VOLUME XCI NUMBER FIVE

THE NATIONAL GEOGRAPHIC MAGAZINE

MAY, 1947

South Dakota Keeps Its West Wild
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"Flying" Squirrels, Nature's Gliders
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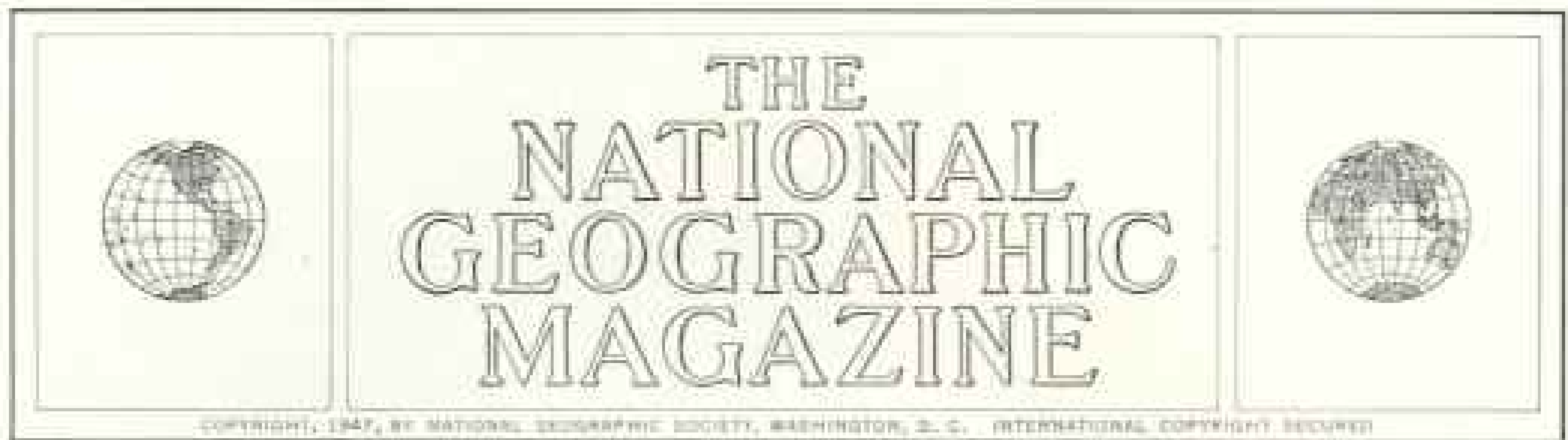
Forty Pages of Illustrations in Color

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D.C.

$5.00 A YEAR 50c THE COPY

Vol. XCI, No. 5 WASHINGTON May, 1947



South Dakota Keeps Its West Wild

By Frederick Simpich

With Illustrations by Staff Photographer J. Baylor Roberts

WHEN Horatio N. Ross struck gold in the Black Hills in July, 1874, he started a rush that turned this South Dakota land from an Indian domain into white man's country.

Miners poured in even from Mexico and Australia, and New England clerks quit their jobs to hurry out there, many only to be killed and scalped by Indians. Few parts of our then wild West saw more frontier turbulence.

To this day, the average action-loving South Dakotan would rather rope a steer or break a bronco than stay cooped up in a house. With all its hunting, fishing, summer camps, roundups and rodeos, the State still reflects something of that blithe, boisterous spirit which marked its audacious youth.

Straddling the swirling Missouri and stretching west from Iowa to share the Great Plains with windy Wyoming, venturesome South Dakota still woos the gods of chance. But today it bets on the weather and not on the cards, as in the noisy Deadwood gold-camp days of Poker Alice, Wild Bill Hickok, and Calamity Jane (page 557).

Today it's the farmer who is the gambler. If it rains, he hits the jack pot. But in dry years he may lose his shirt.

Farming is the State's biggest business.

Heroes in Granite

But last season's horde of visitors didn't flock into South Dakota just to watch men plant corn or thresh wheat. Many came, or stopped off when on trips to the Yellowstone country, to see that colossal shrine of democracy, the Mount Rushmore National Memorial (Plate IX and page 556).

Here rise the stern stone faces of four Presidents—Washington, Jefferson, Lincoln, and Theodore Roosevelt—carved from a high granite peak by sculptor Gutzon Borglum.

Visible from the air for sixty miles, eternal through wind, fire, and earthquake, these giant images profoundly impress even the frivolous. Washington's aristocratic face is 60 feet long; his eye is so big a man may sit in it.

From platforms at the mountain's foot, spectators study the giant heads through binoculars set on swivels. Whatever their thoughts, some sit and stare for silent minutes.

To others this great sculpture recalls that heroic figure of Darius at Persepolis or the winged bulls of Nineveh.

I wanted Washington to open his tight stone lips and start giving his famous Farewell Address.

I thought, too, that a fine elocutionist such as movie actor Charles Laughton, or Maurice Evans the Shakespearean, should go up there and make a radio broadcast of Lincoln's Gettysburg Address, or read the Declaration of Independence through Jefferson's stone mouth, by Nation-wide hookup on July 4th.

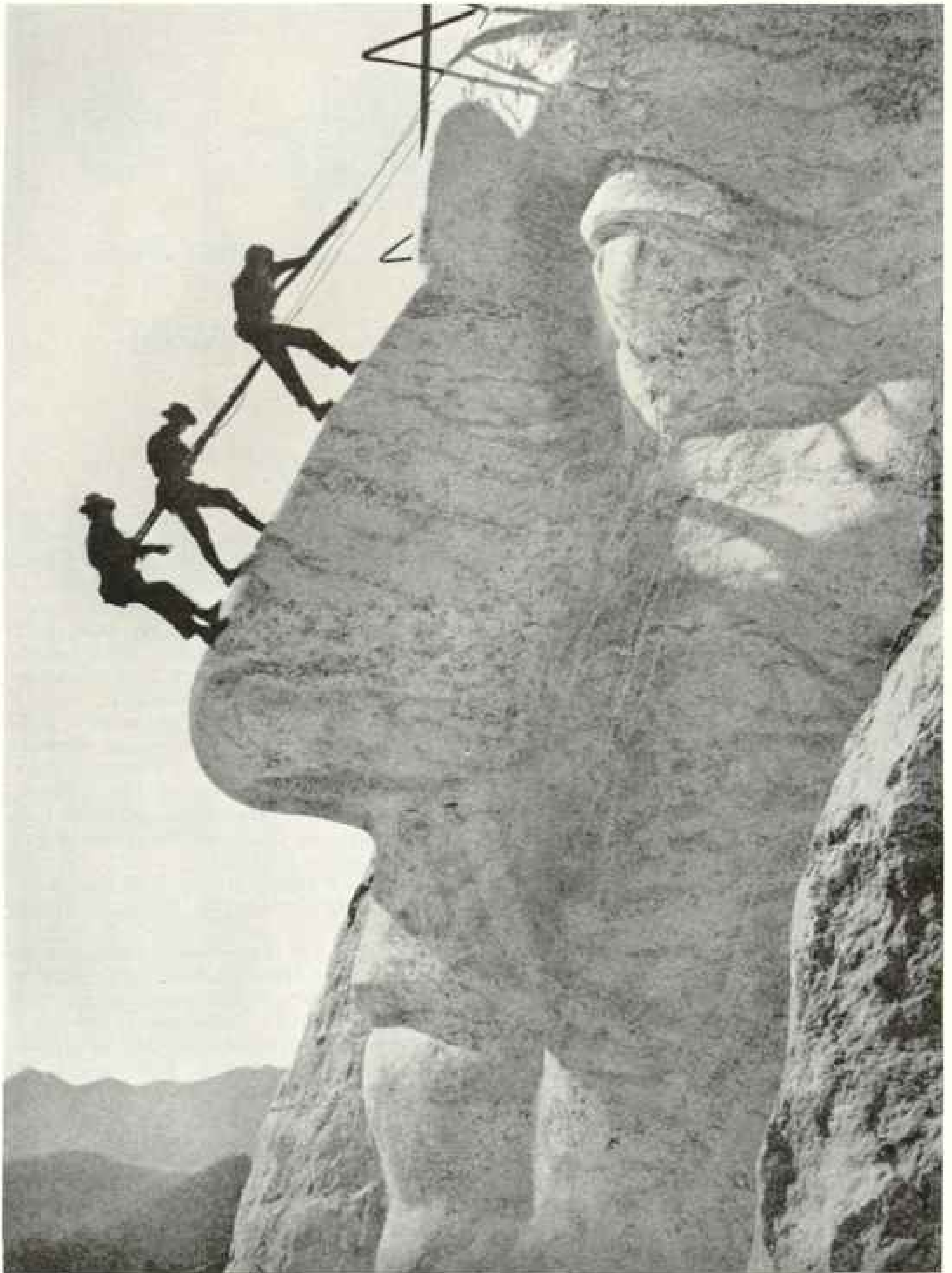
Black Hills a Museum

The Black Hills are like a great museum—what to see next! *

There's Deadwood! Prowling the night spots of this once-gambling, gun-fighting gold camp brings a vicarious fling of sporting life to many.

I know lovers of western history who drive

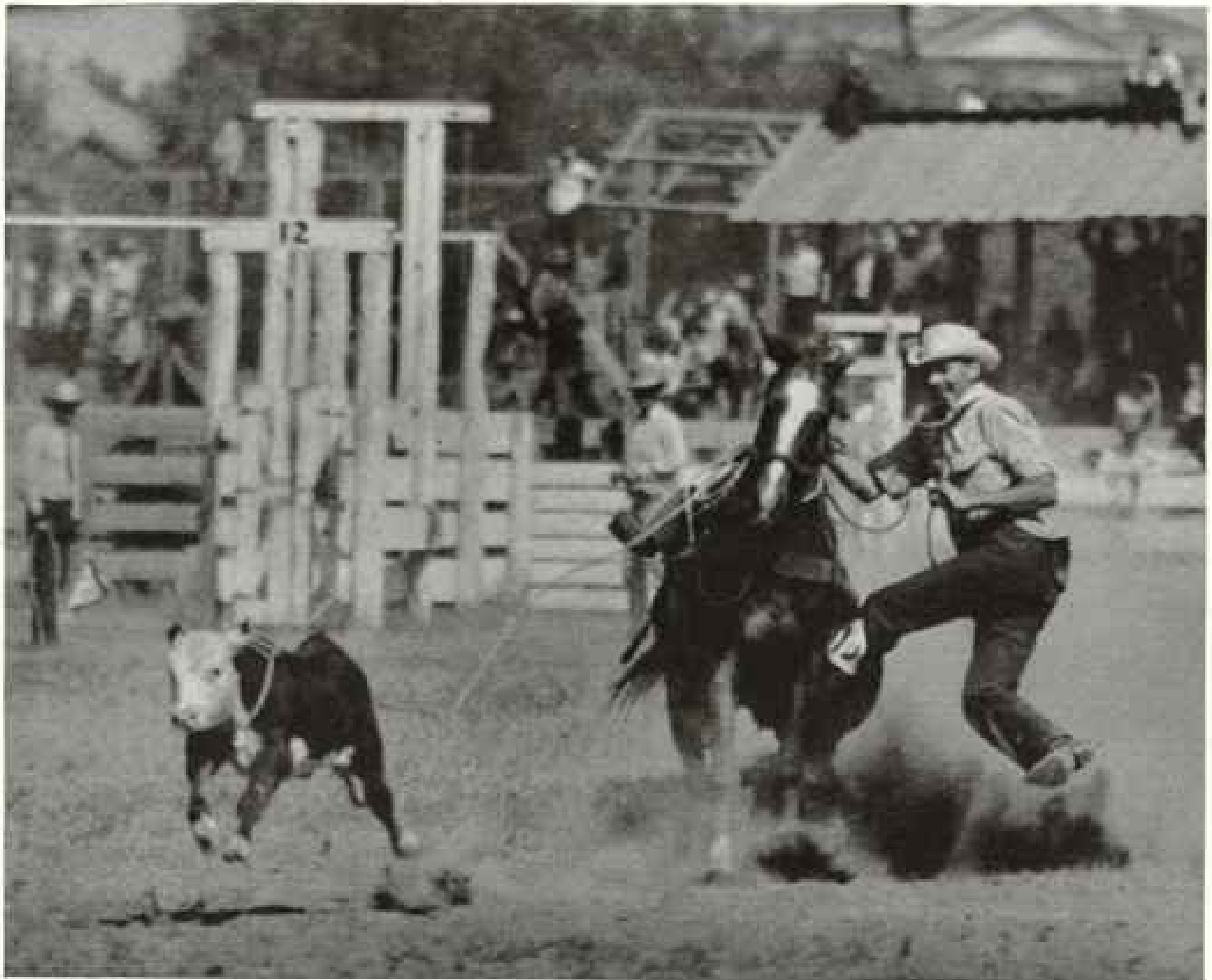
* See "Black Hills, Once Hunting Grounds of the Red Men," in the National Geographic Magazine, September, 1927.



W. L. Highton

Like Human Flies on a Skyscraper, Stonecutters Tickle the Cold Stony Nose of Washington

Across the granite face of Mount Rushmore, in the Black Hills, sculptor Gutzon Borglum (lowest of the climbing figures) carved giant heads of Washington, Jefferson, Theodore Roosevelt, and Lincoln (Plate IX). In thousands of years, it is estimated, wind, water, frost, and sun will erode the faces only a fraction of an inch.



This Remarkable Shot Shows Man and Calf with All Feet off the Ground

Rider here has just roped his calf and is leaping off to tie it. The trained cow pony slides to a stop on his haunches the moment he sees the rope settle over the calf's head. This stops the "dogie" with a jerk, and the horse holds the rope tight while the rider runs forward to secure it. Rodeo at Belle Fourche, Black Hills.

halfway across the continent just to see Deadwood's annual "Days of '76," wherein Jack McCall again kills Wild Bill Hickok and is tried by a kangaroo court. Deadwood's talented presentation of *The Trial of Jack McCall* has already run for years and still it packs them in!

One night I got a summons to sit on that McCall jury. I heard Calamity Jane testify; later she showed me some of the notorious old gambling places, and I met a man who knew the real Calamity (Martha Jane Burke).

She was in turn bullwhacker, Army scout, and brawling virago; but when smallpox laid Deadwood flat she became ministering angel to the sick and dying, and when she was buried here on Mount Moriah, beside other characters famous in early Black Hills history, thousands crowded to hear the preacher praise and bless her.

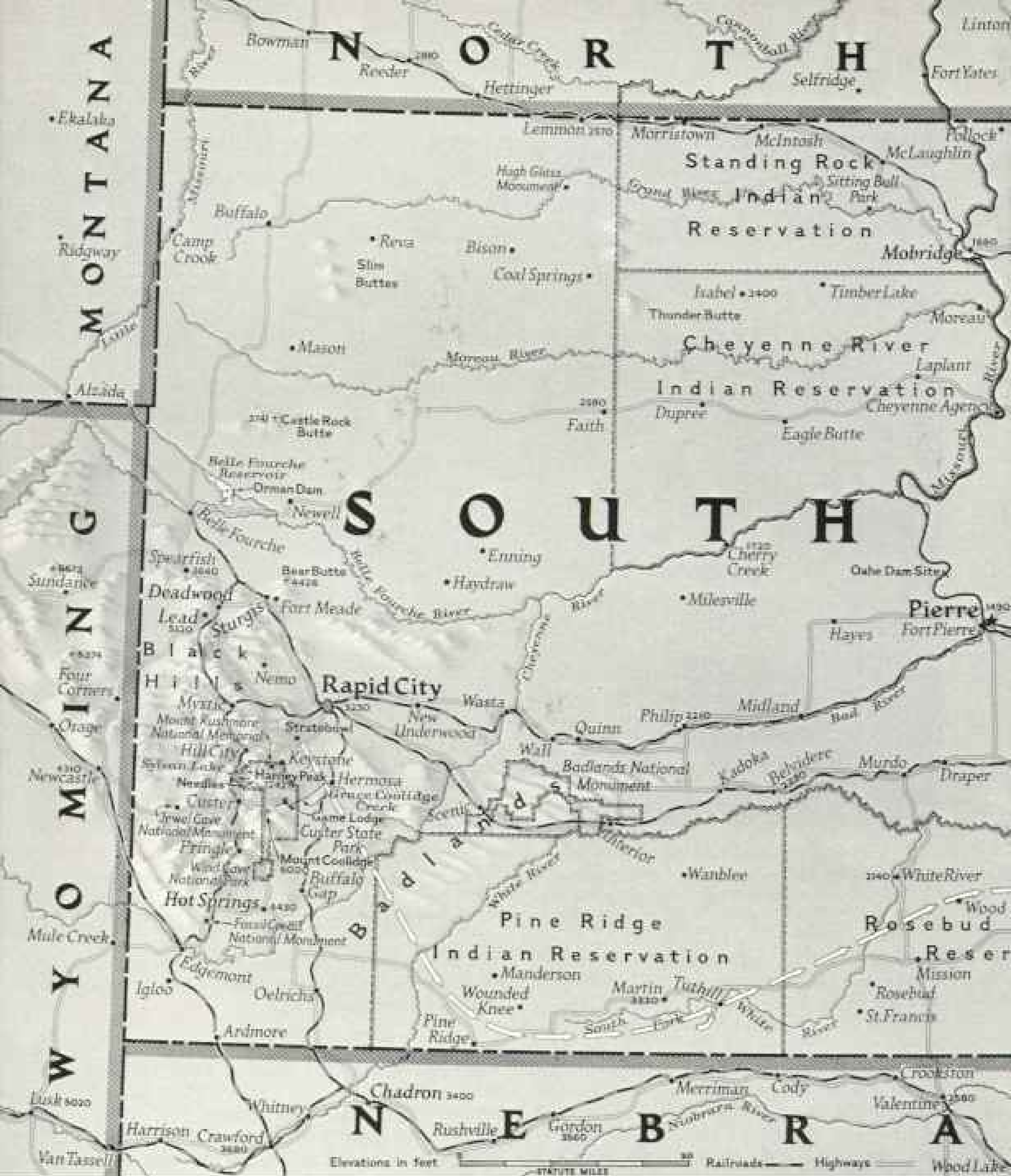
If you prefer speleology to gold-camp phantoms, you can take the trails down into the cool depths of Wind Cave. It charms geologists, and is fine for lovers who fain would steal a subterranean kiss!

A Noisy Gold Mine

Beneath the hilltop town of Lead lies the richest gold hole in the Western Hemisphere, historic Homestake Mine (pages 561, 574). From it has come more than $400,000,000! Exploring it is a trip through treasure dens of Ali Baba. In a flying cage we dropped nearly a mile so fast our ears popped.

Away down here, unsuspected by visitors riding over paved roads far above, is a subterranean highway system—80 miles of railroad, with tiny coaches drawn by compressed-air engines—whistles, headlights, switches, engineers, stations, main lines and spurs!

Bang! It sounded loud as a 16-inch gun. I never knew a gold mine could be so noisy. "That's just a blast," they said, "to shake loose more ore."



Down a long chute, making still more thunder, came tumbling tons of loose ore, to be dumped into bins and hauled up to the stamp mills on the surface.

Cables, long, slick, and greasy-looking, run over giant drums which revolve smoothly at each shaft mouth.

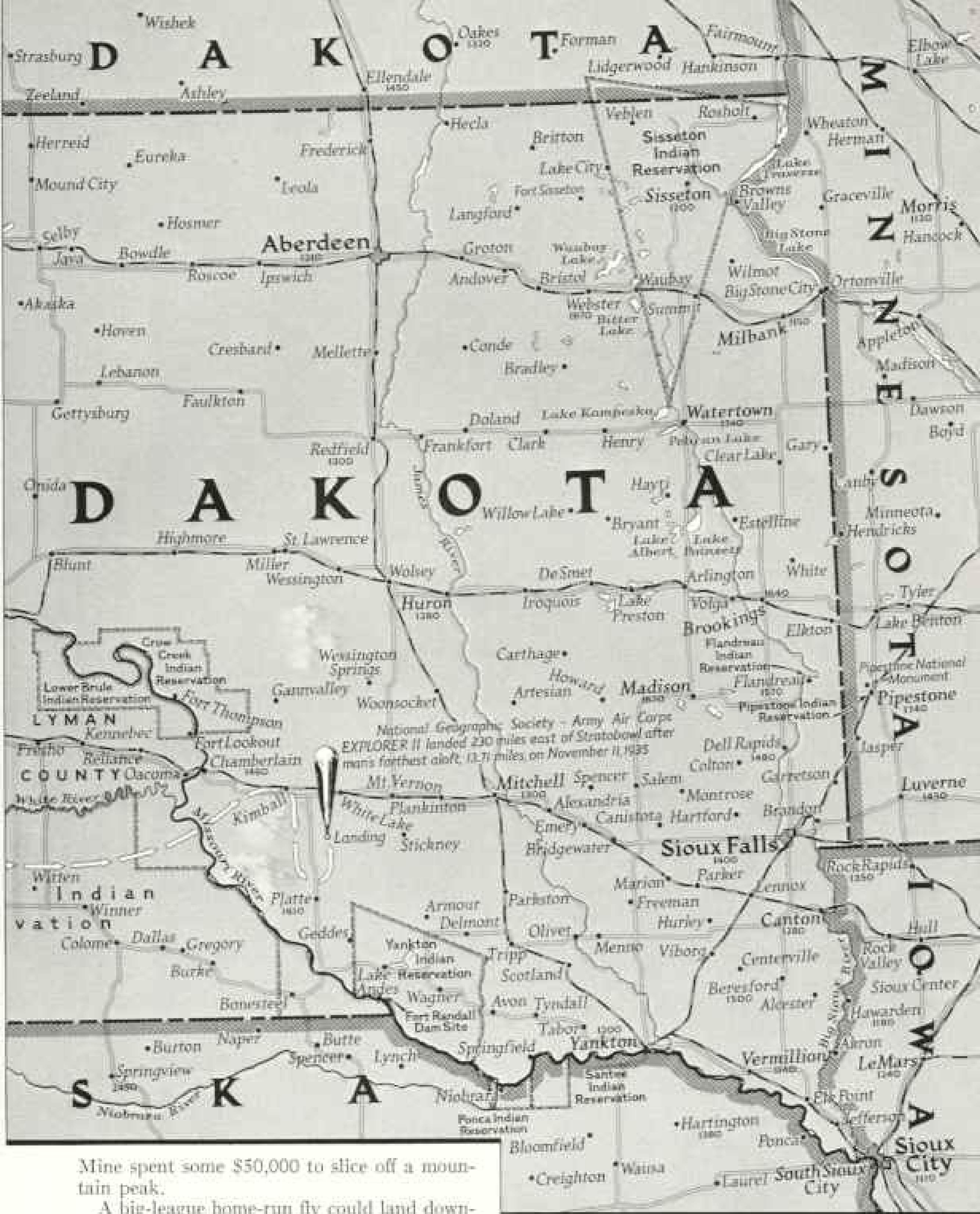
They raise and lower the cages. I watched a calm, bookish-looking man softly pushing tiny buttons that sent these cages, laden with human freight, flying up and down.

"Don't you feel responsible for all those dirty-faced men with little lamps on their caps?" I asked.

"I am responsible," he said simply, and pressed another button!

But no South Dakotan is happy spending his whole time and energy just making a living. These people also like to play.

To make a baseball diamond, Homestake



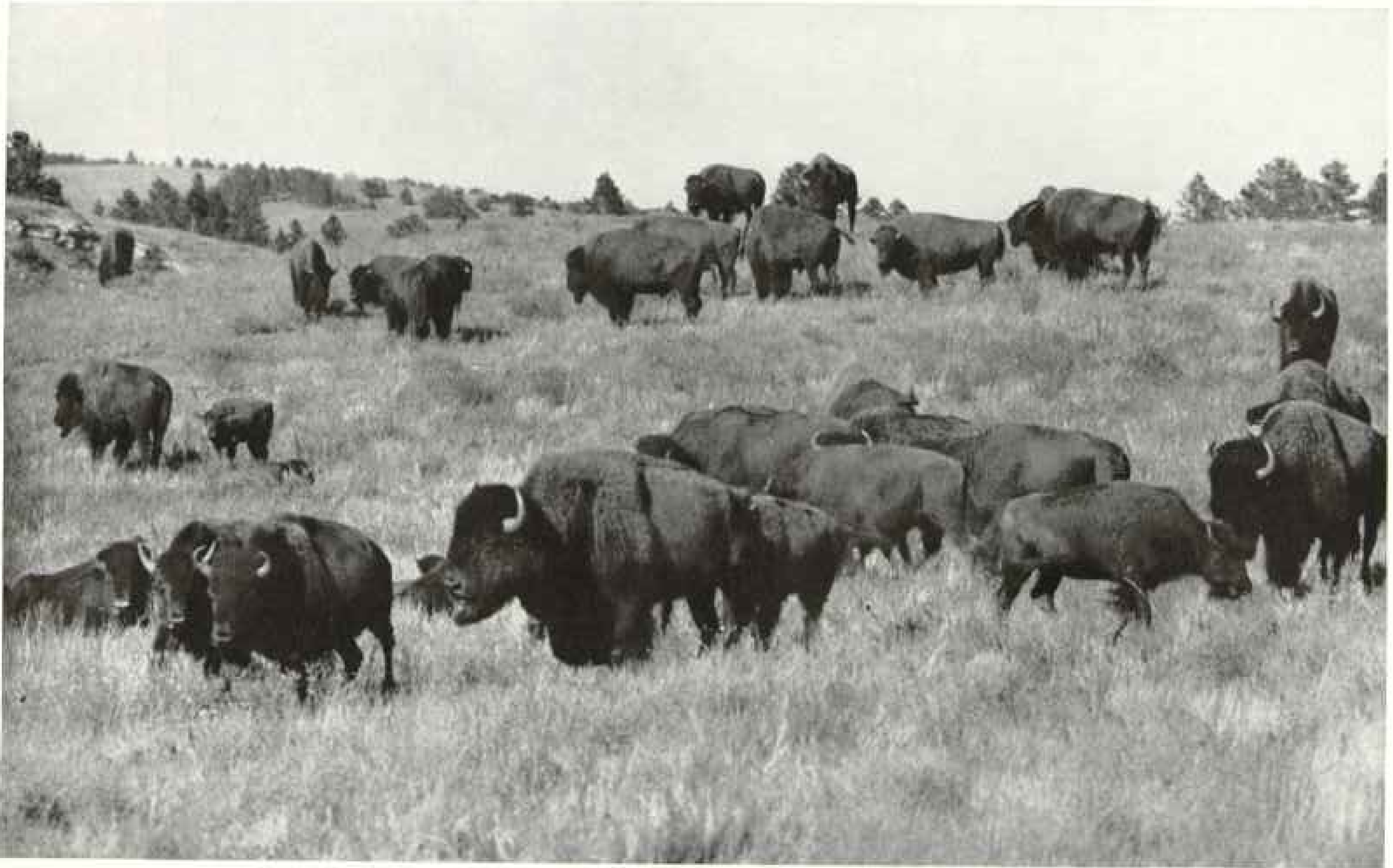
Mine spent some $50,000 to slice off a mountain peak.

A big-league home-run fly could land downhill almost in another county!

Excavating so much rock and ore out from under it, as mining spread, caused whole business blocks of the original town to sag, subside, and collapse. But Lead's vast model auditorium is one of the State's finest pieces of architecture.

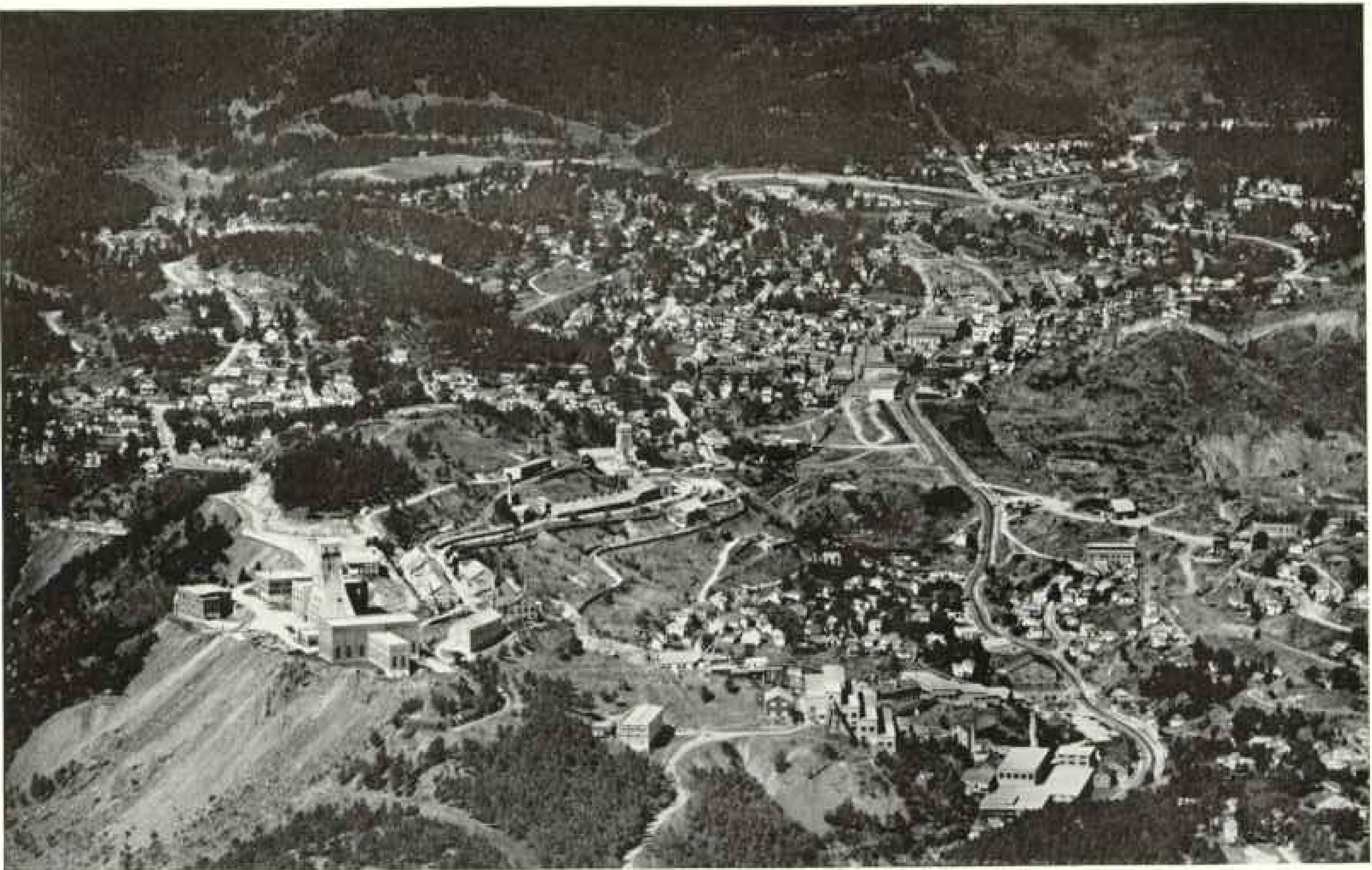
Great Plains Sweep Across South Dakota

First pioneer route to our vast Northwest was the Missouri River, which bisects this State. East of it now lie fertile farms; to the west, the Badlands and Black Hills with giant stone faces carved on Mount Rushmore by Gutzon Borglum; to the northwest, cattle and sheep ranches.



Wild Ancestors of the Bison in Wind Cave National Park Once Roamed These Hills and Furnished Food for Indians

This herd was started in 1913, with help from the former U. S. Biological Survey, the American Bison Society, and the New York Zoological Society. Grazing on 28,000 acres, some 315 animals winter here on grass alone, requiring no other feeding. In winter the hardy beasts sweep away as much as 30 inches of snow to uncover the grass by swinging their big heads from side to side. Years ago, as a youngster, U. S. District Attorney George Philip, of Rapid City, took two buffalo bulls to Mexico and entered them in arenas there to fight Mexican bulls. The bison were victors.



The Tiny Mountain Town of Lead Stands on Top of Homestake Gold Mine, Richest Treasure House in America

Beneath the mine buildings at left, elevators descend nearly a mile. At right, parts of the town have caved in, buildings and all, because of old excavations beneath. To build a baseball diamond in this rugged terrain, a mountaintop had to be sliced off. Everybody here, directly or indirectly, makes his living from the gold mine's operations (pages 557, 574). Historic Deadwood, once also a rich gold camp, lies a few miles down the canyon (page 555).

I wish I might write a whole article just about this amazing Homestake Mine, whose labor relations have been satisfactory!

If you get to Rapid City after dark, be careful next morning; keep calm when you first glance out your hotel window.

Loping right at you, from high up on the skyline, is a dinosaur big as a boxcar. Farther back are still more monsters, some with notches down their backs like saw teeth. They look alive, these man-made effigies, as if they'd just walked in from the near-by Badlands.

Study their skeletons, at the South Dakota School of Mines and Technology in Rapid City, and think what roaring grunts rose when these monsters were feeding, fighting, and mating!*

Lovesick house cats make noise enough. Think of a night brawl between a pair of beasts weighing 40 tons each! "And think of the meat that was on them," said a visitor who wanted a steak, looking at a big skeleton in the museum at the School of Mines.

What Are the Badlands?

Southeast of the Black Hills lies that 5,200 square miles of eroding silt, clay, and dust known as the Badlands, a region where overwhelming elemental forces run amok (map, pages 558-9).

From a Piper Cub we looked down and saw how, with cancerous, crablike crawls, erosion steadily increases the Badlands area. Crumbling canyons creep persistently into adjacent grasslands, looking from above like patterns of giant coral or mile-long maple leaves.

With kaleidoscopic rhythm the patterns changed as evening shadows crawled across this abysmal wilderness. In fancy there emerged then the shapes of the Pyramids, Gaillard Cut, Great Wall of China, Kremlin, Lhasa, and the Taj Mahal; Morro Castle, Alhambra, and temples of the Aztecs and Maya.

It's the slow disintegration of these odd-shaped hills that wears away the Badlands. They blow down, and wash down, to run as mud and slime into the White River, thence into the Missouri and the Mississippi, finally to be dumped into the Gulf of Mexico.

Time beyond count passed since the waters failed and giant animals died here. Some big ones were flesh eaters; positions of bones show how some of their victims died struggling.

Now only small animals exist. Coyotes chase chipmunks at dusk, and prairie dogs waddle and whistle across this waste.

Prairie dogs are quick as lightning. Shoot one and instantly his playmates grab him and drag him down their hole.

Farthest Aloft

Years ago, from miles up in the air, the NATIONAL GEOGRAPHIC MAGAZINE made pictures of these Badlands during history's greatest balloon adventure.†

On November 11, 1935, in a flight jointly sponsored by the U. S. Army Air Corps and the National Geographic Society, Capt. (now Lt. Col.) Albert W. Stevens and Capt. (now Maj. Gen.) Orvil A. Anderson ascended in the gondola of the *Explorer II*, the world's largest balloon, to an officially recognized altitude of 13.71 miles. This was and still is the highest point up in the sky ever reached by humans (Plate XVI).

The balloon which rose from the Stratobowl, near Rapid City, carried nearly a ton of scientific instruments and brought back to earth unparalleled scientific data.

It landed 12 miles south of White Lake, South Dakota, after a flight of 8 hours and 13 minutes, during which the balloonists talked by radio with Washington, San Francisco, and London, and were heard in South Africa and Australia.

"We owe much to that flight," said General of the Army H. H. Arnold, when Commanding General of our Army Air Forces.

The atomic bomb itself was developed in part from cosmic-ray counts recorded on that perilous aerial voyage on which, to keep from dying of cold and lack of air, Stevens and Anderson had to ride inside a sealed gondola provided with oxygen.

It was made of magnesium, then called "Dowmetal." That was a pioneer aerial use of this new, light, stout metal, now in universal use in aircraft.

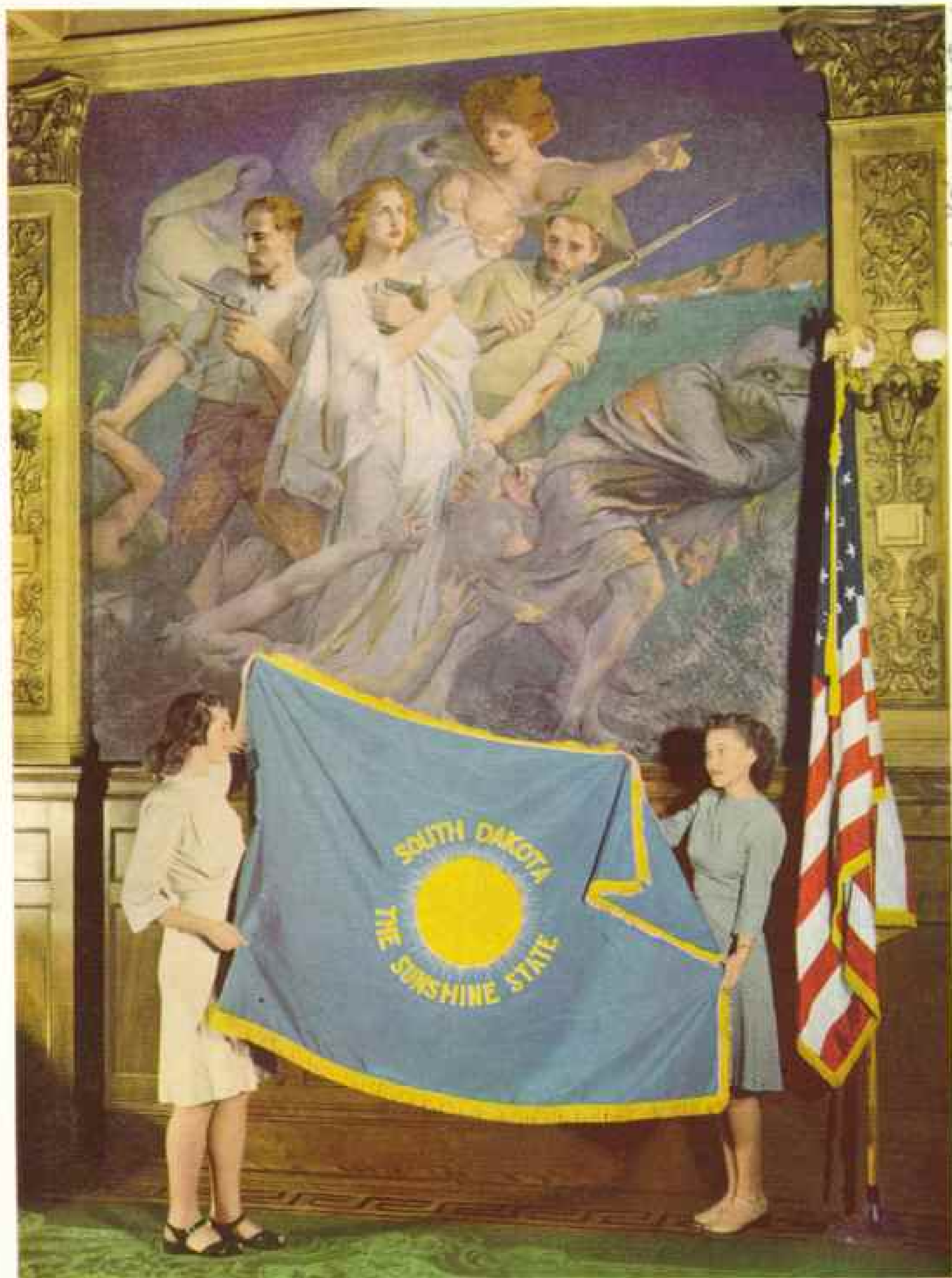
General of the Army H. H. Arnold, in a letter to President Grosvenor of the National Geographic Society, dated November 7, 1945, wrote:

"As you and I well remember, Sunday, Armistice Day, November 11, 1945, marks the tenth anniversary of the free balloon stratosphere flight which the National Geographic Society sponsored with the Army Air Forces, when the world's record of 72,395 feet was established.

"Congratulations are in order on this occasion. We owe much to that flight.

* See "Big Game Hunting in the Land of Long Ago," by Joseph P. Connolly and James D. Bump, page 589, this issue of the NATIONAL GEOGRAPHIC MAGAZINE.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Exploring the Stratosphere," October, 1934, and "Man's Farthest Aloft," January, 1936, both by Capt. Albert W. Stevens.



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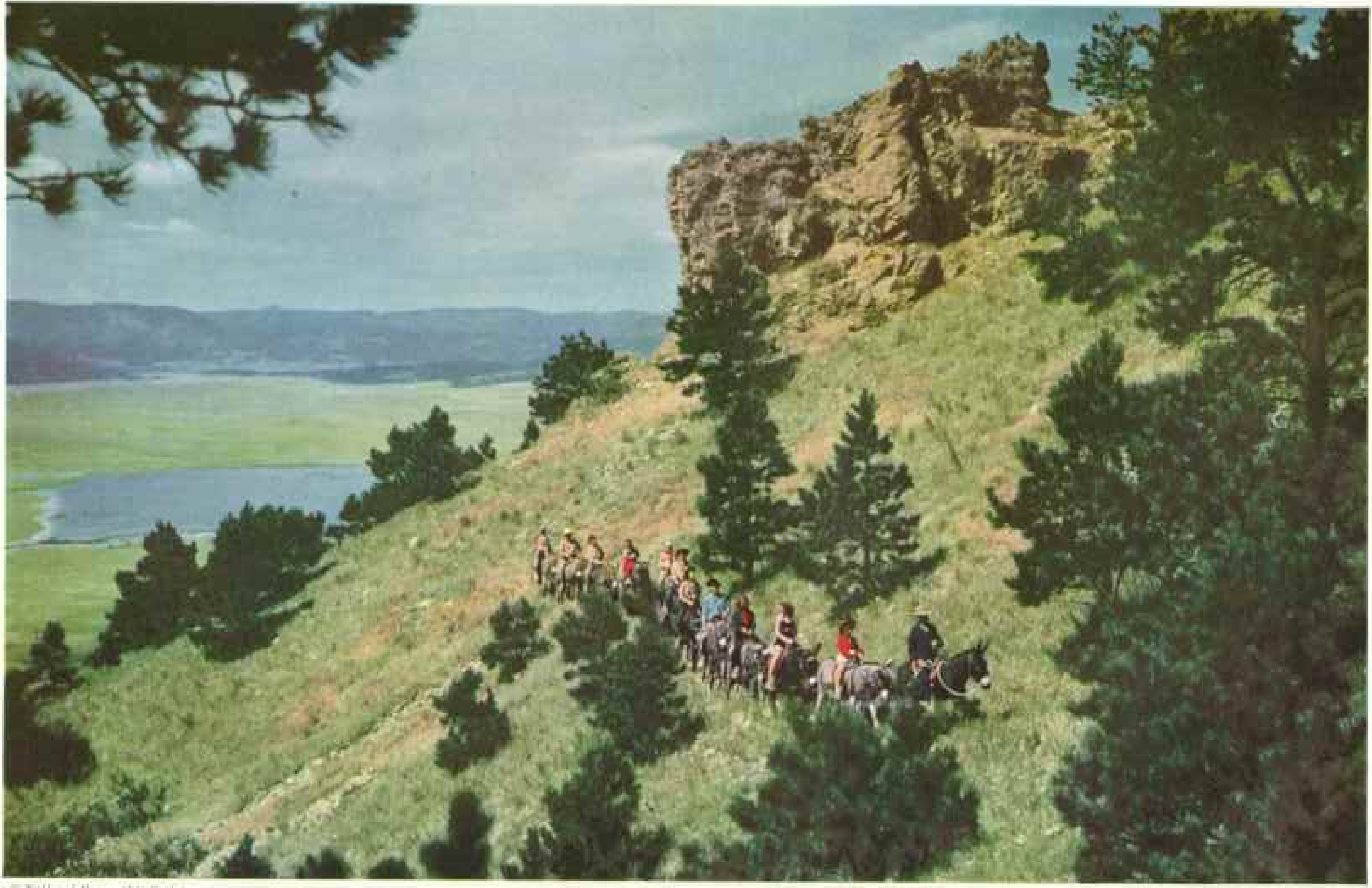
Kodachrome by J. Baylor Roberts

This Striking Mural in the State Capitol at Pierre Portrays South Dakota's Progress

The panel was painted by Edwin H. Blashfield. South Dakota, the central figure, is led forward by Hope, top female figure. Settlers help her conquer the Indians as Evil skulks away. Below is the State flag, designed by Mrs. Ida A. McNeil, of Pierre. On the reverse of the blazing sun appears the State's great seal, in dark blue.



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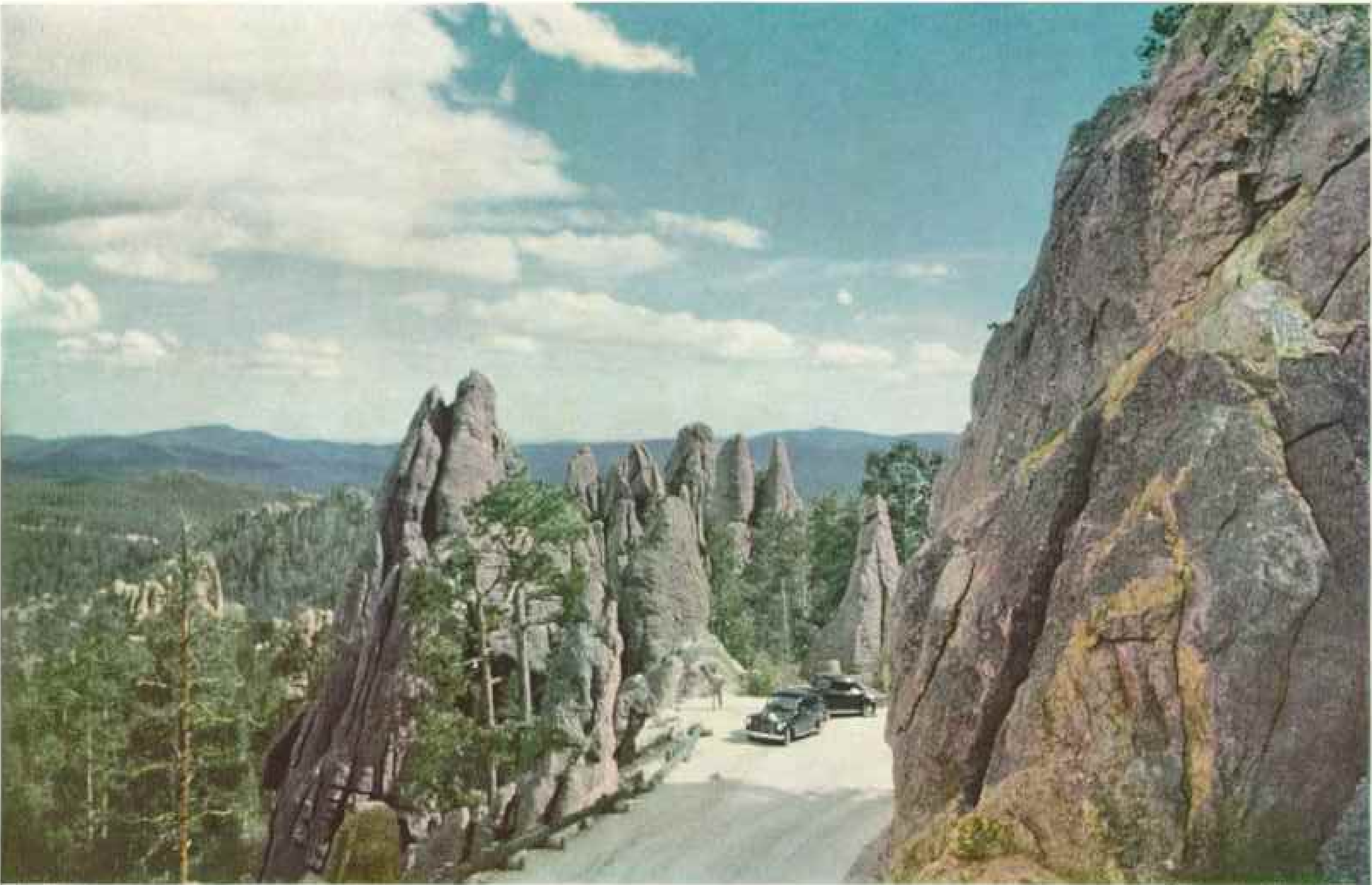
On Sure-footed Mules Sightseers Climb Bear Butte to Enjoy a Scenic Panorama Embracing Thousands of Square Miles

Rising abruptly from grassy plains near Sturgis, in western South Dakota, this peak forms a landmark visible from leagues away. Indians used to post lookouts here. When immigrant wagon trains were seen approaching, the savages attacked. The girl in the bathing suit got badly burned by sun and scorching winds.



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Like Roots of Mastodontic Teeth or Giant Fingers, the Famed Black Hills Needles Point Upward to South Dakota Skies

Here Needles Highway is cut through the solid Black Hills rock. Visitors come by car, in hundreds of thousands, to drive through this weird geological jumble and ponder its wonders. Dizzy loops and sinuated swerves make some people carsick on the twisting transit through the tumbled hills.

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Kodachrome by J. Baylor Roberts

The Historic French Name of South Dakota's Capital City Is Spelled P-i-e-r-r-e, but Local Residents Pronounce It "Peer"

Built in 1832 as a trading post by the American Fur Company on the opposite bank of the Missouri, Fort Pierre was sold to the U. S. Government in 1855, for use as an Army post. Here a bevy of girls, who clerk in the Capitol Building in background, eat lunch on the grounds as Canada geese idle in the lake.

© National Geographic Society

She Prefers Horseback Riding to Motoring

Gwenn Davenport of Sturgis, who learned to ride at 5, is one of the State's best equestriennes. Though now in a New England school, she spends her vacations galloping over South Dakota hills on her favorite pony.

Kodachromes by J. Baylor Roberts

Norwegian Settlers Cling to Old World Styles

Parents of these cone-gobbling girls of Garretson came from Hardanger, Norway; in homeland dress, they listen to Norwegian music at a reunion of Hardanger emigrants. Telephone books here abound in Scandinavian names.

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Kodachrome by J. Baylor Roberts

Last Year This State's Wheat Crop Was So Big that Not Enough Railroad Cars Could Be Found to Haul It Out

In 1946 South Dakota harvested a wheat crop of 53,197,000 bushels. Countless bushels of valuable bread grain were dumped on the ground, for later shipment when cars were available. Low-priced lands and the prospects of quick fortunes in wheat originally lured armies of settlers to these treeless plains.

© National Geographic Society

"Sure, I Can Tell You All about Hybrid Corn"

At Yankton, this vacationing schoolgirl detassels corn for Gurney Seed and Nursery Company. Pulling tassels from six rows of a certain corn, she causes its ears to be pollinated by tassels of another type in two adjacent rows. Resulting seed means better crops.

Kodachromes by J. Baylor Roberts

"I'd Rather Plow with a Tractor than Drive a Horse"

This Milbank boy does a man's work at his steering wheel. With machines youngsters plow, plant, and harvest—as much fun as driving the family car. And without such machines today's big-scale farming would not be possible. Also, their use saves much grain that once was fed to animals.

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Kodachrome by J. Baylor Roberts

Bright-eyed Boys Admire an Indian Chief's Gorgeous Raiment

With pipe and drum, Chief Fools Crow has just participated in a Sioux "grass dance" in Custer State Park, named for the cavalry leader who died at the Battle of the Little Bighorn, in Montana. After the dance, a buffalo was killed for the Indians' Fourth of July barbecue. To show it was their meat, they tied a knot in its tail.

"The contributions by your Society, the scientists you interested in the pioneering effort, and the cooperation you gave the Army Air Forces bore fruit in World War II far in advance of what was imagined to be the results at the time.

"We learned how valuable magnesium could be in the field of aeronautical design, for here was a metal lighter than aluminum, yet stronger; and the trip where no man had been before proved the selection of the metal to be wise. More was learned about 'pressurized cabins,' two-way short-wave radio communication, and the use of electrically heated flying suits; and advancement was made in the little-known field of aviation medicine.

"Many other items of equipment and methods were improved which later played important parts in giving American airmen superiority in the skies of Berlin and Tokyo."

