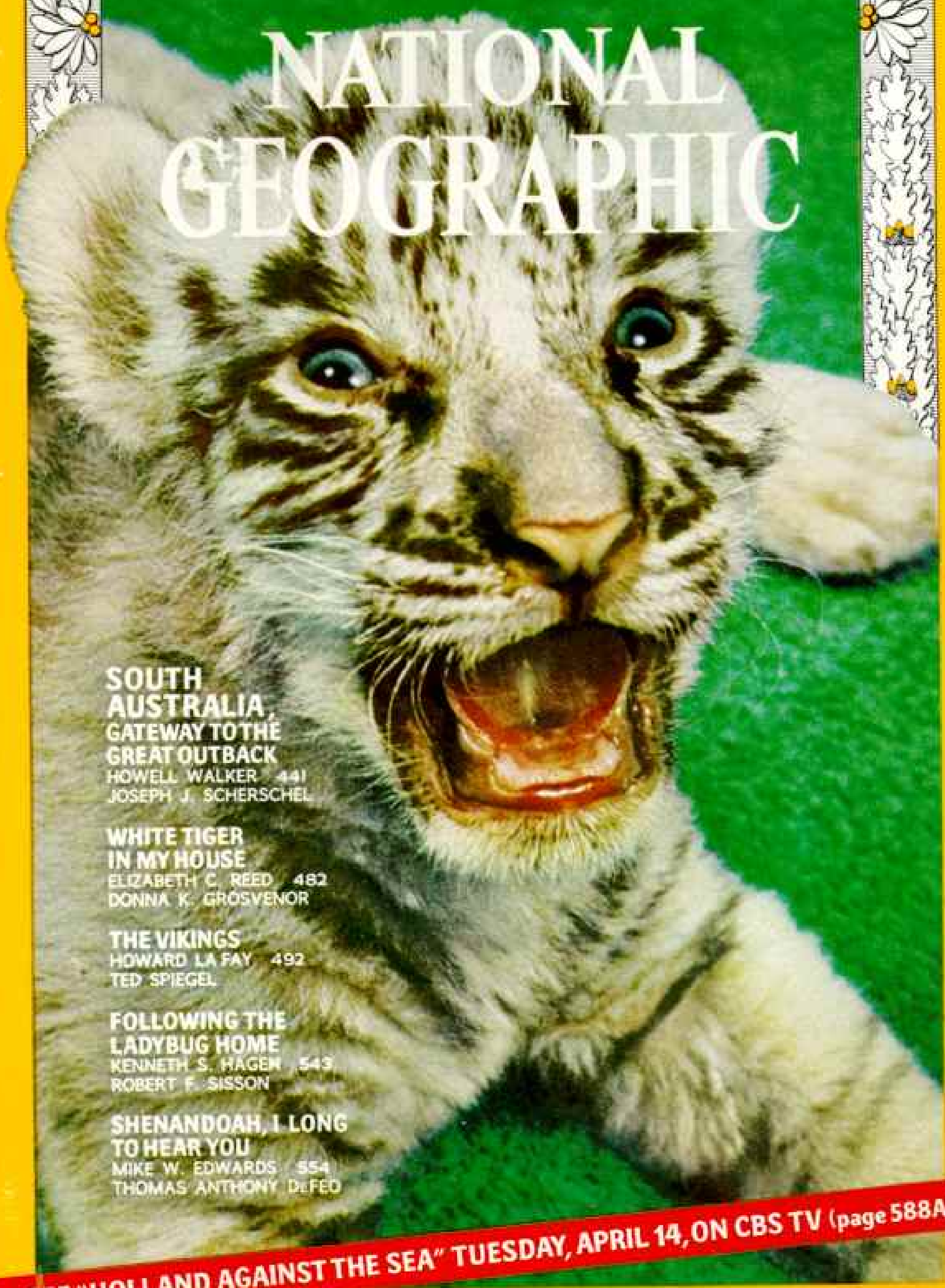
VOL. 137, NO. 4 APRIL 1970

NATIONAL GEOGRAPHIC



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OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

April 1970

NATIONAL GEOGRAPHIC

South Australia, Gateway to the Great Outback

By HOWELL WALKER, Assistant Editor

Illustrations by National Geographic Photographer JOSEPH J. SCHERSCHEL

"SHE'S WILD, MY OATH, SHE'S WILD," he said, squinting at the map as if it reflected a desert glare. "In all that country, only two places will cash traveler's checks."

The bank man in Adelaide and I were staring at the northern three-fourths of South Australia, a state four times the size of the United Kingdom.

"Only two places," he repeated, his words aimed at my incredulity and underlined by a pencil pointing out the towns of Woomera and Leigh Creek.

"Well, then, I'd better take plenty of cash with me. How much do you think I'll need for a few weeks up there?" I asked.

"I haven't a clue," said the bank man. "How will you be traveling?"

"In a small plane with a pilot."

"Perhaps the pilot could advise you."

So I phoned him, and he said, "Where we're going you won't need money."

SOUTH AUSTRALIA, MASSIVE KEYSTONE in the wide arch of the continent's south coast, wedges itself into the heart of the nation (above and maps, page 451). And it falls into two distinct geographical regions —north and south—as different as the Sahara and New England.

The northern sector occupies three-fourths of the state, through which early explorers passed into Australia's immense interior; like most of that great outback, it gets less than ten inches of rain a year, and is sketchily

The author: Howell Walker first went to Australia in 1941, expecting to spend six months on GEOGRAPHIC assignments. Instead he was gone 5½ years—joining the United States Army Air Forces there after Pearl Harbor, serving in Australia, New Guinea, and the Philippines throughout the war, and bringing home a lovely Australian bride. Since then he has returned five times, most recently for this report on vast and varied South Australia.

LONELY LAND OF FAR HORIZONS, *the desolate Nullarbor Plain—whose name means "no tree"—bears the marks of man's march across the continent. Here, beside steel poles strung with telephone and telegraph wires, the single-track Trans-Australian Railway streaks westward, arrow straight for nearly 300 miles—longest such stretch in the world. Overhead, a flying doctor speeds to a clinic at Cook, a tiny settlement in the great outback.* ROADCHROME WITH TELEPHOTO LENS © N.G.S.

Elegant Adelaide

MODEL OF TOWN planning, South Australia's capital grew along broad boulevards and around lush parks, following the design of Col. William Light. He selected the site in 1836 with an eye to its fertile soil and abundant water supply.

High, new office buildings overlook a flat-roofed farmers' market and, at far right, Victoria Square, the tree-graced heart of the city. The Torrens River separates commercial Adelaide from the northern suburbs, background.

Like his London counterpart, Adelaide's Lord Mayor, the Rt. Hon. Robert E. Porter, dons gold-trimmed robe and Chain of Office for ceremonial occasions. Window in the Town Hall commemorates the coronation of King Edward VII in 1902.

settled by people vastly outnumbered by sheep, cattle, kangaroos, dingoes, rabbits, lizards, and flies. It's a land of eternity, infinity, hostility—but not without islands of hospitality and oases of beauty amid the desert.

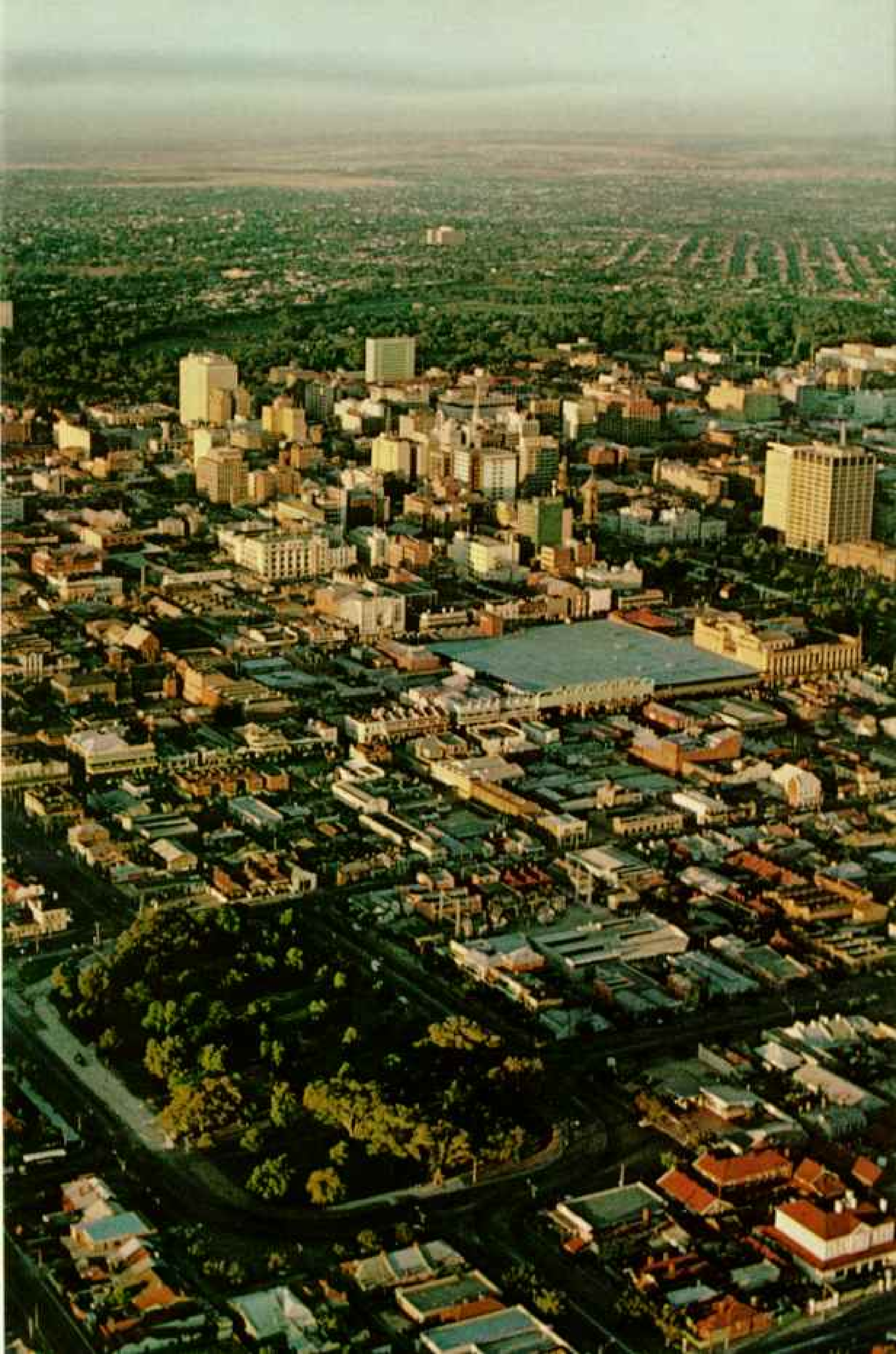
The other region, or southern sector, supports 98 percent of the state's population and some of the nation's most beautiful and productive country. Hills rich in vineyards, olive groves, and almond trees give way to a generous plain that slopes imperceptibly to a sea as blue as the Aegean. At the center of the plain stands the handsome capital city of Adelaide.

Like the state, the city is divided into two parts: North Adelaide with its large homes, gardens, parks, and playing fields; and Adelaide itself, a square mile of office buildings, banks, shops, hotels, and government and cultural centers. Meadowlands, watched over by aged eucalypts, surround both Adelaides, and between the two drifts the Torrens River, placid as a millstream (right).

Named for the consort of Britain's King William IV, Adelaide looks positively and delightfully contrived, like a deliberate model of town planning—which it is. In the capital and its suburbs live two-thirds of South Australia's 1,155,000 people, and I'm inclined to envy every one of them.

But as population and industries grow, city residents fear for the grassy open spaces that have thus far withstood the encroachment of the apartment complex, suburban bungalow, factory, and freeway.

"There's more and more agitation to build on our parklands," a friend told me during a drive about the city. "We're resisting it, though."

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"Who's 'we'?" I asked, expecting to hear of a special committee.

"The sensible people of Adelaide," he said. "That is, people with enough sense to fight for the parks and trees and.... Look at those gums over there. Aren't they beauties?"

Colonization Without Convicts

Under a gum tree on December 28, 1836, a determined band of English folk gathered to hear South Australia proclaimed a province of the British Crown. Then began the colonization of what became the continent's only state not settled by convicts.*

Today the site where that gum tree and South Australia took root is a carefully tended park at the seaside resort of Glenelg, five miles southwest of Adelaide. The tree, now dead, has been lovingly and chemically preserved.

A few months after the proclamation, South Australia's first surveyor general, Col. William Light, laid out Adelaide in the face of furious criticism. The opposition wanted the city on the coast. But Light reckoned the soil and water were better inland.

"The reasons that led me to fix Adelaide where it is," Colonel Light wrote in his journal, "I do not expect to be generally understood or calmly judged of at the present. My enemies, however... have done me the good service of fixing the whole of the responsibility upon me.... I leave it to posterity, and not to them, to decide whether I am entitled to praise or to blame."

Salubriously seated between the Mount Lofty Ranges and Gulf St. Vincent, Colonel Light's city of wide, straight streets and tree-lined boulevards (called terraces here) is as practical for today's traffic as for U-turning bullock teams a century and more ago.

But Adelaide is really a city to walk in, and for me one of the most rewarding strolls is along North Terrace. This is an avenue of airy elegance, enhanced by the capital's stateliest buildings and finest institutions. They include South Australia's oldest church (built in 1838), Parliament House, State Library, Art Gallery, and the University of Adelaide. At the east end of North Terrace you can enter the Botanic Garden and find yourself nearly weeping at the beauty of it all.

North Terrace and the green belt well become this quiet city of culture. As such, it established in 1960 the Adelaide Festival of Arts, which takes place every other year in March. Now a three-week-long event, it attracts international as well as Australian talent. Musicians and folk singers, writers and painters, actors and ballet dancers come from all around the world.

Other foreigners are constantly arriving to stay for good, to become New Australians. They go to work as restaurateurs, teachers,

Taking off in tandem, opponents fly for a "mark," or catch, in the grueling game of Australian Rules football. The receiver gets a free kick. Blocking and shoving for a hundred frenzied minutes of play, teams of 18 members each compete to punch and kick the ball to goal.

Hometown rooters (right) in the black and gold of Glenelg, an Adelaide suburb, cheer their team to victory over the rival community of Sturt. Like their countrymen everywhere, South Australians delight in rough-and-tumble outdoor sports. Normally slow to excite, they become screaming partisans over their four varieties of football: Aussie Rules, soccer, Rugby union, and Rugby league.

*This is the third in NATIONAL GEOGRAPHIC's continuing coverage of Australia's six states and the Northern Territory. See "New South Wales, the State That Cradled Australia," by Howell Walker, November 1967, and "Queensland: Young Titan of Australia's Tropic North," by Kenneth MacLeish, November 1968.

Mod poster on the ceiling, mod styles on the rack, Alice's In Gear draws the mini-skirted in fashion-conscious Adelaide.

doctors, hotel managers, porters, taxi drivers, day laborers, miners, farmers—almost anything you can think of. Large numbers of them find employment in Adelaide's big factories, like Chrysler Australia Ltd., where I spent an afternoon absorbing the step-by-step process of building an automobile.

The manufacture of motor vehicles is South Australia's biggest industry. Besides Chrysler, which employs 6,500 persons to produce 250 autos a day, General Motors-Holden's Proprietary Limited operates on an even vaster scale; it has two mammoth plants in the Adelaide area turning out the Holden—first car native to Australia (opposite).

"Most of our employees," said the public relations officer at Chrysler, "are postwar migrants, New Australians—Italians, Germans, Greeks, Dutch, Poles, Slovaks, British, and so on." Here he paused, and I waited for the league-of-nations cliché I'd been hearing in this context for the past 20 years. But he simply added, "There's probably an Eskimo somewhere in the shop, too."

Warm Welcome for Migrant Families

The subject of New Australians came up in an interview I had with South Australia's Premier Steele Hall, who said, "Since World War II, more than 280,000 migrants from overseas have settled in South Australia—a significantly higher gain than for any of the other states in proportion to population. These migrants and their families are sharing in the state's development, and they are, as you have seen for yourself, helping to provide the work force needed for our increasing industrial activity."*

Barely 41 years old, Mr. Hall is a tall, dark, likable, hard-working man with an easy-going manner (page 474). He drew up a letter to introduce me to anyone anywhere in South Australia—a letter I never had to produce, South Australians being as they are.

There was, for example, Sir Thomas Playford, a former premier who had held the office from 1938 to 1965, longer than any other state leader. Genial, white-haired, and built like a halfback, Sir Thomas talked with me one afternoon in Parliament House.

"For the first 30 years after federation in 1901," he said, "we were kicking against the wind with a flat football, always with the sun in our eyes. Not until 1933 did South Australia, essentially a primary-producing state—sheep, cattle, grain, fruit—begin to look for secondary, or manufacturing, industries. Progress was slow; the country was emerging from the Great Depression.

"We were just starting to move when World War II broke out," Sir Thomas continued. "Our factories—largely automotive—turned to manufacture of war matériel.

"But after the war, the small-arms factories and others were converted to peacetime purpose, and there was unprecedented industrial expansion. In fact, South Australia became

*The author described the impact of immigration on Australia in the February 1956 NATIONAL GEOGRAPHIC.

Catching them as they come, E. A. Thompson unloads bumper brackets from a conveyor at the General Motors-Holden's plant in Elizabeth, near Adelaide. British pioneer James Holden founded the company in 1856 as a saddlery; it merged with General Motors in 1931. After World War II, GMH introduced the first Australian-designed automobile —the Holden.

Served on a fork lift, a body for a Holden Monaro moves from storage yard to assembly line. GMH and Chrysler factories in the vicinity of Adelaide make automobile production South Australia's leading industry.

"**Never mind, mate,** she'll be right." With such assurances, "Nobby" Buckley, the author's pilot and friend, negotiated tricky landings in the state's remote reaches (opposite). Small charter craft link populated south and empty north.

the nation's most industrialized state on a per capita basis."

Sir Thomas led me outside Parliament House to see an inscription on the left side of the main entrance, which recorded:

THE PROMISE
"His Majesty's subjects of the Province
of South Australia are to receive
a constitution of self-government as
soon as the colony shall be in a state
fit to enjoy that inestimable advantage."
EDWARD GIBBON WAKEFIELD
Founder of South Australia 1834

"Now, over here," said Sir Thomas, crossing to the right side of the entrance. . . .

But not so fast. Edward Gibbon Wakefield, British author and colonial promoter, never set foot in South Australia. Why call him its founder? And why in 1834?

Actually South Australia was born that year in a London board room. Two years later, colonization of the province began as an experiment—combining business, politics, and faith—based on theories put forward by Wakefield. He proposed that proceeds from land sales in South Australia be used to finance the passages of settlers. They could work for the landowners until they had saved enough to buy their own land. When ready for it, the colony would receive self-government.

The experiment succeeded—eventually. On the right of the main entrance of Parliament House an inscription tells of the fulfillment of the promise in 1856 and the erection of the building in 1936—a century, almost to the day, after the proclamation of the province under the gum at Glenelg.

"Hang On Now and Let's See . . ."

Two miles north of that old gum tree, Capt. Noble S. D. Buckley taxied our Cessna 182 onto a runway of the Adelaide airport. Just before take-off, he turned to me and said, "Hang on now and let's see what happens."

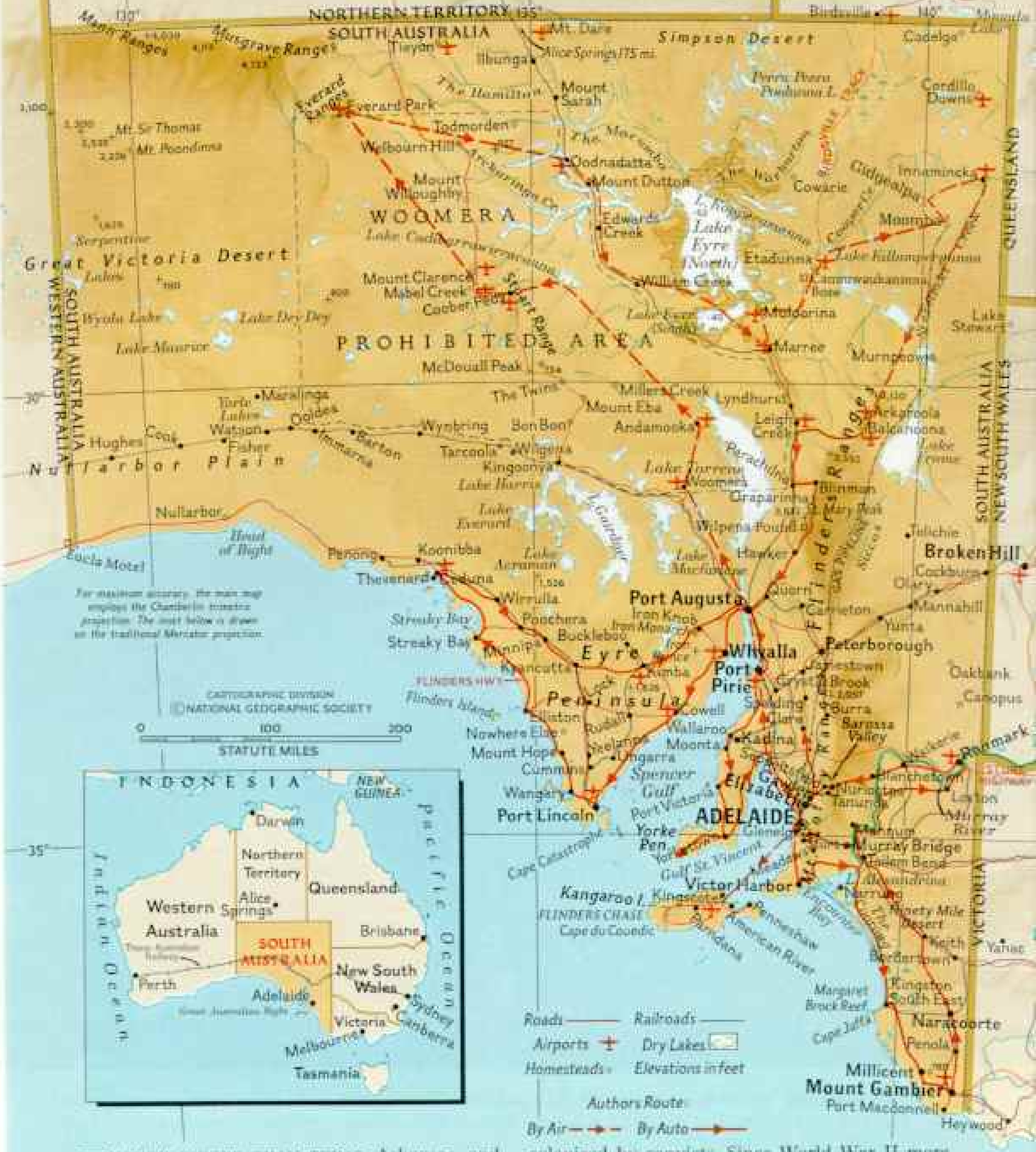
By his own admission, Nobby Buckley (left) was something of a fatalist. He also admitted, "I've had some close calls and bent quite a few aeroplanes. I believe you learn by bending them."

Nobby, however, was no novice. He was born on December 26, 1905. "And I've been getting stale Christmas pudding for my birthday ever since," he grumbled. After 63 stale puddings Nobby was stocky as a stump but agile as a squirrel. He seemed to handle planes and people alike, with intuitive ease.

We headed north, flying over the eastern shore of Gulf St. Vincent. To me the land looked like savanna and, come to think of it, about the color of Georgia's Savannah River—mud brown. Tall stacks marked Port Pirie, site of the world's largest lead-smelting and refining works; the plant treats silver-lead-zinc concentrate railroaded from mines at Broken Hill in neighboring New South Wales. More stacks still farther north rose above a key power station at Port Augusta.

This water-poor state develops no hydroelectric power. It has, in fact, but one river of consequence, the Murray (pages 472-3), a stream too sluggish to excite a turbine; in its 400-mile course through South Australia, the river drops only 70 feet. And so, until last November when natural gas was first piped from fields 500 miles north of Adelaide, the state had to rely mainly upon coal for power.

Exactly 109 miles northwest of Port Augusta, we flew—with special government permission—into the Woomera Prohibited Area,



THOUGH BIGGER THAN TEXAS, Arkansas, and Louisiana combined, South Australia has fewer people than Denver, Colorado, and 98 percent of them live in the southern quarter of the state. The land to the north lies largely flat and arid, but some areas support sheep and cattle on far-flung ranches (called "stations" in Australia). A familiar sight and sound in the countryside, the piping shrike (above) is the symbol of South Australia.

First settled by the British in 1836, South Australia developed as the continent's only state not colonized by convicts. Since World War II more than 280,000 immigrants—mainly British and central Europeans—have come here to live and work.

Today South Australia leads the nation in shipbuilding, smelting, and sawmilling. It operates one of the country's largest steelmaking plants, ranks high in the manufacture of automobiles, and produces 70 percent of Australia's wine.

AREA: 380,070 square miles. **POPULATION:** 1,155,000. **MAJOR CITY:** Adelaide (pop. 770,750), capital. **CLIMATE:** Mild winter (June, July, Aug.); hot, dry summer (Dec., Jan., Feb.). Average annual rainfall: 20.77 inches in Adelaide area; 10 inches or less in northern three-fourths of the state. **CURRENCY:** Australian dollar equals U.S. $1.12.

Amphitheater without an audience, five-mile-wide Wilpena Pound lies between sheer quartzite peaks of the Flinders Ranges. The basin, which began to form twelve million years ago, harbors dense

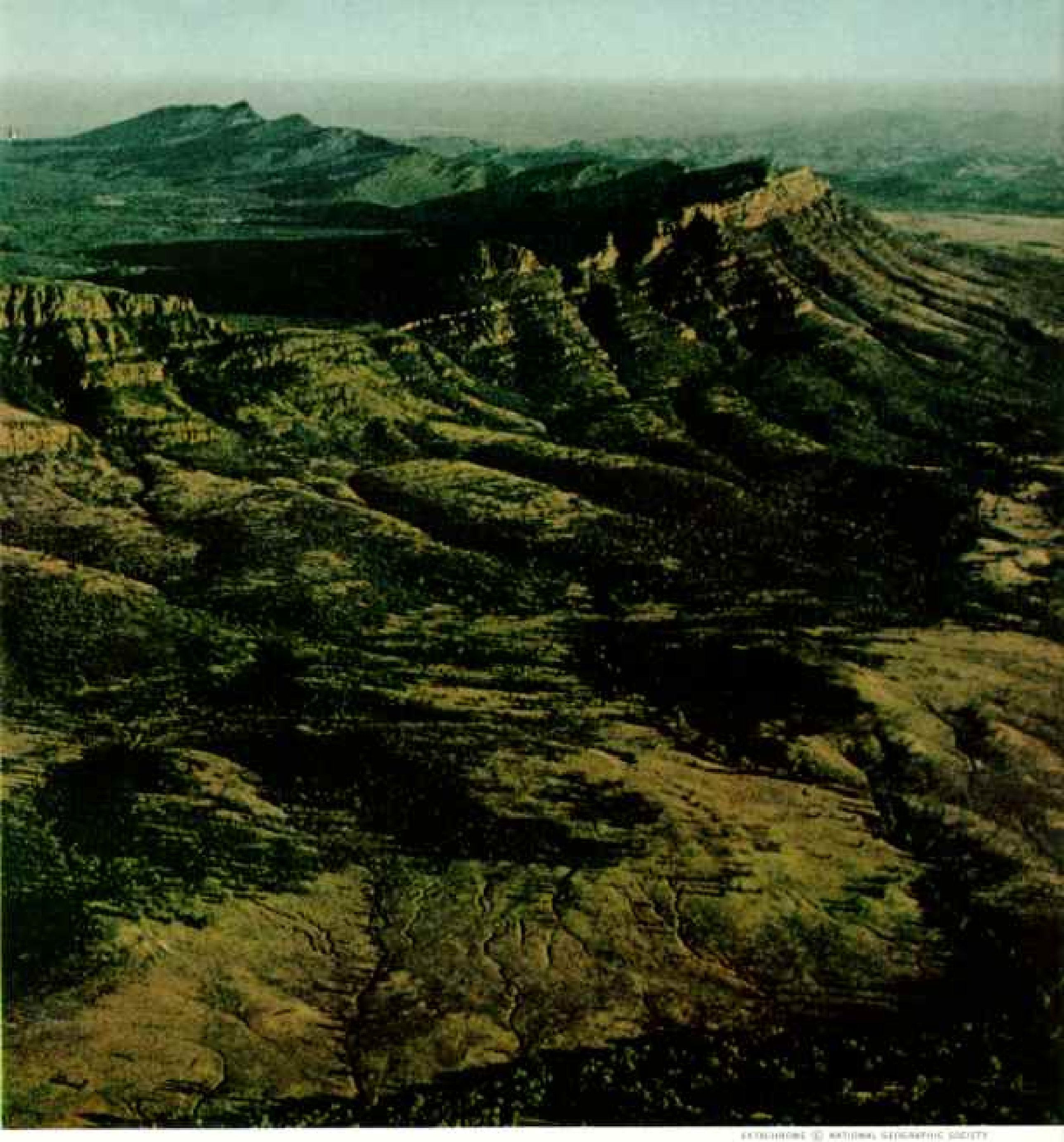
a tract of 73,000 square miles. It's a prohibited area because the British and Australian Governments use it as a weapon-testing range. Also, Australia and the United States have cooperated in the establishment and operation of a tracking station near Woomera for the U. S. space exploration program.

At Woomera, we received "Conditions of Entry to Prohibited Areas." I'll quote just one: "You shall not, unless duly authorized in writing by the proper officer, by letter, orally, or any other means, disclose any information relating to . . . the Prohibited Areas."

Even so, I think it permissible to repeat what the deputy chief of the tracking station told me. "There is nothing unique about this station," he said, "except its position on the face of the earth."

Which, I suppose, is to say "If you've seen one tracking station, you've seen 'em all."

South Australia's desolate expanses—too vast for the wildest imagination—reach out



EXTACHROME © NATIONAL GEOGRAPHIC SOCIETY

forests and a variety of the continent's unique animal life. Named for a fancied resemblance to a livestock pen, the Pound attracts visitors to a chalet near the gap, top right, that forms its only entrance.

for monotonous mile after monotonous mile in all directions from Woomera. Had Nobby and I flown toward the Great Victoria Desert in the west, we would have come to the Nullarbor Plain. Over this flat, seemingly endless plateau with not a tree (hence its name, from the Latin *nulla arbor*), I have traveled by train on the world's longest stretch of straight track—nearly 300 miles (pages 442-3). You'd never guess that the desperately dry limestone plain ever received enough rain to build up big subterranean lakes. They flood huge caves as far beneath the surface as 300 feet. But the water's salt content discourages any thought of trying to tap it for irrigation.

For our own underground explorations Nobby and I went north from Woomera to the opal fields in the barren hills around Andamooka. Approaching by air, I might have been looking down on an old ghost town in the western United States (pages 460-61).

Our welcoming party consisted of one

sprightly jeans-clad young lady by the name of Mrs. Randal (Terry) Newson. In a nondescript vehicle she drove us to what resembled a modern motel—an anachronistic structure in this frontier settlement of a forgotten era. We had come to the home of opal buyer Dag Johnson, originally from Narvik, Norway. He had invited us to be his house guests while in Andamooka.

A well-built man of about 30, Dag retained the fair Scandinavian complexion. He dressed sensibly in white sport shirt, white shorts, and sandals (no socks). We followed him into the courtyard and settled down under a grape arbor to sip beer poured from a big pitcher—a most pleasant thing to do in Andamooka on a hot afternoon.

Andamooka, I learned, produces more than $2,000,000 worth of opals a year. There are some 800 men digging in the fields. The population of the place fluctuates between 1,200 and 1,500.

Dag had to leave us to attend to opal business, and Terry Newson said, "I'd like to show you the town. Ready to go?"

It all started in 1930 with the discovery here of opals. But unlike Adelaide, Andamooka is no model of town planning. It looks

Rugged life of the outback reflects in the face of David Joseland, who runs 4,500 cattle on 2,400 square miles at Everard Park. His wife and children, and the aboriginal stockmen with their families, live in a region so sparsely settled that maps show individual ranches and wells for the guidance and safety of travelers.

Respecting the aborigines for their culture as well as for their ability as stockmen, Mr. Joseland has accumulated a prized collection of their artifacts.

as though someone wanted a house here, so he put it here; someone else wanted a house there, so he put it there; and so on. The original post office was set up in a man-made cave and, with a few refinements, is still in use.

We visited the cooperative store, which has literally anything you'd need in Andamooka; called at the police station to meet patrolman Philip—"We don't know his last name," Terry said; "everyone just calls him Philip"—drove past the school, a soccer field, four restaurants. . . .

"There is no church," Terry told me, "but Sunday school is held at the hospital."

Two nurses guided us through the hospital. We saw the one patient. Healthy spot, Andamooka. Plenty of fresh air outside the mines. Plenty to eat. Four restaurants.

For dinner with Postmaster Gordon Bohlin, his wife Rae, and Dag Johnson, we went to a restaurant called The Church of Berlin. No one satisfactorily explained the name beyond saying that a German, Gus Krotofil, runs the place. The exterior resembled any other corrugated iron shed in Andamooka—depressing enough to kill your appetite. The interior, however, immediately restored faith in The Church of Berlin—and your appetite. Everybody in the one large, clean, well-appointed room appeared glad to be there. For me the biggest surprise was not the marvelously tender filet mignon but the exquisite china on which it was served.

Miners Cherish Their Independence

After dinner Gus Krotofil came over to our table and invited us to have an American whiskey that was so fine it could be sipped as a liqueur with coffee. Under these genial circumstances we tarried at the table, watching the comings and goings of others. Just about every man there was an opal miner, and I noticed that all of them dressed alike except for distinctly individual hats that remained on the heads. The uniform consisted of shorts and sandals; no shirt, no socks, nothing else.

A middle-aged miner with a luxurious paunch scuffed in his sandals across the room to select a cigar, sniffing it fastidiously before plunking down his money.

"The thing about these miners," Gus said, "is they know exactly what they want. They're even fussy about beer."

Next day Terry Newson took us to the opal mine of Hans Lindross. He came to Australia four years ago from Göteborg, Sweden, and decided to try his luck in the opal fields of Andamooka. We found him 32 feet underground, using a jackhammer to get at a seam.

"Of course I am my own boss," said Hans, and in that statement were couched the contentment and the independence of any Andamookan opal miner. "But I must make some discipline. So I come here at eight each morning and work at least eight hours a day."

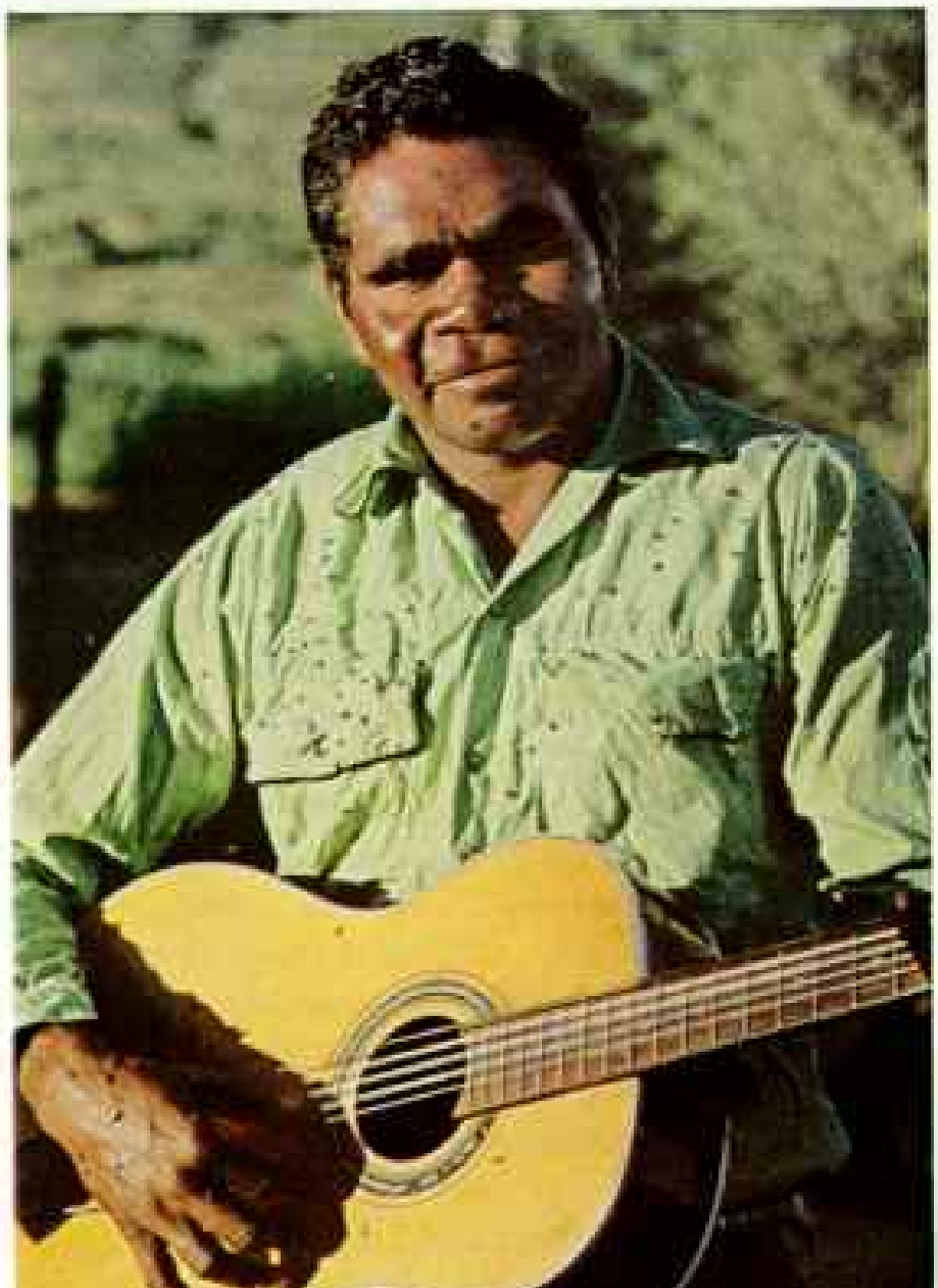
Once a miner strikes a good seam, he picks away at it delicately until either it or he peters out. The pay dirt can yield stones worth anything from a few dollars to several thousand. Much depends on how the opal is cut and polished. No two stones are alike.

Nor has anyone yet discovered the extent of these opal

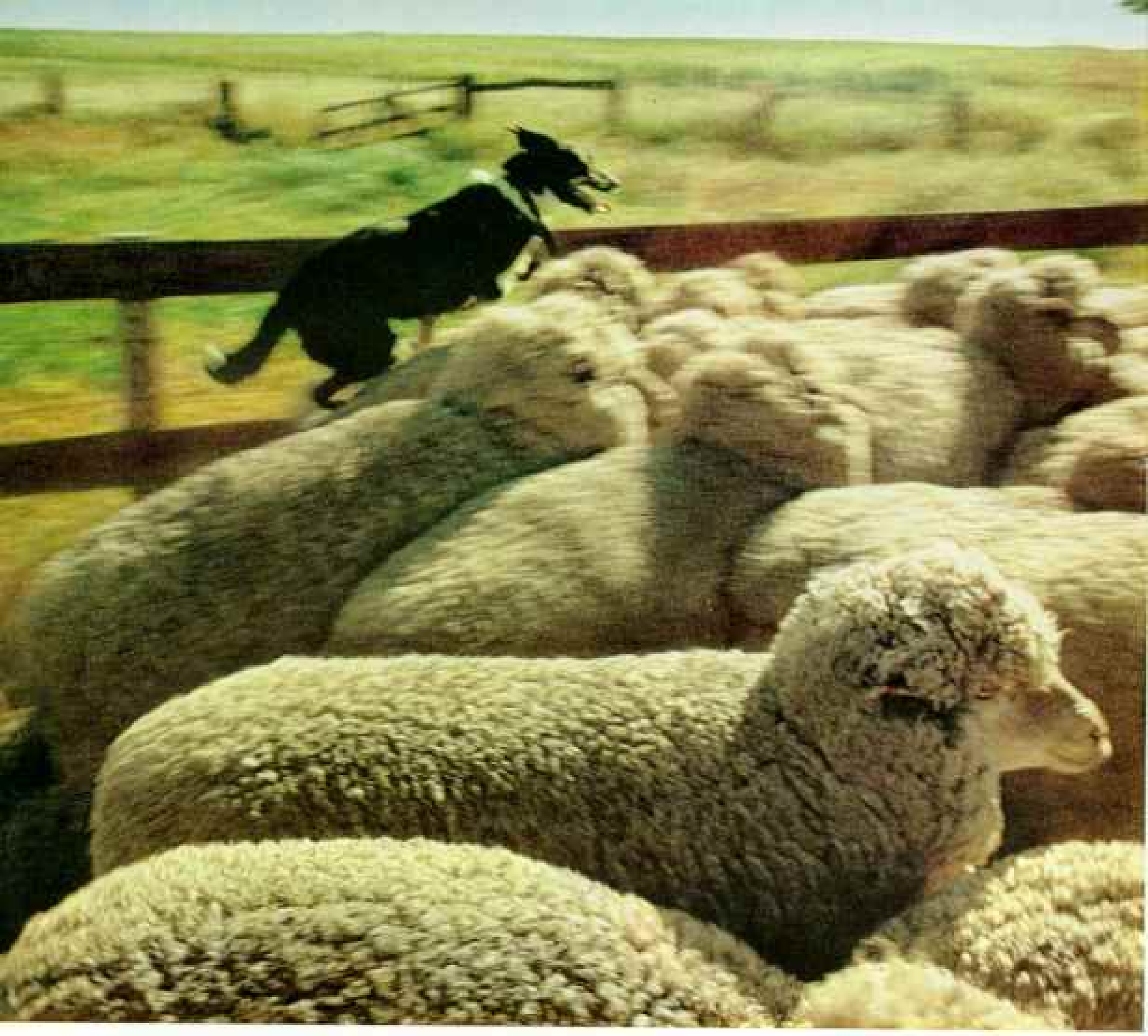
Roiling the red dust, Mr. Joseland cuts out a fat shorthorn for market. By mammoth trucks (called road trains) and by rail, his beeves will reach Adelaide.

In the chill of dusk, aboriginal ranch hands (left) drink tea before boiling salted beef for supper. Of the state's 5,500 aborigines, many cluster at cattle stations where they become able stockmen. Clinging to their own customs, they share food and possessions in common.

Undisturbed by the outback's ever-present flies, an aboriginal stockman named Richie strums a repertoire of cowboy songs; sometimes he lapses into traditional chants recalling his kinship to the beloved land that he still roams on "walkabout"—times when he returns to the bush life of his nomadic ancestors.



KODACHROMES BY JOSEPH J. SCHERSCHEL © N.G.S.



fields. But Nobby Buckley, who enjoys an uncanny familiarity with the subterranean secrets of South Australia, has a theory that commands respect. For in his time Nobby has done a lot of water-divining, well-drilling, and aerial reconnaissance for uranium. He believes that opals occur in much of the country between Andamooka and Coober Pedy, the state's other opal-producing center, 170 miles to the northwest (map, page 451).

Over these potential fields we flew to Coober Pedy, a lonely settlement in an even more desolate region than Andamooka. My map showed an inviting blue lake almost as long as its name—Cadibarrawirracanna, an aboriginal term meaning "place to get gum-tree scoops for honey." But I saw no trees, and the lake was a sun-baked salt pan.

More appropriately, the aboriginal name of Coober Pedy means "hole in the ground." In the early years here, beginning in 1915 when opals first attracted diggers, the residents all lived underground. They sought to escape the fierce heat; then, too, it was easier to burrow than to bring in building materials. But with improved transport and air conditioning, above-ground construction caught on. Even so, about half the population of 1,500 still dwells and delves for a living in the coolth of the earth.

West Wall Ends at the Indian Ocean

For instance, Mr. and Mrs. Eric Smith, with a son and a daughter, live in what they call "Aladdin's Cave." It is a windowless, electricity-equipped, air-conditioned complex of shop, living room, kitchen, laundry, three bedrooms, and bath—all carved out of the natural reddish-brown sandstone.

"This west wall," Eric Smith told me,

For sweaters in Tokyo, skirts in Milan: Merinos move to a shearing shed at Narrung in the southeastern part of the state. A border collie skillfully manages the mob.

Bent to their task, shearers strip fleece at the outback's Oraparinna station. South Australian sheep produce an annual average of 12 pounds of wool per animal, highest clip in the country. Fiercely competing against man-made fibers in world markets, Australians have developed techniques for permapleating and checking shrinkage of wool fabrics.

patting the sandstone, "is 1,200 miles thick. From here to the Indian Ocean."

Twenty-five miles west of Coober Pedy, Nobby made a faultless landing at Mabel Creek, cut the engine, and beamed, "Well, we got away with it again." He seemed to attribute the success of each flight to luck.

