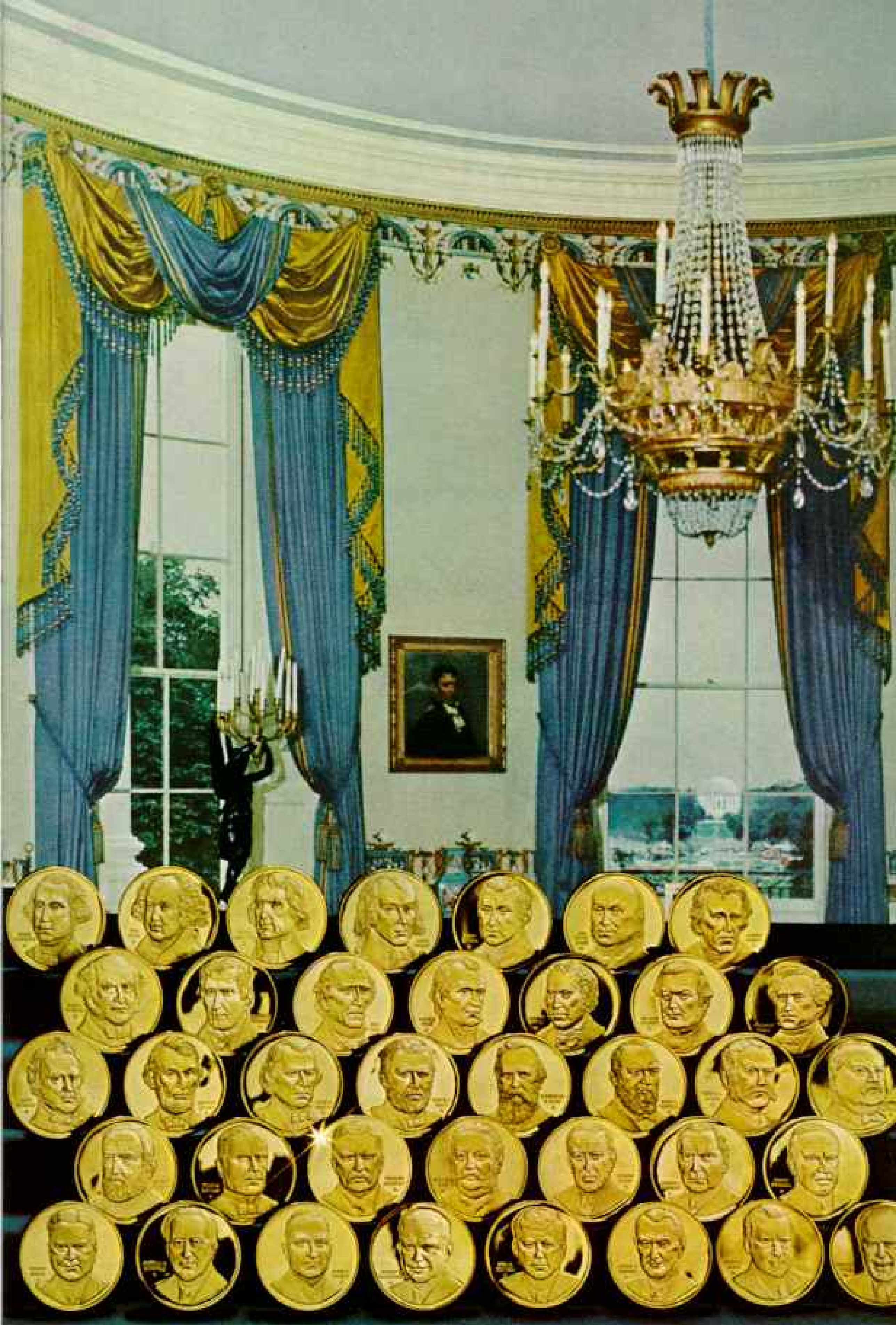

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Presidential Medals

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The non-profit, bipartisan White House Historical Association was established more than a decade ago through the initiative of President and Mrs. Kennedy. During each succeeding administration, the Association has been steadily enhancing the White House as a shrine of American history—a place where all Americans can come to appreciate historic objects and works of art identified with our Presidents.

To further this work, the Association is now pleased to announce the limited minting in solid gold of the official White House Historical Association commemorative medals honoring the Presidents of the United States.

These famous Presidential Medals were previously available only in sterling silver and in gold electroplate on sterling. Now these medals will be struck in gold *for the first and only time*. The complete set may well become one of the most important and most valuable commemorative medal collections ever minted.

A historically significant collection

Our country's greatest living medallist, Gilroy Roberts, was commissioned to sculpt the portraits of the Presidents. And our country's largest private mint, The Franklin Mint, was appointed to strike these distinguished Presidential commemoratives, in solid gold.

Mr. Roberts spent the better part of two years researching and sculpting these portraits. And each portrait was authenticated by Clement Conger, Curator of the White House.

The portraits are thus historically accurate works of art—individual medallic masterpieces that will serve as a standard for generations to come. Depicting each of America's 37 Presidents —from George Washington to Gerald R. Ford—they are an enduring tribute to our nation's highest office, and a magnificent expression of the continuity and the greatness of our country.

As a further measure of the importance and historical significance of this collection, it is noteworthy that these are *the first gold commemorative medals* to be authorized by the White House Historical Association and *the first series of medals to be minted entirely in gold by The Franklin Mint.*

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Now, for the first time in more than four decades, American citizens have the right to acquire and own works of medallic art minted expressly for them in solid gold.