That November day in 1935, when the balloon went up, fully 50,000 spectators were present, many having waited all night in the cold to see the ascent. Some came from 200 and 300 miles away.

These stouthearted sons and daughters of South Dakota pioneers are a sincere, generous people. Their kindness to the scientists was infinite.

Amazing Custer State Park

South Dakotans are steady visitors to the Black Hills and their amazing Custer State Park. Here stands 7,242-foot Harney Peak. Hard by rise the majestic Needles, strange stone obelisks that point up like the supplicating fingers of pagan gods (Plate III).

Primeval forests drape these hills of glittering blue lakes, murmuring brooks, and grassy valleys where buffalo graze and deer and elk play in a land as Edenlike as on that solemn Seventh Day when God had finished the world, and rested.

Civilization's only marks are a few small lodges and cabins and the winding, climbing roads, without which nobody could see these wonders.

President Coolidge brought his family here in 1927 and turned this park's Game Lodge into a summer White House. Miners and cowpunchers still speak fondly of that quiet, unpretentious family.

Mrs. Coolidge became so popular that they changed Squaw Creek's name to Grace Coolidge Creek; they named Mount Coolidge for the President. More to his taste, they dammed off a big hole in a creek and threw scores of hungry trout into it.

All Mr. Coolidge had to do was drop in his hook and jerk out one big fish after another! If he ever suspected a prank had been played on him, he never hinted at it; he just kept on catching fish, which was his way!

Region of Farms and Factories

While these Black Hills truly are the show window of the State, its food crops come more from other sections.

Ride east and you find that most rich farms, prosperous trading cities and their factories—including Sioux Falls, the metropolis—lie along the Missouri River or on toward the Iowa and Minnesota lines.

Whites had settled hereabouts years before that eventful Black Hills gold strike.

Two French brothers camped near where Fort Pierre now stands 61 years before Lewis and Clark ventured up the muddy Missouri. They wrote that they "deposited a tablet of lead" here and wished to "take the latitude," but their astrolabe was broken.

I saw that plate in the museum at Pierre! Little Hattie Foster, a girl of Fort Pierre, picked it up on a near-by hill one Sunday some years ago. On it is a date, March 30, 1743, and a Latin inscription printed with die-punch type . . . "In the 26th year of the reign of Louis XV . . . most illustrious Lord . . . Pierre de La Vérendrye placed this."

A. H. Pankow, of the State Highway Commission, was with me. "You're like all other writing people—you want to stand and stare at that old plate. Those dead Frenchmen can't help you with your story. They can't read the NATIONAL GEOGRAPHIC! But there's plenty of very-much-alive South Dakotans who do. Why don't you get in a police car with a highway patrolman and have a look?"

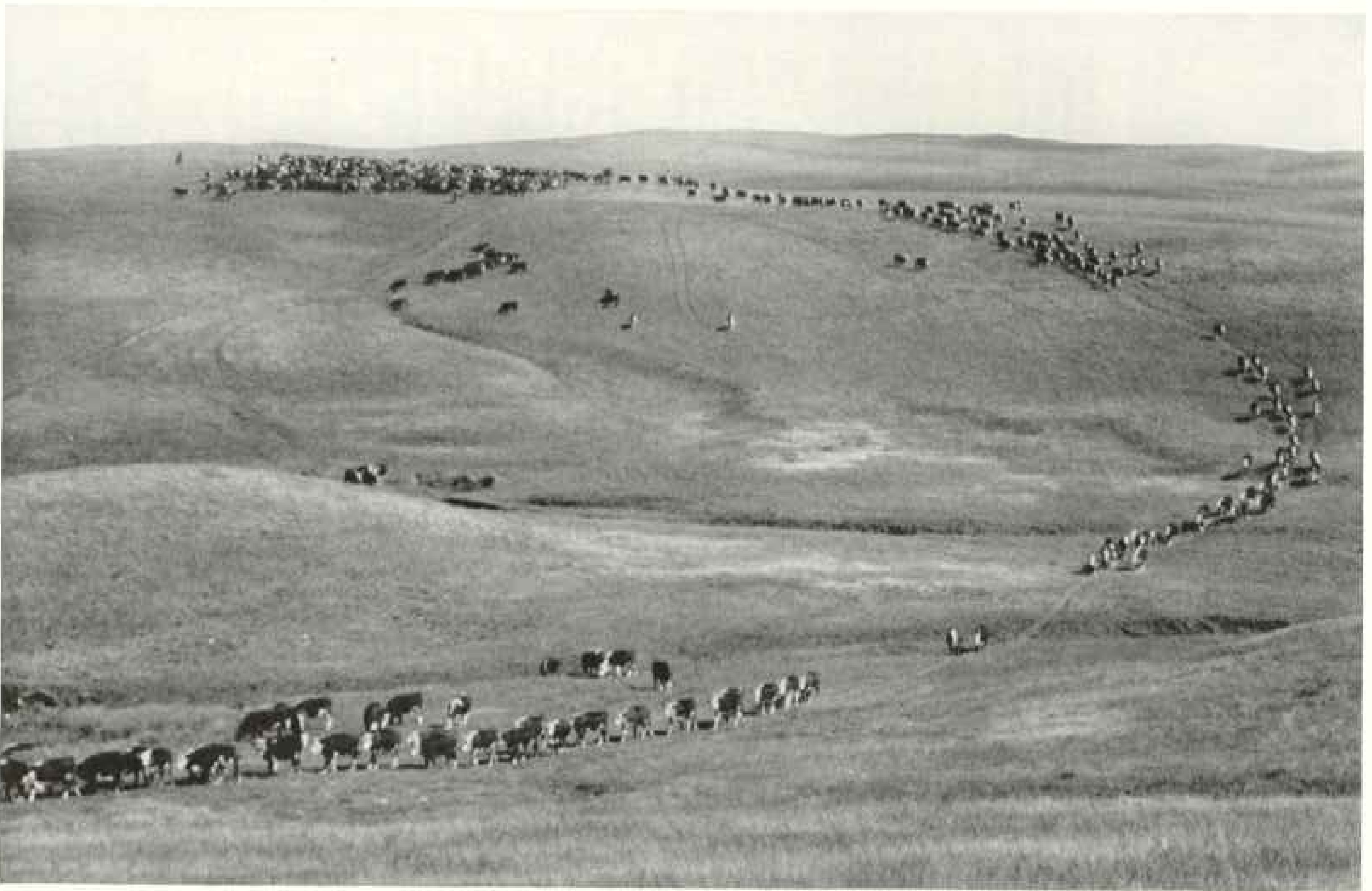
I did. Radiotelephone tied us with police stations in distant cities and with other patrol cars. Hour after hour, hollow metallic radio voices spoke . . . "Farmhouse afire west of Watertown" . . . "Woman killed in smashup on Route 16" . . . "Calling all cars! Watch for stolen Buick, tag number . . ."

When I wanted to reserve a hotel room in some town ahead, the obliging harness bull just reached for his radiophone.

New Wealth in Wheat

"Call the State Agricultural College at Brookings," I suggested, "and see if Dr. Niels E. Hansen is there." He was. Hansen is one of three men who brought hard wheat into our States.

Dry-country forage plants brought from Soviet lands by Hansen are also changing the



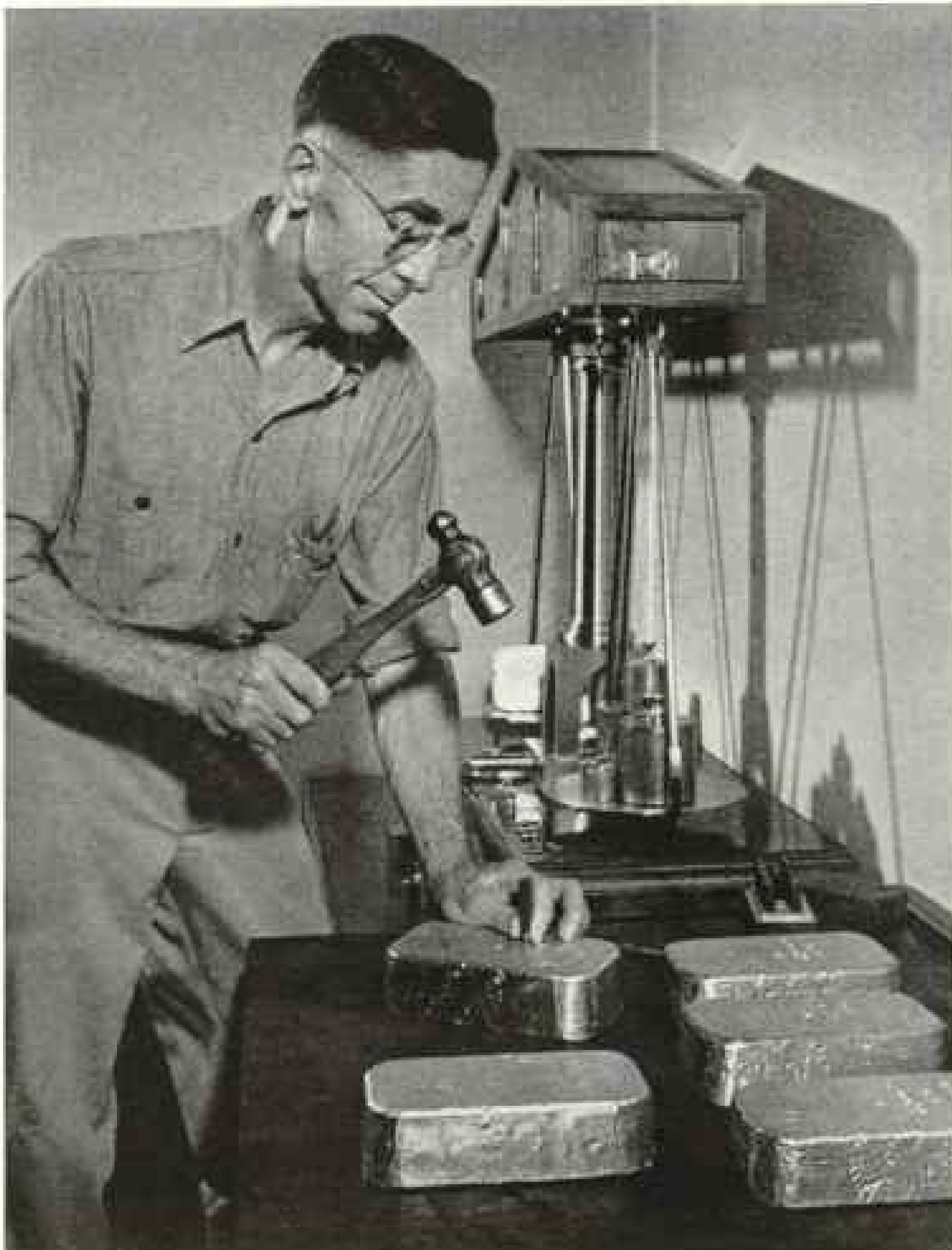
Sluggish, Fat, White-faced Steers Stroll Leisurely to Market over Great Plains Where Once the Half-wild Longhorns Thundered

In Lyman County, 1,000 two-year-old Hereford steers are rounded up on the ranch of Cornelius Clarke. From here they are driven to another pasture, where those chosen for marketing will be cut out and driven 25 miles to the railroad pens at Kennebec. They were fattened entirely on grass. Their weight is now about 900 pounds.

In Vast Treeless Plains of Northwest South Dakota, as Near Castle Rock Butte, Sheep by Thousands Feed on Succulent Wild Grasses

Yet here, as elsewhere in our sheep States, flocks are diminishing because of higher wages for herders, big world carry-over of wool, and other economic conditions.

"Bulldogging"—a Rider Dives from His Running Horse, Grabs a Fleeing Steer's Horns, and Twists Him Down on His Back



He Is Stamping Gold Bars to Show Weight and Origin

These five bars, worth about $17,000 each, are from famous Homestake Mine, at Lead, South Dakota, which already has yielded hundreds of millions of dollars' worth of treasure. A ton of ore from this nearly a mile deep mine may hold only a fraction of an ounce of gold (pages 557, 561).

As whites poured in and buffalo were killed off, cattle began to take their places. By 1888 some 950,000 Texas longhorns were grazing here.

Hoofs, Horns, and T-bones

But rearing big herds on unfenced range, leaving them to shift for themselves in winter, failed to work.

Came that still-talked-of fatal winter of 1886-87, with one of the worst blizzards in Black Hills history.

When spring winds finally melted the drifts, cattle lay dead in bunches. Streams running bank-full carried not only ice cakes and driftwood but thousands of beef carcasses. Such tough animals as did survive had frozen ears, tails, and feet.

Many "cattle kings for a day" went out of business. Those who survived changed their ways of raising cattle.

Today, where once vast, open ranges flourished you find only relatively small ranches, with fences, barns, and shelters. Z Bell, near Rapid City, managed by its attractive owner, Evangeline Wortman, is typical.

whole aspect of grazing in the Midwest and Northwest.

"In the summer of 1897," said Hansen, "I was east of the Volga River in a dry steppe region. Hundreds of camels passed us with tea cargo from China. In choking dust I poured water from my canteen on a sponge and fastened it over my mouth and nose; but the camels appeared well nourished.

"The reason was a native grass, called *gitniak*. I brought the first samples to America, where it is called crested wheat grass.

"Some observers say this grass will soon cover millions of acres of the dry prairie regions of many western States and western Canada. I'm glad I had a wet sponge that day."

Such ranches grow hay for their cattle or buy winter feed. Instead of herds of ten, fifteen, or twenty thousand, a fair-sized one may not run over two thousand; yet the State has far more cattle today than in those halcyon days of the open range (page 572).

Corn is South Dakota's chief crop, but 80 percent of it is fed to livestock.

Much stock raised is made into meat by John Morrell and Company at Sioux Falls. This huge but compact and sanitary plant can handle, every day of the year, about 6,000 hogs, 900 cattle, and 2,000 sheep.

The Morrell Company was founded at Bradford, England, in 1827. Later it came to the

States and began packing meat for export to the British Isles.

Now it is the fifth largest and by far the oldest packer in the United States, with three big packing plants and 16 branch houses, employing about 10,000 people (Plate XIII).

Its Sioux Falls plant alone ships about 10,000 carloads of meat a year.

Together with the Sioux Falls Stockyards Company and a number of other packing plants, Morrell's furnishes a home market where South Dakota farmers can sell their livestock without having to pay freight to Kansas City, Omaha, or Chicago.

Hot, Dusty Throats Cry for Lots of Cool Water

This scrubbed youngster is part of a schoolgirl crew working last summer at Yankton for Gurney Seed and Nursery Company. She has just finished one round of detasseling and is at the faucet of one of the two 15-gallon kegs of water carried on trucks for the crew (Plate VII). "Why ask Pop," such girls say, "when we can earn our own pin money?"

Shelter Belt Trees

Since the dust storms of the 1930's thousands of farmers have signed conservation contracts. This includes pond digging, contour plowing, grass seeding, terracing, and care of shelter belts (pages 576, 577).

In the great Federal tree-planting program of 1935, 3,207 miles of these tree rows were set out by Government men, and about 97 percent lived.

You come upon other groves that look like natural forests. They were set out 40 to 50 years ago, when homesteaders were given an extra piece of land free, provided they planted it to trees.

Fire-control study is also part of soil conservation. Before me now lie grim pictures, too morbid to print, showing piles of cattle and sheep burnt to death by prairie fires.

I flew over one fire, on the Pine Ridge Indian Reservation, and saw behind it a waste area burnt black as coal. These fires are not so big and bad now as when all this land was grass, unfenced and unfurrowed. But in grassy areas they're still disastrous.

"It's their speed and intense heat that make them hard to fight," said a fire insurance agent. "In short-grass country we used to put them out with a dead horse or cow, killed for the purpose and used as a 'drag.'

"But in high grass this wouldn't work—we couldn't stand the heat.

Fire Fighting by Backfiring

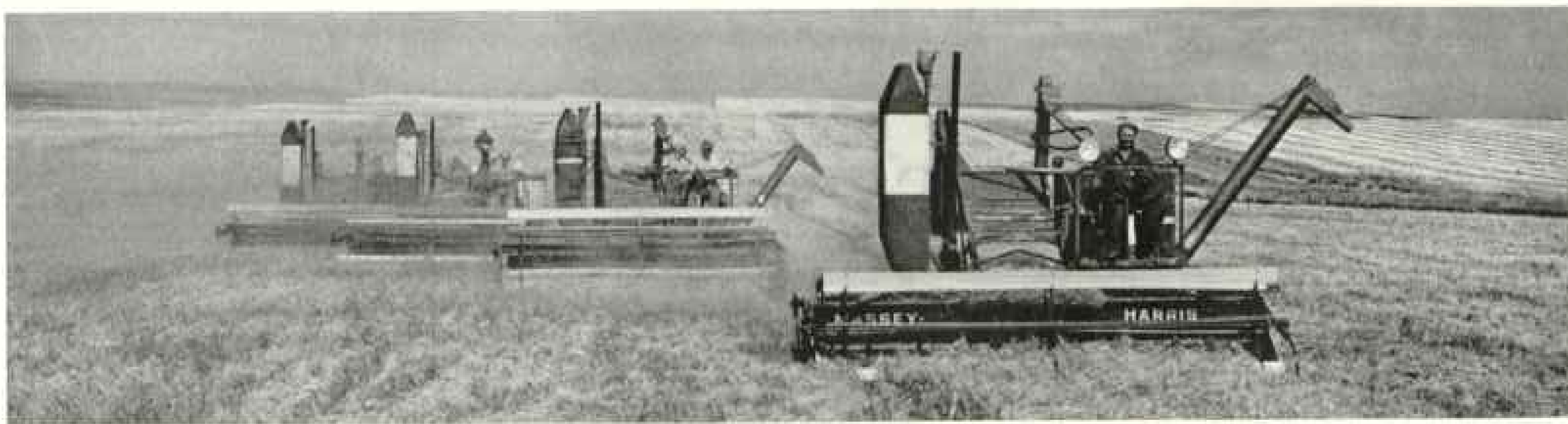
"We use other methods, too. One is backfiring. In this, you run away ahead of the fire, plow furrows a few yards apart, and burn off the grass in between. When the big fire gets there, that stops it. We also use fast trucks to drag a mat of chains and asbestos

Donald E. Haskins

Odd Patterns, Like Tattoo Marks on Earth's Face, Form When Farmers Fight Wind and Water Erosion with Contour Plowing

Crooked streaks at right result from contour work, in which furrows follow a level course around hillsides. When fields are plowed up and down hillsides, rain and snow water rushes down, washing away much topsoil. In some dry regions, alternate land strips check wind erosion, or dust blowing, on ground left in clean fallow.

South Dakota Farmers Plant Long Shelter Belts of Trees to Guard Fields Against High Winds—Near Mitchell



Cutting and Threshing Wheat, Four Self-propelled Harvesters Move Like Monsters Across Fenceless Plains near Presho

New-style combines dispensing with horses and tractors reduce two-man crews to one. Cutter bars are in front rather than on the side. Threshed grain is stored in bins behind the drivers; spouts pump it to wagons. Headlights are for night harvesting. As the crop matures, the mechanical army advances from south to north.

blankets to smother fires, and some use trucks with water-spray pumps."

Most experienced ranchers, along toward August when it gets dry, prepare fire-guard strips around their haystacks and buildings.

Lightning starts some fires. Others may ignite when hot sun shines through old bottles, or even through glass water jugs. Careless people start the most.

This State truly is farm-minded (Plates VI and VII). In all our land I never saw better cultivated corn than in the fertile stretch from Sioux Falls to Yankton.

From the farm college at Brookings, where we talked to Dr. Hansen (page 571), thousands of boys and girls have graduated. Others have been educated at the University of South Dakota in Vermillion, at Rapid City's South Dakota School of Mines and Technology, and in other fine seats of learning at Aberdeen and elsewhere (Plates XII and XV).

"Show Me the Indians!"

But when you scan the campus crowds and glance into classrooms, you ask, "Where are all the Indians of college age who live in South Dakota?"

Maj. John R. Brenman built the first house in Rapid City. His widow still lives there. She showed me her husband's diary. Its first entry reads:

"May 4, 1876. Wm. Cogan murdered by Indians, scalped and ears cut off." Page after page, day after day, is full of similar entries. All along these Black Hills roads are graves of whites—miners, traders, immigrants, soldiers—pony express riders—unknowns—"killed by Indians."

In melodramatic South Dakota annals Indians have been both villains and heroes.

"Show us where Sitting Bull was killed in the Messiah War," so many tourists say. That was at Sitting Bull Park, in the northern part of the State, and here's a tale: The day he was shot, Sitting Bull had with him an old trick horse he had trained while with Buffalo Bill's "Wild West" show.

When the shooting started, this trick horse, mindful of his old circus role, sat down in the midst of the melee and held out his front foot to shake hands!

The Chicago *Inter Ocean*, on August 27, 1874, carried a five-column front-page story from its correspondent, William E. Curtis, who was with Custer's exploring expedition in the Black Hills when Horatio Ross made his gold strike (page 555).

He wrote that officers, privates, bullwhackers, and scientists all met on a common level, as Custer's force fell to with shovels, tent pins, bowie knives, and mess pans to dig and wash for gold.

But Custer himself, though he didn't minimize the gold strike, had more to say about Indians. Today they're still a problem, even though scalping yields to face massage and permanent waves, and bucks may wear horn-rimmed glasses and smoke Owl cigars.

Some 30,745 Sioux are now "enrolled," and live on nine reservations; biggest are the Pine Ridge, Cheyenne River, and Rosebud, covering some 7,170 square miles. "But since you whites quit killing us and commenced whistling at our squaws," said an educated half-breed, "it's hard to say just *who is an Indian*."

Being initiated into a fun-loving Rapid City society, the "Singing Tribe of Wahoo," where I was christened "Big Pencil," I met Wasicun Tan-in-yan-Najin (White-Man-Stands-in-Sight), a stern-faced old Sioux chief garbed in all his feathers. Just when I was wishing for an interpreter, he grinned and said, "I've taken the NATIONAL GEOGRAPHIC for years."

All Indians, except a few older ones, now speak English, and many take the newspapers and write to Congressmen to get jobs for their daughters waiting on table in State park cafes. Some do fairly well running a cow ranch, but they don't like to milk!

When Red Cloud led a band of Indian dancers in a performance at Deadwood's Gem Theater years ago, an astonished audience was seeing the end of an epoch. The war dance had changed from a prologue to massacre and scalping of whites to a showman's act by red men to pick up cash at county fairs and wild-West shows.

Sioux dances are still top line at many a rodeo. Tenderfeet shudder in ecstasy at savage war whoops and tom-tom beats. Indians enjoy the wild-West shows too, especially when free meat is passed out or when they can beg a firewater shot from a cowboy. (It is unlawful to sell whisky to Indians.)

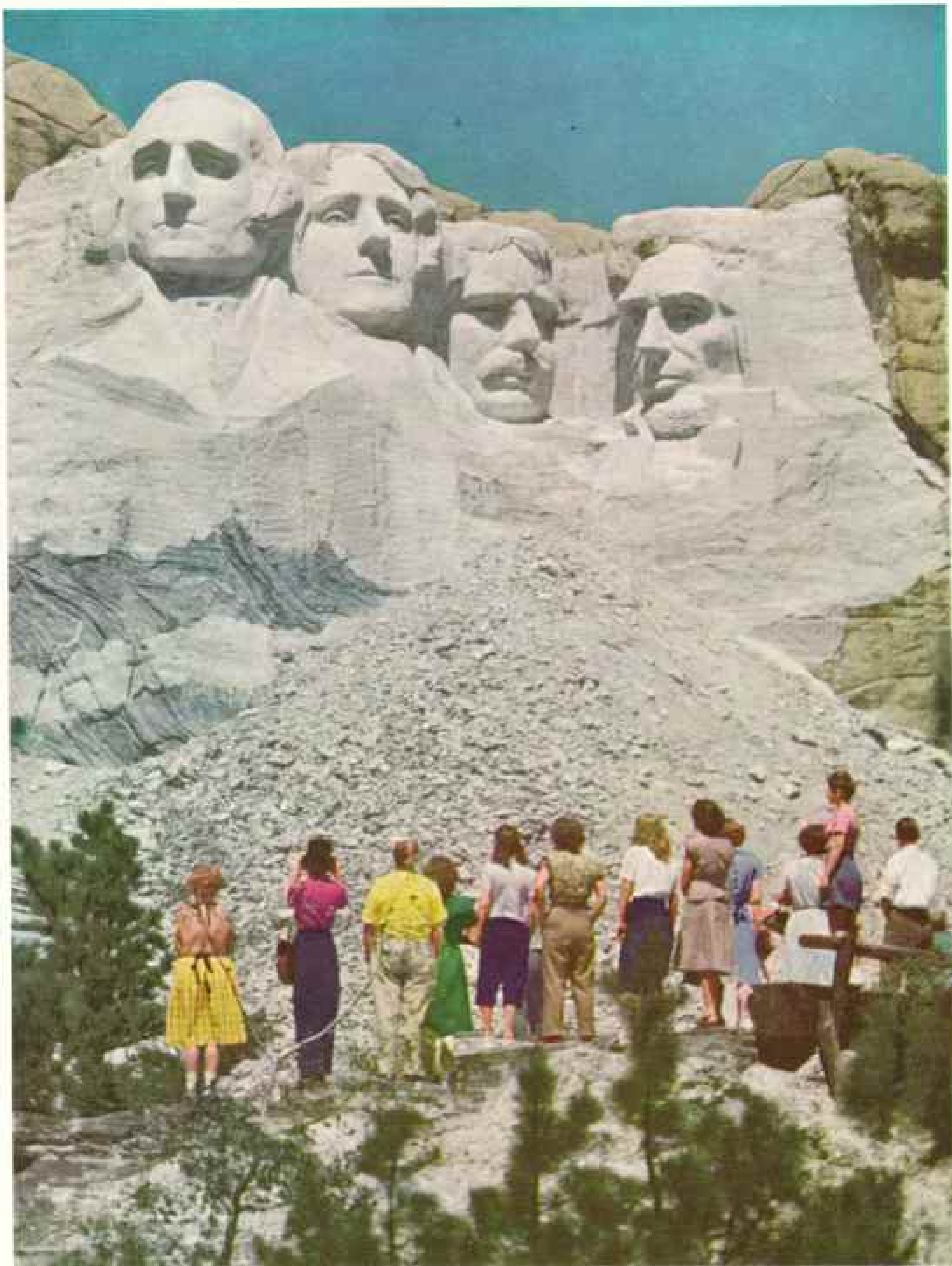
Tall Tales of Pioneer Days

After an Indian dance in Custer State Park a surplus buffalo was shot for the Indians. Our cameraman, Joe Roberts, played the role of Buffalo Bill. As it fell, old Chief Fools Crow ran in and tied a knot in the big bull's tail (Plate VIII).

"Why that hairy four-in-hand?" I asked.

"To show it's our meat," he said.

Old Indians still repeat tribal tales about Custer, Crook, Miles, Harney, all whites who fought this way. Harney Peak was named for Gen. William S. Harney. When he was



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Kodachrome by J. Baylor Roberts

Stern Faces of Washington, Jefferson, Theodore Roosevelt, and Lincoln Gaze from Mount Rushmore in the Black Hills

Gutzon Borglum carved these heads. Washington's face measures 60 feet from chin to forehead; beside it the giant head of Egypt's famous Sphinx would be a pygmy. A man could stand erect in Lincoln's eye. From the air the monument is visible 60 miles away. This picture is deceptive; spectators are many hundreds of feet below the faces.

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In This Corn Palace a Hungry Mule Could Literally Eat Himself Out of House and Home!

Built in the thriving city of Mitchell, in the southeastern part of the State, this unique structure is used for fairs, exhibitions, and conventions. It is freshly decorated with ears of corn each fall. Here American Legionnaires parade through this city where corn is king.

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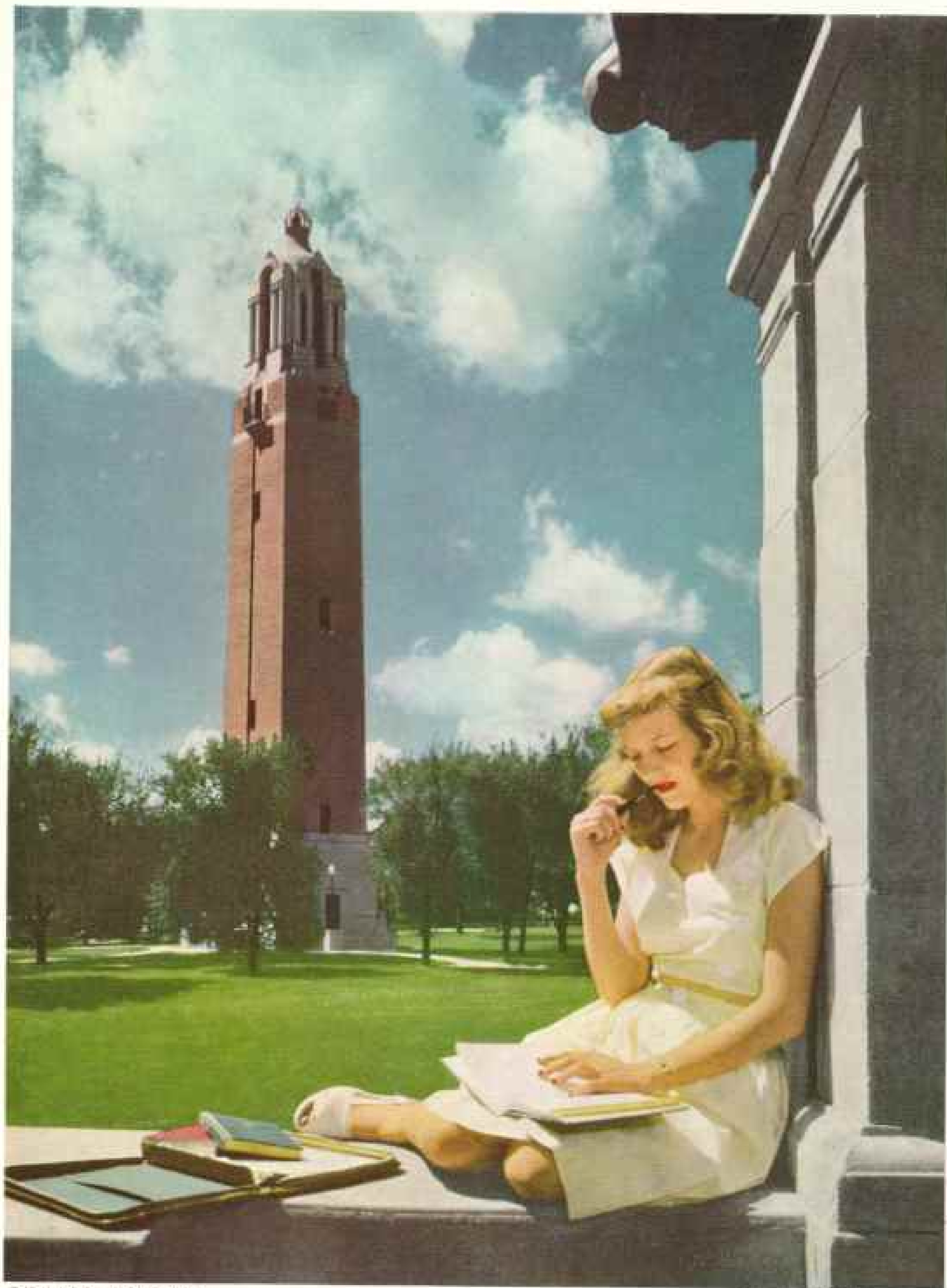
Kodachrome by J. Baylor Roberts

Glorifying the Horse, Every Good-sized Town Boasts a Riding Club, Its Fancy Mounts Glittering with Gay Caparisons

Here is Rapid City's Boots and Saddle Club, trotting toward the grandstand at Black Hills Roundup in Belle Fourche. Just before this picture was taken, the riders had danced a mounted quadrille to music—dangerous when galloping horses tangle up in dust clouds.



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"Final Exams Tomorrow, so I've Sure Got to Cram!"

On the steps of Coolidge Sylvan Theater at the State College of Agriculture and Mechanic Arts, in Brookings, a puzzled coed bites her pencil—and thinks. Coughlin Campanile in the background. Thousands of the State's farm boys and girls have been trained here for useful living.

Makes You Hungry Just to Smell All That Smoking Bacon!

These men take down bacon slabs that have just been smoked; every 20 hours 3,000 slabs pass through the busy John Morrell Company's 11 smokehouses at Sioux Falls.

© National Geographic Society

Kodachromes by J. Baylor Roberts

Indian Dolls, Accurate in Every Feature and Detail of Dress

Marjorie Holmquist, Rapid City airline agent, examines this valuable group at Game Lodge, Custer State Park. An Indian artist worked years, carving faces of Crazy Horse, Sitting Bull, Spotted Tail, and other Sioux.

© National Geographic Society

Kodachrome by J. Baylor Roberts

"Dakota Woman," Painted by Harvey Dunn, South Dakota Artist, Reflects the Loneliness of Prairie Wheat-farm Life

Not a tree! Only an old umbrella to shade her infant while she dreams of greener lands back east. Hung at Mitchell, this painting belongs to the Dakota Galleries, sponsored by Friends of the Middle Border, an organization devoted to preserving Midwest tradition.

© National Geographic Society

Kodachrome by J. Baylor Roberts

"Can You Pick Out the Patch Your Boy Friend Put on His Shoulder When He Went to War?"

Preserved at the University of South Dakota at Vermillion, this quiltlike collection is made up of insignia worn by students who joined the armed services.

© National Geographic Society

Kodachrome by Edwin L. Wisherd

Here the Stratosphere Balloon Ascended to Greatest Height Ever Reached by Man

From this natural bowl near Rapid City, the National Geographic-Army Air Forces *Explorer II* soared aloft on November 11, 1935. Captains Albert W. Stevens and Orvil A. Anderson ascended to 72,395 feet. Left to right, Pilot Anderson (now a Major General), General of the Army H. H. Arnold of the Army Air Forces, and Thomas W. McKnew, Secretary of the National Geographic Society, install a plaque commemorating the ascension.

campaigning here as a young lieutenant, he tried to impress the Sioux by telling them that our Army's medicine men could kill a man or a dog and then restore him to life.

"Here, surgeon," he said to an Army doctor. "Chloroform that dog, then revive it—give 'em something to talk about!"

The dog passed out quietly enough—and stayed out. He died!

That was a joke on Harney the Indians could enjoy. They yelled with glee. "White man's medicine heap strong!"

Pioneer Army posts are scattered through this country, as at Forts Lookout, Pierre, and Meade. Here troops were kept to guard settlers against Indians.

Now Indians Fight on Our Side

Now these Indians fight on our side. Crowds of them have served, first as scouts and Indian police, and then in the World Wars, where they fought and died beside their other American brothers-in-arms.

Gold camps and cow ranches, booming in the Black Hills country after 1874, were peopled largely by native Americans, adventurers from many States.

"Not so eastern South Dakota. It lured farm-minded folk not only from other States but from Europe," said U. S. Senator Harlan J. Bushfield, a member of the National Geographic Society since 1920. "I myself was born in Iowa, and brought to South Dakota when I was two years old."

Reared here, and serving as Governor before he was sent to represent his State in Washington, Senator Bushfield is a good example of a South Dakota adopted son.

He has had much to do with the State's highway expansion and has backed the building of the multiple-purpose Fort Randall and Oahe Dams in the Missouri River. Work on the former has just started.

"In early days," he continued, "big land-selling companies used colonizing agents to bring in settlers by thousands, especially from Iowa, Wisconsin, and Minnesota." It was then that new towns mushroomed on the prairies. Aberdeen, now a big, busy city, was a land-boom town; so was Ipswich. Two weeks after it was started, it had two banks and three newspapers.

One pioneer bank was merely a board laid on two barrels. On it the "banker" spread out his money. When he had to go to lunch, he put his deposits in a satchel and carried it in one hand and his six-gun in the other!

Sod was used then to build homes. Times were hard. Men worked from sun to sun for $10 a month. Farmers' wives sold eggs for 5 cents a dozen. Ipswich folk gathered old buffalo bones to get cash.

Hamlin Garland lived on a homestead near Aberdeen. His vivid portrayal of prairie life shows up in his *Main Traveled Roads* and *A Daughter of the Middle Border*, the latter a 1922 Pulitzer Prize winner.

Life wasn't without brighter moments. At Aberdeen young L. Frank Baum edited the *Saturday Pioneer*. Later he won fame with his *Wonderful Wizard of Oz*.

Banker Frank B. Gannon was an Aberdeen pioneer quick in repartee. At a ferryboat one day a man asked him for 25 cents to pay his way across the Missouri.

"How old are you?" asked Gannon.

"Thirty-five," was the answer.

"Well, if you haven't saved 25 cents in 35 years, it makes no difference which side of the river you're on!"

Autumn gunfire festoons these Dakota skies with floating feathers as some 98,000 out-of-State hunters and every native who can find a fowling piece join in bagging ring-necked pheasants. Then the State's take from licenses and sale of shells, food, quarters, and transportation may reach $10,000,000.

No such mass bird hunting occurs anywhere else. In 1945 the bag was more than 7,500,000 pheasants!

Rodeos Recapture Days of Old

In a stage version of *Quo Vadis*, I saw a gladiator twist a bull's neck till it cracked.

"Bulldogging" in wild-West shows is like that. Cowboys called "bulldoggers" leap from running horse to galloping bull, seize him by the horns, drop beside him, and seek to throw him and flip him over, feet up, by twisting his neck. This may be as dangerous as riding that man-killing humpbacked Brahman bull of Texas (page 573).

South Dakota is a busy spot on that rodeo circuit of cow towns which stretches from Arizona to Oregon. Out here are few Broadway productions, no big league baseball or well-known race tracks; wild-West shows take their place.

"I don't want any cowboy to get gored to death or have his ribs cracked by a bronco; but if that's going to happen anyway, I better be out there!" That's how rodeo fans reason. Somebody gets hurt at every performance. At a Belle Fourche rodeo I saw them call the ambulance three times.

Comedy relaxes the strain. There's a clown with a trick mule whose tail pulls off, to the delight of small boys.

One clown I saw stands in a rubber barrel, his head and shoulders above its rim, and from

He Put This Calf in a Sack to Keep It Quiet—on an Airplane Ride

Thus secured, the calf couldn't jump about and hurt itself or leap out of the plane. A Midwest group, South Dakota Flying Farmers and Ranchers, now owns and uses planes for inspecting herds, fences, and windmills, for putting out rock salt, and for quickly running many other ranch errands. Bill Hunt, of Karlen Ranch, north of Reliance, holds the calf.

there taunts the infuriated bull with a red flag. When the animal charges, the clown drops down into his barrel, which the bull hits with vicious force. After he's knocked the barrel over, the bull often keeps on hooking it, rolling it about the arena, the clown tumbling about inside.

Sometimes a crazed bull crashes through a corral fence and scatters the spectators, or madly charges the nearest horse.

"Cow belles" gallop in between acts to do rope tricks and fancy riding, such as standing on their heads while riding or crawling under the necks of their running horses. But no gal tries to bust a bronc or throw a bull.

Most thrilling act of all is the wild horse finale. This means roping, blindfolding, bridling, saddling, and riding a small herd of absolutely wild, unbroken horses.

Two men work with each horse, which may bite, squeal, kick, or strike with his front feet.

South Dakota civilization was set up by men on horses. With equine aid men subdued Indians, drove big herds up from Texas, hauled in freight, ran the pony express, and pulled stagecoaches full of passengers and golden treasure from the mines. (One Deadwood-Cheyenne stage was armor-plated, to repel gunfire from bandits.)

The Horse Still Exalted

Today, people here still exalt the horse. Riding clubs dot the State. Sioux Falls horse shows draw entries from Minneapolis and Kansas City. Deadwood's riding club is known for its magnificent mounts, costly saddles, and the gorgeous raiment of its members.

Rapid City's boot and spur fans are top liners at wild-West shows. Their best act is dancing a horseback quadrille to music. This is a graceful but intricate and none too safe mass movement of weaving, turning, galloping horses that would delight even old-time cavalry teams that used to astonish Madison Square Garden horse-show crowds (Plate XI).

It's this glorification of the horse in South Dakota culture that puts the rodeo above all other sports. With it these robust and still a bit reckless people recapture, vicariously, the rough-and-tumble struggle their forebears had to win to survive. They love their past and make it live again in these bone-breaking gladiatorial matches between men, bulls, and broncos that keep their West wild.

Big Game Hunting in the Land of Long Ago

By Joseph P. Connolly and James D. Bump

President, and Director of the Museum, respectively, South Dakota School of Mines and Technology

CAN you imagine a hunting expedition of nine men fully equipped for three months in the field, but having orders not to kill anything and not to "bring 'em back alive"?

Such an expedition, under the joint sponsorship of the National Geographic Society and the South Dakota School of Mines and Technology, left Rapid City on a morning in early June in search of museum specimens of rhinoceros, saber-toothed tiger, giant pig, the antelopelike Protoceras, tapir, horse, and any other game that might be encountered.

But this game had lived, died, and been buried some thirty millions of years ago. The hunting ground was the Badlands of South Dakota, and the quarry was the fossil bones entombed in the rocks of that area.

When this region southeast of the Black Hills was subtropical, wet, and covered with jungle growth, small, mouselike rodents and tiny lizards lived here as neighbors to huge hornless rhinoceroses.

Three-toed horses, small camels without humps, tiny deer, giant swine, and many other forms grazed side by side, ever on the alert for such deadly foes as predaceous dogs and saber-toothed tigers.

Region Deserves Better Name

It was the American Indian, earliest human inhabitant of South Dakota, who first applied the name "Badlands" to this area, as he found it relatively dry and deeply eroded. He called it "Makosica" (*mako*, land; *sica*, bad).

The early French-Canadian trapper avoided the region when he could because of the difficulties of travel. He could not improve on the Indian name and referred to the area as "Mauvaises Terres." Likewise, the western pioneer could see little value in land so roughly battle-scarred by Nature; with a literal translation he adopted the early name, and it is so known today.

In some respects the name is unfortunate, as it has given rise to many misconceptions.

One evening in camp the senior author read to the members of the expedition a description of the Badlands that had recently appeared in a Sunday newspaper: "The visitor's fancy is taken even further back into the past by the twisted, tortured, barren Badlands. They are a no man's land of unimaginable desolation, where not even a sheep could find a livelihood."

Grins of derision spread through the group. And one man muttered, "Armchair travel writer."

As we glanced over the floor of the valley where we were camped, we saw spread out before us a brilliant carpet. Golden-yellow cactus blossoms, the white of the evening primrose and the mariposa lily, and the bright splashes of the scarlet mallow, all were set in a background of abundant rich grass. Not far from camp grazed herds of sleek, well-fed horses and cattle, and that day we had seen two huge flocks of sheep.

"Table-tops" and Valleys Fertile

It is true that the severely eroded slopes and pinnacles of the Badlands are barren, but thousands of acres on the upland tables and the larger valley floors are level and fertile.

Much of this area is covered with wild grasses, which afford good grazing for stock. The animals' drinking water is obtained from the rivers, from the numerous springs near the tops of the tablelands, from shallow wells, or from ponds formed by small rain-conserving dams.

Thousands of acres are planted each year to wheat, oats, flax, corn, and other crops, and have yielded abundantly in spite of the semiarid conditions.

Gradually people are losing their timidity regarding the country, and each year thousands of travelers plan their trips so that they may see something of its weird beauty.

How did these Badlands originate? Why the profusion of grotesque, rough topography? Why did so many prehistoric animals find a grave here? How were these entombed bones so perfectly preserved that now we may unearth them and decipher the fascinating history of the geologic past?

The story would be much too long for these pages if we started with the time when life first existed on this planet, more than a billion years ago. Let us turn to one of the later chapters in the geologic history of the earth, the Oligocene epoch of the Tertiary period.

As time is measured by the geologist, this chapter begins "recently," thirty to forty millions of years ago! The general outline of the continent had then reached about its present form, and life had passed through more than 90 percent of its evolutionary stages.

The midwestern United States had just been freed from a great inland sea. Several hun-

Joseph P. Connolly

"Big Game Hunters" Who Pried Their Quarry from the Rocks of South Dakota

Members of the National Geographic Society-South Dakota School of Mines and Technology expedition to the Badlands. Left to right, Dr. J. P. Connolly, leader; J. D. Bump, assistant leader in charge of field operations; Mahlon Binder, Blair Molander, and Merle Crew, technical assistants; Desmond Yetter, cook; Curtis Graversen and Thomas Blackstone, technical assistants, and A. C. McIntosh, biology professor, School of Mines. Technical assistants are School of Mines students majoring in geology.

dred feet of mud had settled to the bottom of this sea, and, hardened into black shale, now formed the foundation of the new land. The Rocky Mountains and the Black Hills had just been folded or pushed up from below. The Alps and the Himalayas were not yet in existence.

Hundreds of streams drained the newly formed Rockies and Black Hills, their waters muddy with fine silt. As they rushed down their mountain gorges and spilled out upon the plains to the east, the waters suddenly slowed down. They dropped their burden of sediment, which was built up into a great apron along the foothills of the Rockies and entirely surrounding the Black Hills (map, page 592).

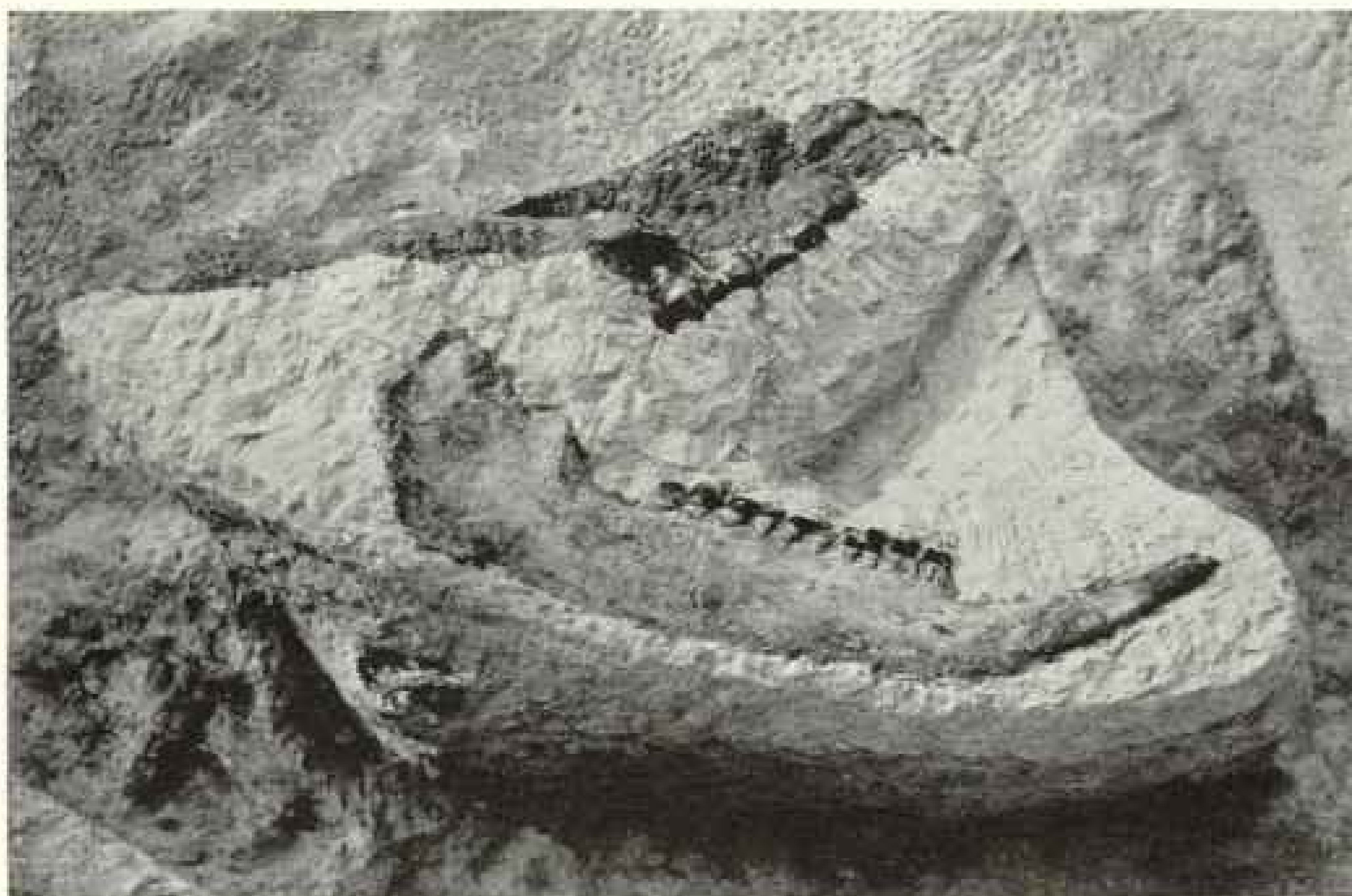
The plains country became an area of broad, meandering streams with braided channels, of shallow lakes and marshes, with some uplands. At intervals through this period the land was raised slightly. This increased the velocity of the streams, and they cut narrow, tortuous channels in the mud. As they slowed down again, they filled these channels with sand, later to be transformed into winding threads of sandstone interbedded with the clays.

Ash and dust, spewed out of volcanoes to the west, were carried here by the winds and deposited with the water-laid sediments. All of these processes resulted in the formation in South Dakota of a series of beds or layers of fresh-water sediments piled on top of each other and reaching in places a thickness of about 600 feet.

Fossils Gave Names to Rock Beds

This series of beds is known as the White River formation, from the principal stream that drains the area. The formation's lower third comprises the Titanothere beds, the middle third the Oreodon beds, and the upper part the Leptauchenia beds. The names have been chosen from the animals of long ago whose remains are found most abundantly in each division.

The expedition planned to carry on most of its work in the Leptauchenia beds. Close to their base, but found in quantity in only two places in the Badlands, are weird-looking masses of grayish-green sandstone. They are the remains, after erosion, of the channel-deposited sands, now hardened into sandstone.



J. D. Bump

The Badlands Yield a Rhinoceros Skull and Jaws 28 Inches Long

Within a stone's throw of the expedition camp, but high on a cliff side, workers found this specimen—largest of the species so far uncovered in the White River beds (page 595). The skull and lower jaws, with prominent canine teeth, were completely joined. A trench has been dug around the find and it is ready for a protective covering of burlap and plaster.

Because one of the most characteristic fossils of these channel sandstones is the Protoceras, they have been named the Protoceras Channels, or Protoceras Sandstone. Their maximum thickness is about 40 feet, and seldom is there a single exposure for more than 300 feet horizontally.

Hordes of Strange Animals Attracted

During this epoch the climate was subtropical, and an abundant rainfall brought about a luxuriant vegetation. Various creatures moved in to take advantage of the food supply, and there developed a horde of animal life. Flesh eaters preyed on the eaters of plants and on one another.

As death came, either through natural causes or from the struggle with tooth and claw, most of the remains were probably destroyed completely by disintegration and weathering. But some of the bones, and now and then the entire skeletons, became buried in the accumulating sands and muds and were thus preserved. By the long, slow process of mineral replacement the bones have since been partly petrified. It is these remains of the life of long ago that have attracted scientists to the Badlands for nearly a century.

Toward the close of the Tertiary period—probably 15 to 17 million years ago—the earth was troubled again with a deep internal unrest. The Rocky Mountains and Black Hills were raised to greater heights and the low-lying Badlands formations were elevated to a plateau. The once-sluggish streams were quickened and began to scour their channels deeper. Many new tributaries developed, and quickly (in a geologic sense) the upland plateau was dissected and carved by the streams into valleys, walls, spires, pinnacles—all the grotesque erosion forms we see there today.

Meanwhile, the warm, humid climate passed. The region became semiarid and cooler. Many forms of life became extinct, and evolutionary changes were quickened in others.