At the airstrip we met Ian Rankin, the epitome of an outback Australian born to work sheep and cattle. He was tall and lean as a young gum. His keen, dark eyes could spot a kangaroo mouse's tracks where you and I could see none. With him were his children—Greg, 8, and Mary, 6.

We all piled into a Land-Rover and rode to the homestead—a comfortable one-story building with generous high-ceilinged rooms, tall windows, and extra-wide hall making a breezeway through the center of the house. Ian's wife Margaret welcomed us in the kitchen, which smelled of freshly baked bread.

Ian told me that his 2,500-square-mile property carried 30,000 sheep, 1,900 cattle, and some horses.

"We use horses and motorbikes for working sheep," Ian said. "But for mustering cattle we use only motorbikes; they're quicker. Also, sometimes the cattle are so far from the homestead that the horses are too tired to work fast when they finally get to the mustering area."

Ian drove Nobby and me 35 miles out into the bush to see some of his cattle. There we encountered, of all things, a double-deck bus that used to serve Adelaide and its suburbs. Now it served Ian's stockmen as a mobile home; they slept on the upper deck, cooked and ate on the lower. When the cattle were moved to another part of the station, the bus moved—under its own power—with them.

On our way back to the homestead Ian stopped at a pole in a pasture. He removed a piece of tattered canvas from an old-fashioned telephone and advised Margaret we were heading home, then replaced the canvas.

"Wonder what Mr. Bell would think of that," Ian mused.

Jet Planes Steal Camel's Thunder

The Rankins' nearest neighbors are atypically near in this land of infinite distances. Mr. and Mrs. Charles Kunoth have a sheep station at Mount Clarence, only eight miles north of Mabel Creek.

"But I really got started at Marree," said 68-year-old Charlie, "about 230 miles east of here. I was born four miles north of Marree in the bottom of a buggy at 3 p.m., and the temperature was 120.

"Marree was a great camel center—staging base—in those days," he said. "It was all camels then. I grew up in the camel era."

And now Charlie's living in an age when jet planes streak overhead on the 3½-hour continent-spanning flight between Adelaide and Darwin—a journey that would have required three months by camel.

Leaving Mount Clarence, we left the northern fringe of South Australia's sheep country and flew over land that somehow supports cattle. How livestock could live off the sere, reddish earth mystified me; yet, mind you, everyone called this a good year. I strained to find signs of life on the land that appeared as flat and barren as the copper bottom of a frying pan. Once, though, I did see a herd standing as if in sun-struck stupor around a small, muddy, man-made pond.

PHOTOGRAPHS BY JOSEPH J. SCHERSCHEL © N.G.S.

Gems of the desert

THE LURE OF WEALTH draws opal miners to Andamooka; the chance to be their own boss holds them. Helter-skelter, they raise bungalows and water tanks beside craterlike diggings in the sweltering outback, where summer temperatures hover at 120° F.

Toys to his daughter, rough opals promise gems for German immigrant Arnold Neumann (above). Richly colored patches shine from chunks on his scale. Cutting and polishing bring out flashing colors that give the gems value (right).

From the South Australian fields of Andamooka and Coober Pedy come many of the world's finest opals, a treasure worth nearly $4,000,000 a year.

We droned on and on, over the unchanging, unmerciful, unrelenting immensity. It all looked so similar in the blazing noonday sun that sometimes I was sure we were flying south instead of north—over the same ground we'd already seen.

From afar the white house at Everard Park cattle station stood out clean and cool against the hot, red earth. Nobby circled the homestead and made a perfect landing at the airstrip three miles away.

Former Actress at Home on the Range

With characteristic outback hospitality, Everard Park had delayed the midday meal until we arrived. We sat at the kitchen table with the family: David and Helen Joseland and two of their children, Tim and Jane.

David had the build of a heavyweight boxer (page 454). Helen the charm of a leading lady. (She had, in fact, acted in two Australian films.) I felt aged around them, and I must have seemed a grandfather-type to the small children. Nevertheless, we all were soon on a first-name basis.

The airy, bright, one-story house at Everard Park takes the shape of a wide-angle V in the most practical orientation to sun and breeze. And within the angle spreads an unexpectedly green lawn, unexpectedly bordered with flowers—altogether an ambitious and well-rewarded effort in such unsympathetic soil.

How unsympathetic? Well, Everard Park embraces 2,400 square miles but supports only 4,500 cattle. This works out at less than two beasts per square mile, or one to 341 acres. That's why you're not apt to see many cattle on the property; the cows are somewhere out yonder, grazing over an area half as large as the State of Connecticut.

What I couldn't miss, though, was the savage splendor, the color, the haunting loneliness of the Everard Ranges. Amid these red granite hills, west of the homestead, we spent a carefree Sunday with the Joseland family. We walked between boulders big as bungalows and followed a ravine listlessly shaded by white-trunked, writhing gums and came to a cool rock pool.

The children could not resist it and splashed in. Their shouts echoed wildly, flushing a flock of brilliant green parrots into swift flight. The birds wheeled almost as a single thing across the russet face of a cliff, sailed against a deep-blue sky, then melted again into the foliage.

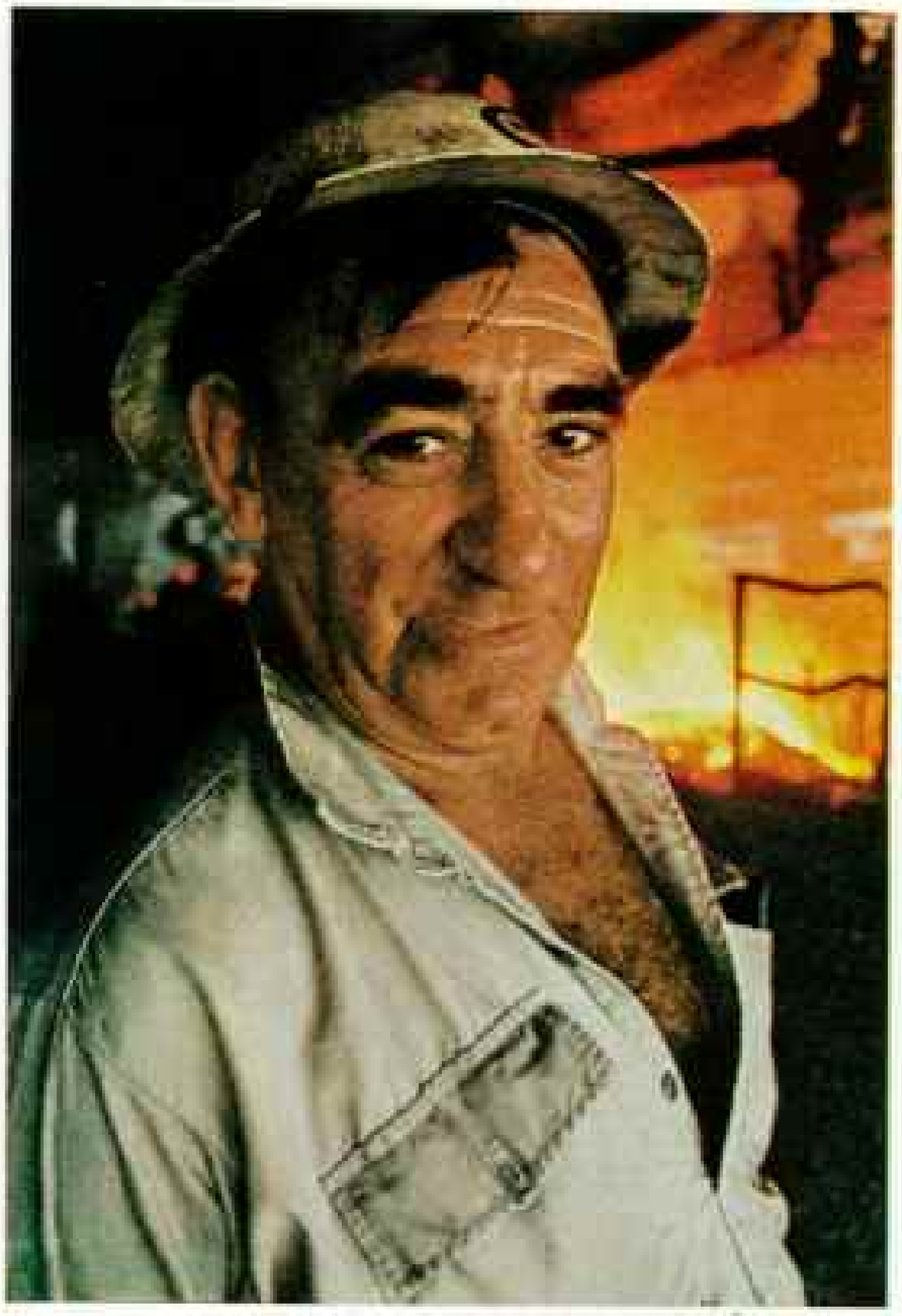
Foliage. I won't have cause to mention that word again until we approach the other, or eastern, side of South Australia. Now, as we descend for a landing near the sun-baked settlement of Oodnadatta, the country holds nearly as much promise as Death Valley.

At the Oodnadatta airfield Nobby asked if we might get a ride into town. The chap who refueled our plane pointed to an old truck.

"You could use that," he said, "except she's got no brakes."

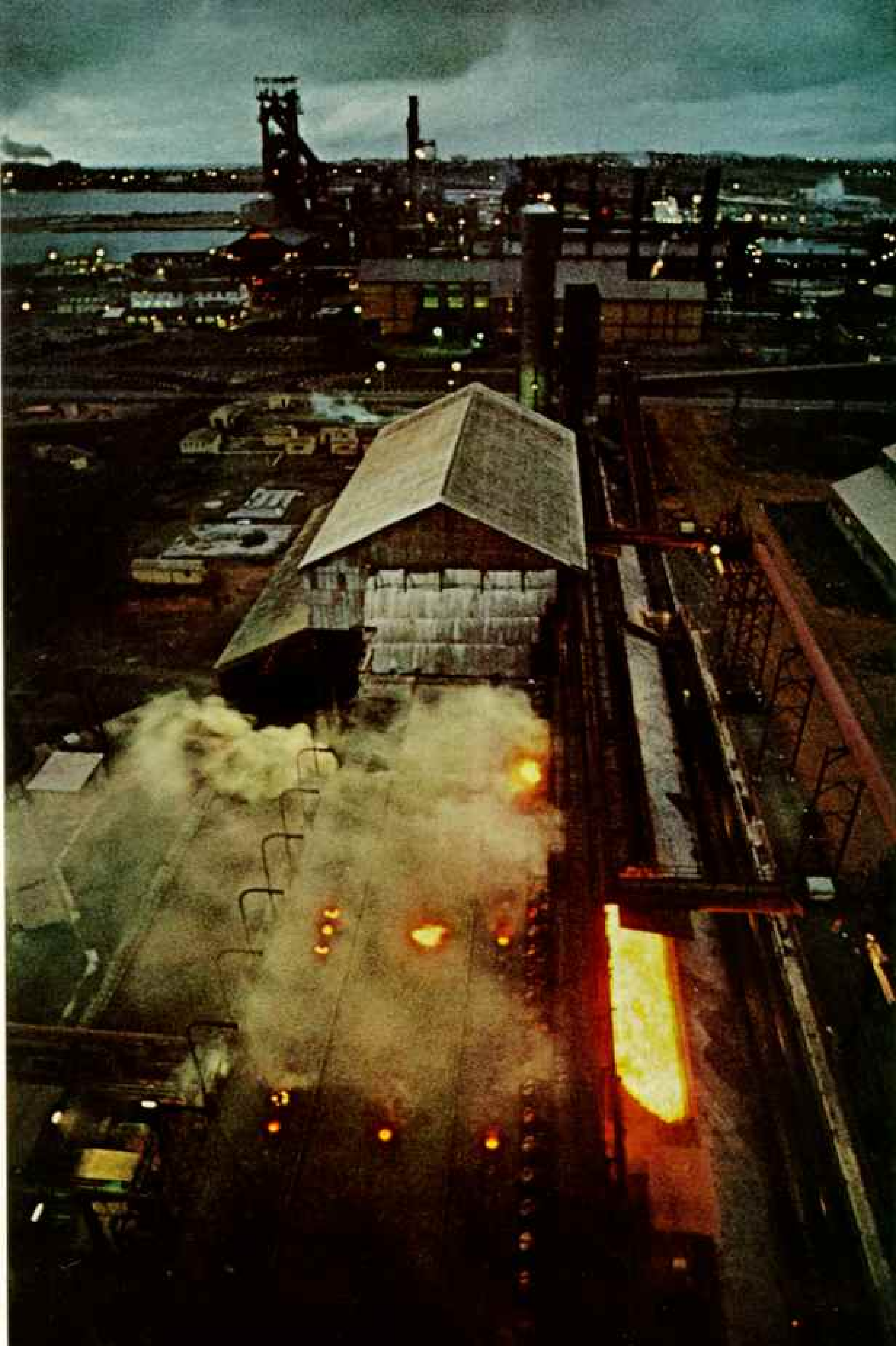
"Who needs brakes?" Nobby asked rhetorically. "Off we go."

We went to the police station to say good'ay



Blast-furnace foreman Roy Jasper works his 28th year at the Broken Hill Proprietary Company Limited steel yards in Whyalla (right). With skilled labor in short supply, Australia invites manpower from overseas by offering partial travel fares, help in finding jobs, and even low-cost housing.

Steel town that never sleeps: The B.H.P. plant seethes at dusk in its own fire and smoke. Fed by ore railed from hills 30 miles west of Whyalla, the massive mill throbs around the clock to pour 1,100,000 tons of steel a year.



Koala means "no drink," and the aboriginal word well describes the gentle marsupial that draws moisture only from its food, the leaves of certain eucalypts, or gum trees. With oddly arranged fingers—the first two oppose the other three—a koala (left) clings to a branch in a sanctuary at Waikerie. *Phascolarctos cinereus* faced extinction by fur hunters until the 1920's, when conservation laws began to protect the continent's dozens of marsupial species.

Shielded by a friendly flipper, a seal pup drowses with the grownups near Streaky Bay. The light mane of the old bull gives *Neophoca cinerea* its common name, white-capped hair seal. Lacking soft underfur as adults, the mammals had little appeal for American and British seafarers who almost exterminated Australian fur seals in the early 1800's. Now, with hunting outlawed, both fur and hair seals thrive in colonies here and on offshore islands.

to Sgt. Lloyd Bevan, a friend of Nobby's. Bevan and just two other policemen worked a beat of 100,000 square miles—twice the size of New York State. In a Land-Rover they patrolled almost the entire northern third of South Australia; a glance at the map shows how roadless the region is (page 451).

"And to think," said Lloyd Bevan, "I left a cozy little seaside resort south of Adelaide to take on this job. Glad I did, too."

At high noon Nobby and I strolled up Oodnadatta's main street—unpaved, half as wide as a football field, and empty as Melbourne on Sunday. Not a soul about. High noon. 115° F. Only living things we encountered were flies . . . until we walked into the one-story Transcontinental Hotel and were served lunch by the proprietor.

Lone Nurse Runs Maree's Hospital

We took off from Oodnadatta and headed southeast. On our left spread the white, arid infinitude of Lake Eyre, which my map honestly labeled "Dry Saltpan" (pages 480-81). I saw it referred to once as "a hideous anomaly, a blot on the face of nature, the sort of place one sees in a bad dream."

After that nightmarish landscape, the village of Maree looked like Kansas City. This former camel base is now a railway center

All eyes on mid-meal intruders, sooty kangaroos *(Macropus fuliginosus)* munch brush at Flinders Chase sanctuary on Kangaroo Island. Because 'roos often bound across highways, danger zones are marked by signs, such as this one at the start of a six-mile stretch near Meadows, 17 miles south of Adelaide. Kangaroos formed a mainstay of the aborigines' diet, and in 1802 they supplied explorer Capt. Matthew Flinders with "a delightful regale . . . after four months privation." The grateful Flinders named the locale of his feast Kangaroo Island. Today the states regulate hunting of the continent's four kangaroo species.

on the line between Adelaide and Alice Springs. Its population of 300 is mostly aboriginal, including Alf the mousehawk.

I met Alf at the hospital of the Royal District and Bush Nursing Society. He was perched atop a cabinet, sitting so still I took him to be a stuffed bird. Suddenly, though, Alf came to life and swooped down to alight on the shoulder of Sister Rosemary Mathews. She stroked his sleek brown feathers and whispered something in his ear.

Sister Mathews is the only registered nurse in Marree, which has no resident doctor. She runs the hospital virtually singlehanded, caring for 150 patients a month.

"When it's very hot and I'm very tired," said Sister Mathews, "I drive a few miles from Marree and stop and look around at all the flat, barren land—not at all pretty. But it's my country, and I've come to realize how much I love it. Then I go back to the hospital, feeling better about everything."

A 20-minute hop from Marree took us to Muloorina, a property near the southeast corner of Lake Eyre. We landed and taxied right up to the homestead.

"They've got a good airstrip here now," Nobby said. "Better than the old one marked with camel bones."

Muloorina had been a station for breeding

In a sea-cooled cloister, visitors explore Admiral's Arch on Kangaroo Island (left). A granite outcrop, aptly named the Eagle's Beak, seems ready to devour an inquisitive child (right).

Carved by the buffetings of wind and water, the formations add to the varied attractions of Flinders Chase, a 212-square-mile sanctuary. Platypuses feed in streams, spiny anteaters root for their prey, and penguins fish in waters of the Great Australian Bight. Meadows hum with honeybees, introduced from Italy by a local chamber of commerce in 1884.

camels. But road transport put the camels out of business. Then, thirty years or so ago, two brothers named Stan and Elliott Price bought the run-down property with the intention of raising sheep and cattle.

The brothers tossed a coin to see which of them would live here and manage the unpromising project. Elliott lost, and his wife cried. But they moved in and went hard to work, probably wondering why the aborigines called it Muloorina—"place of plenty."

On Lake Eyre in 1950—one of those extremely rare years when the salt pan contained water—Elliott and two companions were shipwrecked in a storm. Over the "lake" on July 17, 1964, Donald Campbell raced to a world's land-speed record for wheel-driven autos: 403.1 miles an hour. The record stood until November 12, 1965, when it was beaten by Bob Summers at Bonneville Salt Flats, Utah, with 409.2—the existing record.

Elliott Price was not at Muloorina when Nobby and I arrived; he was dying in an Adelaide hospital. But what he left behind told much of the man: 16,000 sheep and 500 cattle grazing on 1,500 square miles watered by wells he drilled and a river he created—a river kept flowing by an 1,800-foot-deep artesian bore producing more than two million gallons a day. He had met the challenge of dry, virgin bushland, and he had bested it. Price was an outback man's outback man.

Muloorina lies 28 miles west of the Birdsville Track. Along this 300-mile cattle route, drovers of old moved big mobs from Birdsville up in Queensland down to Marree for rail transport to Adelaide. Today, however, herd-hauling road trains—55-ton diesel-powered trailer trucks—have all but shoved drovers off the route. But one thing on the Birdsville Track has not changed: The mailman still passes by only once a fortnight.

Northward we followed the track, flying over spots on the map with such names as Cannuwaukaninna, Etadunna (sometimes pronounced "eat your dinner"), Koppera-manna, and Killamperpunna. Then we veered northeast, toward the natural-gas fields in the desert around Gidgealpa and Moomba.

Wells drilled from 7,000 to 13,000 feet deep supply gas to a purification plant in the Moomba field for the removal of carbon dioxide. The processed gas flows through a 486-mile pipeline to Adelaide, providing fuel for both domestic and industrial consumption.

Down on the desert, where men labor in 125° heat, but sleep and eat in air-conditioned quarters, we paid a visit to Gidgealpa well No. 2. Here gas was first discovered in commercial quantities in South Australia. (Gidgealpa No. 1 issued water but no gas.) A sign at No. 2 gave the depth—9,020 feet—then added, "Spudded December 12, 1963."

Spudded? That means drilling began.

Pelicans Float at Desert's Edge

Unrelieved desert spread beneath our plane until we picked up Cooper Creek (map, page 451). In the softness of late-afternoon light we looked upon a rare Australian watercourse; it actually had water in it. On the blue surface a gleaming white platoon of pelicans lined up like well-drilled soldiers. Green-leafed trees graced the riverbanks.

We came down for the night at Innamincka homestead on a huge cattle station, and

Salvation for sailors, this light four miles west of Cape Jaffa has warned vessels off Margaret Brock Reef for nearly a century. In a nightly ritual, the keeper turns up the kerosene lamp.

Four for the pot: Spiny lobsters, the largest weighing 10½ pounds, reward skin-divers at the Cape Jaffa Lighthouse, background. Each year the state's commercial fishermen harvest more than four million pounds of *Jasus novaehollandiae*, locally called crayfish. Most of the catch reaches U. S. markets in the form of frozen tails.

before darkness set in, Nobby and I strolled to a sandy bank of Cooper Creek. Evening flowed over us like a gentle tide. Sitting beside a large water hole, we watched ducks fly in and out, and we saw an ibis. In their going-to-roost restlessness, galahs and white cockatoos shrieked and squeaked, making a frightful racket in the velvet twilight.

Pilot Learns the Hard Way

Next day we set a southwesterly course. The country beneath us deteriorated. Strzelecki Creek, a long arm of Cooper Creek, had gone dead dry. For a study in total sterility, I commend the area; it looked to me as forbidding as the surface of the moon.

An outback friend of Nobby's, who has roamed all over the state and the continent, too, once said of the land we were now traversing, "This is not some of the worst country in Australia; it is *the* worst."

And I could well believe it. For this region made the most hostile desolation I'd hitherto seen seem rather sweet and friendly. From the air it all appeared quite flat, but Nobby said it was actually blistered with 10-foot-high sand mounds, or dunes.

"How do you know they're 10 feet high?" I asked.

"Because I crash-landed down there a few months ago," he replied.

I tightened my seat belt.

Ahead loomed the Flinders Ranges. Somewhere among those mountains nestled the Arkaroola airstrip, where I would rendezvous with a hired car. There I'd say goodbye to Nobby Buckley and the Cessna, and continue my coverage on the ground.

When we got near the mountains, a blustery west wind bounced our little plane about like a harried Ping-Pong ball. Nobby had never landed at Arkaroola's new field, and he didn't want to try it this windy day. The airstrip pressed against a bluff; experience told Nobby the downdraft would be tricky, if not downright dangerous. He decided to use the field at Balcanoona, 14 miles away.

Even there, as we were about to land, a sudden crosswind hit us so hard it fouled our approach. We had to go around again. Safely down, Nobby said, "Well, Howell, we've been dicing with death for nearly a fortnight, and today we could have lost the game."

Piloting myself now in the hired car that had followed us to Balcanoona, I recalled Nobby's prediction about not needing any money on our trip. Except for one lunch, I hadn't been able to spend a cent for food or lodging, thanks to the warm hospitality received everywhere in the outback.

I drove across the Flinders Ranges to the open-cut mines at Leigh Creek, which provide coal for the big power plant at Port Augusta. This in turn supplies electricity for machinery digging the coal, and also furnishes the current for much of South Australia.

Then I headed back into the mountains to spend the night at the living ghost town of Blinman. At an elevation of 2,020 feet, it has the highest post office in the state. It also has the quietest hotel of my acquaintance in all of Australia. Usually, at day's end you can hear a country pub's barroom babel a block away. Not so here.

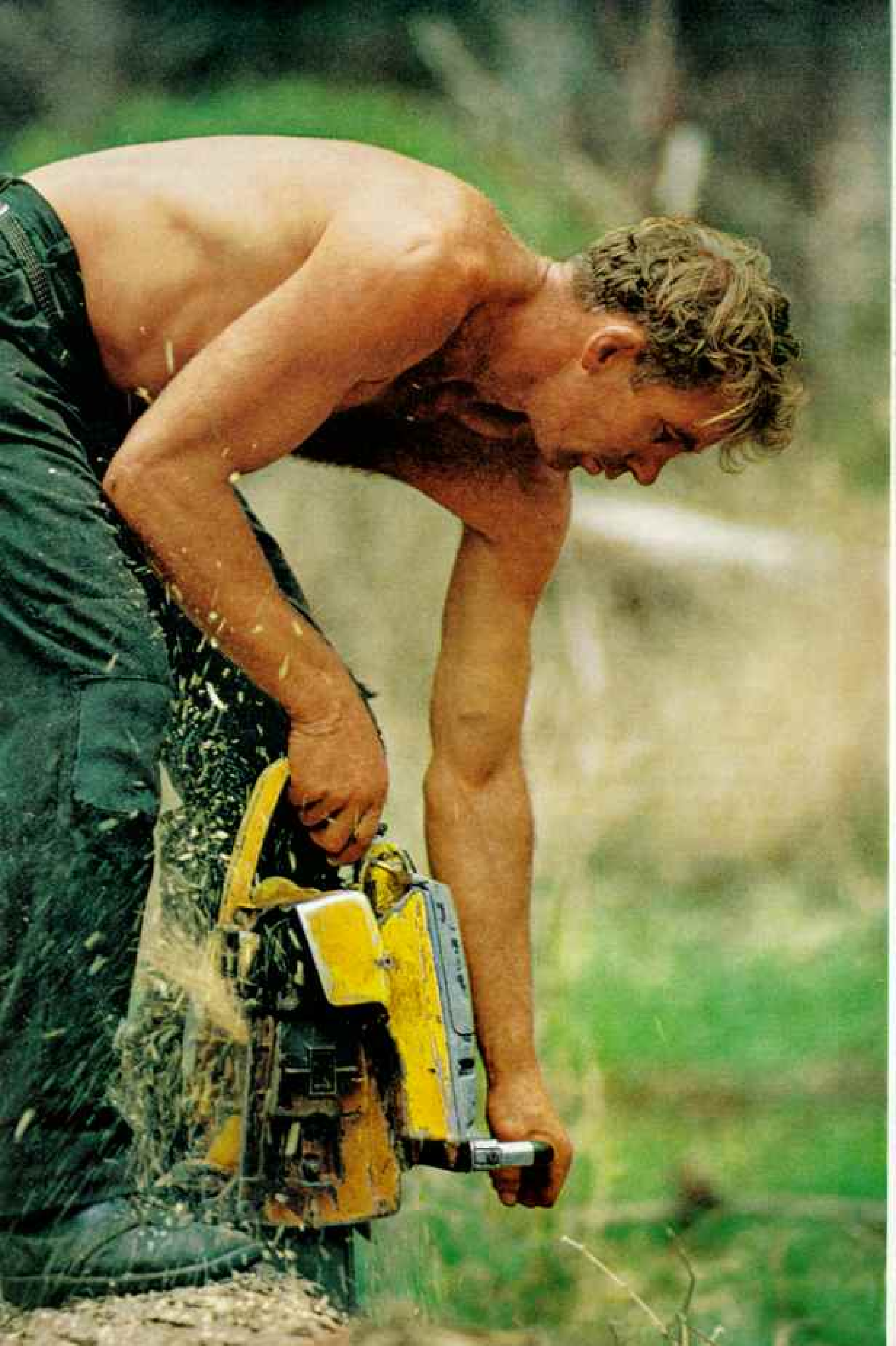
Deferentially, I entered to ask for a room, feeling that I should whisper. There were men drinking beer all right, but they spoke in the reverent tones of pallbearers. Silently the proprietress showed me upstairs to my room, and I settled into the 19th century. Blinman, I decided, must still be deep in mourning for the copper mine that had given the little town its original reason for being here.

Whyalla: Dynamic War Baby

Early morning. Cold. Pungent smell of cigarette smoke. A man coughs. A crow caws. I crawl out from under six blankets, not doubting for one frigid minute that Blinman has the highest post office. And this is a fine spring day in November, the equivalent of May in the Northern Hemisphere.

Southward through the Flinders Ranges I traveled to Port Augusta, then rolled out onto Eyre Peninsula, that flat triangular pendant on South Australia's coast. I soon came to Whyalla and stopped to spend a day in the huge steelworks and the nation's largest shipbuilding yards. These two heavy industries, sparked by World War II, got going here in 1941 with the first tapping of a blast furnace and the first launching—a 750-ton patrol vessel. Since then fifty vessels, including five 60,500-ton bulk carriers, have gone down the Whyalla slipways. And steel production has reached 1,100,000 tons a year (pages 462-3).

Driving out of Whyalla, I noticed a tire shop named Beaurepaire. I was still chuckling over this name some minutes later when —flub, flub, flub, flub—my right rear tire



expired. A sympathetic passer-by helped me change the wheel, and recommended a garage that might fix the damage. But the wretched tire turned out to be beyond repair—beyond even Beaurepaire.

Along the east side of Eyre Peninsula, I was in big wheat country at harvest time. Oats and barley, too. Golden grainfields monopolized the land. And for miles—maybe twenty—before I got to a town, I could see its silos. They towered over the landscape much as churches, seen from afar, dominate the provincial scene in France. Near the end of the peninsula I stopped at Port Lincoln, which ships more wheat than any other place in the state—some 14 million bushels a year.

Little Town Makes Big Claims

In town I met Mr. Tennyson Turner, forthright, friendly, and enthusiastic. He lost no time in telling me that Port Lincoln's harbor is three times as large as Sydney's.

"And," Tennyson added, "ours is the biggest fishing port in Australia."

Tennyson Turner, a lawyer by education and practice, found himself involved in real estate too. He felt compelled to buy up historic buildings before they collapsed, restore them, and encourage people to visit them. I saw two examples of his commendable enterprise: a fisherman's simple stone cottage—with white canvas sails for ceilings—originally built in 1841. And there was a far more pretentious house erected in 1842 "as a dwelling . . . for Eyre Peninsula's Vice Regal representative, the Resident Magistrate."

Beneath Tennyson Turner's enthusiasm for everything in Port Lincoln, there lurked a somewhat wistful attitude toward South

Carving woodland wealth, lumberjack Kevin Howard sections a Monterey pine in a government forest near Mount Gambier, a scenic region of extinct volcanoes, sparkling lakes, and generous farmlands.

Along a colonnade of giants, a log truck grinds toward a Mount Gambier mill. Loggers harvest towering Monterey pines, introduced into Australia more than a century ago. The trees grow 120 feet in 40 years, twice as fast as in their native California. Now 200,000 acres of the pines—the continent's largest planted forest—cloak the southeastern corner of the state and spill over into Victoria, yielding wood products valued at some $45,000,000 annually.

Australia's founding years. I could not disregard his lemony resentment of Col. William Light's having selected Adelaide —instead of Port Lincoln—for the state capital. Tennyson summed up his disapproval by allowing that "Adelaide has survived despite Colonel Light."

Perhaps it's just as well Port Lincoln didn't become the capital. I, for one, like it as is: small, intimate, and—well, it haunts me with the persistence of the last words of Colin Thiele's verse on Port Lincoln, "A loveliness that aches."

And from here beauty—not entirely free of heartache—runs wild around the coast, first charted in 1801-02 by Capt. Matthew Flinders of the British sloop *Investigator*. When off the foot of Eyre Peninsula, Flinders sent eight of his crew ashore to find fresh water. Their boat capsized in a tide rip, and all the men drowned near a rocky cape their captain sadly christened Catastrophe.

A highway named for Captain Flinders invited me to drive along the western shore of Eyre Peninsula. At one intersection a road sign almost persuaded me to take a turn inland to a place called Nowhere Else. Instead I continued to where Gulliver encountered those minuscule citizens, the Lilliputians. For when I reached Ceduna in a remote corner of Eyre Peninsula, I was at the gates of the Kingdom of Lilliput ". . . North-west of *Van Diemen's* Land [Tasmania] . . . in the Latitude of 30 Degrees 2 Minutes South." Obviously, Jonathan Swift wanted *Gulliver's Travels* to include the most outlandish part of the world in the 1720's.

Wallaroo Counted on Copper

From Ceduna I went east to Iron Knob, which stands near massive hills of the iron ore that feeds the steel mills in Whyalla, 30 miles distant. Then I swung around the head of Spencer Gulf and drove south. A flock of greenish-blue parrots exploded from the bush and flashed across the road like a horizontal shower of iridescent opals.

On Yorke Peninsula, which hangs like a well-filled Christmas stocking between Spencer Gulf and Gulf St. Vincent, I stopped for the night at Wallaroo. What an utterly Australian name—Wallaroo. Part wallaby, part kangaroo. With few exceptions the houses here are of stone and one story, the front door ingenuously balanced by a window on either side. They have verandas ornamented with wrought-iron patterns as geometrically intricate and perfect as snowflakes.

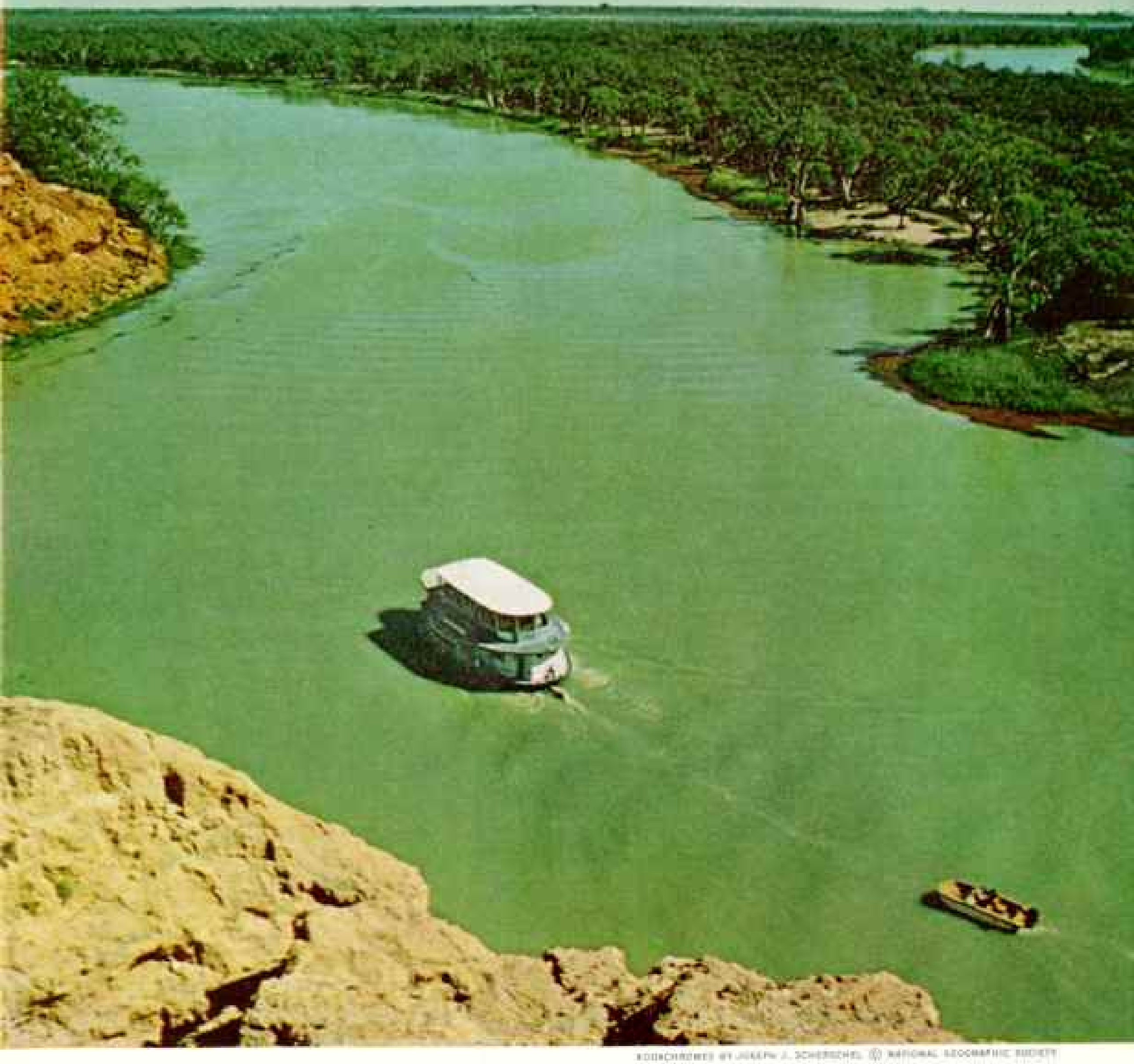
Wallaroo got off to a mining start around 1860 with the discovery of copper in its backyard and at Moonta 10 miles to the south. The copper boom inspired a railway connection with Adelaide. Moonta was the end of the line—perhaps the end of the world for one Cornishman who, having been there, could say to another who claimed he'd traveled everywhere: "Hast thee ever been to Moonta? No? Then thee's never travelled, boy!"

When the mines shut down in 1923, more than $50,000,000 worth of copper had been extracted from some 6,600,000 tons of ore treated at the local smelters, now converted for the production of superphosphate.

At the foot of the peninsula I read a big roadside sign: "Beware—the inviting ocean at the bottom end of Yorke

Slaking the state's thirst, Murray River water irrigates 108,000 acres and is piped into the outback as far as Woomera, 285 miles away. Chief river in the nation, the Murray runs through South Australia for 400 of its 1,600 miles. Here near Loxton, the 96-year-old paddleboat *Mayflower*, now a private pleasure craft, plies upstream, reminiscent of pre-railroad days when side-wheelers ferried goods and passengers.

Feathered fishermen, Australian pelicans, *Pelecanus conspicillatus*, wait for dinner tumbling over a spillway on the Murray. The river's inviting waters lure more than 300 of Australia's 650 species of birds.



KODACHROMES BY JOSEPH J. SCHERSCHEL © NATIONAL GEOGRAPHIC SOCIETY

Peninsula is notorious for drownings. Make sure you are not the next victim."

Only 25 miles of "inviting ocean" separated me from Kangaroo Island. But to get there, I had to drive 200 miles to Adelaide and from there fly with Nobby Buckley.

We landed near Kingscote which, with a population of 1,100, is the largest of the island's communities. Altogether, there are 3,500 islanders and—a singularly remarkable thing for Australia—*not one rabbit*. Another notable claim: the longest school-bus route in Australia—48 miles each way between homes in the west and a central school.

American River, one of the communities, was named for the first boatbuilders in South Australia. Here, in 1803—three decades before the first British settlers arrived—American sealers constructed a 38-ton schooner, using the native pine of the island. They named the vessel *Independence*.

The American sealers were independent and ruthless, too. No sense of conservation. They did not, however, wipe out the seals on Kangaroo Island. We found a big colony in a south-coast cove named, naturally, Seal Bay.

Other animals at home on the island include bandicoots, echidnas, and miniature marsupials like the dormouse possum. At the island's west end, in a fauna and flora reserve known as Flinders Chase, you can get quite close to kangaroos, wallabies, koalas, and Cape Barren geese. All these creatures are native to the island—except the koalas, which were introduced from Victoria and became naturalized denizens.

I was delighted to see Cape Barren geese here in generous numbers, grazing like sheep in green clearings. Not so long ago they seemed on the brink of extinction. And it was doubly reassuring to hear an islander say the goose is now far from being "distinct."

The southwest shore of Kangaroo Island reaches a grandly rugged climax at Cape du Couedic. Everything here is wild—the high coastal cliff, the waves, the wind, *the wind*,

Premier on the wing: The leader of South Australia, 41-year-old Steele Hall, briefs his family on preparations for take-off. From the sailplane, he inspects irrigation areas in the Murray Valley (right).

Turned green by the hand of man, the valley flourishes with orchards, vineyards, and truck gardens. In the late 1880's two Canadian brothers, experts in California's irrigation techniques, first diverted river water to nurture crops at Renmark, sparking settlement of the valley. Now its fruits find markets around the world.

In a state dependent on both farm and factory, the premier encourages agricultural research, and also welcomes increased manufacturing. Recently discovered natural-gas fields of Gidgealpa spur industry, which has already surpassed agriculture as the major economic force in South Australia.

65

KODACHROMES © N.G.S.

Regatta begins with a dash

ANIMATED BY A STARTER'S GUN, life-jacketed youngsters sprint to their sailboats and set rudders for a race at the Seacliff Yacht Club on Gulf St. Vincent.

Angular as his careened sailing canoe (left), a skipper checks the trim of his mast and the set of his sail. If the craft heels too far on the gulf's wind-worried waters, his crew can ride the two hiking boards to steady it.

Resorts dot a broad esplanade along the shore south of Adelaide, and the sea fills with pleasure craft the year round.

THE WIND. The wind doesn't blow; it explodes, and once it swept a bride of two days right off the cliff where she had gone with her camera to take a picture.

Back on the mainland, I drove along the state's southeast coast. The road paralleled The Coorong—a slender lagoon that stretches for 80 miles, separated from the ocean by a strip of low sand hills. A well-disciplined squadron of pelicans passed overhead with ridiculous dignity, and I saw black swans, ibises, ducks, waders, and other water birds.

This part of the state, known as the Southeast, is a region unlike any other in South Australia; chiefly, I'd say, because nature has been kinder to it. For one thing, the city of Mount Gambier has no water problem. Only a mile away, the Blue Lake in the crater of an extinct volcano forms a natural reservoir for the population of 18,000. The supply is pure and plentiful—seemingly inexhaustible. Soundings down to 670 feet, however, disproved the once-held bottomless theory.

Mystery Clouds the Blue Lake

On the other hand, no one has satisfactorily explained why, each November, the color of the lake changes from gray to rich blue; then, beginning in March, it slowly reverts to gray. Scientists have theorized that precipitation of calcium carbonate causes the change, but they can't say why such precipitation should occur with unvarying regularity.

In the Mount Gambier area I found further evidence of nature's kindness—an abundance of coralline limestone. At one of the quarries I watched men cut through the milk-white stone as easily as if slicing cheese. Their power saws moved horizontally and vertically to excise clean, smooth, 70-pound building blocks.

A bus full of school children from another town in the Southeast arrived at the quarry. Their teacher, a friendly-looking fellow, greeted me and said, "Most of these kids live in houses made of this stone, so I thought they'd like to see where it comes from."

This isn't to suggest that the Southeast lacks timber for building. On the contrary, here grow Australia's largest pine forests. In the Mount Gambier Pinelands Area, which extends into southwestern Victoria, 10,000 acres of trees are planted each year—mostly California's native Monterey pine *(Pinus radiata)*. Started in 1876, the plantations now cover more than 200,000 acres, where someone has figured the timber growth amounts to 165 tons per hour (pages 470-71).

With all those trees around, sawmills logically went to work. At the biggest of them I met Herbert Whiteside, the manager. He said that 11 major sawmills in the Mount Gambier Pinelands Area use 588,000 tons of logs a year to furnish more than half of Australia's pine timber. Six wood-processing factories and four timber-preservation plants in the region contribute to the annual production of materials worth about $45,000,000.

Sulphates Save the Land

My road north penetrated pine plantations, broke out into newly cultivated vineyards, then headed for mallee, or stunted-gum, country that defies productivity. But the Southeast, not content to suffer this wasteland known as the Ninety Mile Desert, welcomed a big land-development project initiated and financed by A.M.P. (Australian Mutual Provident Society), the nation's oldest and largest insurance company.

The society's work on this scrub-clearing and soil-improving project began in 1949 and in less than twenty years had brought some 423,000 virtually useless acres into production, paving the way for private development. Thanks to fertilizers, including zinc sulphate and copper sulphate, sheep and cattle graze on the hardwon pastures of efficient farms.

On one of these farms—21 miles south of Keith—I spent half a day with John Tyler.

"In 1954," he said, "I paid $31 an acre for 1,250 acres here. It took five acres of that land to feed a sheep in those days. Now it's worth $67 an acre, and one acre can carry as many as five sheep."

John told me about the first time he came to this desolate region with an A.M.P. official.

"Can't you just visualize," said the A.M.P. man, "how wonderful this country will be when we've developed it?"

"No," John said.

But as John and I returned to his homestead after a Land-Rover tour of his property, I saw a fine flock of ewes in a grassy paddock gilded by the late-afternoon sun, and I said, "What a good sight that is."

"Yes," said John, and I wished the A.M.P. man could have heard the way he said it.

I continued north to meet the Murray River at Tailem Bend (an aboriginal-English name for a river bend where natives encountered drovers tailing, or herding, sheep in the 1840's). The Murray, Australia's principal river, is a phenomenal feature of this largely arid continent. Rising in the state of Victoria, it flows westward to the sea—a distance of some 1,600 miles, the last 400 through South Australia, where more than a million people depend on its water.

At Mannum an old paddle-wheel steamer turned museum reminds one that such river boats used to transport stores upstream to settlements and stations; the boats returned with cargoes of wool, grain, and other agricultural produce. But the expansion of the railroad in the 1920's killed the river trade. Pity, for it must have been a delightfully leisurely business.

Beyond Mannum, farther up the Murray, I entered a well-irrigated region of orchards and vineyards and market gardens. It all grew out of the work of two Canadian brothers, George and William B. Chaffey, who came to Australia in 1886 from California. As irrigation specialists, they applied their talents to the mallee country where the Murray enters South Australia. And the land was blessed with the fruits of their labors: citrus, apricots, apples, prunes, peaches, pears, and grapes for wine and table.

Old Germany Flavors Barossa Valley

Grapes for wine grow especially well in the Murray Valley. But the Barossa Valley, 30 miles northeast of Adelaide, is the best known of South Australia's wine-producing regions.