To bring these solid gold Presidential Medals within the reach of most collectors, the White House Historical Association has authorized their limited minting in two sizes—20mm and 12½mm. The gold medals will be minted *only* in these two sizes, and will be issued to subscribers at the rate of one medal per month. Thus, the complete collection may be acquired on a convenient and systematic monthly basis.

Moreover, The Franklin Mint has agreed to guarantee the original issue price for the entire 37-month duration of the series, even if the price of gold rises so high that the gold content of each medal is worth more than the issue price.

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His work has been exhibited at the Corcoran Gallery of Art in Washington, D.C., the Pennsylvania Academy of Fine Arts, the National Sculpture Society in New York City, and in many cities abroad.

Mr. Roberts' distinguished series of 37 medallic portraits of America's Presidents was created expressly for the White House Historical Association. These portraits have appeared previously only on a proof edition of 45mm medals minted in sterling silver and in gold electroplate on sterling.

The personal signature mark (GR) of Gilroy Roberts appears next to each Presidential portrait, just as it appears on his other medallic works.

SPECIFICATIONS: The official White House Historical Association Presidential Medals will be minted in solid 24 karat gold, in two sizes: 20mm diameter and 12½mm diameter. The thirty-seven Presidential Medals that form the complete collection will be minted exclusively for advance subscribers and issued at the rate of one medal per month beginning in March 1975. There is an absolute limit of one collection per subscriber, and the closing date for entering a subscription is February 28, 1975. After the gold Presidential Medals have been minted, this edition will be permanently closed and the medals will never again be minted in gold.

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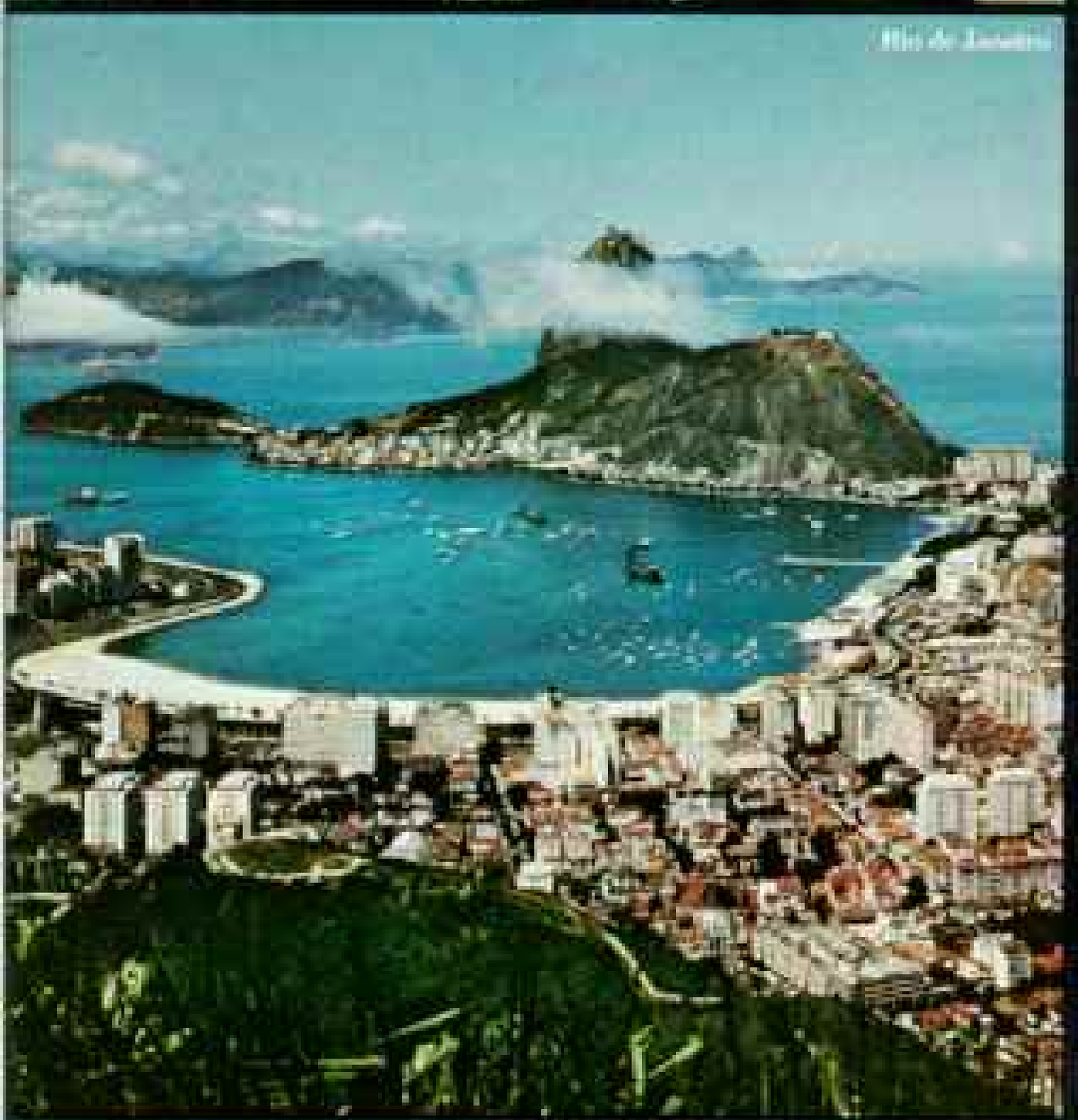

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