This climatic change was one of the three factors that produced rapid and steep sculpturing of the land and the development of typical forms and shapes of badlands country. The factors were: a climate with low rainfall more or less concentrated into heavy showers; a scarcity, therefore, of deeply rooted plants

Storehouse of Prehistoric Fossils—South Dakota's Badlands

In this deeply eroded area southeast of the Black Hills, a National Geographic Society-South Dakota School of Mines and Technology expedition unearthed bones of animals which lived 30 million years ago. Nearly 200 catalogued specimens were collected.

which would protect the soil and rocks from erosion; and a series of nonresistant, fine-grained sediments lying at a considerable height above the main drainage channels.

Occasional thin, hard layers, such as the Protoceras Channel sandstones, alternating with the soft beds, bring about differences in erosion and give rise to the queer "hoodoo" shapes characteristic of many badlands regions.

There is nothing mysterious or violent about the origin of the Badlands. The ordinary, everyday, familiar action of wind, rain, and sun, with the added element of sufficient time, has brought about the result we see today.

After several weeks of careful planning and preparation, our expedition set out for the Badlands. The caravan was made up of three trucks, each piled high with camping and collecting equipment (pages 590, 597).

After passing through the town of Scenic, we soon left the highway and entered the Pine Ridge Indian Reservation. Special permission to work in this region had been obtained from the Oglala Sioux tribal council and the Department of the Interior.

Winding trails led us to the White River. We found it in flood, the white, muddy waters that give it its name running full from bank to bank. Would we be mired down in the center of the stream? Two men volunteered to find out. They waded in cautiously and finally waved us on to a successful crossing.

On the south side of the river we "ran out of road," but negotiated some miles of rough going without serious mishap. We were brought to a stop at the head of a gulch hemmed in on three sides by badland walls; from these projected jagged sandstone ledges, the Protoceras Sandstone which contained our hopes for the summer. This was our destination, and it was to be our home for the next three months.

The camp rapidly took form. The cook tent and the combination mess-study-recreation tent, with connecting fly, were erected close together (page 596). A short distance away we set up a large army squad tent and a smaller headquarters tent. A dugout was excavated in a vertical bank close to the cook tent. In this were placed the kerosene-fired refrigerator and the perishable supplies.

Near the center of the camp we erected a flagpole and hoisted a National Geographic Society flag. Such flags of blue (for the sky), brown (the earth), and green (the sea) have flown in expedition camps from the North to the South Poles and in many other far-flung areas during the last half century.

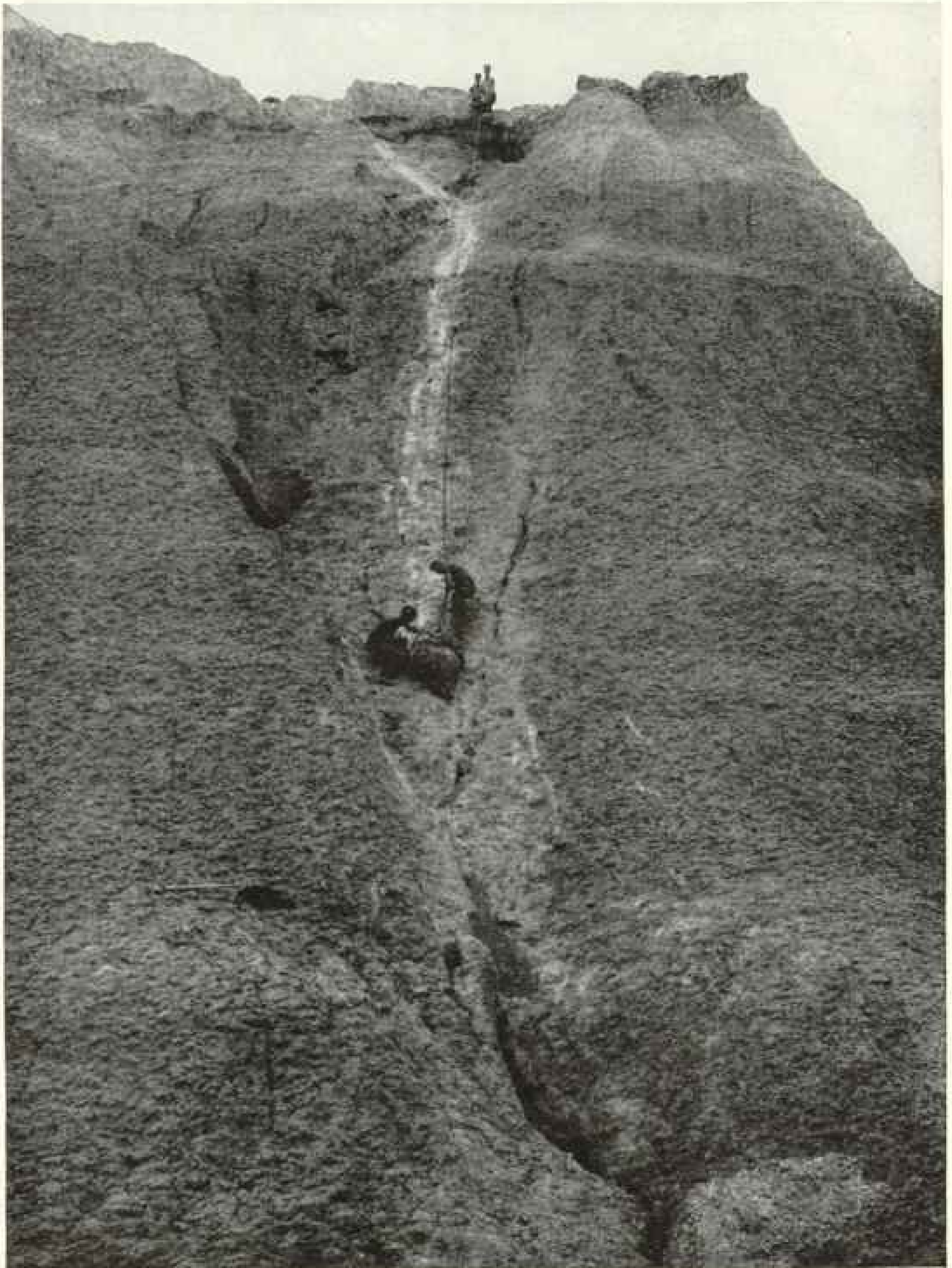
We were fortunate in obtaining plenty of pure water by sinking a pointed pipe close to the bank of the White River. This meant a haul of nearly five miles to camp.

Sun Heated Water for Baths

Our shower bath was improvised from a 50-gallon iron drum set up on a convenient block of sandstone about seven feet high. The water allowed for the shower was the unused portion of the forty gallons transported to camp each day. The sun did the heating, and many were the days when we wished it were not so efficient.

No formation in the Badlands is so difficult to prospect and collect from as the channel sandstones. We knew we were taking the hard way. Months before, after careful consideration, we had decided to concentrate on the channels in spite of the difficulties they offered.

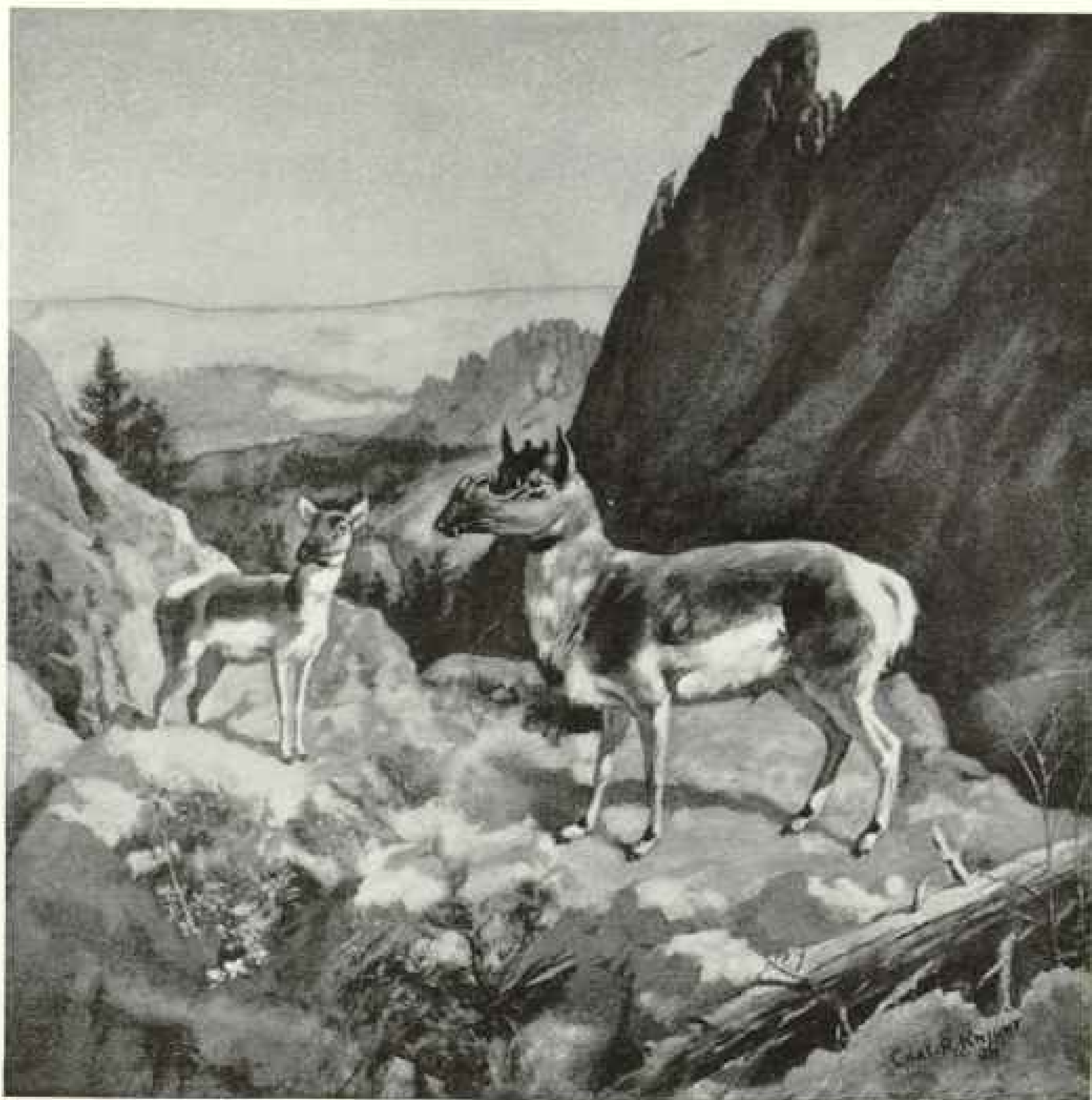
We were aware that fossils were less abundant in this exposed hard rock than in the surrounding soft clays. We suspected that the finding of a complete skeleton or even of skull and jaws joined together would be a rare event. As the channel sandstone had been deposited by swift waters, the bones of any animal would probably be separated and scattered before they were completely covered. They might have been worn by the sand, broken, or crushed before Nature's burial.



J. D. Boyd

Down a Steep Cliff Slides the Carefully Wrapped Skull of a Giant Pig

This heavy specimen was discovered on the crest of a ridge. The prize was encased in plaster and burlap and wrapped in heavy canvas. Then it was lowered with block and tackle down the rough trail. Fossils of this type of prehistoric pig have been found only in the sandstone of the White River region.



Charles R. Knight; courtesy American Museum of Natural History

Before the Dawn of History, Protoceras Roamed the South Dakota Uplands

From the study of skeletons found in the channel sandstones of the upper White River beds, the artist has reconstructed this prehistoric scene (pages 595, 599). Scientists determine the sex of these deerlike creatures by examination of their skulls. Males have bony protuberances which supported horns.

But we knew that there was a more encouraging side to the picture. Good channel outcrops are scarce, little known to prospectors, and unheard of by many because of their remoteness from highways. Anything we found would almost surely be rare, and there was an excellent chance of bringing to light some finds new to science.

We expected many disappointments. More often than not, when a fossil seeker finds part of a bone projecting from a rock and believes that he has a perfect prospect, it turns out to be nothing more than a small fragment. Unfortunately, this fact usually is not determined until hours have been spent in chiseling away a matrix that is almost as hard as concrete.

There are many evenings when the "bone hunter" trudges into camp with nothing to show for his day's labor but a handful of painful blisters. But the memory of such days is soon erased when fortune smiles and a worth-while specimen is found. On these days we know by the grin on the hunter's sun-darkened face and the jauntiness of his walk that he has good news to report.

By the end of June, forty-six specimens had been collected and numbered.

Our practice is to dig out a block of rock containing the bone. This protects it during

transportation to camp and later to the museum. Furthermore, working the specimen out of the rocky matrix is a delicate operation and can best be performed in the laboratory.

One prize of the first month's work consisted of the skeletal parts of some large birds. This material has been studied by Dr. Alexander Wetmore, Secretary of the Smithsonian Institution and member of the Board of Trustees of the National Geographic Society. He described from it a new genus and species, *Gnotornis aramiellus*, and a new species, *Bathornis geographicus*, the latter named for the National Geographic Society.

Bird bones are rare in all fossil beds, and this is especially true in the White River Badlands. Such bones are thin-walled and fragile, usually small. It is believed, also, that birds rarely met their death in places and under conditions favorable for burial and preservation of their skeletons.

Fossil Egg Found in Sandstone "Nest"

Before the summer was over, we had collected the fossil bones of five other birds.

One day, shortly after the finding of the first bird specimen, one of the assistants crawled into a huge sandstone crevice for a few minutes' relief from the sun and saw there a fossil bird egg embedded in the rock (page 600). Fatigue was forgotten as he set about collecting the egg in its sandstone nest. This is probably the first egg that has been found in sandstone of this age. It is larger than those found in the lower clays. Its identity has not yet been established.

A huge rhinoceros skull with the lower jaws joined to it was found high on a small divide only two hundred yards from camp (page 591). It was chiseled out in a block of sandstone that weighed about 500 pounds, a burden that gave us no small problem when we came to lower it down the vertical wall. This specimen of rhinoceros, *Amphicaenopus platycephalus*, is particularly complete and will add much information to that obtained from the fragmentary material from which the genus was originally described.

Then there were specimens of pond turtles, peccaries, tapirs, horses greatly advanced from the early three-toed stage, large pigs, Protoceras, Ancodonts, and many others. Protoceras was a slenderly built animal, much like an antelope. The female was without horns, but the male skull shows three pairs of bony protuberances that supported horns during life. Fossilized remains of Protoceras are rare, and are seldom found complete and uncrushed (pages 594, 599).

The Ancodonts are another group of extinct animals, somewhat larger than Protoceras, whose relationship with other mammals is as yet uncertain. Their fossils are known to occur only in the channel sandstones in the White River region. Complete remains, even joined skulls and jaws, are found rarely.

The work was arduous and exacting, but there was no complaint. It was all too interesting for that. And there were times for recreation and relaxation. Just outside of camp was a good-sized alluvial fan, a gently sloping area built of hard-packed fine sand. It made an ideal court for softball, and early in the summer we had a game every night after dinner (page 596).

Later in the summer horseshoe pitching replaced baseball, and a tournament was played.

After dark everyone assembled in the mess tent for various activities, such as writing up the day's notes, keeping diaries, or "studying shop"—texts on vertebrate paleontology. When Prof. Arthur C. McIntosh, an authority on entomology, was in camp, many interesting evenings were spent outdoors, with the group sitting around a gasoline lantern and identifying insects attracted by the light.

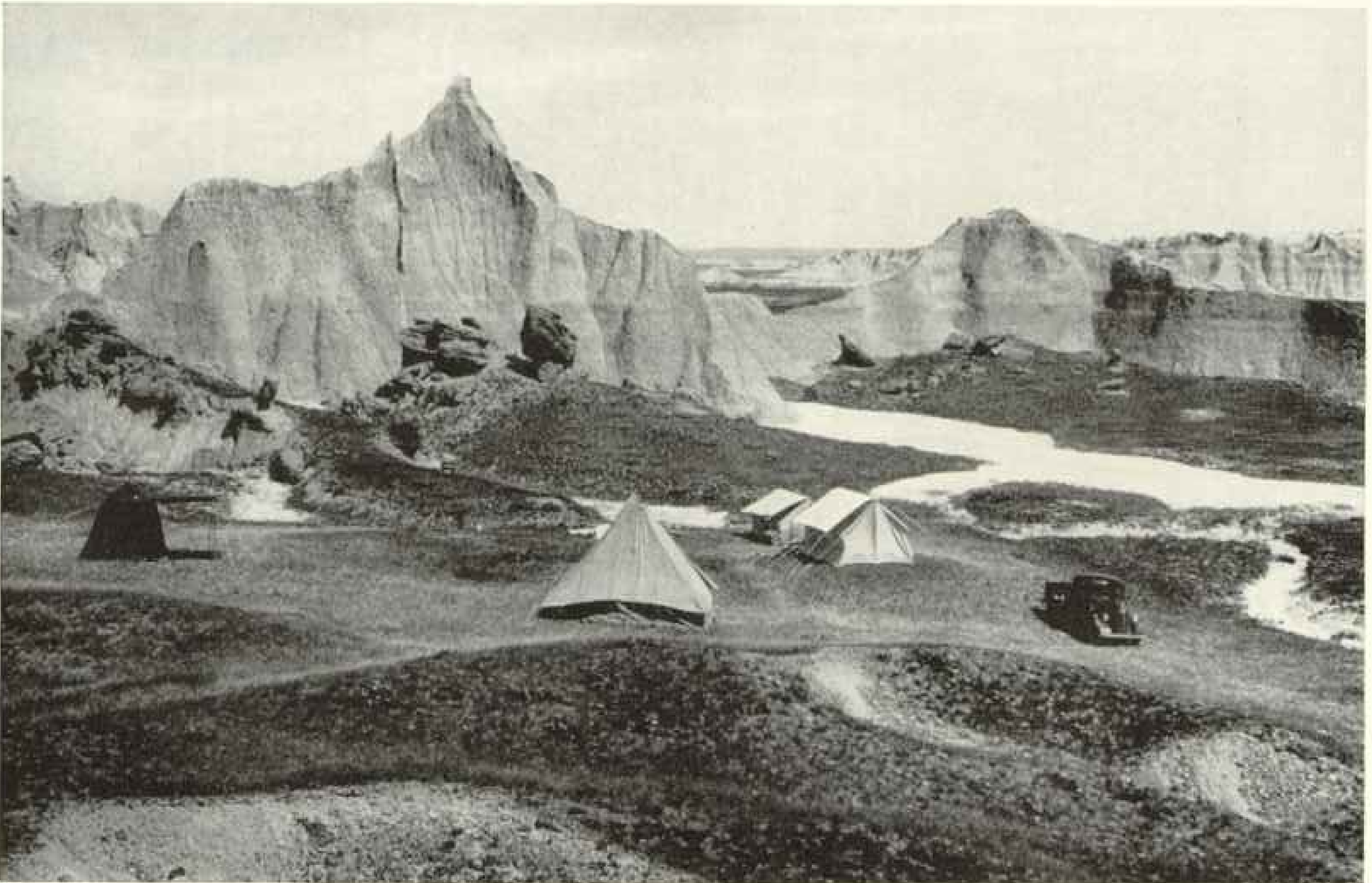
The battery-operated radio receiver was a convenience. It brought news, time signals, and entertainment. There was the added comfort that if at any time an emergency developed, a message could be sent to us from the School of Mines Station WCAT. We had a prearranged schedule for listening.

Summer Sun Kills Snakes in Open

When we first went into the field, some of the men were concerned about rattlesnakes. We killed five during the summer, three of them in or close to camp. We were prepared with the usual snake-bite remedies and used sensible precautions in walking across areas covered with vegetation.

But we did not worry about snakes on a fossil location. These reptiles do not live out in the sun on the barren rock exposures where the collecting was done. The high temperatures, caused by a combination of the direct heat of the sun and radiation from the rocks, are too much for them. We had demonstrated this more than once on previous expeditions. A snake, flipped out of its shady retreat under a rock or cactus plant and left in the full glare of the sun, succumbed in less than twenty minutes.

As July arrived, so did the heat. Many days sent the mercury well above the 100-degree mark on our maximum-minimum thermometer, which was kept in the shade under the north side of a big rock. Actual tests



Joseph P. Connolly

At the Foot of Fantastic Sandstone Pinnacles and Cliffs, the South Dakota Badlands Expedition Pitched Camp

The wide white streak at right is dry stream wash, firm and hard—a natural softball diamond for the boys (page 595).

Joseph P. Connolly

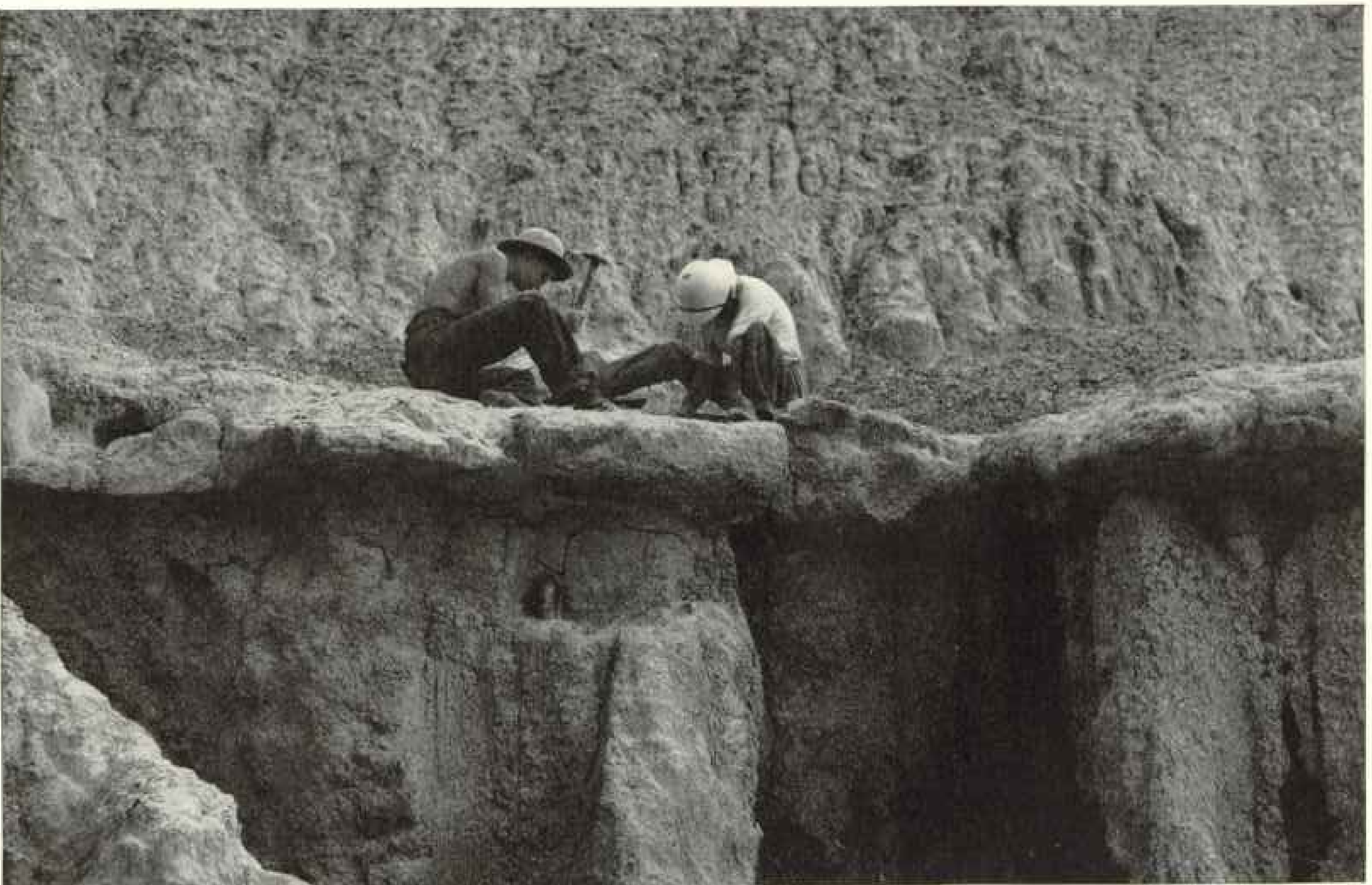
Pushing Across the White River, Expedition Trucks Blaze a Trail into the Badlands

The bottom is hard, so there is no danger of being mired. The third truck, exposed to the "stern waves" of the leaders, shipped water and limped out on two cylinders. In the area drained by the White River, southeast of the Black Hills, lie prehistoric river beds, where the expedition work was carried on.

Joseph P. Connolly

When a Sandstone Chunk Broke from This Ledge, Half of an Anocodont Skull Toppled with It; the Other Half Stuck in the Cliff

Here Thomas Blackstone (upper left) frees the piece of skull from the cliff face. Blair Molander (lower right) extricates the other half from the block which crashed into the gulch (page 601). The fallen chunk was found only after a painstaking search (page 595).



Joseph P. Connolly

Beneath This Ledge, a Long-buried Protoceras, or Antelopelike Creature, Was Found

Here two scientists are hacking out a section containing the skeleton. Some of the bones can be dimly seen on the cliff face just above the small canteen (page 594). The body probably came to rest on the muddy bottom of an ancient stream and was covered by accumulating sand. It had not been disturbed since death.

It was thus readily identified as a female (page 599).

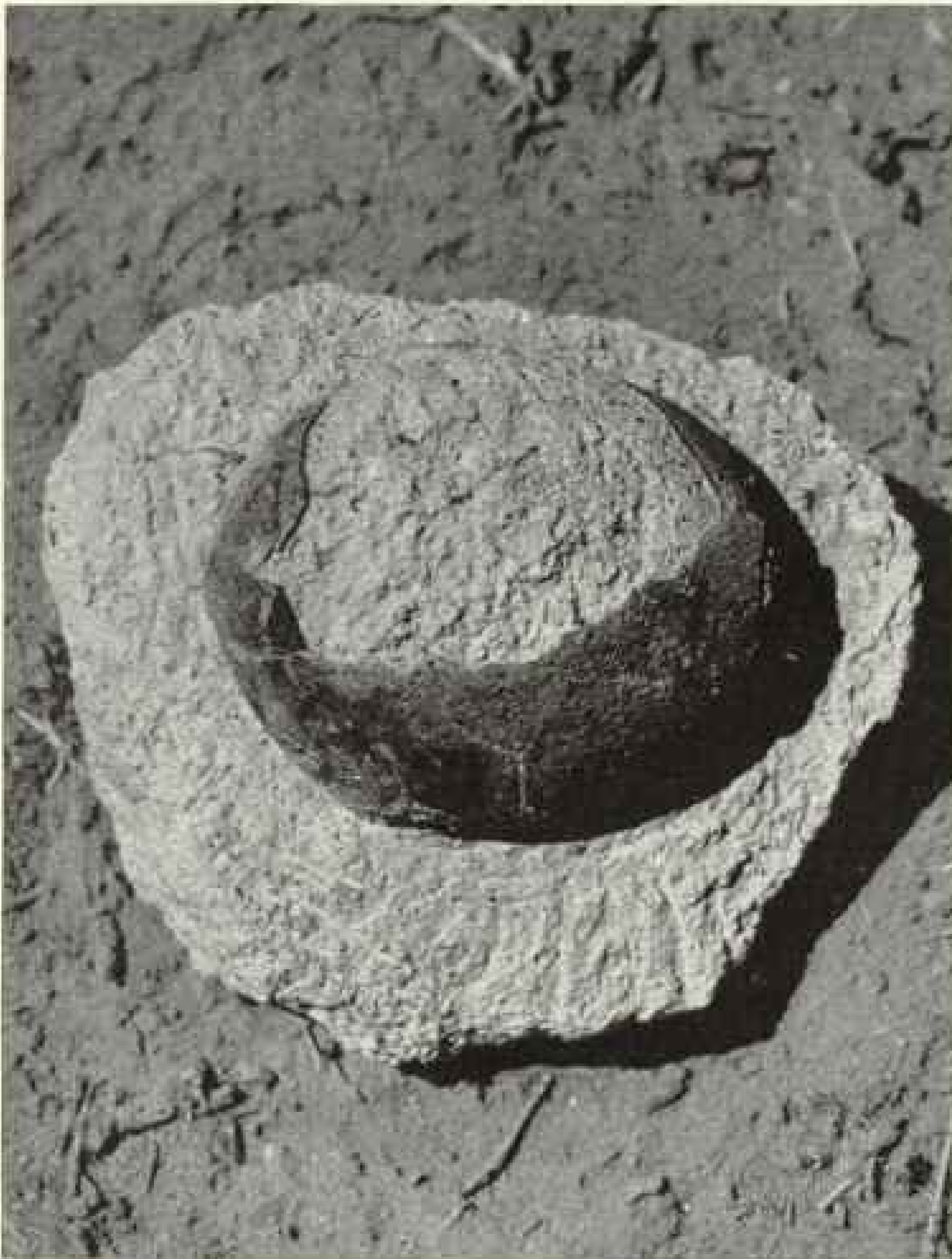
The collection of this specimen was a challenging problem. The ledge hung out over a sheer wall, at the base of which were two large erosion sinks into which the specimen threatened to plunge. We had to leave an unusually large amount of matrix about the skeleton, and the block of sandstone was heavy, but we succeeded in handling it with the aid of block and tackle.

Among other interesting discoveries were a skull of a small, very rare insect-eating mammal; a good pig skull with jaws, probably of the same species as one found in June; another skull as yet unidentified; and specimens of saber-toothed tigers, rodents, and rhinoceroses.

At one time near the end of July there were 13 specimens ready simultaneously for the final stages of collecting.

The bones had been uncovered as much as was desirable, and then by careful work a trench had been excavated around each specimen to leave it isolated on a small pedestal. The fossilized portion and much of the matrix had been hardened by repeated applications of thin shellac. Then a layer of rice paper had been glued on with thicker shellac.

After several days of this sort of preparation, specimens are ready for plastering. Ordinary tissue paper is applied wet to all of the exposed bone to prevent the plaster from sticking to it. Strips of loosely woven burlap four to six inches wide are saturated in a thin mixture of plaster of Paris and then wrapped over and around the specimen. The fingers are used to push the burlap thoroughly into



J. D. Bump

Nature Preserved This Egg in a Sandstone Nest

One afternoon an expedition member crawled into a huge crevice to escape the hot South Dakota sun. There he was amazed to see a fossil bird egg embedded in rock (page 595). The shell was nearly complete. The photograph, made soon after the discovery, shows much of the sandstone matrix still attached.

showed that out in the sun the temperature was often thirty degrees higher. Yet after a month out of doors everyone was in fine physical condition. The evening never failed to bring relief and a comfortable sleep; during the nights the temperature fell to about 66 degrees.

Many fine specimens continued to pour in. A Protoceras skeleton, with the bones perfectly joined and preserved, was found embedded on the under side of a 30-inch overhanging ledge of sandstone.

Unfortunately, the rear third of the skeleton had been weathered away, but the connected skull and jaws were in excellent condition.

all of the irregularities. It is a messy job.

In about twenty minutes the plaster sets, and the specimen has a hard protective covering over the top and sides. Now the pedestal is carefully undermined with a pick and turned over.

Excess rock is chiseled from the bottom, and the under side is sealed with similar protective plaster bandages.

To finish the job of bandaging and bringing in all the specimens that were ready, we decided to work into the night. There would be a full moon and cool working temperatures. We each ate a sandwich, and by 5 o'clock were on the way again.

Two of the crew took the truck to attempt a passage to the rugged area where the fossils were located. The others hiked, loaded with large canteens of water, plaster of Paris, burlap, and canvas. The cook had been ordered to have a banquet ready at midnight.

J. D. Bump

Shellac Tightly Binds Uncovered Bones and Matrix

Another Ancodont skull has just been unearthed. To protect it, shellac thinned with alcohol is poured over the entire chunk of bone and stone. The liquid penetrates all the pores. When the alcohol evaporates, the shellac hardens and firmly holds all parts of the specimen together (pages 595, 598).

Before dark a giant pig skull weighing more than a hundred pounds had been collected. As we labored at another huge specimen located on a high, knife-edge ridge, we were under the careful observation of a large hawk soaring over us. Its nest and young were on a crag some 300 yards away.

Bats by the score annoyed us as they swooped and dived within a few inches of our heads, and now and then we would hear the mournful howl of a coyote echo and re-echo among the canyon walls.

But it was fun to work in the cool of the night, and before long we were struggling up the side of a sharp divide with the last large specimen.

We could not safely take it down toward the truck, and we had to carry it to camp, tugging the heavy load across places that had seemed practically impassable in the daytime when we were empty-handed. It was midnight, and the moon was nearly overhead as a weary group sat down to a welcome meal.

Rich Haul from Small Ledge

August frequently brings a slowing down of field work. Unexplored parts of the field are farther from camp, and it is necessary to drive to the working locality over poorer trails.

The hot weather becomes more of a trial, and working conditions in general are not so favorable.

But this August was different. We could

Burlap Bandages Protect a Find of Three Rhinoceros Skulls

As soon as the chunk of brittle, fragile bones has been "tooled out" of the surrounding shale, it is covered with cloth saturated with a thin mixture of water and plaster of Paris. This hardens into a cast.

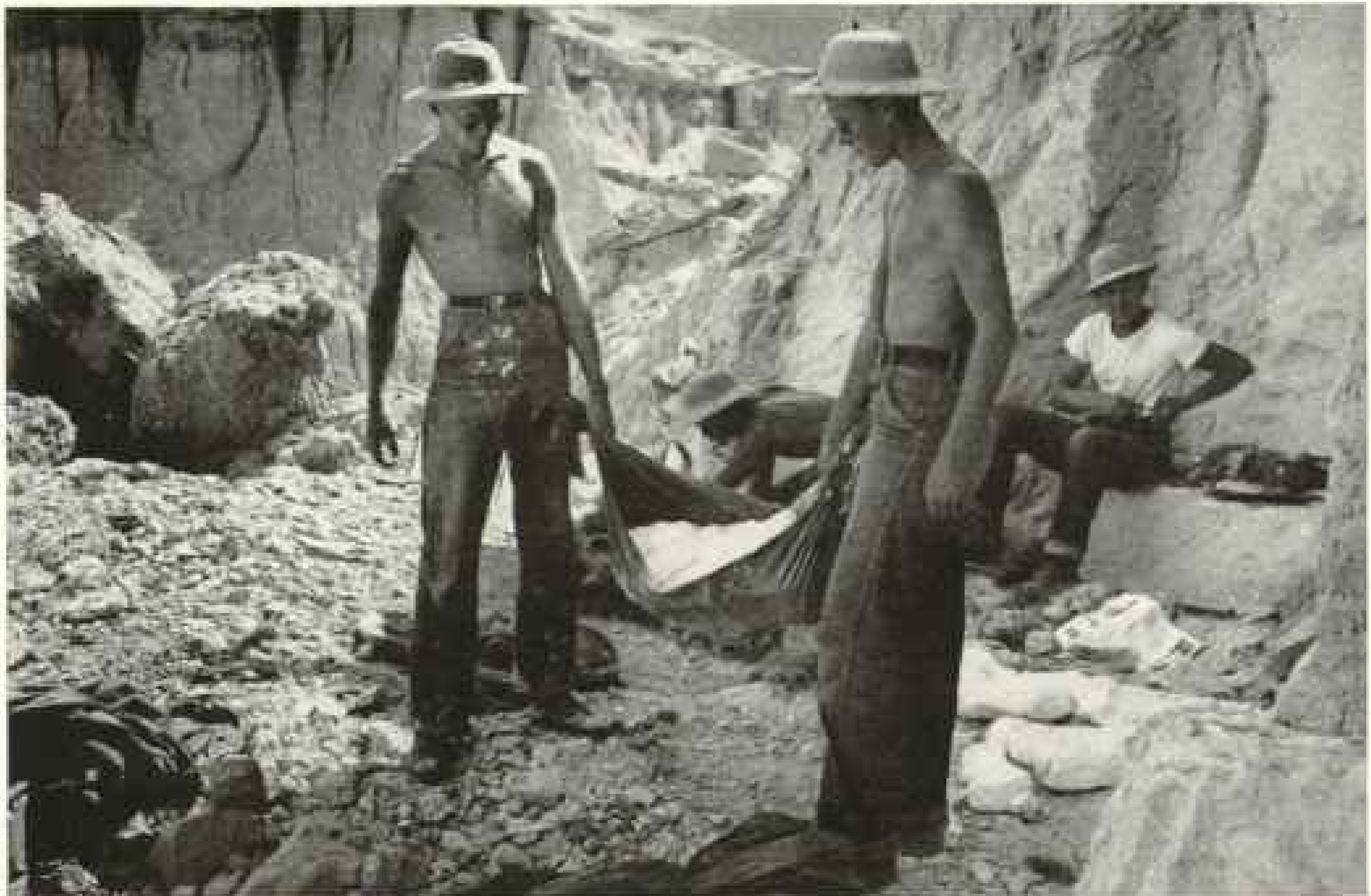
Joseph P. Connolly

Encased in Plaster Casts, Bone-filled Rocks Are Loosened at the Base

Expedition members enjoyed working with the rhinoceros skulls, because they found the specimens in a shady spot. In July the thermometer often rose to 130° F. in the sun and above 100 in the shade.

Anxious Moment!—Will the Bone-laden Blocks Break Off Cleanly?

Did the workers dig deeply enough so all the rhinoceros bones will come up intact within the chunk? Or will fragments remain embedded in the quarry floor? Fortunately, each section turned over safely.



Joseph P. Connolly

Expedition Workers Carry the Blocks to the Valley in Canvas Slings

Closest truck approach was half a mile away and the path led over a ridge. Sixty-nine packages of skulls and skeletal remains were transported by hand from this one digging.

J. D. Bump

The Expedition Risks Axles and Springs to Load the Giant Pig Skull

Tedious descent from the ridge completed (page 593), the fossil is lifted aboard. The truck bumped its way into seemingly impenetrable places to pick up the loads of "prehistoric game."

not collect the specimens and transport them to camp as fast as they were discovered. The average quality of the specimens was better than those we had found in June and July.

High up on the side of one narrow draw about five miles from camp we located an outcropping of sandstone less than 10 feet thick and not more than 200 feet long. From it we took 14 extraordinarily fine fossils. Among these were two sets of gigantic pig skulls and jaws, each collected in a block weighing between 400 and 500 pounds. The skulls are more than 30 inches long and have great oval-shaped tusks.

Other Valuable Finds

Other valuable finds were three rhinoceros specimens, one a nearly complete set of skull and jaws; a male Protoceras skull in perfect condition; and a tapir skull of large size.

From other areas came important discoveries: a perfect rodent skull and jaws with a few foot parts, from a nodule in the Leptauchenia clays; a very important female skull belonging to the Protoceras family; the nearly complete foot parts of several animals, always a welcome find; Leptochoerus, Ancodonts, horses, and several rhinoceros specimens.

From one quarry alone we collected a rhinoceros group consisting of two adult skulls and jaws, the skull and jaws of a baby rhino, and most of the skeletons (pages 602-3).

Many interesting stories could be told of various incidents that might have been accidents.

One man sank the point of a pick into his foot in an effort to prevent a fall from a vertical cliff.

Another time the truck broke through an innocent-appearing dry crust and sank to the box in gelatinous mud. Before it could be rescued, a flood from a local cloudburst rushed down the canyon and threatened its destruction.

One day Professor McIntosh wandered away in the early morning with an insufficient sup-

Joseph P. Connolly

Scientific Jig-saw Puzzle—Putting a Pig's Skull Together

Merle Crew fits the pieces in the South Dakota School of Mines laboratory. The specimen lies upside down on the table, huge tusks protruding at left. Sandstone matrix has been carefully removed.

ply of drinking water. He finally staggered into camp "absolutely dehydrated," just as we were about to organize a rescue party by moonlight.

There were no serious accidents, however. The summer passed quickly, and when the last week in August arrived we broke camp. The results of the expedition exceeded our most optimistic hopes. Each member had performed his part well; the weather man was not too unkind, and luck played on our side.

Fossils Reach "Operating Table"

Our summer work resulted in 194 catalogued specimens. Much slow, painstaking, but fascinating work lies ahead of us, and it has already begun.

The big rhino, two huge hogs, and several smaller specimens have been on the "operating table."

The plaster bandages, put on in the field, have been cut away. The rocky matrix has been carefully removed with small chisels, dental picks, and scrapers.

Each small bit of bone or tooth that may be broken off by accident in the field laboratory is saved and labeled and will be accurately replaced before the mount is completed.

If there are missing parts, because of accidents of burial thirty million years ago or because of later weathering or erosion, they will be restored in plaster. Many of our specimens are so nearly complete that little restoration will be needed.

Some of the finds, we already know, do not fit the description of any previously known forms, and we are sure, therefore, that we have some other new genera and species.

Many of the trophies are on exhibition in the School of Mines Museum and in Explorers Hall at the National Geographic Society headquarters in Washington. Others, incomplete, but of scientific value because of their rarity, will be filed at the school in storage cabinets for the use of scientists.

Nautical Norfolk Turns to Azaleas

By William H. Nicholas

AN IDEA, the depression of the thirties, and nine years of hard work have transformed a 40-acre stretch of tangled undergrowth outside Norfolk, Virginia, into an azalea fairyland.

Last year, between March 17 and April 22, the height of the season, 75,000 azaleas burst into bloom in this youthful addition to the Nation's floral show places. In a wooded setting of wax myrtle, sweet bay, dogwood, holly, cypress, and tall loblolly pines, the dazzling display thrilled 67,500 visitors.

The man who had the idea was Frederic Heutte, Norfolk's French-born Superintendent of Parks and Forestry (Plate IV). In 1937 he visited the azalea gardens of Charleston, South Carolina.* A horticulturist since he was 14, Heutte was so impressed with Charleston's magnificent azalea showing that he wanted Norfolk to have azalea gardens, too.

Climate Favorable to Azaleas

He felt sure his city's geographical location was favorable. Almost surrounded by water, its temperature is more even than that of most eastern cities. Seldom has the thermometer dropped lower than 20° F. above zero.

Heutte believed that not only could cold-hardy varieties be raised here, but also delicate southern species which could not survive at other places so far north. Therefore, he reasoned, Norfolk azalea gardens would have a longer blooming season than gardens farther south, because they could have many varieties of both early- and late-blooming types.

Norfolk's ship-minded city fathers gave the project enthusiastic approval and backing. For a location they chose a tract in Norfolk's watershed properties about six miles from the city limits. It comprises about 75 acres of high, wooded ground, and an equal acreage submerged by an arm of Little Creek Reservoir.

Here moisture from the lakes and the presence of many tall trees afford additional protection in winter.

In 1938 several hundred Negro women, unable to find work, were on Norfolk's relief rolls. To give them employment, the city formulated a WPA project for the azalea park, with 90 percent of the work to be performed by women. With a trial fund of $50,000 the job was begun.

By the end of 1938 a section of underbrush had been cleared and 4,000 plants, of 12 varieties, purchased by WPA, had been set out. Propagation from these was begun immediately. Another $100,000 WPA grant was made available later. The employees took pride in their work and some are still there.

Today 40 acres have been cleared, with 25 devoted to azaleas. On them are 75,000 blooming plants and many thousands of cuttings.

Visitors may wander over six miles of trails—a main path a mile in length from start to return, and five radiating walks.

Other Flowers Bloom in Profusion

In addition to azaleas, more than 5,000 rhododendrons,† vast quantities of camellias, Japanese iris, daffodils, and mountain laurel have been planted. An ultimate objective, in addition to improving and increasing the azalea display, is to build up impressive showings of other varieties of blooms in other months of the year.

Growing of Indian azaleas justified Mr. Heutte in his belief that delicate species would thrive outdoors the year round in Norfolk. Most Indian azaleas require greenhouse cultivation in cold weather.

The Formosa clone *(R. phoeniceum)* shown in Plate I is more than 12 years old, and was one of the originals in the garden. It is five feet tall and about the same breadth. The Formosa (not named after the island) usually reaches a height of eight feet, but this one may exceed that size, for in the last few years its growth has been about a foot a year.

The blooming Hinodegiri azaleas (*R. obtusum* Hinodegiri) shown in Plate II belong to the Kurumes, a race introduced to cultivation in the eastern United States by the late Dr. E. H. Wilson, the famous plant hunter of Harvard University's Arnold Arboretum.

In 1914, when Dr. Wilson was in Japan, he visited a nursery district near Tokyo where for the first time he saw these plants in dwarf forms, bearing flowers of many colors. Some of them were brought to the United States three years later at his direction.

Across the water from the Hinodegiri in Plate VIII stands a bed of *R. arnoldianum* plants, cold-hardy hybrids developed in the Arnold Arboretum and by near-by Massachusetts azalea enthusiasts.

* See "Charleston, a Colonial Rhapsody," by B. Anthony Stewart, National Geographic Magazine, March, 1939.

† Azaleas are classified as rhododendrons by botanists, although their superficial differences are so prominent that in gardens they are regarded as separate individuals. In L. H. Bailey's *Standard Cyclopedia of Horticulture* all azaleas are listed under rhododendron. For example, the torch azalea is listed as *Rhododendron kaempferi.*

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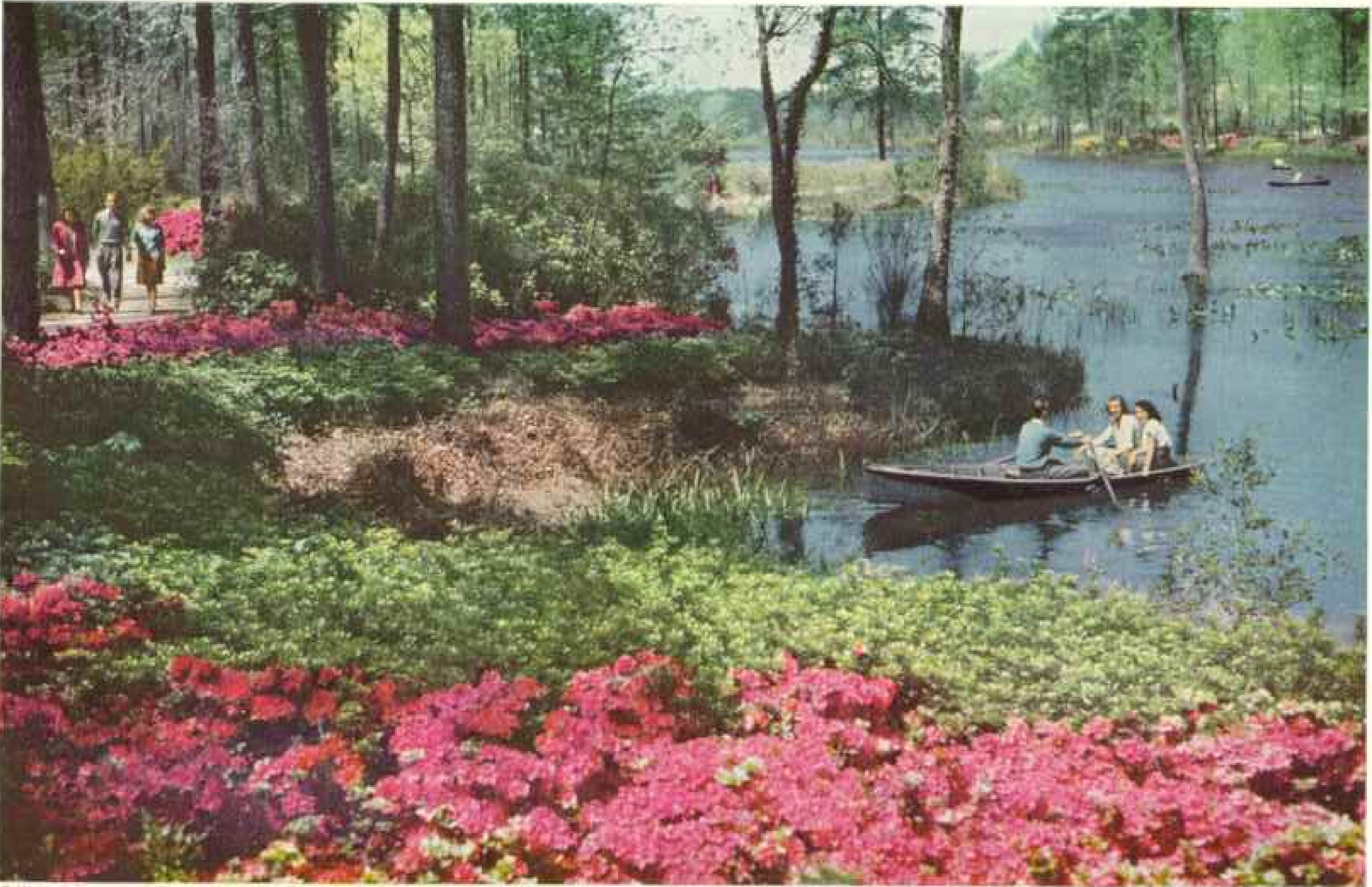
Kodachrome by B. Anthony Stewart

Bright Banks of Indian Azaleas Outshine an Admirer's Daisy Crown

This Formosa is one of 75,000 plants of blooming size which have made the public azalea gardens of Norfolk, Virginia, a national show place. Begun in 1938 as a work-relief project, the gardens now have replaced tangled undergrowth on a tract six miles from the city limits. Twenty-five acres are planted in azaleas alone.



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Kodachrome by B. Anthony Stewart

Paths and Rowboats Take Visitors to Gardens Which Are Half Water and Half Land

About 75 acres of Norfolk Gardens are wooded land, with a like area submerged by an arm of Little Creek Reservoir. In foreground are Hinodegiri azaleas (Kurumes), introduced to cultivation in the eastern United States by Dr. E. H. Wilson, famous plant hunter. The green plants, macranthas, are the last to bloom.

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Kodachrome by B. Anthony Stewart

Loblolly Pines Protect Flowering Shrubs by Filtering Sunlight and Feeding Soil with Needles

These trees are ideal "big brothers" for azaleas. Just the right amount of light seeps through to allow undergrowth to flourish. Their dead needles, shed yearly, give proper acidity to the earth. They also "insulate" the soil and form a mulch which keeps moisture from evaporating. Dogwood forms a canopy in background.

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Kodachrome by B. Anthony Stewart

Too Ambitious Plants Need Pruning Shears

Portions of this Atropurpureum specimen have grown too fast and are being cut back by Frederic Heutte, French-born superintendent of Norfolk's Bureau of Parks and Forestry. With him is the Norfolk Gardens' supervisor, Daniel L. Harrison, a former sea captain.

Kodachrome by John E. Fletcher

Azaleas Come in Many Varieties, Admirers in All Sizes

This youngster and her mother examine delicate Formosa blossoms. More than 65,000 persons see the annual show, in late March and early April, when the blooms are usually at their best. Visitors wander over some six miles of trails, all bordered with dazzling flowers.