To the Barossa during the 1840's came German emigrants—Lutherans largely—seeking religious freedom. They built simple but sturdy stone houses like those they left behind in Europe. They kept their German customs and native tongue. They planted vines and made wine and delighted in gay harvest festivals, dancing the dances and singing the songs of their distant homeland (opposite).

The Barossa Valley has retained its Germanness with commendable tenacity. At one of the Lutheran churches I wandered through the graveyard, reading epitaphs in German. Snails clustered on some of the tombstones.

Partners in a juice-making jig crush grapes at the Barossa Valley Vintage Festival. They vie with other teams in the time they take to fill a pail at left. Many of the valley's vintners descend from German Lutheran immigrants. South Australia produces most of the nation's fine wine.


Barossa

"**Good Heavens,** did man ever see such country!" exclaimed an 1846 explorer of the outback. Southerly winds shape these 60-foot sand ridges beside Lake Eyre, background, a salt pan lying 52 feet below sea level and covering 3,000 square miles.

PHOTOGRAPHED BY JOSEPH J. SCHERSCHEL © N.G.S.

as if to mark time or symbolize a folk in no haste to relinquish its simple traditions.

I'm afraid, though, that the quiet, uncomplicated kind of life, albeit nostalgic and endearing, is fading out of fashion. Oh, you may now and again hear the old refrain, "Yes, it's quiet in South Australia—we like it that way." But less and less. Less and less because the rusty philosophy, as expressed in "she'll do," simply isn't good enough for Australia today.

Yet here and there I'm selfishly pleased to find resistance to change in what I, for the past quarter of a century, have known and loved as the Australian scene. Consider, for instance, the dilemma of a country town called Clare, 50 miles north of the Barossa Valley. Under the headline, "Storm over gum tree," an article in Adelaide's daily *News* reported: "A rumpus has arisen over an Electricity Trust proposal to destroy a tree described as 'a particularly beautiful gum' at the northern entry to Clare."

Townsfolk Battle to Save a Tree

I went to Clare to see this tree and hear residents' views. Some townsfolk flatly refused to countenance the destruction of the gum to make way for "a miserable power line." On the other hand, businessmen wanted the tree removed because they insisted that it impeded the growth of industry.

High tension lines. Industrial growth. Improved communications and transportation. Standardization, at long last, of rail gauge all the way from Sydney on the east coast through the heartland of South Australia to Perth in the up-and-coming far west. All these are encouraging trends. They promise well for South Australia, a state which until recently has lurked in the wings but now plays a major part in the dramatic development of a continent on the move.

Who knows? Next time I go to South Australia I'll probably be able to cash a traveler's check wherever Nobby Buckley happens to get away with a landing. Still, I'd feel very sad indeed if "a miserable power line" had displaced that gracious old gum on the edge of a country town called Clare. THE END

White Tiger in My House

By ELIZABETH C. REED

Photographs by
DONNA K. GROSVENOR

IT WASN'T MY HUSBAND'S FAULT. Still, the timing could not have been worse. I was busy in the kitchen, preparing dinner for 14 guests, when he telephoned.

"Do you want the white cub now or later today?" Ted asked.

I should be used to that kind of question. My husband, Dr. Theodore H. Reed, directs the Smithsonian Institution's National Zoological Park in Washington, D. C. As a result, I've been foster mother to four hybrid bears, one grizzly cub, and two young leopards. Oh yes, and to a ring-tailed lemur that used to perch on my shoulder drinking orange juice.

Rewati, though, would be a different breed of cat—the only white tiger cub in the Americas. Ten years ago my husband had journeyed to India to escort her mother to this country. For the past decade, Mohini—Enchantress—has been one of the zoo's most popular attractions. With her blue eyes, and gray-brown stripes on whitish fur, Mohini is a mutant—a color variation of the orange Bengal tiger.

Zoo officials hoped to perpetuate Mohini's whiteness by mating her with Samson, an uncle of hers bred from an orange Bengal mother and a white father. In 1964 they were successful. Mohini gave birth to three cubs, including a white one, but the white cub died of a virus at 19 months.

This time Mohini had been mated with another orange tiger carrying a white gene, Ramana, and eight days before my husband's telephone call she had given birth to a white female cub. Indian Ambassador Nawab Ali Yavar Jung suggested her name, Rewati, after a pure mountain stream in his country.

Eight-week-old Rewati prowls her temporary territory—the author's backyard in a Washington, D. C., suburb.

EXTACHROME © NATIONAL GEOGRAPHIC SOCIETY

Mohini had been a model mother at first, but now zoo officials were worried. She had begun to lick her offspring excessively and pace nervously around the cage carrying it in her mouth. The rare and valuable cub was in danger; someone would have to take over the mother's role.

My husband felt he had no right to ask any of his associates to assume that grave responsibility. Rewati would come to our house where he could watch her closely—and I was drafted as foster mother.

That afternoon, before the dinner party, Ted brought the baby tiger home. It was hard to realize, staring at that appealing little 2½-pound bundle of fluff, that she would become a regal giant of 400 pounds or more. We scurried around the house, turning an upstairs bedroom into a nursery, complete with incubator, baby scale, and nursing bottles.

If I was a bit preoccupied that night, I'm sure the guests understood. There was at least $10,000 worth of infant tiger in that incubator upstairs. And, really, it was more than just a matter of money. Countless thousands of people had already learned of Rewati through the news media, and were eager to see her when she was old enough to return to the zoo. What if I blundered in my mother's role? There was so much that I didn't know—that no one knew—about hand-raising a white tiger cub!

Of some three dozen white tigers in captivity, most remain in India. A pair in the Bristol Zoo in England has produced four young; a female is owned by the Crandon Park Zoo in Miami. Mohini and her offspring complete the list of those living elsewhere.

Hungry Cub Changes Household Habits

Because the fat and protein content of nursing milk varies widely among the big cats, Ted had searched all available zoo literature for information on tiger's milk. He found nothing. We settled on a commercial formula for baby animals, and Rewati took an ounce of it. Well, the first hurdle was behind us; we would vary the formula cautiously, guided by the cub's growth rate and bowel movements.

My youngest child is 18, so I had forgotten how exhausting a new baby in the house can be. When Rewati began yowling her first night, Ted and I awoke with a start. Two pairs of bare feet hit the floor in unison. Arriving simultaneously, side by side, at the nursery doorway, we managed to wedge through—the way millions of other parents have done. Rewati just wanted her bottle and a dry blanket.

From that time on, she wanted those bottles every 3½ hours around the clock. Soon, she would outgrow the incubator, graduate to an open box 2½ by 4 feet, and then move on to a larger pen in the basement.

On the tenth day of her life—two days after she arrived at the house—both her blue eyes were open. On the 13th day she managed a wobbly walk. On the 22nd day she exhibited signs of playfulness, shaking her towel like a puppy.

But her 24th day was the one I had been waiting for. Rewati slept the whole night through. And so did I.

Room, board, and love

A SQUIRMING BUNDLE of snowy fur, dark stripes, and pink nose, Rewati arrived last April in the cage of famed white tigress Mohini at the National Zoological Park in Washington. When the 420-pound mother seemed nervous in handling her 2½-pound offspring, zoo director Theodore H. Reed whisked Rewati to his own home in nearby Maryland. There his wife Elizabeth, a veteran foster mother of zoo babies, lavished round-the-clock care and affection. Dr. Reed (right) winces as Rewati grooms his beard. Mrs. Reed (above) feeds the 6-week-old cub beneath a portrait of Mohini, whose remarkable story was told in Dr. Reed's May 1961 NATIONAL GEOGRAPHIC article: "Enchantress! Rare White Tigress Comes to Washington."

Our first crisis came a few days later when we found the cub crawling in tight circles, unable to use her hind legs. My husband consulted the zoo's veterinarian and other specialists. They treated Rewati without being sure what her ailment was. Rewati received antibiotics, oxygen treatments, outside exercise sessions, and a formula bolstered with egg and brandy. In a week she was well again, roaming our newly fenced backyard, which had now become her "jungle."

Her weight had tripled by then, and she had begun to feed from a bowl—baby cereal and strained beef mixed in milk. Frankly, Rewati was a messy eater; I faced a cleanup project after every meal.

A tigress grooms her cubs by licking them. I used a damp washrag on Rewati, and she'd roll her ice-blue eyes blissfully during the ceremony.

There was nothing catlike about the way she walked; her lunging, rolling gait, in fact, reminded me more of a puppy. She would prowl the dim recesses behind the shrubs, pausing now and then to sharpen her claws on my camellia bushes, then pounce out to attack the big red plastic ball that was her favorite toy (page 488).

Occasionally, we would let her roam free in the house. I still have vivid memories of cozy dinners—with a white tiger frolicking under the table.

Cat of another color, a stuffed playmate joins 3½-week-old Rewati in the Reeds' nursery.

Scientists recognize only one tiger species, *Panthera tigris*, although color and size vary from region to region in its native Asia. Rewati's Bengal strain normally wears an orange coat.

In 1951 a white mutant Bengal, lacking normal pigmentation in his hair, skin, and eyes, was captured in northern India by the Maharaja of Rewa. All of the white tigers now in captivity descend from this one animal, which died in December of last year.

One member of our family viewed Rewati's arrival with something less than enthusiasm—Ebony, our big black tomcat. In those early days, he'd stand in the nursery doorway glaring balefully while I attended to the tiny cub. Or was it a hungry glare? I kept the two apart.

But as the white cub grew, Ebony's attitude changed to one of aloofness. Rewati wanted to be friendly. She even sidled up to the cat and gave him a playful nuzzle. Ebony leaped up on the fence and sat there outraged, licking furiously at the spot where he had been "contaminated."

Until the tiger arrived, Ebony had taken our affection for granted. Now he felt that his place in the Reed household was threatened. At the slightest provocation, the tomcat would leap up on my lap, doing his best to play the role of a cuddly kitten.

Suddenly Ebony's troubles doubled. The zoo bought an orange Bengal cub as a playmate for Rewati. She was Sakhi—in Hindi, "close and dear companion" (page 489).

The white cub and the orange one would romp in the yard together, much to Ebony's disgust. It was amusing to watch the tomcat prepare to traverse tiger country. He'd plot his course across the yard carefully—and I'm sure he had escape routes in mind every foot of the way.

Surprise Encounter Proves a Shock

Rewati hated to be alone. As long as someone was within sight when she was in the yard—even Ebony—she was content. If she was left alone, I could count on hearing yowls and a scratching on my kitchen door. "Spoiled tiger," appeared more than once in the record I kept on our tenant.

I tended to forget, sometimes, that everyone does not have a tiger in his house. One day a man from the electric company came by to read the meter. Preoccupied, I waved him toward the basement where Rewati was napping. The meterman survived the shock—though I did get a polite phone call from the electric company asking how long I planned to keep that tiger down there.

Like all proud parents, we invited friends to "come see the baby," and they came by the dozens. I counted 35 adults and children in a single day. Ted brought fellow zoo officials home, too. He took one in to tiger-watch at midnight, and the stillness soon was shattered by tiger yowls. "Ted should let sleeping tigers lie" was my rather testy journal entry next day.

Sometimes, when Ted worked late, Rewati and I would watch television. The programs seemed a bit tame, though —with a white tiger curled up next to me on the couch.

She was my "$10,000 tiger." I managed to get used to that. Then Ted mentioned casually that she really was worth about $35,000 by now! I wished he hadn't told me.

I rarely left the house. But when it was absolutely necessary to go out, I'd round up a tiger-sitting friend and give her only one rule to follow. "If the house catches fire, just take the cub and leave."

By the 60th day, Rewati's weight had climbed to 15 pounds and she was now eating ground meat. Even in play, her teeth and claws could hurt.

Play's the thing

NOVICE HUNTRESS, 8-week-old Rewati (left) stalks a plastic ball, her favorite toy until she punctured it with a particularly ferocious pounce.

Infinitely more fun was a real playmate, Sakhi, a normal-color Bengal cub purchased by the zoo as a companion for Rewati. Photographer Donna Grosvenor (right) acts as go-between for 6-week-old Sakhi and Rewati, 3 weeks her senior.

At 4 months (below right), a much heftier Rewati—destined to weigh more than 400 pounds—romps with Sakhi during a reunion at the zoo.

In need of a napkin, Rewati at 6 weeks shows renewed appetite after recovering from an undiagnosed ailment that temporarily stole her strength and sense of balance. With teeth and claws daily becoming more formidable, she soon outgrew her foster home. When she was 9 weeks old, the Reeds sadly relinquished her to the zoo.

Tiger tag

BACK AT THE National Zoological Park, her permanent home, 4-month-old Rewati frolics with keeper Tony Olds (left), whose thick gloves fend off inadvertent thrusts of her claws.

All four feet in the air (below), the fast-growing 28-pound cat lunges for a trouser cuff of head keeper Bert Barker.

The Reeds look in regularly on their former charge. While visitors gaze in awe, the foster parents pat Rewati's extended paw and exchange affectionate chuffing sounds with the regal white tigress who—they will always remember—shared their home as an infant princess.

Before, it had been easy to get tiger-sitters when I had to leave the house for a few hours; now there was less enthusiasm.

The time had come to send Rewati to her permanent home in the zoo where Bert Barker, head keeper of the large carnivores, could assume the mother's role. Sakhi—three weeks younger than her white playmate—would stay on in the house for a couple of weeks until she was on a solid food diet. Then she too would become a zoo resident.

The two cubs had a final romp in our yard that last day. Even Ebony sensed something, for his icy reserve melted a bit. Crossing the yard, he stopped to eye a waving tiger tail. He couldn't resist; for a few seconds he batted the tail back and forth with his paws. Then, recovering his dignity, Ebony stalked off.

Rewati went home to the zoo, and two weeks later Sakhi left. My house has never seemed so large and quiet.

Do I miss my tigers? There were times—especially during those 3 a.m. feedings—when I'd mutter, "May this house be safe from tigers." But miss them? Of course I do.

It is comforting, though, to remember that both Rewati and Sakhi are secure and healthy under the tender care of Bert Barker. And neither of them will ever be lonely, for hundreds of thousands of adults and children visiting the zoo enjoy my tigers now.

And there's always this: One day my phone is sure to ring again, and Ted will be at the other end of the line, saying "Get the nursery ready."

I wonder what kind of infant I'll be asked to mother then? THE END

THE VIKINGS

By HOWARD LaFAY

National Geographic Foreign Staff

Photographs by TED SPIEGEL

FOR SOME 250 YEARS, from the end of the 8th century A.D. to the middle of the 11th, most of the known world fell prey to the ruthless raiders called Vikings. Sailing south from their Scandinavian homelands, these men of the north, or Norsemen, terrorized a Europe sundered by the decay of Charlemagne's Frankish Empire.

Vikings founded earldoms and kingdoms from the Thames to the Volga. Although barbarians compared to the civilized Europeans they overran, the roughhewn Norsemen left an indelible imprint upon the future. They dominated Russia and gave it its name. They crossed the Atlantic 500 years before Columbus. Jet aircraft winging across Arctic wastes employ a navigational principle first used by Viking captains. Even their gods live on in the days of our week—Thursday is Thor's day, Friday belongs to Frigg.

Searching for the obscure details of the turbulent Viking era took me on a journey into the past; the search also took me across

"Blond was his hair, and bright his cheeks. Grim as a snake's were his glowing eyes." As a 10th-century poet described the Viking, so another artist carved his likeness in elkhorn, cold-eyed beneath a warrior's helmet (opposite). Manning swift ships like the Danish reproduction above, these marauders, merchants, and colonizers swept out of Scandinavia a millennium ago to terrorize Europe and western Asia, leaving not only a reputation for savagery but also a legacy of bold exploration and of respect for personal freedom.

CARVING, DISCOVERED IN 1937 AT BIRKA, SWEDEN, NOW IN STATE HISTORICAL MUSEUM, STOCKHOLM; PHOTOGRAPHS © N.G.S.

the sometimes forbidding boundaries of the modern world—from piney Newfoundland forests to the wind-swept shore of the Caspian Sea, from the long arctic nights of Iceland to soft breezes beside the Bosporus. It ended in England, where William the Conqueror, himself of Viking blood, won a victory 900 years ago that casts its shadow still across the entire English-speaking world (map, pages 505-7).*

"THE HARRYING of the heathen miserably destroyed God's church in Lindisfarne by rapine and slaughter." That terse sentence in the Anglo-Saxon Chronicle for A.D. 793 marks the sudden explosion of the Vikings into the mainstream of history (following pages).

The heathen who sacked the small tidal island off Britain's east coast had sailed across the choppy sea in unstable ships with perilously little freeboard. They had come from misty northern reaches beyond the Christian pale, and outlandishly carved heads of horses and serpents and dragons glared from the prows of their fragile vessels (page 492).

In the centuries that followed, groups such as this slew unarmed monks, looted sanctuaries, plundered libraries that preserved the precious literary legacies of the ancient world. What they could not carry off, they wantonly burned. So ceaseless and fierce became their depredations that congregations throughout Europe prayed: "*A furore Normannorum libera nos, Domine*—From the fury of the Northmen deliver us, O Lord!"

The origin of the word that gave the age its name, *viking*, lies lost in the past. Ancient sources attest only that it gained currency as a verb rather than as a noun and that throughout Scandinavia to "go viking" meant quite simply to embark on an expedition of piracy and plunder.

As the ninth century dawned, Swedes, Danes, and Norwegians surged out of their frosty fastness at the top of Europe in a giant, ever-advancing pincers that eventually encompassed the continent. Born merchants as well as warriors, they traded as often as they raided; and, with increasing frequency as their world broadened, they settled on the sites of their conquests.

Nor were they indifferent to the unknown world, these bearded giants who worshiped strange gods and avidly sought glory in death rather than peace in life. As their power waxed, so did the quality of their ships and their seamanship.

In that pre-Copernican age, everyone knew that the gray mystery of the North Atlantic led only to a turmoil of monsters fringing the edge of the flat world. Right-minded mariners, fearing the certain calamity that lay beyond the horizon, never willingly left the sight of land. Yet generations of Norse skippers pressed relentlessly toward the sunset. In the bleak oceanic waste, they colonized the Orkneys, the Shetlands, the Faeroes, the Hebrides, Iceland, Greenland. And just before the end of the first Christian millennium, adverse winds blew a Greenland-bound captain, Bjarni Herjulfsson, past his destination. Before making his way back, he coasted a land "well-wooded and with low hills"—America.

Three sources illuminate the Viking Age. Archeology reveals the articles and apparel of everyday living; comments left by those who encountered Vikings at home or abroad acquaint us with their ways; finally the sagas —most of them composed in Iceland in the 13th century, 200 to 300 years after the events they portray—provide sweeping histories of northern heroes, important families, and even of entire nations.

These sources combine to

Great Dragon . . . Long Serpent . . . Names of ships renowned in sagas find form in the ninth-century Oseberg vessel, whose graceful hull dominates Viking Ship Hall in Oslo, Norway. Burial sepulcher for a noble lady, the ship was brought to light at Oseberg in 1904. Seventy feet long between arching bow and sternposts, she carries a mast and wears 15 oar ports along each gunwale. The love of the Viking for his ship rings in his epics and even finds expression on his coins. Those at right depict a shield-rimmed warship and a stockier *knarr*, used for trading.

THE SPREUL, MARIE GUILLEMETTE © N.G.S.; COINS FROM STATE HISTORICAL MUSEUM, STOCKHOLM

*See "900 Years Ago: The Norman Conquest," GEOGRAPHIC, August 1966, and "A New Look at Medieval Europe," December 1962, both by Kenneth M. Setton.

Also, "In the Wake of the Vikings" and "Tracing William the Conqueror," chapters in the Society's recent book *The Age of Chivalry*, available from National Geographic Society, Dept. 61, Washington, D.C. 20036, $11.95 plus postage.

throw a fitful light on life in Scandinavia before the sudden eruption of the Viking Age. In the first century Tacitus mentions a people called the Suiones—doubtless forebears of the Swedes—well-armed, acquisitive, skilled in sailing curious ships "with a prow at each end." The Gothic historian Jordanes, in the middle of the sixth century, reports upon the ferocity of the inhabitants of Scandinavia and on their extraordinary stature.

Archeology offers a complementary picture of a primitive society based on agriculture, fishing, hunting, and animal husbandry. Geography—the fjords of Norway, Sweden's network of streams and lakes, Denmark's 500 islands—had early turned the Scandinavians seaward. From the Bronze Age on, they excelled in the construction of swift, sturdy vessels. An affinity for ships, in fact, marks every phase of Scandinavian history.

The burials of the age—chief source of archeological information—followed a mixed pattern of cremation and inhumation, usually with weapons, household utensils, and food interred with the remains. A great man or a great lady merited a fully fitted ship as a sepulcher; slaughtered horses, hounds, and slaves accompanied the dead on that final

"Out of the north an evil shall break forth"

TERRIFIED MEN recalled the words of the prophet Jeremiah when a band of Vikings struck the monastery at Lindisfarne off the English coast in 793, pillaging and slaying without mercy. "Never before has such a terror appeared in Britain," moaned a contemporary chronicler.

On a stone depicting the attack (left), raiders advance with upraised swords and battle-axes. A museum at Lindisfarne preserves the sculpture, here set amid 11th-century ruins.

The Vikings stepped into history with their attack on Lindisfarne. For these warriors, the ultimate aim of life was death in battle; only then could they enter Valhalla, the Hall of the Slain. Many carried hammer-shaped amulets (upper right), symbols of Thor, thunder god and mighty warrior.

Of surer help in battle was the sword. The Norse discarded the light ornate blades of an earlier era for simple, strong weapons (lower right) which they honored with names such as Legbiter. Wooden or elkhorn hilts topped the tough blades, forged of iron and steel.

AMULET AND SWORD FROM STATE HISTORICAL MUSEUM, STOCKHOLM

voyage (pages 516-17). Lesser men would be buried with boats. Those of no resources would, at the very least, have graves covered by stones arranged in the outline of a boat.

Investigators have found no townsites in Scandinavia antedating A.D. 800. During most of the Viking Age, the kings and *jarls*, or earls, of the north reigned in glorified farmsteads, and the chief business of the courts—particularly through the long gloom of winter—centered upon nightly drinking bouts. Scandinavian royalty possessed a limitless capacity for mead—a beverage made of fermented honey—as well as a chilling propensity for finding death in the dregs of a drinking horn.

The sagas inform us that the Swedish king, Fjolnir, capped a night of wassailing by stumbling into a vat of mead wherein—perhaps quite happily—he drowned. A chronicle attests that Athils perished after toasting the death of an enemy "with immoderate joviality." Sveigdir gave tipsy chase to a dwarf and was seen no more. Gudrod, who had captured and wed an unwilling princess, toppled suddenly into the marriage bed, where he was skewered by an agent of the unblushing bride.

Athils lies in a huge mound at Gamla—or Old—Uppsala, the royal seat of pagan Sweden.

Two other sixth-century monarchs sleep in equally imposing man-made hills beside him, and many smaller barrows are toward the horizon. I visited Gamla Uppsala after a snowfall, and children were slamming down the slopes of the mounds on red and yellow sleds. Yet the scene held no gaiety. The mounds are too high, too blunt, too funereal to support joy. Kings once burned here, and the smoke of the pyres seems to linger on the air.

From the royal mortuary, I crossed a road into the grove surrounding Old Uppsala Church, built upon the ruins of a pagan shrine. Writing in the 11th century, the historian Adam of Bremen had described the shrine as "entirely decked out in gold." Inside Thor was locally worshiped as king of the gods; Odin, as god of war; and Frey, as patron of "sensuous pleasures."

Every nine years, Adam related, the entire population flocked to Uppsala to witness a special sacrifice, where "of every living thing that is male, they offer nine heads, with the blood of which it is customary to placate gods of this sort. The bodies they hang in the sacred grove that adjoins the temple. . . . Even dogs and horses hang there with men."

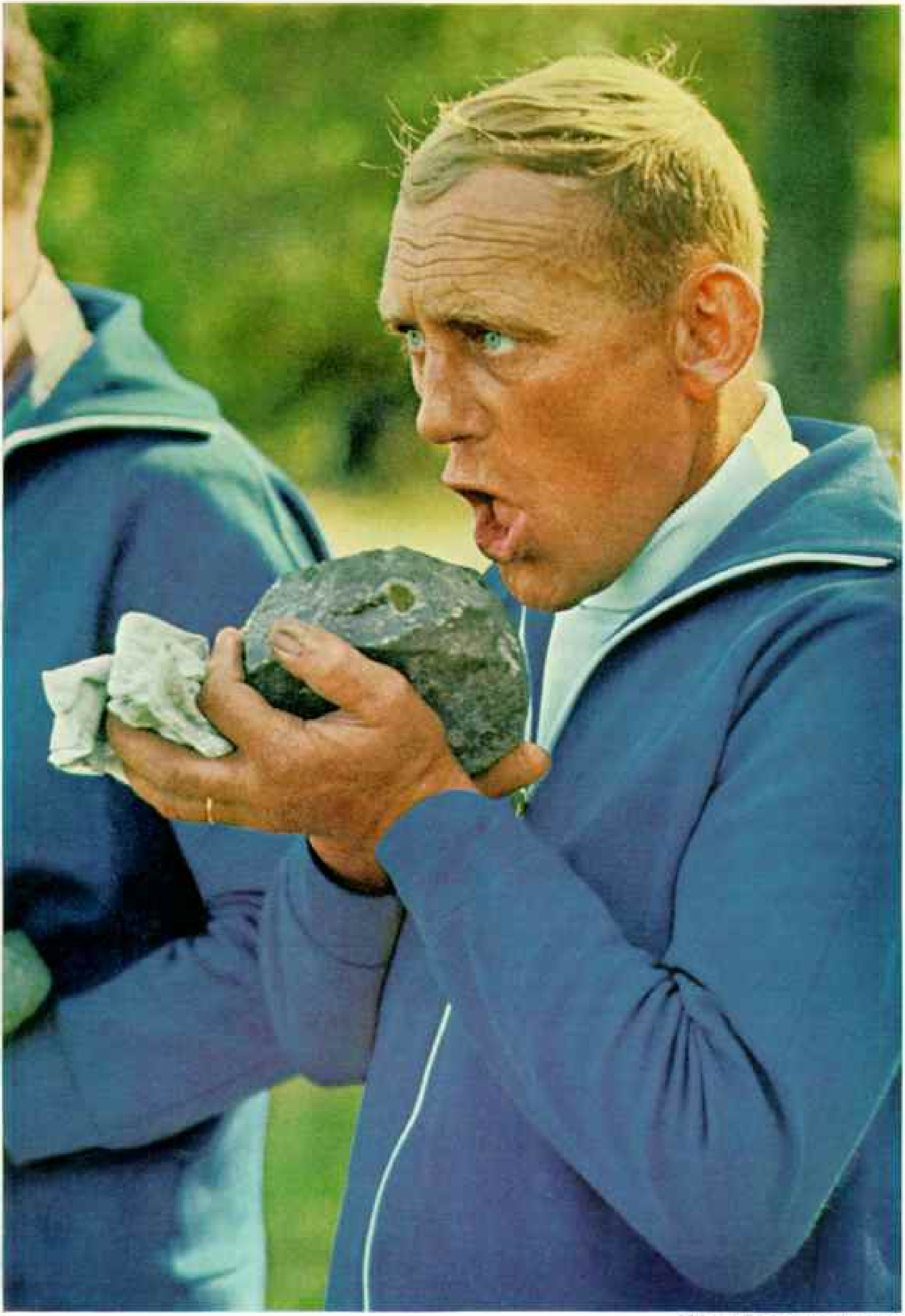
"May godheads grant me luck"

AS THE VIKING WARRIOR pleaded before entering battle, so present-day contestants invoke fortune's aid at the Folk Sports Olympiad on the Swedish island of Gotland. Here, like a flashback to the distant past, the island's modern Northmen—tall, fair, and handsome—perpetuate the old sports and superstitions.

His eye on a peg 65 feet away, a Gotlander (right) blows on his stone for luck in the venerable game of *varpa*, won by tossing nearest a stake, as in horseshoes. A wind-blown blonde, emblazoned with the emblem of her local varpa club (above), awaits her turn.

Tilting backward to balance the weight of a 16-foot pole, a muscular islander poises for a throw in the grueling game of *stångstörtning*, much like the Scottish caber toss. Shortly he will lunge to his feet and send the beam flying.

Both in sport and in battle, the concept of luck loomed large to the Northmen, or Norsemen. When a man wished to go *viking*—raiding for plunder—he sought to sail with a chief renowned for luck in battle.



Strolling through the trees, I glanced up, half expecting to see the same grisly fruit silhouetted against the sky. The ancient religion of the north boasted little theology and no promise of salvation. Immortality of a sort came if you died fighting. Then the warrior-maids called Valkyries would carry you to Valhalla to banquet on mead and pork until the far-distant day when the gods themselves —because in that fatalistic religion even the gods were doomed—fell in battle before the powers of darkness.

Superstition reigned supreme. Of all the desirable qualities a man might possess, luck ranked far above skill or intelligence or virtue. Certain individuals won wide renown for woman-luck or weapon-luck. And when a Norseman decided to go viking for a season, he sought a chief famed for victory-luck.

THE VIKINGS balanced their blood-reeking religion with a passion for poetry. The art of the *skalds*, or court poets, followed a complex, rigid formula that featured alliteration, internal rhyme, and the elaborate metaphors called *kennings*. "Hawkfell," for example, formed a kenning for "hand," since thereon perched one's hunting falcon; a battle might be "the reddening of spears" or "the Valkyries' magic song." Blood became "wound-dew" and to slay enemies was "to feed the ravens" or "sate the eagles."

Poets of the Viking Age prospered as never before, for verse alone could memorialize the deeds of great men. No self-respecting king or jarl would venture into battle without a complement of skalds behind his shield-wall. King Harald Hardraada of Norway, himself no mean poet, cannily assured eternal fame by employing ten of the finest. The poets traded their verse unashamedly for gold; the greatest of them, Egil Skallagrimsson, in a stately lament on the death of his friend and patron, Arinbjørn, candidly wondered who would now

. . . fill high hawkfell of my hand
With skald's reward for skilled word?

Poetry, if well enough crafted, could even forestall the wrath of kings. The mid-10th century offers the bizarre spectacle of the same Egil literally composing for his life. After falling into the hands of his sworn enemy, King Eric Bloodax, Egil fashioned a poem overnight and, as the king brooded on his high seat the next morning, the skald recited 20 dazzling stanzas in praise of his royal captor. With an eye wisely cocked to immortality rather than the mere doing of justice, Eric spared his blood enemy.

If a skald's words could buy life, so could they also mock death. In the 11th-century battle of Stiklestad, the skald Thormod jerked an enemy arrow from his chest, examined the tip, and proclaimed, "Well has the king fed us. I am fat even at the heart-roots." Whereupon he fell dead.

"Before the Vikings, Scandinavia was a self-

Intricate artistry of a rug pattern fascinates author LaFay in a factory at Baku, on the Caspian Sea, as he traces the sweep of the far-

contained society," said Arne Emil Christensen, Jr., a curator of the Museum of Antiquities in Oslo, as we approached the Viking Ship Hall. "Swedes, Norwegians, and Danes spoke a common language, shared a common culture, and knew little of the world outside Scandinavia. Just preceding the Viking Age, we find evidence of a marked population explosion. The number of burials multiplies and place names increase.

"But the land couldn't support more people.

So they took to their ships—the finest in the world—and raided the richer lands to the south. These ships, even more than the men who sailed them, forged the Viking Age."

The vaulted silence of the Viking Ship Hall offers a majestic vista. There, as we entered, the serpent prow of the Oseberg ship sailed inexorably, miraculously, out of the past (page 494). A sublime work of art, richly decorated and perfectly proportioned, it had seen almost fifty years of use before being buried

EXTACHROME BY TED SPIEGEL, RAPHO GUILLUMETTE © N.G.S.

ranging Northmen. Near here, in 943, a band of Viking raiders succumbed to tough Moslem tribesmen and an epidemic of dysentery.

near the Oslo Fjord in the mid-ninth century.

"Almost certainly this was the type of vessel that raided Lindisfarne," said Mr. Christensen. "It's beautiful, but has serious weaknesses. The freeboard measures a scant foot, making it vulnerable to swamping. And the towering stem and stern, each 15 feet tall, would have caught the wind and made it unstable."

We passed on to the less ornate Gokstad ship, found north of Sandefjord in 1880.

"Now this was built a generation or two after the Oseberg," Mr. Christensen said. "The shipwright has given the hull a more efficient shape, improved the mast step, and added two feet of freeboard. The strakes are of solid oak, hewed from naturally curved planks. The ribs and planking below the waterline are lashed together with spruce roots, giving the ship great flexibility in heavy seas.

"With all the resources of modern technology, you could not construct a more seaworthy ship of this type. It's a classic."

Each of the ships had served as a sepulcher —Gokstad for a chieftain, Oseberg for a lady of high estate. When archeologists dug up the Oseberg ship in 1904, they found the bodies of two women—one old and arthritic, the other young and healthy. Scholars believe that the younger woman was sacrificed to accompany her mistress on the death voyage.

I toured the rich trove of grave goods—wood carvings of unbelievable complexity, collapsible tents and beds for shipboard use, gilded ornaments, textiles, and two trim small boats found in the Gokstad barrow.

"The old Norse," Mr. Christensen said, "were obsessed by ships. They regarded them much as the British 19th-century aristocracy regarded horses. Essentially, the Gokstad and Oseberg vessels are pieces of sculpture. The shipwrights worked without plans. They shaped the shell with hand and eye, then fitted the ribs to the planking."

INCREDIBLY ENOUGH, the Viking art of boatbuilding has survived to our day. Along Norway's west coast, some men still shape lithe and handsome craft in the old fashion (pages 510-11). I found one in the little village of Lysekloster that hugs the edge of the Lyse Fjord, an hour's drive from Bergen.

"It's always sad for me to visit him," a Norwegian friend had told me. "I think it will be sad for you, too. Twenty years ago 15 such boatbuilders worked in this district. Now only he remains alive."

Arriving in Lysekloster, I picked my way down a steep slope to the edge of the fjord, where a sprawling wooden workshop bore the sign "Alfred Søvik, Båtbygger." The crystal waters of the fjord slapped at a small wharf beside the barnlike building. Landward, forested hills soared high and green.

Mr. Søvik, compact, gray-haired, well into his sixties, led me into his workshop where accumulated wood shavings curled shoulder-high against all four walls. The air was redolent of pine, and a gleaming, graceful boat

lay on stocks in the center of the room.

"It's almost finished," Mr. Søvik said. "Just a few days' more work. It's for a fisherman here in the fjord."

The vessel was a twin to the small boats dug up with the Gokstad ship, even to the incised parallel lines decorating every plank. The strakes overlapped, and—just as in the old vessels—rivets fastened them together.

"Who builds boats like these nowadays?" Mr. Søvik asked with gentle irony. "Just some old men with no ability for anything else."

He traced the gunwale with a finger.

"I use only naturally curved wood. I find the timber while walking through the forest. You mark this tree as properly bent, or that as having an ideal fork for a stem or stern. Then when you need them, you fell them."

Mr. Søvik showed me his tools; all could have come from a Viking burial mound.

"They're not commercially available, of course, so I have to forge my own," he said.

OPPOSITE PAGE FOLDS OUT

Straddling a plank, he swung an ax in graceful, almost metronomic strokes, demonstrating how he hewed the wood into its final, impeccably smooth shape. When he finished, he was panting.

"Pardon me," he said. "But I've had several heart attacks. I can't work at full speed any more."

In the Viking tradition, he uses no plans, relying on hand and eye to shape the exquisite shell of the boat. And his unit of measurement is the all-but-forgotten *alen* (about 21 inches) employed by old Norse shipwrights.

"I learned how to make boats from my father, and he from his father. My family transmitted the techniques from generation to generation. But now I have no sons. And I can find no apprentice. Young men today, with their advanced educations, take no satisfaction in building old-fashioned boats."

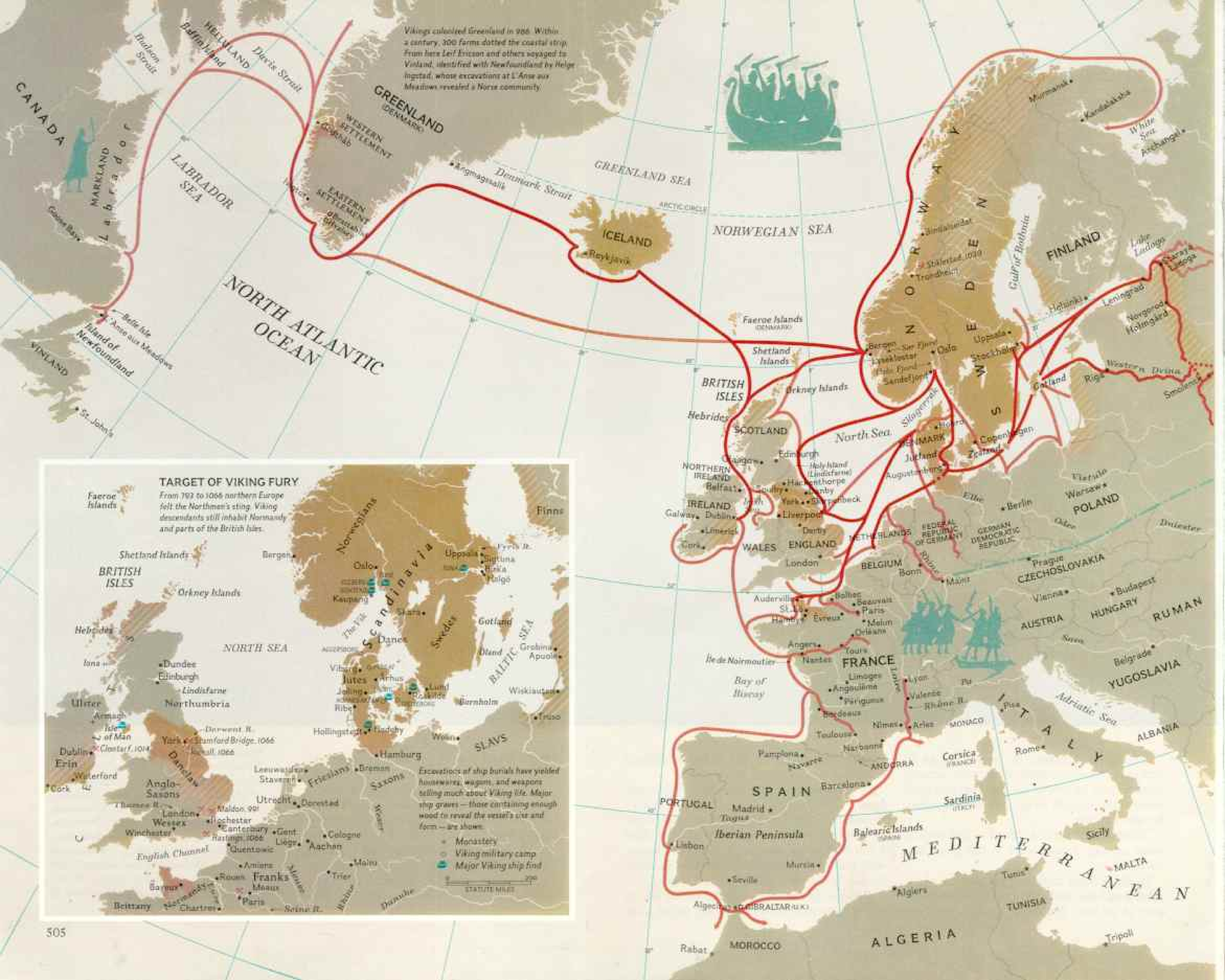
Because I couldn't think of anything else to say, I motioned, rather gauchely, to the tools and stacked planks: "What will happen to all this when you retire?"

He smiled wryly. "After me—plastic."

So I left him, a maritime sculptor, an artist of the end time, shaping his archaic symmetries in the solitary shop beside the Lyse Fjord. With him and his kind would die an art that began in the Bronze Age—an art that had fathered the sleek sea-steeds and wave-plungers that first

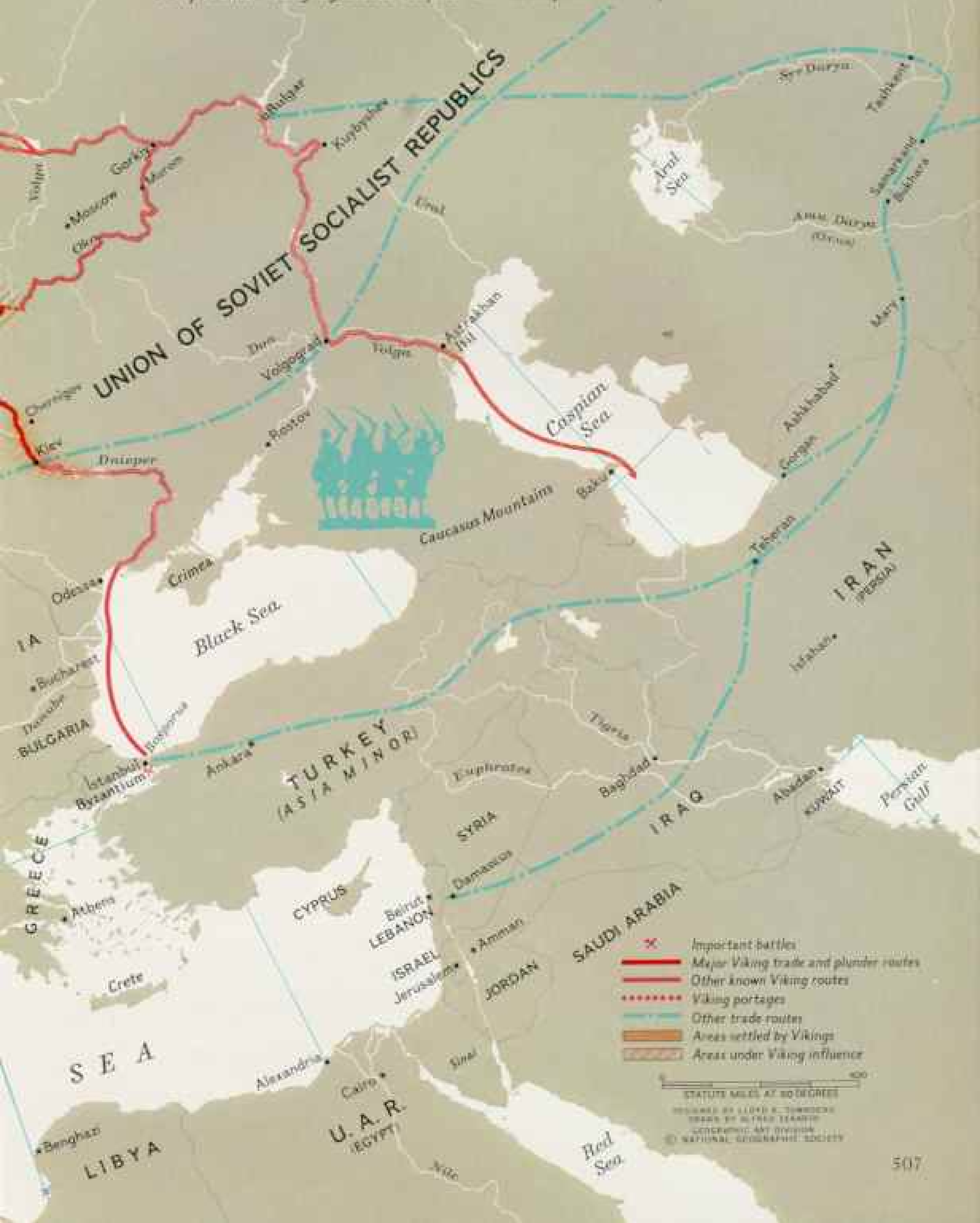
(Continued on page 509)

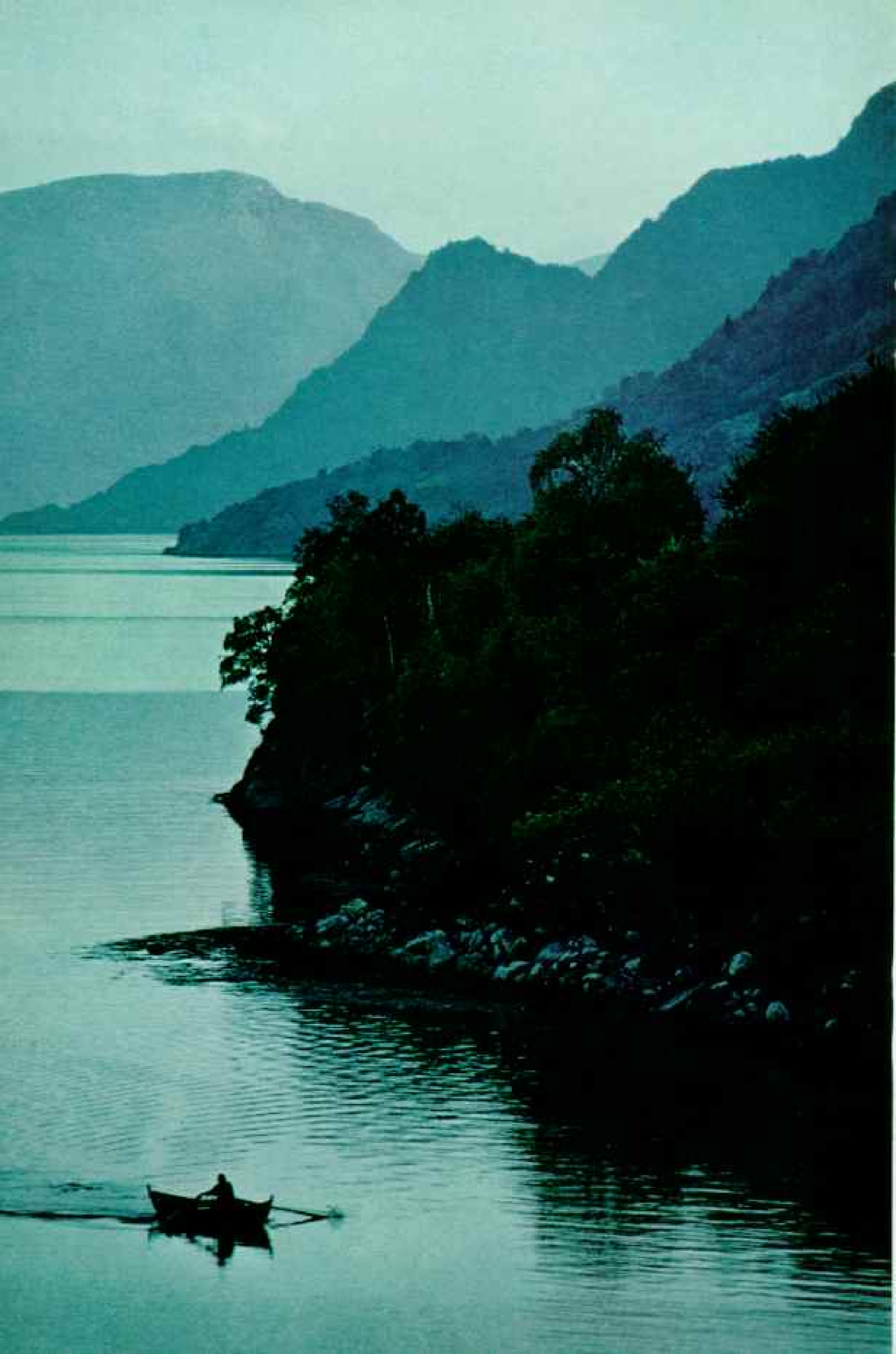
Straining at the sweeps, Danish Boy Scouts send a 32-oar Viking ship skimming over the water near Augustenborg, off Jutland. The Scouts built the craft with Norse tools and methods, copying a ship unearthed at Ladby, Denmark. Such boats gave the Vikings their fearsome striking power along seacoast and riverbank. Developing navigational techniques still in use today (pages 526-28), they dared strike out of sight of land to explore the western sea.


Vikings colonized Greenland in 986. Within a century, 300 farms dotted the coastal strip. From here Leif Ericson and others voyaged to Vinland, identified with Newfoundland by Helge Ingstad, whose excavations at L'Anse aux Meadows revealed a Norse community.
CANADA
Hudson Strait
Baffin Island
HELLULAND
Davis Strait
GREENLAND
(DENMARK)
WESTERN SETTLEMENT
EASTERN SETTLEMENT
LABRADOR SEA
Labrador
MARKLAND
Goose Bay
Belle Isle
L'Anse aux Meadows
Island of Newfoundland
VINLAND
St. John's
NORTH ATLANTIC OCEAN
Angmagssalik
Denmark Strait
GREENLAND SEA
ARCTIC CIRCLE
ICELAND
Reykjavík
NORWEGIAN SEA
Faeroe Islands
(DENMARK)
Shetland Islands
BRITISH ISLES
Orkney Islands
Hebrides
SCOTLAND
Edinburgh
Holy Island (Lindisfarne)
NORTHERN IRELAND
Belfast
IRELAND
Galway
Dublin
Limerick
Cork
York
Liverpool
Derby
WALES
ENGLAND
London
North Sea
NORWAY
SWEDEN
Murmansk
Kandalaksha
White Sea
Archangel
Trondheim
Bergen
Oslo
Sandefjord
Uppsala
Stockholm
Gulf of Bothnia
FINLAND
Lake Ladoga
Helsinki
Leningrad
Novgorod
Holmgård
Gotland
Riga
Western Dvina
Smolensk
DENMARK
Jutland
Copenhagen
Zealand
Elbe
Berlin
Vistula
Warsaw
POLAND
Oder
Dniester
NETHERLANDS
FEDERAL REPUBLIC OF GERMANY
GERMAN DEMOCRATIC REPUBLIC
BELGIUM
Bonn
Rhine
Mainz
Prague
CZECHOSLOVAKIA
Vienna
Budapest
AUSTRIA
HUNGARY
RUMAN
Sava
Belgrade
YUGOSLAVIA
Auderville
Beauvais
Paris
Evreux
Melun
Orléans
Angers
Tours
Nantes
Île de Noirmoutier
FRANCE
Bay of Biscay
Loire
Limoges
Angoulême
Périgueux
Bordeaux
Lyon
Valence
Rhône R.
Toulouse
Nîmes
Arles
Narbonne
MONACO
Po
Pisa
ITALY
Adriatic Sea
ALBANIA
Rome
Corsica
(FRANCE)
Sardinia
(ITALY)
Pamplona
Navarre
ANDORRA
SPAIN
Barcelona
PORTUGAL
Madrid
Tagus
Iberian Peninsula
Lisbon
Murcia
Seville
Balearic Islands
(SPAIN)
MEDITERRANEAN
Sicily
MALTA
Tunis
Algiers
TUNISIA
Algeciras
GIBRALTAR (U.K.)
Rabat
MOROCCO
ALGERIA
Tripoli
TARGET OF VIKING FURY
From 793 to 1066 northern Europe felt the Northmen's sting. Viking descendants still inhabit Normandy and parts of the British Isles.
Faeroe Islands
Shetland Islands
BRITISH ISLES
Orkney Islands
Hebrides
Iona
NORTH SEA
Dundee
Edinburgh
Lindisfarne
Northumbria
Ulster
Armagh
Isle of Man
Dublin
Erin
Clontarf, 1014
Waterford
Cork
York
Stamford Bridge, 1066
Derwent R.
Danelaw
Anglo-Saxons
Thames R.
London
Maldon, 991
Wessex
Rochester
Canterbury
Winchester
Hastings, 1066
Quentowic
English Channel
Amiens
Rouen
Franks
Meaux
Paris
Bayeux
Brittany
Chartres
Seine R.
Bergen
Norwegians
Oslo
Kaupang
Scandinavia
Skara
Danes
Swedes
Uppsala
Sigtuna
Birka
Helgö
Gotland
Öland
BALTIC SEA
Grobina
Apuole
Viborg
Jutes
Århus
Jelling
Ribe
Lund
Roskilde
Bornholm
Wiskiauten
Truso
Hollingstedt
Hedeby
Wolin
SLAVS
Hamburg
Bremen
Frisians
Saxons
Leeuwarden
Stavoren
Utrecht
Dorestad
Gent
Liège
Aachen
Cologne
Mainz
Trier
Weser
Danube
Finns
Excavations of ship burials have yielded housewares, wagons, and weapons telling much about Viking life. Major ship graves—those containing enough wood to reveal the vessel's size and form—are shown.
Monastery
Viking military camp
Major Viking ship find
STATUTE MILES

THE VIKING WORLD

Swarming out of Scandinavia in the ninth century, the restless Vikings struck south at England, Ireland, and the Frankish Empire. To the east they threaded Russian rivers, plundering and trading; soon they controlled the Dnieper, waterway to the riches of Byzantium. Exploring Northmen sailed into the Mediterranean and touched the shores of Africa. Colonists braved the unknown sea to settle Iceland, Greenland, and North America. The sagas, contemporary accounts, and archeological finds weave the tapestry of their travels, but since ships leave no tracks, many sea routes shown are speculative. Viking figures are adapted from Norse picture stones preserved in Gotland.


N. Dvina
Volga
Gorky
Murom
Moscow
Oka
Bulgar
Kuybyshev
UNION OF SOVIET SOCIALIST REPUBLICS
Ural
Syr Darya
Tashkent
Aral Sea
Samarkand
Bukhara
Amu Darya
(Oxus)
Mary
Astrakhan
Itil
Don
Volgograd
Chernigov
Kiev
Dnieper
Rostov
Caspian Sea
Ashkhabad
Gorgan
Baku
Caucasus Mountains
Teheran
IRAN
(PERSIA)
Isfahan
Crimea
Odessa
Black Sea
IA
Bucharest
Danube
BULGARIA
Bosporus
Istanbul
Byzantium
Ankara
TURKEY
(ASIA MINOR)
Euphrates
Tigris
Baghdad
IRAQ
Abadan
KUWAIT
Persian Gulf
SYRIA
Damascus
CYPRUS
Beirut
LEBANON
Amman
ISRAEL
Jerusalem
JORDAN
SAUDI ARABIA
GREECE
Athens
Crete
SEA
Alexandria
Cairo
Sinai
U.A.R.
(EGYPT)
Benghazi
LIBYA
Nile
Red Sea
Important battles
Major Viking trade and plunder routes
Other known Viking routes
Viking portages
Other trade routes
Areas settled by Vikings
Areas under Viking influence
0
400
STATUTE MILES AT 60 DEGREES



conquered the western ocean. I trudged up the slope with the rueful knowledge that my friend had been right about the sadness.

BORNE ON THEIR SWIFT SHIPS, driven by a lust for gold and glory, the Scandinavians struck out in force in the ninth century. Danes and Norwegians generally steered their longships down through the North Sea toward the fat and ill-defended coasts of Britain, Ireland, and continental Europe. The Swedes thrust across the Baltic into the vast birch forests and steppes of Russia. Following rivers and lakes, their ships plowed ever southward down the Volga and the Dnieper toward the wondrous marts of Baghdad and Byzantium. With them they carried cargoes of furs, honey, amber, wax, and—most important—fair slaves to trade for the silks and silver of the Orient.

The energetic Swedes swiftly attained supremacy over the native populations. In their principal northern trading center, Novgorod—which they called Holmgård—their leaders ruled as princes. Contemporary documents refer to these merchant-colonists as the Rus, most probably a corruption of the Finnish word for Sweden, Ruotsi, or Rowing Way. In any case, they eventually gave their name to the entire country—Russia.

Arab and Byzantine authors of the 9th and 10th centuries mention the Rus frequently. An Arab, Ibn Fadlan, wrote of an encounter with them on the Volga: "I have never seen more perfect physical specimens, tall as date palms and blond and ruddy; they wear neither tunics nor caftans, but the men wear a garment which covers one half of the body, leaving a hand free." The fastidious Arab also branded the unhygienic Rus "the filthiest of god's creatures."

On another occasion Ibn Fadlan witnessed the ship burial of a Rus chief: "They collect his goods and divide them into three parts, one for his family, another to pay for his clothing, and a third for making *nabīd* [perhaps beer]. . . . They stupefy themselves by drinking this nabīd night and day; sometimes one of them dies cup in hand."

He describes how a girl slave volunteered to be burned with her master, and how the man's ship was drawn ashore and placed on a scaffolding, with wood piled beneath it. The Rus then built a pavilion on the deck and placed therein a brocaded mattress.

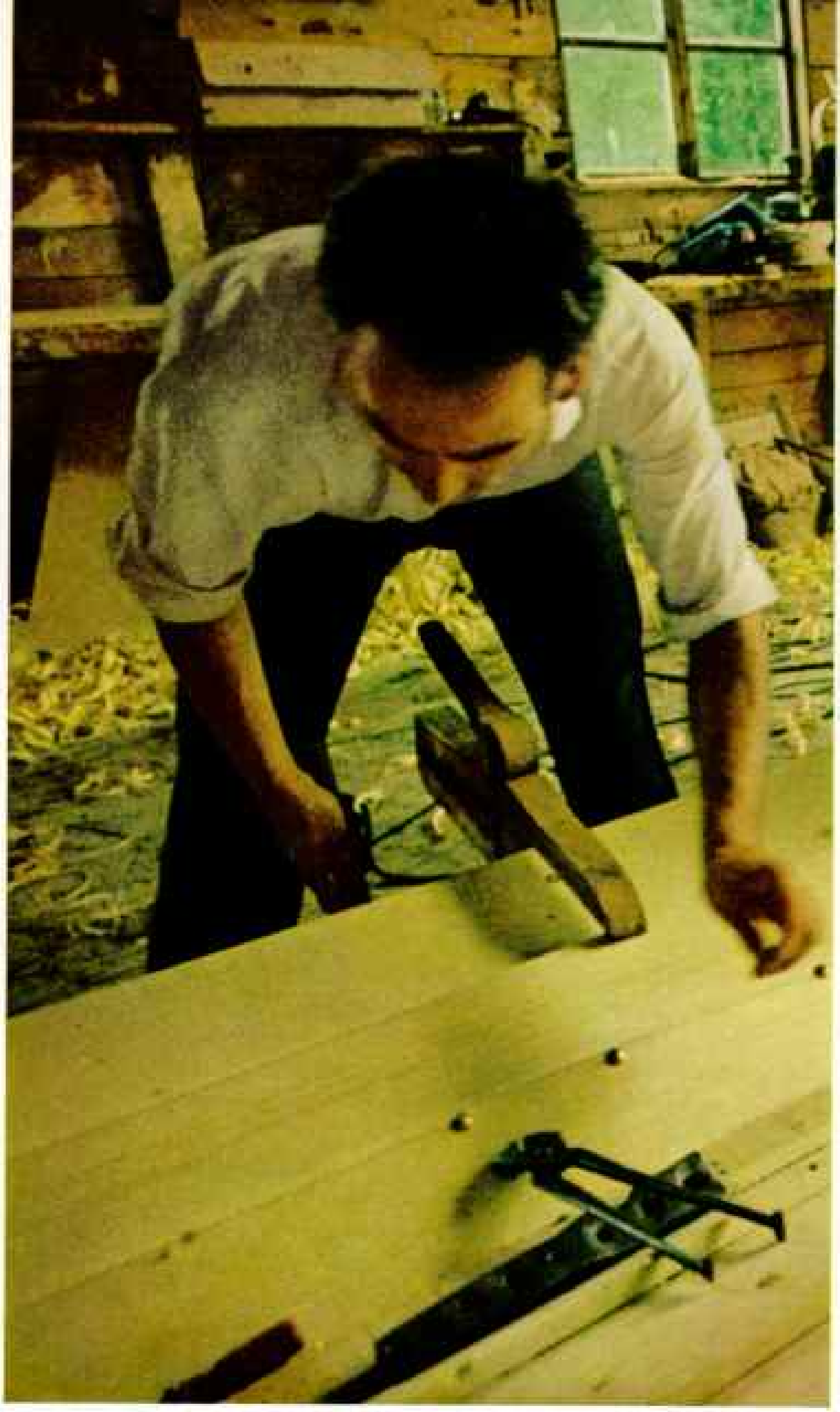
They dressed the corpse richly, "carried him into the pavilion on the ship," and "seated him on the mattress. . . ." They placed nabīd and food and weapons beside him and "brought a dog, which they cut in two and put in the ship." They ran two horses "until they sweated, then cut them to pieces with a sword and put them into the ship. They took two cows which they likewise cut to pieces. . . ."

Land that launched an age: Its face to the sea, its rugged interior hostile to the plow, fjord country such as this at the Sør Fjord in Norway saw the flowering of the Viking era. A population explosion spurred Norse expansion, as did Viking custom: When a man died his land went to his eldest son, who in turn compensated his brothers. With his stake, many a younger son outfitted a ship to go trading or raiding.

EXTACHROME (BELOW) AND KODACHROME BY TED SPIEGEL, RAPHO GUILLUMETTE © N.G.S.

Sunlight streaming into her kitchen, Mrs. Hulda Vollan of Bindalseidet, Norway, kneads dough in a wooden bowl strikingly like one found in the Oseberg ship. In medieval times, Viking women cared for homes and crops while their men roamed the seas.

Heir to his ancestors' art, Asmund Vollan shapes a rib for a Bindals boat, a small craft little changed since Viking days. Mr. Vollan selects individual boat members from living trees, then creates his craft from a plan in his mind's eye. He had marked this tree because of its natural curvature where trunk meets root.



Once aboard the ship the slave girl met "the old woman called the 'Angel of Death,' who was to kill her. . . . Then men came with shields and sticks. She was given a cup of nabīd; she sang at taking it and drank. . . . I saw that she was distracted. . . . Then the old woman seized her head and made her enter the pavilion. . . .

"Thereupon the men began to strike with the sticks on the shields so that her cries could not be heard and the other slave-girls would not be frightened and seek to escape death with their masters."

Inside the pavilion, the girl was laid beside the corpse and put to death by stabbing and strangling. Finally, the closest relative of the dead chieftain set the ship afire. "The flames engulfed the wood, then the ship, the pavilion, the man, the girl, and everything in the ship" (painting, pages 516-17).

Four times Rus fleets sailed the Black Sea and brashly attacked Constantinople, which every Viking knew simply as Miklagärd, the Big City. Impressed by the valor of the Rus, the Byzantine emperors recruited a special corps of Northmen for their army, calling it the Varangian Guard. For more than two centuries the Varangians served Byzantium

Staccato hammering of father and sons rivets overlapping strakes in the Vollans' yard. The thin planking leaves the hull flexible and free to work with the seas. Widely spaced ribs will be added when the planking is completed.

Helping hands (left) launch a finished craft on log skids.

as shock troops in the field and as the emperor's bodyguard at home. Many a runestone in Scandinavia mourns a warrior who *"vard daudr i Grikkium*—died among the Greeks."

Kiev, which became the stronghold of the Rus, is now the third largest city in the U.S.S.R. and capital of the fertile Ukraine (pages 514-15). The oldest section of Kiev stands on a bluff overlooking the west bank of the Dnieper. Trees line the pleasant, sloping streets, and the towers of churches and monasteries—most of them closed or converted into museums by government decree—dominate the skyline.

Over glasses of tea one evening, I discussed the city's early history with Professor Vassili Dovzhenok, a member of the Institute of Archeology of the Academy of Sciences of the Ukraine.

"To be sure," he said, "the Vikings played a role in Kiev from the 9th to the 11th centuries. But their importance gradually diminished. In the second and third generation, the Northmen who had come to the Dnieper turned Slav, borrowing language, customs, and beliefs and taking many Slav girls to wife.

"It's notable that 9th- and 10th-century rulers of Kiev had Viking names, but the names of the last and probably the greatest princes, Svyatoslav, Vladimir, and Yaroslav, were purely Slavic. The Vikings assimilated into the local population, leaving no discernible mark on the culture."

"WEALTH SHALL HE OFFER *who longs for a maiden's love," proclaimed a Norse poet. A hoard discovered near Oslo, Norway, included gifts to please a woman's vanity: a finely wrought gold neck ring and a necklace of glass beads and silver ornaments. A warrior may have won this jewelry while raiding in France in the ninth century.*

Whimsical figures known as gripping beasts delighted the Norse. Amber creature above, found in Norway, clutches its ankles. A well-to-do merchant's wife in Gotland might have pinned her cloak with the gold-and-silver box brooch at right.

BROOCH FROM STATE HISTORICAL MUSEUM, STOCKHOLM; OTHER OBJECTS FROM HISTORICAL MUSEUM, OSLO

Somber eyes of a future queen gaze from a church wall in Kiev, in the Soviet Union. Yelisaveta wed Harald Hardraada, last great Viking king, who fell before the English in 1066. Her grandfather, Prince Vladimir, a descendant of Swedish Vikings, brought Christianity to Kiev in the 10th century. His bronze statue overlooks the Dnieper River and modern Kiev (right).

PAINTING (LOWER LEFT) BY TOM LOVELL; PHOTOGRAPHED BY TED SPIEGEL, RAPHO GUILLUMETTE © N.G.S.

"I have come from a far land . . . send me a merchant . . . who will buy from me as I wish." Thus Vikings prayed for profits, noted a contemporary. Here haggling begins beside a carved ritual pole at Bulgar, a caravan mart on the Volga River.

Under the eye of his red-caped chief, a bare-chested Viking offers a slave girl to a Persian merchant who dangles a purse of coins behind him. Squatting Norseman weighs bits of Asian silver, his payment for piles of furs. Chinese silks are also bartered for the prized skins. Business done, the Vikings load their longboats for the voyage home, to gather goods and slaves for the next trading season.

Under Yaroslav the Wise, the Rus court attained its golden age. Controlling the Dnieper, Yaroslav filled his treasury with the profits of the lively north-south commerce.

"Remember this," a resident of modern Kiev told me. "At the time of Yaroslav, 75,000 people lived here, and Kiev Rus was the biggest and strongest state in all Europe."

WHILE SWEDISH VIKINGS had been pressing through Russia toward their own ethnic extinction, Danes and Norwegians had been plundering Western Europe. The British Isles, with their moistly fertile fields, drew the land-starved Scandinavians like a lodestone.

First came the Norwegians, doubling the northern hook of Scotland and sending their longships scudding down the Irish Sea. En route, they pillaged and settled the Orkneys, the Shetlands, the Hebrides, the Isle of Man. But Ireland was their goal, and there they ravaged without mercy. "There was no place in Erinn," wrote a 12th-century historian, "without numerous fleets of [Vikings] and pirates; so that they made spoil-land and sword-land and conquered-land of her, throughout her breadth and generally. . . ."

By 845 the Norwegians occupied fortified harbors from Galway in the west to Cork in the south. They also built the town that eventually became Dublin. Not far from the center of the modern city, archeologists have uncovered traces of the original settlement.

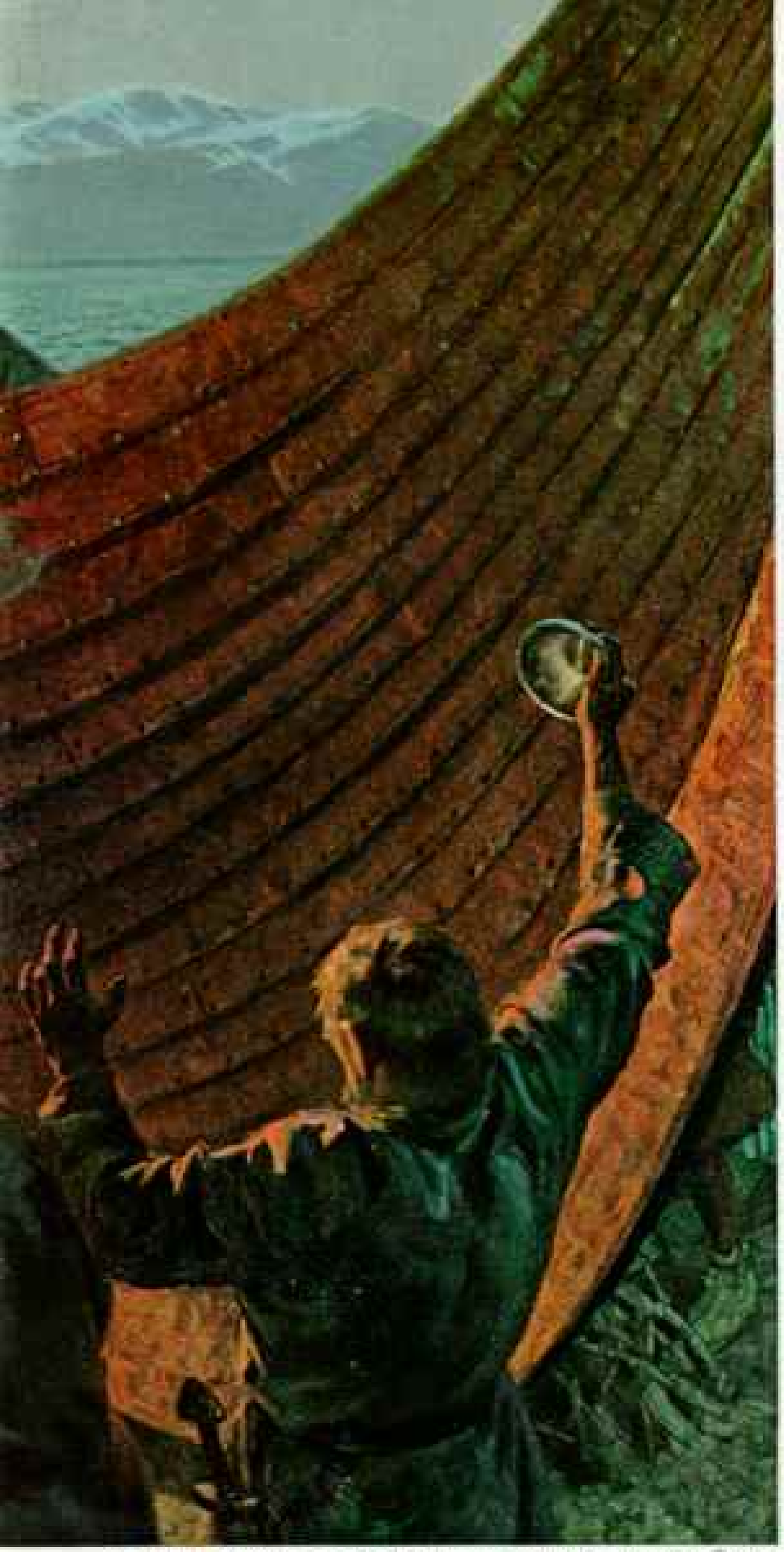
A nondescript fence, just opposite the Gothic splendor of Christ Church Cathedral, protects this portal into the past. Breandán Ó Ríordáin, Assistant Keeper of Irish Antiquities, the archeologist who has supervised the excavation, showed me through his dig.

"We had to penetrate 14 feet of debris to reach the original level," he told me, "and some of it is unmistakably Viking."

The streets had been made of timbers—like a modern boardwalk, but cruder—in the fashion of every Viking town ever uncovered (page 527). The jammed-together houses had sheltered merchants and craftsmen.

"A combmaker lived here," said Mr. Ó Ríordáin, pointing to a floor plan outlined by the remains of a wickerwork and mud-daub wall. "We found antlers he used as raw material, blanks he had carved, and a few finished products. Over there lived a shoemaker, to judge from the leather scraps. We've found brooches, pins, weights, even a mold for casting silver hammers—the symbols of Thor [page 497]. Some of the objects are identical to items from Scandinavia. Not until the 11th-century strata do we find a merging of Norse and Irish cultures."

The Vikings apparently made no attempt



PAINTING BY TOM LOVELL, PHOTOCHROME BY TED SPIEGEL, RADIO GUILD/MILLETTE © N.G.S.

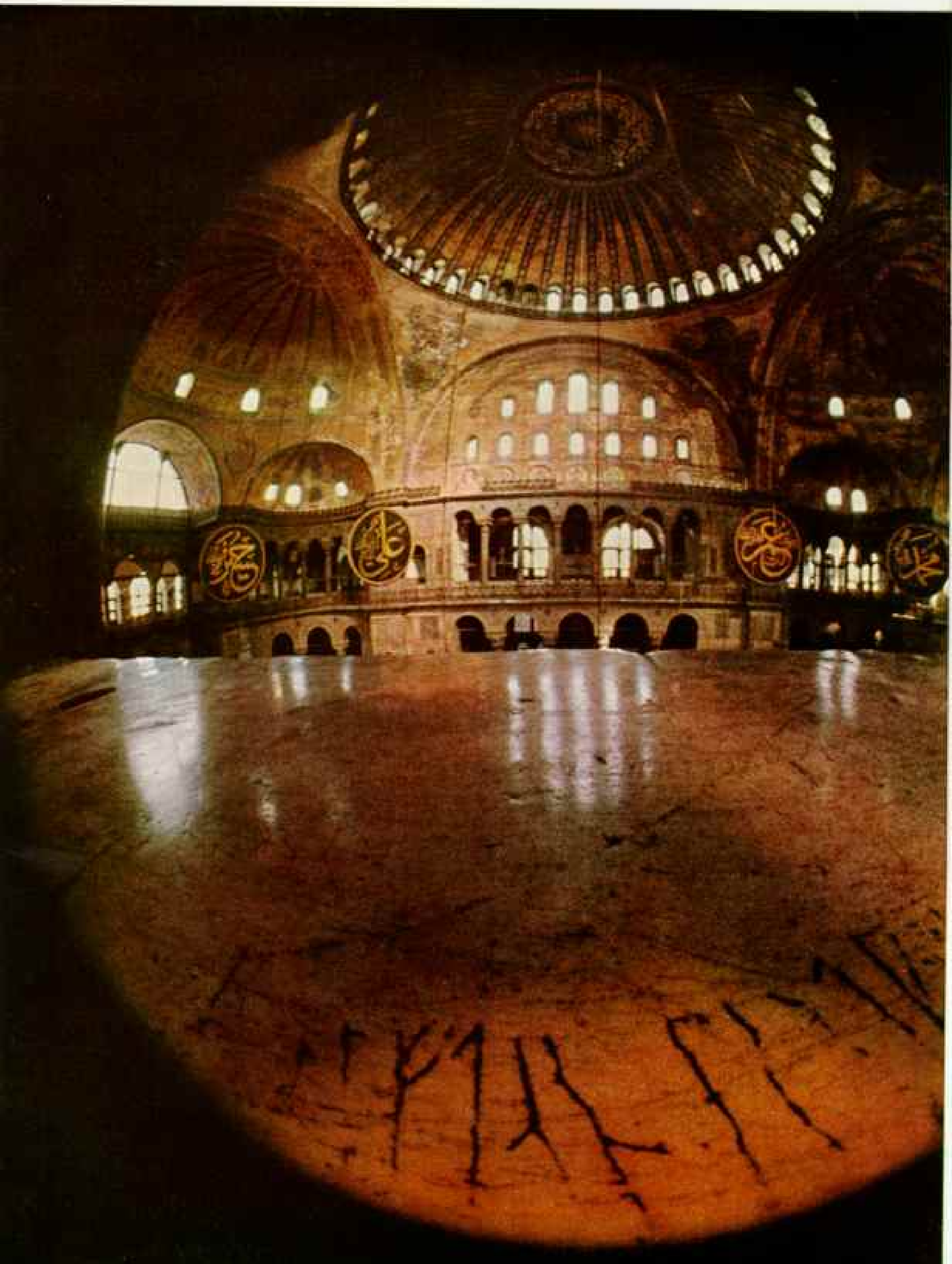
to conquer the country as a whole. They controlled the harbors, however, until 1014, when Brian Boru, High King of Ireland, defeated them in a bloody battle at Clontarf.

One finds few clear imprints of the Viking Age on Irish life. Perversely enough, Irish tradition even identifies the occupiers as Danes, rather than the Norwegians that most of them actually were. A few family names hark back —Searson to Sigurdsson and Sugrue to Siegfried—and two persistent folk beliefs: that the Danes brewed the finest beer ever tasted in Erin, and that foxes are Danish dogs spitefully left behind when Brian Boru drove their masters out of Ireland.

In 834 Danish Vikings first appeared in force, raiding along the English Channel. In

"We burn him in a moment, so that he enters Paradise at once." Thus blandly did a Northman explain a Viking funeral to an Arab at Bulgar. After the death of a Viking chief, friends and family threw themselves into a 10-day orgy of drinking and pleasure-taking while preparing for the cremation. On a beached longship they raised a pavilion and outfitted it with meats, fruits, and animal sacrifices. Then an old woman called the "Angel of Death" stabbed a slave girl who had volunteered to accompany her master. Finally, the deceased's closest male relative, naked (left), kindles the ship, and motions other mourners to add their torches, sending the warrior on the final swift journey.

Testimonials to greed and grief: A hoard of silver gleams in Gotland's Historical Museum beside the runestone memorializing Rodfos, a warrior killed while viking in the East. The silver treasure includes coins that reflect Norse rovings: Arabic, Byzantine, German, Bohemian, Hungarian, and Anglo-Saxon.



France they sailed up the Loire River and sacked Nantes, up the Seine and plundered Paris.

The words of the monk Ermentarius of Noirmoutier echo down the centuries like a litany of dread:

"The vikings over-run all that lies before them, and none can withstand them. They seize Bordeaux, Périgueux, Limoges, Angoulême, Toulouse, Angers, Tours, and Orléans are made deserts. Ships past counting voyage up the Seine, and throughout the entire region evil grows strong. Rouen is laid waste, looted and burnt: Paris, Beauvais, Meaux are taken, Melun's stronghold is razed to the ground, Chartres occupied, Évreux and Bayeux looted, and every town invested."

But tragedy struck both ways. The Vikings, throughout the age, suffered fearful casualties. A Swedish runestone preserves the history of one family:

THE GOOD FARMER GULLE HAD FIVE SONS:
AT FYRIS FELL ASMUND, THE UNFRIGHTENED WARRIOR,
ASSUR DIED OUT EAST IN GREECE,
HALVDAN WAS IN DUEL SLAIN,
KARE [DIED AT DUNDEE], DEAD IS BOE TOO.

Originally, most Northmen had gone viking only in the summer. But the middle of the ninth century saw many taking up semipermanent residence on French rivers, wintering near the mouths and harrying inland in the fine weather. Chroniclers even write of the "Loire Vikings" and the "Seine Vikings."

Other fleets ranged south in search of new targets. In 859 two chieftains, Bjørn and Hasteinn, led 62 ships from the Loire on an epic Viking voyage. Following the French shoreline to the Bay of Biscay, they commenced to loot the Iberian coast in leisurely fashion, pausing in the shadow of the Rock of Gibraltar to sack and burn the neighboring Moorish city of Algeciras.

Then, for perhaps the first time, the terrible dragon ships of the north nosed into the mild blue waters of the Mediterranean. Unopposed, the crews pillaged the North African littoral, deriving singular delight from capturing the first dark-skinned people they had ever seen; they called them "blue men."

They coasted Spain, ravaged the Balearics and southern France, and wintered in the Rhône River delta. Systematically they despoiled the cities of the region, including Arles and Nîmes. Sailing on to Italy, they put Pisa to sword and brand.

On the return voyage, the Vikings suffered a severe defeat at the hands of a vengeful Moorish fleet. The vessels that managed to escape hastened northward, pausing in Navarre to capture Pamplona and extort a huge payment for the return of its prince. Finally, in 862, the battered fleet once more dropped anchor in the Loire. Forty ships had been lost, but the surviving Vikings had gained wealth and glory in heaping measure.

By 900 little plunder remained along the French rivers. Monks

Brand of the restless Norse scars a polished balustrade in the sanctuary of İstanbul's vast Hagia Sophia. Scratched twig-shaped runes, foreground, are illegible except for the name "Halvdan." Their author may have belonged to the Varangian Guard, an elite Byzantine corps that recruited Vikings for their ferocity. Circular plaques in the background name caliphs who succeeded Mohammed.

had fled their monasteries; untended farms decayed. Nonetheless, a Danish army headed by a Norwegian named Hrolf arrived in the first decade of the 10th century to ravage what was left in the lower Seine Valley.

In 911 the Frankish King Charles the Simple—who was anything but—ceded as a dukedom all the lands Hrolf then occupied, in exchange for peace. Baptized in 912, Hrolf parceled out his fief among his followers. All embraced Frankish ways and, within two generations, the language as well. Their name, Nordmanni, or Northmen, passed to their new homeland in the form of Normandy.

While both Ireland and Western Europe suffered nightly, England felt the fullest fury of the Viking assaults. As the ninth century advanced, the early sea-borne raiders gave way to well-organized Danish fleets and armies bent on conquest and colonization. Successively London, Rochester, Canterbury, and—briefly—Winchester fell to the invaders.

Only King Alfred the Great, who reigned in Wessex, proved capable of resisting and even defeating them. While Alfred saved England, he could not drive the Danes from the northeastern third of the country. There they occupied an enclave with a boundary running roughly from the Thames estuary to modern Liverpool (map, pages 505-6). Since Danish law and custom prevailed there, this territory became known as the Danelaw.

Certain legacies of the Danelaw linger still in England. The Old Norse suffixes *-by* (town) and *-thorp* (outlying settlement) invariably identify former Viking habitations. So the

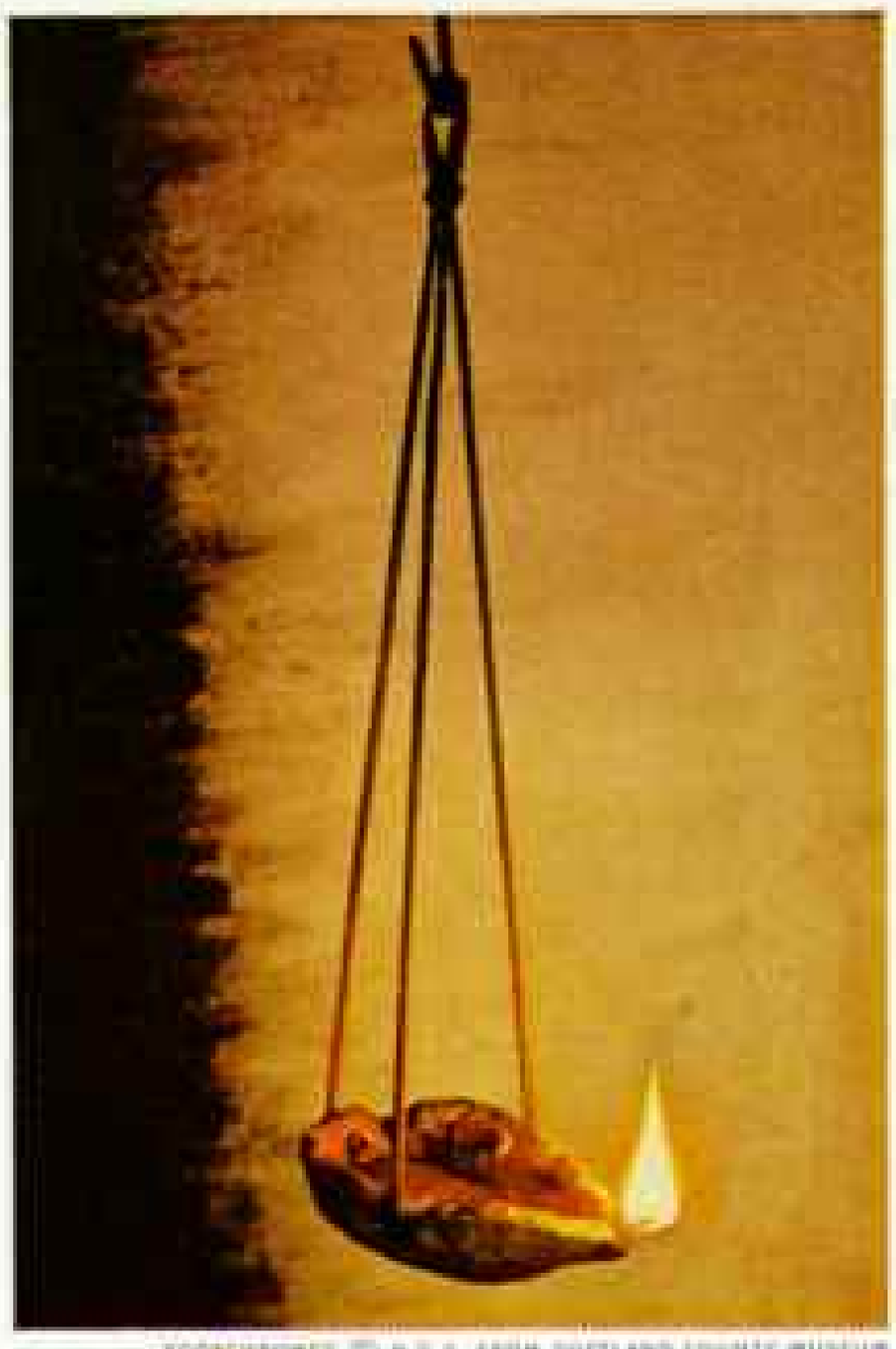
seemingly indigenous English Danby proves to be Old Norse for "Danetown," and Hackenthorpe was once "Hakon's Farm." The name of that great horse race, the Derby, has a Norse root, as do numerous words of the Yorkshire dialect, such as *bec* (stream), *fors* (waterfall), and *fell* (hill).

One day, as I drove through the old Danelaw, I passed towns called Skirpenbeck and Soulby. The following day I was driving through Normandy and passing towns called Bolbec and Hambye. It was an eerie sensation. I had gone from one nation to another, one culture to another, and one language to another. Yet, where each shared a common Viking ancestry, I found the place names virtually interchangeable.

Toward the end of the 10th century, the line of strong English kings sired by Alfred fell into decline. In 978, the crown passed to Ethelred Unraed (usually mistranslated as the "unready" rather than the true "uncounseled"). The disastrous 38-year reign of this inept and irresolute monarch spelled the doom of Anglo-Saxon England.

Viking raiders, who had prudently avoided England for a generation, began to strike in ever-increasing numbers. Soon entire armies swarmed ashore. Olaf Tryggvason of Norway led the first one in 991. Ethelred then erred mightily; he levied a special tax on his subjects—the Danegeld, or Danegold—and pacified Olaf with the proceeds.

Scenting easy treasure, more Vikings poured into England. Olaf returned in 994 with King Svein Forkbeard of Denmark to share a

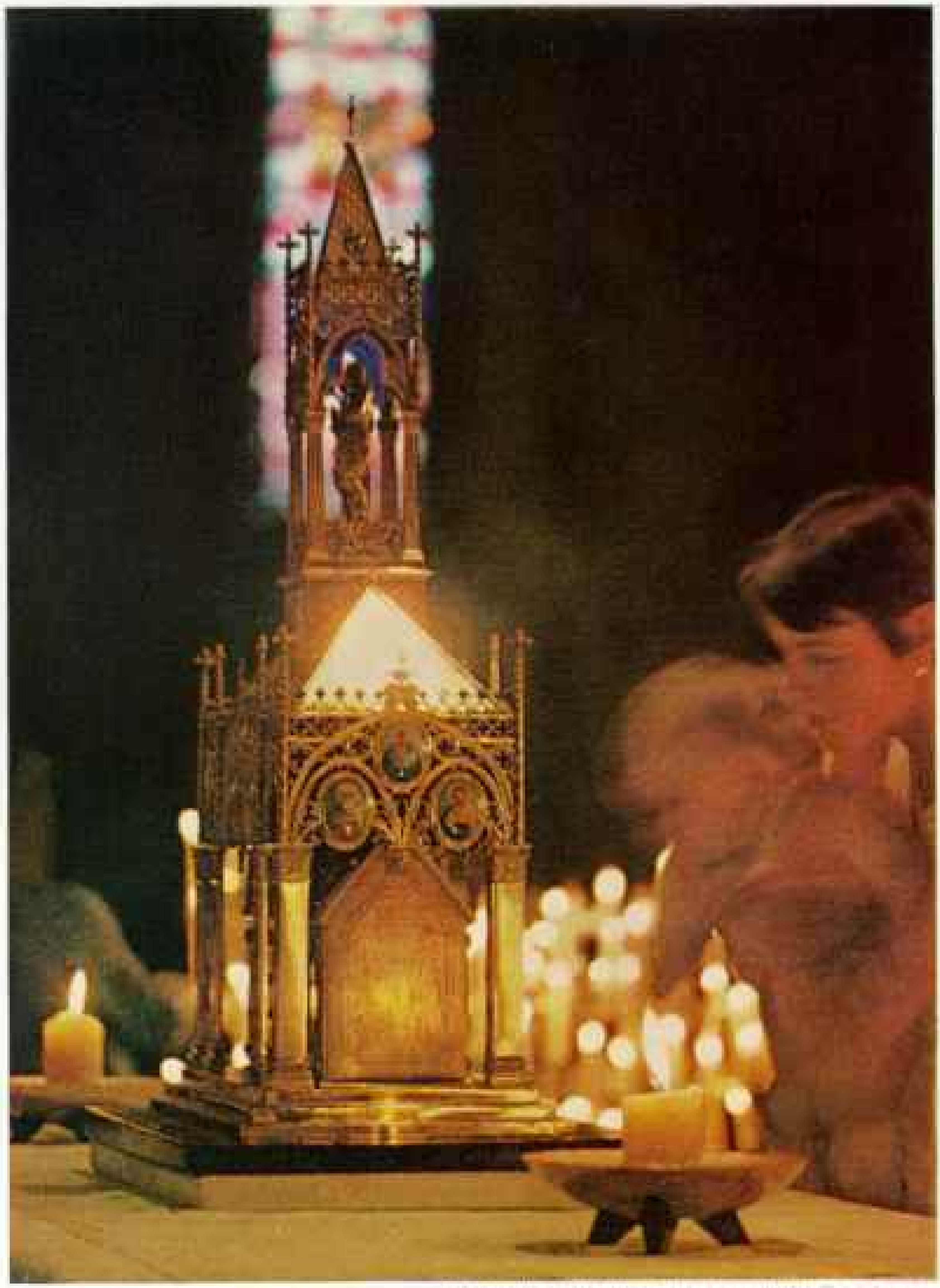


ACCESSIONED © N.M.S. FROM SHETLAND COUNTY MUSEUM

Aglow again: This Shetland Islands lamp —now a museum piece—may once have lit a snug Viking home.