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Kodachrome by John E. Fletcher

Brilliant Masses of Azaleas Beneath Towering Pines Make an Exotic Picnic Setting

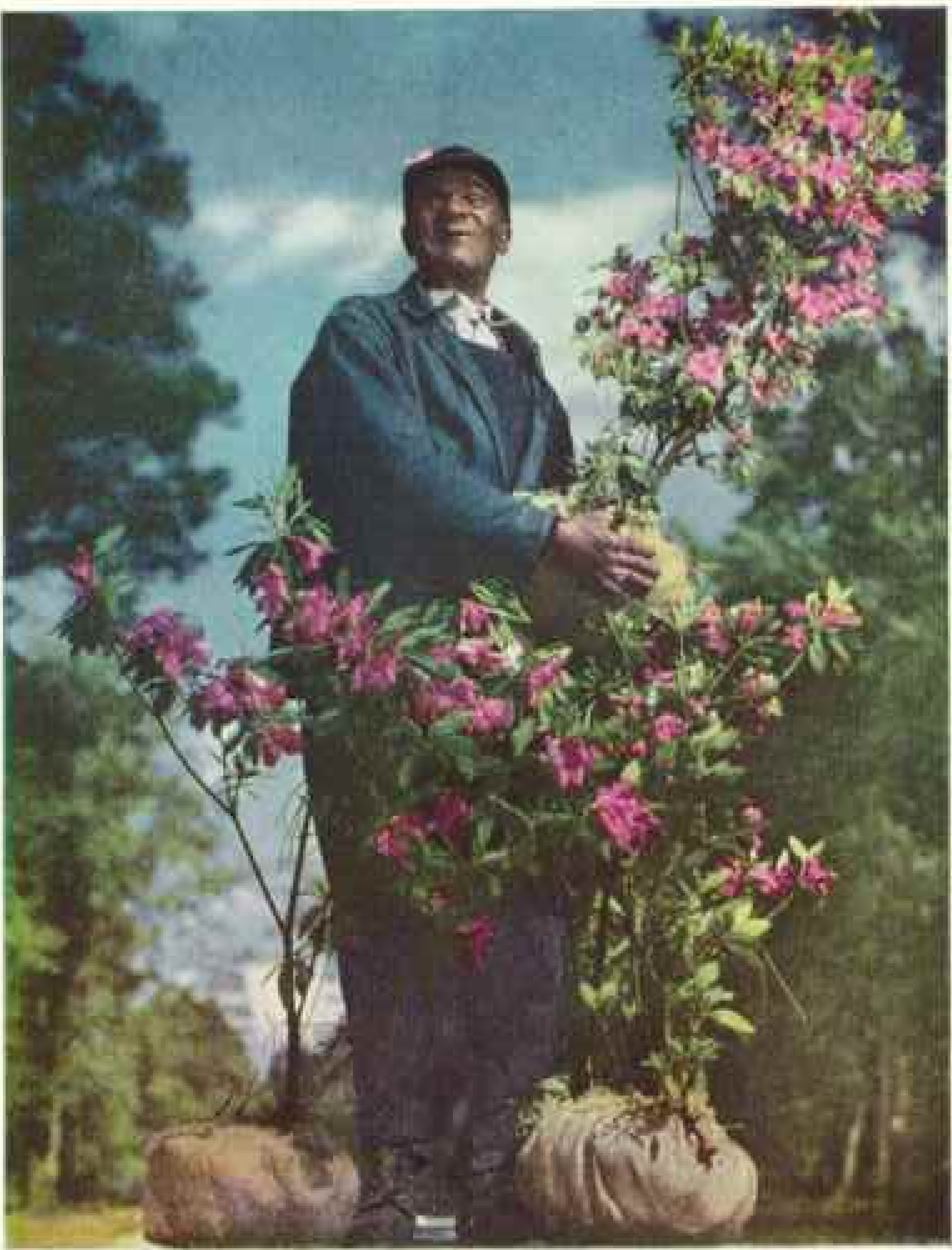
Many such groups hold outings in Norfolk Gardens. Botany students on field trips are frequent visitors. Supported entirely by the city, the gardens are open every day. In the foreground above are Hinodegiri azaleas, with Hinomayo behind the picnickers.

© National Geographic Society

Ansco Color by B. Anthony Stewart

A Nine-year Labor of Love Helped Create a Beauty Spot for Tidewater Virginia's Busy Metropolis

These four women have worked in Norfolk Gardens since the project started. Here they rake loblolly pine needles from a path, as a fire precaution and to provide mulch for the azalea plants (Plate III). The women also are adept in azalea propagation, preparation of beds, and planting.



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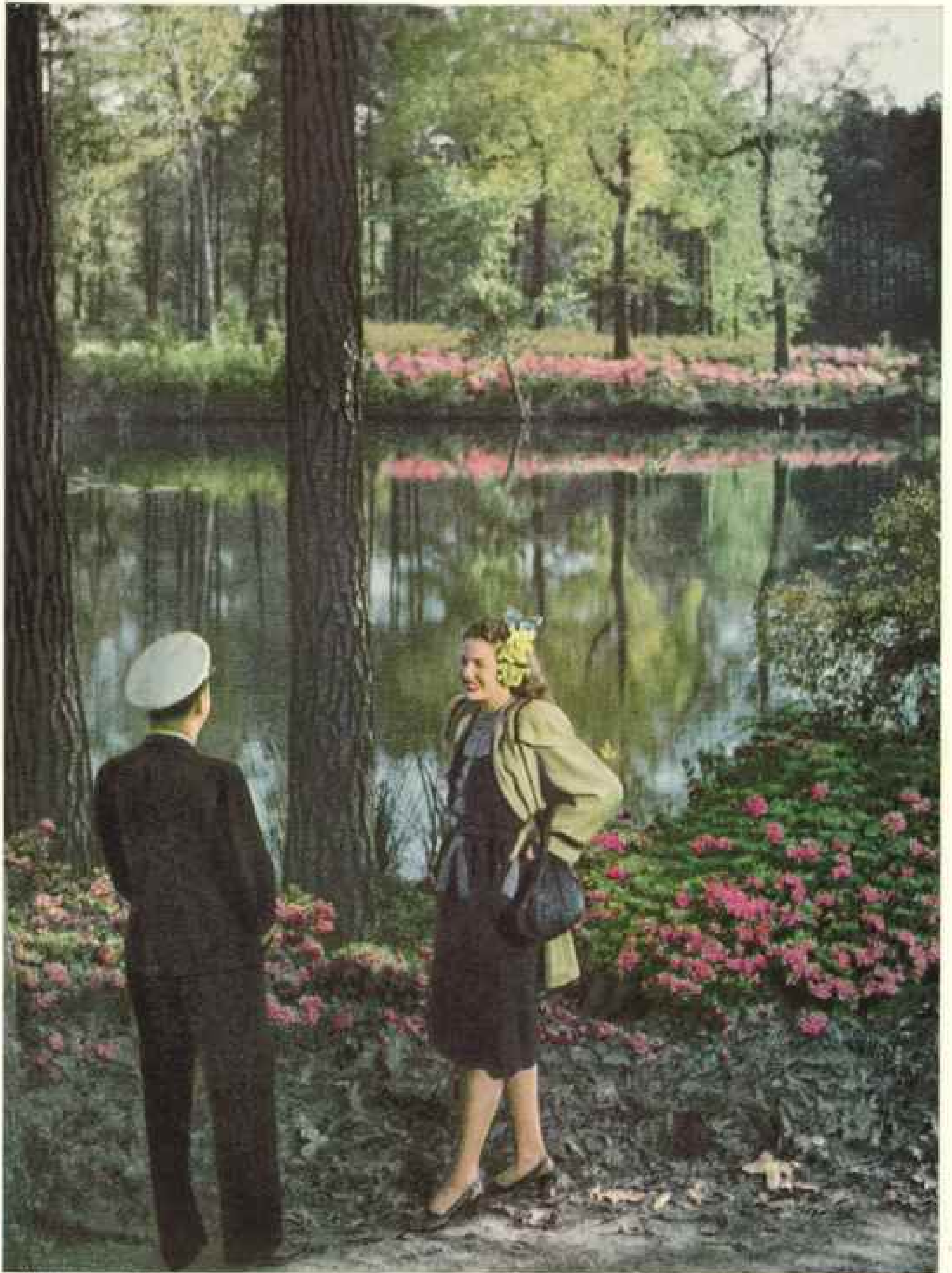
"Know-how" Makes Him an Expert at Transplanting

Uncle Nep Thomas, holding a specimen of his favorite Salmon Queen azalea, is over 70. He has set out a large share of the plants now in Norfolk Gardens. His efforts have also helped supply other city parks with flowers.

Kodachromes by B. Anthony Stewart

Careful Handling Is Important in Azalea Culture

Forewoman Josephine Rollins shows how a plant's delicate roots are balled and wrapped in burlap for even the shortest move. Late or midsummer are good times to plant cuttings. Azaleas also can be raised from seed.



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Kodachrome by B. Anthony Stewart

Landscape Designs Are Planned with an Eye for Pleasing Vistas

Hinodegiri azaleas in the foreground and *R. arnoldianum* on the far side are mirrored in the still water. The taller yellowish plant at right is Scotch broom. Norfolk Gardens also boast 5,000 rhododendrons and vast banks of camellias, Japanese iris, daffodils, and mountain laurel.

Cruising Colombia's "Ol' Man River"

By Amos Burg

WITH a condor's perspective I peered down from the Bogotá-bound plane on the jungle-covered isthmus hooking on to the Continent of South America one hour out of Panamá.

Colombia's Pacific coastline was to the right, its Caribbean frontage to the left. Ahead, the northern spurs of the Andes rushed forward to meet us.

Within a few minutes we flew by the 11,000-foot peaks of Tres Morros over the Western Range (Cordillera Occidental) and headed into the interior.

My seat companion, a Colombian, smiled understandingly at my map searchings.

"We must fly over three parallel ranges to reach Bogotá," he said. "Most of my ten million countrymen dwell over 4,000 feet above sea level, although mountains constitute only the western half of Colombia."

Pack Trains and Airplanes

Below us, as we approached the lower Cauca Valley, I discerned trails, roads, and towns scribbled on the landscape. Like a giant centipede a pack train crawled along a mountain trail below.

The Colombian continued: "These pack trains provide the only transportation for hundreds of mountain communities. We've built most of our highways and railways in the last 20 years. Such construction has been very difficult and costly."

He jabbed his pencil at several places on my map. "Our people live in half a dozen or so large clusters all isolated from one another by mountain barriers."

I could see the barriers. Astern lay the Western Range, with its toes in the Pacific. Close to the east over the left wing rose the Central Range (Cordillera Central).

Beyond it, and barely emerging above its 12,000-foot peaks, I could spot the hazy ramparts of the Eastern Range (Cordillera Oriental). Its farther slopes, a hundred miles beyond, roll down into the sparsely settled, river-ribbed *llanos*, open tropical plains of the tributaries of the Orinoco and Amazon. They comprise over half of the national territory (map, page 618).

Here was part of the gigantic stage over which the patriot armies of Simón Bolívar, the Liberator, battled to free a continent.

At Medellín a dark-eyed daughter of the Conquistadores in the neat uniform of an airport hostess assisted me through the customs to a sleek, American-built airliner of the Aerovías Nacionales de Colombia, known as Avianca. We headed for Bogotá.

"The airplane has revolutionized life in Colombia," said a Scotsman next to me. "When I came to the country 33 years ago, transportation was in the Middle Ages.

"Bogotá was as isolated as Lhasa, Tibet. It took from eight days to a month to reach the capital, depending upon the stage of water in the Magdalena and how many times the steamboat got stuck. Now we can fly from the coast in little over two hours.

"With nearly 27 years of continuous service, Avianca is one of the world's oldest commercial airlines—which makes me one of the oldest commercial passengers," he recalled.

The Colombian pilot beckoned me forward to the cockpit and told me he had been trained by Pan American World Airways in Florida.

"In 1920, when the forerunner of this line was organized in Barranquilla, its Junkers planes carried 12 passengers and nearly a ton of freight," he told me. "In 1946 Avianca carried about 200,000 passengers and some 25,000,000 pounds of freight. We think we are doing a good job for Colombia."

Climbing Through Climates

We crossed the Central Range. Down the 12,000-foot slope to the tawny, winding Magdalena, I viewed in one perpendicular glance all the climates of Colombia.

"Climate is all a matter of altitude," the pilot said. "Observe the bands of vegetation. The tropical zone extends from the Magdalena up to about 4,000 feet. Then the subtropical begins and ranges up to 7,500. You can see the coffee trees in this zone.

"Above this the temperate highlands extend from 7,500 to 10,000 feet. Above 10,000 feet lie the high, chilly basins that end in the snow fields of Tolima" (page 622).

Here near the hot Equator a man could take a thermometer, climb from the torrid Magdalena, and in one day make his choice of any climate he desired.

Far in the distance we sighted Bogotá sprawling at the base of a mountain in the Eastern Range at 8,660 feet elevation. The suburbs spill out on a 400-square-mile savanna (page 620).

As we swooped in, I observed cattle and sheep grazing, and many farms varying in size from large estates to tiny subsistence plots.

Henricks Hodge from Three Lions

Water Powers Medellín Factories

El Salto de Guadalupe (upper left) plunges down a mountainside higher than Niagara. Cheap power from its hydroelectric plant attracts cotton mills and other industrial concerns. A cable car climbs the mountain beside the conduits. Colombia's rugged Andes hamper delivery of goods, but modern roads and rail and air lines are uniting isolated areas.

The landscape with its scattered trees and hedges of willows and eucalyptus trees appeared austere after the lush vegetation in the tropical lowlands.

The sharp air at the Techo airport had the tang of a New England autumn.

A Colombian, his blood thinned from living years in torrid Barranquilla, tugged his overcoat closer about his neck with a mock shudder. A Bogotano after a month of sun-bathing on the hot beaches at Cartagena rubbed his hands and sniffed the invigorating air.

Like most Colombian cities, Bogotá has made seven-league strides toward modernization during the past generation. Modern office buildings shoulder century-old churches.

Bogotá's Open-air Forums

As I zigzagged through crowds swarming on narrow streets, I noticed men talking animatedly. Like the Athenians, Bogotanos assemble in the open air for discussion. Every utterance by a public man must be run through the grinding mills of these street assemblies.*

At noon the street in front of *El Tiempo*, a leading newspaper, was clogged with dark-dressed Bogotanos discussing news flashed on a big bulletin board (page 621).

In coffee shops men carried on discussions over small cups of the black beverage.

Here in the capital representatives from every nook of a Republic given to sectionalism meet and blend.

Remotely situated Bogotá has long enjoyed a reputation for hospitality, culture, and good manners. It was no small task packing in grand pianos and Venetian mirrors on muleback over the mountain trails from the Magdalena to satisfy the urge for fine things.

While the coastal city of Cartagena was attacked by pirates of the Spanish Main for more than two centuries (page 655), Bogotá, behind her Andean walls, serenely developed her rich and mellow ways. By 1571, half a century before the Pilgrims landed at Plymouth Rock, Bogotá was a cultural center of the New World.

Letters to the Editor

Bogotanos write fluently and often. The Republic's numerous periodicals give local writers a chance to express their views.

I watched one of the night editors of *El Tiempo* thumb through a thick sheaf of letters to the editor. Many were scholarly essays expressing various writers' views on politics, literature, philosophy, marriage, and many other subjects.

* See "Hail Colombia!" by Luis Marden, NATIONAL GEOGRAPHIC MAGAZINE, October, 1940.

Kurt Severin from Black Star

Fluted Columns Impart Grecian Lines to the Portico of Colombia's Capitol

It houses the Senate, House of Representatives, and executive offices. Across the plaza stands the old Cathedral with its twin belfries. Bogotá, founded in 1538, was named in part for Bacatá, name of a Chibcha Indian capital of the region. The bootblack wears a poncho, or woolen blanket with a slit for his head.

Drawn by Harry S. Oliver and Irvin E. Alleman

From Tropical Coasts Colombia Rises to Snowy Mountains

Nearly three times the size of California, this Republic borders both the Pacific and the Caribbean. Three lofty Andean ranges divide the western part, where most of the ten million people live. Tributaries of the Orinoco and Amazon water the eastern plains. On mountain slopes veined with gold, fine coffee is grown.

The director of the new National Library sent me a guide. José Manuel was an energetic, resourceful man; he maintained his speed even at 8,660 feet elevation.

In a few days he piloted me through 16th-century churches, Government buildings, the Geographical Institute, the Radium Institute, the National Library, the National University (page 623), and miscellaneous streets and buildings I was too tired to remember. He topped these off with a bullfight.

In the stadium, Circo Santamaría, 25,000 excited Bogotanos cheered the despatching of six local bulls of ancient lineage, with pageantry and elaborate formality.

A leading bullfighter and toast of Bogotá was Conchita Cintrón, a young Peruvian girl whose superb horsemanship bewildered the bulls and incited the shouting Bogotanos to fling hats, coats, ties, even shirts, into the arena.

Later all these objects of adulation were tossed back to the spectators.

AP from Press Ass'n

Meet the Belle of the Bogotá Bull Ring!

Young Conchita Cintrón received acclaim as the leading *torero* in the stadium where 25,000 Colombians regularly shout themselves hoarse at bullfights. In tribute to her expert horsemanship, excited spectators threw their hats and coats—even shirts—into the arena. Later a thousand fans visited her hotel, shouting, "We want Conchita!"

Back at the Granada Hotel, a thousand Colombian bobby soxers milled in front of the entrance, shouting, "We want Conchita!"

"I can't type these Colombians; they all seem different," I remarked to the Swiss manager.

"There are nearly ten million individuals in Colombia," the manager replied.

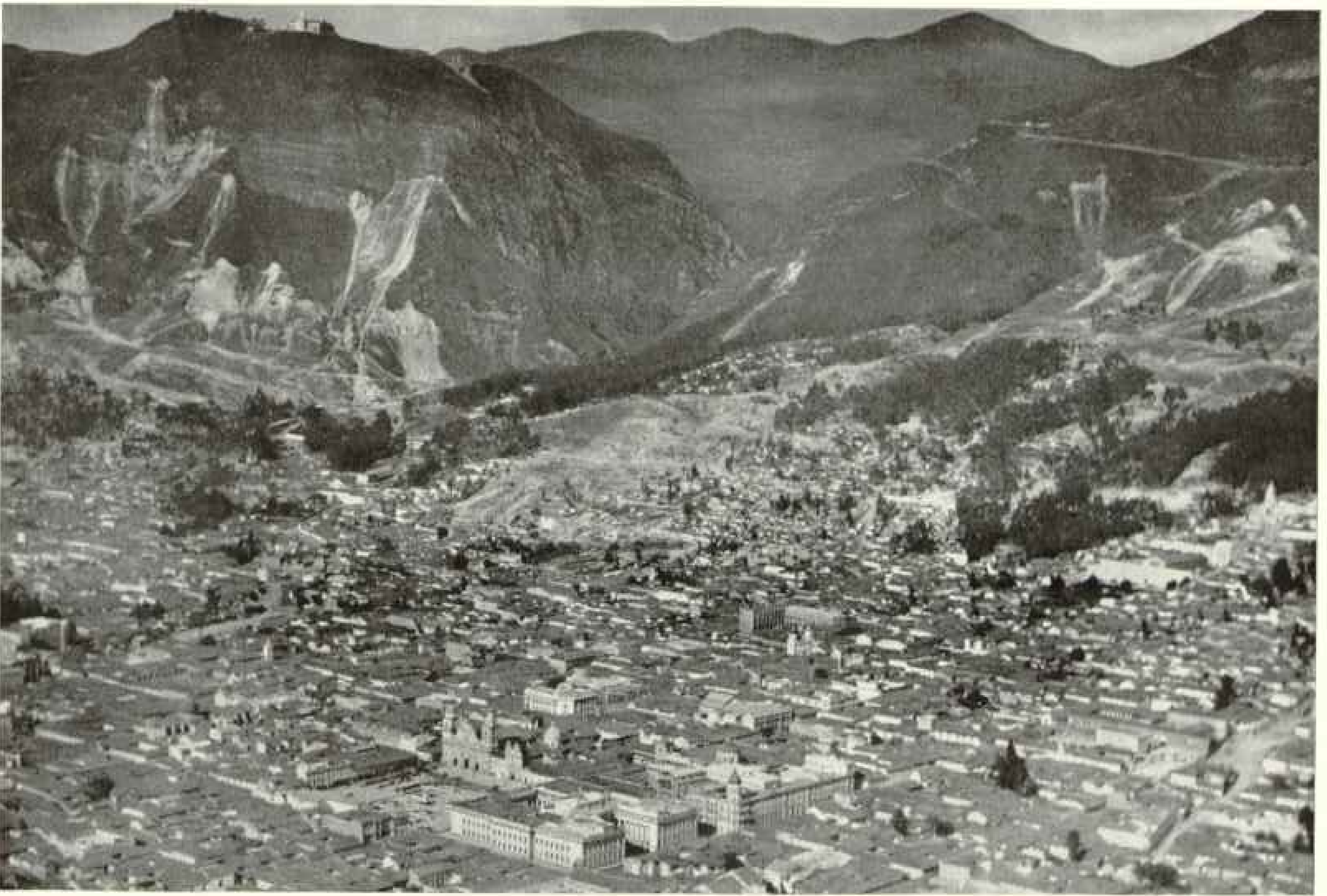
From Mule Train to Motorcar

After Bogotá was founded in 1538 by the glamorous Gonzalo Jiménez de Quesada, the city jogged along for centuries to the snail pace of Spanish colonial policy. But not so in recent years. Long pent-up energies were exploding. Narrow streets were being widened to accommodate traffic other than the mule trains of its early centuries. Highway construction has speeded up.

The 80 miles of mountainous highway between Bogotá and the llanos is a good example of the natural obstacles Colombian engineers have to overcome in road building.

It was market day when we passed through the town of Cáqueza. Country people were streaming into the plaza with produce and wares for barter.

The Conquistadores found little gold on the savanna, but a large reservoir of labor was supplied by the civilized and sedentary



On a Plateau More than a Mile and a Half High, Colombia's Capital, Bogotá, Nestles Beneath Andean Peaks

Staff Photographer Luis Marden

Dark-suited Bogotanos Scan Late News Bulletins as a Prelude to Spirited Café Conversations

The daily throng before a newspaper office grows thickest about 5 o'clock. Afterward the men settle in their favorite shops and over small cups of coffee hold rapid-fire discussions of politics, business, and sports (page 616).

© Hans Koester

Once an Active Volcano, Tolima Thrusts Its Snowy Crater 19,049 Feet above the Sea

Colombia's highest mountain rises sharply 18,000 feet above the Magdalena River, only 35 miles away. Fifty-three persons were killed when a Barranquilla-to-Bogotá four-engined plane crashed recently on El Tablazo, a peak half that height. El Tablazo is 80 miles northeast of Tolima.

Amos Burg

Ultramodern Buildings Embellish the New 50-acre Campus of National University, Rising on Bogotá's Outskirts

Amos Burg

A Barefooted *Llanero* Stages an Impromptu Dog and Pony Show

His dark clothing indicates that he lives at a high altitude. In the lowlands and Tropics dress becomes more colorful. Hard-riding plainsmen from eastern Colombia helped Bolívar free the country. Now the *llanos*, comprising over half the national territory, support only 120,000 persons (page 625).

Chibchas. Many of these were put to work as serfs on the large estates for the production of food, the principal occupation today. Now a third of the population of Colombia lives on the savanna of Bogotá.

Wandering through the market, we saw the principal products of the Chibchas—wheat, potatoes, and maize. The people are largely mestizos of Spanish and Indian descent and show in their high cheekbones, slanting eyes, and occasional handsome faces the blending of two races and two temperaments (pages 625, 627).

On the road we met pack trains carrying wood or potatoes, or an occasional boy seated between two milk cans slung on the back of a long-eared, listless donkey. Sometimes we passed whole families all slicked up in their somber Sunday black, hiking to town.

Here, as everywhere in Colombia, I encountered a gentle dignity and friendliness in these countryfolk. Addressing a barefooted child on the road never failed to evoke a responsive, shyly spoken "Buenos dias, Señor."

Hiking Boots for Cattle

At times we met herds of llanos cattle being herded toward Bogotá (Plate XV). At first I was mystified by a peculiar rustling sound until I noticed that each animal wore homemade boots of a tough fiber known as *fique*.

I fell in step with one of the herders who wore sandals made of the same fiber and carried a coffeepot in a blanket roll on his back.

"These cattle, Señor," he explained, "are from a ranch three days out into the llanos from Villavicencio. The journey for them to Bogotá takes eight days, during which each animal will wear out 12 boots and lose 50 to 75 pounds of flesh. We must rest them one hour in every four."

On both sides of the valley patches of corn and plantains (page 628) clung precariously to steep mountainsides. Since valley bottom

Amos Burg

In Pre-Spanish Days, Chibcha Indians Fashioned Intricate Gold Ornaments

Dwelling in the valleys around present-day Bogotá, they developed an advanced culture nearly equal to that of the Incas. These specimens of their golden headdresses, figurines, and bowls are preserved in the National Museum, in the Banco de la República building in Bogotá. In one ceremony, Chibcha chiefs were powdered with gold dust, which they washed off in a sacred lake.

land is scarce here, farmers cultivate land so steep that a single misstep might send one spinning down through two or three farms.

We watched a farmer harvesting corn, moving up and down his perpendicular patch like a sure-footed mountaineer.

We saw a farmer jabbing seed holes with a stick that he used also as an alpine staff.

Stretches of the road accommodated only one-way traffic. While we were held up behind a line of trucks we ate boiled eggs and sardines from the village store.

When several truck drivers saw my camera, they tidied up in a local stream, then trailed behind us so we could photograph them.

Heavy rains were causing mud slides, and one slide completely blocked the road. But a truck driver honked defiantly at the muddy obstacle, charged into it, and with hind wheels spinning a few inches from the edge of a thousand-foot drop made his way through.

I asked the reason for his death-defying rush.

"Ah, Señor, it was a matter of great importance," one of my truck-driver models explained. "The man was hauling a load of beer for a fiesta to be given that night in the llanos and he had been invited to share the refreshments!"

In "the Land of the Future"

Just before sunset we burst out on a promontory known as Buenavista and beheld the endless leagues of plains rolling away to the blue horizon.

North and south, as far as we could see, the front of the Eastern Range resembled a mighty coast range breaking off into the sea, so abrupt is the demarcation line between valley and plain. These vast llanos, watered by the numerous tributaries of the Orinoco and the Amazon, are inhabited by only 120,000

Alton Borg

A Señorita Flashes a Smile as Warm as Medellín Sunshine

She comes from the stock of old Spanish families who sought their fortunes in the New World. Colombians are democratic and hospitable. They also are independent. "There are nearly ten million individuals in Colombia," the author was told by a Bogotá hotel proprietor (page 619).

than 1,000 feet in elevation, have spelled hardship, suffering, and disease to many.

But Colombians, whose intrepid forefathers dreamed first of the empires they conquered, speak of the llanos as a fantastic land of unknown wealth and opportunity.

They quote former President Alfonso López, who said, "This is the land of the future."

At the foot of the Eastern Range we learned that the old frontier town of Villavicencio believed this for several reasons. American and Colombian oil explorers were dashing back and forth between their town headquarters and their concessions in the llanos.

In an attempt to eliminate one bar to successful settlement of the llanos, the Rockefeller Foundation, in co-operation with the Colombian Government, has for some years been studying the transmission of jungle yellow fever by wild animals and insects, especially its main mosquito vector, *Haemagogus spegazzinii* var. *falco.**

persons. Yet they comprise over half of the national territory.

As we stood there on the road, three mounted *llaneros* (plainsmen) caracoled by, their clothes, saddles, and bridles garnished with many trappings (page 624).

Such hard-riding horsemen have profoundly affected Colombian history. It was the llaneros who followed Bolívar high into the Andes to break the back of the Spanish army in the decisive battle of Boyacá, August 7, 1819.

At present the llanos country is alternately a land of floods and droughts. The population has dwindled to less than it was in 1850. Remains of deserted settlements and missions fringe the lonely rivers. The vast plains, less

"We shall also have a slaughterhouse," a cattle buyer told me. "Our cattle lose too much beef climbing from here to Bogotá."

The Llanos One Big Airfield

"We feel that we've speeded up settlement in the llanos," the local agent of Avianca said. "We serve 240,000 square miles. Just tell us where you want to go."

He spread out a map showing Avianca's lines radiating out from Villavicencio.

"We carry anything, anywhere. If a rancher

*See "Life Story of the Mosquito," by Graham Fairchild, and "Saboteur Mosquitoes," by Harry H. Stage, both in the National Geographic Magazine for February, 1944.

desires service, he signals the pilot by spreading a sheet on the ground. The flat llanos are one big airfield."

"The Indian has jumped from dugout to airplane," one pilot interposed. "However, I always carry a screw driver. Some naked aborigine is always asking me to tinker with his Singer sewing machine."

"The llanos are a sportsman's paradise," the agent continued. "We can set a party down in the llanos one hour from Bogotá, give them a good duck hunt and a chance at game ranging from a rabbit to a jaguar, with fishing thrown in, and return them the next day. Many of the ducks shot here were banded in Canada."

Strange, too, are the tales told in Villavicencio about the country south of the Guaviare River. Here the llanos merge with the unbroken Amazonian rain forests.

Amos Burg

An Indian Harvest Hand Enjoys a Bowl of Luncheon Gruel

Descendants of the Indians of the Bogotá plateau, he and his fellows raise wheat, potatoes, and corn. When the Spaniards came to Colombia, they put Chibcha farmers to work as serfs on their estates (pages 619, 624).

Jungle Ants and Caymans

In a little clearing flanked by impenetrable jungle, Colombia's most southerly settlement, tiny Leticia, squats forlornly on the banks of the Amazon nearly 2,000 miles from the Atlantic.

Carnivorous ants travel in vast armies and devour everything in their path. Along the river, natives with the aid of gas lanterns spear caymans at night for their hides.

Travel is confined to rivers or to trails tunneled through the forests.

Here, too, the airplane flies in and out of jungle clearings loaded with chicle, rubber, and other products for the coast.

Returning from the llanos, twilight overtook us outside Villavicencio. As we drove along, strange shouts came from the swamps and hills like hoarse-voiced herders calling to one another. We stopped in wonderment.

Down the road I queried a llanero. "Señor," he said, "the sound you hear comes from a very small frog who talks only at night."

At the hotel I requested a bath.

"But, Señor," the attendant explained, "our tanks are dry; you must wait for rain."

That night the warm rains fell heavily and I took my shower in the open patio.

Returning to Bogotá, I flew in an Avianca plane to Cali over the Central Range by the shaggy, snow-dusted dome of Tolima. The journey by rail and auto requires 12 hours; in less than an hour my plane was over the

Cauca River and landing at the Cali airport.

The change from the high savanna of Bogotá to this sun-drenched city at the foot of the Western Range was inspiring. For one thing, my tight chest cold brought on by overexertion in the high Andes vanished in the mild and salubrious air of the Cauca Valley.

Cali Is Air-minded

Cali had a carefree, wide-awake 20th-century air in a colonial setting.

Since the completion of the Pacific Railway in 1914, an ever-increasing volume of freight has poured through Cali from western Colombia for the ocean port of Buenaventura. But Cali really began to build and bustle when the city became a major air terminal for airliners flying up and down the west coast of South America. This gave the city world-wide connections.

Girls walking to work in light, colorful dresses seemed to enjoy the softly falling June rains, knowing perhaps that a few minutes of sun would dry them as thoroughly as a Turkish towel.

Once I was caught in the botanical garden in a sudden cloudburst accompanied by high winds. For an hour I crouched forlornly under a leaky umbrella tree while the deluge flooded the streets. The Cauca and its tributaries ran yellow with the rich topsoil of the valley.

Driving my hired car through the narrow streets was an ordeal. Both cars and buses dash with unslackened speed through the blind intersections, depending upon a warning honk to avert a collision. From the modern reservoir on a hill overlooking Cali I heard hundreds of honks floating up from intersections.

Beyond Cali the Cauca River wended through a flood-plain valley 15 miles wide, bordered by the abruptly rising Western and Central Ranges. The valley extends from Popayán on the south to Cartago on the north. Its incredible fertility and summerlike climate inspired Baron von Humboldt to call it "the paradise of America."

The director of the agricultural station at Palmira took me on a tour of 300 acres of experimental crops. He pointed out tobacco, rice, cacao, cotton, beans, yuca, and many other crops being improved, including numerous varieties of citrus fruits.

Spanish Cattle Become Colombian, Too

I inquired about the Spanish cattle grazing in the lush valley pastures.

"After so many generations they have become Colombian cattle," the director explained. "We have imported the huge, tick-resisting zebu from Texas to invigorate the strain. The zebu gives our cattle size and stamina; then we generally mix about three other local breeds to improve the quality of the beef."

One day when I ventured a quarter of a mile into a pasture a huge, Texas-born zebu bull, which appeared to be about the size of a Baldwin locomotive, rose out of the grass and came charging at me. On the homestretch I was diving headlong through the barbed-wire fence and the brute was snorting down my neck.

One day I enjoyed a 10-mile drift down the Cauca on a farmer's bamboo raft loaded with *plátanos*, or plantains (Plate IV). Throughout tropical Colombia they are served cooked in some form for almost every meal. The raft-jammed landing near Cali where the plátanos were unloaded and sold resembled a cluttered invasion beachhead.

After the plátanos were taken ashore, the rafts were pulled apart and sold. A 30-foot length of bamboo suitable for building construction brought about a dollar (Plate V).

I motored out to La Manuelita, largest of Colombia's dozen or so sugar mills. An ideal climate and a fertile soil have made sugar a top crop in Colombia's richest agricultural valley (Plate VI).

Mules and Oxen Move a Sugar Mill

"La Manuelita was bought by James Eder in 1864 from the estate of the father of Jorge Isaacs, famous Colombian novelist," the superintendent said. "It had a primitive mule-driven sugar mill then. Mr. Eder's improvement was to install waterpower.

"In 1899 he began the Herculean task of transporting by mule and oxen an entire steam sugar mill from Scotland over the Western Range from Buenaventura to Palmira. The mill required three years to transport and erect. At one time, 1,200 mules and 600 oxen were used for transport."

Today 7,000 acres growing sugar-cane stalks 10 to 15 feet tall keep some 600 employees feeding the mill grinders the year round.

The waves of progress that have modernized such cities as Cali have only begun to lap at the traditions of the smaller colonial towns in the valley.

I motored out to Bolívar to see Kathleen Romoli, an American woman who liked Colombia so well that she wrote a book about it, then bought a small farm and decided to stay.

We strolled through her adopted village.

"Six families have formed the nucleus of the society here for over 300 years," Mrs.

Amos Burg

Indians Leave Their Dugouts Empty while They Peddle Fruit and Fish

In these hand-hewn craft, bobbed-haired Indians from the Chocó bring their fish, rice, bananas, and pineapples to the markets in Buenaventura, Colombia's Pacific port (page 630). Planks heighten the canoes' sides to withstand rough coastal seas. Four tribes inhabit the hot and rainy Chocó region (page 639).

Romuli said. "They are people of gracious manners who take an interest in the plans for the improved water system or the new road. The best families generally run a store; it is a time-honored profession.

"I purchased my farm from a fine old patriarch who was head of one of the six families. Although he was a small man, his bearing and manner showed that he was conscious of his position."

Mrs. Romuli led me into a coffee shop.

"The transactions were all conducted around this table," she continued. "Always there was a group seated around the table directly interested in the sale. Then there was a second group of people who stood in a circle just looking on. At first they worried me, but I found that they were genuinely interested."

I made the 100-mile trip south to Popayán in a streamlined two-car Diesel train which climbed 2,600 feet on a spectacular roadbed carved from a mountainside.

Queen of Colonial Cities

There, at the southern terminus of the railroad, Popayán, queen of colonial cities, sits dreaming, mildly querulous about all the hubbub concerning modern progress. Proud of her four centuries of glorious memories, traditions, and culture, Popayán makes few

concessions to modernism. The splendid new administration building for the Department of Cauca is built on colonial lines and might also be of the centuries.

On my arrival in Popayán I put up at the Lindbergh Hotel. The "Lone Eagle's" Latin-American goodwill flight also inspired the owners to emboss his plane *Spirit of St. Louis* on the dining-room plates and soup bowls.*

Popayán is tenaciously conscious of its memories. The silent shades of her illustrious sons—poets, scientists, statesmen, patriots, engineers, and several Presidents of the Republic—still live in the hearts of her people.

The bells of Santo Domingo Church directly across the street from the hotel awakened me at 5 a.m. and kept me awake by ringing in rather insistent tones at 15-minute intervals until 8. Women and girls came down the quiet streets and entered the church for Mass.

"Yes, Señor," my waiter said, "they are beautiful bells. Our guests never fail to mention them."

After breakfast a sunny, open-faced boy of 15 met me at the hotel entrance and with innate and charming courtesy offered me his services as a guide. As his bare feet pattered on the pavement beside me, our course was illuminated by his running commentary.

"This, Señor, is the Street of Patriot Fathers. Many great men of my country were born in these homes. Some of them became martyrs for freedom under the banners of Bolívar. Here is the home with its great patio where our beloved poet Don Guillermo Valencia, known to all Colombians as 'El Maestro,' lived and sang his praises of Popayán (Plate XIII).

"Many times he has spoken to me here on this street. I know some of his poems by heart, and so does my friend, the shine boy, who polished your shoes at the hotel this morning."

Many houses of Popayán were Andalusian-style, with large windows, spacious patios, and wide doors, built by noblemen who brought their families from Spain after the conquest. The family coat of arms hung above the doors.

The "Voice of Popayán" Bell

A young professor of literature from Popayán's University of Cauca walked with me to the Plaza Caldas where attractive señoritas with dark hair and lustrous eyes promenaded in pairs as twilight crept quietly down the dreaming streets.

Across the plaza, in the belfry of San Francisco Church, the great gold and bronze bell known as the "Voice of Popayán" tolled the Angelus for evening prayer. On the Central Range the volcano Puracé threw a fiery curtain of ashes into the sky.

The professor philosophized about the United States:

"I know your country has a great industrial output. Popayán is a city of 30,000 persons and she has 30,000 poets."

Then he added, "Of course we recognize your contribution in making the jeep; it would be wonderful on our mountain roads."

The mountainous area extending south from Popayán to the Ecuadoran border is little known to the average Colombian. An American mining man who had driven into Popayán from Pasto, 175 miles to the south, described the Pan American Highway through this region as "a zigzagging, breath-taking route along high precipices."

During the war of independence Pasto was staunchly royalist. How these remote mountain communities ever heard of the wars and revolutions that harassed Colombia until the end of the 19th century, let alone ever got to them, always puzzled me.

Upon my return to Cali I took the railroad train to the port of Buenaventura on the Pacific. The route, which replaced hundreds of pack mules upon its completion in 1914, climbs through a 5,000-foot pass over the Western Range.

As my train coasted down the seaward slope along the Dagua River, the luxuriant jungle and air, heavily scented with jasmine, became more and more redolent of the Tropics.

Buenaventura a Busy Port

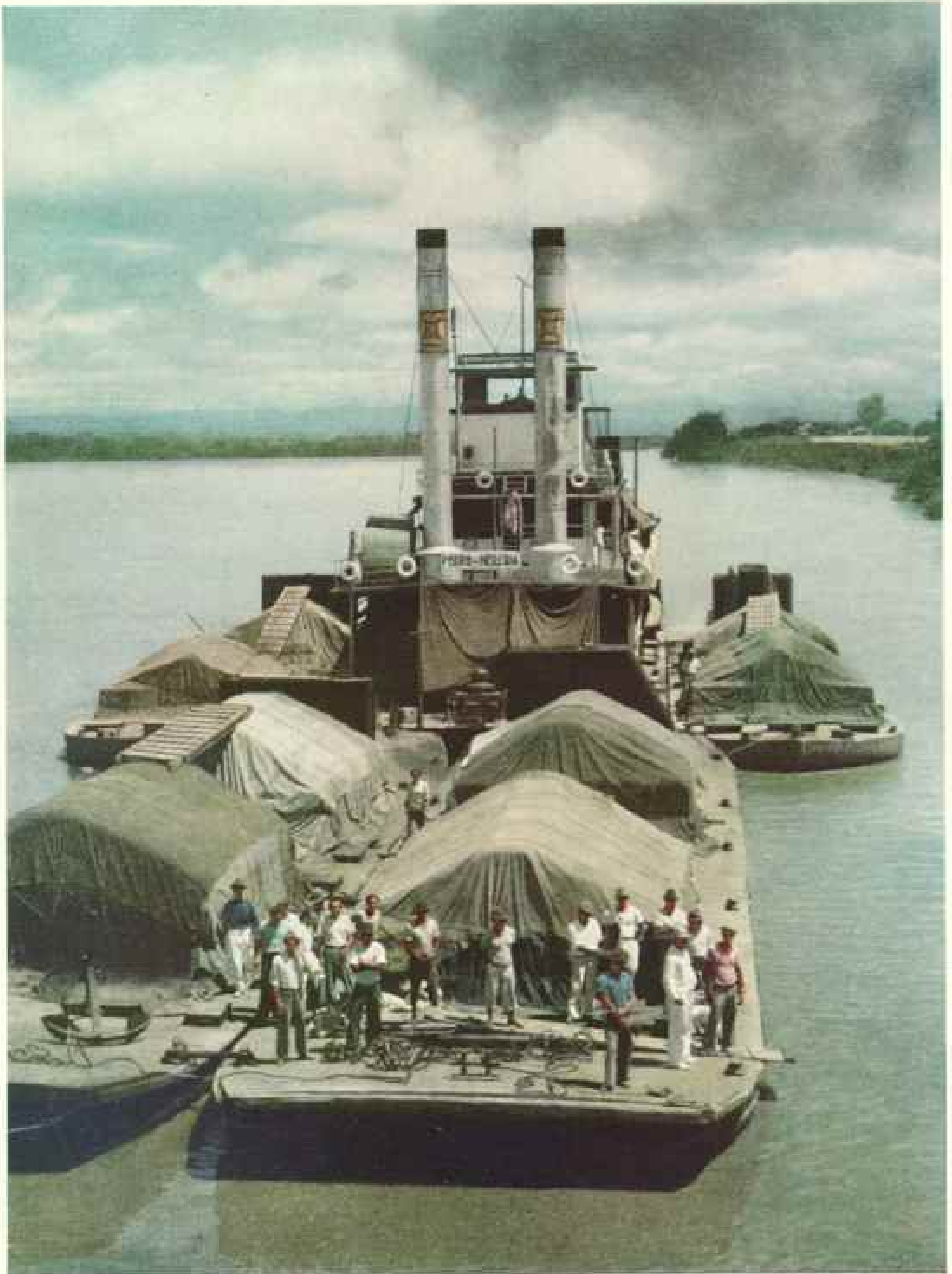
My hotel in Buenaventura looked down upon one of the best-protected harbors on the west coast of South America. The docks, terminal facilities, and warehouses, as up-to-date as those of the Canal Zone, now handle freight for western Colombia.

Modern buildings have established a beachhead on the water front and new ones are now slowly engulfing the older town of narrow streets and ramshackle structures.

The mornings in Buenaventura were hot and depressingly sultry, but around noon a freshening breeze from the Pacific began to rattle the split-bamboo curtains on my balcony.

Then I studied through my binoculars the Indian and Negro outrigger canoes scudding for town laden with cargoes of pineapples, yucas (cassava), corn, and fish. As the canoes approached the boat basin, the men generally

*See "To Bogotá and Back by Air," by Col. Charles A. Lindbergh, NATIONAL GEOGRAPHIC MAGAZINE, May, 1928.



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Kodachrome by Amos Burg

A Twin-stacked Steamboat Pushes Freight Barges up Colombia's Main Highway

For four centuries the Magdalena River has been the chief traffic artery from the Caribbean to the interior. Shoal-draft paddle-wheel steamers carry 190,000 passengers and a million tons of cargo annually. Mountains flanking the river's upper reaches give way toward the mouth to tropical forests and plains.

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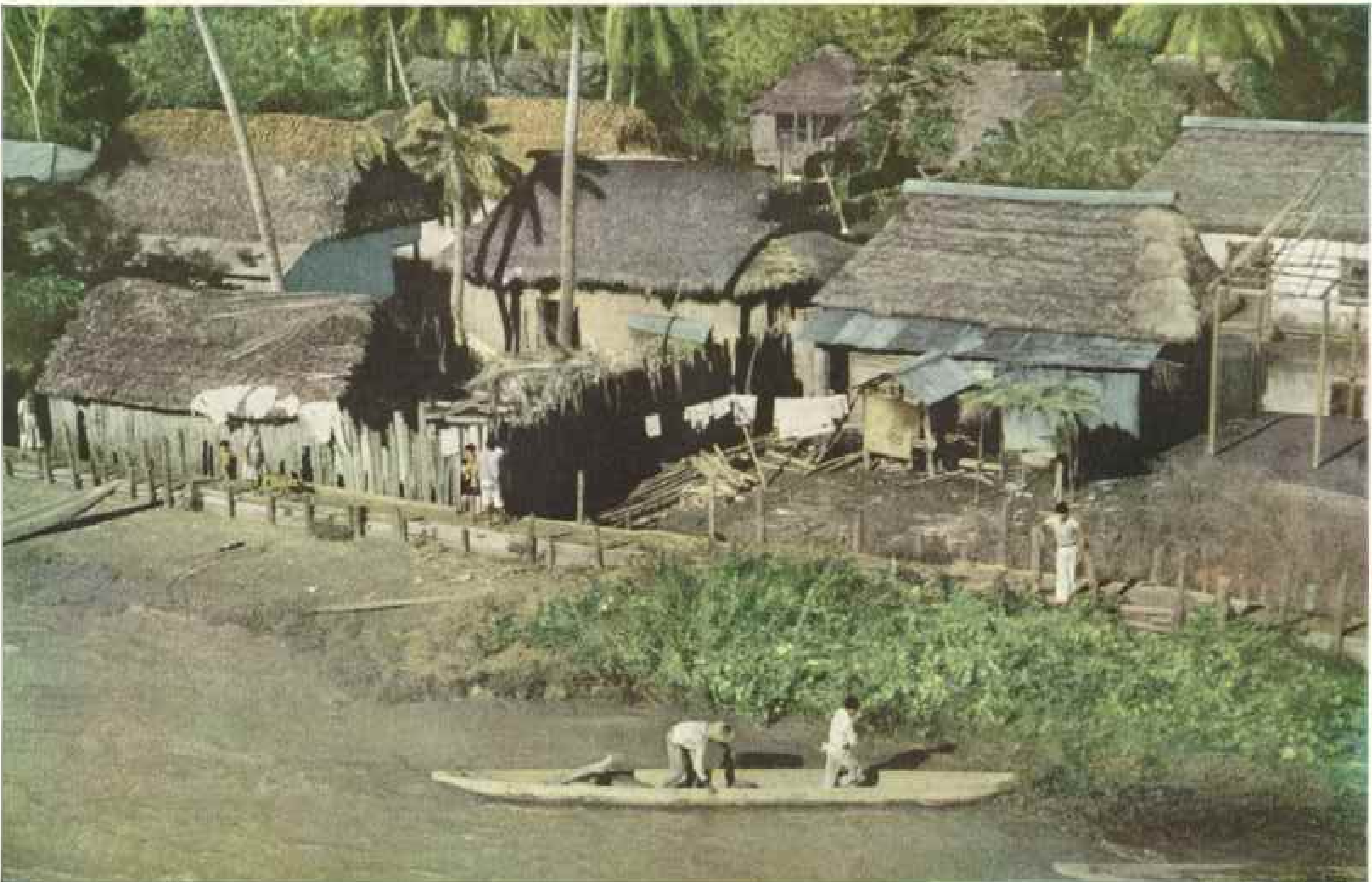
Kodachrome by Amos Burg

Stern-wheelers on the Magdalena Resemble Mississippi River Boats of Mark Twain's Day

Steamers tie up at La Dorada, nearly 600 miles from the mouth. The trip upstream takes a week or more, depending on the depth of the tortuous channel. Low water and sand bars often ground the ships. The journey downstream goes twice as fast. The river is navigable for about 800 of its 1,000 miles.



© National Geographic Society Kodachrome by Amos Burg

Alongside a Tropical Village of Thatched Houses, a Dugout Noses into the Muddy River Bank

Colombians hollow logs to make these canoes, which serve as fishing boats and ferries. Some dugouts are propelled by gasoline engines (Plate II). Because the Magdalena often overflows its banks in the rainy season, a low dike has been built at this village for protection from flood waters.

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Homemade Bamboo Rafts Float Bunches of *Plátanos* Downstream to Market

Fragile craft clutter the Cauca River "beachhead" near Cali. The *plátanos* (plantains) resemble green bananas, and are served baked or fried at most meals. The Cauca is the Magdalena's chief tributary.

Kodachrome by Amos Burg

At Journey's End the Rafts Are Dismantled and Reassembled as Houses

Bamboo grows in groves in the fertile Cauca Valley. After unloading the plantains, boatmen take the rafts apart and sell the lengths of bamboo. These become fence posts and frames and roofs of new homes.

© National Geographic Society

Kodachrome by Amos Burg

Sugar Cane Shoots Up 15 Feet in the Fertile Cauca Valley. Oxen Haul the Stalks to Near-by Mills

Here, half a mile above sea level, the juicy cane grows beside tobacco, corn, and plantains. La Manuelita, largest of Colombia's sugar mills, grinds and refines 7,000 acres of cane. Steam-mill equipment, imported from Scotland, took three years to transport and erect. Candy factories in Medellín and Barranquilla use much of the output.

© National Geographic Society

Kodachrome by Amos Burg

Many Colombian Families Get Their Beefsteak from the Well-filled Cattle Pens of the Medellín Market

More than 12,000,000 cattle fatten on Colombia's lush pastures. Few ranches are large; most raise fewer than 100 head. Zebus, imported from Texas, add size and stamina to native breeds. Double-decked barges transport many animals to city stockyards. The meat is consumed in Colombia; most hides are sold abroad.

Medellín's Sunshine Ripens Grapefruit All Year Round

The even, warm climate produces fruit, flowers, and vegetables in steady abundance. Orchids grow in profusion. Farmers cut alfalfa eight or ten times a year.

© National Geographic Society

Kodachromes by Amos Burg

For Little Fingers, Embroidery Requires Patience and Concentration

These schoolgirls are learning needlework in Bolivar, named for the South American hero. Traveling schools and 600 small libraries supplement Colombia's modern educational program.

slipped a pair of trousers over their breechcloths.

When I visited the basin the Indians fascinated me. The men were grave, dignified, and well set up, with clean, ruddy skins spattered with scars from jungle scratches. Their black hair was bobbed off evenly. The women, slender and nymphlike, wore only a loincloth.

Dinner with an Indian Family

No banquet could have honored me more than the meal I was invited to with an Indian family aboard their dugout. While we squatted and feasted on roasted yams and boiled rice served by the little mother, they answered my questions with frank simplicity.

These Indians belong to one of the four tribes inhabiting the Chocó Intendency, which extends from the San Juan River, just north of Buenaventura, to the Panamanian border.

The Chocó, with approximately 18,000 square miles of area, has a population of 111,000 and a climate that would be the despair of any chamber of commerce. Rains beat down for 300 days a year on hot, pestilential jungles.

Negroes, descendants of former slaves who worked the mines, have proved even more adaptable to this environment than the Indian, who is being shoved back into the less accessible regions by the black man. *Cayucos* (dugout canoes) used on rivers and bays are the only local transport (page 629).

The Chocó is rich in gold. One morning I struck up a conversation with a middle-aged American in the hotel lobby who was carefully scanning the advertisements in an aviation magazine.

He said he had lived and mined in the Chocó for five years. He insisted that he and his wife had found more happiness here than in New York, where he had been a welding contractor.

They had a radio, icebox, and washing machine, all operated by their own hydroelectric plant. Once a week a plane flew in with their magazines and other mail. The country, he said, was largely unexplored and very rich in gold and platinum. His work was mining gold with Negro labor, but his hobby was finding the gold.

I inquired about his interest in aviation.

"Oh," he replied, "I am going to buy a helicopter so I can fly over the jungle on my exploration trips and sit down anywhere."

After returning to Cali, I boarded a train running northward through the Cauca Valley for Medellín. Beyond the colonial city of Cartago the train followed the canyoned Cauca, then left the river and climbed up the steep slopes of the Central Range into Medellín.

Although Medellín was founded more than a century after most of Colombia's principal cities, it has assumed leadership in the economic life of the country. Numerous mills sounded their vibrant chant of greeting. Perhaps the climate is partly responsible for the accomplishments of its citizens; the continuous freshness of spring pervades the city (Plates VII, VIII, XII, and page 643).

For over a century the Basques, Andalusians, and converted Jews who founded the city remained locked within their mountain-ringed basins in self-sufficient isolation.

"We had large families then as we do now," a leather manufacturer, father of 18 children, told me. "Since 1800 the Department of Antioquia, with Medellín, has colonized many towns; yet our own population has continued to grow. In fact, Manizales, built on a knife-like ridge 80 miles to the south, is already competing with us. When Medellín had a bad airplane wreck, Manizales wanted to get a larger plane, fill it with more people, and stage an even bigger wreck!"

Colombians, interested for centuries in cultural pursuits and politics, are turning their competent hands more and more to such endeavors as promoting world coffee markets, manufacturing textiles, and managing airlines.

Students who formerly went to Europe for education are now turning to the United States for courses in engineering, agriculture, chemistry, and business, to supplement courses in their own academies and universities.

The manager of Fabricato, one of the largest of Medellín's textile mills, invited me out to see his factory.

"We have made great technical and social advances in the past 25 years," he said as he guided me across the enormous floor where 3,000 workers tended 1,500 chattering weaving machines and 50,000 spindles.

"We produce cotton textiles for the domestic market and also for export to Venezuela and Ecuador. Our company has built dormitories equipped with lounges, radios, and lecture rooms for employees. Also we have a clinic and a 50-bed hospital, which are likewise maintained free for the employees."

A Gold Mine for Every Family

"Almost every Antioquian owns a gold mine," I was told in Medellín. Gold supported the Antioquians during the lean centuries before coffee was introduced. Today the Department of Antioquia accounts for one-half to two-thirds of the gold and platinum mined in Colombia.

Alluvial mining began on a large scale in 1900 when Jack O'Brien of Carman, Nebraska, trained his hydraulic monitors against the mountains of Antioquia to wash out the gold. Besides the monitors and gold dredges, small operators work the creeks with their wooden pans.

I never lost anything during my stay in Colombia because strangers always returned pieces of equipment I had mislaid during the commotion of travel. Several times I was warned about petty thieves and told how even valve caps and windshield wipers disappear from cars left on the streets. Yet mule pack trains from the mines, laden with sacks of gold dust or bars of gold and escorted by a few muleteers, plod along lonely mountain trails, bound for the nearest point of shipment to the Casa de Moneda, the Government's refining and assay office at Medellín.

Here I watched a small Ford truck, loaded with gold bars, rattle up to a halt. An unimpressed driver climbed out, reached over the tail gate, and grabbed two bars of gold, which he then lugged into the building, leaving the rest of the gold unguarded.

The truck was not armored. No eagle-eyed guards fingering the triggers of their tommy guns stood about. I looked for the valve caps on the tires; yes, they were gone. The windshield wiper the driver was carrying in his pocket; he just wasn't taking any chances.

I wandered into a room where workmen were pouring a hundred pounds of gold into bars (page 659). It was some time before I could attract anybody's attention to ask questions. Finally I was left free to play with a stack of gold bars while the men went about their business.

Commercial Medellín shares with the rest of Colombia the art of gracious living. Here, in 1891, the Society for Public Betterment was organized. It is comprised of public-spirited men in a hundred communities throughout Colombia who strive to make their towns beautiful and progressive.

The Colombian tells you, "No city can be great without culture. We will make our city greatest."

Orchids—and More Orchids

One evening on my way to keep a 9 o'clock dinner engagement, I stopped at a flower store and purchased six orchids for my hostess. The price was 50 cents. I bought a dozen more.

When I arrived at the home and stepped into the softly lighted patio, I saw scores of beautiful orchids hanging in baskets around the edge. I gave the orchids to the maid who had answered the door.

As I rambled about Medellín, sometimes I caught glimpses through an open door of a sunny patio, hung with ferns, flowers, and caged singing birds, and with a fountain in the center.

In the surrounding hills I visited white villas with lovely gardens which grew more flowers, fruits, and vegetables than I could name. At such an altitude in the Tropics there is scarcely any change in temperature throughout the year. Lettuce planting is staggered to supply salads the year round.

Here the currents of Spanish heritage in architecture, art, religion, and trade have been mingling only for a generation with those of the New World. Window balconies protruded into the street just high enough for me to bump my head on dark nights. Behind the bars of these windows the faces of señoritas glowed softly in the twilight (page 626).

One night I was a bystander in a serenade. A romantic lover stood outside a shuttered window and wooed his lady with a six-piece orchestra and a vocal accompanist he had hired. An onlooker sighed, "Ah, the señorita lies awake with her head on her pillow and she is very happy."

Coffee is Colombia's king crop. The price brought by the 4,500,000 bags of coffee that flow to world markets from thousands of Andean plantations each year means much to the country. Coffee makes up well over half the total value of all Colombia's exports in most years, and sometimes much more. Its price determines to what extent Colombians can purchase foreign goods and raw materials for domestic manufacture.

Life among Coffee Growers

Field men of the National Federation of Coffee Growers of Colombia took me on a two-day tour of coffee *fincas*, small farms or plantations. As most of Colombia's 900 million trees grow on slopes too steep for other uses, I rode a mule. The mule seemed to be always pointed up or down. Occasionally, when the beast leveled off, I'd relax my grip around his neck and catch glimpses of finca life.

Much of our traveling was done through small family fincas that raise 90 percent of Colombia's coffee crop. The job of picking the crop is enormous. Millions of pounds of dark-red "cherries," as the coffee berry is known, must be picked one by one. A tree yields on the average one and a half to two pounds.

Machine inventors are stymied because the

Amos Burg

Admiring Friends Watch a Medellín Artist Paint a Mural of the Americas

Guided by a sketch, Ignacio Gómez Jaramillo fills in the figures of his huge canvas. This popular portrait painter has exhibited his works in New York. In colonial days Colombian artists were inspired by Spanish masters, who usually chose religious themes. Art waned during the 19th-century unrest.

cherries do not ripen at one time. Several pickings are required each season. The coffee trees are shaded for slow ripening and delicate flavor usually by spreading guamo trees. For this reason Colombian shade-grown, mild coffee commands high prices on world markets.

After being depulped, dried, hulled, polished, and sorted (page 642), the beans are put in sacks. Now they begin to roll toward world markets.

On muleback, two sacks to an animal, the long caravans weave over steep mountain trails to aerial cables, highways, and railroads, or to some Magdalena River port.

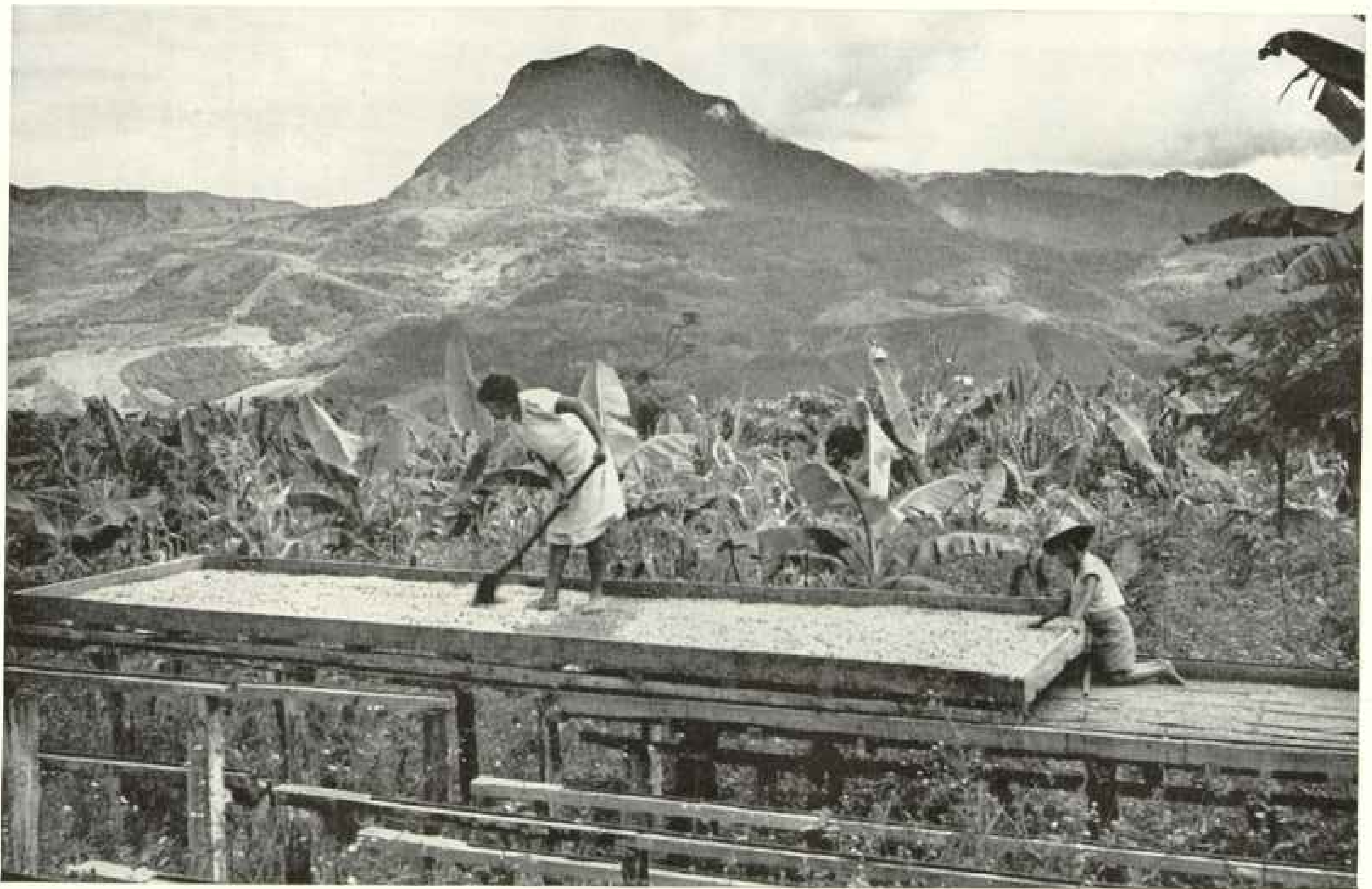
More and more coffee is being shipped out through the Pacific port of Buenaventura (page 630). The bulk rolls down the Magdalena River on barges to Cartagena and Barranquilla on the Caribbean for ocean shipment, mostly to New York (Plate XVI and page 657).

From Medellín I followed the coffee trains over the Central Range through a region of numerous villages, lofty jungle trees, giant ferns, and thatch-roofed adobe houses crawling with crimson and purple bougainvillea.

"Ol' Man River" of Colombia

After 100 miles I saw in the distance the yellow waters of the Magdalena, the four-century-old highway of Colombia, snaking its way northward to the Caribbean.

Stern-wheel steamboats of the Mississippi River type were moored to the concrete quay. Chains of longshoremen were discharging cotton and sugar cane from the coast, and loading



Amos Burg

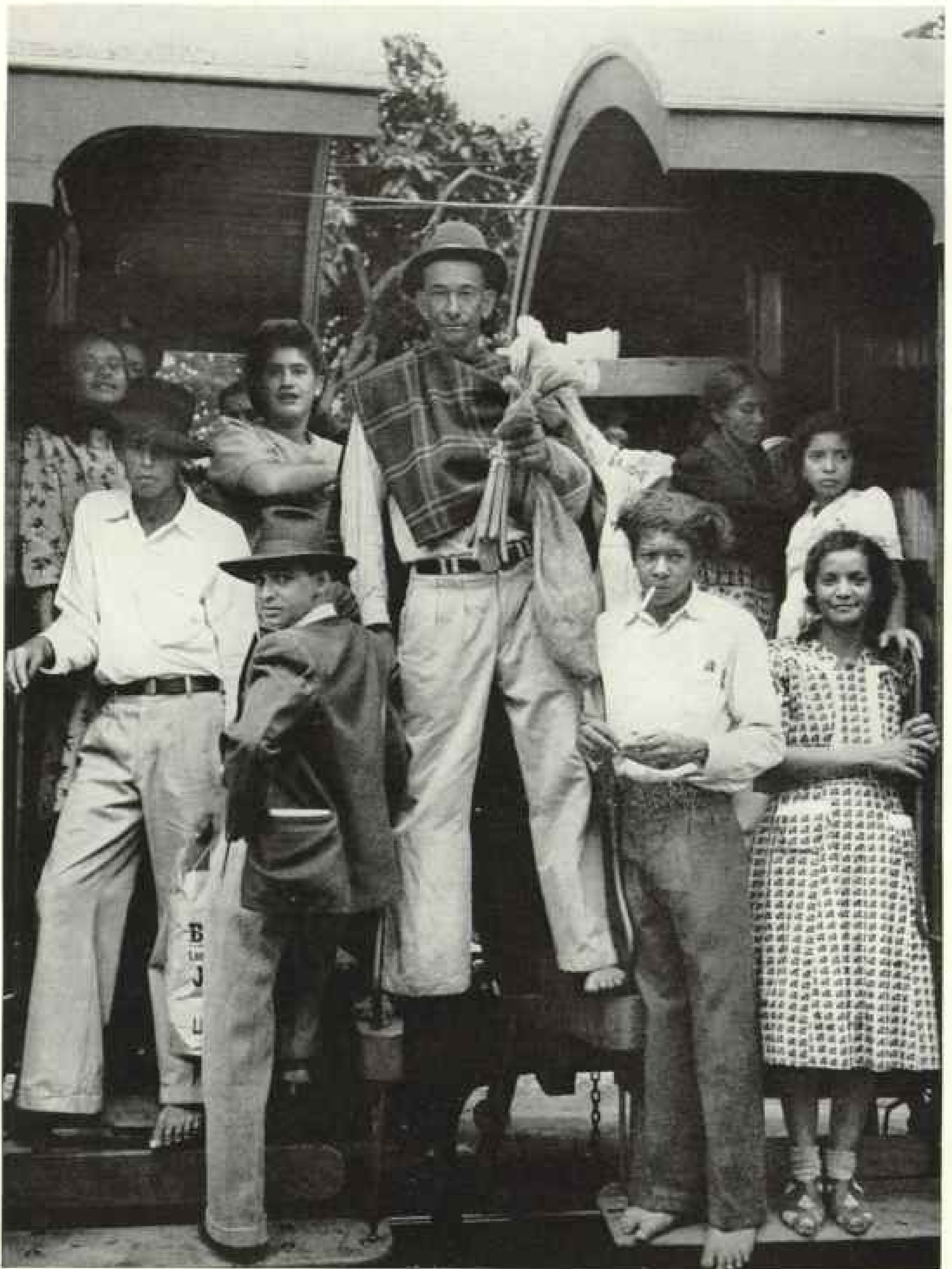
In Case of Rain, a Roller Shoves This Rackful of Drying Coffee Beans under the House

Most Colombian coffee is raised on small *fincas* (farms), with women and children sharing the work. Grown in the shade of guamo trees on mountainsides unsuitable for other crops, this coffee achieves a mild flavor that brings high prices. Each dark-red "cherry" must be picked separately, with several pickings a season (page 640).

Henricks Hodge from Three Lions

Where an Open Stream Once Coursed, Automobiles and Streetcars Roll along a Medellín Avenue

The rivulet along La Playa, one of the principal streets, has been covered. Ceiba and other flowering trees now shade modern shops and offices. Farther along the avenue are fine residences. Coffee trees border the golf course. One orchid grower here turned his hobby into a business when his plants numbered 30,000.



Henricks Hodge from Three Lions

Even Steps and Platforms Are Crowded on Wooden Coaches

On the Antioquia railroad a man in a business suit rubs elbows with barefoot countryfolk. One farmer takes home a bouquet of calla lilies. The woman at right wears bobby sox with her sandals. Antioquia Department, of which Medellín is the capital, produces the best coffee and contains Colombia's principal gold mines.

W. Winston Thomas

"It's My Ball!" Shouts a Soccer Player in Galapa's Village Square

On vacant lots throughout Colombia, boys enjoy fast games of the national sport in and out of season. The country offers other sports ranging from skiing to hunting jaguars and caymans. Pre-Spanish Indians liked to play *turmequé*, a game resembling bowling, using flat stone disks.

grain and potatoes from the plateaus and mountains of coffee from the fincas of Antioquia and Caldas for the 500-mile voyage down the Magdalena.

Clutching a letter from the company's offices in Medellín, which rather vaguely informed the captain I was to be a passenger on the *Jesusita*, I strode up the gangway with my equipment, threaded my way among the milling passengers, put my baggage down in front of the captain, and presented my letter.

No, the company had not sent my ticket to him; in fact, he'd never heard of me. Besides, the captain hinted, all of his cabins were occupied. He suggested that I take another boat.

I knew the Colombians consider it especially impolite to mistreat a guest. Besides, I liked the *Jesusita*. So I sat on my baggage and looked wistful.

Finally a pilot gave me his bare cabin, which had a broken window. He said he always slept in the pilothouse when the ship was under way.

With flags flying and orchestra playing we swung downstream bound for Barranquilla.

Now under way, the cooling upstream breeze tempered the sultry tropical air. A magnificent river panorama began to unfold.

From the top deck I gazed down on villages, towns, dugouts, forests, and men floating downstream on balsa rafts heaped with plantains and other tropical fruits.

Occasionally we passed women scrubbing clothes along the shore and gossiping the while.

The *Jesusita* throbbed with the faint tremor of progress as the 8-foot pistons turned the huge stern wheel 19 revolutions a minute. The steam exhaust emitted a plume of white steam over the thrashing wheel.

The Magdalena River, navigable for 800 miles of its thousand miles, courses through a mountain-walled valley sparsely settled. Since Quesada's men towed their boats against its turgid current in 1537, on their way upstream to found Bogotá, the river has been the main trunk of Colombia's transportation into the interior (Plates I, II, III, and X).

Turning Back History's Pages

Of the major Colombian cities, all but four are in the Andes. Since their founding, their first mule trails sought the Magdalena for an outlet to the sea.

For me it was like turning back the pages

of history a hundred years. The Magdalena River traffic is like that of the Mississippi at the time of the Civil War. Half of the steamboats carry passengers, mail, and express.

The passenger and express boats, such as the *Jesusita, Santander, Medellin,* and *Catatumbo,* which maintain relatively fast schedules, shove a single steel barge; freight steamboats handle five or six.

The Magdalena is far from ideal for navigation. The channel is constantly shifting. No attempt is made to control it by use of wing dams. The capricious currents dig where they may. It is up to the pilot to read the water and know his river. It takes years of apprenticeship to become a Magdalena River pilot.

I spent many hours in the huge wheelhouse where the pilots live during the whole voyage, seldom coming down to the lower decks.

On pitch-dark nights, while lying down below in my bunk, I could tell when the channel was bad by the excited way the steering cable ran back and forth in the trough that passed through my stateroom. Sometimes there would be a bump when we hit a bar and the bells in the engine room would clang.

But only the steering cable would register excitement. The pilots exhibited admirable skill and coolness.

During a voyage on the *Santander* I saw this "river queen," with her three decks full of people, jam herself crosswise in the narrow river above Barrancabermeja. The captain, who was playing with a baby, scarcely looked up. The pilots skillfully extricated the ship from what appeared to me a perilous position.

During low water a dozen or so boats may be stuck on a bar for days awaiting a rise in the river. As the supplies run low, cattle are driven down to the boats for food, and crews scour the bars for turtle eggs.

Rice, Beans, Rice—and Beans

The trip is by no means an Epicurean delight. I had my plate of native rice, with a fried egg on top, for breakfast. Rice was served three times a day. Beans vied with rice in number of times served.

The cow, which I knew would be served for the evening stew, was chopped up on the barge ahead in the morning. But the valley is a commissary of tropical fruits, and these weighted the tables in bountiful heaps. I could almost live on the fruit, and it was very cheap. I purchased a bushel basket of oranges for 10 cents, and the vendor threw in the basket.

Between the river towns there was an almost unbroken line of forest, parted occasionally by a grass hut set in a tiny clearing just large enough to maintain a subsistence garden. On the edge of the river a fish net was generally drying on the bushes and a dugout was moored to the bank.

I was up early each morning to see the varied bird life that gave sound and color to the green forests. Gaily plumed long-tailed macaws held raucous conferences; fruit-eating toucans with their enormous beaks split the air through the shadowy forest aisles; swooping, chattering kingfishers swung low along the water.

As we approached the flat delta country where the Western and Central Ranges fell away from the river, thousands of white egrets stalked the swamplands.

Towns That Stood Still

The dozen river towns where we stopped, such as Puerto Wilches, La Gloria, Mompós, and Zambrano, some dating from the conquest, are almost as isolated by their forested and swampy hinterlands as the mountain-ringed Andean towns. They have remained the same for generations. Some have deteriorated, although the buildings often possess a kind of ruined dignity (Plates X and XIV).

For everything they depend upon the river. Even with such a multitude of steamboats, the three-toned whistle of the *Jesusita* signaling for a landing stirred one of these river towns like a stick in an anthill. People beelined for the river with their wares and produce, and many with only their curiosity.

Some of the towns, such as Bocas del Rosario, have tin- and thatch-roofed houses and narrow alleys, muddy and wet from the rains. They seemed to have slept for three centuries. Others have awakened to find the river diverted and a mud bar deposited in front of the town. Or the hungry river has eaten away the banks and threatens to engulf the water front and carry it downstream.

Mompós, "Valiant City" of the war for independence and once a chief trading post on the Magdalena, was put off the main river by a channel shift.

Its market steps still walk right down into the river where dugouts tie up by the scores, loaded with fruit and vegetables.

Here a Colombian widow ceded a million acres of grazing land to a Mormon company. It imported prize Herefords and attempted to start a ranch, but floods, droughts, and fever defeated the project.

As we neared Barranquilla, gulls, graceful harbingers of the approaching sea, swung in behind us. A fresh wind whipping up waves

Open-toed Sandals Fit the Stirrups of a Hard-riding Plantation Overseer

Equipped with lariat, chaps, riding crop, and machete, he regularly inspects the cane fields. Few Colombian farms are mechanized. Oxen plow fields as in the days of the Conquistadores.

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Kodachromes by Anne Burg

Seven-year-old Girls in White Carry Lilies to Their First Communion

Their sheer dresses and veils follow tradition for this Roman Catholic sacrament. It usually takes place in May when flowers bloom abundantly. Spanish explorers proclaimed Christianity in Colombia in 1509.

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Kodachrome by Amos Burg

From His Bridge the Captain of the *Jesusita* Eyes the River Bank, Eaten Away until the Town Is Threatened

At La Gloria the Magdalena's uncontrolled, capricious currents push back the shore line. Soon water-front houses may topple into the river. Villagers scarcely have room to greet the steamer. In contrast, some communities have been isolated when the river has deposited sand bars and changed its course (Plate XIV).

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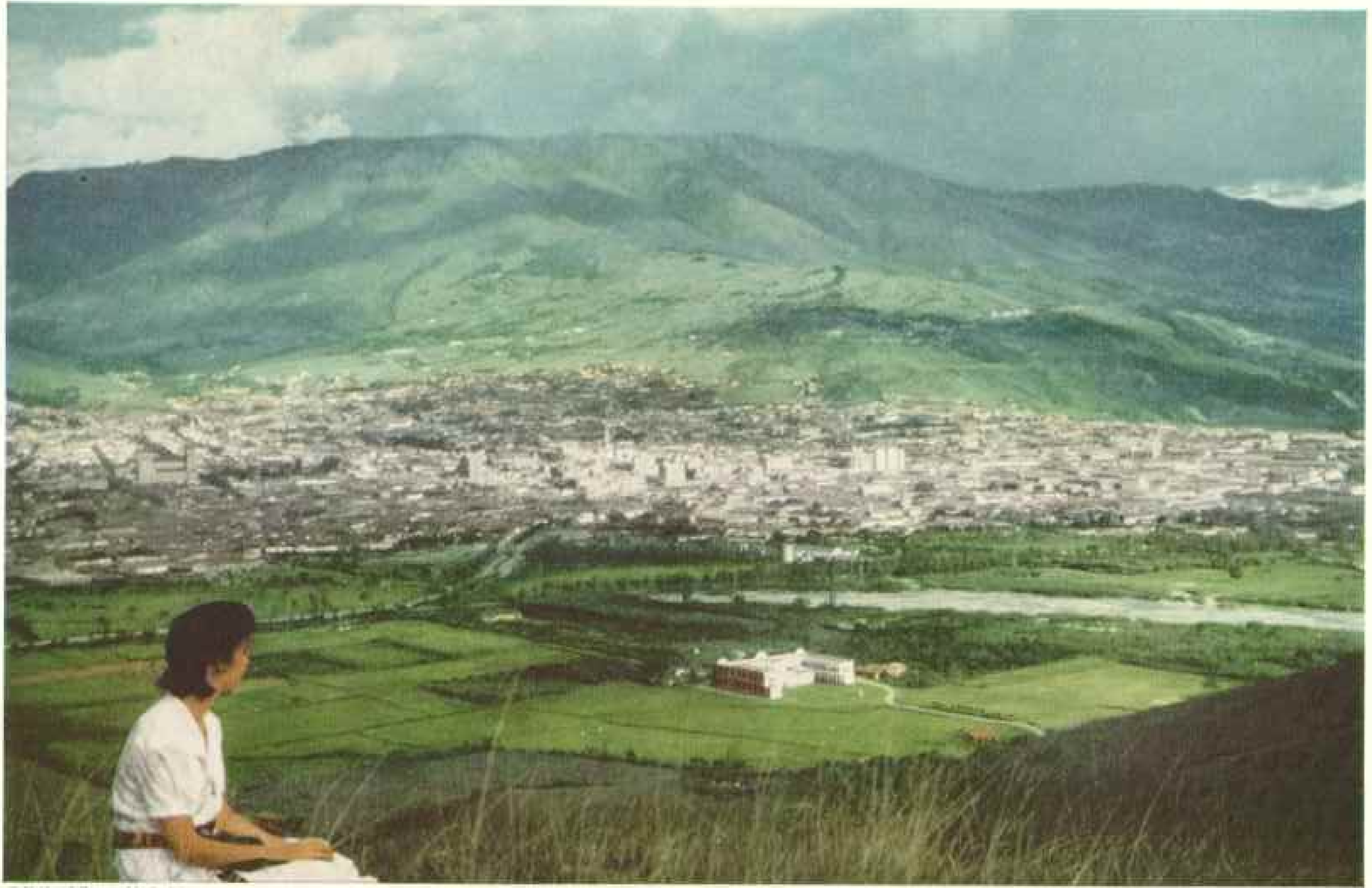
Kodachrome by Amos Burg

In an Airplane Age, Sure-footed Burros Still Deliver the Goods to Colombia's Mountainous Interior

More than 800,000 mules and donkeys carry coffee, hides, and grain from the uplands to railroad centers and river towns. The houses present forbidding walls to the street, but behind them sunny patios furnish a comfortable center for family life. A commercial airline connected isolated Colombian cities as early as 1920.



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Tall, Modern Buildings of Medellín Are Dwarfed by the Mountains Which Ring the Manufacturing City

Cotton mills and other factories dominate the fast-growing community, situated nearly a mile above sea level. Its energetic businessmen often are called "Yankees of South America." Medellín coffee is a prize export. Here, too, Colombian gold is refined and cast into bars, and the School of Mines turns out trained engineers.

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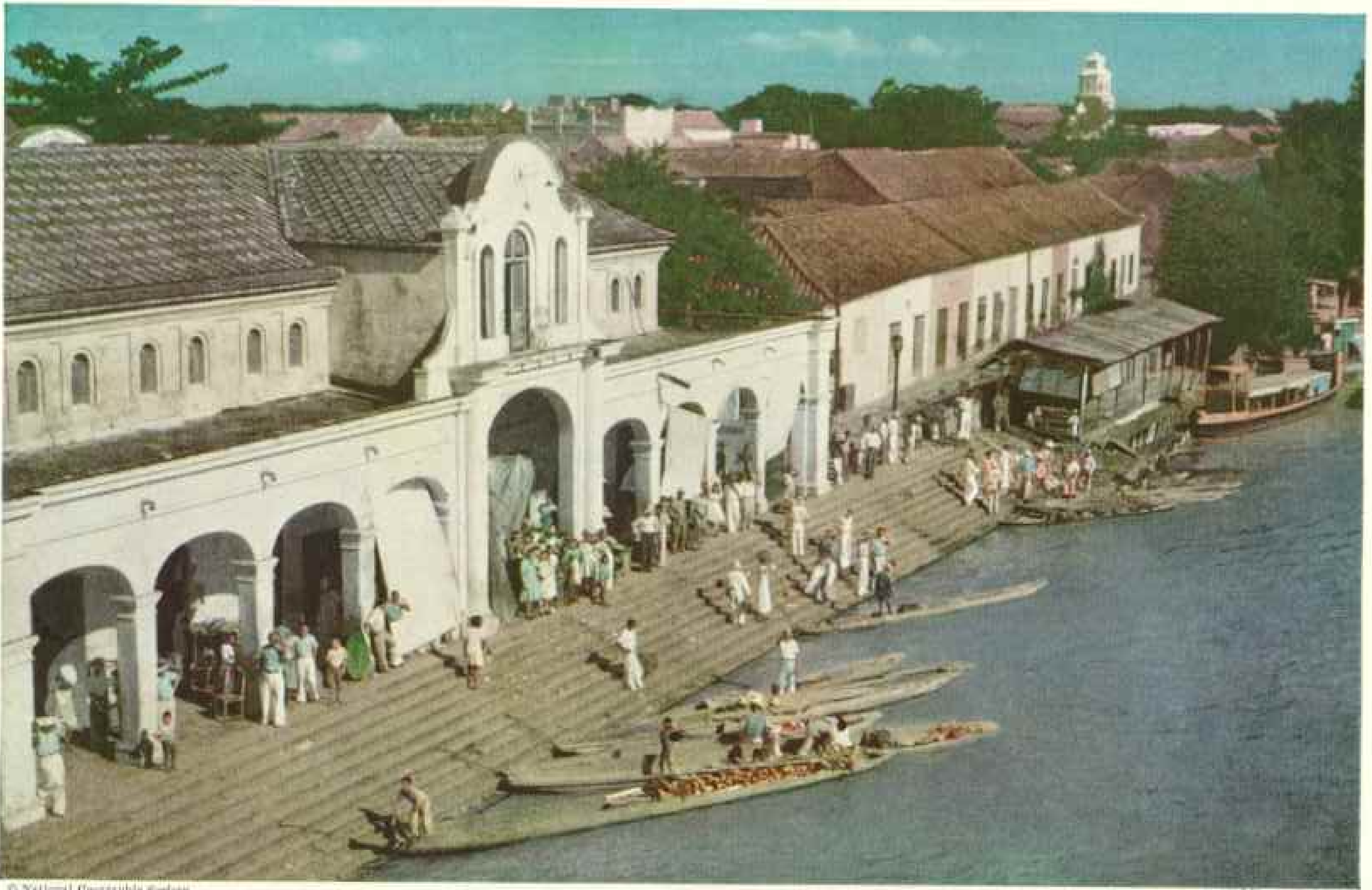
Kodachrome by Amos Burg

Delicate Plants in the Patio of His Popayán Home Furnished Inspiration for a Revered Colombian Poet

Here lived Don Guillermo Valencia, known to his countrymen as *El Maestro*, who wrote classical verses and also translated immortal poems into Spanish. After his death in 1943 the Government purchased his mansion. A magnificent city in colonial times, Popayán preserves its cultural tradition and still attracts men of letters.



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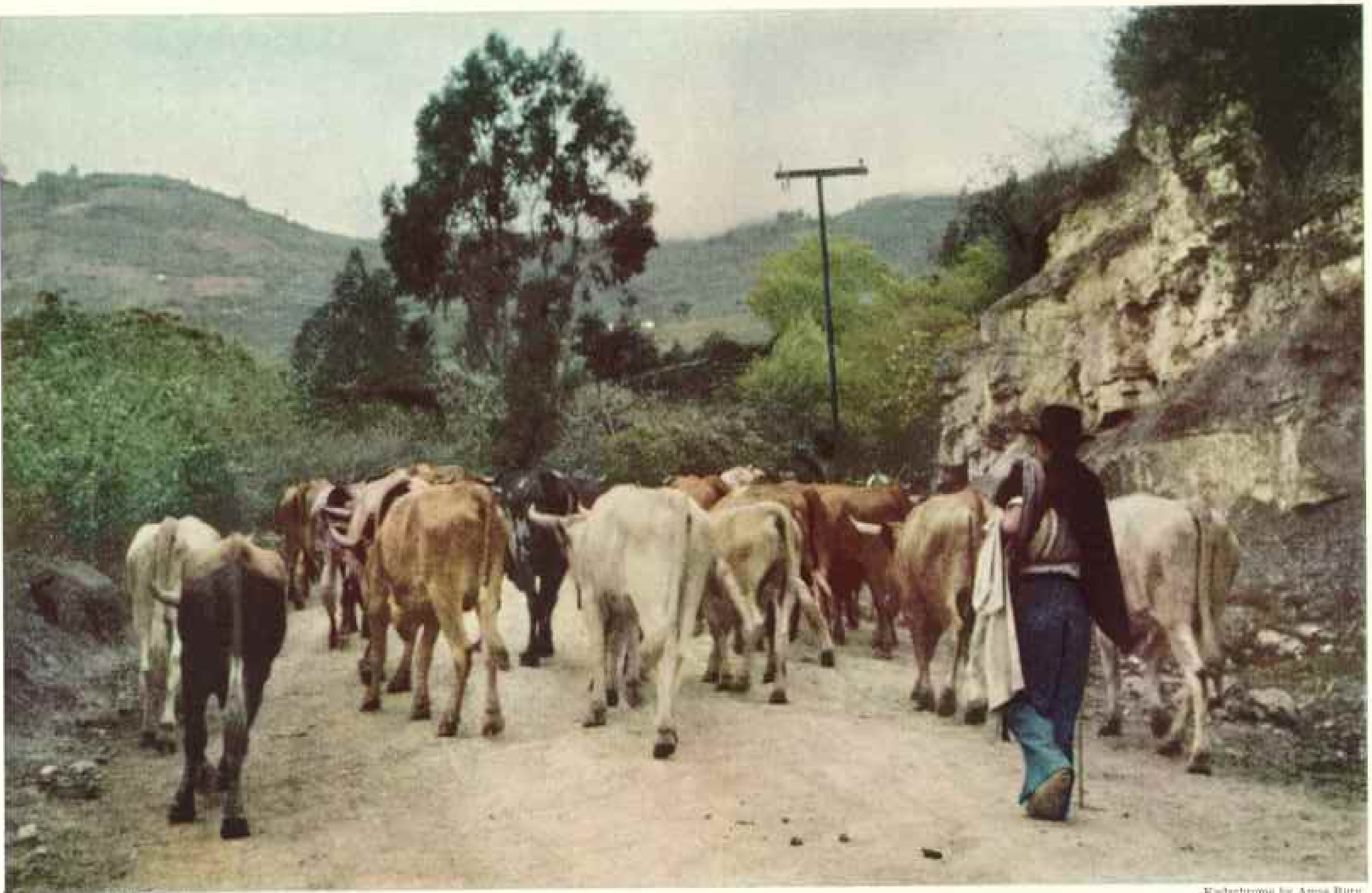
Kodachrome by Amos Burg

Steamboat's Coming Round the Bend! Mompós Residents Line Market-place Archways for the Big Event

Once an important trading center on the Magdalena, Mompós was left stranded when the tricky river shifted. It now stands on a side channel which large steamers avoid. Founded in 1537, the town was named for an Indian chief. It is called Valiant City because of its heroic participation in the struggle for independence.



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Kodachrome by Amos Burg

From the *Llanos* (Plains) of Eastern Colombia a Herd of Weary Cattle Plods Downhill on an 8-day Journey

Each animal may lose between 50 and 75 pounds on the grueling trip to Bogotá. They rest one hour of every four. On some journeys the cattle wear fiber "boots" to protect hoofs. Grazing areas closer to city markets are now favored.

Sacks of Coffee Beans, Colombia's Chief Export, Are Loaded on River Steamers

The crop is mild-flavored and of high quality. Much of it is shipped to the United States.

© National Geographic Society

Kodachromes by Anna Borg

Pole-pushing Boatmen Shuttle Cargoes along a Shallow Canal in Barranquilla

The small boats transport freight between the Magdalena River docks and the downtown section of the busy port. Here the poles are pressed against a bridge. The craft moves ahead as the men walk aft.

on the river made the *Jesusita's* bow flop like a number 12 slipper on a number 7 foot. Four days after leaving Puerto Berrio, the *Jesusita* docked in the steamboat-cluttered basin at Barranquilla, Colombia's main port on the Caribbean (Plate XVI and page 657).

In the general spurt of progress that affected every large city in Colombia, things have happened in Barranquilla.

The city is situated on the west bank of the Magdalena, 12 river miles from the sea. Its progress really began with the unplugging of the bar-choked mouth of the river.

This was accomplished by constructing two parallel mile-long jetties that enabled the river to scour its own channel through the millions of tons of silt dumped annually on the bar. By 1935, 10,000-ton vessels were able to come over the bar and up to Barranquilla to discharge their cargoes.

Long-time rival of Santa Marta and Cartagena for the ocean outlet to the Magdalena Valley, Barranquilla now controls a major portion of the trade. But the bugaboo of a silting river mouth still haunts port authorities.

I found the new Barranquilla had a pure water supply, excellent municipal services, attractive homes, sport facilities, beautiful plazas and promenades, and one of the best hotels in South America. Its spacious airport is a crossroads for planes shuttling between the Americas.

As I walked the sunny streets where the tropical sun glared from the white buildings, an urchin called out, "Hey, Joe, gotta cigarette?"

Memories of Buccaneers

I arrived in Cartagena, lying three hours' journey by road southwest of Barranquilla, after seven months of tropical wanderings. The "Queen of the Indies" I had saved before departing from Colombia.

Founded in 1533, Cartagena was built into the greatest fortress in the Western Hemisphere. Today it remains the hemisphere's finest historical museum. Its city walls, 40 feet high and 60 feet wide in places, with 27 bastions and outlying forts all connected by underground tunnels, were two centuries in the building (page 656).

Because of its wealth, Cartagena became the coveted prize of the buccaneers and pirates of the Spanish Main almost from the day of its founding. Here tribute and booty extracted from Spain's South American colonies were accumulated for transport to Spain on the treasure fleet which sailed yearly under convoy.*

Sir Francis Drake with 20 ships descended on Cartagena in 1586, sacked and set fire to part of the city, and even stole the church bells. After nearly two months' sojourn, this ungrateful guest departed.

Nearly a hundred years later the French buccaneer Jean Bernard Desjeans, the Sieur de Pointis, besieged the city with 22 vessels and 5,000 men.

In 1741 Admiral Edward Vernon with a powerful British fleet of 186 vessels and 28,000 men, including American Colonials, attacked Cartagena. After 56 days of siege, Vernon retired to Jamaica, leaving 18,000 dead. Lawrence Washington, half-brother of George, returned to Virginia after participating in the unsuccessful campaign and on the banks of the Potomac built a home which he named Mount Vernon in honor of the Admiral.

Cartagena, embracing the ideals of Bolivar, was the first city to declare its independence from Spain. The Spanish army captured the city in 1815 after a terrible siege, during which 6,000 Cartagenians died of starvation and pestilence. In 1821 the city capitulated to the forces of Bolivar, and the Spaniards had to salute the tricolor of Colombia.

For a week I wandered reverently through the twisting, narrow streets of this heroic city where every stone is a precious heritage. Even here the closely knit city has spilled over the ancient walls into new residential sections that rival those of Barranquilla.

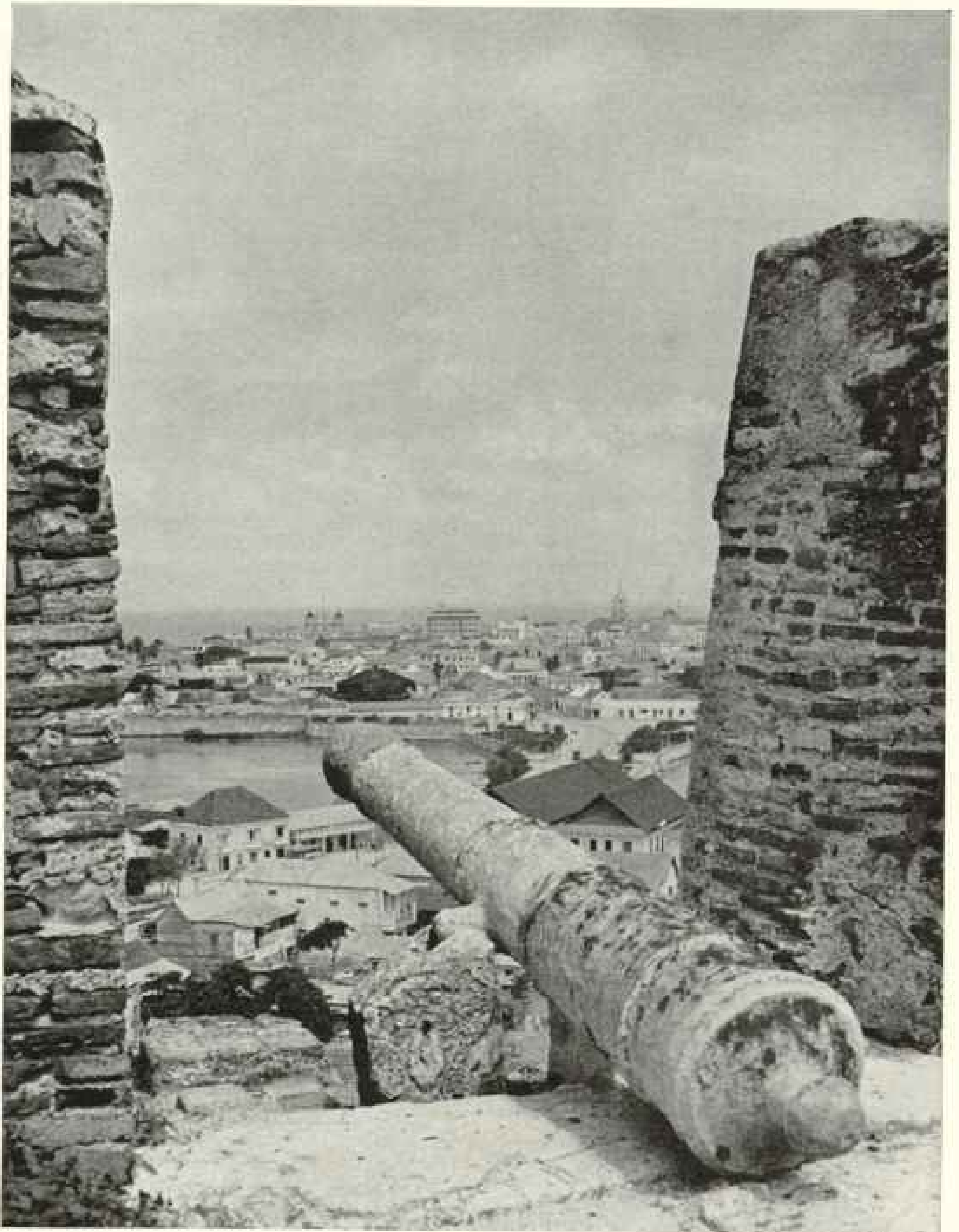
Cartagena today is beginning to receive an increased share of trade from the Magdalena Valley. Trails and rivers connect it with the vast back country of Bolivar Department, where range tens of thousands of cattle. Some day travelers will rediscover this glorious old city, and treasure will again flow into her coffers.

Down the Caribbean coast close to Cartagena I watched tankers load Colombian oil for world markets. Through a looped 10-inch pipe line with a capacity of 55,000 barrels daily, oil flows from the more than a thousand wells in the De Mares concession, in the Magdalena Valley, 334 miles from El Centro to a terminal at Mamonal, a few miles below Cartagena. For most of the way the line parallels the river.

From Petrólea, in the Barco concession on the Venezuelan frontier, oil flows through a 12-inch pipe line—capacity 75,000 barrels daily—for 263 miles across country to the port of Coveñas.

I flew over part of this line. For a distance the pipe is laid through jungles where pump stations force the "black gold" over mountains a mile high to the Magdalena Valley.

*See "Haunts of the Caribbean Corsairs," by Nell Ray Clarke, NATIONAL GEOGRAPHIC MAGAZINE, February, 1922.



Kurt Severin from Black Star

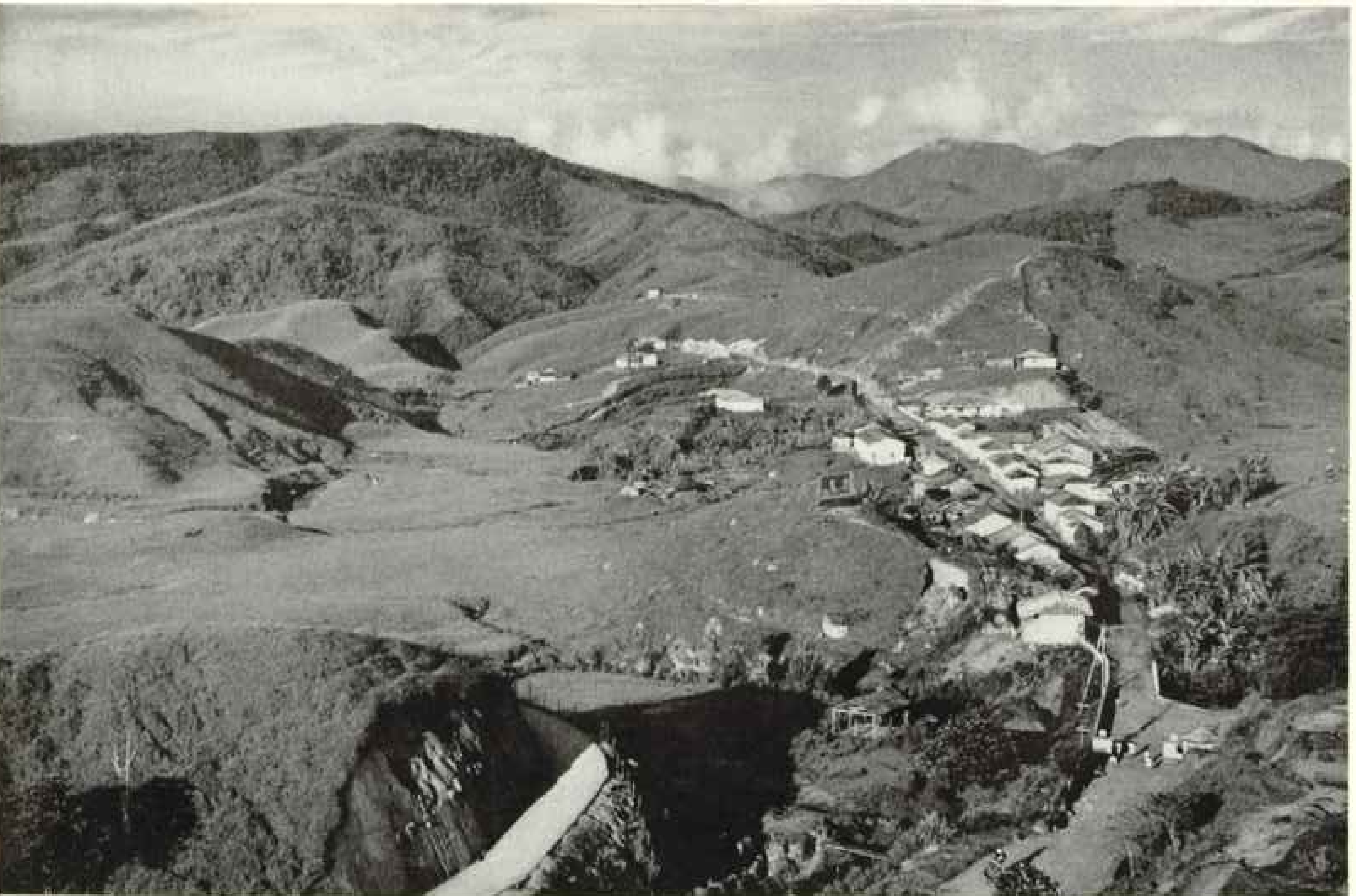
Perhaps This Old Cannon Fired on Sir Francis Drake's Raiding Ships

Four centuries ago Cartagena was the greatest fortress on the Spanish Main. Gold and gems, booty from South American colonies, were gathered there for annual shipment to Spain (page 653). Hilltop battlements and city walls 60 feet wide were built to protect the wealth from buccaneers, but Drake and other adventurers plundered the "Queen of the Indies." Up-to-date hotels and offices rise in the distance near the old Cathedral, along streets shaded by overhanging balconies. Crumbling barricades atop a hill called La Popa command the harbor entrances.

Staff Photographer Luis Marden

Coffee Enough for Hundreds of Thousands of Cups Is Stowed Aboard Ship at Barranquilla

Colombia ranks next to Brazil in coffee production. An average of 4,500,000 bags is exported annually, much of it from Barranquilla. Located near the mouth of the Magdalena, this city has become Colombia's leading Caribbean port. Stern-wheel steamers ascend the river nearly 600 miles collecting coffee, grain, and potatoes (page 641).



Henriksen Hodge from Three Lions

Thatch-roofed Houses of El Salto ("The Waterfall") Hug the "Main Street" as It Winds High into the Mountains

Residents of this shoestring village northeast of Medellín farm or work in the near-by hydroelectric plant on the Guadalupe River (page 616).

Amos Burg

Molten Gold Forms Bricks in Medellín's Casa de Moneda

Workmen pour a hundred pounds of gold into bars. Since the glistening metal first attracted the Conquistadores, Colombians have mined an estimated billion dollars' worth. Hydraulic monitors wash the ore from mountainsides. Colombia is South America's largest gold producer.

Henricks Hodge from Three Lions

"This Fat Hen Will Make a Nice Dinner"

Since electric refrigerators and iceboxes are scarce in Colombia, housewives make their purchases daily in the large central market. To ensure freshness of their wares in the country's varied climate, butchers slaughter their own animals, and poultry is sold alive and cackling.

Amos Burg

Gem Experts Appraise Colombian Emeralds, the World's Finest

Richest deposits lie in the Muzo area, about 65 miles north of Bogotá. Indian miners use sharp crowbars and shovels to uncover the green stones. The Colombian Government monopolizes the mining, cutting, and marketing of emeralds. Production has been small in recent years because of the large supply in vaults of the Banco de la República. Emeralds frequently develop flaws after exposure to air.

Irreconcilable Motilone Indians, resenting this encroachment on their ancient lands, have presented many calling cards in the form of triple-barbed arrows whizzing at oilmen from jungle ambush. That is why the right of way has been cleared to a width of 180 feet.

Fields now are producing only a dribble of Colombia's potential petroleum reserves. The country is today producing some 23,000,000 barrels a year; the greater part is exported. In export values oil is second to coffee.

From Cartagena I flew northeastward on Avianca along the Caribbean coast over Barranquilla to Santa Marta, one of the oldest existing cities on South America's mainland. Rising abruptly behind the city to 18,947 feet, the everlasting snow fields of the Sierra Nevada de Santa Marta glistened in the sun.

Below were numerous green patches, marking the groves of a former banana empire.

The war hit the world's banana exports hard, Colombia suffering more than any other South American country.

Part of the drop, however, was due to the inroads of sigatoka, a leaf blight capable of destroying whole groves. Effort has been made to control the disease by spraying.

At the present time, some shipments of poor-quality fruit are being made by small independent growers, but not much progress has yet been made in rehabilitating an industry which once led South America with an average export of 7,000,000 bunches.

Now the plane circled three miles outside Santa Marta over the Hacienda San Pedro Alejandrino.

Here Simón Bolívar, lonely exile and great general who won freedom for six South American countries, died on December 17, 1830, sick and disillusioned. The Greater Colombia he had envisioned had ceased to exist.

Before his death he said, "Those who have served the Revolution have plowed the sea."

If the great Liberator could see the progressive Colombia of today, a well-functioning, enlightened democracy, taking her honored place as a potent force in the council of world nations, his disappointment would surely turn to pride for the realization of an ideal perhaps even better than he had dreamed.*

*For additional articles on Colombia in the NATIONAL GEOGRAPHIC MAGAZINE, see: "Round About Bogotá," by Wilson Popenoe, February, 1926; "Over the Andes to Bogotá," by Frank M. Chapman, October, 1921; and "Stone Idols of the Andes Reveal a Vanished People (San Agustín Region)," by Hermann von Walde-Waldegg, May, 1940.

Your Society Observes Eclipse in Brazil

ON MAY 20, 1947, from a camp in the high rolling country of the interior of southern Brazil, an expedition of the National Geographic Society will observe for the seventh time a total eclipse of the sun.

This expedition is a joint undertaking of your Society and the United States Army Air Forces and is already established near the village of Bocaiuva, 400 miles north of Rio de Janeiro. The site was chosen because it offers the best likelihood of clear skies at eclipse time.