Long, low, thick-walled, and warm, the croft house of a Shetland Islander retains the style of the Viking home. Brow-bumping doorways give entrance. Small windows let light through the thatch roof, held down with stone-weighted ropes.

From Scandinavia to Greenland, archeologists have uncovered remains of similar homes dating from Viking days.



KODACHROMES BY TED SPIEGEL, RAPHO GUILLUMETTE © N.G.S.

"From the fury of the Northmen deliver us, O Lord!" The prayer, common in ninth-century France, seemed answered at Chartres during a battle in 911. After daring raids along the Seine (left), the Viking Hrolf sailed up the Eure to attack the wealthy city. When a bishop rushed to the battlements waving a standard—a relic believed to be the Virgin Mary's veil—legend tells that the Vikings panicked and fled. Actually, Frankish reinforcements drove them off. The candle-lit reliquary of the Virgin's Veil in Chartres Cathedral (above) shows the bishop brandishing the cloth.

"Ships past counting voyage up the Seine, and throughout the entire region evil grows strong," wrote a monk in the 860's of the ravaging fleets. Viking bands often headquartered on islands such as these near Jeufosse. Desperate, Frankish King Charles the Simple bought off the powerful Hrolf in 911, giving him the lands that became known as Normandy. The Viking pledged his fealty in return. William the Conqueror, a descendant of Hrolf, conquered England in 1066, the same year that Norway's King Harald Hardraada was slain by the English at Stamford Bridge.

Gleanings from the sea: Loading their horse-drawn wagon, Frenchmen harvest salt from evaporation pans much as their ancestors did in the ninth century, when marauding Norsemen seized their island of Noirmoutier and its salt trade. Earlier, the Vikings had followed a pattern of loot and leave, raiding in spring and summer and returning home in autumn. But here near the mouth of the Loire, in a region of pleasant vineyards and plentiful plunder, they established their first winter base in 842.

Danegeld of 16,000 pounds of silver. In 1002 Svein collected 24,000 pounds; in 1007, 36,000 pounds. Norway's future king, Olaf the Stout, led a fleet up the Thames in 1009, tore down London Bridge with grappling irons, and sailed through the wreckage to plunder all the fair valley beyond.

Ethelred paid his last Danegeld in 1012—a stunning 48,000 pounds of silver. But the next year saw Svein Forkbeard once more on the attack. The English, drained of treasure and hope, could endure no more. Ethelred fled and his people submitted. Svein died soon after, but his able son Knut became King of England in 1016.

KNUT WELDED England and most of Scandinavia into a short-lived North Sea Empire. He could with justice characterize himself—as he did in 1027—"King of all England and Denmark and Norway and part of Sweden."

Historians theorize that England did not fall to a series of haphazard Viking campaigns, but rather suffered defeat in a 20-year war carefully organized and prosecuted by Svein Forkbeard. The existence in Denmark of four strategically scattered military camps—all dating from about the year 1000—lends weight to the theory. All were constructed to the same rigid geometric pattern, all commanded vital waterways, and all apparently served as staging areas for England-bound Vikings (page 531).

Archeologists have excavated extensively in the camp at Trelleborg in western Zealand. Lying as it does amid the green serenity of cultivated fields, Trelleborg strikes a visitor like a sudden clang of arms. Primitive and powerful, an earthen bulwark rises out of the plain in a huge circle. I climbed to the top of the

Sons of the Norse living leagues apart, a Frenchman and an Englishman share blue eyes, facial characteristics, and surnames inherited from a common ancestry. Fisherman Jean Anquetil, of the French town of Auderville, probably descends from Vikings named Arnketill—"eagle's kettle." English farmer George Thirkettle's name may stem from Thorketill—"kettle of Thor."

The Englishman lives in a region known in history as the Danelaw. In the mid-800's Danish expeditions attacked the English coast and in subsequent years gobbled more and more territory. Finally in 886 England's King Alfred the Great concluded a treaty with the Danes that left them in possession of a third of England.

rampart, more than 55 feet thick and 23 feet high, and surveyed the remains of the Viking camp. My eye traced the outlines of 16 long boat-shaped barracks. To the east and south, outside the great defensive barrier, I could see the remnants of 15 similar buildings defended by an outer bulwark and a moat.

Specialists have attempted to reproduce one of the barracks. Leaving the rampart—patrolled now only by drifting sheep—I walked to the reproduction and stooped through the low door. Wan, wintry light filtered through a chimney hole in the center of the roof. It lit a rock-lined open hearth below. An earthen bench lined the side walls.

Once, a millennium ago, men about to go "west-viking" to England had lounged on such benches. They had eaten there, quaffed ale, honed their spears, oiled their leather, mended their shields. Skalds had chanted beside the fire and, when ale and poetry failed, the warriors had wrapped themselves in cloaks, stretched out, and slept as the embers died.

I had a peculiar sensation of having seen this before. Although I had never been in such a building, it seemed overpoweringly familiar. Then, in a rush of remembrance, I knew why. This longhouse of another age differed in no essential from the quonset huts of my own military service. Cots had lined the walls like benches; our hearth had been an iron stove in the center of the hut. In the evening, the troops—preparing for a foreign expedition where the Danegeld was paid in death—had lounged on their cots, cleaning rifles, sharpening bayonets, mending equipment. And our own skald, an Oklahoman named Harvey, had sung softly of "The Hills of Home."

NOT FAR from Trelleborg, the historic Danish city of Roskilde lies at the head of a fjord of the same name. About halfway between Roskilde and the sea, as the Viking Age closed, five ships had been loaded with stones and scuttled in an attempt to block the channel—presumably against an attack.

In 1962, archeologist Olaf Olsen and naval architect Ole Crumlin-Pedersen achieved a spectacular salvage of the crushed, wave-worn remains of all five vessels. The unhurried work of restoration proceeds beneath the eyes of visitors to the Viking Ship Museum in Roskilde. Three specialists work full time fitting together the five mammoth jigsaw puzzles from the past. When no unusual problems arise, they can reconstruct one strake, fore to aft, of one ship in a week.

"The exciting aspect of this find," Dr. Crumlin-Pedersen told me as we viewed the skeletal vessels, "is that we've identified several varied types: two different warships, and three assorted workaday craft. Now this one," he gestured toward the bare outline of a low, lithe vessel almost 100 feet long, "was a true Viking longship designed to carry 50 or 60 men. From the lines, we can tell that it sailed well and swiftly, and was light enough to be rowed very fast. The worn keel indicates that it was often dragged ashore. It's a perfect example of the ships used on foreign raids.

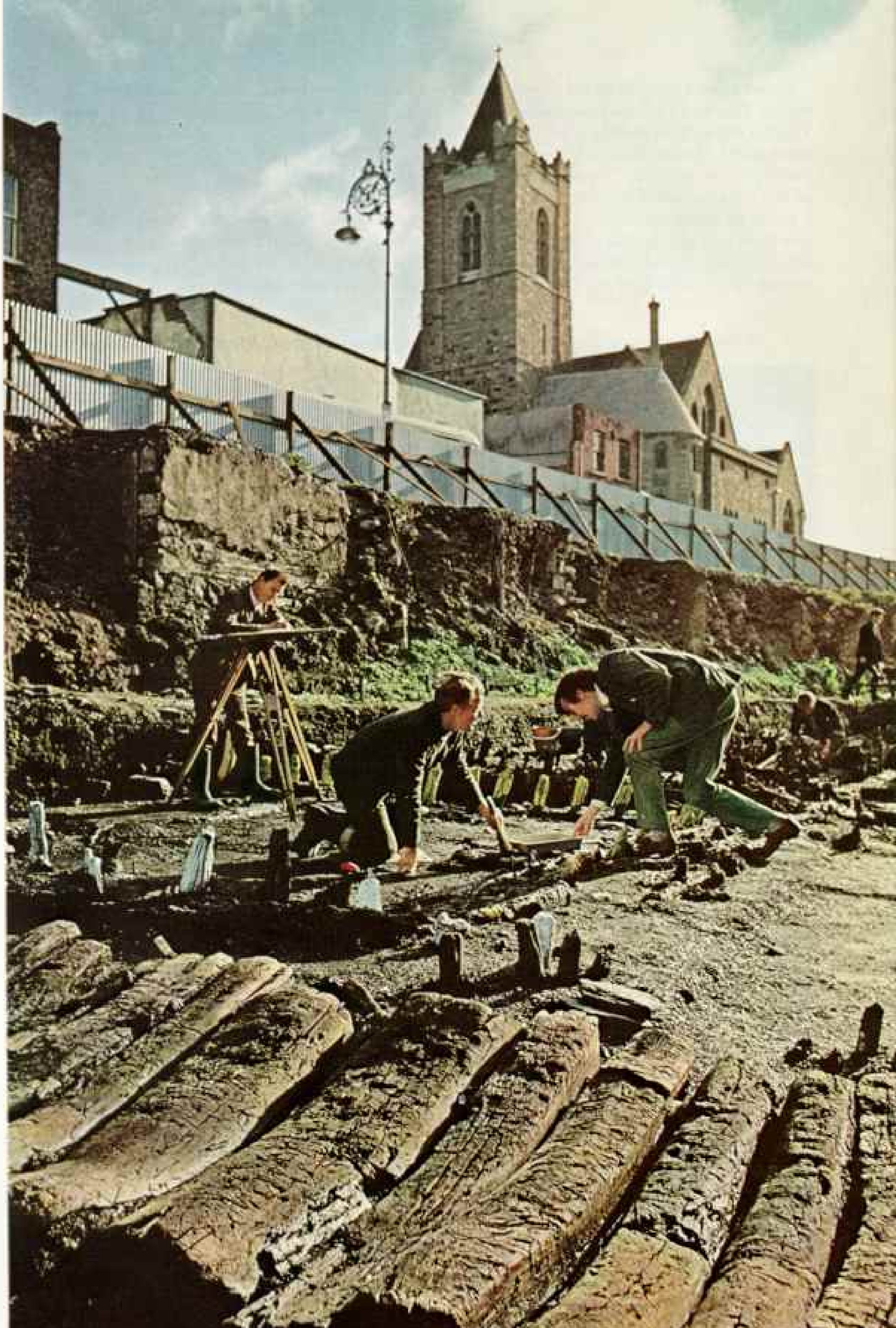
"On the other hand, this," he indicated the partial reconstruction of a tubby ship some 50 feet in length, "was designed to carry bulky loads. It's an ocean-going *knarr*, or cargo ship, the first ever found, and probably resembles the vessels that colonized Iceland and Greenland and even Vinland" (page 495).

Scarred by Viking boots, a timber street from a Norse settlement at what is now Dublin, Ireland, lies unearthed by archeologists. Viking traders created a port here in the 840's. Excavations on High Street in the 1960's uncovered the corduroy road, along with Viking houses, shops, and artifacts. Staghorn at left probably was used as a practice piece for an artisan's intricate designs.

Vessels such as these found at Roskilde carried the Viking world on its last and greatest thrust—this time across the wide Atlantic. Between 800, when the first Norse colonized the Faeroe Islands, and 1000, when they finally stepped ashore in North America, their questing ships explored more than 3,000 linear miles of unknown ocean (map, pages 505-6).

The insistent question arises, how did they navigate?

Clues abound: The sagas mention a *solarstein*, or sunstone, that could locate the sun in an overcast; an early Icelander, Star-Oddi, left a chart of sun positions for dawn and midday throughout the year; part of a wooden disk possibly used to determine bearings came to light in a Greenland ruin.



Based upon a study of all the sources, archeologist Thorkild Ramskou concluded that the Vikings did indeed possess a sunstone. In his office at the Danish National Museum in Copenhagen, he told me: "I published a paper on the subject—all of it conjecture as to what a sunstone might be or do—and received letters from two Danes, one of them Jørgen Jensen, Chief Navigator of Scandinavian Airlines System. Each informed me that similar, but quite sophisticated, devices now guide jets across the Polar region at latitudes where magnetic compasses are useless."

The modern instruments, called sky compasses, filter sunlight—already polarized in its passage through the atmosphere—by means of a polarizing lens. Aiming the lens directly overhead, a navigator can determine the direction of the sun's rays and thus the position of the sun itself.

Viking town springs to life at New Hedeby, Denmark. Boy Scouts build reproductions of

Following this lead, Dr. Ramskou discovered that several crystals found in Scandinavia and Iceland have natural polarizing properties. These react to sunlight exactly as do the sky compasses.

Dr. Ramskou fished a small, rough disk of a semiprecious crystal called cordierite from his desk drawer and handed it to me. "This mineral could have been a sunstone."

I held the dull, asymmetric disk between my eye and the daylight outside the office window. Traversing slowly, I rotated the stone. Suddenly, the translucent crystal became opaque.

"Now," said Dr. Ramskou, "you know how to locate the sun." Once a sailor has that information, he can plot his latitude. Basically, the Norsemen used navigational procedures that persisted well into the age of steam: They hugged coastlines where they could and, when

houses excavated by archeologists. The youths thatch one roof; turf covers another at center.

they had to strike off across the open sea, they sought the latitude of their destination and stuck to it until they arrived.

"Incidentally, S.A.S. invited me to fly to Greenland to test a sunstone against a modern instrument. The crystal proved amazingly accurate, locating the sun within 2.5 degrees of its true position, and tracking it until it dipped seven degrees below the horizon. I was fascinated to note that the jet's route—up the Norwegian coast to 68 degrees of latitude, then west to Greenland—paralleled the old Viking route" (map, pages 505-6).

Inching across the North Atlantic, Norse settlers reached Iceland sometime around the year 870. In 982 Eric the Red explored Greenland, 200 miles farther west, and colonization soon followed. Bjarni Herjulfsson sighted the New World in 986, but no one landed there until the voyage of Eric's son, Leif the Lucky, just before the year 1000.

Eric the Red's Saga and The Greenlanders' Saga record the ill-starred Norse attempt to colonize America. Leif came first to a forbidding mass of mountains and glaciers which he named Helluland, meaning Flatstone Land. Then he sailed south and went ashore on a sandy beach with woodlands beyond, which he called Markland, or Forestland.

Farther south still, he and his crew came upon a land "so choice, it seemed to them that none of the cattle would require fodder for the winter." They found "salmon there in river and lake . . . bigger than they had ever seen before," and grapes as well. Leif built a house and wintered there. He called his discovery Vinland. Virtually all scholars now agree that Helluland was Baffin Island and Markland was Labrador. Vinland has not been positively located, although some identify it with the Island of Newfoundland.

Another son of Eric, Thorvald, explored the new continent even farther. At a certain headland, he and his party came upon "three skin boats . . . and three men under each"—Indians or Eskimos! They killed eight of these Skraelings, but one escaped. Other Skraelings then attacked the Norsemen; an arrow dispatched the luckless Thorvald.

The Norse mounted at least one major effort to colonize Vinland. Early in the 11th century, according to The Greenlanders' Saga, Thorfinn Karlsefni fitted out three ships, loaded them with 65 people and ample livestock, and sailed to Leif's old winter quarters in North America (painting, pages 532-3). His colony prospered for two years—during which time Karlsefni's wife gave birth to a boy named Snorri—the first white child born in America.

Then trouble developed again with the Skraelings, culminating in a pitched battle. At the end of the second winter, Karlsefni gave up the struggle and sailed back to Greenland.

Historians speculated for centuries about these saga accounts until Norwegian scholar Helge Ingstad vindicated them completely in 1962, when he discovered a Viking settlement at L'Anse aux Meadows near the northern tip of Newfoundland. Carbon-14 testing dates it at approximately A.D. 1000.

Mr. Ingstad and his wife, Anne Stine, an archeologist, spent eight years excavating

Circular bastion of Viking hordes, Fyrkat lies on the plain near Hobro, Denmark. Outlines mark 16 boat-shaped barracks that probably housed Svein Forkbeard's troops. From this fort and several others, each 400 to 800 feet across, they struck at England in the 10th and 11th centuries, exacting huge ransoms for peace.

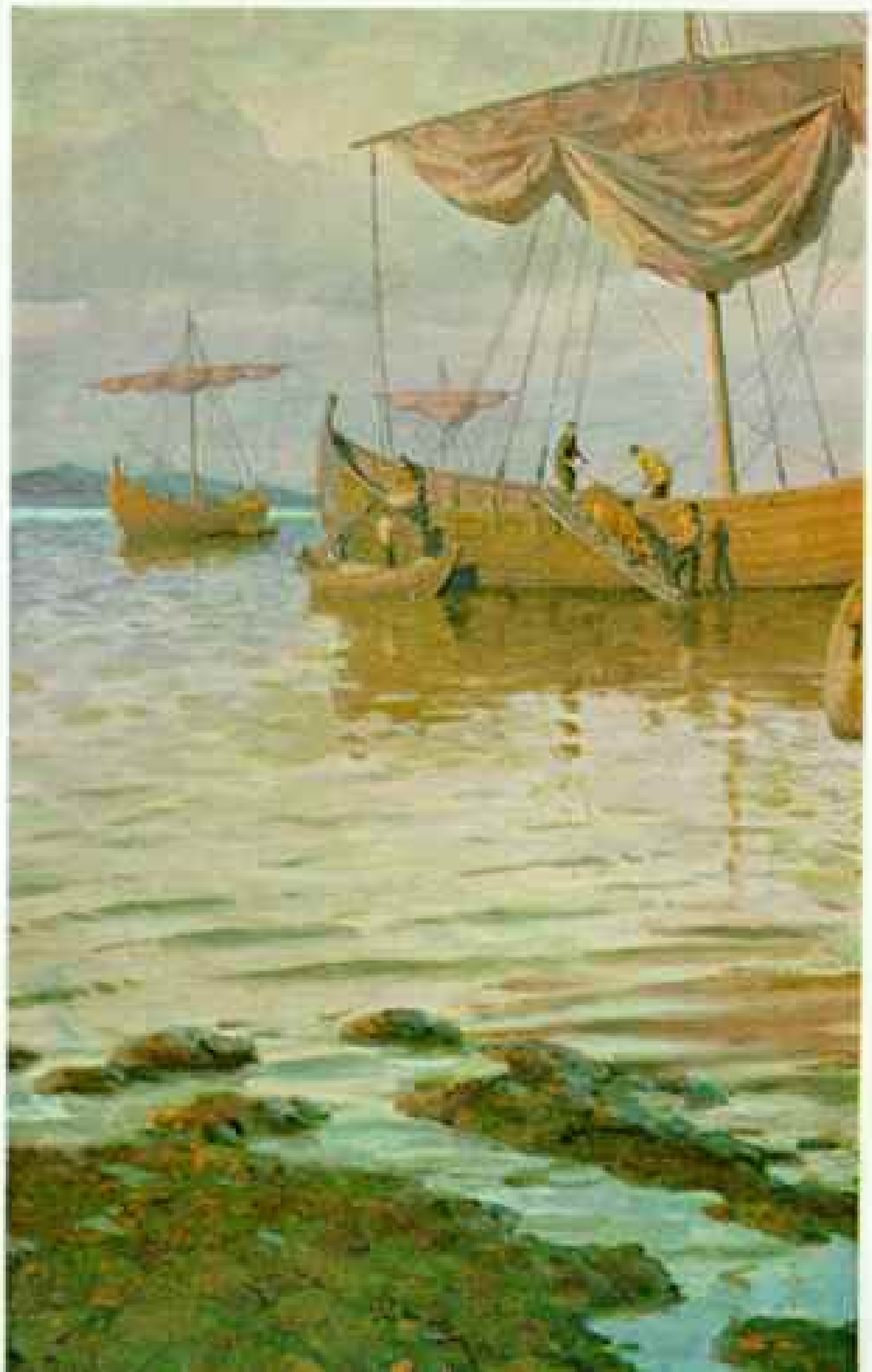
Fighting for his throne in 1030, Norway's King Olaf the Stout, wearing crown, falls before rebellious countrymen in this illustration from a 14th-century copy of an Icelandic saga. Olaf, later canonized, Christianized his country by offering death, maiming, or exile as alternatives to baptism.

KODACHROMES BY ROBERT W. MADDEN (LOWER) AND TED SPIKER, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Hunger for land, for "good and fragrant grass," drove the Vikings westward. In 986 Eric the Red and a band of colonists left Iceland to settle at Brattahlid (above), now a ruin, in southwest Greenland. From here Leif, Eric's son, set out on his voyage to America.

America's first colonists, led by Thorfinn Karlsefni, land at Vinland on the North American coast in the early 11th century. Two men lug a tool chest ashore. For two winters, the sagas relate, the settlers prospered. Then strife with Skraelings—Indians or Eskimos—forced return to Greenland.

"Vikings lived here," says Norwegian author Helge Ingstad, excavating at L'Anse aux Meadows, Newfoundland. Aided by National Geographic Society grants, he unearthed Norse ruins and artifacts at this only identified Viking colony in America.



at L'Anse aux Meadows. Objects of metal and wood disintegrate rapidly in the acid soil, but the Ingstads have found a whetstone for sharpening needles, a spindle whorl, and a bronze pin—all obviously of Viking origin.*

LAST YEAR I visited L'Anse aux Meadows. The "choice" land of the sagas remains so still. The old settlement lies beside an ellipse of beach protected by headlands and islands. Berries, scarlet and dusty blue, carpet the springy earth. A stream of cold, swift water winds down into the bay. Salmon lurk in the shade of its banks and once, as I rounded a bend, a huge trout leaped convulsively.

Southerly winds temper the climate of the Newfoundland promontory. Winters here are relatively short and mild, summers a slow dream of quivering green as the breeze ruffles the junipers and laurels.

Ten Newfoundland families inhabit the tiny hamlet of L'Anse aux Meadows, hard by the Viking site. Curiously, they live not unlike the old Norsemen. They keep cattle and sheep, and the pasture does indeed last through the winter. With the seasons, they take trout in the streams and seals in the bay. In the autumn they hunt for ducks and, whenever the opportunity arises, they trap a few lobsters. And, as one man told me, they like their way of life "wonderful well."

With Mr. Ingstad I walked through the excavated relics of the Viking settlement—past the smithy with its scattering of thousand-year-old charcoal, past the trenches streaked with the dark-brown, time-compressed layers of turf that had formed the walls of the longhouses. Green moss creeps inexorably across the earthen floors, engulfing the cooking and storage pits and even the great central hearths. A sizable group—certainly no smaller than Karlsefni's—had occupied this site.

"Why did the colony fail?" Mr. Ingstad echoed my question. "Probably because the Vikings' weapons were no better than those of the Skraelings, and the Skraelings far outnumbered the Norse. Columbus succeeded,

*Mr. Ingstad's initial discoveries are described in "Vinland Ruins Prove Vikings Found the New World," in the November 1964 NATIONAL GEOGRAPHIC.

PAINTING BY TOM LOVELL, BASED ON ARTIFACTS AND ON ERIC THE RED'S SAGA AND THE GREENLANDERS' SAGA © N.G.S.

Wielding his flensing knife like a warrior's pike, an Icelander carves blubber from a whale. Wheeling gulls scream for scraps. The whaling station, near Reykjavik, processes the behemoths for animal food. The Norse, feeling their way across the frigid North Atlantic,

KODACHROME BY TED SPIEGEL, RAPHO GUILLUMETTE © N.G.S.

settled Iceland in the 870's. There their democratic instincts found expression in the Althing, the world's oldest surviving representative assembly. Today only Icelandic preserves a close resemblance to the Old Norse tongue that united the roving Norwegians, Swedes, and Danes.

I think, largely because he had firearms."

After the failure in Vinland, the Viking world began to shrink. The thriving settlements in Greenland slipped into slow decay. Norse seamanship declined, and with few captains willing or able to cross the Atlantic, first the Greenlanders, then the Icelanders were abandoned to their own resources.

For Greenland, the isolation proved fatal. Sometime around 1500 the last Norse remnant—its very existence forgotten by Europe—died or departed. No man knows which; no man knows why.

Alone among the colonies, Iceland survived.* And, because of its long solitude, it survived as a relic of the 11th century. Among Scandinavians, only Icelanders still speak a language Vikings would have understood. Locked in medieval loneliness, sustained by the afterglow of the splendid past, Icelandic authors immortalized the Viking Age in the sagas—one of the world's great literary forms.

*See "Sailing Iceland's Rugged Coasts," by Wright Britton, NATIONAL GEOGRAPHIC, August 1969.

In the depths of the Icelandic winter, dawn doesn't break until almost noon. So it was pitch dark at 10 a.m. on the December day I was received in the office of Dr. Kristján Eldjárn, famous historian and President of Iceland. I asked Dr. Eldjárn's opinion of the historicity of the sagas.

"There is general agreement," he said, "that the sagas mix fiction with historical elements. The difficulty lies in determining which is which. For centuries scholars have studied the descriptions of Vinland and the sailing directions given in the sagas. But no one has been able to locate Vinland with certainty. Still, the historical fact remains that the Norse did indeed reach America.

"Icelandic culture," Dr. Eldjárn continued, "stems to a very large degree from the Viking Age. Our language is the most important and most obvious example. Nor has the structure of our community changed in any essential way. You might recall that in the year 1000 the Althing—Iceland's legislative body—adopted Christianity as the official religion. It was a

pagan, Thorgeir of Ljosavatn, who announced that all should be baptized. And all were. There was no bloodshed, no persecution. Icelanders are still just as devoted to democratic procedures" (painting, following pages).

The Twilight of the Gods foreshadowed the twilight of the Vikings. By the middle of the 11th century, old patterns were shattering throughout Scandinavia. Harald Bluetooth had brought Christianity to Denmark; Olaf the Stout had spread it with torch and sword through Norway; Christian bishops evangelized in the ultimate pagan redoubt of Sweden. Everywhere the Cross of Christ was supplanting the hammer of Thor.

At the same time, a chaos of fragmentation convulsed the northern world. War raged almost constantly among the Scandinavian states. In Ireland, the Celts brought a bloody end to Viking suzerainty; Iceland had declared independence. With the collapse of Knut's empire, Anglo-Saxon monarchs reascended the English throne.

Adding to Norse grief, professional armies had become the rule rather than the exception throughout Western Europe. No longer could a harrying fleet expect to find unprotected coasts and defenseless towns. So the Viking Age faded, slowly, in a diminuendo of dissension, raids, invasions, and reverses.

Through these darkling decades flashed a final human meteor: the most ferocious, cultured, and vivid of the Sea Kings—Harald Sigurdsson, called Hardraada, or Hard Ruler, who reigned over Norway from 1047 to 1066.

As a boy of 15, Harald had been blooded in battle at the side of his half-brother, King Olaf, fighting to regain the Norwegian throne. Although severely wounded, Harald managed to escape the rout of Olaf's followers and flee to Kiev, where he found refuge in the glittering court of his kinsman, Yaroslav the Wise. There too he found love, in the person of Yaroslav's daughter, Yelisaveta.

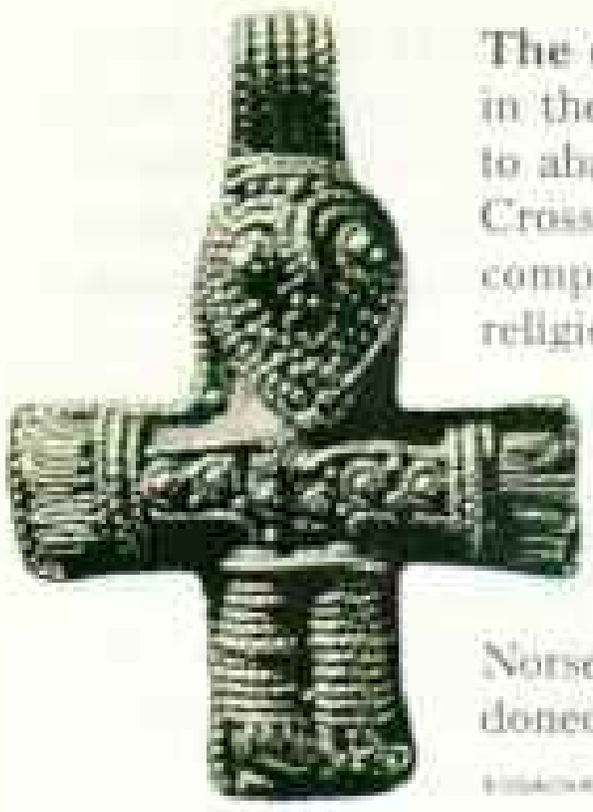
IN THE CATHEDRAL OF ST. SOPHIA in that mellow city beside the Dnieper, I sought out a famous mural dating from the time of Harald. In colors muted by a thousand years, three daughters of Yaroslav stare across the centuries: Anne, who became Queen of France; Yelisaveta, fated to become Queen of Norway; Anastasia, future Queen of Hungary.

"Four of his sons also married into the royalty of Byzantium and Germany," a Russian told me. "No wonder our historians call Yaroslav the father-in-law of Europe."

I remained for a long time in the cathedral staring at those royal maidens of Kiev Rus. All have a certain stately loveliness. But in the end it is Yelisaveta who lingers in the memory—she of the wide, haunted eyes, of the mouth touched by tragedy, of the hand extended in supplication: Yelisaveta, gentle-born, but destined to live out her life amid the blood-quarrels, crude huts, and drunken, gluttonous revels of the north (page 514).

For three years Harald Sigurdsson fought valorously in Yaroslav's Viking cohort. But heroism and love, unbuttressed by a crown, made poor currency to win a princess; Yaroslav rejected the throneless Norwegian. So Harald sailed down the Dnieper toward that magnet that had lured generations of Norsemen—fabled Miklagård.

Descendants of Viking steeds race over the Icelandic plain. The Norse brought the forebears of these small, sturdy horses to the island. The breed survives unchanged.



The old gods fade. Gathered at the Althing in the year 1000, Icelanders debate whether to abandon Norse deities in favor of Christ's Cross. Conflict looms. Then a leader forces compromise: The island will adopt the new religion, but families may keep some pagan ways in private. The crucifix at left —oldest found in Sweden—dates from about 900. It was unearthed from a woman's grave at Birka.

By the end of the 11th century, Norse power waned and the Vikings abandoned their bloodstained web of conquest.

PHOTOGRAPH © N.H.M., STATE HISTORICAL MUSEUM, STOCKHOLM

In Byzantium Harald joined the Varangian Guard and eventually became its commander. For 10 years he wielded sword and battle-ax for the empire, campaigning from the Greek islands to Asia Minor, from the Caucasus Mountains to the golden walls of Jerusalem. In the process, he accumulated incredible booty. A fearsome figure, Harald towered well above six feet. His saga reports him as fair of hair and beard, but "one of his eyebrows was slightly higher than the other."

In 1044 Harald sailed back to Kiev and found that his immense wealth had convinced Yaroslav of his merits. With Yelisaveta as his bride, Harald then returned to Norway. The combined thrust of his personality and his gold brought him the crown in 1047.

His 19-year reign fully justified the cognomen Hardraada. Byzantium had left Harald with a taste for autocracy, and within his kingdom he ruthlessly suppressed all opposition. Any potential claimant to power he caused to "kiss the thin lips of the ax."

On his longship *Dragon*, Harald bore his banner Land-Waster through Scandinavia, harrying, looting, destroying. A contemporary, Adam of Bremen, called him the "Thunderbolt of the North." Still, amid the carnage, the king found time to explore "the expanse of the Northern Ocean in his ships."

THEN, IN 1066, his misaligned gaze turned to the greatest prize of all—England. At the death of Edward the Confessor, Earl Harold Godwinson had seized the English scepter. But William of Normandy had a claim to the throne; so did Harald of Norway. Both acted. And in the autumn of that year, within the space of three weeks, these three protagonists, Harald Hardraada, the archetypal Viking, Harold Godwinson, himself of half-Viking ancestry, and William of Normandy, descendant of Vikings, fought two battles that determined the fate not only of England but of all Europe.

Harald Hardraada struck first. Accompanied by Harold of England's disaffected brother, Earl Tostig, he led 300 ships down the coast of Northumbria. The Norse army disembarked at Riccall, gained victory in a sharp battle, and entered York unopposed.

Then, unaccountably and completely, victory-luck ran

PAINTING BY TOM LOVELL © N.G.S.


TOM
LOVELL

out on the warrior who had "fed the ravens" from the Black Sea to the Atlantic. Through overconfidence or carelessness, Harald led part of his army to Stamford Bridge. There, cut off from the fleet and reinforcements, lacking even his coat of mail, the Norwegian king was surprised by Harold Godwinson on September 25.

Although much repaired and rebuilt, Stamford Bridge still arches across the Derwent eight miles from the old Viking center of York. Now, however, it bears the inevitable stigmata of the 20th century—a traffic light at either end. Standing on the bridge under a glowering winter sky, I gazed across the meadows and slopes where the two armies had clashed nine centuries before.

I TRIED to envision that long-ago clash. The English had advanced from the west. As the disorganized invaders rallied around Land-Waster, a contingent of horsemen had galloped forth from the English host. The smallest of them hailed Earl Tostig and offered him sovereignty over all of Northumbria if he would abandon his cause.

And what, asked Tostig, would be given to Harald Sigurdsson?

"Seven feet of English ground," responded the horseman, "or as much more as he is taller than other men."

"Make ready for battle," cried Tostig.

As the troop clattered away, Harald asked, "Who was that man who spoke so well?"

"King Harold Godwinson."

"What a little man that was," Harald said, "but he stood proudly in his stirrups."

Then, as the armies formed ranks, the Norwegian king composed a poem, duly hailed by his followers. But Harald grimaced. "That was a poor verse; I shall have to make a better one." And—perhaps with Yelisaveta in mind—he did:

She told me once to carry
My head always high in battle
When swords seek to shatter
The skulls of doomed warriors.

Charging, the English smashed into the Norse shield-wall. Spears reddened as the Valkyries sang their fateful dirge; wound-dew drenched the grass. The shield-wall broke. Englishmen, hacking furiously, engulfed Land-Waster. Then the Thunderbolt of the North threw away his shield and, like a berserker, "rushed forward ahead of his troops, fighting two-handed." Until an English arrow pierced his throat.

"The remaining Norwegians," declares the Anglo-Saxon Chronicle, "were put to flight, while the English fiercely assailed their rear until some of them reached their ships; some were drowned, others burnt to death."

Without delay, Harold of England wheeled his forces southward to face the Norman threat. Ironically, he who had conquered the mightiest warrior of the Viking era would himself, in a matter of days, lose his kingdom and his life to the cool, calculating William in the Battle of Hastings.

Meanwhile, Harald Hardraada's giant body lay sprawled in the flotsam of battle. What final image had fixed his glazing mind's eye as he fell? Was it the Dnieper cleaving the green heights of Kiev like molten jade . . . brocaded princesses gliding through palaces beside the Bosporus . . . the clash of arms on Sicilian shores . . . *Dragon* plunging through the blue Atlantic?

This king had known the Viking world in all the wide, waning glory of its sunset. And when Harald Sigurdsson—Hard Ruler, Varangian, Jerusalem-farer, poet—died at Stamford Bridge, the Viking Age sank finally below the horizon of history.

I stood on the ancient bridge as dusk fell, bringing with it a light drizzle. No man or car had come this way, yet the imperious traffic lights continued to flash their signals into the unheeding mist.

As I turned away, the light before me gleamed amber; the reflection glittered across the wet pavement like a slash of gold. The light switched to red; the gold became blood. Yellow and red, gold and blood—a fitting blazon for the era that had perished here.

Descending from the bridge, alone in all that lonely landscape, I recalled a poem of the olden time: "No man lives till eve whom the fates doom at dawning." THE END

Blond his hair and bright his cheeks, like those of his Viking forebears, but the eyes of this Norwegian lad sparkle only with friendliness. A seafarer still, he carries oars and mast to his boathouse after a sail on his beloved Oslo Fjord.

Following the Ladybug Home

By KENNETH S. HAGEN, Ph.D.

Illustrations by National Geographic Photographer ROBERT F. SISSON

THAT GAILY POLKA-DOTTED BEETLE the ladybug has long been known as a friend of man because of its appetite for aphids, mealybugs, and scale insects that suck the life from plants of farm and garden.

Here in California we have a problem with ladybugs: "How're you gonna keep 'em down on the farm?" We hope to induce our little friends to spend more time in our fields, eating crop destroyers, instead of winging off to the mountains for a nine-month sleep each year.

Ladybugs have been known for centuries as enemies of plant pests, but not until the late 1800's did man send them into a major battle. At that time a voracious pest from Australia, the cottony cushion scale insect *(Icerya purchasi)*, was accidentally introduced into California. Multiplying rapidly as orchardists stood helpless, it soon killed thousands of citrus trees.

Seeking a counterforce, entomologists turned to the invader's homeland. They found it in a reddish ladybug appropriately called *Rodolia cardinalis*.

In two years imported rodolias conquered the scale insect pest in California. Bringing the beetles from Australia cost $1,500; the investment saved an industry worth more than a hundred million dollars today.

Since then other insects, such as parasitic wasps and flies, have joined the war against creatures that chomp and suck their way through the giant salads provided by man's laboriously tended fields and groves.

For 18 years, as an entomologist, I have specialized in

Nose to nose with their favorite prey, ladybugs prowl alfalfa in quest of juicy aphids. Prized by farmers for their war on pests and by children for their delicate beauty, the beetles were known to Englishmen in the Middle Ages as ladybirds, creatures of Our Lady. The French called them *bêtes de la Vierge*, "animals of the Virgin." Here, in their weak-sighted search for food, two ladybugs encounter aphids. Studying this species, the convergent ladybug, in a University of California laboratory at Albany, the author hopes to increase its usefulness as a living pesticide.

the biological control of plant pests; that is, the technique of pitting "good" bug against "bad" bug. Lately I have concentrated my research on *Hippodamia convergens*, the convergent lady beetle, so called because it carries a pair of converging white dashes on its black thorax (above).

Of the 4,300 known species of the ladybug family (Coccinellidae)—including some 370 in North America—about 40 resemble convergents and also feed on insect pests. Convergents, however, rank as the most abundant and as the champion aphid-eaters. Their most distinctive habit is also the source of our problem—the twice-yearly migration that marks the beginning and end of the California convergent ladybug's marathon dormancy.

Even though most convergents spend only a fourth of their one-year life span devouring pests, they eat so ravenously that their presence can spell the difference between profit and loss to a farmer. Without ladybugs and some equally staunch allies, the insect Mafia would gain the upper hand and require greater use of chemical pesticides.

The California convergent ladybug begins its life when the eggs hatch in March and April, in a sunny valley field. The tiny larvae begin eating aphids, gorging themselves for perhaps three weeks before entering the one-

35 TIMES LIFE SIZE; KODACHROME © N.G.S.

Hardly ladylike in its victim's eyes, a convergent ladybug gropes for an alfalfa aphid, one of thousands it will consume in its year of life. Its own enemies include assassin bugs, wasps, and birds unaware of the ladybug's bitter taste. Modern man, with his pesticides, kills many. In earlier times, English farmers burning off their hop vines fretted about harming the beetles, giving rise to the rhyme, "Ladybug, ladybug, fly away home, Your house is on fire, and your children will burn!"

week pupal stage. Then, splitting their pupal skins, they emerge as hungry young adults.

Immediately they seek more aphids. Chances are that they will find few, or perhaps none, since the pests were devoured at a furious rate by the same ladybugs when they were larvae. Because of the aphid shortage, the adults migrate to the mountains, there to remain until spring. Finally they return to the valley to lay their eggs and die, completing the cycle.

Migration from valley to mountains comes in late May and early June. On many mornings I have watched the young starved adults rising from fields in California's Central Valley. A single acre of alfalfa infested with aphids during the spring may yield more than 50,000 adult convergents by late May.

Unlike other ladybug species, which fly low and horizontally across the fields, the convergents fly directly upward, quickly vanishing from sight.

A few days later, I have seen a myriad of these lady beetles flying in the canyons of the Sierra Nevada, some fifty miles to the east. One warm afternoon in June, I counted 20 to 35 convergents whizzing past me each minute as I stood on a dam spanning the middle fork of the Yuba River.

To trace their migratory trail, I traveled the ladybug flyways in a light plane equipped with insect traps—retractable disks of bronze mesh coated with a sticky mixture of castor oil and resin. Extending the disks below the plane, I caught beetles at altitudes ranging from 2,000 to 7,000 feet.

Regardless of how high they flew, I found, they moved in a zone where the temperature rarely was lower than 55° F. Here, apparently, they leveled off and were borne eastward on the prevailing upper-air winds to their destinations.

Hungrier than ever after traveling from valley to mountains, ladybugs immediately seek food. As at the lower level, they prefer aphids; more often, they must settle for pollen.

Another ladybug phenomenon then arises: If they feed on aphids—and if the weather remains warm enough—the ladybugs will lay eggs. Pollen, however, mainly produces fat to tide them over their nine-month dormancy.

Heavy with fat, the beetles form small tight clusters and bed down in leaf litter beside streams. Here they rest until the first rain in October stirs them to brief activity.

Twice-yearly trek distinguishes California's *Hippodamia convergens* from stay-at-home ladybugs. Following the beetles' trail in a light plane, the author learned that, when aphids grow scarce in Central Valley croplands, convergents ride upper-air currents 50 miles or more into the Sierra Nevada. There they winter until hunger and spring breezes drive them back to lush fields and food.

Egg clusters assure new ladybug legions

UPSIDE DOWN on an alfalfa leaf (right), a male fertilizes a female during spring mating season.

As if setting up tenpins, the ladybug (above) deposits a cluster of sticky, pale-yellow eggs on the leaf of an English walnut. In 40 minutes she laid a dozen, which hatched in five days. A ladybug well-fed on aphids may release a cluster of from 10 to 50 eggs every day for a month.

22 TIMES LIFE SIZE. ROSMORPHOTOS BY ROBERT F. SISSON © N.G.S.

On the first clear day after the rain, the beetles take flight, reassembling in huge aggregations at a lower altitude in the mountains (pages 552-3). The convergents choose sites farther from stream banks, as if aware that their summer retreats will be shaded and awash from floods during the winter.

Congregating in densely packed millions, the ladybugs will spend the rest of the fall and winter in well-drained sunlit retreats. Snow may cover them for months, but in the places chosen, melting occurs especially early.

Slumber Ends With Warming Weather

Several times while visiting such wintering sites, I have been nearly trapped by rock slides and swollen streams. And in the High Sierra winter I have often wished I had built-in antifreeze and fat reserves like the ladybugs.

Bright, clear days in late February or March trigger the most important activity of all. The aggregations break up, and the ladybugs devote themselves to several days of frenzied mating.

The habit of aggregating may be vital to the mating function. Without this clustering, migration might scatter ladybugs too widely for them to find mates. Another possible advantage of aggregating is that the groups generate a musty odor, warning predators that ladybugs are distasteful.

Soon after mating, the beetles await another windless day to travel back to the aphid-swarming valleys. When it comes, again they rise to the 55° level and catch the upper-air current, now blowing generally from northeast to southwest.

Seeking to trace the convergents' return to the valleys, some student volunteers and I

12 TIMES LIFE SIZE

Hatching and hungry, larvae twist and turn until they split their skinlike eggshells (right) and wriggle free. They will soon start their search for food. If no aphids are feeding nearby, they may devour their later-emerging brothers and sisters.

As larvae, the young develop through four stages, called "instars," each time shedding their outgrown skins (next four pages).

Attacking with scythelike mandibles, a convergent in the final larval stage sucks life fluids from a plump pea aphid. By now, two weeks after hatching, the youngster has consumed about 350 aphids. Soon it will cement its tail to a leaf and shuck off its last larval suit (below). Then

Larval skin splits to begin pupation.

Bared pupa rears defiantly at a touch.

12 TIMES LIFE-SIZE. KODACHROMES BY ROBERT F. SISSON © N.G.S.

begin five to seven days of pupation, the miracle of metamorphosis that transforms its warty, tapered body into the graceful dome of the adult.

Darkening, it awaits final transformation.

8 TIMES LIFE-SIZE

went to the High Sierra in early February and marked thousands of aggregating beetles with yellow and blue paint. When they left the mountains, we estimated the wind direction and drove some thirty miles southwest, toward the valley. With insect nets we swept the vegetation, looking for marked ladybugs.

Considering the vast area involved, it would have been fantastic luck to find even one marked beetle. We were not that lucky.

Balloons Fail to Follow Flyways

Later, we tried helium-filled weather balloons fitted with thermostats which were preset to valve off either helium or water ballast as the balloons rose above or descended below the 55° zone. Thus we hoped to keep them drifting in the same layer of moving air sought by the wind-borne beetles.

We planned to follow the 15-foot balloons by airplane and automobile; where they touched down we hoped to find marked beetles.

Unfortunately, our three balloons never got beyond the Sierra. Two exploded before reaching the 55° zone, and the third soared thousands of feet above the zone and burst.

Someday I hope to hire a manned helium balloon, take thermometer, binoculars, and camera aboard, and ride it from the mountains to the 55° level, drifting with the wind in that zone. Then a search in the area where the balloon lands would immensely increase the chances of finding marked beetles.

Sometimes, during the beetles' return flights from the mountains, the wind blows them off course or beyond their goals. Ladybugs that winter in the Coast Ranges often finish their return journey far out in the Pacific. Days later, the sea washes up millions of dead beetles—reddish ribbons stretching for miles at high-water mark along the beaches.