Dr. Lyman J. Briggs, Chairman of your Society's Research Committee, will lead a group of 14 scientists from the National Bureau of Standards, Yerkes Observatory, Lick Observatory, Georgetown University Observatory, Bartol Research Foundation, U. S. Naval Research Laboratory, and Army Air Forces.

Photographs of the eclipse from a B-17 bomber flying at 30,000 feet will be taken by Army Air Forces photographers. They also will attempt to photograph the moon's shadow as it races across the ground below.

First Television of Eclipse

This eclipse will be the first in history to be televised. Motion pictures of the eclipse will be flown immediately to the United States and sent out over television channels within 48 hours after the event.

In addition, the eclipse will be described as it takes place in a special broadcast by short-wave radio. The eclipse will not be visible in the United States.

The period of totality will be 3 minutes and 48 seconds at Bocaiuva, from 9:34.8 to 9:38.6 a. m. local time. This will correspond to 7:34.8 to 7:38.6 a. m. Eastern Standard Time, since eastern Brazil is in the second time zone east of New York.

An important feature of the expedition's program will be a check on the validity of the Einstein theory of relativity, with its strange concepts that space is curved and that everything has a fourth dimension—time.

This check will be made by photographing certain stars that will be visible near the sun during the eclipse. If the Einstein theory is correct, the light rays coming from these stars will be slightly bent by the gravitational pull of the sun as they pass by it. This will cause the star images on the photographic plates to be slightly displaced from their actual positions.

Comparing these pictures with others taken of the same stars six months later will reveal whether this bending took place.

Behavior of the ionosphere, the radio-reflecting layer high above the earth, will be studied during the eclipse. The ionosphere is composed of several layers of air which are ionized, or made electrically conducting, by ultraviolet light and particles from the sun.

Using radio impulses as probing tools to reach up from 50 to 250 miles aloft, the scientists will investigate what happens to the ionosphere when these radiations from the sun are cut off during the eclipse.

Terrifically hot gases of the sun's chromosphere, just above its surface, and the corona, the thin, nebulous envelope of gas surrounding the sun far out in space, will be investigated with spectrographs. These instruments break up light into its various wave lengths, which reveal what elements are present in these gases and how they are affected by the sun's intense heat.

A Much-traveled Camera

The sun's corona will be photographed in black and white and in color with a much-traveled camera which previously has photographed eclipses in Brazil, Russia, and on Canton Island in the Pacific.*

Measurements of the exact times of the four "contacts," the times when the moon begins to cover the sun, when it completely covers it, when the sun begins to emerge from behind the moon, and when the sun completely emerges, will be carried out.

These will provide a check on the movements of the sun, moon, and earth in relation to one another and to the stars, upon which are based our measurements of time.

An elaborate program of meteorological observations, before, during, and after the eclipse, to help determine whether it has any effect on the weather, will be carried out by the Army Air Forces.

These data also will be used in the calculations of the bending of starlight in the relativity experiment.

Whether or not the eclipse has any effect on the mysterious cosmic rays that fall continually upon the earth from outer space will be investigated. Observations to determine how the intensity of cosmic rays varies with latitude and altitude also will be made.

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Observing a Total Eclipse of the Sun," by Paul A. McNally, November, 1932; "Photographing the Eclipse of 1932 from the Air," by Capt. Albert W. Stevens, November, 1932; "Eclipse Adventures on a Desert Isle (Canton)," by Capt. J. F. Hellweg, September, 1937; "Nature's Most Dramatic Spectacle," by S. A. Mitchell, September, 1937; and "Observing an Eclipse in Asiatic Russia," by Irvine C. Gardner, February, 1937.

Ernest P. Walker

Brother Nonchalantly Nibbles a Nut on the Hand of a New Acquaintance

The "flying" squirrel and his mate, Beautiful, are pets of the author. Lt. and Mrs. Lloyd G. Ingles, California zoologists, quickly made friends with Mr. Walker's curious and trusting squirrels.

Staff Photographer Edwin L. Wisherd

Beautiful, "Wings" Outstretched, Leaps for Her Companion's Right Shoulder

The little "flying" squirrel cannot actually fly, but with her gliding membrane spread wide to help sustain her in air, she can add many feet to a normal leap. From the top of a tall tree a flying squirrel can glide 50 yards.

"Flying" Squirrels, Nature's Gliders

By Ernest P. Walker

Assistant Director, National Zoological Park, Smithsonian Institution, Washington, D. C.

WHEN I was a boy, I climbed a big beech tree. The top was a dead snag with many woodpecker holes in it. When I got up to the snag I pounded it with my fist. Immediately, little gray faces with big eyes peered out of almost every one of the woodpecker holes for an instant. Then there were a scurry and a shower as between six and a dozen "flying" squirrels leaped out in all directions and glided to adjacent trees.

As I think back, the incident reminds me somewhat of the shower effect produced by lawn sprinklers. This glimpse was far more than most people ever see of the so-called flying squirrels.

Not until I became intimately acquainted with them did I fully understand the meaning of "gay abandon." These delicate and gentle little creatures are sprightly in their movements and are attractive and lovable.

They are highly specialized little squirrels, and plentiful throughout much of their range in North America.* Other flying squirrels, both much larger and smaller and closely or distantly related to them, inhabit Europe, Asia, and western Africa.

Glider "Wings" of Membrane

The flying squirrel of the eastern United States weighs about 3½ ounces. Head and body are about 5 inches long and the tail about 4 inches. Coloration above ranges from grayish buff to dark gray or slate. The under side of the head, body, and gliding membrane is white, except for delicate buff on the flanks.

The flying squirrel's fur is fine and soft. Its eyes are large, and its tail is flattened and shaped much like a feather. Arms and legs are very long, but do not appear so because they are enclosed in the large, loose skin of the body and gliding membrane (page 672).

At each wrist is a slender cartilage. It projects outward when the arm is extended and thereby extends the membrane just back of the hands (page 668).

The small creature has the appearance, when sitting, of being very fat or of wearing clothes that are much too large for it. Actually, when it extends its arms forward and out and its hind legs backward and out, it stretches the membrane so that its body takes on almost a square form and is flat. We then see that it is slender and delicate in build.

Flying squirrels are so strictly nocturnal that many people do not know of their existence, even in regions where they are common. Few have seen them and very few indeed have observed their behavior in the wild. Occasionally they appear at a bird feeding shelf.

Sometimes, when a tree is felled, they are found living in a hole in its trunk or in one of the limbs. Again, they may dwell in a bird box or nest in an attic, where their activity at night annoys the human occupants of the house.

Sometimes they come down a chimney into a family's living quarters and meet a sad fate at the hands of people who do not realize what gentle, inoffensive creatures they are.

Seek Lofty Home Sites

Usually flying squirrels live among trees, making their nests in hollow limbs, old woodpecker holes, or other shelters high above the ground. Their movements are not limited to climbing up and down the trees or merely leaping between objects, for their remarkable form gives them power to glide long distances.

Glides of more than 50 yards have been recorded.

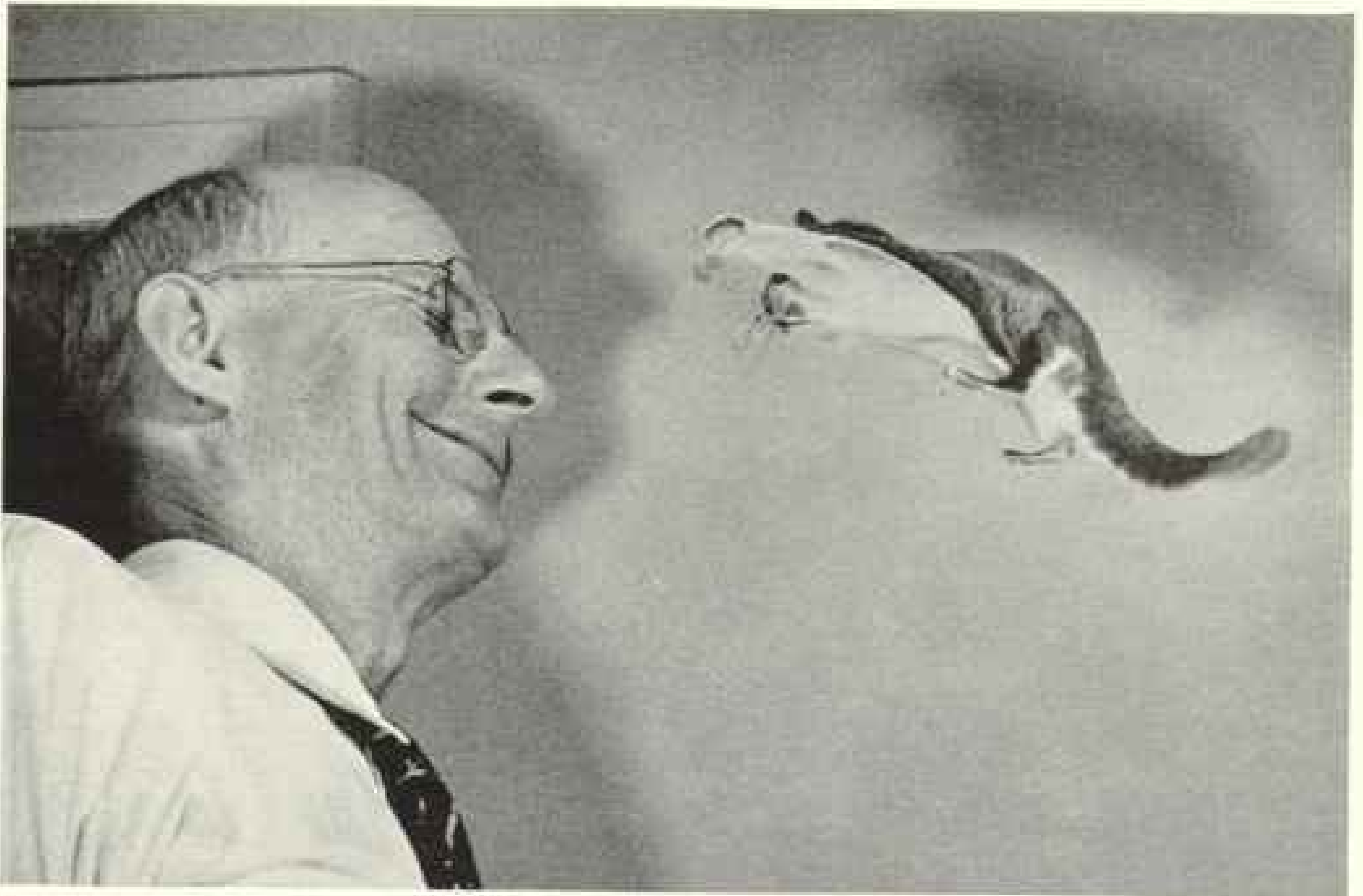
To take off, they seek an elevated point, then leap out into space. Spreading their arms and legs, they take on the form of miniature gliders and steer themselves by raising or lowering their arms to warp their flattened forms. Perhaps the tail also plays some part in steering. Certainly it acts as a stabilizer and assists in making the upward swing.

When approaching a landing, usually in a tree or upon some other tall object, they swing slightly upward to check their speed and bring their long arms and legs forward as shock absorbers. Upon alighting, they dart around to the other side of the tree or limb, probably as a precaution to escape any enemy that might be following them.

They feed largely on nuts, which they gather and store in their nests or wherever they find a cavity large enough to hold a nut securely.

Intimate observations of flying squirrels in captivity, even when they have a great deal of freedom, do not take the place of those in the wild, but many accurate deductions may be made by such close study.

* North American flying squirrels comprise two distinct groups—the smaller species (*Glaucomys volans*), of the eastern United States and parts of Mexico; and a larger species (*G. sabrinus*), occupying timbered sections of the western United States and Canada, with one form ranging into northern New England and border States along the Great Lakes.



Ernest P. Walker

"Look Before You Leap, Brother"

The pet squirrel usually does, but his master shuts his eyes as a precaution in case the landing place is his spectacles. These photographs were made with electric-flash apparatus at 1/5000 of a second.

I had known flying squirrels since boyhood and had often told people what charming pets they become, but I had not raised any until slightly more than two years ago. Then two of my zoological friends, Mr. and Mrs. John H. Hamlett, took two babies of four from a nest when they were three days old. They cared for them until they were nearly five months old, when they were turned over to me because my friends were going to travel.

By this time the young were fully grown and had developed their remarkable agility in leaping, gliding, and scurrying over surfaces. They had become so thoroughly domesticated that they had no fear of human beings.

As Household Pets

Now they seek human companionship at every opportunity and are as curious and free with strangers as the friendliest dog. They sleep all day in the nest box in their cage, but in the evening they begin to awaken.

They groom themselves and sit and dream, sometimes for half an hour, just as we would like to do in the morning. When they are fully awake they dash about in their cage, waiting to be released.

They do not like daylight, or normal lighting in a room at night, and they quickly seek a dark spot or one with subdued light. I am certain that lighting which is normal for humans makes many small mammals acutely uncomfortable.

A dim blue light is not objectionable to my flying squirrels, so I am trying to become more nocturnal.

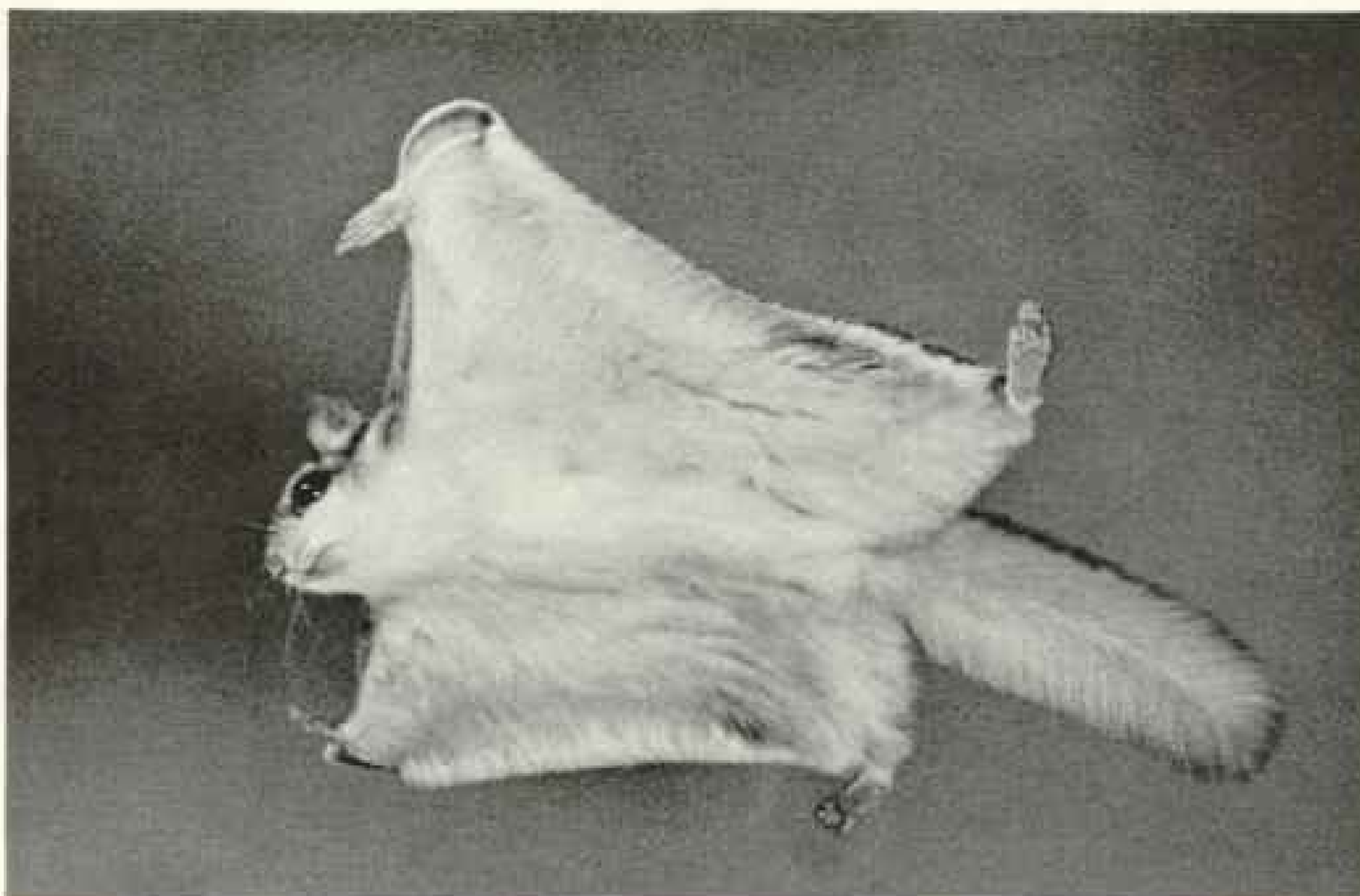
When the cage is opened they leap to their human companion and dash about him, exploring, going over and inside his coat or shirt and up his trouser legs. Generally they make as thorough an exploration as they would of a tree in their native haunts.

Some of my friends suddenly develop remarkable agility when the squirrels get inside their clothes. To the squirrels it is almost as good as scampering about in a hollow tree!

When they climb on clothing or press their soft fur against one's skin, their presence is only disconcerting. But when they try to climb on bare skin, their tiny needle-sharp claws tickle and are uncomfortable.

My squirrels' extreme fondness for humans made it easy to induce them to leap to me from a distance. They leap many times in succession before becoming tired of the game, and then, after a short rest, they will resume.

With this enthusiasm on their part, it was not very hard to photograph them while they



Ernest P. Walker

In Mid-glide, the Squirrel Can Turn to Right or Left

This prevents collisions on skims down wooded hillsides. Landing on flat surfaces, the animal swings feet forward and digs in with claws to check momentum. In "flight" the body, gliding membrane, and feathery tail present a broad, flat surface.

were leaping and gliding. I tried this with ordinary photo-flash bulbs and a camera shutter operating at 1/500 of a second. I obtained many gliding and leaping pictures, but the action was so fast that all of them showed considerable movement.

When I began using electric-flash apparatus, producing a light which glowed with intense brilliance for from 1/5000 to 1/20,000 of a second, I obtained satisfactory results. The gliding pictures which accompany this article were taken with such equipment and are, so far as I know, the first made which show flying squirrels in action (pages 662, 664, 666, 667, 668).

When I invite the squirrels to glide to me, I usually pat my chest with my hand as a signal. They almost invariably land on my hand or the spot I have patted.

By indicating to them different landing spots I have found that they are very accurate in reaching their destinations. My squirrels truly believe in looking before they leap, a characteristic which is very different from that of pocket mice and kangaroo rats. These animals, which live on the ground, often leap without looking.

Before taking off on an unfamiliar leap, the squirrels lean far to one side, then far to the other, and finally rise as high as they can on their arms, closely examining the spot to which they propose to leap. Are they measuring the distance by triangulation?

Connoisseurs of Nuts and Fruits

My pets are fond of a wide variety of nuts. Pecans are their first choice. They also like acorns, almonds, English and black walnuts, chestnuts, and peanuts. Acorns doubtless constitute the greater portion of their food in the wild.

I offer them many kinds of fruit. Occasionally they eat raspberries, blackberries, or mulberries, but they are quickly satisfied. They are indifferent to almost all vegetables and leaves, although at times they consume a blade of grass, a leaf of clover, a tree leaf, or a bite or two of carrot.

They are rather fond of the buds of a few trees, particularly during the winter and early spring, so I try to supply them with what appears to be their favorite spring salad.

Few laymen realize the extent to which rodents eat meat. In the wild, most of their meat diet probably is insects, either in the adult form or in the larval stages.

Beautiful, in Mid-air, Tries for a Shoulder Landing

Before she jumped, she studied the distance carefully, cocking her head at different angles (page 665). Usually she judges the leap accurately. Occasionally Brother prefers to land in Mr. Walker's face.

Ernest P. Walker

Needle-sharp Claws Take a Firm Shirt-front Grip

Mr. Walker signaled the landing place by patting his shoulder with one hand. Claws tickle through the shirting. From nose tip to tail tip a flying squirrel is about 9 inches long, but weighs only 3½ ounces.

Staff Photographer Edwin L. Wisherd

Whiskers Pointed Forward, Black-eyed Beautiful "Floats Through the Air with the Greatest of Ease"

But she moves much more rapidly than the Man on the Flying Trapeze. Whiskers are a second pair of eyes for flying squirrels and other small nocturnal mammals. Outstretched in the dark, they brush against unseen obstacles and warn of danger ahead. In this series are the first successful action photographs of flying squirrels.

Ernest P. Walker

"Upside Down" Shot of Beautiful's Glide Shows Widespread "Wings" and Relaxed Tail

Mr. Walker placed his camera on the floor, lens pointing upward, and flash-photographed his pet as she passed over it. Cartilage extending from the squirrel's wrist helps to stretch out the gliding membrane. Relaxed position of tail indicates its lack of importance in gliding, except just before landing. Note acorn in mouth.

I have discovered that flying squirrels enjoy grasshoppers, the seventeen-year locust, moths, butterflies, meal worms, corn borers, wood borers, and a few other insects I have offered them.

White grubs, so plentiful in acorns, they find particularly delicious and often select wormy acorns merely for the sake of opening the nut to get the grub. No doubt wild squirrels consume vast numbers of these and other insects.

Some Nuts Hard to Crack

Pecans are about the hardest nuts my pets can open. Frequently, while they may be very hungry for pecan meat, they do not attempt to open the nut, apparently aware that it is too hard for their tiny teeth. At other times they will work on a pecan at intervals for several days and finally find a weak place in the shell, through which they cut.

Handling a pecan is a big problem for such a little fellow. It is much as if a person were to try to carry and eat a large watermelon without resorting to equipment or force to break it.

A flying squirrel's first act upon coming upon a pecan is to grasp it in both hands and turn it until the point, or blossom end, faces him. Then he works the nut into such a position that he can cut a slight groove and notch in the two slightly flattened depressed areas on either side of the tip of the nut. This requires four or five quick bites (page 670).

Gripping the groove and notch in his teeth, he can carry the nut by the small end.

To get the meat from a hazel nut, the squirrel cuts a small round hole in the shell, usually near the rough stem end of the nut, and then cuts the meat into bits and removes it from the shell with his teeth or tongue, or both. The dormice of Europe open filberts similarly.

My pets cache nuts and other food in many different locations—on the top of a window casing, in the folds of a shower curtain, in my pockets, in the tops of my socks, inside my collar, on my arm, or in the angle of my elbow. They search out locations and tamp the nuts into place with their teeth.

They use their long, slender hands to reach for objects too far away to pick up with their teeth, and to handle nuts and other food. They are accurate and dexterous.

Their hands and feet are remarkably strong to enable them to check momentum from leaps and glides and to hang, sometimes, by a single finger or toe.

They regularly hang head downward by their toes, using their hands to hold food. I believe they sometimes sleep hanging head downward. I have seen them sleep hanging by their fingers, head up.

Almost any hole, crevice, or crack that is as much as 1½ inches in diameter will provide refuge for flying squirrels. The squirrel housing shortage in Washington, D. C., where very few old trees with cavities remain, forces both flying squirrels and gray squirrels to seek shelter in attics of dwellings.

Apparently some of the human occupants of the buildings do not appreciate such delightful neighbors, for in the office of the National Zoological Park we receive many questions about ways to eliminate them. I usually suggest putting plenty of nest boxes in trees.

Insatiable curiosity sometimes gets them into traps set for other animals, to the disgust of the trapper and to their own sorrow.

My pets have never bitten my hand severely enough to draw blood. Occasionally they will set their teeth on my finger and pinch gently in protest against my picking them up or disturbing them when they wish to do something else; but ordinarily it is not necessary to pick them up.

They leap to me and try to stay with me as long as they can, and they especially enjoy going into my pocket to explore or to sleep. My little male often takes a notion that he wishes to sleep in my pockets.

They show affection in many ways. One will stand on my shoulder and gently bite the rim of my ear or put his nose into my ear and sniff rapidly. This seems to be a way for many animals to express affection.

Almost all animals show affection and companionship by grooming their companion's coat. My pets do this to each other and frequently to me, using their hands, teeth, and tongue. Once Beautiful, the female, began cutting gently with her teeth at a rough spot on the skin of my bald head!

While still sluggish upon arising from sleep in the evening, the squirrels enjoy being in my hands. As I stroke them, or rub them behind the ears and on the cheeks and chin, they turn their heads to make those parts easily accessible. They also enjoy having me rub their backs along the spine, and offer no objection when I lift their gliding membranes or manipulate their tails.

Sure-footed and Agile

Later, when they are thoroughly awake, they are so active that they do not care to sit quietly so long.

Their extremely long arms and long legs are used to good effect when climbing. It is incredible how rapidly they can climb and how sure-footed they are on smooth surfaces. They

Ernest P. Walker

"I Cannot Carry Forests on My Back, Neither Can You Crack a Nut"

Beautiful's sage manners recall the retort of "Little Prig" to the mountain in Emerson's *Fable*. Here she notches the pecan with her teeth so she can carry it by its tip to a likely spot for a leisurely meal (page 669).

run up or down the polished chromium-plated legs of my camera tripod by gripping it rather than by clinging with their claws.

Occasionally they encounter a surface so large and smooth that they cannot get a grip on it, and then they slip to the floor or land on another surface. This obviously embarrasses and surprises them, as their experience fails to take into account any surface to which they cannot cling.

In their enthusiastic exercises they often develop a complex routine of running, leaping, and climbing in a single maneuver, which may require only a few seconds to execute but will be repeated without intermission for many minutes—perhaps almost an hour at a time.

One exercise involved running in an inverted position on the under side of a chromium-plated shower curtain rod.

They prefer the highest spot they can find. They apparently fear resting on the floor or ground more than momentarily.

When danger threatens—sudden movement, an unknown sound, or a strange animal or person—they usually leap to me or take refuge in the highest nook or crevice they can find, from which they peer out to learn the cause of danger.

Crumpling of paper alarms almost all small mammals, including flying squirrels. Perhaps it suggests the rustling which a dangerous animal might make in dry leaves.

No doubt many animals looking into, or sniffing in, a hole occupied by flying squirrels have had their eyes or noses scratched. Even my pets strike with their hands with incredible speed when one ventures to put a finger into their nest box.

Until a person is accepted by the squirrels as a friend, or as a bit of the scenery, they usually are silent. But when at ease they utter a low chuckling note to express pleasure. Sharp *chucks* connote displeasure, as do sharp chirps or squeaks at each other. They emit barks, similar to those of gray squirrels but higher pitched and not so loud, if danger threatens. When annoyed they stamp their feet.

After our pair had lived with us for about seven months I suspected that Beautiful was going to have young. I became certain of it when she started to pluck the fur from around her eight nipples. Eleven days later she gave birth to two babies, which were naked, pink, and blind, and weighed 88 grains each.

She was an ideal mother and never left the little ones for more than a few moments until they were large enough to crawl out of the nest. I weighed them and took photographs

Ernest P. Walker

"*Chuck, Chuck!* I Much Prefer to Be on the Inside Looking Out"

Favorite pastime of the pets is investigating shirts and trousers. It's more fun than exploring a hollow tree. Lively scenes often are enacted when Brother and Beautiful conduct their expeditions underneath the clothing of Mr. Walker's guests.

and notes every few days from the day they were born until they were practically the size of their parents.

At the age of three days they began to show distinct bluish tones on their backs—hair had begun to grow under their skins. By the fifteenth day they were clothed above with a thin gray coat, while beneath they were naked except for a sparse growth of white hairs.

As the hair on the back grew longer, the coloration gradually became lighter; at the same time the white fur of the under parts grew longer and denser.

The little ones were slow in developing. The mother nursed them until they were fifty-six days old, and they tried to nurse occasionally for two weeks more.

"Baby Book" for Twins

Two women in a gift shop exchanged significant looks when I made inquiry for cards announcing the birth of twins. The cards were sent to friends who knew our family of little folk.

When the babies were about four months old they flew to Brazil with a friend of mine to make their home with her. At last reports they were doing well as much beloved guests.

Their baby book follows:

1st day: Naked, blind, pink. Weight 88 grains.

3d day: Traces of coloration on top of head, neck, and shoulders, indicating growth of hair under skin. The young cry frequently. Voice much like twitter of barn swallows.

5th day: Weight ¼ oz. and 7 grains. Bluish black above. Pink beneath.

8th day: Weight ¼ oz. and 37 grains.

15th day: Weight ½ oz. and 32 grains. Hair above gray. Naked beneath. Eyes beginning to show slight crack.

20th day: Weight ¾ oz. and 50 grains. Upper parts fully haired. Under parts show fine white hairs scantily distributed except on chin. Eyes not yet open, but lids black. Tail and legs blackish.

23d day: Weight 1 oz. Tail black above, whitish beneath, flattened. Eyes not yet open.

25th day: Eyes have opened during past 12 hours.

28th day: Weight 1 oz. and 82 grains. They crawl fairly well and look fairly bright. Fully haired beneath, white and creamy.

42d day: Weight 1½ oz. and 50 grains. Still nursing but beginning to nibble at solid food. They are beginning to climb about and hang on the sides of the nest bag. Beautiful, the mother, sometimes carries them back into the nest when she thinks they are too venturesome. Brother, the father, does not try to approach

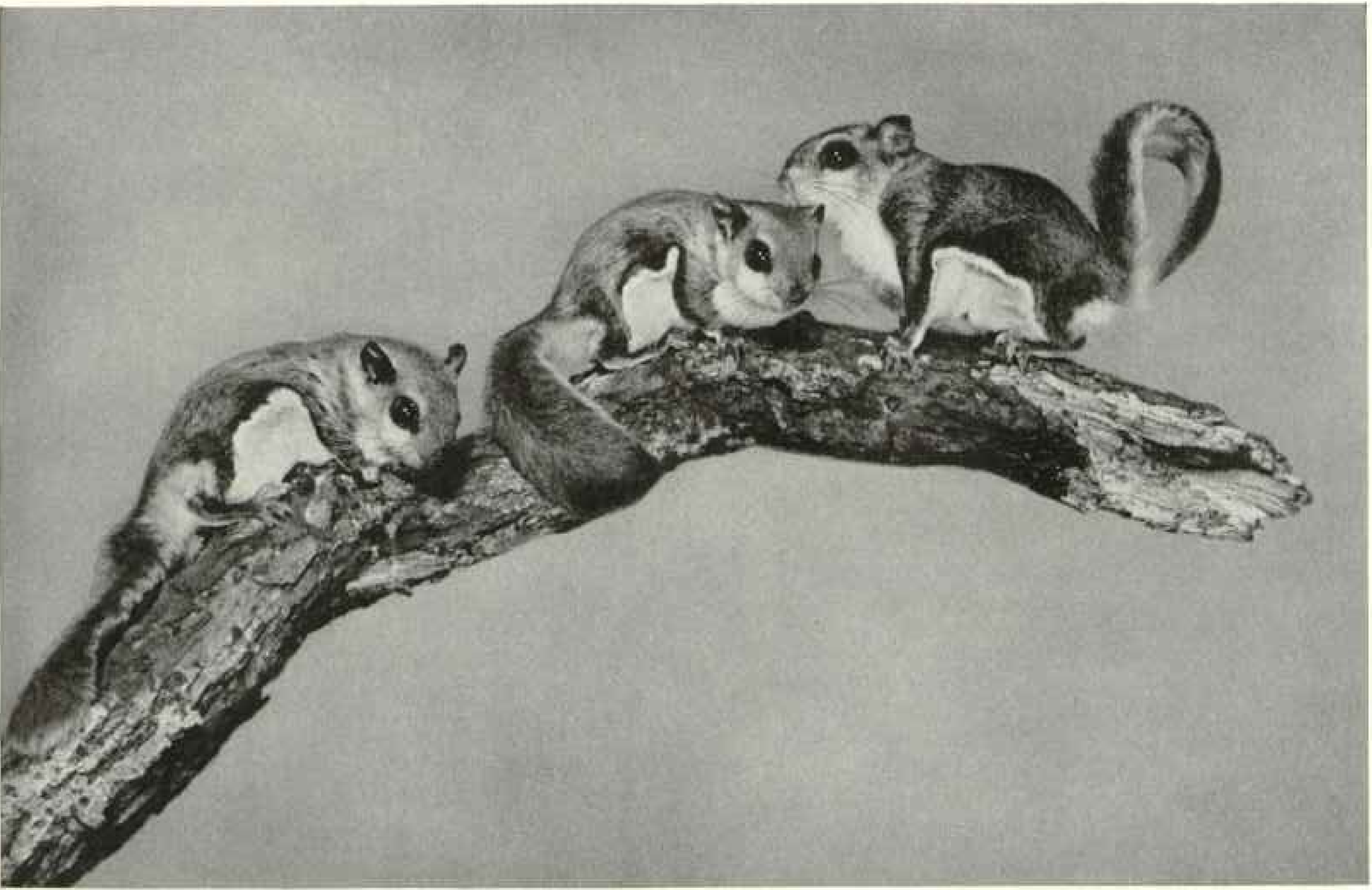
Inside Her Master's Collar Goes an Acorn for Safekeeping

Beautiful firmly tamps it into place with her teeth. Tops of socks or pockets also are acceptable storage bins. Droll flying squirrels have been known to replace one kind of nut, left for them on a window sill, with another variety.

Ernest P. Walker

Loose Gliding Membrane Unites Front and Hind Legs

Unextended, the membrane clings to Beautiful like an ill-fitting, oversized overcoat. It is covered with the same kind of soft, velvety fur as the rest of her body. Her tail is flattened and shaped much like a feather.



Ernest P. Walker

Out on a Limb, but Who's Afraid? Mother (Right) Proudly Presents Her 56-day-old Offspring

The twin flying squirrels were born in Mr. Walker's apartment. The tiny babies each weighed one-fifth of an ounce at birth. Here they have just been weaned. At the age of four months they traveled by air to Brazil to make their home with Miss Bertha Lutz, a biologist and a friend of the author (page 671).

Staff Photographer Edwin L. Wisherd

"How's the Article Coming, Mr. Walker?" the Pet Squirrel Seems to Say

Brother has climbed up on a tree branch to watch the author work on his manuscript and to keep sharp watch for a tidbit. Flying squirrels, sprightly, delicate, and gentle, like human companionship and make entertaining household pets (page 664).

the babies or Beautiful, and if I place him near them he is nervous and tries to get away. Beautiful tolerates him to within about a foot of the babies, but dashes at him if he comes closer. Once she gave me a gentle pinch accidentally when she was trying to bite him.

56th day: Completely weaned. Gaining strength and agility but still not as strong or accurate as the parents.

59th day: Weight 2 oz. and 29 grains.

68th day: This evening, for the first time since two weeks or more before the babies were born, Brother was not afraid of Beautiful or her babies (his children). Heretofore, she chased him whenever he came near her. This evening he showed no fear when I took him into the bathroom where Beautiful and her babies live. She made no effort to chase him, and he smelled noses with one of the babies, and they even sat close to each other. The young are now practically full-grown and rapidly gaining agility and confidence.

When my little pets are at liberty and I desire to catch them, I merely go near them, and they usually leap to me. If they are hanging on a curtain, I place my hand or arm, or some other portion of my body, near them and they step onto it.

Sometimes they leap from me before I get them to their destination, and the process must be repeated. It is extra-good fun for them; they are not attempting to escape.

Usually I can call them to me by rubbing or rattling nuts together in my hand, or scratching with my fingernail on a book or piece of wood to make a sound like a squirrel gnawing on a nut. Sometimes they come to me when I say "Nuts." It may be a coincidence, but I believe they know the word.

Having lived with golden hamsters (*Mesocricetus auratus*) on almost as intimate terms as I have with flying squirrels, I have observed the remarkable contrast in the forms and habits of these two highly specialized animals.

Hamsters are short, heavy-bodied, densely furred little rodents, somewhat like small guinea pigs. Their coat is a beautiful golden brown above and an immaculate white beneath. They are almost tailless.

Most of their lives are spent on the ground or in burrows, and with these terrestrial habits are associated behaviors in marked contrast to those of the flying squirrels.

Such differences accompany high specialization of animals for their particular modes of life. But interest in animal study is heightened by comparing and contrasting the modes of life and variations associated with the specialization and adaptation of animals.

Lundy, Treasure Island of Birds

By Col. P. T. Etherton

With Illustrations from Photographs by J. Allan Cash

About a dozen miles off the coast of north Devon, looming out of the Atlantic, is the solitary island of Lundy, strangest and perhaps least known of the islands of Britain. This strategic sentinel commands the shipping lane from Bristol and the west country and has a history as romantic and swashbuckling as anything in Stevenson's *Treasure Island*.

Here is the island of the storybooks, where you land in a sunny cove with no sounds save the swish of oars against the bow and the cries of hundreds of sea birds.

Here is a beach which has figured vividly in many a story; this is the island of adventure, with an ancient tower, above the cove, which must have been a pirate's lookout. Below it are caves where treasure could be buried and the pirate might count his pieces of eight, with pistol and cutlass by his side.

As one looks out, there is a singularly fine seascape—waters of iris blue, dotted along the shore with splashes of amber from the seaweed.

A Floral Revue

Strangely beautiful is this island with its little glens and ravines painted by Nature's own hand. Here, before the birds on the mainland have heralded the arrival of spring, Lundy has already said it with flowers. As the months go on, the floral revue continues, for the island specializes in wild flowers.

I crossed to Lundy in a naval patrol boat from Bideford and was landed in the sunny southeast cove. With me were officers and men of the United States Army in Europe, for the overlord of Lundy has always welcomed our transatlantic cousins and allies. A thousand birds curved across the clouds and cried out at our intrusion (map, page 679).

We climbed up and up by a rocky path flanked by rhododendron, veronica, hydrangea, and wild flowers to the "king's" house (pages 676, 677). It was built more than a hundred years ago, a 12-room house equipped on up-to-date lines. Most of the windows look down the path and out over the Bristol Channel to the north Devon coast.

Here lives Mr. Martin Coles Harman, the only king outside of royalty in the British Isles, a staunch believer in private enterprise and ownership, and with the individual taste for liberty so dear to Englishmen. He is a vigorous personality, a good raconteur, and owes allegiance only to King George.

Lundy has been privately owned throughout historical times, and various charters and letters of authority have been granted it by kings of England.

In the earliest recorded period of its story the island is found in the possession of the Montmorency family, the Irish and English branches of which were called De Marisco. The first to come to Lundy was Sir Jordan de Marisco, about 1150, and this notorious family, members of which frequently occur in the annals of England as filling important offices under the Crown, ruled over Lundy for about 135 years.

Unfortunately, we cannot be certain of dates, as the early records of Lundy, which apparently were kept at Cleeve Abbey on the mainland, were sent to London, where they were destroyed in the Great Fire of 1666.

Because of these feudal charters, Lundy boasts sovereign rights and semiroyal prestige. Its overlord has rights and privileges which sound strange to modern ears.

He has his own stamps, can remove anyone he wishes from his domain, and can land any cargo free of restraining customs or excise. He can deny anyone the right to land, and he controls all fishing and marine catches for a specified distance offshore. No tax of any kind is levied, and fishermen are not allowed without permission.

Besides being an overlord by right of tenure of this Lilliputian strip of heather- and fern-covered land, he possesses the hard asset of some of the finest granite in the world, used in early Victorian days in the construction of the Victoria Embankment along the Thames.

Census Shows Eleven People

Human habitations are limited on Lundy—a house, a few cottages, and the lighthouses. There are three lighthouses, but one of these is now used as a wireless station and can obtain advance notice of Atlantic weather. Only one store, where certain foods may be bought, serves the island.

A Lundy directory would contain the names of only eleven people, six of these being lighthouse men.

Mr. Harman told me how, besides weather forecasts, this island was responsible for introducing rabbits into Great Britain.

Lundy's Buckingham Palace Is an Ivy-clad, 111-year-old Villa

Situated in a pleasant ravine, the Villa overlooks the landing beach and cove. Here lives Mr. Martin Coles Harman, "king" of Lundy. Islanders long referred to Great Britain as "the adjacent island."

The first Norman overlord brought them here, and they spread, as rabbits have a habit of doing. Today they abound, though many of them have turned black, probably as a result of inbreeding.

Long ago strange primitives inhabited this outpost of Britain. During excavations above the western shore a burial place was found. It was a massive crypt built with blocks of granite, and in it were two stone coffins side by side, one ten feet and the other eight feet in length.

The skeletons were those of giants; the biggest one was measured before the bones were moved and taped 8 feet 2 inches. The second, which was that of a woman, was 7 feet 8 inches.

Mystery of the Skeletons

Seven other skeletons were buried in a line, and then came a mass of bones—men, women, and children heaped in a common grave. Was it a massacre on a vast scale, or was it a human sacrifice to a deceased king and queen?

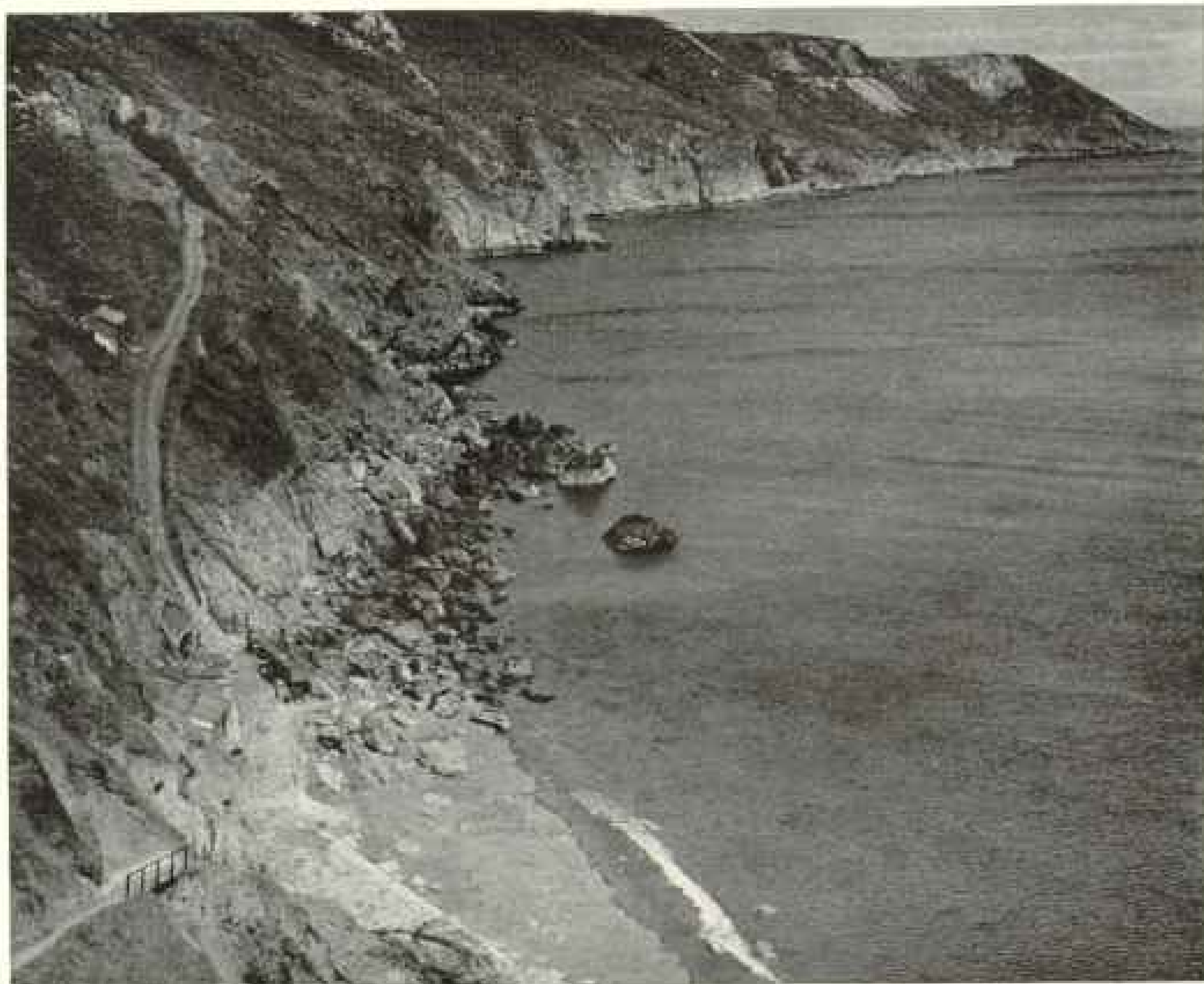
The Vikings, Scandinavian sea rovers first to cross the perilous Atlantic in their dragon ships, took a liking to the island, and called it *lunde ey*, or "puffin island," in honor of the predominant bird population of those days.

As I have said, the records trace back to prehistoric times and primitive flint heads. The authentic story of Lundy is fragmentary.

The first book on the subject appears to have been in Icelandic. There are others in Latin which require a profound scholar to interpret, for they abound in ponderous and legal phraseology. Another effort is in Welsh. In fact, these three languages seem to have had control of the island story long before the King's English was finally employed.

The full and complete chronicles of Lundy, its colorful and glamorous history, have still to be given to the world.

In the 12th century, King Stephen presented it as fief to one of the De Montmorencies, or Mariscos, a name as prominent among



The Feet of Centuries Have Climbed the Steep Approach to Lundy's Table-mountain Top

Before 1819 it was a tortuous, rock-lined path, heavily guarded by crosswall with iron gate and stout chains. A visitor in 1752 described it as "so narrow and steep that it was scarcely possible for a horse to ascend it." Present road leads from landing cove to owner's Villa and beyond.

the feudal barons of Britain as Montague or Montgomery.

In those days of violence the Lord of Lundy had to make his home a fortress in which he could shut himself up and be safe from the attacks of his enemies. So, high above the cove he built a mighty castle. It had a massive tower, deep ditches, and a drawbridge, with narrow slits for windows in the thick granite walls, while for moat it enjoyed the protection of eleven miles of sea (page 680).

At one time Marisco Castle might well have attracted the attention of the United Nations, or any adolescent league of law and order, for from its turreted fastness came raid after raid against the mainland and passing merchant vessels.

The aggressors retreated to the safety of a hide-out with walls nine feet thick and with an adjoining precipice on one side, which I inspected, over which undesirables were hurled to the rocks below.

Sir Jordan de Marisco fell foul of Henry II, who wished to give Lundy, valuable for both position and fisheries, to the Knights Templars. The King was defied by the local sovereign, who went even further. He started plundering passing vessels to show his indignation and independence, and Henry could do nothing about it.

A Feud Between Kings

Richard the Lionhearted was too busy with the Holy Land and crusading to be stung into reprisals by the "Lundy mosquito," but when his brother John reigned in his stead the old feud between the island King and the islet king was renewed.

John tried his best to evict the Mariscos from their inheritance; but, secure in their seagirt citadel, they could be defiant and tell him there was another king's business besides his own. "Get out," ordered the impetuous John. "Come and get us out," was the reply.

Islanders Stick Puffins on Their Letters to Carry Them Across the Channel

Lundy provides its own mail service to and from the mainland. Puffin stamps, added to regular postage, pay the cost. "Puffins," no longer minted, are island coins, roughly equal to British pennies and ha'pennies.

Lundy's Agent Prepares Sets of Puffin Postage for Stamp Collectors Everywhere

But some 50 years later the De Mariscos went too far and took part in the attempted murder of Henry III. The King was avenged and the island declared forfeit to the Crown. For nearly 40 years royal governors held in check the aggressive tendencies of the islanders. Under the redoubtable Edward I, the king who believed in the rule of law to order his doings, Lundy was restored to royal favor.

The ill-fated Edward II tried to escape the wrath of his rebellious barons by fleeing there in 1326, but he was betrayed by contrary winds and driven ashore on the Welsh coast. From here his wanderings subsequently led him to Berkeley Castle, where he was destined to die a horrible death in the grim dungeons of that stronghold.

Historic Island Characters

In the Civil War of Stuart days a new character appeared upon the scene in the person of Thomas Bushel, who was working the silver mines on the mainland of Devon. Bushel had been appointed to govern the strategic island for Charles I.

This he did by refortifying the old castle with batteries until, bored with idleness, he turned, like his predecessors, to plundering shipping.

Lundy was the last place in the British Isles to be surrendered to the Parliamentarians, and then only with the written consent of Charles I.

Thomas Bushel passed on, and in the fullness of time came another notorious character, Thomas Benson, a link with America by reason of his contract with the government of that day to transport convicts to Maryland and Virginia.

Benson was wily. The contract stipulated that he should convey the convicts overseas, and this he did by taking them to Lundy, where they were set to forced labor and construction works on the island (page 687). He took to freebooting and became one of the most notorious smugglers in the west country.

Benson is supposed to have collected a fortune and hidden it in a cave below the castle, but the treasure has never been unearthed by search parties (page 684). He treated outsiders with complete contempt and fired on all ships which approached the island without dipping their colors.

Finally Benson hatched a plot to claim insurance on a ship which he intended to scuttle, after having landed the cargo in the dead of night. When his Lundy escapade was discovered, he fled to Portugal.

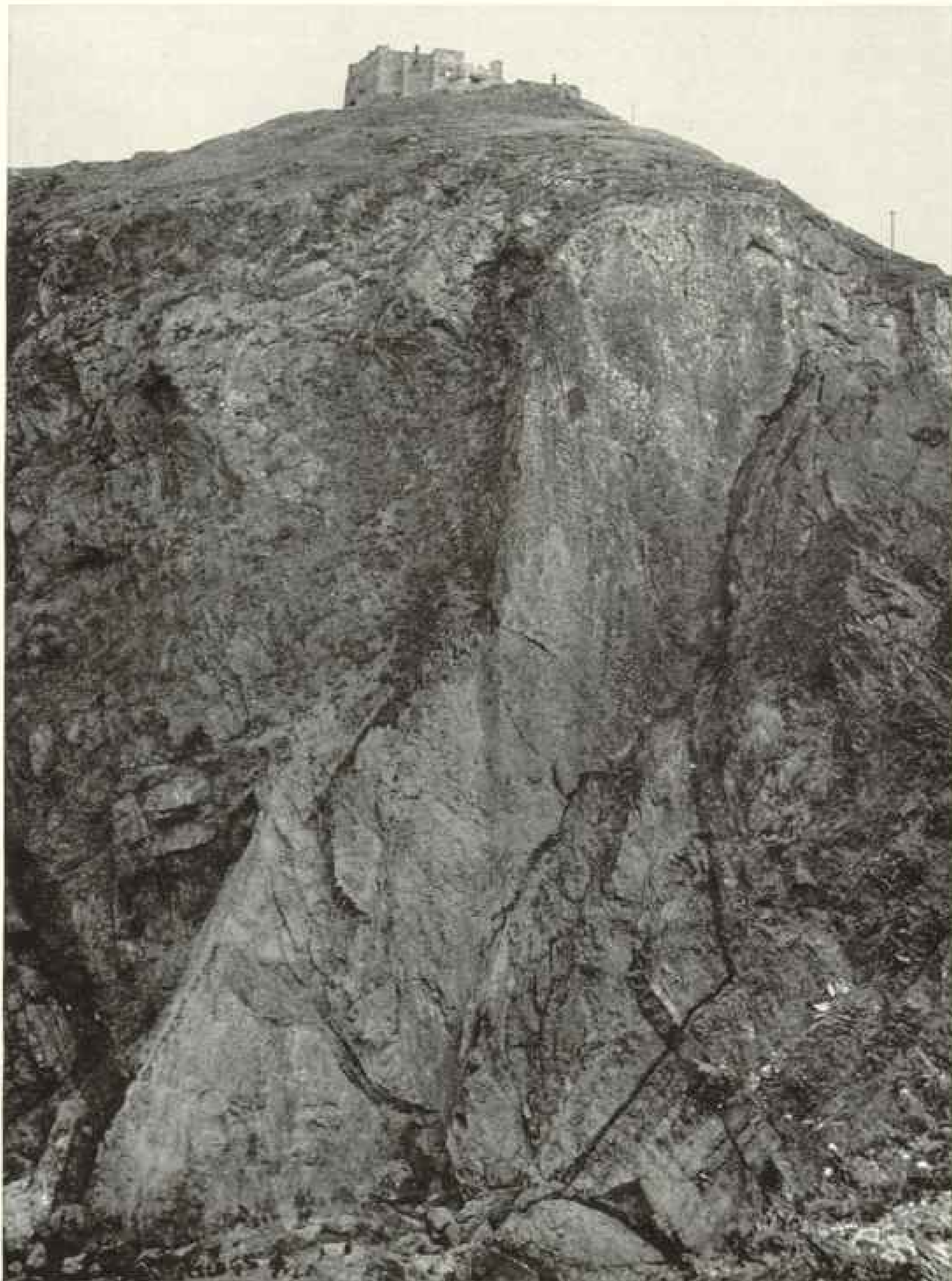
Today steamers still shelter under the east, or lee, side of Lundy. They are no longer cannonaded by Benson and his round shot, but find rest from the buffeting of the gales.