The migration ends about sunset, when the 55° zone descends to earth. If the ladybugs land in aphid-free areas, they will take off again in search of prey-filled fields. If they fail to find aphids before exhausting their fat reserves, they are doomed to starvation.

The lucky ones end up in fields of alfalfa, barley, wheat, and sugar beets—all favorite haunts of aphids. By early May all the adult beetles are dead. But each female has laid, on low-lying vegetation, clusters of from 10 to 50 oval, yellowish eggs, to launch a new generation.

Fecundity of the female convergent depends upon the number of aphids available. One ladybug, arriving in an alfalfa field after its long flight from the mountains, must eat at least

100 large pea aphids or 300 smaller spotted alfalfa aphids to produce a cluster of eggs. One ambitious female in my laboratory laid 1,346 eggs over a 74-day period. During this time she ate 7,325 spotted alfalfa aphids.

The average female lays about 400 eggs in her lifetime. Should all hatch, these larvae could destroy 140,000 spotted aphids before becoming pupae. Some alfalfa fields in the Central Valley have been known to harbor more than half a million hungry ladybug larvae. Failing to find aphids, the larvae eat one another.

After rodolia's success against the cottony cushion scale, California State entomologists collected ladybugs in the mountains and distributed them to valley farmers as an experiment in aphid control. Five years of study revealed that about 90 percent of the beetles promptly flew away from the site of release. As a result, the state abandoned its program, but several prospectors gave up the search for gold and turned to "mining" the big aggregation sites for ladybugs to be sold to agricultural supply firms. In the High Sierra, some people still gather ladybugs for sale, scooping them by hand into plastic mesh bags.

Despite negative views of entomologists, mountain-collected ladybugs find a ready market at prices as high as $10 a gallon—roughly 70,000 beetles. From cold storage many shipments go to nurserymen and amateur gardeners who believe that enough beetles remain where released to help control rose and other aphids.* Some dealers attribute a recent boom in ladybug sales to growing concern over the use of pesticides.

How to Keep Them Down on the Farm?

One of my first assignments at the University of California was to learn why ladybugs flew away from release points, and to prevent their departure if possible. That was 17 years ago, and we now know a lot more than we did then, though we still don't have all the answers.

The convergents' "fly-first, eat-later" habit can be changed, I found, by caging mountain-collected beetles that have wintered over in the heights and feeding them artificial diets

*See "Rose Aphids: Cameras Probe the Bizarre World of a Garden Pest," by Treat Davidson, NATIONAL GEOGRAPHIC, June 1961.

before releasing them, thus curbing their instinct to fly.

Although we have fed the beetles many combinations of protein, carbohydrates, vitamins, and minerals, we have yet to achieve an artificial food with egg-stimulating powers equal to aphids. Our search for "ingredient X" in aphids goes on; it may be a hormone.

My tactic now is to spray artificial food in fields during late May and early June to keep emerging adult ladybugs from migrating. This should establish better ratios of beetles to aphids for the rest of the summer in a wide area. A promising new food, marketed as "Wheast," consists of yeast grown on cottage-cheese whey. With sugar and water, it stimulates egg production in green lacewings and hover flies, both natural enemies of aphids. But it is less successful with convergents.

The knowledge gained from studying ladybugs has proved of real value, for we were able to apply it against the spotted alfalfa

Opening the door to adulthood, the ladybug thrusts its head from the pupal prison, which still adheres to the leaf. By now its outer armor has thickened; the body has shortened and sprouted wings. Camera poised, staff photographer Robert F. Sisson waited almost sleepless for three days to film the beetle's half-hour struggle to emerge.

Jeweled debutante making her bow (lower left), a glistening convergent strains free of the pupal case. Egg to adulthood takes three weeks in warm weather, as long as six in cold.

Groggy but gaining strength, the ladybug tarries beside her shell as hormones provide a last-minute tune-up. Final brain cells develop, and the body hardens, anchoring muscles so she can fly within an hour. Spots appear, usually 12 on a convergent. Pigments in the aphid diet will redden the pale back.

Of the 4,300 known ladybug species, some 370 inhabit North America. The convergent, found continentwide, takes its name from converging dashes on its black thorax.

To "fly away home," a ladybug rises on wings that flutter 75 to 91 times a second. Raised covers remain rigid in flight. Photographer Sisson discovered that most ladybugs rise backward at first, then zoom forward.

As aphids grow scarce in late May, California convergents fly vertically to a 55° F. temperature zone for their wind-borne ride to the Sierra Nevada. There they fatten on pollen, then swarm for their nine-month sleep (right).

In massed millions that all but hide the ground, ladybugs congregate in the Sierra. Snuggling into forest litter, they pass cold winter days dormant or sluggishly crawling. Here, clustered northwest of Nevada City, California, beetles climb on the author, inflicting pinprick bites when squeezed by clothing or flesh. As many as 30 million may inhabit a quarter of an acre. Collectors gather gallons of beetles for release on aphid-infested crops, hoping the bugs will stay where put.

Spring will bring restlessness and mating and the hungry flight back to the valleys in search of aphids. After laying eggs, the spent insects die, ending their year-long life.

aphid, which invaded California from the Near East about 15 years ago and caused heavy damage. University entomologists, including myself, were joined by experts in other fields. We tried various countermeasures, which included insects, pesticides, and aphid-resistant varieties of alfalfa.

But the aphids still held the upper hand, forcing farmers to spray broad-spectrum insecticides three or four times a year. This chemical warfare had a major disadvantage in addition to increasing environmental pollution: it killed helpful as well as harmful bugs.

Timely help came from the Near East. A colleague discovered that three species of tiny parasitic wasps native to the eastern Mediterranean lay their eggs inside aphids; the larvae, when hatched, consume their hosts. So the wasps became allies in the fight.

Out of all this evolved an integrated program of man-made and natural controls. We found that only a single summer application of a selective poison, harmless to helpful insects, was needed to subdue alfalfa-eating

FOREGROUNDED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER ROBERT F. SISSON © N.G.S.

aphids—*if* ladybugs were available to work the spring shift. And if we can, indeed, succeed in keeping ladybugs on the job longer we may further reduce the use of chemicals.

Although my research has concentrated on convergents and alfalfa, many species of ladybugs are at work in the West, saving grain and other cultivated crops, helping to preserve grass on cattle ranges, and cutting down on the generations of aphids breeding in the wild.

Rodolia remains an important ally, as citrus growers found after trying DDT. The chemical destroyed fruit pests but it killed rodolia too, and cottony cushion scale began to reappear. New supplies of beetles brought into the groves promptly checked the invasion.

Meanwhile our high-flying convergents continue to thrive and earn our esteem as a natural resource worth millions of dollars a year in terms of crops saved. Come spring, they return to our fields and gardens. By learning more and more of their ways we hope to make them ever more welcome and expand their aphid-eating role. THE END

DRAWING BY C. J. CHIPPER, JR., ABOUT 1880, BETTMANN ARCHIVE

Young George Washington, studying a chart, surveys the valley in 1748

Shenandoah, I Long to Hear You

By MIKE W. EDWARDS
National Geographic Staff

Photographs by THOMAS ANTHONY DEFEO

FRANK BUCKLES eased his car across the shallow, gravelly bed of Bullskin Run. On the other side, we got out and walked up a grassy hill, somnolent under its canopy of maples and oaks.

"You're standing on the first land George Washington ever bought," he said. "He was not yet a man, but he saw a future for himself in this country."

We were five miles southwest of Charles Town, West Virginia. I had asked Mr. Buckles, a serious student of local history, to show me the land that fascinated Washington when, as a surveyor's apprentice, he crossed the Blue Ridge and descended into the Shenandoah Valley in 1748.

Washington was not the first man to be drawn to the Shenandoah, a cornucopia spilling nature's plenty into what we know now as Virginia and West Virginia (maps, pages 562-3). When he ventured into the valley, the land already was being cleared by early colonists, bold men who had dared put a formidable mountain range

Fingers of dawn touch a mantle of mist as Virginia's Shenandoah Valley wakes to a summer day. Beneath time-smoothed peaks of the distant Blue Ridge spreads a fertile land whose glens, groves, and famous river have for two and a half centuries molded men who helped shape the Nation.

KODACHROME © N.G.S. 554

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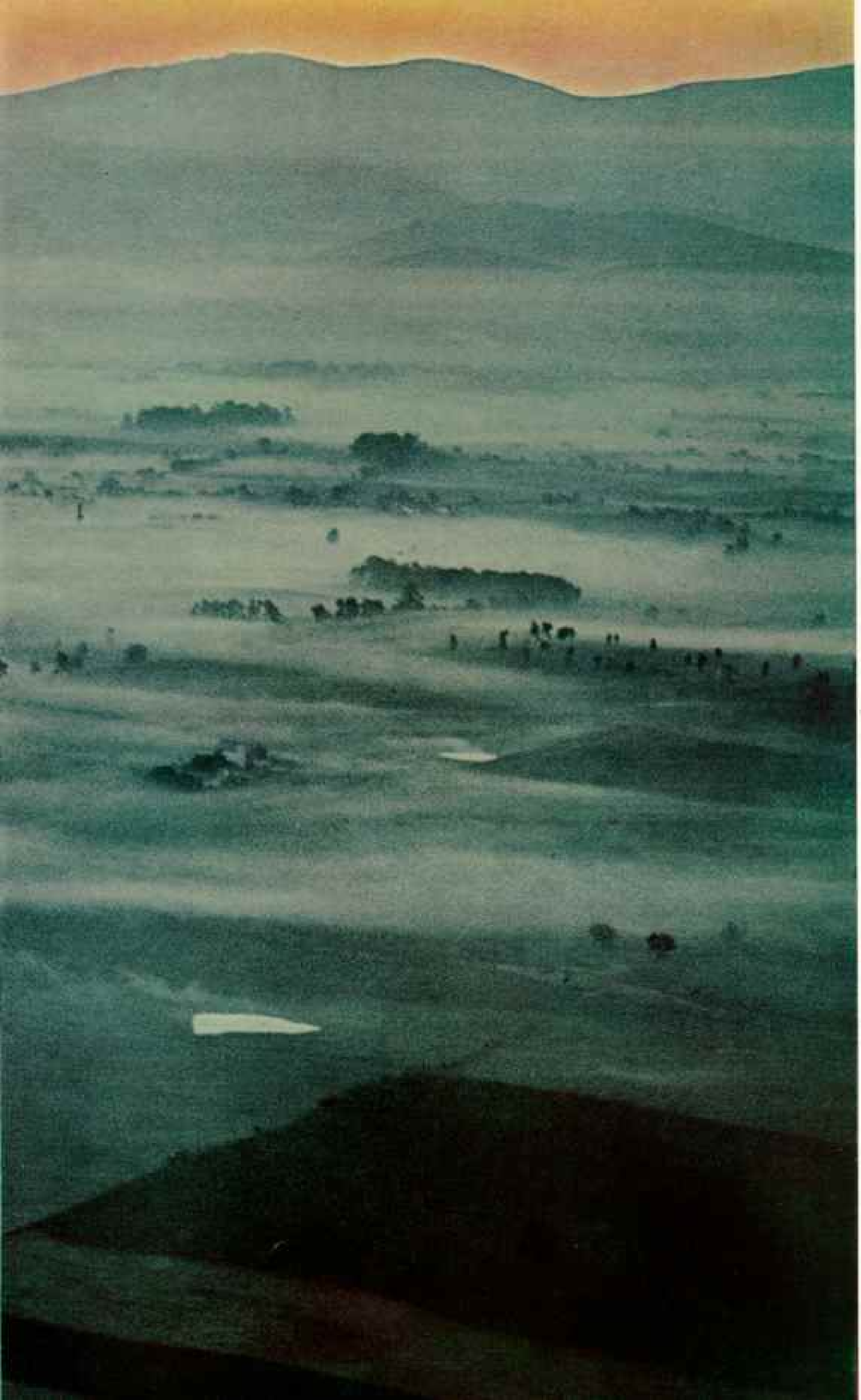


between themselves and the Atlantic. The Shenandoah has been making history ever since—and fascinating nearly all who come in contact with it.

I had come to the Shenandoah to enjoy its beauty and to learn about its past. Washington, although only 16 years old in 1748, was more practical. He cast upon the land the critical eye of a farm youth. As he rode through the valley, he noted in his diary that "the Land exceeding Rich and Fertile all ye. way produces abundance of Grain Hemp Tobacco &ca."

Valley Wilderness Tutors Washington

Husbanding his surveyor's fees, Washington was able to buy a thousand acres along Bullskin Run when he was but 18 years old—two years after he first glimpsed the land "exceeding Rich and Fertile." Later he bought still more land.

Today real-estate investors would count his purchases as incredible bargains. For a tract of 456 acres he paid only £122—less than the surveyor's fees he once earned in a month afield.

When he first saw the Shenandoah, Washington's prospects were quite modest for a son of Tidewater gentry. Third eldest surviving son of his late father's two marriages, he could look forward to no substantial inheritance; Mount Vernon would not be his until the death, years later, of his half-brother Lawrence's widow. The family even considered sending young George to sea.

"He wanted very much to improve his fortunes," Mr. Buckles observed. "The valley helped him do it."

Mr. Buckles's interest in Washington springs from his own tie with Shenandoah's past; Buckleses were among its first settlers, arriving the year of Washington's birth.

Although he never lived on his Bullskin lands, Washington visited them often. Lawrence invested in adjoining property, and eventually Washingtons owned large acreages around Charles Town.

George's affinity for the wilderness grew so strong that for a decade he spent much of his time there. As a surveyor, landowner, politician, and commander of Virginia's frontier defenses in the French and Indian War, he crisscrossed the Shenandoah, learning lessons crucial to the destiny of the colonies he later led to independence and nationhood.

Other famous names abound in the valley, among them Stonewall Jackson, John Brown, Cyrus McCormick, Woodrow Wilson, and Richard E. Byrd. There were pioneer families named Houston and Lincoln. The Shenandoah became known as a land of great men and great events, a valley of heroes in the two Virginias.

A wide, bumpy furrow across the brow of the continent's eastern mountain ranges, the Shenandoah covers nearly twice the area of Delaware; more than a quarter-million people call it home. Near Steeles Tavern in Augusta County, Virginia, the most southerly tributary of the Shenandoah's South Fork begins a winding, northward course. Near Front Royal the waters merge with the sizable North Fork, which starts as a rushing mountain brook among the high ridges along the West Virginia border. For 140 miles of the great valley's length, the river coils like a braid of silver between the steep heights, finally joining the Potomac where

Veteran of the valley, Eugene Munch was born in the same log house as was his father and lives on soil tilled by his ancestors before the Revolutionary War. Even at 93 he gardens daily in summer. "He grows the finest potatoes in the valley," claims his wife Clara, who cans the corn, beans, and other vegetables her husband raises. The Munches dwell in a secluded vale called Fort Valley in a cleft of Massanutten Mountain. A lover of the outdoors, Mr. Munch missed going hunting last fall for the first time in half a century because of an ailing knee. He relishes talk of local history, a reflection of his family's long ties to the land and his own years as a high school history teacher.

Virginia, West Virginia and Maryland meet.

The 4,000-foot peaks of the Blue Ridge on the east (foldout, pages 555-7), and the Alleghenies on the west, wall out megalopolis and Appalachia. Many of the Shenandoah people I met live today on land their ancestors cleared when the Thirteen Colonies were not much more than a coastal strip of towns and farms.

In rural Fort Valley, tucked away in a crevice of Massanutten Mountain, a valley within a mountain within a valley, I asked Eugene Munch why he never moved off the land Munches settled before the Revolution.

"I've done some traveling, and there isn't any air freer or purer than right here," he answered, "and I never found any water clearer or colder than comes off these mountains."

At 93, Mr. Munch is a hearty testimonial to the salubriousness of Shenandoah air and water (above). He was digging potatoes in his garden when I visited him on a September afternoon. We talked about his plans for hunting deer when the season opened.

"He means it, too," Mrs. Munch told me. "He went last year and nothing's going to keep him from going this year."

As it turned out, he didn't go because of a bad knee—a temporary ailment, Mr. Munch assured me.

The Shenandoah is like Gene Munch—of venerable age, but vigorous still.

BACKGROUND (ABOVE) BY THOMAS ANTHONY DEYO; FOREGROUND (FOLLOWING PAGES) BY THOMAS ANTHONY DEYO AND WILSON A. BROWN © N.G.S.

Fairyland in stone, Luray Caverns annually attract half a million visitors (following pages). In Saracen's Tent, at a depth of 90 feet, tourists gaze at draperies of glittering stalactites. Railed walk at extreme right leads toward the chamber housing the Great Stalacpipe Organ, which uses formations as "pipes" by striking them with rubber-tipped hammers.

Shenandoah Valley

Trying to provoke a slave uprising, John Brown and 21 men attacked the U.S. Arsenal and Armory at Harpers Ferry in 1859. He and surviving comrades were captured in the Armory fire-engine house after fighting that left the lives of 10 followers, including two of his sons. Convicted of murder, conspiracy, and treason against Virginia, the Kansas abolitionist was hanged at Charles Town.

According to legend, George Washington used this building in Winchester, Virginia, as his survey office and later as his headquarters when he commanded Virginia's frontier defenses in 1755–58 during the French and Indian War.

In Frederick County, the state's top apple-producing area, Winchester plays host each spring to the Shenandoah Apple Blossom Festival. The valley produces more than half of Virginia's annual harvest, some 10 million bushels.

Eight of the many caverns in the Shenandoah Valley's underlying limestone are open to the public. In the Luray Caverns an "organ" plays music on stone formations.

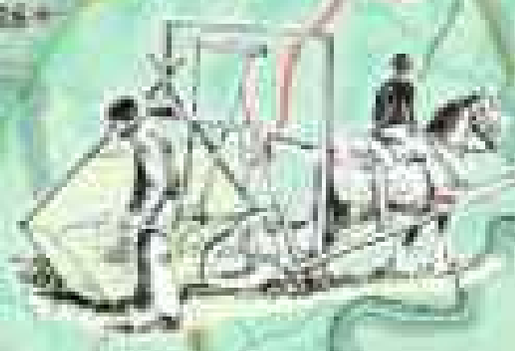
Capture of a Federal battery by Confederate young cadets from Virginia Military Institute at Lexington aided in temporarily stopping the Union advance in the Battle of New Market, May 15, 1864.

Confederate Gen. Thomas J. Jackson, who earned "Stonewall" for his courage during the First Battle of Manassas (Bull Run), thoroughly confused the enemy in his classic Valley Campaign of 1862.

At the limestone columns called Natural Chimneys near Mount Solon, Virginia, an annual jousting tournament takes place in August, when "knights" compete in one of the Nation's oldest continuously held sporting events.

Poultry farms in the Shenandoah Valley produce four-fifths of Virginia's chickens and turkeys.

Woodrow Wilson, 28th President of the United States, was born in 1856 in the manse of the First Presbyterian Church in Staunton, Virginia. His father, the Rev. Joseph R. Wilson, was pastor.



Cyrus Hall McCormick built his first reaper on his father's farm in Rockbridge County, Virginia, in 1831 and gave the first public demonstration of the device that same year at nearby Steeles Tavern.

Shenandoah Valley

Divided highways

Other highways

Civil War battlefield site

Elevations in feet

County names shown thus: PAGE

STATUTE MILES

Walled by mountain ranges, the Shenandoah Valley stretches serenely for 140 miles between East Coast megalopolis and the rugged Appalachians to the west (above). Paralleling the North and South Forks of the Shenandoah River (opposite), U. S. Highway 11 and Interstate 81 serve as corridors for burgeoning industry.

Charting the future, Vice Mayor Kenneth L. Jones, right, and City Manager Edwin D. Martin inspect parking-lot blueprints in Staunton, the valley's largest city, with 25,000 people. A funeral-home owner long active in community affairs, Mr. Jones is the first Negro ever elected to municipal office in Staunton.

Popular legend tells that the valley's name —an Indian word—means "daughter of the stars." It may or may not be true. But whatever the facts, the valley is a heavenly place.

And a happy one. Farms prosper. Small cities, spacious and sparkling in the sun, impress a visitor from the crowded, sooty seaboard. Several million tourists escape the urban East every year to enjoy the valley's beauty and breathe the pure air Gene Munch relishes. Many build weekend homes there.

The Shenandoah shows both its age and its vitality along the Valley Pike. I took the pike south from Winchester, over rolling hills, across streams flashing sunlight in groves of willows and sycamores, through cities the early settlers named: Strasburg (valley people pronounce it STRAWZ-burg), Edinburg, Harrisonburg, and Staunton (STANT'n).

Before any settlers came, the valley knew the footfall of trading Shawnee and warring Iroquois; in fact, one eminent etymologist holds that Shenandoah is Iroquois for "deer." By Washington's time the trail had become the Great Wagon Road, and to Civil War armies it was the Valley Pike, a name that lingers still. Officially U. S. 11, it was the valley's main stem until completion of Interstate 81 in 1969.

The first settlers cleared only as much land as a family could till. But they built large barns to match the soil's rich yields.

The farms along Highway 11 remain small,

and the barns large. They are typical of the Shenandoah, which yields half Virginia's apple crop, nearly all her poultry, and much of her beef, dairy products, and vegetables.

I heard of new industries and growing populations almost everywhere—at Winchester, Harrisonburg, Staunton, Waynesboro, Luray, Martinsburg. I found it so even in Middleway, a little jewel of a village eight miles west of Charles Town. With narrow maple-shaded lanes and not a billboard in sight, it looked as I imagined a village looked in the 1800's.

In Scollay Hall, Middleway's comfortable old tearoom, my wife and I finished a huge Sunday dinner—salty Virginia ham, fried chicken, mounds of fresh vegetables. Then we went for a stroll.

On the front porches of the sturdy brick and clapboard houses, people sipped iced tea. Then, to my dismay, I saw a sign directing traffic to a new printing-supplies factory. I followed its arrow, relieved to find it on the other side of a hill from the village, where its modern configuration did not disturb Middleway's well-tended past.

City Changed Hands Dozens of Times

When I visited Winchester, 15 miles to the southwest, Ben Belchic, President of the Winchester-Frederick County Historical Society, warned me to expect such dichotomies of past and present as he showed me the city's old homes.

Many have pedigrees. For example: the home of Revolutionary War Gen. Daniel Morgan and the headquarters of Civil War Gens. Stonewall Jackson and Philip Sheridan.

Winchester also was the home of the famous Byrd brothers: Richard, explorer of Arctic and Antarctic,* and Harry, towering Virginia political leader and for almost 33 years a United States Senator. Harry Jr. now holds his late father's Senate seat.

"Many of the houses were built before the Civil War and some before the Revolution," Mr. Belchic remarked as we drove through the narrow streets, laid out 200 years before anyone worried about traffic jams.

We talked of Winchester's history. The city changed hands often in the Civil War—72 times, according to one diarist's count of occupations by army units large and small. Then we talked about modern changes: industrial growth, suburban sprawl.

"Here, you've got to look backward and forward at the same time," Mr. Belchic observed. "There's a lot of history behind, and a lot ahead."

Old Grave Hints at a Catastrophe

Mr. Belchic's words echoed in my mind the next day when I drove out to Opequon Church and walked in its graveyard. Presbyterians organized a body of believers on that site in 1737—one of the first congregations west of the Blue Ridge.

In the graveyard I knelt over a fieldstone slab and made out the crude letters and their wide embellishing serifs:

JOHN WILSON
INTERED HERE
THE BODYS OF
HIS 2 CHILDER &
WIFE YE MOTHER
MARY MARCUS
WHO DYED AGST
THE 4TH 1742
AIGED 22 YEARS

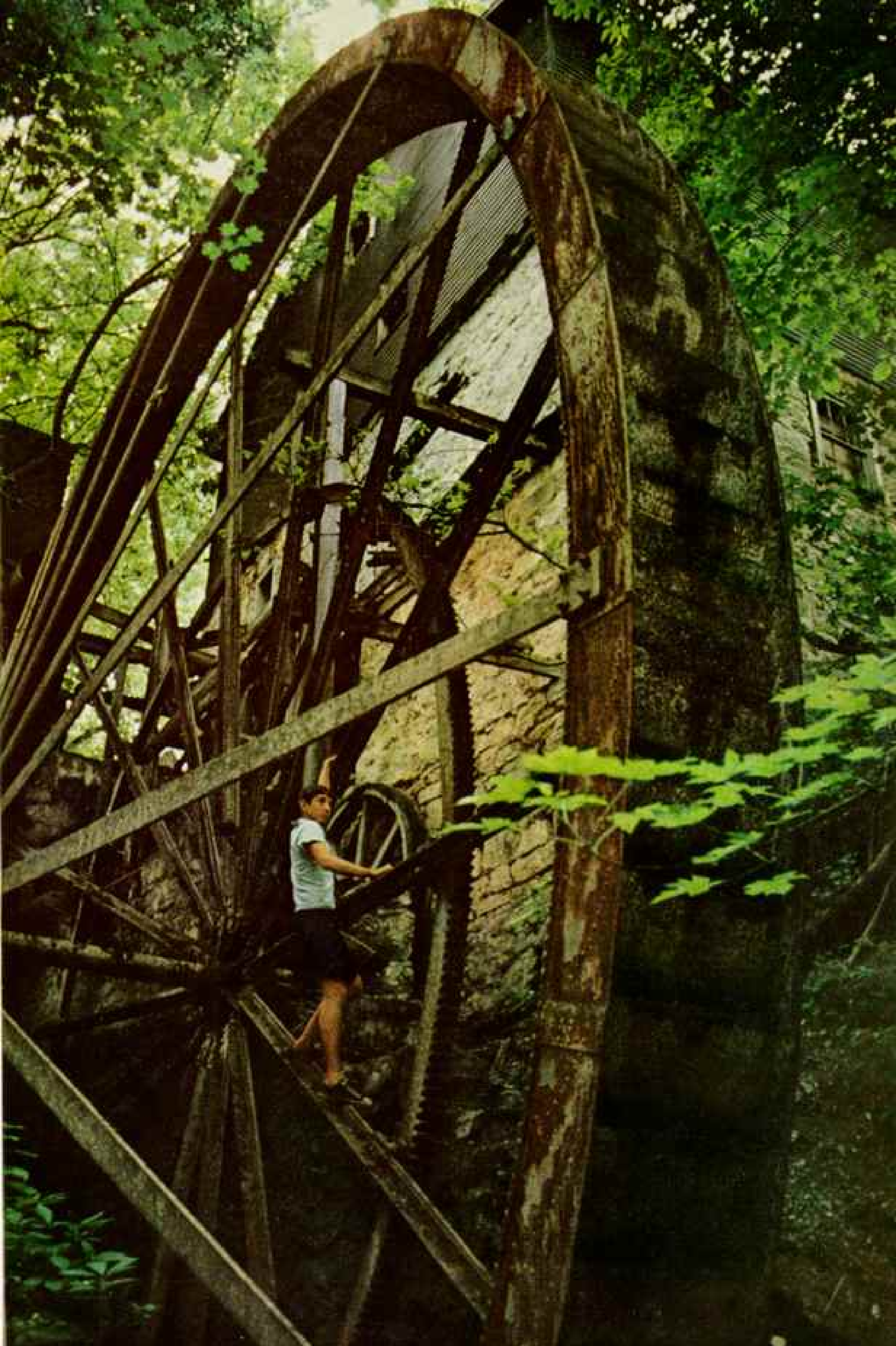
What calamity befell John Wilson's family? A massacre by Indians? Smallpox? A fire engulfing their tiny cabin?

I never worked out a satisfactory answer. As I pondered their fate, I was aware of the present intruding on my funereal reverie—the dualism of past and present about which Ben Belchic had spoken. From U. S. 11 a quarter of a mile away, traffic rumbled noisily. Near the highway, bulldozers growled, clearing more land in Winchester's neat industrial

*See "Admiral of the Ends of the Earth," by Melville Bell Grosvenor, NATIONAL GEOGRAPHIC, July 1957.

Its creaking stilled, a 40-foot water wheel stands locked by rust in Shepherdstown, West Virginia, on the Potomac, at the north end of the Shenandoah Valley. Powering a gristmill for Thomas Shepherd, it ground corn and wheat for Civil War combatants, for whom this land served as granary, highway, and battleground. Here Gen. Stonewall Jackson masterfully confounded the War Department in Washington with a series of whirlwind maneuvers, outfighting the men of three Federal commands. Gen. Robert E. Lee marched through on his way to Gettysburg. The valley's role as a haven for Confederate forces ended in 1864-65, when Gen. Ulysses S. Grant ordered a Northern Army to lay waste to it systematically "so that crows flying over it . . . will have to carry their provender with them."

EKTACHROME © N.G.S.



park. It already accommodates such prestigious firms as Capitol Records (pages 568-9), Rubbermaid, and Harris Intertype.

Later, I visited Richard D. Robertson to ask what industry found so attractive in the valley. Mr. Robertson, a vice president of Philip Morris U.S.A., directs the several operations of the General Products Division. This includes the American Safety Razor factory near Staunton, where he has his office.

As we talked, I reflected on one of the advantages the valley offers industry: the view an executive has from his office window. We looked out on a farm where fat Herefords and Angus meandered over an emerald hillside. No number of tranquilizers, I reckoned, could soothe the nerves of a harassed captain of industry as well as that bucolic scene.

But does this kind of thing really attract expensive managerial talent? Mr. Robertson answered for himself.

"My family and I moved here in 1961 from

Appalachian artist Robert Kuhn works and lives in a former Episcopal church atop 2,800-foot Tanners Ridge near Stanley, Virginia. In a shower of sparks from his welding torch, he works on his steel sculpture, "Girl With Jacks," for an exhibit in Washington, D. C.

Good life in the Shenandoah: Mr. and Mrs. Gale Richmond relax at Oak Hill, their home in Augusta County. The many-windowed house looks out on a 600-acre tree farm. A former textile executive, Mr. Richmond joins growing ranks of the semi-retired in the peaceful valley.

Darien, Connecticut, where we were 40 minutes from all the advantages of New York. It was a major change, but now we love it."

Mr. Robertson told me his firm chose its valley site for several reasons—good transportation, a climate in which the company was made to feel welcome, and adequate power and labor. But he dwelt upon the people who man ASR's production line. The rate of absenteeism has been low—less than half the national average.

"But what I like most about them is that they're pleasant," Mr. Robertson said. "Walk through our factory and you'll find people who smile and say hello. I've operated businesses all my life, in the United States and overseas, and I've never found a nicer bunch of people to work with."

There's a slightly unkempt look about American Safety Razor's men—Vice President Robertson included—as they arrive for work. And ASR is quite happy about it.

REPRODUCTIONS BY THOMAS ANTHONY DEFEO © N.A.M.

Spoon-feeding a mold with molten brass, a foundryman casts candlesticks at Virginia Metalcrafters in Waynesboro. Founded in 1890 to make stoves, the firm has kept craftsmanship alive with reproductions of 18th-century antiques.

Music maid at the Capitol Records plant in Winchester oversees a battery of automatic stamping machines; each presses 100 discs an hour, here the

The company encourages them to shave at the factory, providing 300 stubbly faces upon which the quality of ASR's principal product —the razor blade—can be tested.

Just across the valley in Waynesboro, General Electric employs 2,200 people in the manufacture of controls for missiles, spacecraft, aircraft, and heavy machinery. Among the employees are 200 engineers.

The transformation of a largely agrarian economy into one balanced by industry was not achieved without some agony.

"All of a sudden the local people were finding strange new faces in their churches and their PTA's," a Chamber of Commerce spokesman told me. "Some of these newcomers were expressing ideas that were pretty foreign to what local people felt. They had to swallow hard sometimes. But they accepted the newcomers—and their ideas."

This is one way the valley is changing.

Autumn Spectacular Lures Throngs

On autumn weekends, the colors of the valley and its mountain rim lure bumper-to-bumper traffic to the 105-mile-long Skyline Drive, in Shenandoah National Park atop the Blue Ridge. On haze-free days you can see

Beatles' album, "Abbey Road." Employing round-the-clock shifts recruited from a large and willing force of skilled labor, the newly opened factory joins a fast-growing roster of nationally known industries in the valley, including Du Pont, Westinghouse, General Motors, General Electric, and the 3M Company.

across the valley 25 miles to the Alleghenies. It is a magnificent view any time of year, and to Governor Alexander Spotswood of Virginia, it called to mind great discoveries and the splendor of past civilizations.

Leading a party of adventurers into the Shenandoah in 1716, Governor Spotswood was one of the first colonists to see the magnificence of Virginia's western domain. The explorers gave the South Fork of the river what they thought to be a fitting name: Euphrates. On its banks the governor buried a bottle containing a paper which claimed the territory for George I. It was the occasion for a celebration probably unequaled since.

As John Fontaine, a member of the party, recorded it, the dozen or so men were called together and their guns loaded. "We drank the King's health in champagne and fired a volley, the Princess' health in burgundy and fired a volley and all the rest of the Royal Family in claret and a volley. We drank the Governor's health and fired another volley.

"We had several sorts of liquors, viz., Virginia red wine and white wine, Irish usquebaugh, brandy, shrub, two sorts of rum, canary, cherry punch, water, cider, etc."

The governor understandably seems to

have been somewhat bemused. He returned to Williamsburg believing he had almost reached Lake Erie; Indians told him it lay just beyond a distant mountain. Actually he hadn't come within 250 miles of the lake.

The valley looks good not only from the Blue Ridge, but also, I found, from 160 feet underground. Visitors can obtain the lower view because caverns honeycomb the Shenandoah's limestone floor—chambers shaped slowly but inexorably by subterranean waters. Eight of the many caverns are open to tourists, and in one of them the stalactites play music (pages 560-61).

Hymn Rings Out From Three-acre "Organ"

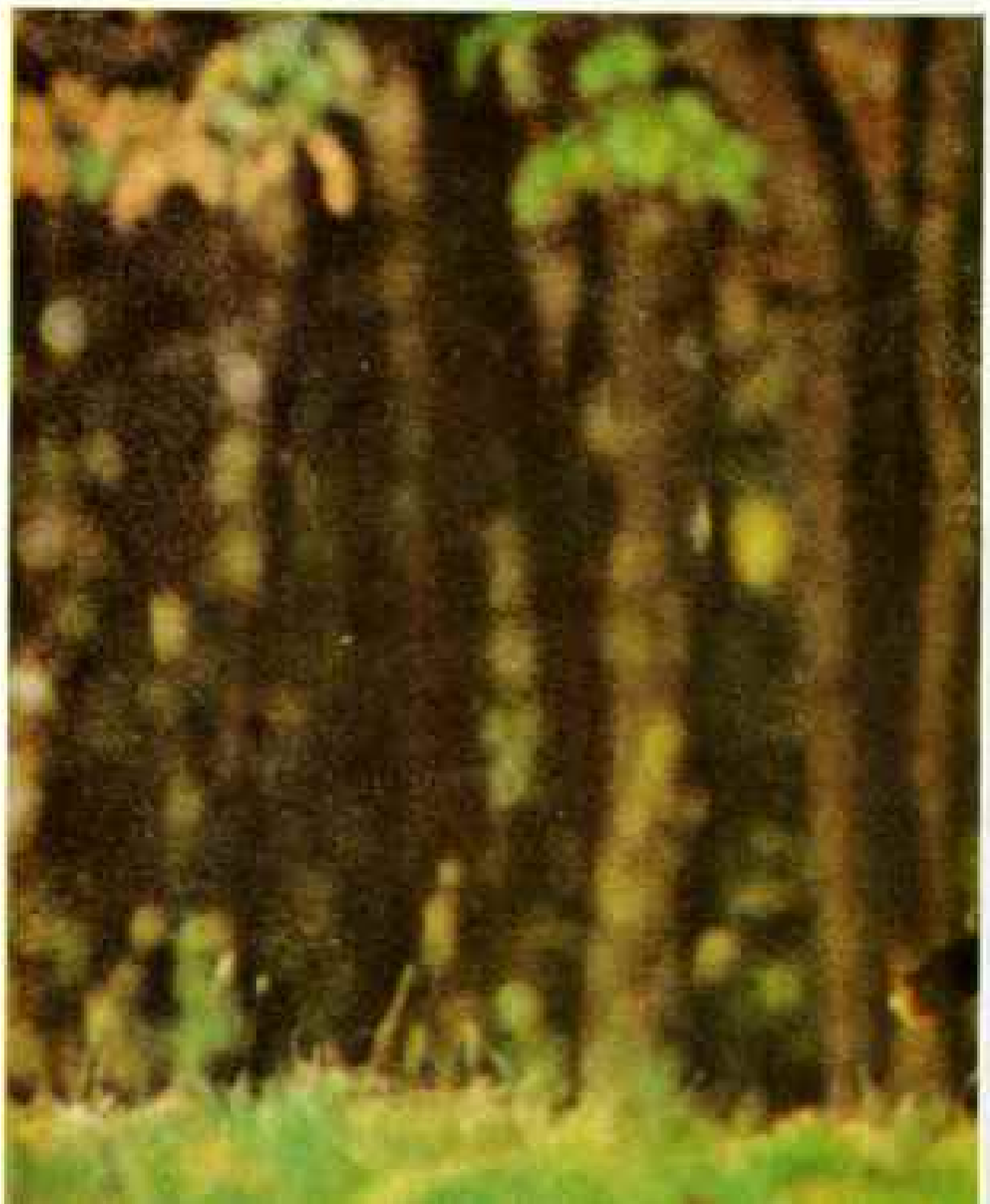
In a vaulted chamber of Luray Caverns, amid eerie spires of stone, guide Linda Sullivan pressed a button. The somber notes of "God Be With You Till We Meet Again" resounded majestically in the cool, moist air.

"You are standing inside the world's largest musical instrument," she announced. With 40 other persons who were touring the cave, I stood in awed silence as rubber-tipped hammers, triggered electronically, thumped stalactites over an area of three acres. Some emitted a low and mournful bass, deep as a foghorn. Others responded with high clear tones that rang like costly crystal.

"It's a promotion man's dream," I said later to Frank Yates, a member of the staff of Luray Caverns Corporation. "P. T. Barnum couldn't have thought up anything wilder."

"But the man who thought it up is dead serious about it," Mr. Yates answered. "He's worked for years to perfect it."

Leland W. Sprinkle of Springfield, Virginia, an electronics engineer and organist, approached Luray Caverns President H. T. N.



"So tame I could almost pet them," marveled photographer DeFeo of deer roaming Shenandoah National Park. Browsing whitetails constantly delight motorists on Skyline Drive, a 105-mile mountaintop highway threading the park in the Blue Ridge.

Unaware of a trap about to be sprung, wild turkeys crowd around grain bait in million-acre George Washington National Forest. A few seconds later a state wildlife official, hidden with the photographer, touched off small concealed cannons that catapulted a net over the feeding birds. Captives will be shipped to stock other Virginia forests.

Bull's-eye! Charging at full gallop, a "knight" spears a ring at the 148th annual Natural Chimneys Jousting Tournament last August. Tourists flock both to the tourney and to the chimneys, seven weirdly weathered towers of limestone reaching to a height of 120 feet.

EKTACHROME (ABOVE) AND KODACHROME © N.G.S.

Graves in 1954 with the idea of an "organ" that would use stalactites as "pipes."

"I thought he was a screwball," Mr. Graves said. "How do you make rocks give music?"

Mr. Sprinkle went through the cave, patiently testing the stalactites. When he found one that was slightly below a required tone, he brought it up to concert pitch by grinding away some of its bulk. Eventually he hooked the stalactites' rubber-tipped hammers to a large organ console through a maze of electronic gadgetry, using miles of wire. The result is an incredible instrument that creates music from solid rock.

Retuning Due in a Thousand Years

I met Mr. Sprinkle on a Saturday night when he was in the cavern to record music. He took me to an isolated chamber to see the organ's brain. Although there is a console in the cavern, he explained, most of the selections that tourists hear are produced mechanically, player-piano fashion, on 40-inch-wide sheets of perforated Mylar. The varied repertoire on plastic includes "A Mighty Fortress Is Our God," "Deck the Halls With Boughs of Holly," and Bach's "Minuet in G."

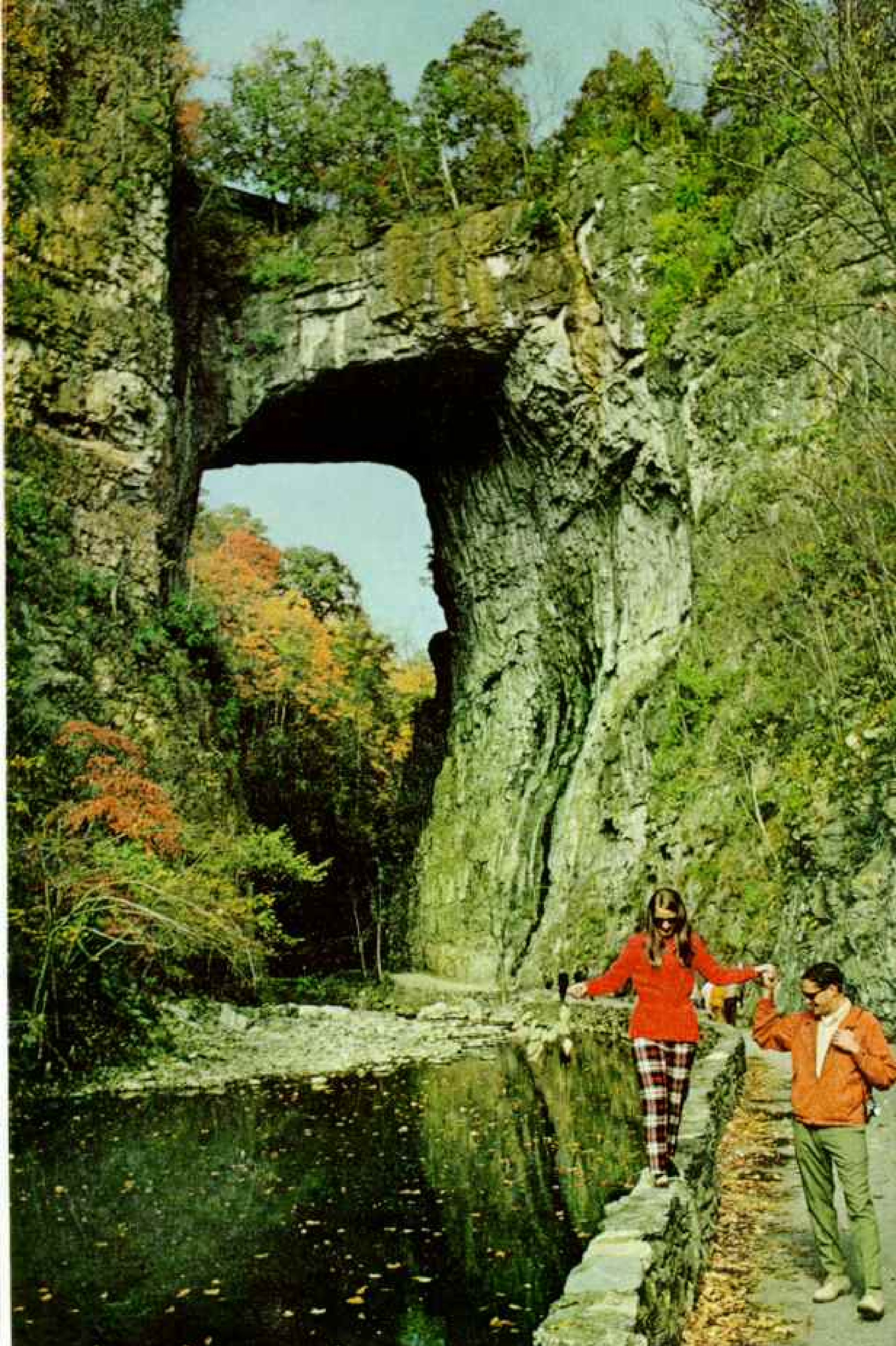
Mr. Sprinkle went to the console and played a sprightly Irish tune, listening critically to the response of each stalactite. I asked if the stones would ever need retuning. "Since they grow about a cubic inch in 120 years, the big ones should be checked at least once every thousand years," he said.

Besides carving caverns, water has left other strange phenomena in the region. Natural Bridge, which, strictly speaking, lies south of the Shenandoah, is the remainder of a cavern that collapsed (opposite).

At Mount Solon, within the Shenandoah, wind and water exposed seven limestone pillars ranging in height from 65 to 120 feet. They look rather like the remains of an ancient turreted fortress.

Under a more prosaic name, Natural Chimneys, these shafts have been a popular tourist attraction for four decades, and also the locale of what some Virginians claim to be the Nation's oldest continuously held sporting event. Legend says that a jousting tournament took place there in 1821, when two young gallants

"**Bridge of God,**" Monacan Indians called famed Natural Bridge when they worshiped beneath its 215-foot-high arch. Young surveyor George Washington traveled through this area about 1750, a trip that may explain the initials "G. W." carved in the rock behind the foliage at left. Thomas Jefferson considered the limestone wonder "the most sublime of Nature's works," and purchased it from George III for a mere 20 shillings. Still privately owned, the span lures 260,000 visitors a year.