The western shore is rocky and precipitous, battered by Atlantic waves with a 2,000-mile punch behind them.

By way of a change from homemade adventures and privateers, there came in 1625 Turkish corsairs from the Middle East, who stormed the island under the nose of Britain

Lonely Sentinel of Bristol Channel

Off Hartland Point, on England's rugged north Devon coast, this colossal granite block looms 400 feet above the pounding sea. Its plateau top, outlined above, measures some three miles long, averages half a mile wide, and covers about 1,116 acres.



Secure in a Seagirt Citadel, the De Mariscos Defied British Kings

This feudal Norman family ruled Lundy for 135 years. About 1200, Sir William de Marisco built the castle perched on the cliffs facing the near-by Devon coast. Fortified by stone-throwing machines, it commanded the landing beach. Today, only a few rooms and the walls, nine feet thick, are left to attest its medieval might.

Lundy's Agent Keeps a Watchful Eye on Approaching Ships

He reports to Lloyds all craft taking shelter in the cove. The famous London firm has had a signal station here for 64 years. The first cable to the mainland, about 1882, failed because of frequent breaks. Another, in 1892, lasted four years. First message from the island's owner at that time, the Reverend Hudson Heaven, was "The Kingdom of Heaven rejoiceth."

and took off some of its people. During Queen Anne's reign French marauders unexpectedly captured the stronghold and turned it for a while into a typical "Frenchman's Creek" for privateering.

A new high in strategem and lawlessness was reached about 1700, when a party, pretending to be friendly Dutch, came ashore for milk and supplies for their sick captain—or so they said. The ship stayed in the cove for several days, and then the crew announced the death of the skipper, with a request that they be allowed to bury him ashore.

A "Dead" Skipper Comes to Life

The islanders, lulled into a sense of false security, agreed to this pious wish. The ship's crew landed with the coffin and solemnly marched up the hill to where a church at that time stood.

After prayers the ship's company asked that the inhabitants leave the church for a moment and promised that they would be readmitted to see the body interred. So out the islanders went, all unsuspecting, and a few moments later the whole ship's company, armed to the teeth, burst from the building, headed by the "dead" captain.

They killed or made prisoners their too-confiding hosts and carried off everything they could lay hands on, including most of the cattle. The "coffin" had been full of arms.

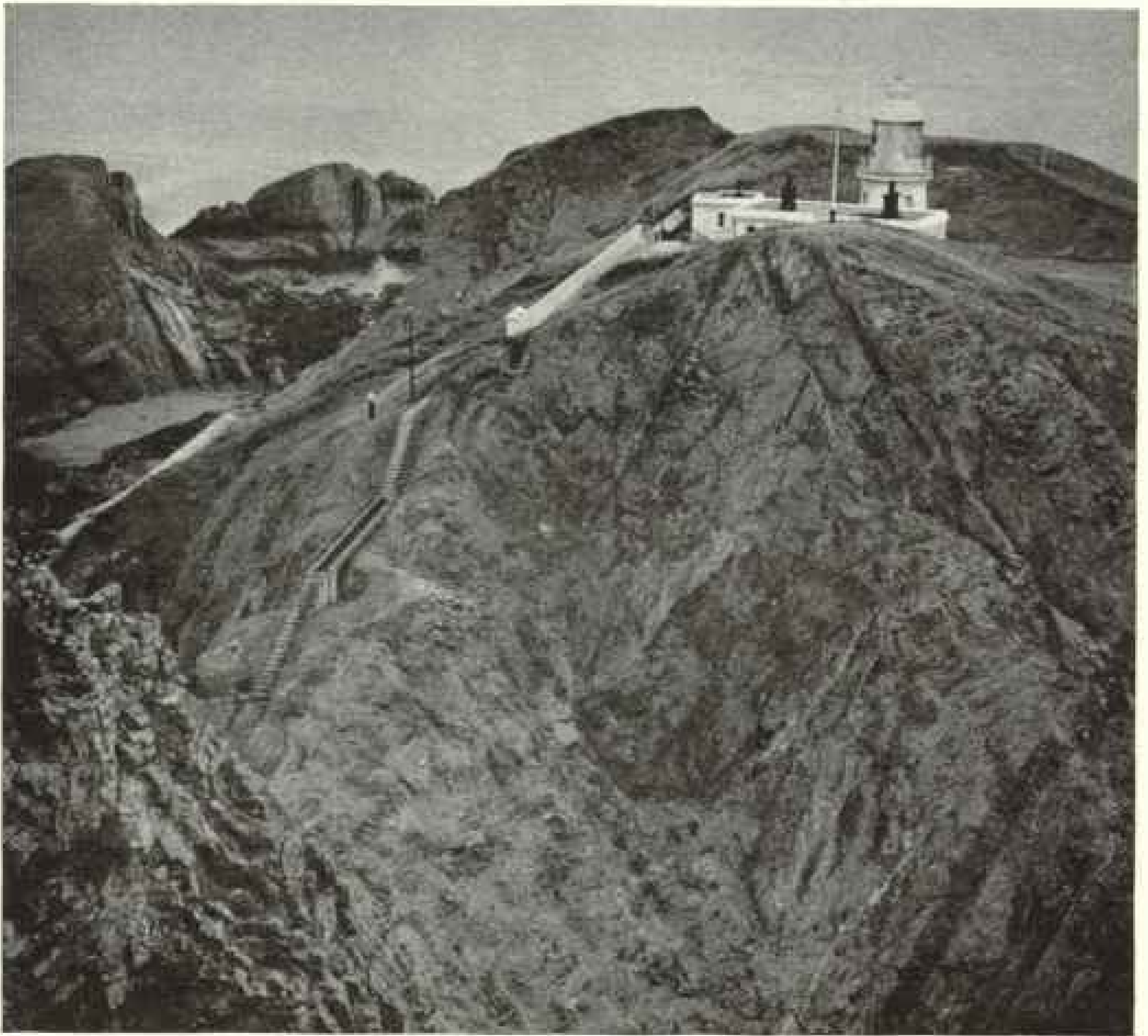
The history of Lundy varied between sovereign rights and piratical wrongs until in 1836 a new type of owner took possession. W. H. Heaven was followed by his parson son, the Reverend Hudson Heaven, through whom the island came to be known as the "Kingdom of Heaven."

The cleric carried out many improvements. He built the present substantial house of the owner at Mill Combe with its beautiful view, and its flower and kitchen gardens. Heaven was a scholar and went in for research, but unfortunately he never gave to the world the result of his investigations and the wealth of knowledge he must have possessed.

A Sanctuary for Men and Birds

During the recent war Mr. Harman, who bought Lundy in 1925, made a point of entertaining American officers and men who needed peaceful surroundings. No finer spot for a rest cure could be imagined.

His son, Corporal Harman of the Royal West Kent Regiment, posthumously won the



Lundy's South Light Warns Sailors of Racing Tides and a Rock-bound Coast

The strong flash of this beacon is familiar and welcome to mariners plying busy Bristol Channel. Situated 11 miles off the north Devon coast near the Channel's entrance, Lundy has been a ships' graveyard since man first ventured on these stormy waters. Old wrecks, like H. M. S. *Montagu*, still show at low tide.

Victoria Cross. He died fighting in Burma after deeds of almost incredible bravery, which, had he lived, would have made him a worthy overlord of this famous island.

The overlord's real love and interest in the island settle around "my birds," as he calls them, and the sanctuary he has provided for them.

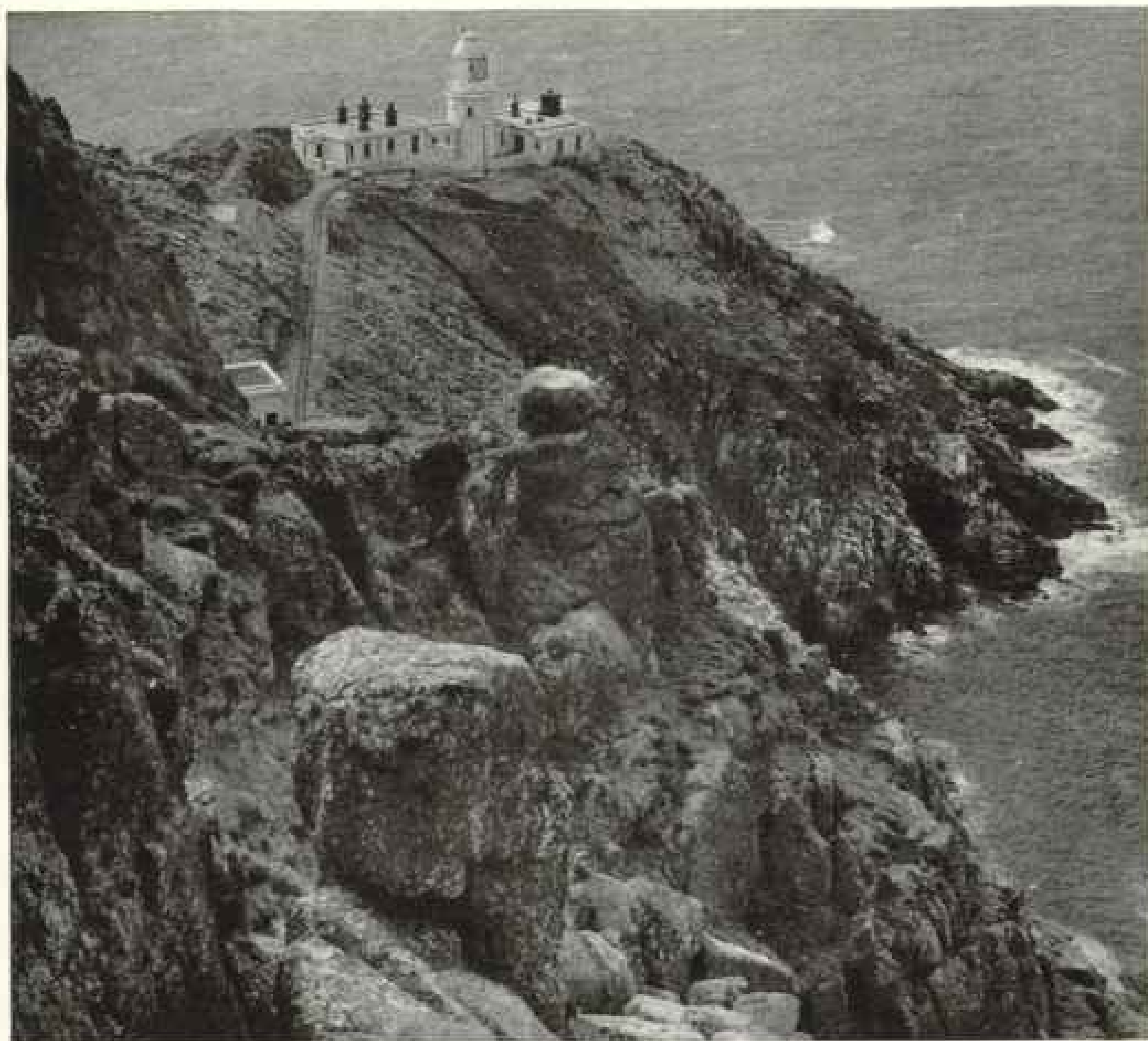
In fact, the island appears to belong to the birds. Mr. F. W. Gade, in the course of nearly twenty years' observation, has recorded no fewer than 145 different species of birds, either breeding on or visiting the island.

The recently formed Lundy Field Society, of which Mr. Harman is the first president, and whose elected members are given annual invitations to visit Lundy, has erected a trap in which birds can be caught, banded, and released in a few minutes. It is for migrant birds coming, according to season, from faraway places and often going on to distant destinations. Thus Lundy is a sort of Clapham Junction for the birds.

Birds Travel Great Distances

The voyages of Columbus from Spain and of John Cabot from Bristol were no greater than the journeys the migrant birds of Lundy have been making since before the writing of history.

In a great many instances these journeys, covering vast distances, are made along routes used year after year, and with a remarkable degree of faithfulness to the calendar. In some cases the birds proceed in small convoys of twenty or more, the young, curiously enough, often preceding their parents in the high adventure of oceanic flight.



Keepers of Lundy's North Light Live on a Wild, Bleak Promontory

The light keeps twin vigil with its sister beacon on the southeast point, some three miles away. A natural tunnel, 60 feet high and 800 feet long, pierces this bold headland, favorite haunt of nesting sea birds. A boat can sail through at high water. Fresh-water "Virgin's Spring" bubbles up from its floor.

The sea birds of Lundy must consume an enormous quantity of fish, especially during the height of the breeding season, but it seems to make no measurable difference in the supply.

The birds of Lundy are a serial story of the centuries, a feathered *Odyssey* of exploration, pioneering, and pilgrimage, with a homing instinct thrown in.

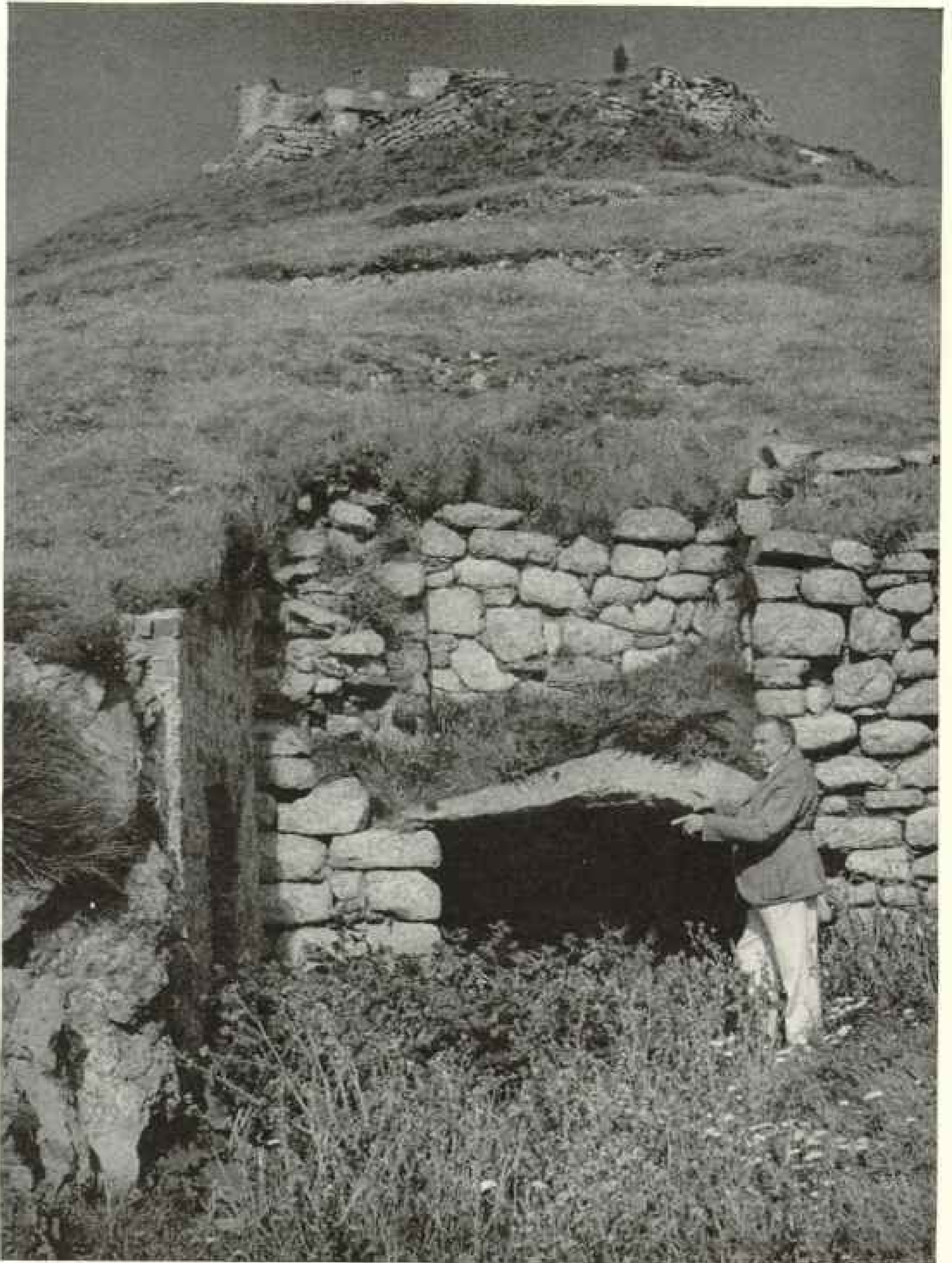
Most of the migrants arrive and pass through by day; comparatively few settle and breed. They arrive in wind-blown spring months, glimpse a verdant isle that looks good, a journey's end, a promised land.

The noise of the birds joins the ceaseless undertone of the surf in a chorus that is at times almost cosmic. Indeed, as you approach a closely packed colony of breeding sea birds, the voices of the wind, waves, and birds combined are almost deafening. They are there in their armies—black-backed gulls, puffins, guillemots, kittiwakes, razorbills, shags, cormorants, shearwaters, and oyster catchers (pages 688 and 693).

Birds Link Lundy with Distant Lands

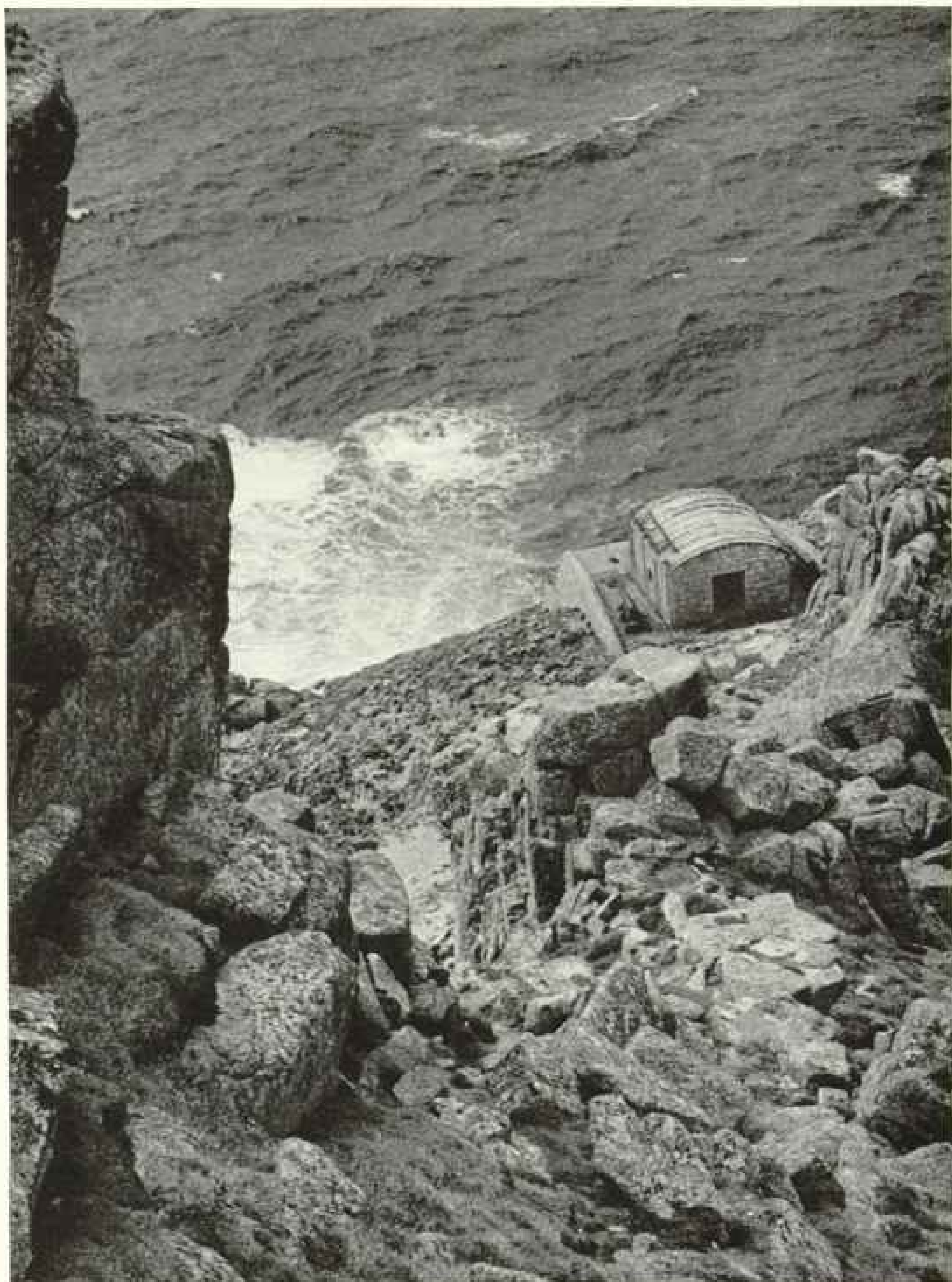
It is fascinating to watch the bird clouds of Lundy. I was stirred by the strong lines of feathered flight linking Lundy with other countries, and my mind explored the romance of these many visitors or settlers, some of them, perhaps, unconscious links with the great New World while man believed the globe to be flat and confined to the continents of Europe, Asia, and Africa.

The birds, of course, may have known better, but that is still part of the unwritten story of Lundy. Could some of them have



Benson's Cave Recalls an Island Lord Whose Notorious Deeds Still Live in Lundy History

Thomas Benson rented the granite island for £60 a year. He turned his hand to smuggling and piracy, fired on passing ships that would not dip their colors. Finally, in the 1750's, he fled to Portugal. Islanders claim he hid his ill-gotten gains in the cave, built centuries before perhaps as storeroom for Marisco Castle (above).

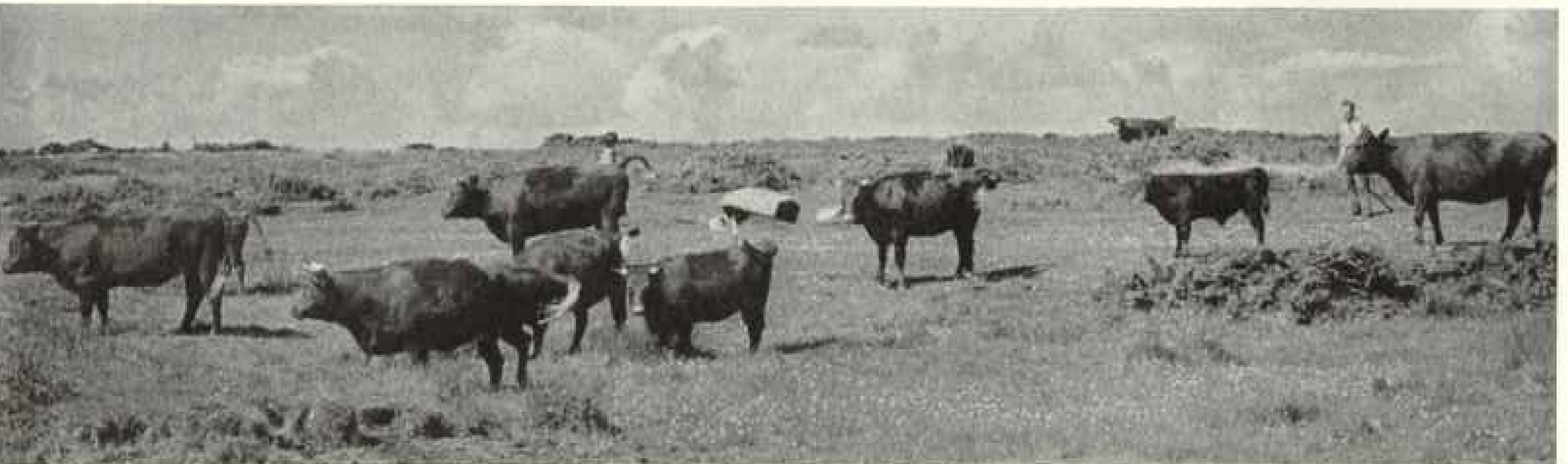


Muzzle-loading, 18th-century Guns Still Bristle from the Face of Lundy's Westwall

This Battery is 200 years old. High point in the island's tumultuous history was the 17th century, when it was held at various times by Turkish pirates, Spanish soldiers, and French privateers. It was headquarters of a notorious buccaneer, Capt. Robert Nutt, whose ghostly vessel is still said to haunt Lundy waters.

When Fog Blankets Lundy, Granite Markers Guide Islanders Across the Rolling Plain

At such times frequent blasts of fog-exploder and foghorns and the hooters and sirens of hidden ships pierce the silence.

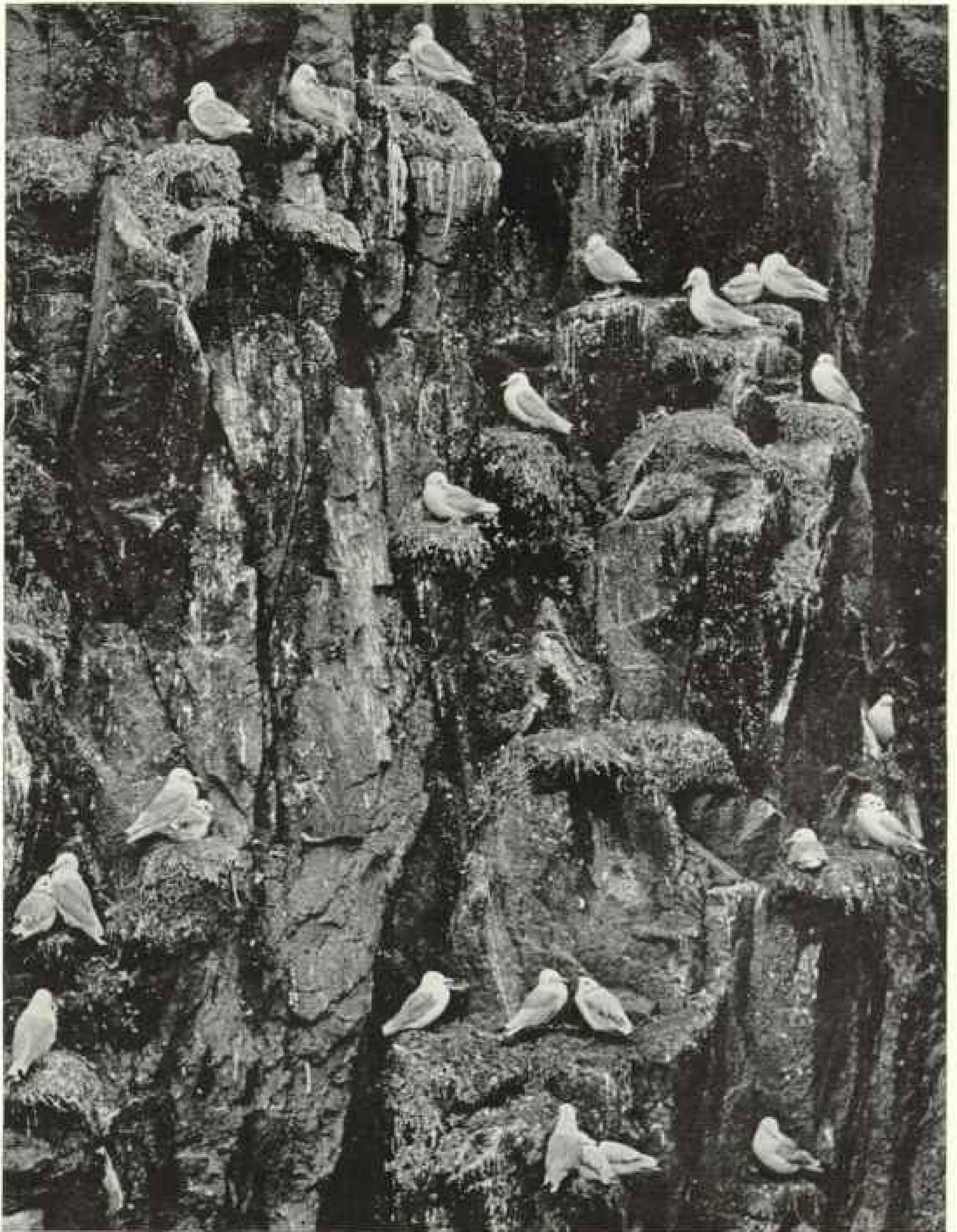


Sleek Devon Cattle Promise Well for the Owner's Plan to Restore Prosperity to Lundy Farm

Much of the island's 1,116 acres is devoted to agriculture. Full exposure to the Gulf Stream tempers the climate. Frequent mists provide ample moisture for pasturage.

But for Thomas Benson's Wiles, the Men Who Built This Wall Might Have Founded Families in America

In 1747 Benson contracted to ship convicts to Maryland and Virginia. Instead, he sent them to Lundy, where they built the walls which still quarter the island. In court he cleared himself, proving the contract bound him merely to transport them "over the sea." Other frauds finally undid him (page 679).



Dainty Kittiwakes Cling Like Leeches to the Sheer Face of Their Granite Gully

Three thousand nesting pairs were counted on Lundy in 1939. They crowd dark, rock-ribbed northern gullies and rarely visit the island's top. Any narrow ledge on vertical or overhanging cliffs makes a suitable nesting site. Occasionally a bird alights on the wrong nest, or an unattached male intrudes. A noisy but harmless fight follows, and owner expels interloper. Kittiwakes fish in tide races and over reefs and rocky islets off the island's northern tip. At home on the waves, they often rest on the sea far from land (page 683).

Lundy Ponies Hold a Tête-à-tête Across a 200-year-old Wall

About 30 of the fat animals graze on the bracken-strewn pastures near the island's center. The author found them "friendly little creatures, but not sufficiently tame to let a man get too close" (page 691). An ornithologist who spent five months on Lundy described their leader: "A Welsh stallion, pacing proudly with flowing mane and tail, was symbolic of the island's spirit of freedom."

brought any seeds of the future, any visible links between the Old World and the New in their aerial traffickings of the past?

Among the interesting birds that have visited Lundy during the past few years are: the hoopoe, rose-colored pastor, crossbill, Greenland falcon, bittern, waxwing, bee eater, siskin, and hawfinch.

The fulmar petrel has now taken to nesting there; his former southerly limits appear to have been the western islands of Wales. He has been gradually coming farther south in recent years. This distinguished resident, if approached or disturbed, squirts an oily fluid at the intruder of his peace, after the manner of a New World skunk when annoyed.

Among other notable birds breeding on Lundy are the peregrine falcon, raven, buzzard, Manx shearwater, and the corncrake, which is now a rare bird in England. The Cornish chough, which bred regularly on the island until about forty years ago, is not a breeding species there today.

Foghorn Scared Away the Gannet

Until the end of the last century you could meet the aristocratic solan goose, or gannet, the first-recorded reference to which occurred in respect to Lundy in 1321. Alas, the gannet no longer breeds on the island. It was, apparently, scared away by the booming notes of the foghorn established at the lighthouse in 1897.

The islanders have not, however, abandoned all hope of seeing these two famous birds return, for the gannet breeds freely on the uninhabited 21-acre island of Grassholm, about 50 miles northwest of Lundy. A few pairs of choughs also breed within a score of miles of Grassholm.

The cuckoo is here in numbers and mostly parasitic on meadow pipits. He takes off at the end of July for North Africa, where I have met him in the winter. The common wren, which appears to love islands, abounds.

According to a noted ornithologist, Mr. Richard Perry, a bird census before the war counted, among others in the spring season, approximately 19,000 nesting pairs of guillemots, 10,500 pairs of razorbills, 3,500 puffins, 3,000 kittiwakes, and 1,000 Manx shearwaters, apart from herring gulls, shags, ravens, and falcons, down to meadow pipits, robins, swallows, and cuckoos. Altogether, the approximate number of breeding pairs on Lundy was over 40,000.

Strange Rock Freaks, Like the "Rocking Stone," Gird Lundy's Cliffs

Once this Logan Stone was perfectly balanced and could be rocked by hand, but now it is stable. One story says a vandal vacationist, about 90 years ago, tipped it with a crowbar. Another blames weather action, which wore away its slim resting point. Other queer formations are "Knight Templar," "Mouse-hole and Trap," and "Devil's Chimney."

Lundy is an increasing bird paradise, with the first prize handed out to the enchanting puffins, whose profile portraits appear upon the island stamps (page 678).

These birds, after looking in once or twice earlier in the season, settle on the island in April and depart again on their pelagic wanderings in July. How they contrive to breed and muster in almost Biblical fashion is something of a mystery, since they believe in "only children," laying but one egg.

They have a community sense almost as highly developed as human beings in overcrowded areas of wartime Europe. Undismayed by lack of domestic facilities, they build their own burrows, each several feet long and in some cases amounting to an underground apartment house with entrance hall and rooms leading off it. On Lundy some puffins share burrows, and to save labor they often turn rabbits out of their quarters.

In relation to its area, the island can now lay claim to being one of the most important world bird bases. Lonely, weather-beaten, northern, this island is one I would sooner fight for, Marisco fashion, than for some charmer among Pacific coral islets.

It is an ideal spot for bird identification and observation. In the crowded nesting season you can find with effortless ease the grassy nests of the herring and black-backed gulls, each with its mottled clutch of five brown eggs, or the decayed nesting materials used by the dainty kittiwake.

Laboratory for Bird Study

You can become friendly with the Pickwickian puffin. You can watch the gorging of schoolboy guillemots and cormorants. You can guess at the diving speed of the falcon or admire the graceful circles cut by the moth-like buzzard in the upper air where he lingers

Dirty Weather in Bristol Channel Sends Ships Scurrying to Lundy's Cove

In this sheltered bay as many as 170 vessels at one time have taken refuge from westerly gales. Plans to enlarge the harbor with a breakwater have been thwarted by deep water, race tides, and frequent fogs.

to escape the attention of the homemaking carrion crows.

You can examine the peculiar arrangements of guillemots and razor-billed auks for their young, which use the precipice edge without nest of any kind. The egg seems to be so shaped by Nature that when knocked it does not roll over but spins around from end to end, thus avoiding disaster. When hatched it is a minor wonder how the chicks get down to sea level. Their first flight is victory or death as they parachute downward, using their baby wings for the first time.

Each shelf and corner of crag and rock are crammed with a black-coated, white-waistcoated, feathered population. Leisurely, carefree, primitive, they know there are more fish in the sea than they ever take out of it.

On the western shore of the island, where amber seaweed clutches the rocks and no safe landing is possible, I found colonies of puffins, with razorbills in thousands.

In the trees which surround the owner's house at Mill Combe, and in the old castle walls and the massive keep, the owl occasionally broods and blinks among man's and Nature's battlements.

I watched the successful poaching of black-headed gulls indulging in what many people during the war in Britain would have liked to do—egg lifting, on a large and unpunished scale.

Wild Ponies and Japanese Deer

In the center of Lundy is a small lake, which in summer becomes a dried-up marshland, surrounded on every side by masses of heather. Here the semiwild ponies are friendly little creatures, but not sufficiently tame to let a man get too close. There are about fifty of them roaming over the central and northern parts (page 689).

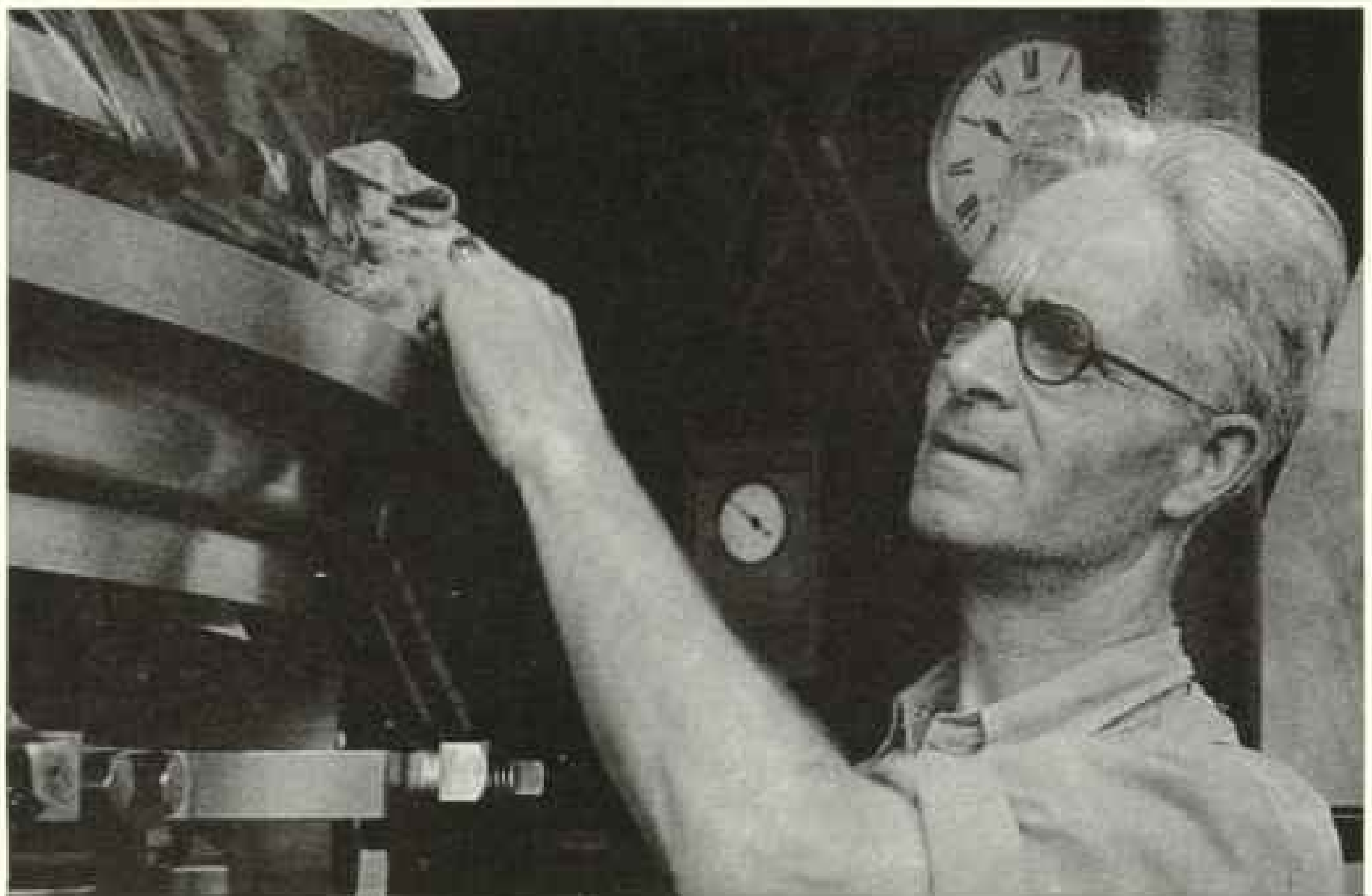
This is also the haunt of a few Japanese deer, imported years ago, and some wild red deer from Exmoor. How the latter came to be marooned no one seems to know. The

"The Difficulty of Getting to Lundy Was Exceeded Only by the Difficulty of Getting Away"

So reported a visitor in the age of sailing vessels. Wind, tide, rocks, and fog still make visits of uncertain duration. Landing beaches are few, small, isolated by sheer cliffs. Here a keeper gingerly lowers himself by rope some 300 feet to the beach below South Light. Broken jetty marks attempts to make a deep-water pier.

Preening Cormorants Annex Gull Rock off Lundy's Eastern Cliffs

About 145 species of land and sea birds visit Lundy (page 682). Guillemots, puffins, gulls, razorbills, shearwaters, and kittiwakes come in thousands. Cormorants are counted by the dozen. They particularly favor this bald monolith for sunning and displaying themselves. Some few frequent island waters all winter.



For 50 Years South Light Has Shed Its Gleam Across the Wave

Here the keeper cleans and polishes, a job he has done for 35 years. After five more he may retire to his stamp-collecting hobby. This beacon (page 682) and the Devon mainland light at Hartland Point mark an 11-mile southwest entrance to Bristol Channel.

Agent and Shepherd Meet on a Lonely Lundy Moor

Prehistoric remains, medieval ruins, and records of several villages indicate a large population in the past. But in the last ten years the island's population has averaged 12. During the war, unbombed Lundy welcomed American servicemen on leave.

combes (ravines) are their favorite retreat, where the ferns and bracken reach a height of four and five feet and honeysuckle is found side by side with hydrangeas.

Where Wild Goats Roam

The northwest corner is the stamping ground of wild goats, probably put ashore in far-off days, as the pirates did on the Spanish Main and other places where it might be necessary to establish a hide-out and find supplies ready to hand. There are said to be about thirty on Lundy; I saw two herds, one of 17 head and another of 12.

Like all the goat family, the Lundy breed chooses the most inaccessible rocks and precipitous cliffs for exercising purposes. I have hunted ibex in the Himalayas, as well as in the Tien Shan of Central Asia, but the Lundy goat can hold his own for negotiating bad ground and for his speed downhill when alarmed.

In the late afternoon they come out to feed on the grass along the plateau, posting a sentinel while the rest of the herd feed. The watcher takes up a commanding position and keeps a careful lookout; not for a moment does he relax his vigilance, least of all to lie down or feed with the rest.

Here is one of those puzzling mysteries of wild life. How do the goats arrange this military discipline among themselves? Is it done by selection, or according to a roster, with a penalty for slackness or insubordination?

Often there are murderous happenings in connection with the wild goats. They exercise with carefree skill on precipices no man would dare to climb alone. Ordinarily they are safe enough, but occasionally marauding gulls will flap their wings at some baby goat and cause him to fall to his death on the rocks far below.

A cabbagelike plant, new to science and probably unique in the plant world, has recently been discovered on the island. Perhaps it is the cabbage of the ice age, a close relative of the first of all cabbages. Here it has been for hundreds of years.

The overlord told me that this unusual cabbage *is* believed to be the ancestor of all the cabbages in the world; it is called *Brasicella wrightii,* after Dr. Elliston Wright, of Barnstaple, a noted botanist, who discovered it.

Its blossoms are pollinated by two kinds of beetles which feed on its leaves.

In a deep combe on the east side grows the rare royal fern; it is a leading feature among some 260 species of plants listed on Lundy.

The trapdoor spider has also taken up quarters on the island, its only known locality in the British Isles.

"How long this particular species has been in residence on Lundy no one knows," said the overlord, "but he has certainly been here for forty years or more. He probably came as the result of the wrecking of some vessel which was homeward bound from the New World."

Crab and Lobster Are Symbols of Her "Royal" Position

As cook and housekeeper she provides for the general welfare at the owner's Villa. T H on marker stands for Trinity House, lighthouse authority which built Old Lighthouse (page 697) and began contributing to road upkeep in 1819.

Nature's School Children—the Gray Seals

Nature's school children are here on picnic, for the gray seals have a large colony. The seal loves a crowd; in fact, it is usually only when in numbers that breeding takes place, for the seal seems to seek noise and excitement in his mating ventures.

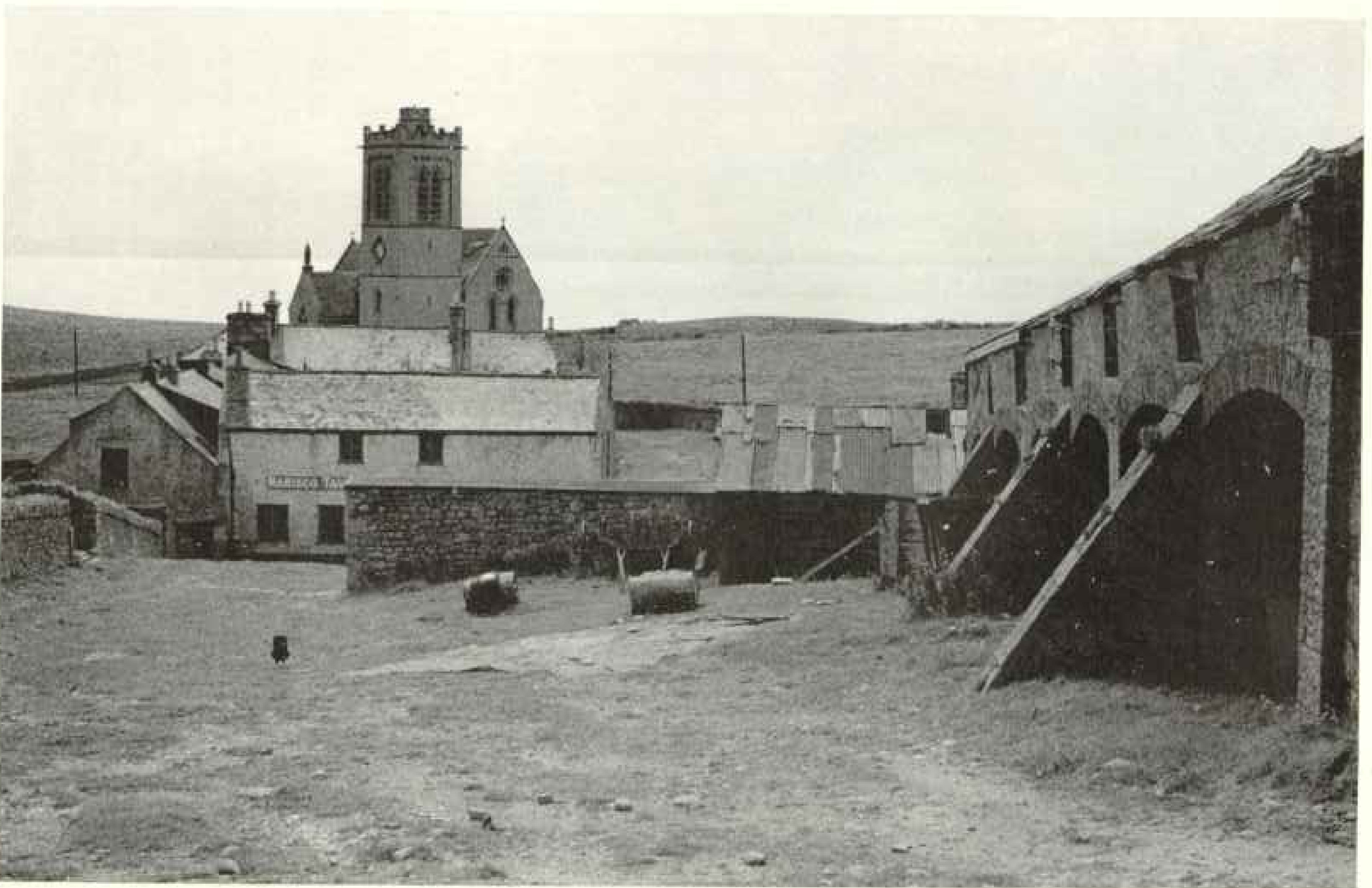
Along the eastern shore, which is the more sheltered, an expert at lobster catching told me of the "powerful lot of lobster" around Lundy. When we got tired of lobster hauling, we took to catching mackerel with lines.

On the western side there are strong tides and currents, and here on a dark night many a good ship has foundered. Ancient and curious coins have been found among the rocks and embedded in the sand—coins that formerly belonged to galleons wrecked there, no one knows when.

This shore line must have a wonderful tale to tell. Long years ago a ship beating up from the Ivory and Gold Coasts of Africa was driven ashore on the rocks. It had on board a cargo of ivory and leather bags holding gold dust; some of the ivory was afterwards recovered, but the gold dust has long since become merged with the sand.

The stoutest ship ever built would not last long against the surf and waves that come rolling in with 2,000 miles of sea power behind them. When they have lifted the doomed craft up on the foreshore, the jagged teeth of the rocks soon tear the ship to pieces.

In 1906 H. M. S. *Montagu* was driven ashore, a brand-new battleship which was trying out wireless for the first time. Parts of the equipment and guns were salvaged after immense efforts, but the seas were relentless and soon battered the warship into a jigsaw. Now only the barbettes can be seen at low spring tides, wedged firmly in the rocks, a reminder of what the sea can do.



Though Lundy Was Not Bombed, War's Neglect Marred the Face of This Old Farmyard

In the background is Marisco Tavern, where islanders and friends gather (page 698). Beyond it is handsome St. Helen's Church, built by the Reverend Hudson Heaven, a former lord of Lundy, largely from the granite stones of abandoned cottages. Completed in 1896, it was dedicated to the mother of Constantine the Great.

On the Windy Slopes of Beacon Hill the Shepherd and His Dog Pasture a Woolly Flock

Periodic sea-borne raids once played havoc with island flocks. Old Lighthouse, built in 1819, was abandoned 50 years ago. Low cloud banks shut off its gleam, over 560 feet above the pounding surf. In early days islanders lighted fires on Beacon Hill to signal the mainland in emergencies.

Lighthouse Keepers and Shepherd Join Visitors in "The Cup That Cheers"

On the tavern's wall hangs the inevitable game of darts. Lundy's eleven islanders are vastly outnumbered by thousands of migratory sea birds that annually make the island their home. A 1939 bird census counted more than 40,000 nesting pairs (page 689).

Perhaps the most striking example of enraged ocean power was that of a sailing ship, borne along by a tremendous and intolerant wind. The storm came smashing down, and the ship was lifted onto the rocks. The impact of the roaring wind, the punch of the giant waves on the knife-edge rocks, crushed and smote her down.

Up above, the moon was shining fitfully; below it the crew on the rocks were working desperately, fighting for their lives. Three managed to scale the cliffs and make their way to the lighthouse.

But when the lighthouse men returned with ropes and tackle for rescue purposes, there was no sign of the ship; it had vanished. The sea had swallowed it up.

Sailing leisurely along the sheltered east shore, it is inspiring to look up at massive old Marisco Castle, weather-beaten for nearly 800 years, yet still keeping a stern eye on the approaches to this bird island.

History has come and gone and left it with nothing but a past. For centuries Lundy lived; now it dreams away its old age, windswept, sea-haunted, and sun-warmed.

"You can make the tour of Lundy in four hours, finding difficulty in telling one day of the week from another," my host told me.

Yet few will forget this abode of solitude and sea birds, this curio of feudalism, this sovereign island set in the ebb and flow of Bristol Channel. All the king's commands and all the king's men could not dispossess the lords of Lundy, and there is still a wild freedom about their realm. Human history seems to have been blown away with the wind.

No Lawyers; No Police

Lundy in spring and summer is a lovely retreat, its sheltered combes gay with flowers and ferns. Pouring down these ravines are tiny streams of pure water. There are no snakes on the island. The inhabitants get along well enough without a police force or a lawyer. Their domestic economy is simplicity itself. There is no doctor; you hardly need one with a soft climate and no microbes.

This historic island, with stone remains dating back to the days when St. Patrick started on his lecture tour of Ireland! This dream island, claiming companionship with Juan Fernández of Robinson Crusoe and Pacific fame! Blessed Lundy! No wonder Marisco, and those who followed him, never wanted to leave you!