To the cry of hounds and the stirring notes of the huntsman's horn, elegantly garbed members of the Blue Ridge Hunt ride out from Carter Hall near Millwood. The sprawling manor house, completed in 1792, served as headquarters

EXCAVATING BY THOMAS ANTHONY DEVER (C) N.G.S.

for Stonewall Jackson, and often hid Col. John Mosby, the Confederacy's evasive "Grey Ghost." Though damaged during the Civil War, it escaped the total destruction suffered by many fine homes as the tides of battle swept the valley.

competed for a lady's hand. Now riders gather annually on an August weekend to try to spear suspended steel rings at full gallop (page 572).

Stories of grass so tall it could be tied over a horse's saddle attracted the first settlers to the Shenandoah in the 1720's and 1730's. They were Germans, Scots, Irishmen, Englishmen, a few Swiss, and a few Frenchmen.

While the Blue Ridge made Virginians hesitate, settlers streamed south from Maryland, Pennsylvania, and New Jersey, across the Potomac River and into the valley (maps, pages 562-3). Some obtained land grants from the Virginia governor and council. Some merely squatted. Some paid rent to Thomas, Lord Fairfax, whose 5,200,000-acre proprietorship, the Northern Neck of Virginia, included half the valley.

Same Farm Nurtures Eight Generations

At Winchester I went to visit Dr. Garland Quarles, who has carefully studied the records of early settlers, to ask what kind of people they were.

"A few well-to-do families came in the early 1700's," he said, "but mostly they were just ordinary people—shopkeepers, farmers, artisans."

The roots the settlers put into the valley soil went deep. "My children are the eighth generation of Snapps to live on this land," apple grower Roland Snapp told me as we stood at the back door of his home on the Cedar Creek Grade, near Winchester.

He pointed into a gently sloping valley. "My father, my grandfather, and my great-grandfather were born in a house that stood there," he said. "In a geographical sense, I haven't gone very far in the world."

Mr. Snapp showed me the thick, speckled paper upon which Lord Fairfax granted a tract to John Snapp on July 23, 1750. The

words, written in a flourishing hand, began:

"The Rt. Hon. Thomas Lord Fairfax, Baron of Cameron in that part of Great Britain called Scotland and Proprietor of the Northern Neck of Virginia, to all whom this present writing shall come sends Greeting. . . ."

For "compensation to me paid," plus an annual quitrent of "one shilling sterling money" for each 50 acres of land, Lord Fairfax granted to John Snapp 400 acres "on the east side of Little North Mountain beginning at a hiccory and red oak sapling. . . ."

Beyond Mr. Snapp's orchard, the sun was setting over a low ridge. "That's Little North Mountain," he said.

Mountains and valley teemed with game when Washington surveyed in the Shenandoah. "One of our Men went out with ye Gun and soon Returned with two Wild Turkies" records a typical entry in his diary.

Turkeys still live in the Shenandoah, in part thanks to the favorable environment afforded by the George Washington National Forest (pages 570-71). This million-acre domain includes the Alleghenies along the Shenandoah's western edge, part of the Blue Ridge, and part of Massanutten Mountain. The national forest has helped make outdoor recreation one of the Shenandoah's biggest business; some 460,000 hunters, 300,000 fishermen, and 400,000 hikers, picnickers, and swimmers enjoy the forest each year.

But its ranges can't boast of as many turkeys as can Robert H. (Twig) Strickler and his brother Charles, known as "Chip." Their corporation, Rocco Feeds, Inc., grew two million domestic turkeys last year—18,000 tons of meat for Thanksgiving dinners and lunch-counter meals across the Nation—and hatched 21 million chickens. Such huge production enables Rockingham and nearby counties to account for 80 percent of Virginia's poultry output. Feed mills, meat processors, and allied

Big time in apple town

EARLY EACH MAY when trees bloom and bees buzz (left), Winchester plays host to more than 100,000 visitors at the Shenandoah Apple Blossom Festival.

Twenty-year-old Nancy Hardin, daughter of the Secretary of Agriculture, reigned as queen during last year's three days of pageantry, parades, and parties. Here, escorted by U.S. Senator Harry F. Byrd, Jr., she leaves the front steps of John Handley High School, scene of her coronation.

Last January Miss Hardin wed Douglas L. Rogers, son of the Secretary of State. The marriage between the scions of two Cabinet Members was hailed by President Nixon as "an historic first."

Senator Byrd represents the ninth generation of a noted Virginia family. His father, whom he succeeded in the Senate, became the world's largest individual apple-orchard owner, with some 4,000 acres and 200,000 trees in rows as long as two miles. Virginia ranks sixth among apple-producing states, harvesting 10 million bushels a year.

firms swell Rockingham's gross income from poultry to $70,000,000 annually.

On a farm outside Harrisonburg, the Stricklers showed me how science and mass-production techniques have transformed the poultry business.* We entered a building where 64,000 Vantress Cross chicks reveled in air-conditioned comfort. The temperature, too warm for me, was just right for them.

"We keep it at 82°," Twig said. "That's the optimum temperature for producing the largest bird from the smallest amount of feed."

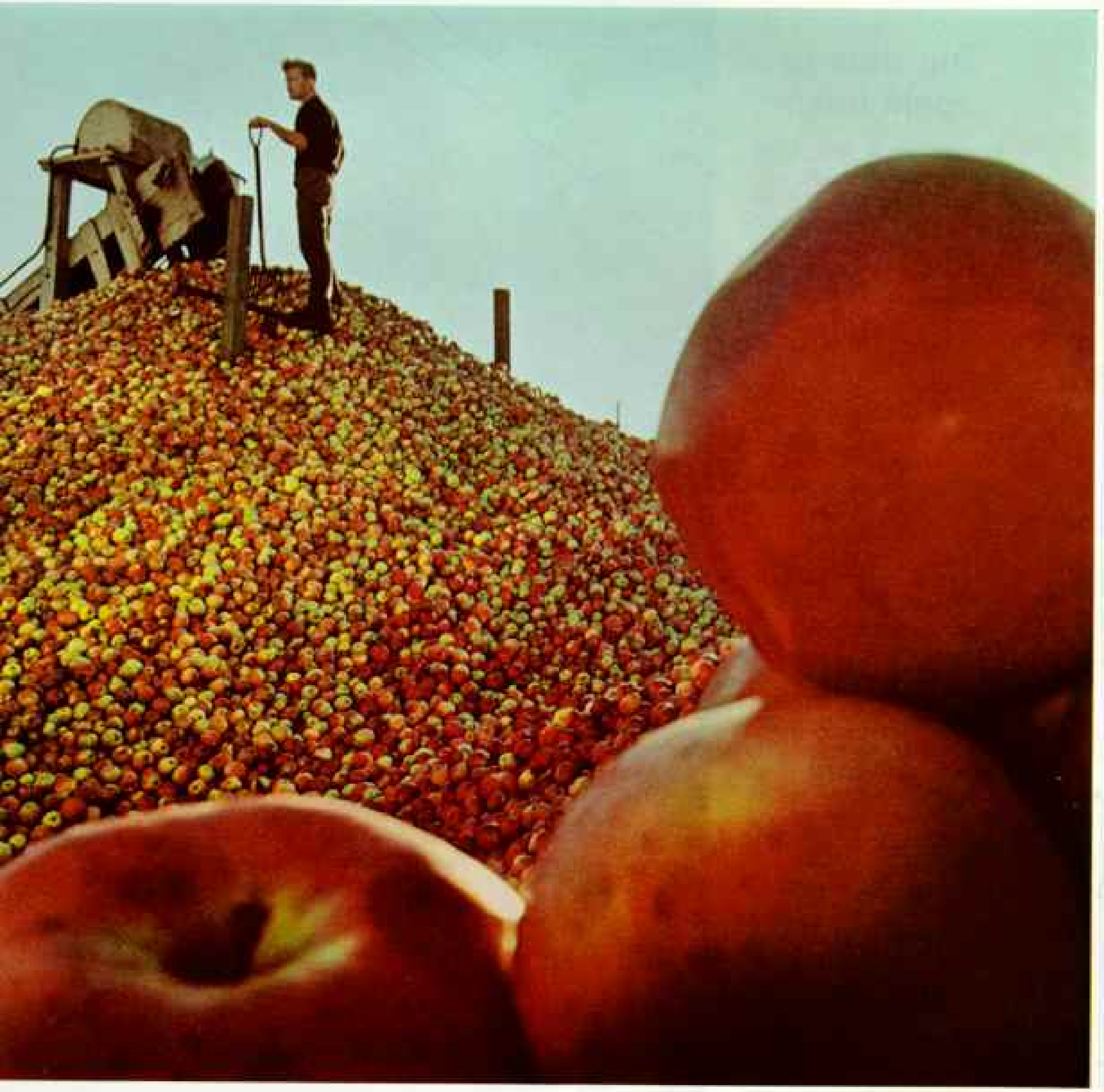
With such careful control of the environment, broilers can be grown to slaughtering size in 8 weeks, Twig said. "Not many years ago we thought we were doing really well to get them ready in 14 weeks."

Machines That Pick Apples

Around Winchester I found a similar scientific-industrial revolution overtaking the Shenandoah apple orchards, the legacy of another early enterprise in the valley. Washington required each of his farm tenants to put at least four acres in apple trees.

Valley orchards, in an average year, yield

*See "The Revolution in American Agriculture," by Jules B. Billard, GEOGRAPHIC, February 1970.



five million bushels—Red Delicious, Golden Delicious, Yorks, Staymans, Romes, Winesaps. Valley folk so appreciate the revenue from them that they stop whatever they are doing around the first of May to hold the Shenandoah Apple Blossom Festival.

This annual extravaganza—no other word quite describes it—of pageantry and pomp climaxes in a four-hour-long parade that transforms Winchester's streets into rivers of color. The festival has become so famous that it fetches marching bands from as far away as Miami and New England (page 577).

A new instrument of agricultural revolution, the mechanical picker, has invaded the orchards. It grasps a limb in large claws and shakes vigorously, tumbling the fruit into a canvas bed stretched around the tree.

I found researchers at Virginia Polytechnic Institute's experiment station at Winchester busy with the question of whether the machine equals the efficiency of a good pair of human hands. The machine works faster—but the hands bruise fewer apples.

Two orchards near Winchester already own mechanical pickers, hedging against one of the grower's most frustrating uncertainties, the availability of labor at harvest.

John F. Watson, executive secretary of the Virginia State Apple Commission at Staunton, told me about other developments that have helped the growers.

"Stop-drop" sprays retard the maturing of tree cells next to the apple stems—the cells that cause the fruit to fall. This allows the grower more time for picking. Powerful sprayers apply a faster and more even coat of chemicals to combat rust, scab, mildew, mites, leaf rollers, and codling moths.

Bulk loaders enable the grower to handle more fruit with less labor. Dwarf and semi-dwarf varieties make picking easier and yield more apples per acre than standard trees.

"Apples do grow on trees," Mr. Watson conceded. "But gosh, they need a lot of help."

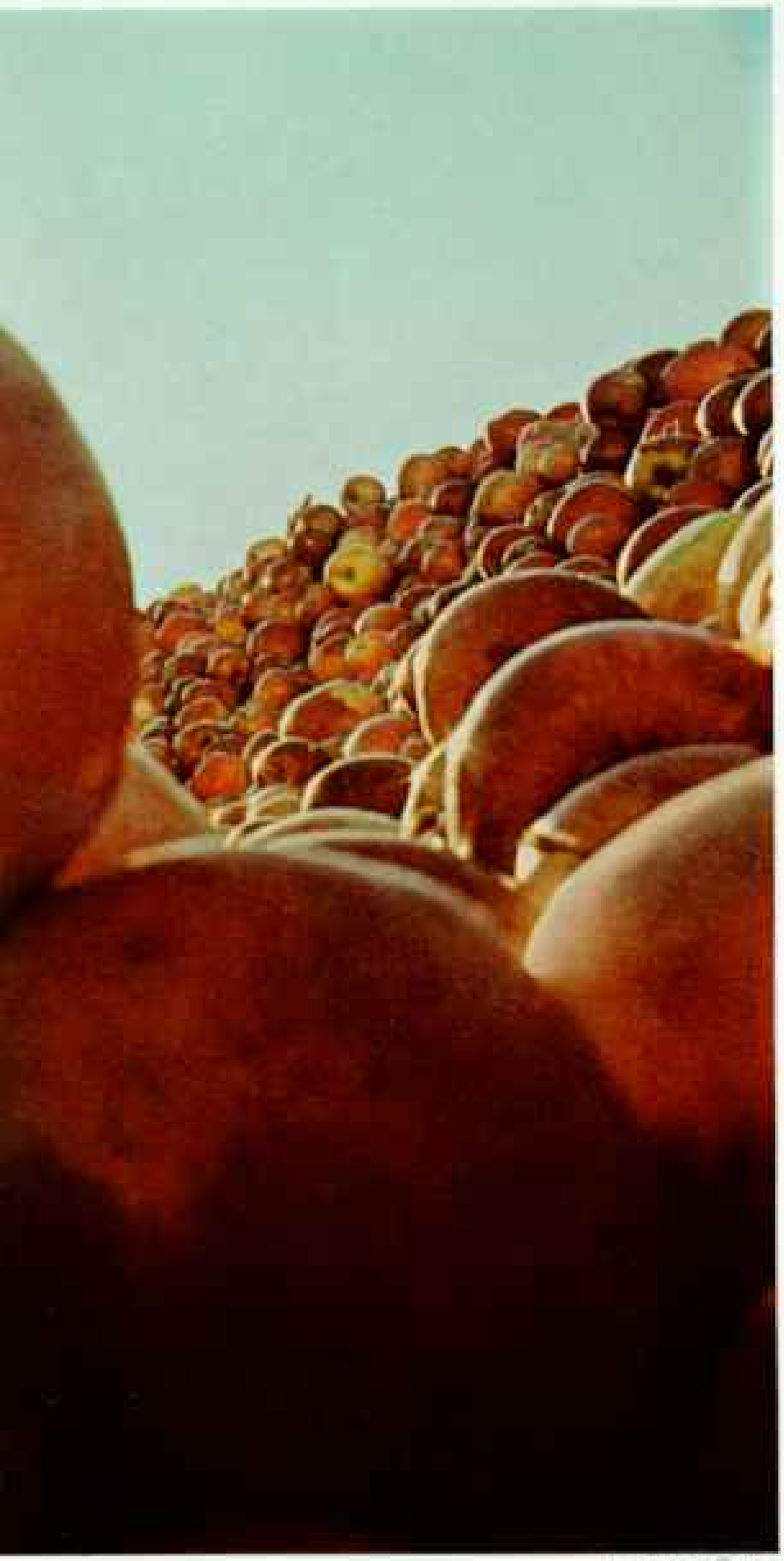
Mennonites Cling to the Old Ways

Amid the highly mechanized agriculture of the Shenandoah, some people still live in the horse-and-buggy era—by choice. These are the Mennonites.

"We're Mennonites of the Old Order," stressed 70-year-old Walter Beery when I visited his home. "We follow the old ways."

On a quiet Sunday morning at Dayton, where the Beerys live, I saw a procession of black buggies carrying large Mennonite families to church services (pages 582-3). Merchants in nearby Harrisonburg provide hitching posts in front of their stores for Mennonites who drive into town to do their shopping.

Mrs. Beery and three Beery daughters



Atop an Everest of apples, a workman feeds a vinegar mill at the H. J. Heinz plant in Winchester. Piled high by the conveyor beside him, the fruit cascades down to a water flume in the foreground and washes into a press. The operation devours 28 million pounds of apples each year, pouring forth 2,600,000 gallons of vinegar.

In leisurely loops, the North Fork of the Shenandoah River wriggles northward past trough-topped Massanutten Mountain. Within the stream's coils lie grainfields, bluegrass pastures, and comfortable farmhouses standing in the shadow of commodious barns. Ridges lean like flying buttresses against the massive nave of Massanutten, which rears abruptly from the valley floor.

Cheeks rippling in the slipstream 6,500 feet above the valley, a skydiver prepares to leap. Plummeting earthward, he will twist his body into intricate arabesques, then open his parachute with only 2,000 feet to go. Swelling ranks of the Shen-Valley Skydivers at Waynesboro attest to the popularity of the daring sport.

greeted me in ankle-length dresses, beneath which showed lace-up black shoes and black stockings. Kerosene lanterns stood on a shelf in the living room; the Beerys eschew electricity and all its conveniences.

Old Order Mennonites, Mr. Beery explained, not only dress and live simply; they do not vote, bear arms, recognize divorce, or welcome extensive education. "The Bible says the father shall make known the ways to the children," he observed. His daughters Lydia Ann, Carrie, and Vada, in their forties now, completed the seventh grade.

Hands Must Be Kept Busy

As we sat in the living room, Carrie and Vada put finishing touches on throw rugs loomed in pioneer fashion. I realized that the Beery household knew few idle moments.

"We were all brought up to work," Mrs. Beery explained. "We're not satisfied any other way."

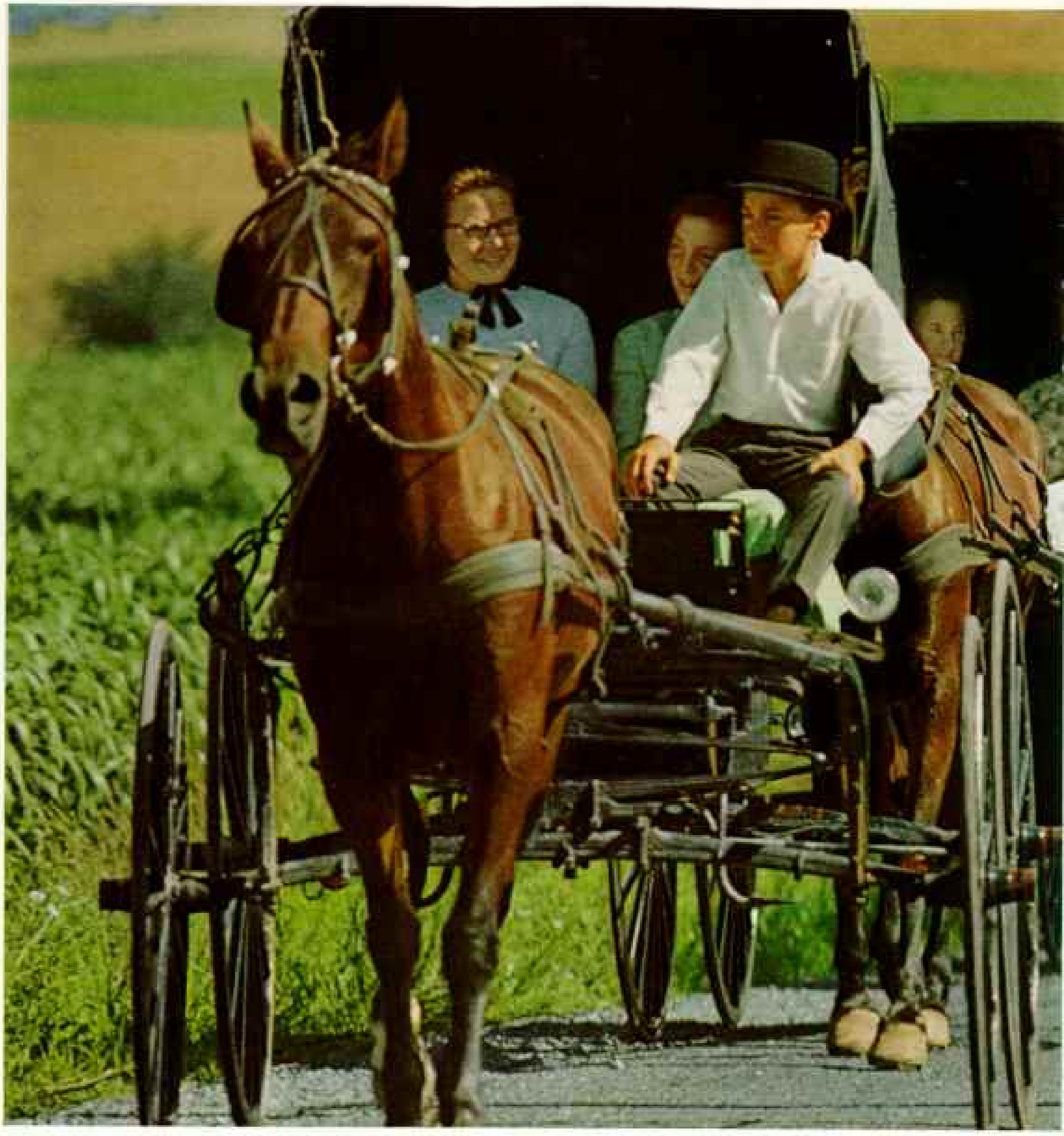
Mr. Beery raises broilers. Mrs. Beery grows flowers and vegetables to sell. The daughters add to the family income by weaving rugs and coverlets, besides helping with chores. "Carrie milks the cows and Lydia Ann is my baker," Mrs. Beery said.

I was treated to Lydia Ann's skill at lunch —brown bread still warm from the oven, peach shortcake, and gingerbread. These went with a meal of fried chicken, butter beans, tomatoes, cabbage, cantaloupe, and watermelon-rind preserves. Eating is one of the pleasures of the Shenandoah.

Still, there are difficulties for the Beerys. It grows harder each year to maintain the old ways, when everything moves so fast, Mrs. Beery told me. A horse-drawn buggy becomes a hazard on a high-speed road.

"We drive the five miles to Harrisonburg only about twice a year now because of the traffic," she said. "Sometimes I wonder if there is any room left for us."

Most Mennonites have made various compromises with the pace of the world. Some use electricity in their barns, but not in their houses. Some have electricity in both; many



drive cars. The Eastern Mennonite branch approves of higher education, supporting a college for 950 students at Harrisonburg.

The students of Eastern Mennonite College treated the valley last fall to a display of student power as awesome as any on demonstration-wracked American campuses —but in a different way. They organized not to lay siege to a library but to build one.

Plans for a $1,400,000 library building seemed too ambitious for the school. A federal grant of $388,500 was available—but only if the college raised $400,000. As the deadline approached, some $111,000 was still lacking.

This sad news unleashed the whirlwind force of virtually the entire student body. Some students returned to hometowns—one young man even flying to Canada—to seek donations. Others sought odd jobs nearby.

The movement was infectious. Four students received $500 for cleaning a chicken house. Three others made $1,000 by chopping a family's winter wood supply. One group waxed a car and received a $200 donation.

In only two days, student power had earned $54,000.

Now students scoured the valley for antiques and bric-a-brac to be auctioned. They

Riding the rigs of yesteryear, Mennonites head home from church. Families tend to be large, sometimes filling more than one buggy. These farming people live near Dayton, center of an Old Order sect that eschews automobiles and modern dress.

brought back 2,000 items, all donated—furniture, old coins, glassware, paintings. When the last of nine raspy-throated auctioneers had disposed of these, the student contribution toward the library totaled $112,000. The next morning the college trustees met and voted to award a contract for construction.

Historically, it is not student power but church power that valley educational institutions have most often known.

"Before public schools were established, the churches realized it was their responsibility to educate the young," explained Miss Martha Dabney Jones, headmistress of Stuart Hall. A preparatory school for girls at Staunton, it was founded by Episcopalians in 1844.

A paternal attitude by the early churches helped to make the valley an educational center. Seven colleges and nine preparatory schools ably maintain this reputation.

In 1842 Presbyterians in Staunton established the Augusta Female Seminary, now Mary Baldwin College. Both Mary Baldwin and Stuart Hall have expanded, but both still occupy their original Greek Revival buildings. On a hill near the two schools stands the birthplace of Woodrow Wilson, an educator before he entered politics.

Education Survives the Havoc of War

Not even the Civil War's devastation could kill the valley's interest in education. In fact, it promoted it. After the war, cavalryman Charles S. Roller returned to Fort Defiance, where he had been headmaster of a school in ante bellum days. This time he opened a school that emphasized military instruction.

It is not clear whether he set out to build a new officer corps against the time the South would need one. "But I don't think there's much doubt that the war played a part in his thinking," said Col. Malcolm H. Livick, superintendent of Augusta Military Academy, the school founded at Fort Defiance.

One of five military schools in the valley, it has helped Virginia earn global fame as a military training ground. This year's 416 cadets represent 26 states and 6 nations.

The Valley of Virginia—of which the Shenandoah forms the northern part—boasts many other educational institutions.

Two of these, at Lexington, long enjoyed associations with famous men. George Washington gave $50,000 worth of stock in a canal company to a small academy there, which became Washington College. It took the name Washington and Lee after Gen. Robert E. Lee served as its president. At neighboring Virginia Military Institute, Stonewall Jackson taught artillery tactics and natural philosophy. VMI counts as its most distinguished alumnus Gen. George C. Marshall, Army chief of staff in World War II and author of

In a Sunday surcease from drills and studies, cadets attend service in the Stonewall Jackson Memorial Hall at Virginia Military Institute in Lexington. From the walls hang flags of the 26 states that formed the Union when VMI was established in 1839.

Before the Civil War, Jackson taught for 10 years at the college. Behind the altar a huge painting depicts the charge of the corps of cadets at the Battle of New Market. Called out as last-ditch reserves, the students overwhelmed a key battery, briefly halting the Union advance.

Candles' warm glow bathes students during commencement at Southern Seminary Junior College in Buena Vista.

KODACHROME (ABOVE) AND KODACHROME © N.G.S.

the Marshall Plan for European recovery.

The past, like the valley's limestone floor, always lies close to the surface in the Shenandoah. The sentinel watching over all the great events that have taken place there is the river itself. Looping through the valley, taking the runoff from hills and hollows (page 580), it flows as sonorously as the song sailors spread around the world in the age of sail:

O Shenandoah, I long to hear you,
Away, you rollin' river.
O Shenandoah, I long to hear you,
Away, I'm bound away,
'Cross the wide Missouri.

Folk song authorities believe the song originated on rivers farther west, perhaps on the Missouri—although the first men who sang it might well have been transplanted valley natives longing for home.

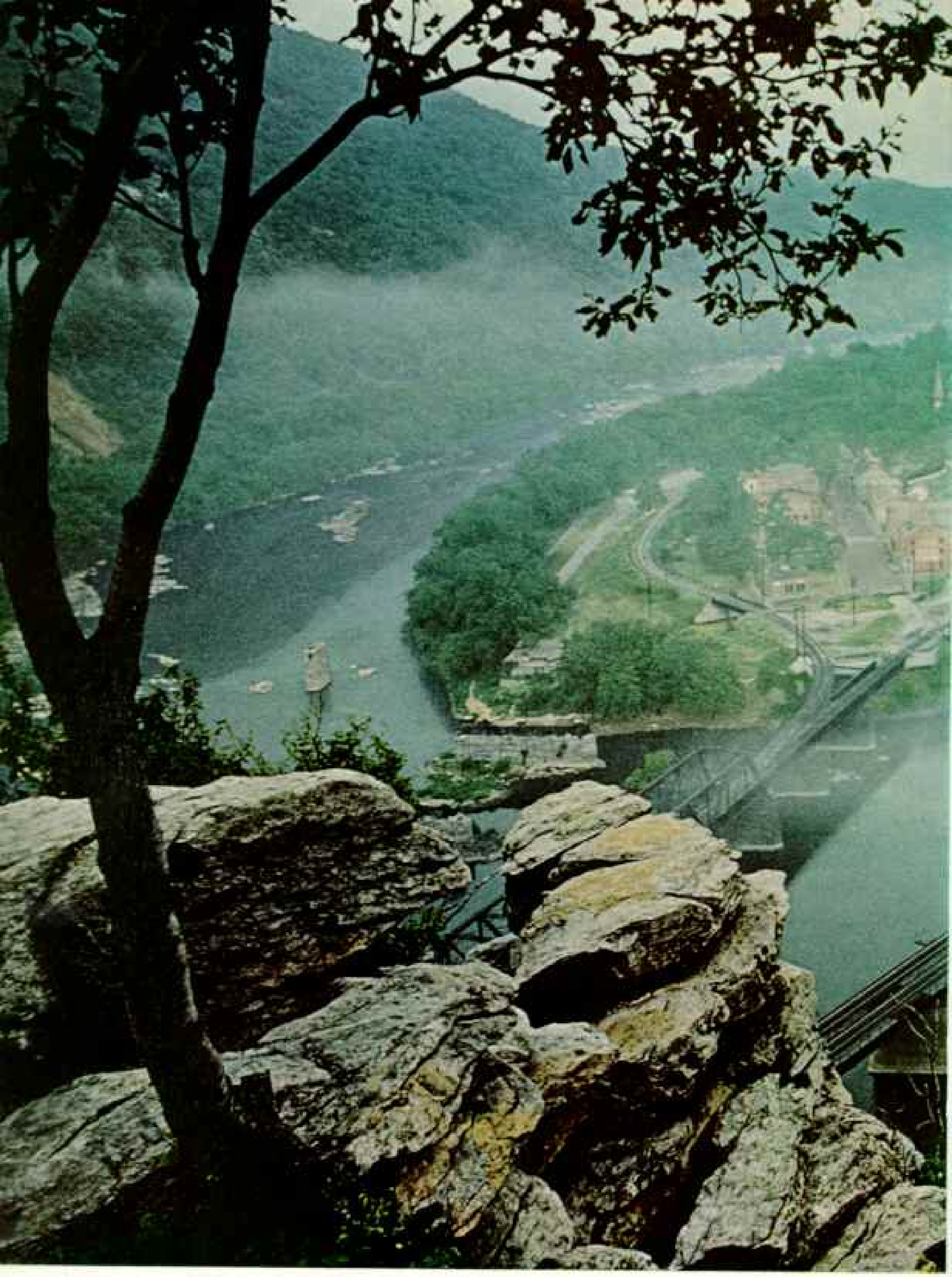
Some versions tell of a trader who courts the daughter of an Indian chief named Shenandoah. Cavalrymen sang a lusty version on the frontier. Somehow reaching the ocean, the song was carried to far-flung anchorages as a chantey that made shipboard chores go easier. No matter the history; the fame of "Shenandoah" is secure as one of the most beautiful folk songs in English, a worthy companion to a beautiful valley.

Historic sites add to the valley's luster. Within a few miles of one South Fork tributary were born—16 years apart—two men with a mighty destiny in the West. Sam Houston helped found Texas. Cyrus McCormick improved upon a contraption his father had tinkered with. When his reaper was perfected, in a log workshop that is now a museum, McCormick had set in motion a force that would revolutionize the grain harvest and make the Great Plains a granary for the Nation.

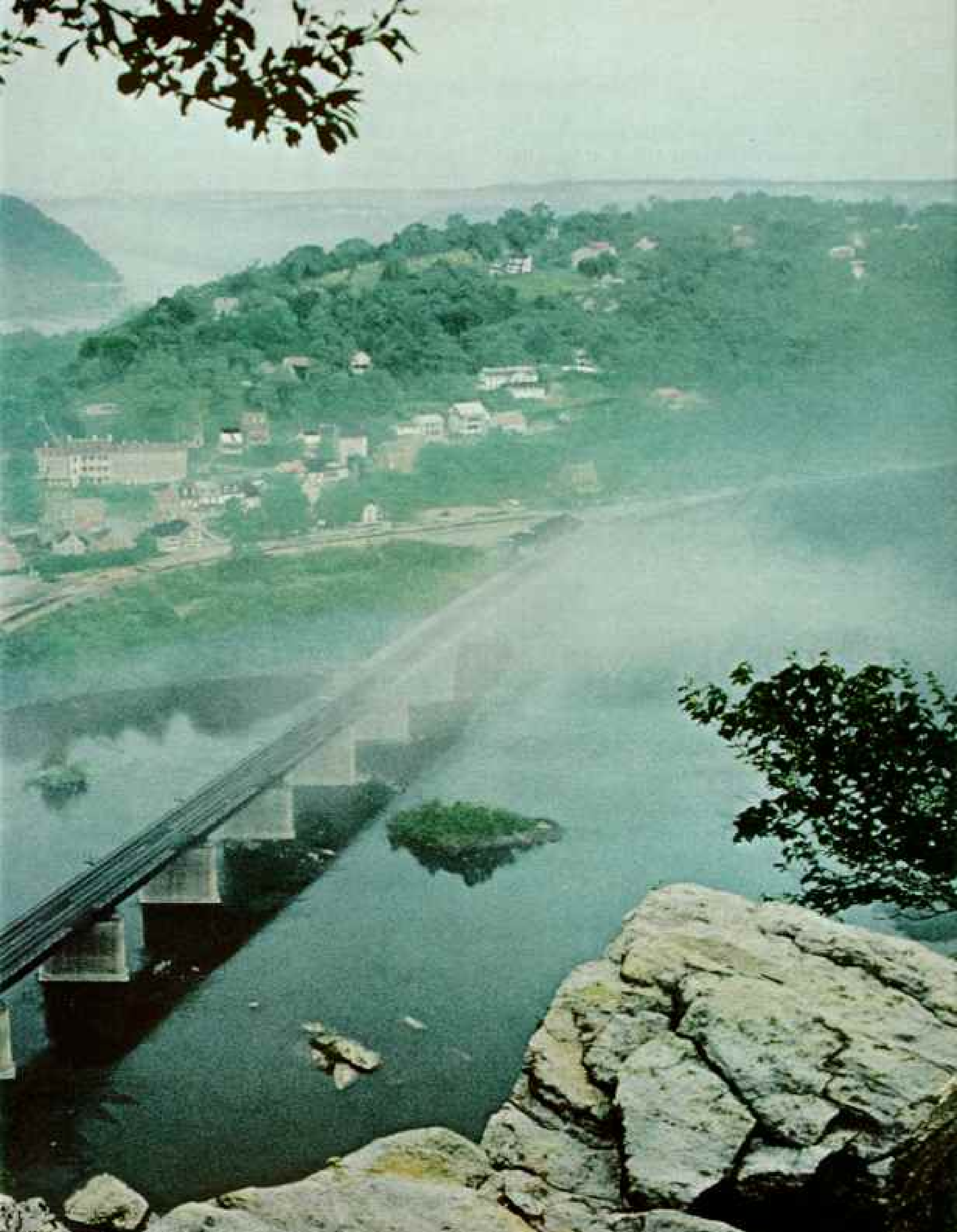
Wandering past the town of Shenandoah, the South Fork enters Page Valley, between the steep flanks of Massanutten Mountain and the Blue Ridge. Jackson played tag with Union forces along this part of the river and around Massanutten in the Civil War.

In a 3½-month campaign that has fascinated military strategists ever since, he marched the length of the valley three times. He struck the Federals at Kernstown, McDowell, and Front Royal, chased them out of Winchester, and thrashed them when they followed him to Cross Keys and Port Republic. His rapid maneuvers and stunning blows tied down more than 60,000 of the enemy, while a Union army before Richmond awaited reinforcements. But Jackson's 17,000 men slipped away to Richmond instead.

The North Fork, after tumbling down from



"Worth a voyage across the Atlantic," wrote Thomas Jefferson of the vista at Harpers Ferry, West Virginia. Here at the valley's northern tip, waters of the Shenandoah, left, rush to join the Potomac. Near the point, they eddy around piers of two destroyed bridges,



PHOTOGRAPHS BY MARIUS L. LOPEZ, NATIONAL GEOGRAPHIC STAFF © N.G.S.

a Shenandoah span swept away by a flood in 1936 and a Potomac trestle traversed by John Brown's raiders in 1859. Baltimore & Ohio trains use the two existing bridges. The National Park Service has restored many of the buildings in the historic riverside town.

the lofty ridges of its birth, passes through pastures near Broadway where in the 1700's lived a family named Lincoln. Two Lincolns, father and son, moved to Kentucky in the van of Shenandoah pioneers peopling western lands. The younger, named Thomas, was Abraham Lincoln's father. The Lincoln family cemetery, nearly overgrown with thistles, lies on a hillside above Linville Creek.

The first sizable town along the North Fork is New Market, founded by another pioneer, John Sevier. He later helped found something larger, the State of Tennessee.

On the hills north of town, dignitaries will gather next month to dedicate a new Hall of Valor, a million-dollar museum on the site where boys marched into battle in 1864. In one of the Civil War's more incredible tragedies, 257 cadets of Virginia Military Institute (page 584) were brought up from Lexington and thrust into the war because, simply, there was no one else. Three were not yet 16 years old. When the shooting stopped, 10 lay dead or dying and 47 had been wounded.

The North Fork has a hard time working around Massanutten to join its sister river. Between Woodstock and the mountain, it sweeps grandly through seven horseshoe bends. Finally reaching Front Royal, the North Fork joins the South Fork, and the augmented stream rolls into West Virginia.

At Harpers Ferry, where Washington prevailed upon Congress to establish an arsenal that John Brown later raided,* the Shenandoah joins the Potomac for a rocky plunge through the Blue Ridge. Thomas Jefferson thought a view of this convergence worth a trip across the Atlantic (preceding pages).

Elegant Washington Homes Survive

Of all the valley's historical figures, Washington looms greatest, and seven homes of his kin stand in and around Charles Town. Dolley and James Madison were married in Harewood, built by George's brother Samuel. His brother Charles built Happy Retreat in the town that bears his name.

Most elegant of all the Washington homes, Blakeley and Claymont Court regally face each other on hilltops a mile apart. George's grand-nephews, John Augustine and Bushrod Corbin Washington, who married sisters, built them in 1820.

*See "History Awakens at Harpers Ferry," by Volkmar Wentzel, NATIONAL GEOGRAPHIC, March 1957.

I was struck by the contrast between these homes and the rude frame building at Winchester which, legends claim, served Washington both as a surveyor's office and as a command headquarters in the French and Indian War. Winchester preserves this humble relic as a museum.

The building was even humbler in Washington's day, Mrs. Frances Hobbs, the hostess, told me. "There are three rooms now, but in the 1700's there was only the middle one."

We measured it: 13 by 17 feet.

"Of course, no one on the frontier had much furniture to take up space," Mrs. Hobbs said.

Young Colonel Develops an Iron Will

Attempting to defend Virginia's frontier from the Potomac to North Carolina, Washington knew dire frustration in Winchester. Shortages of munitions plagued him. Indians easily avoided his scattered forces, scalping settlers in isolated cabins and then vanishing. Desertions thinned the ranks of the militia under his command.

Washington in desperation gave deserters the sternest justice. When courts-martial ordered two deserters shot, Washington hanged them instead, pointedly assembling his troops to watch.

Then the 25-year-old colonel wrote Governor Dinwiddie: "Your Honor will, I hope, excuse my hanging instead of shooting them. It conveyed much more terror to others. . . ."

In time, Washington brought a semblance of order to his command. If his men did not win victories, they at least kept the Shenandoah from being overrun. For the young commander, it was ideal training for the bitter days at Valley Forge.

Before leaving the Shenandoah in 1758 to take up the life of a planter at Mount Vernon, he got a taste of politics, winning a seat in the House of Burgesses.

"Washington's greatness as a general did not lie in his brilliance in winning battles," my friend Dr. Quarles remarked as we talked at Winchester one day. "He had an iron will, and that was what kept the Continental Army together in the Revolution. That will was developed right here on the frontier."

As I visited the numerous Washington landmarks in the beautiful and bustling Shenandoah, I thought again and again of Ben Belchic's words: "There's a lot of history behind, and a lot ahead."

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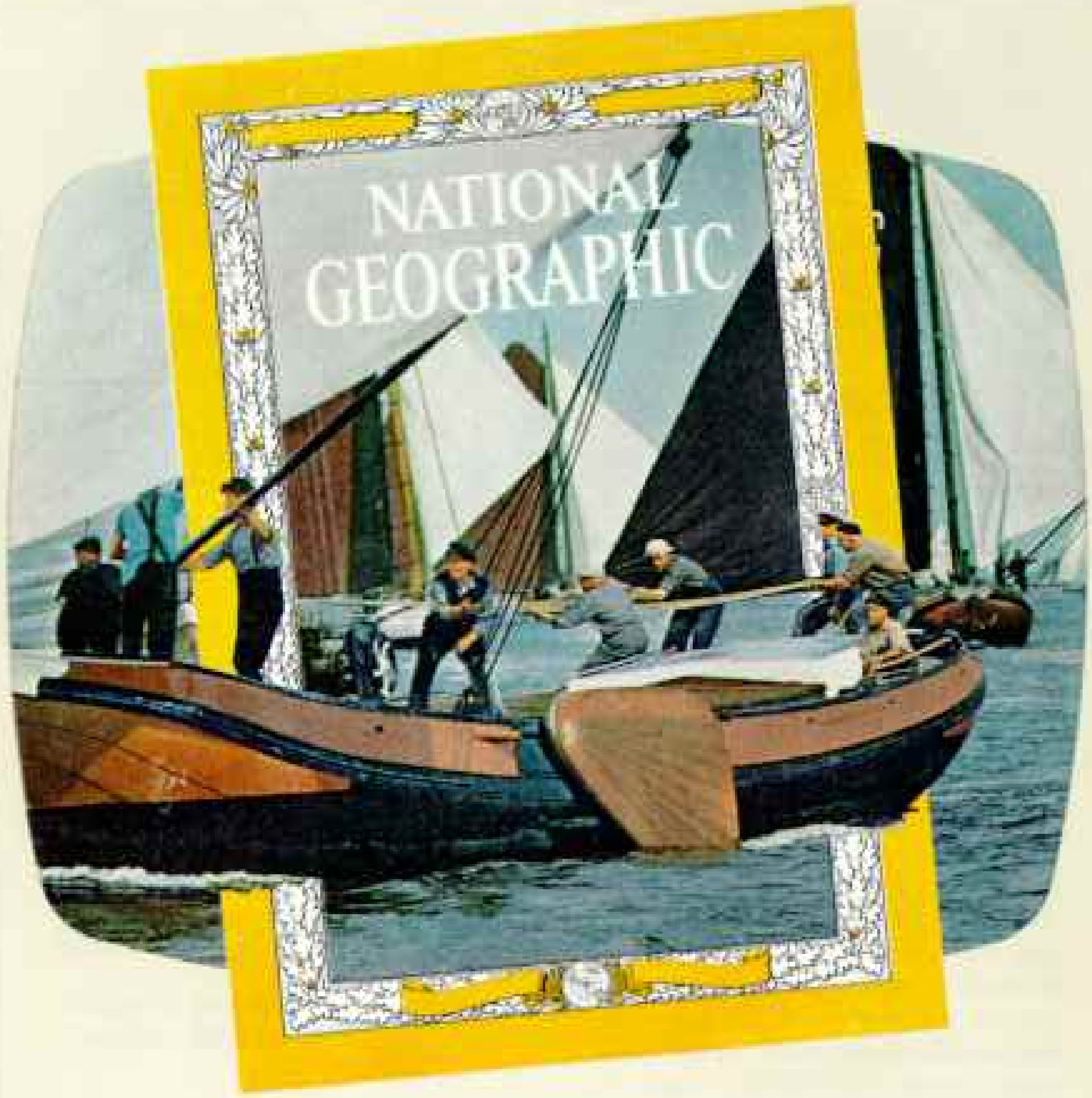

Holland Against the Sea

SEE IT IN COLOR, TUESDAY, APRIL 14

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Watery world of the dauntless Dutch

HIGH TIDES churned by gales smashed dikes in the winter of 1953, and rampaging waters invaded the Netherlands, claiming 1,800 lives. Reeling but resilient, Hollanders created the colossal Delta Project, a masterwork of defenses designed to shut out the sea forever. Their incredible accomplishments unfold on your television screen on Tuesday, April 14, when National Geographic presents "Holland Against the Sea," final documentary of its 1969-70 TV series.

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Weaving supple willow shoots, polderboys fashion a mattress that will shield a dike from the scouring sea.

Waterway and windmills symbolize the Netherlands.

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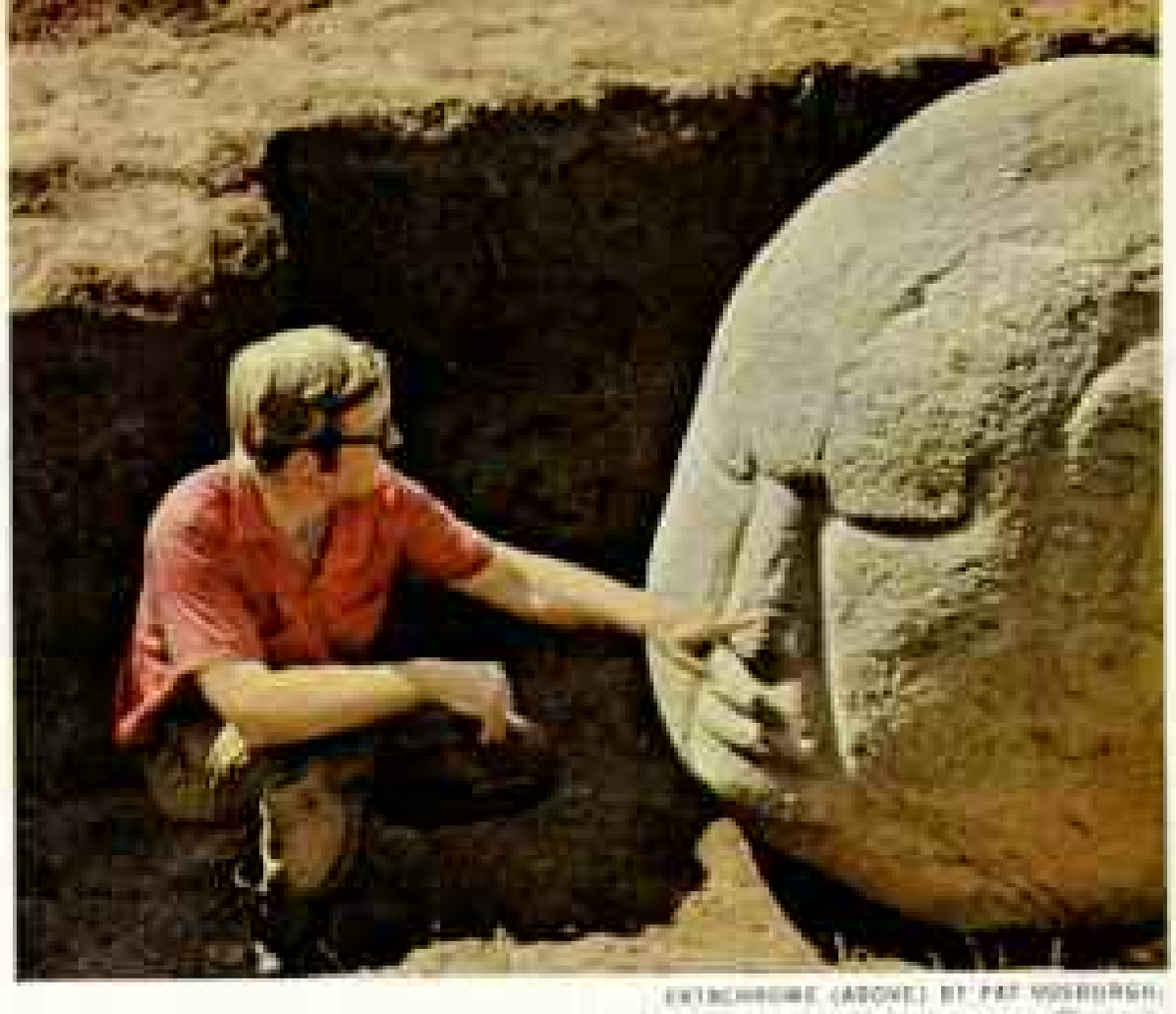
GLOWERING stone head sees the sun once more at Monte Alto in southern Guatemala, where a little-known culture flourished nearly 2,500 years ago. National Geographic Society expedition leader Dr. Lee A. Parsons, Curator of Collections at the Peabody Museum of Archeology and Ethnology, Harvard University, studies the four-foot-high monolith. This and eight other giant sculptures—three heads, four full-figure boulders, and one large cat-monster—have been found by natives of the area. Dr. Parsons's team unearthed one more head and a mammoth full figure.

Another exciting find, a green soapstone mask (right center), came to light amid a cache of funerary urns. Since the mask predates the urns by as much as a thousand years, Dr. Parsons believes later occupants of the site may have reburied it.

He and his associate Edwin M. Shook hope to learn how this culture relates to the Olmecs, a Gulf Coast people who created similar stone heads. Your friends will welcome a chance to help support such exploration into man's past and to read the results in NATIONAL GEOGRAPHIC. Nominate them for Society membership on the form below.



EXTACHROME (ABOVE) BY PAT ROBBURGH
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You Don't Play "Beat The Clock."

A TWA un-guided tour is based on the idea that a person whose life runs by the clock all year long doesn't want a vacation run by the clock.

So we let you make your own schedule, with nobody telling you what to do.

Alone, But Not Lonely.

On such a tour, you'd be alone without being lonely. Because we've arranged for people to give you advice in every city. They can give you directions, tell you where to get a good meal, or help you rent a car.

The Law Of The Bus.

One of the things people remember about our un-guided tours is how they discovered places on their own. For instance, you might get on a bus and stay on until the end of the line. This is a perfect opportunity to meet the local people and practice the sentences from your phrase book. To get back, use the *law of the bus:* if you stay on long enough, it goes back to where you started.

A Typical Un-typical Day.

If you were in Rome you could take the CD bus (at the Piazzale Flaminio) to the Flea Market in Trastevere.

After you work up an appetite from bargaining, you could eat at La Cisterna, Alfredo's (their Fettuccine Al Burro is a knock-out), or Corsetti's.

Later on, you might like an evening of dancing at Cabala, if your feet hold out.

Cheaper Than You Think.

You can see these fancy places without paying fancy prices. A typical two-week TWA Bonus Adventure to Lisbon, Madrid, Rome, and Paris starts at $499.* Which includes air fare to Europe and between cities, hotels, private bath, breakfast, and the advice of a local host.

Of course, TWA has other tours that go all over the world. Your travel agent can help you decide which one suits you best.

By now, it should be obvious that a TWA un-guided tour is the best way to see Europe.

After all, people on vacation should have the freedom to see what they want to see, whenever they want to see it.

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with a big assist from Mazola.

The new Mrs. Warner is determined that her husband is going to be as happy as she can make him—and as healthy. She knows that more and more medical authorities insist that the average American diet is unbalanced, and she's following their recommendations when it comes to feeding her husband.

She watches his calories and makes sure he eats fewer fats. And she uses polyunsaturated vegetable oil instead of solid fats wherever she can.

And the oil she uses is Mazola® 100% Corn Oil.

Why Mazola? Because of all the leading national brands, Mazola is highest in polyunsaturates.

Mind if we say that again? It's important. Of all the leading national brands, Mazola is highest in polyunsaturates.

So to Mrs. Warner, only Mazola is good enough for her Bill—and more than worth the few extra pennies it costs.

P.S. She uses Mazola® Margarine, too. It's made with liquid Mazola Corn Oil.

Best Foods A Division of CPC International Inc. cpc

Five years ago we brought you a camera that takes the guesswork out of fine photography.

You made Honeywell Pentax a classic.

Only continuing acceptance by discriminating users can make a product a classic.

Most products—even those in the higher price range— depend on "cosmetic" changes to maintain appeal. How many fine watches, automobiles—or cameras—can you name that are so inherently superior they maintain leadership with essentially their original design?

The Honeywell Spotmatic that "took the guesswork out of fine photography" when it was introduced five years ago, is still the world's best-selling fine camera.

And this classic hasn't rested on its laurels. Inside, the Spotmatic has been improved and refined. A total of more than 140 modifications have been made since its introduction. These subtle, but significant, changes provide even greater perfection and satisfaction in use.

The "classics" have one thing in common: Simplicity.

Operating the Spotmatic is simplicity itself. There is so much professional know-how built into the Spotmatic that it has been called the computer camera. This means you're free to concentrate on subject matter and composition. Whether you're an advanced hobbyist or a beginner, Spotmatic makes you a better photographer than you thought you were.

Perfect exposure every time.

Unlike other built-in metering systems, the Spotmatic meter measures the light through the taking aperture of the lens. It reads the light from the *in-focus* image on the ground glass, which corresponds *exactly* to the image at the film plane. With Spotmatic, you see what you get...and you get what you see. Perfect exposures, every time.

You can feel—even hear—the difference!

Visit your Honeywell photo dealer and get the feel of a Pentax. So classicly functional, it feels as if it were made just for your hands. Aim it. You'll see how easy it is to control the diaphragm ring and center the exposure meter needle without removing your eye from the viewfinder. Cock it. Snap it. Listen to the shutter. Compare the sound to other cameras—the professionals instinctively judge camera quality this way.

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Your precision Spotmatic will take a lifetime of fine photos. And there are 27 superb, matched Takumar lenses to help you keep growing, photographically.

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*Honeywell Pentax in the U.S. and Mexico; Asahi Pentax elsewhere.

Honeywell

The fry pan has egg on its face.

The steam pot is half-baked.

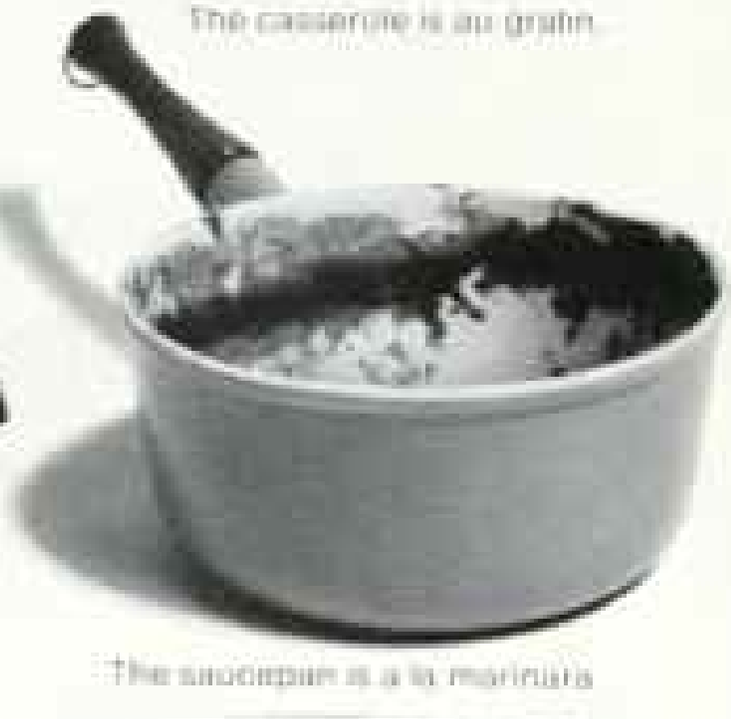
The casserole is au gratin.

The oven racks are mighty fine.

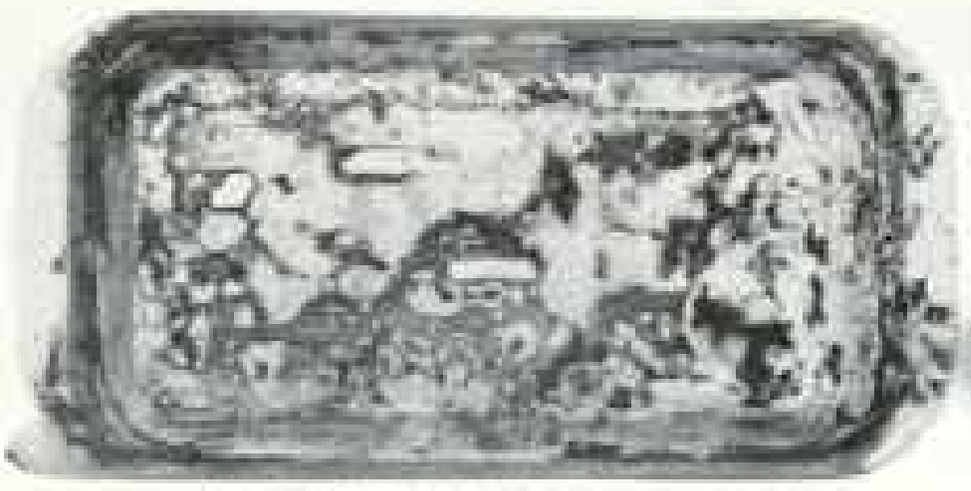
The soufflé dish didn't finish its spinach.

The roaster sticks to meat and potatoes.

The Angel Food tin looks like the devil.



The saucepan is a la marinara.



The baking pan has leftover meat loaf.

The pie plate has its crust.

Your pan handling days are over.

If you get a KitchenAid dishwasher with the automatic Soak Cycle.*

It soaks pots and pans automatically, and keeps them out of the sink and your hands out of the soapsuds. Load it up with pots, pans, dishes, glasses, silverware. Fill both sides of the dual detergent dispenser, and push the Soak Cycle button. Everything will sit and soak, and then get washed, rinsed and dried automatically.

You'd never know you had eggs for breakfast, spaghetti for dinner and Angel Food cake for dessert.

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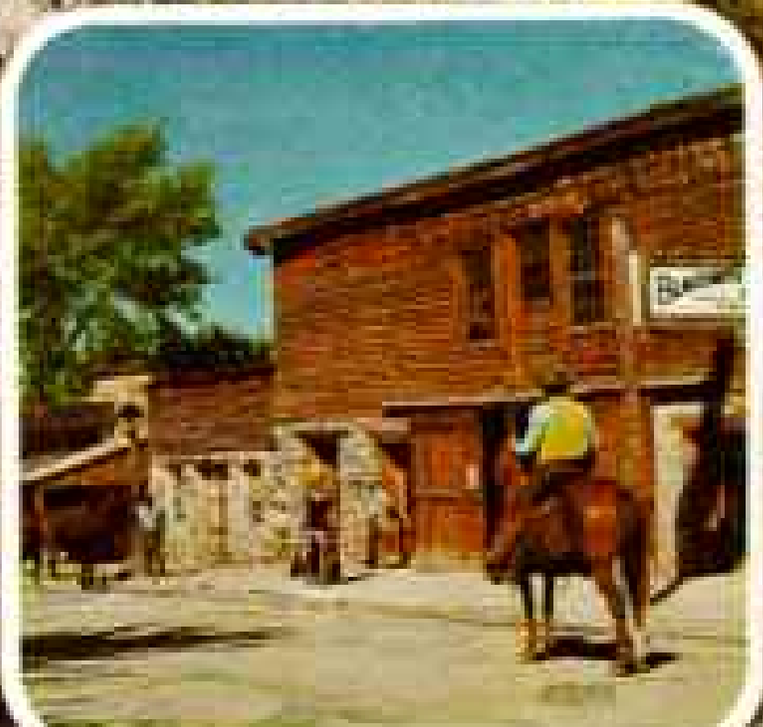

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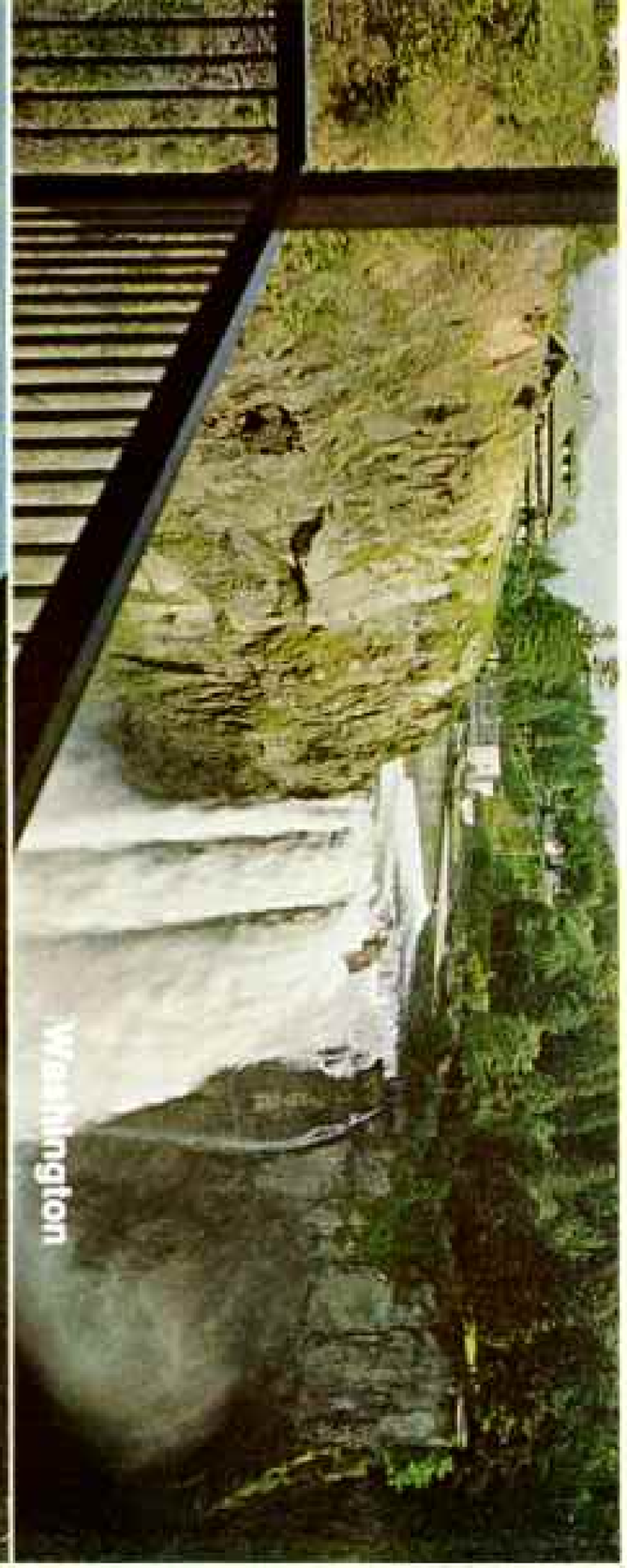

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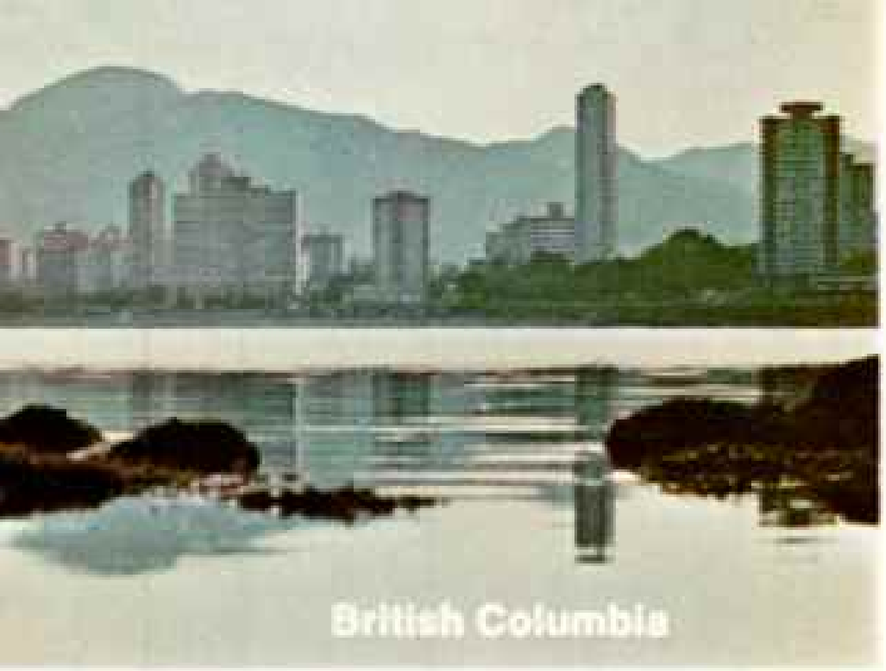
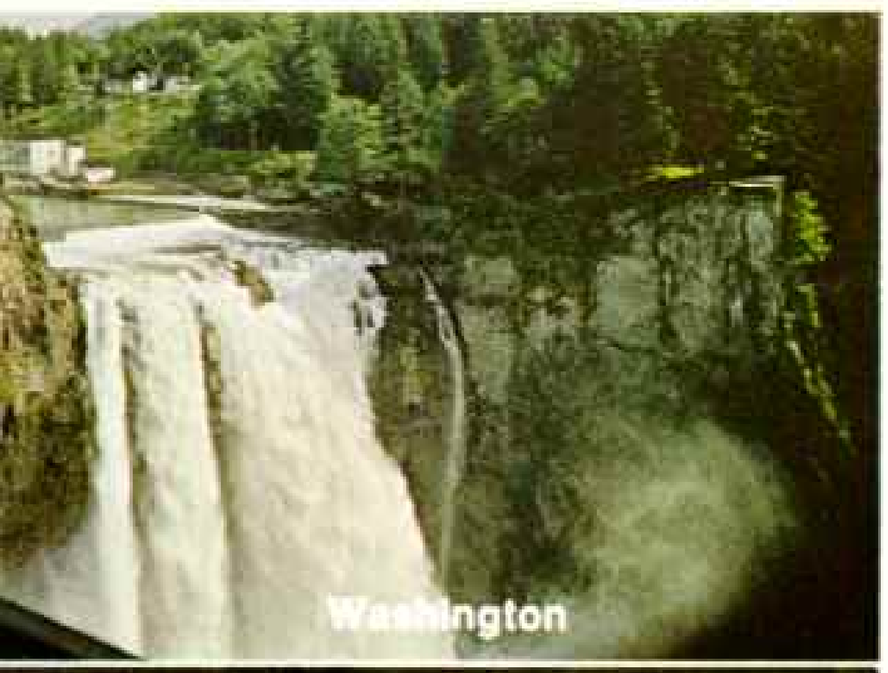


in the great, green Pacific Northwest



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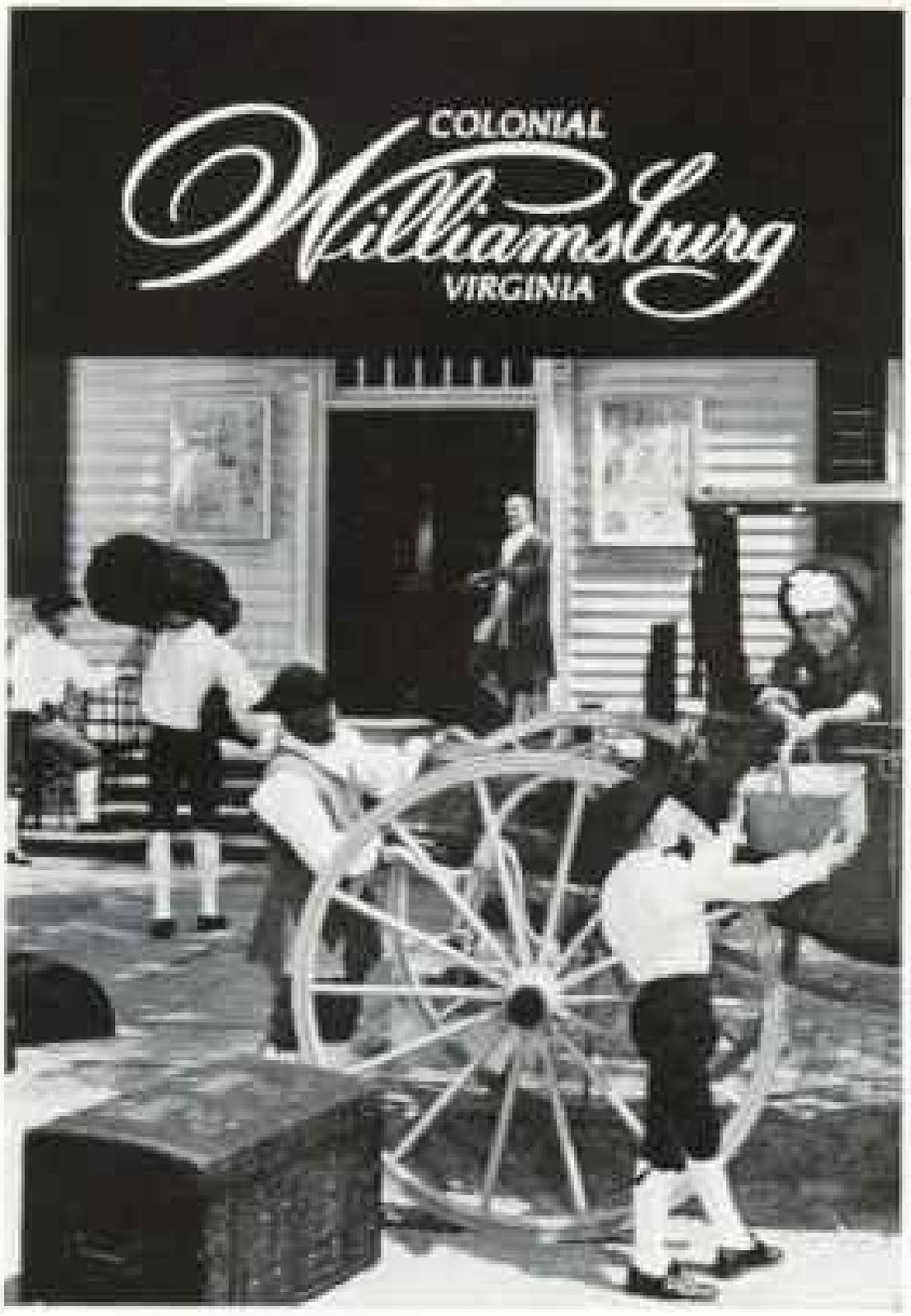

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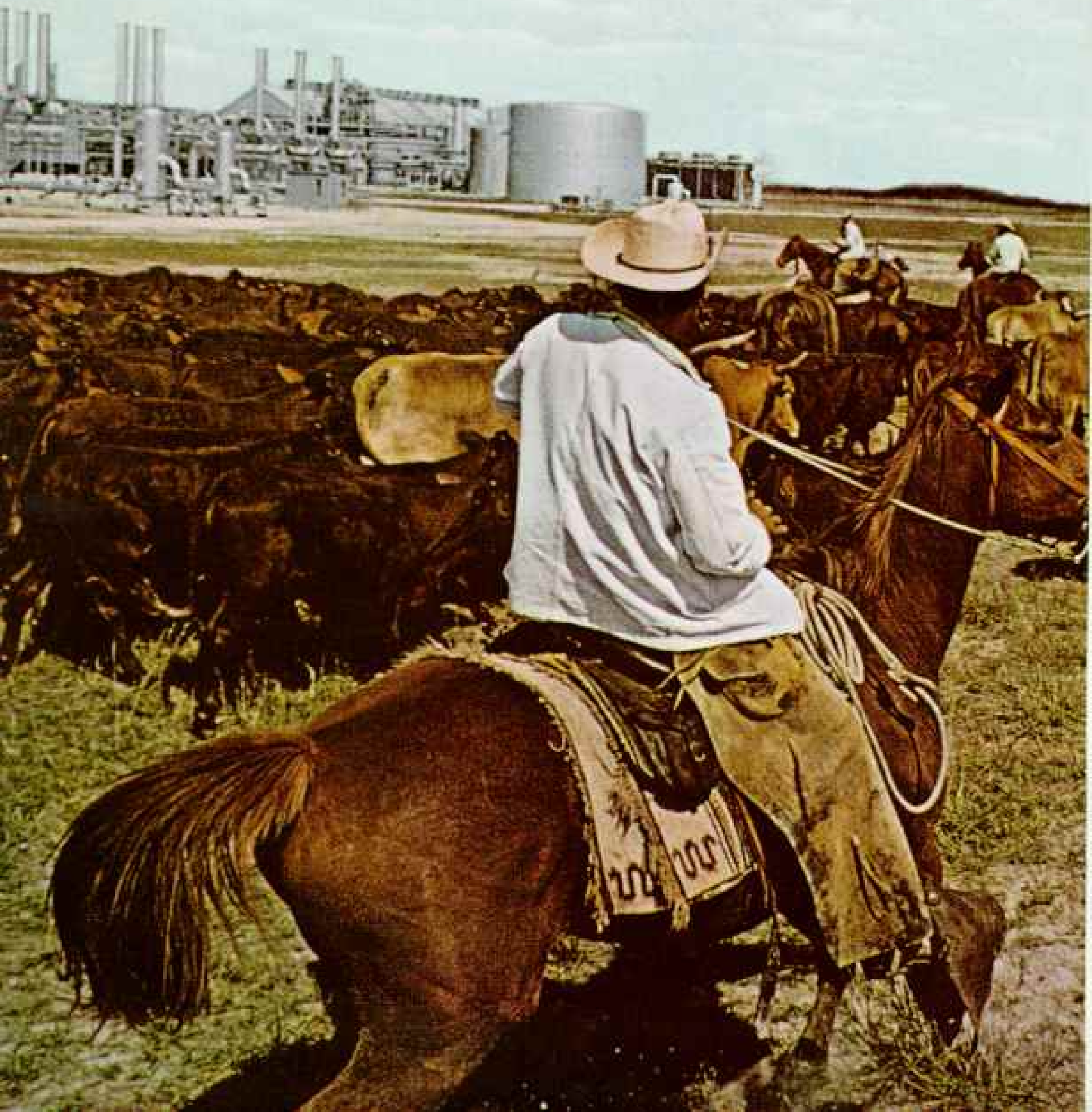
There are schools and stores and fire stations. Five hundred cowboys. Two thousand cow ponies. A training track for race horses. And five hundred miles of private road. Yet there is more wildlife on the ranch today than ever before in its history.

We, at Jersey, believe this last fact proves something about our affiliate, Humble Oil & Refining Company. Good housekeeping.

They have been drilling for oil and gas on the ranch for forty-five years. If running an oil field were the noisy, messy business some people think it is, how come wild geese, wild turkey



the King Ranch.

and bobwhite quail elect to stay and multiply by the thousand?

If pipelines and gas plants pollute the water, how come deer, nilgai and javelinas guzzle it? And thrive.

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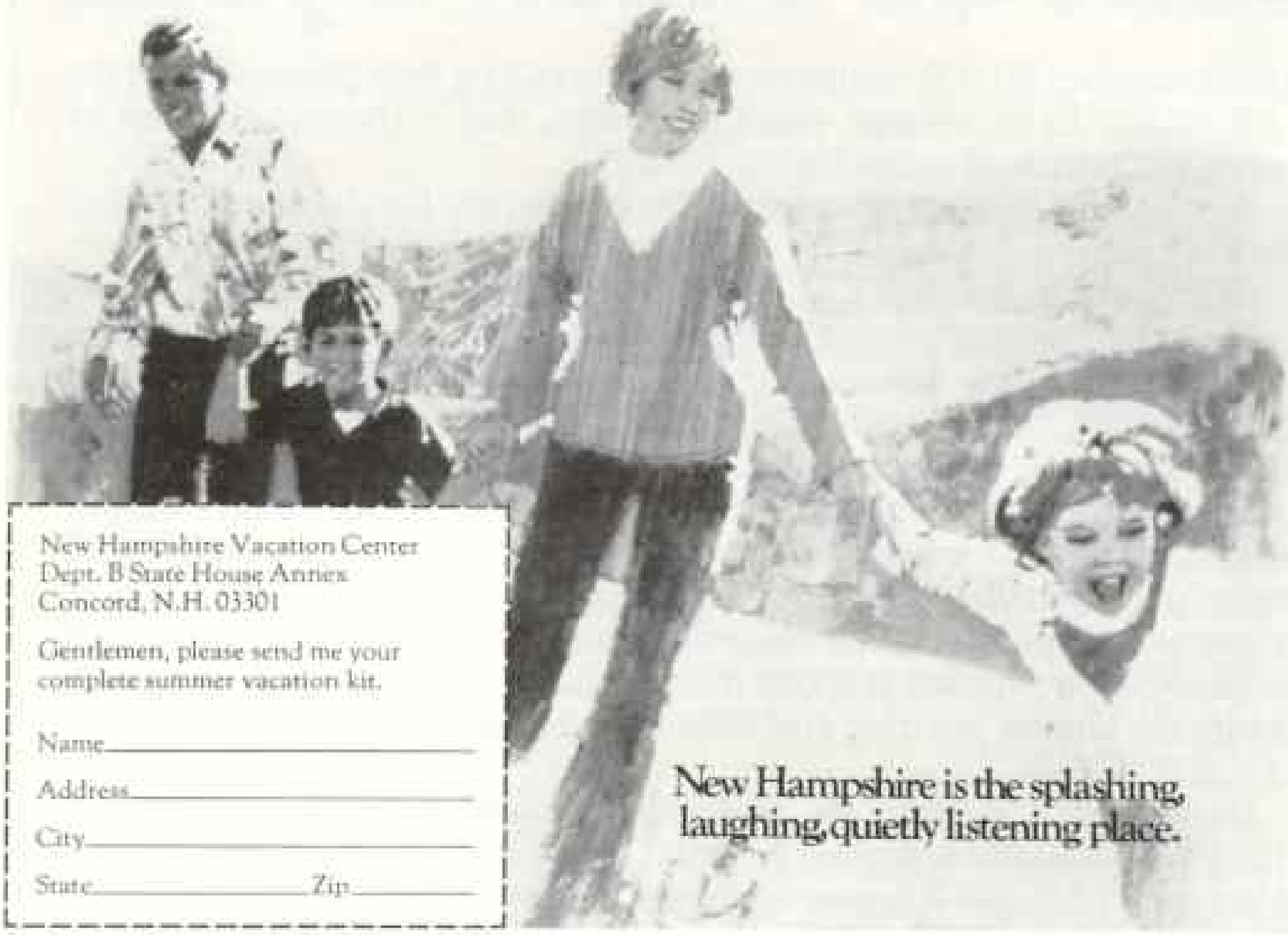

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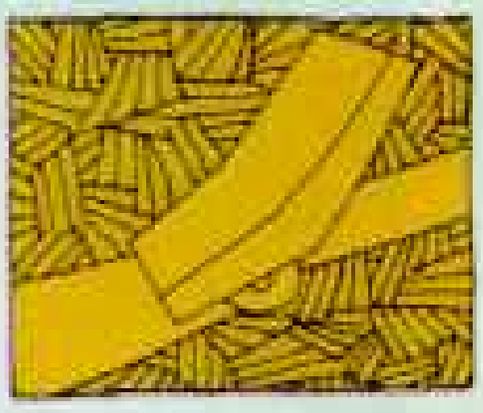

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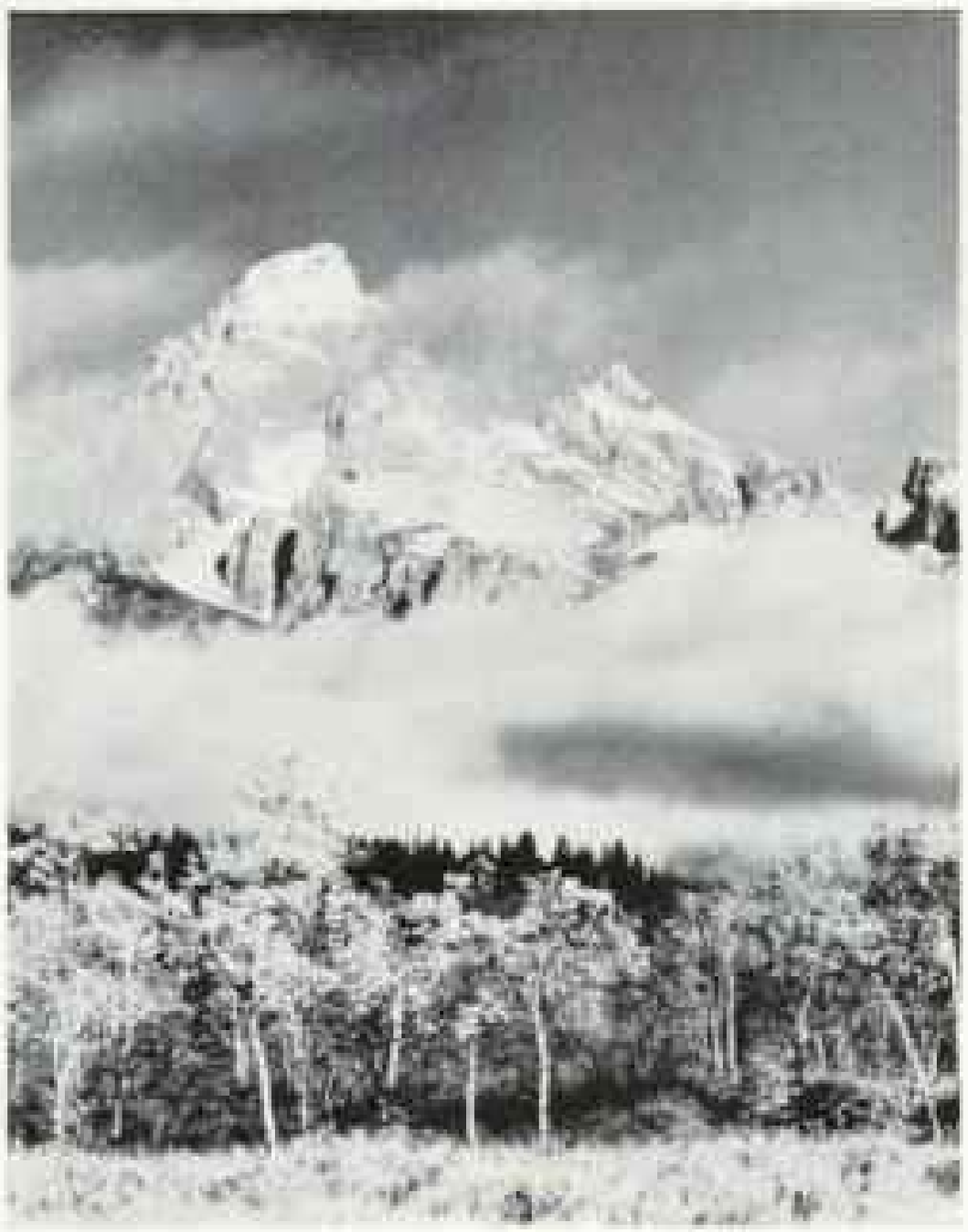

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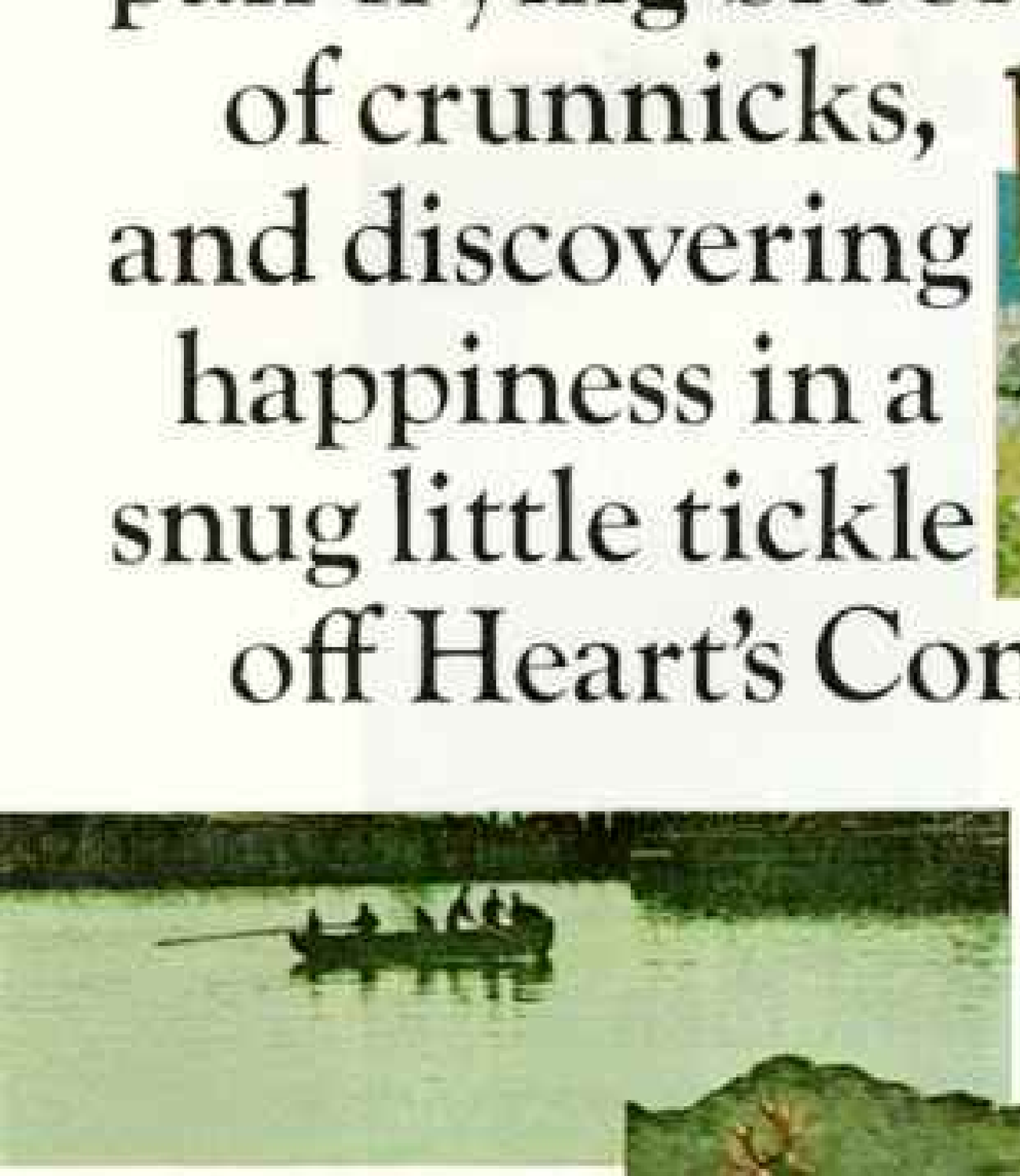

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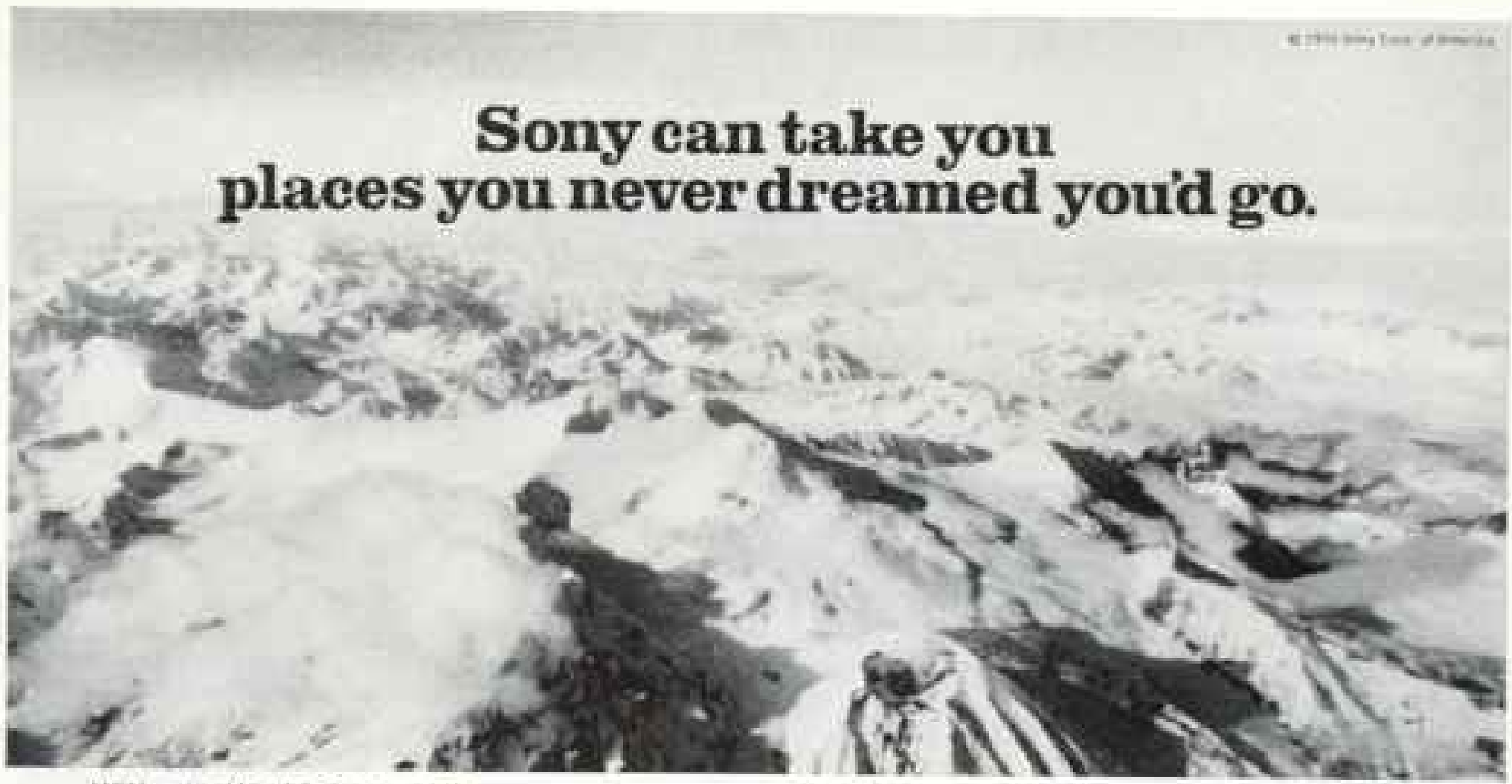

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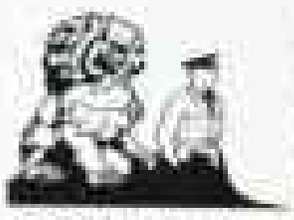
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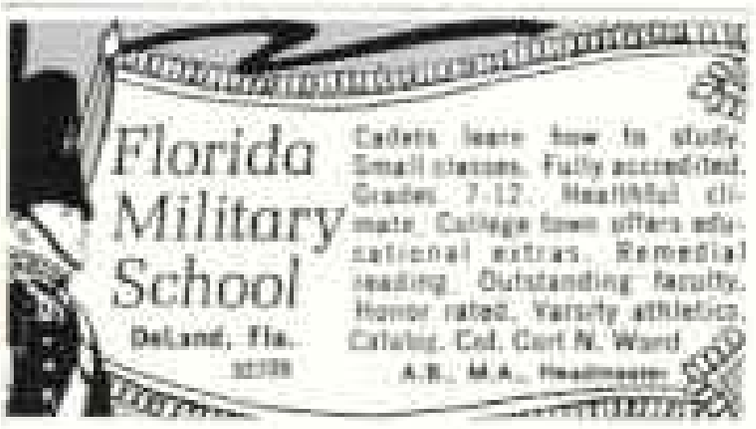

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