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To carry out the purposes for which it was founded fifty-nine years ago, the National Geographic Society publishes this Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society-U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

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One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

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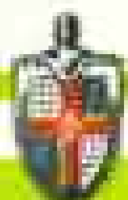

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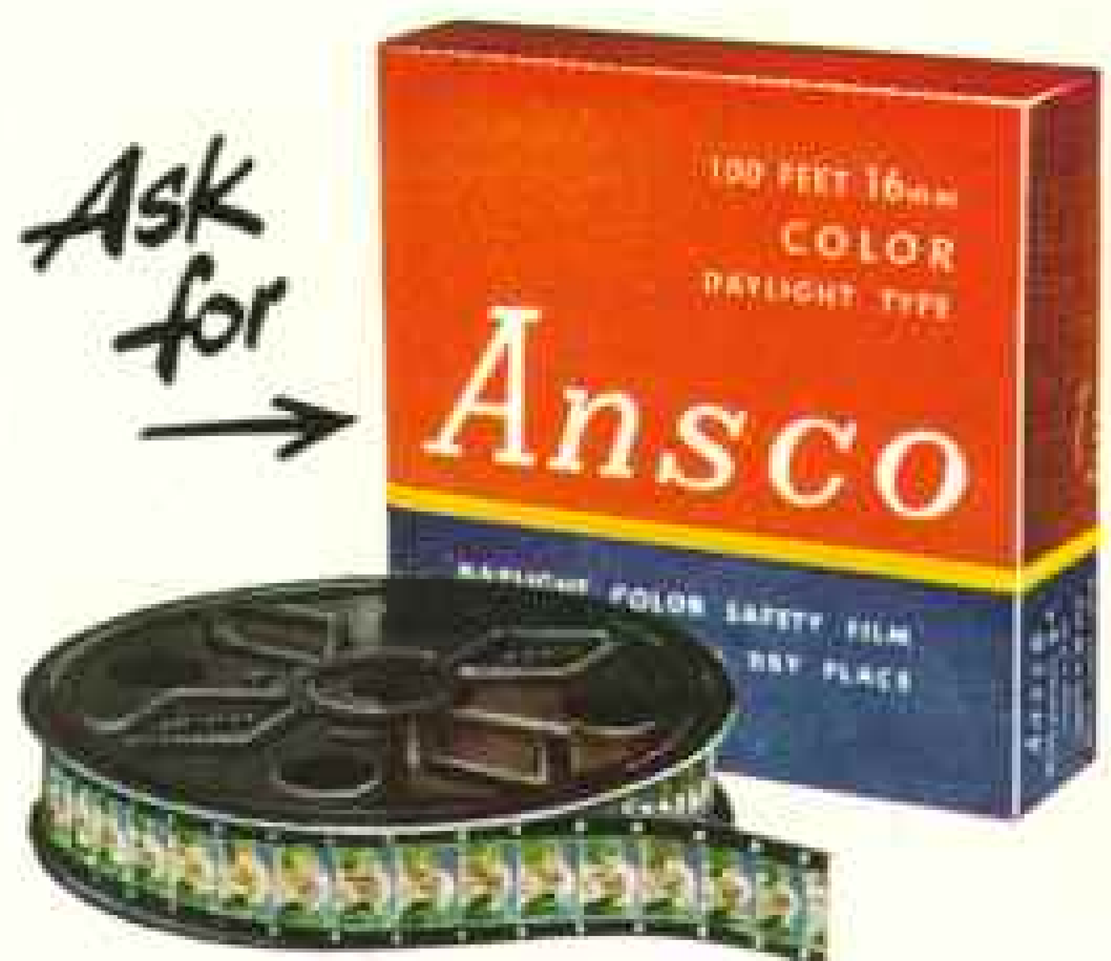

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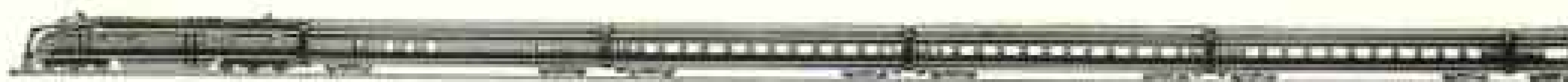

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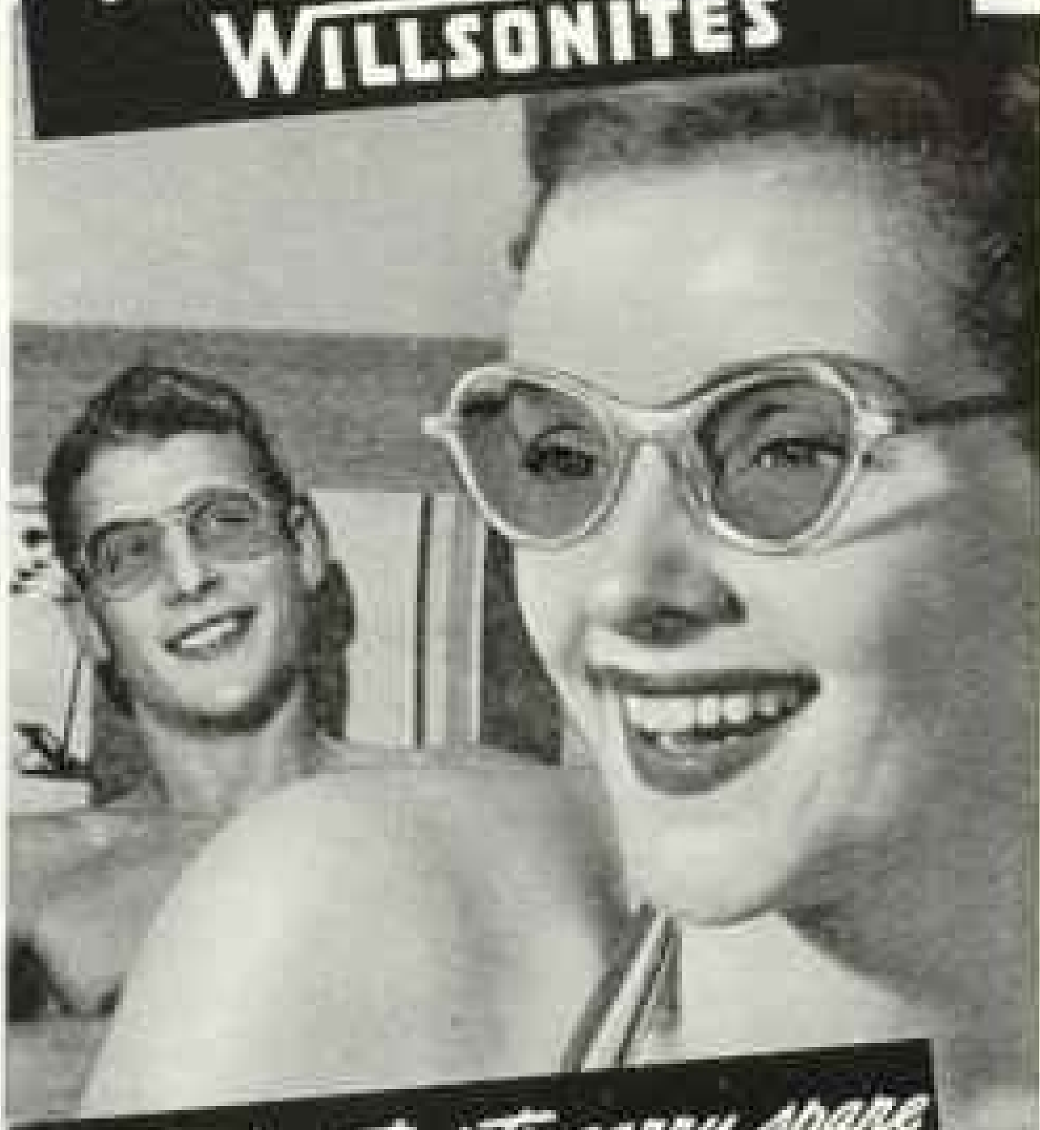

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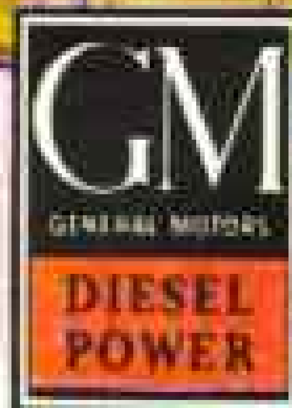

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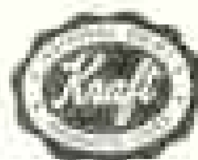

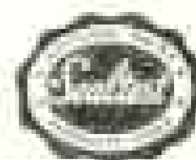

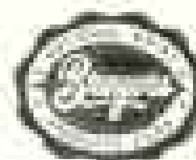

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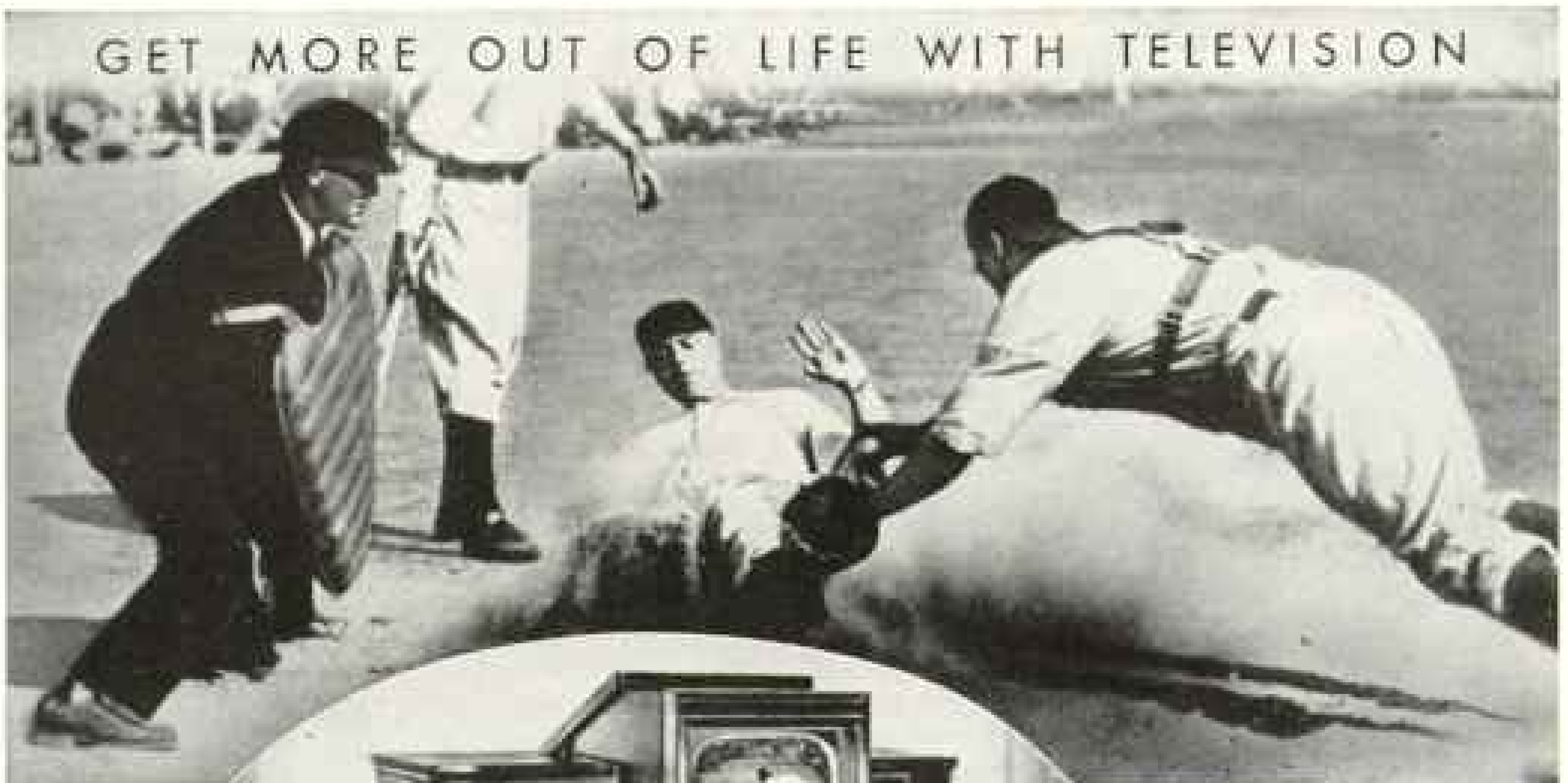

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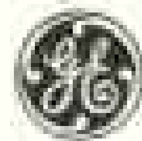

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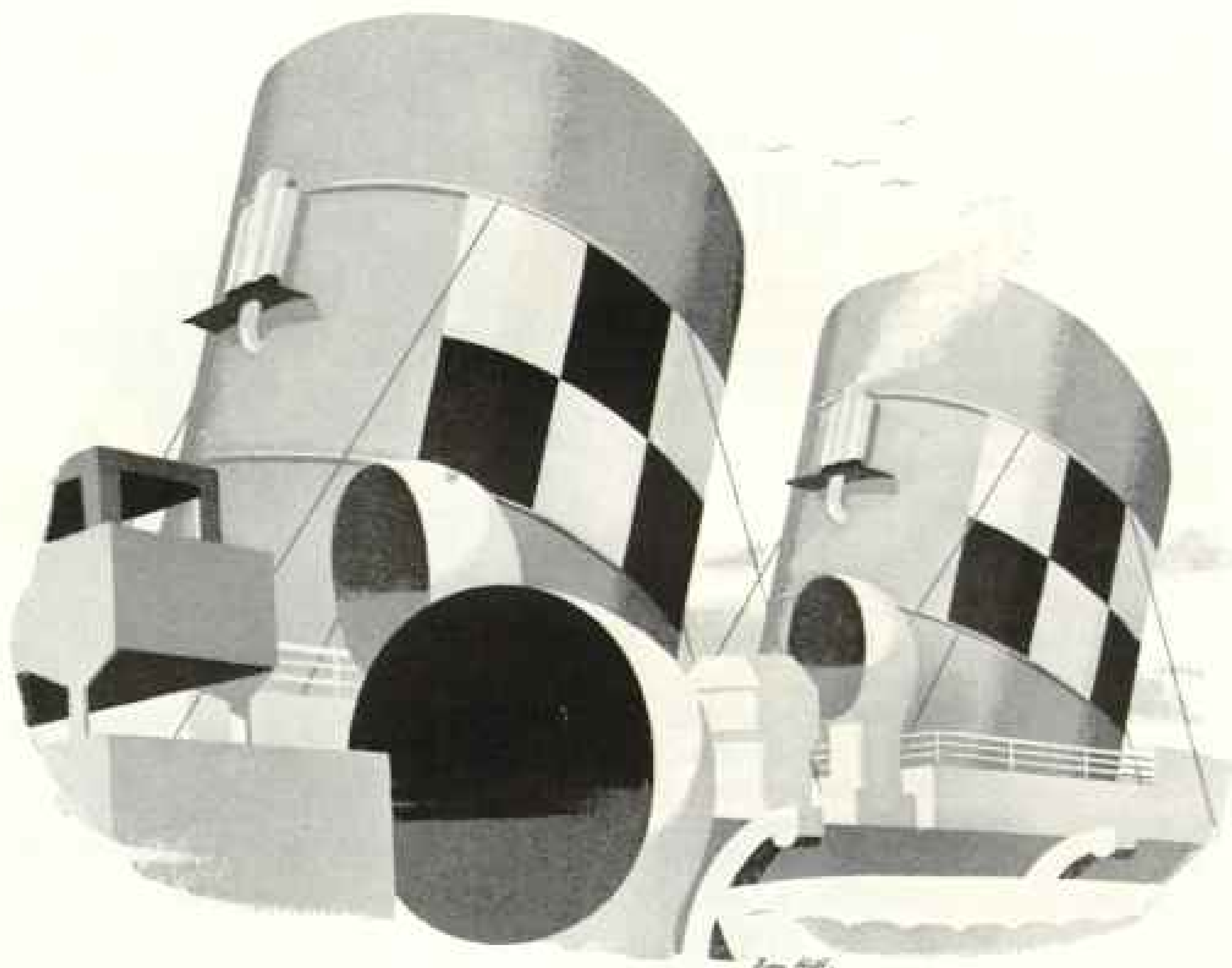

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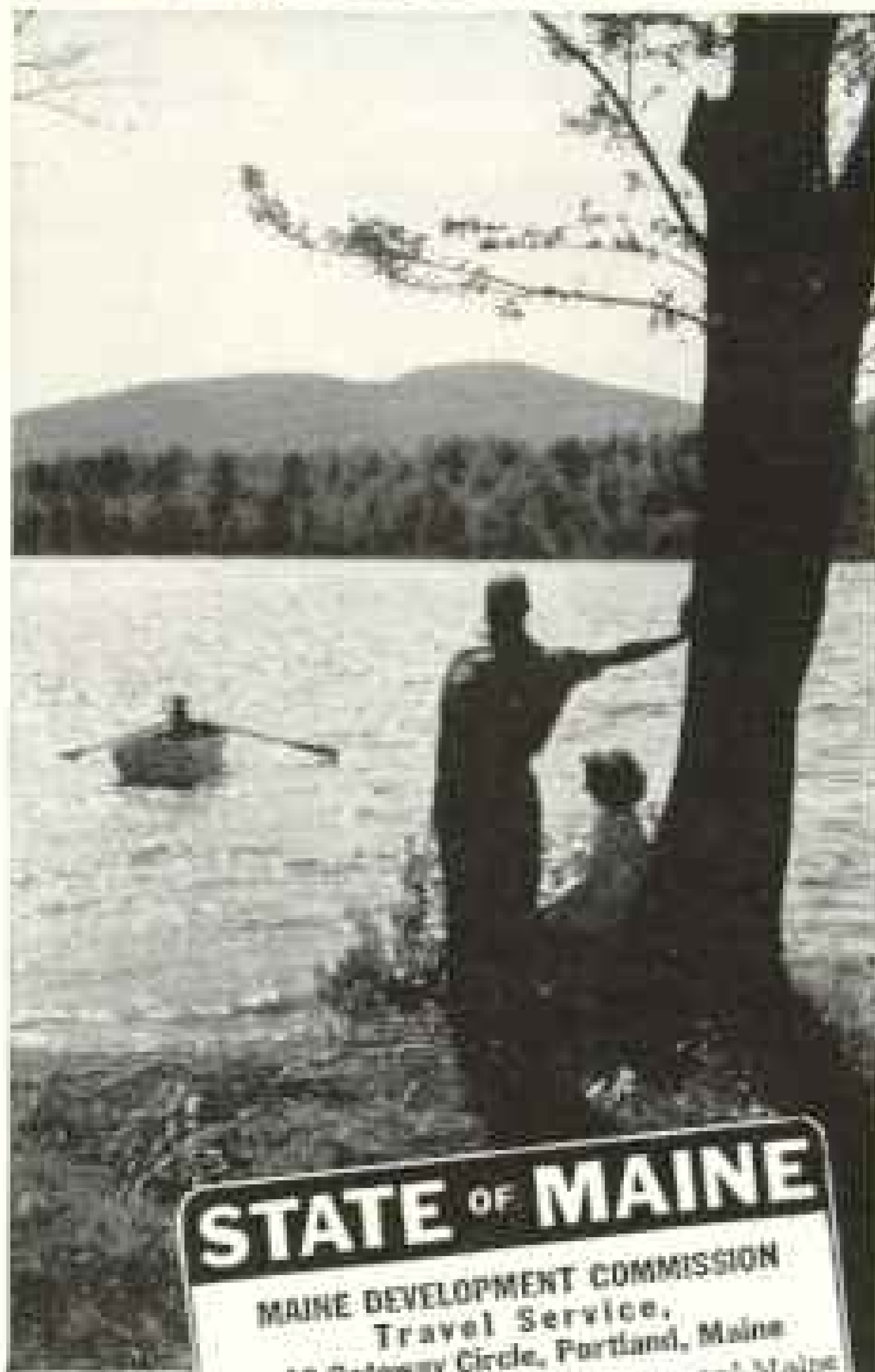

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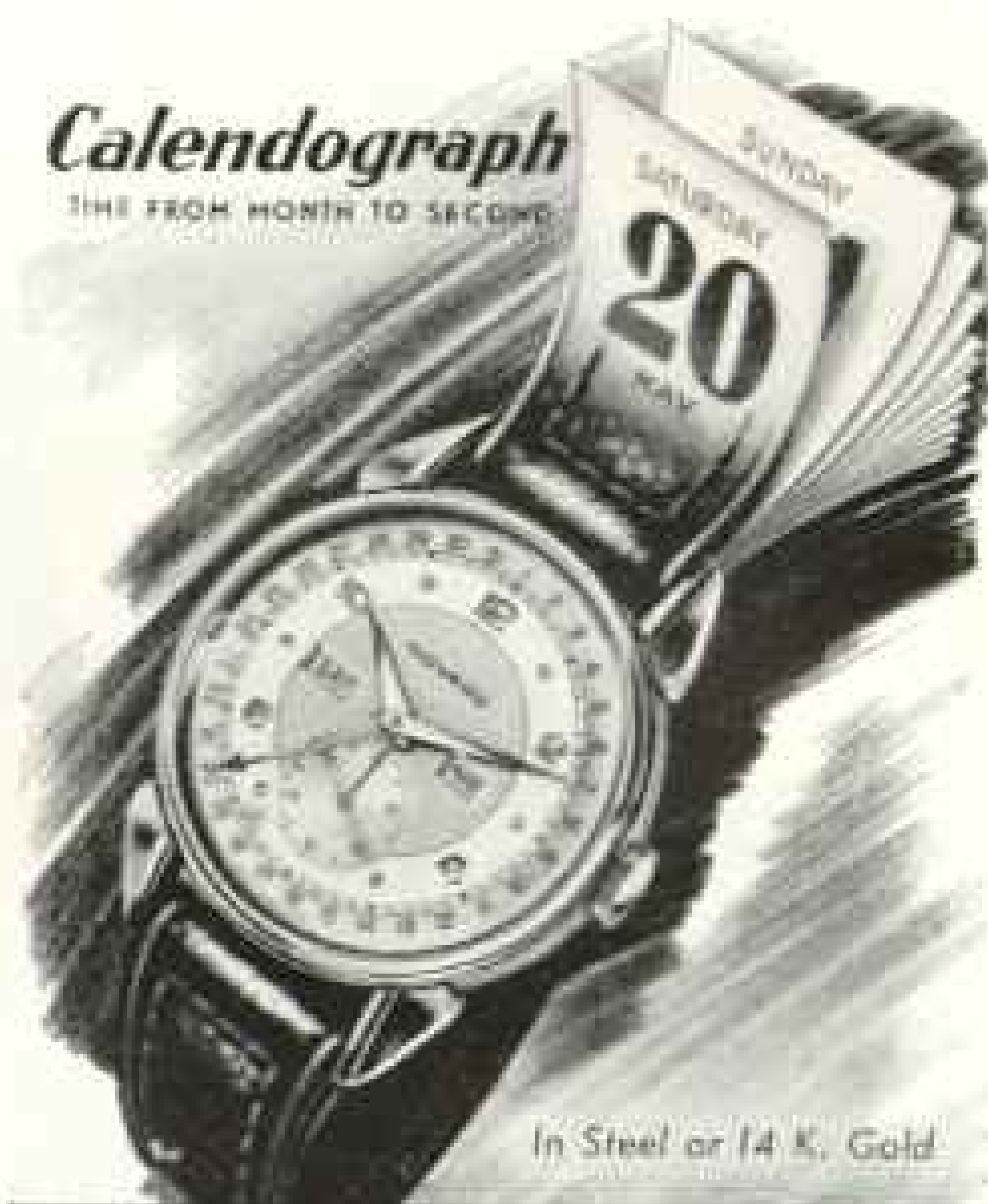

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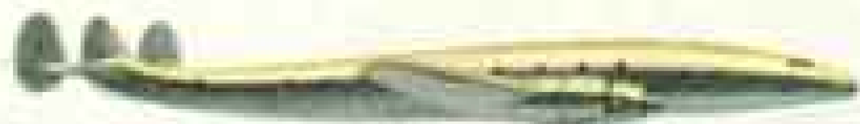

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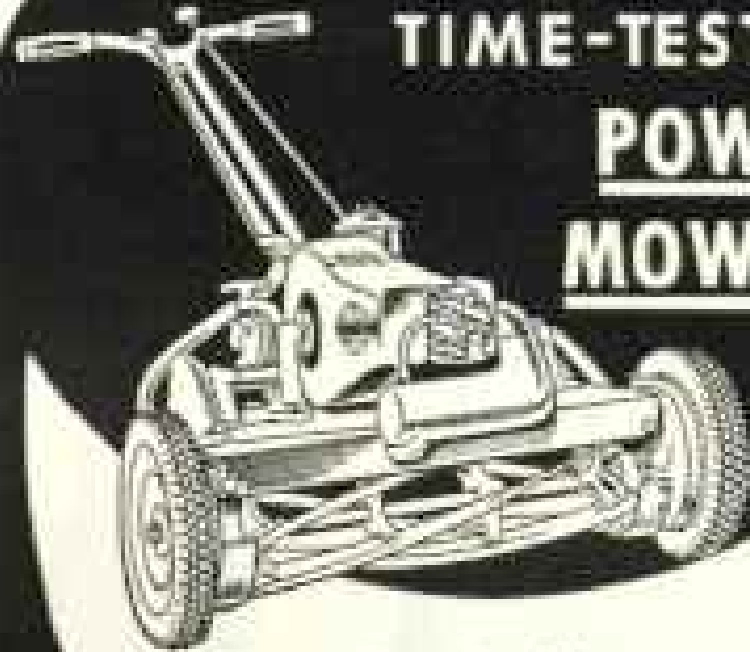

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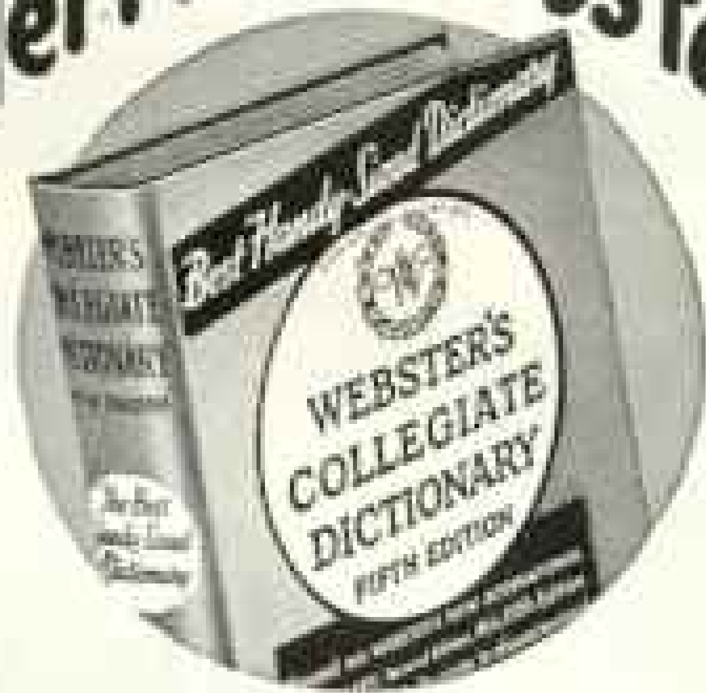

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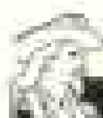

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Q. Is there hope of conquering tuberculosis?

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Q. What are the important steps in this campaign?

A. First: constant effort to find and treat more cases in the early stages when the disease is easier to control. Second: adequate treatment for active cases, preferably hospital care, which will help to avoid infecting others. Third: proper care for people who have had tuberculosis, including medical supervision and occupational guidance to prevent recurrence. Fourth: a drive to eliminate poor health habits and conditions which invite tuberculosis.

Q. Why are periodic examinations so important?

A. Tuberculosis, especially in the early stages, often has no symptoms. Its discovery then depends on a thorough medical examination, aided by X-ray. Such examinations are particularly important among adults, especially older persons, workers exposed to silica dust, and other special groups which have high tuberculosis death rates.

Don't let tuberculosis frighten you

Today, through modern medical skills, most cases of tuberculosis can be controlled if caught in time. The earlier that treatment is started, the better are the chances for a prompt and lasting cure.

If you should have tuberculosis, your physician will recommend treatment, probably in a sanatorium. Once the disease is brought under control you can usually return to a normal way of living, with periodic checkups to make sure the disease does not become active again. You should faithfully follow your doctor's instructions in order to speed recovery and maintain good health afterward.

Regular medical examinations provide comforting reassurance even if you don't have tuberculosis, and suggest immediate treatment if the disease should be detected. For further information about such examinations and about the disease itself, ask your physician, public health officer, or local Tuberculosis Association.

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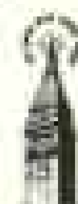

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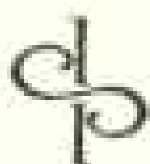

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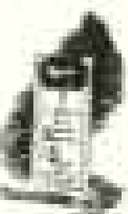

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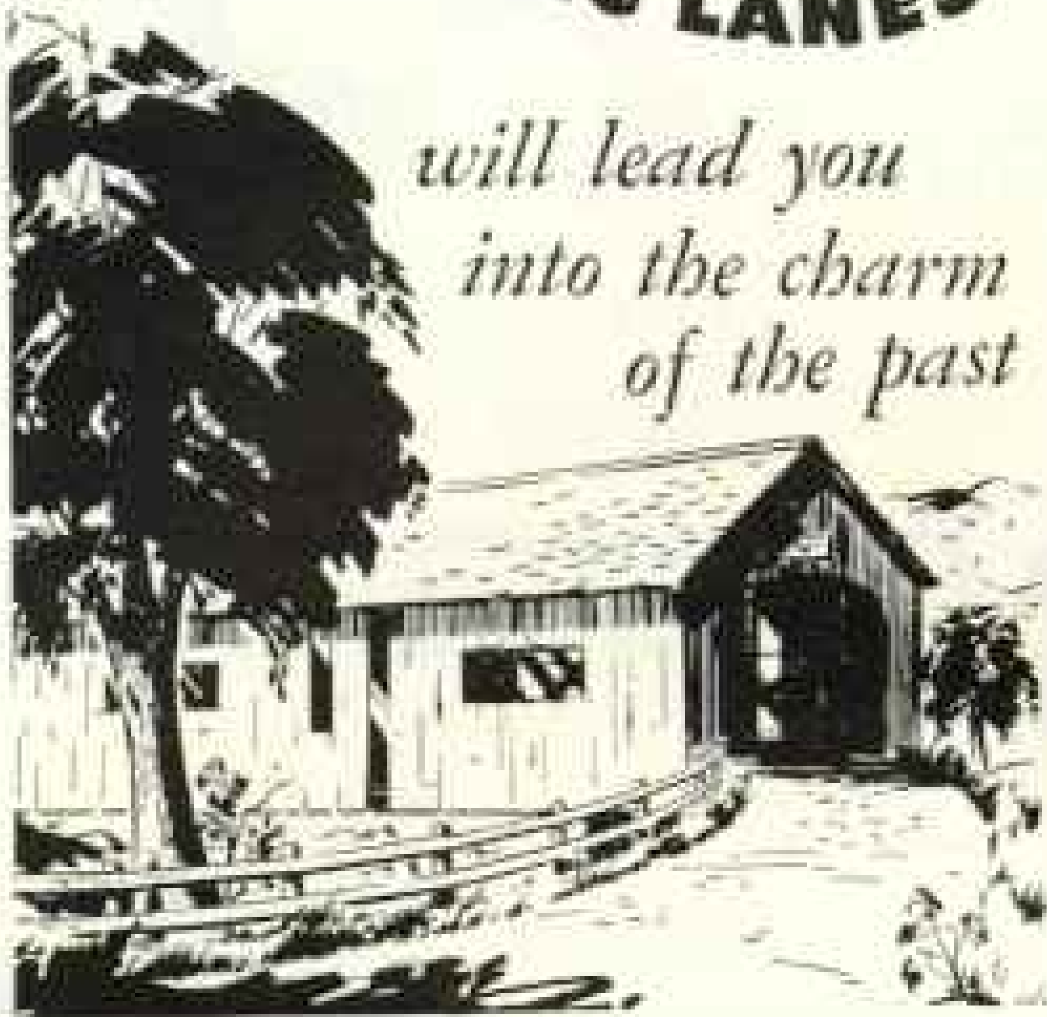

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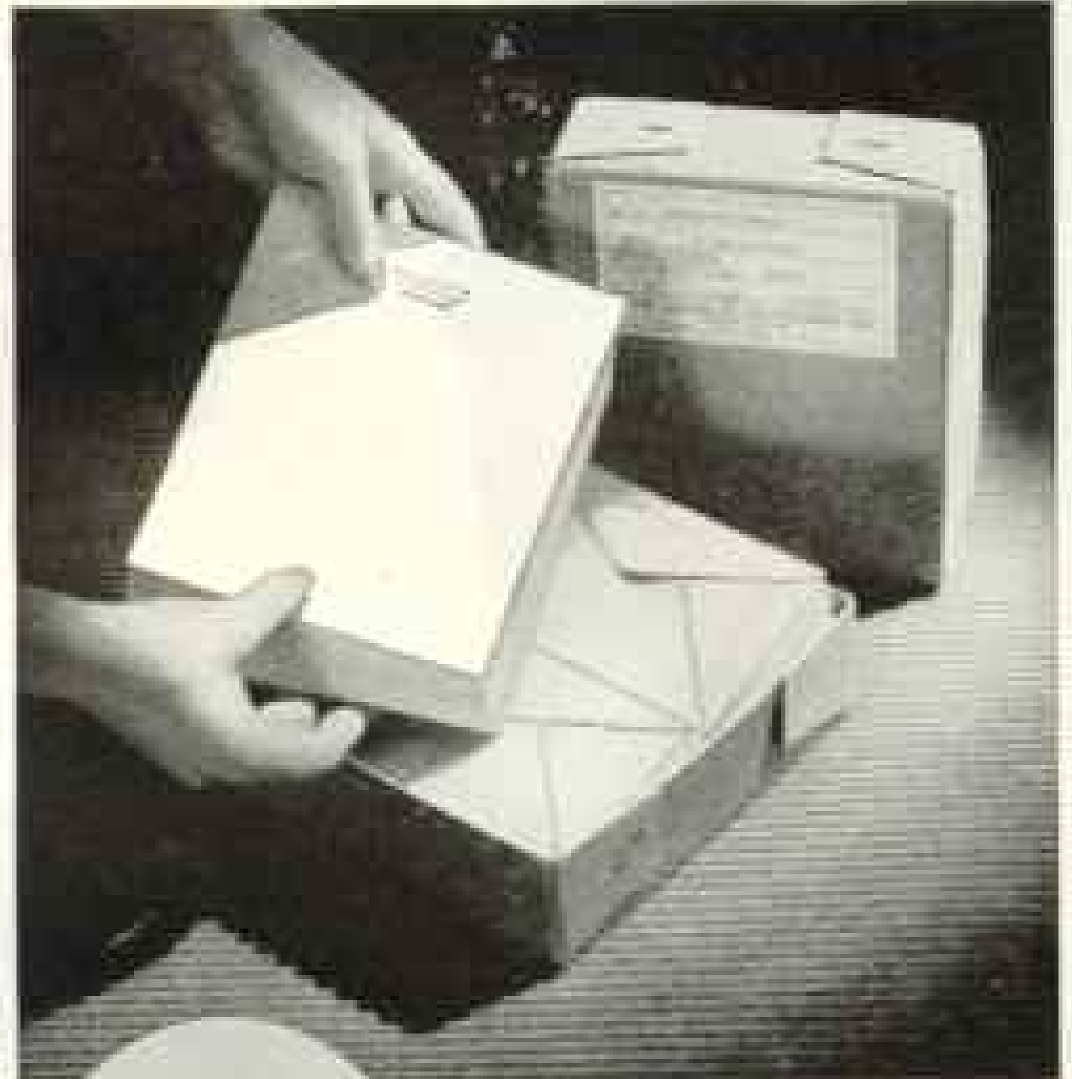

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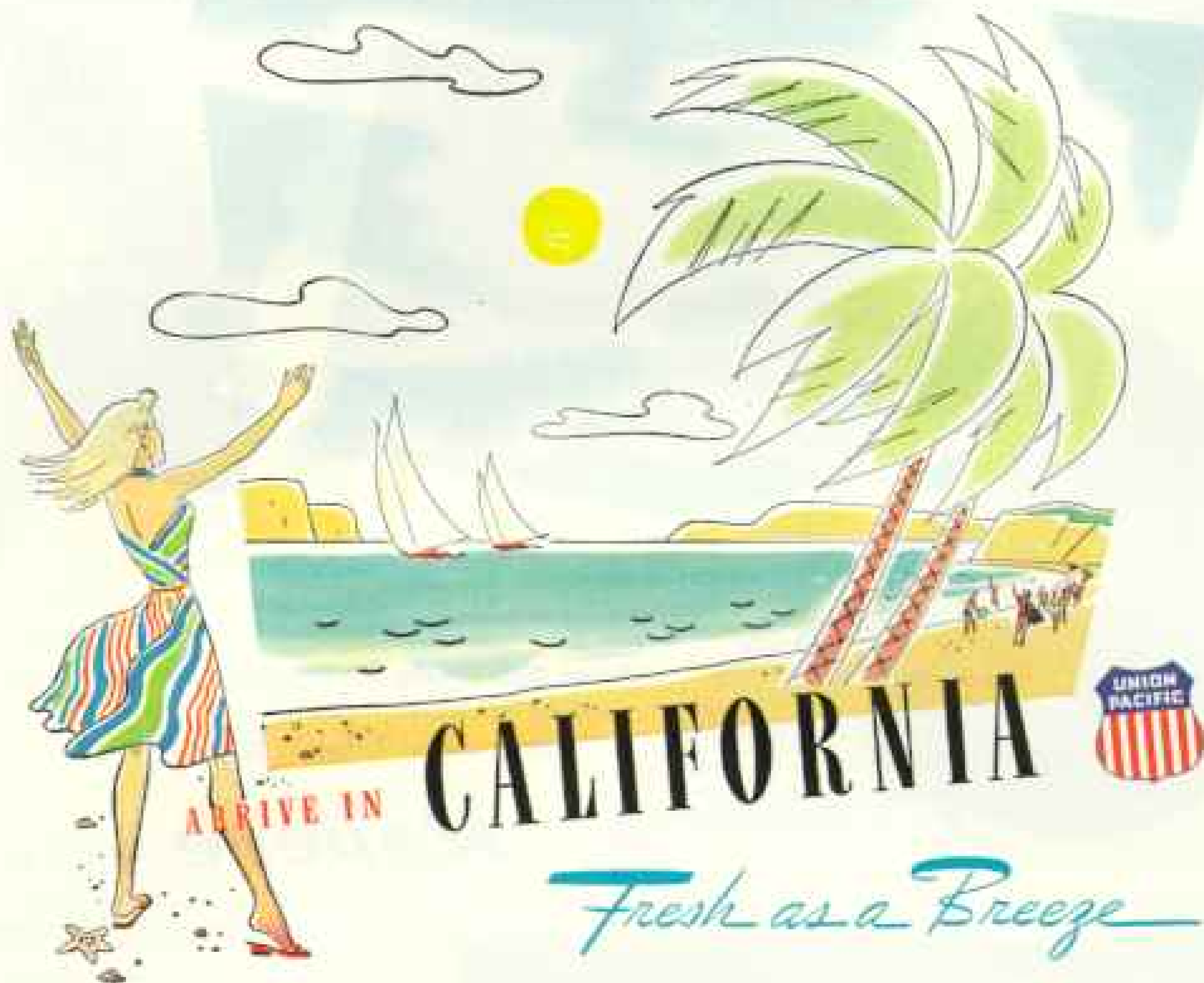

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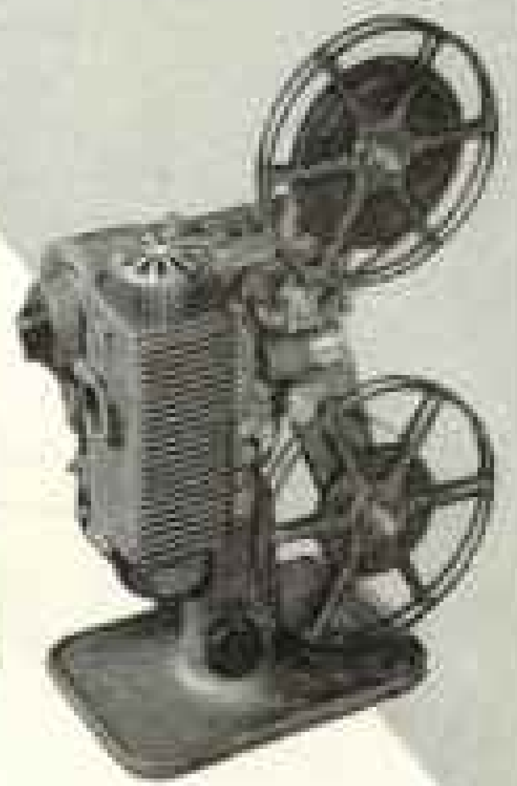

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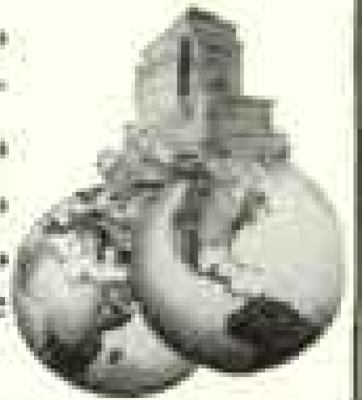

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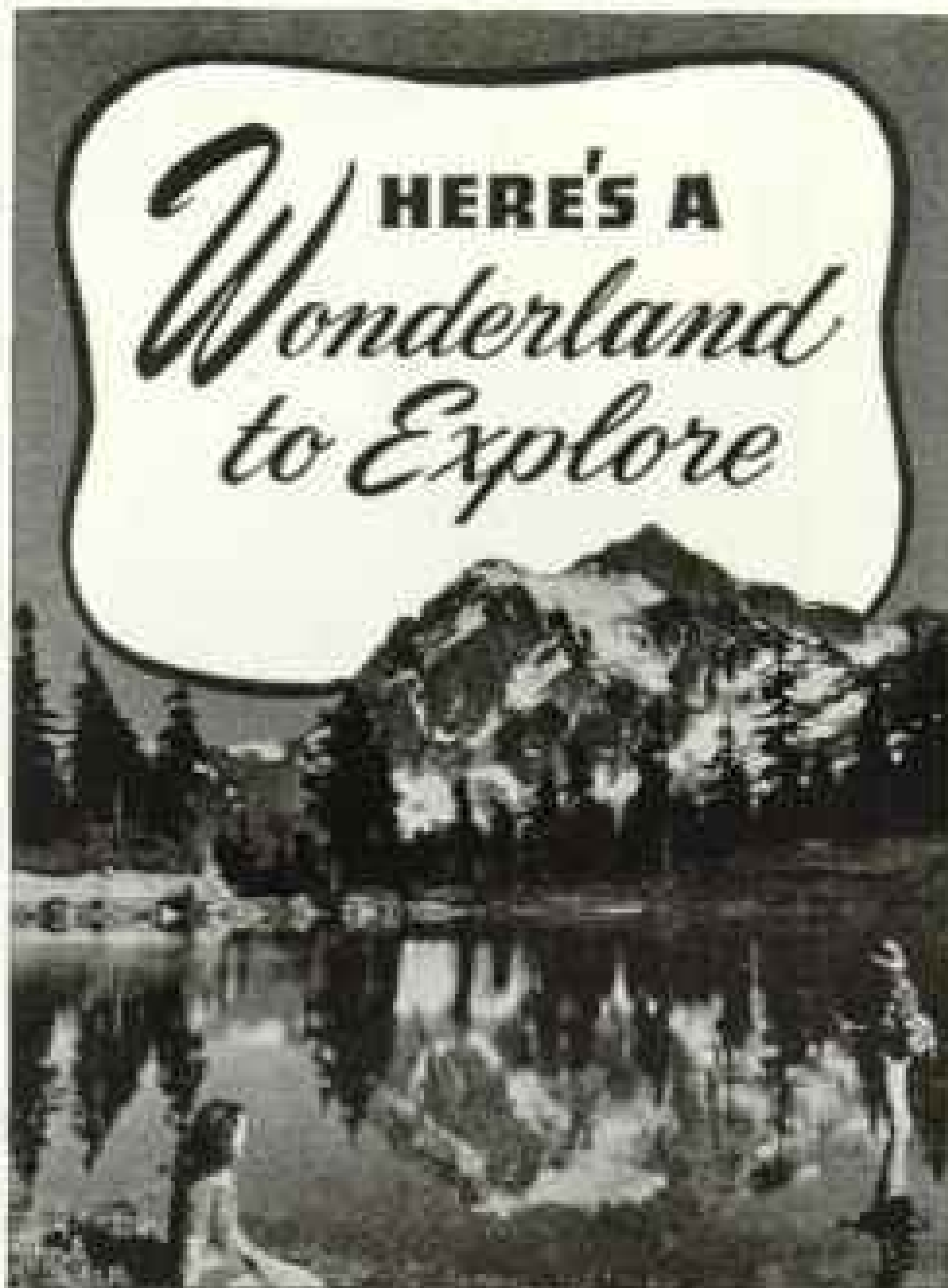

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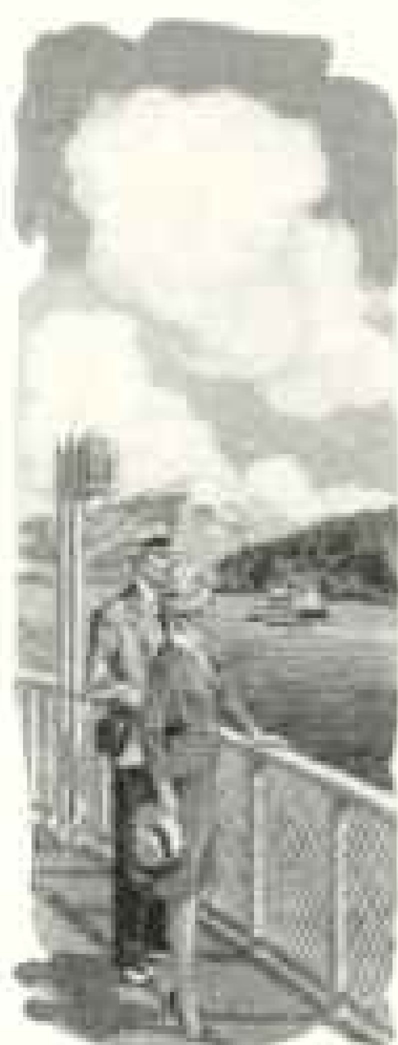

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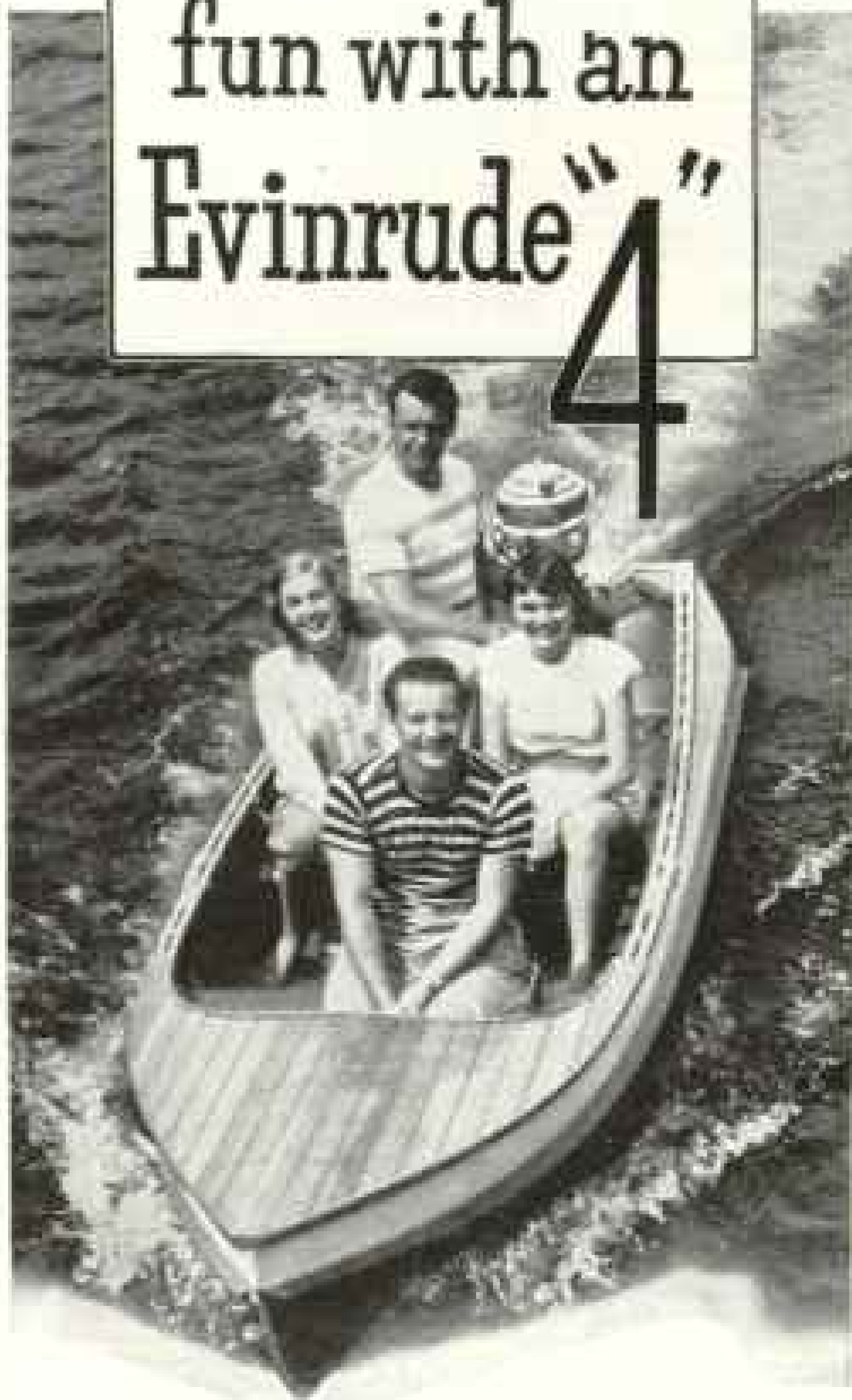

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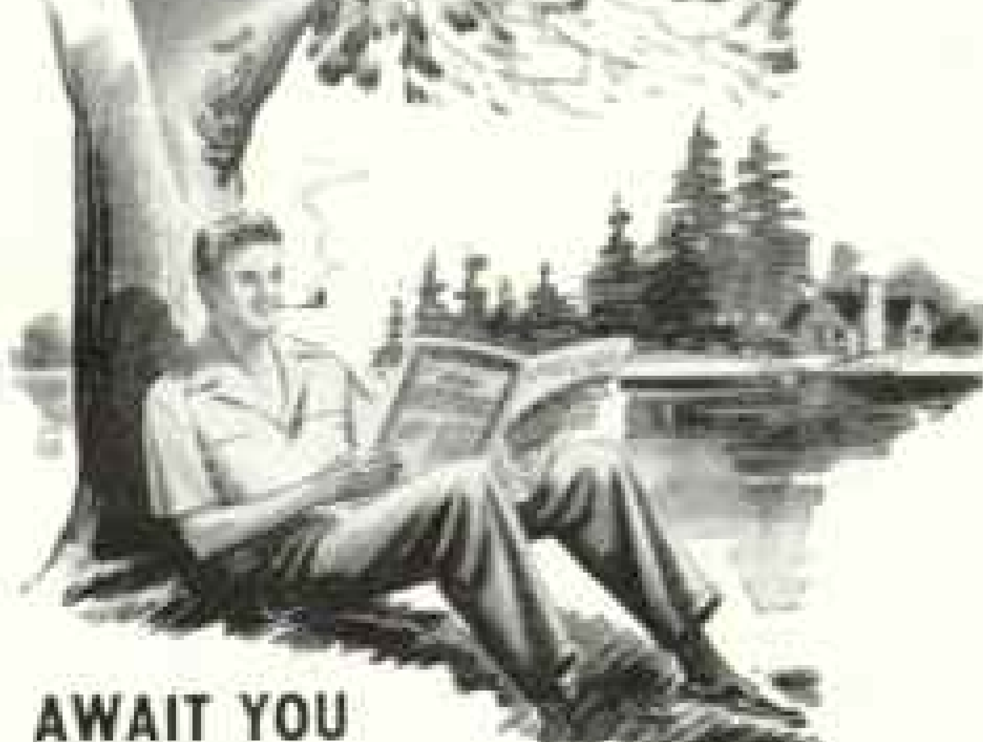

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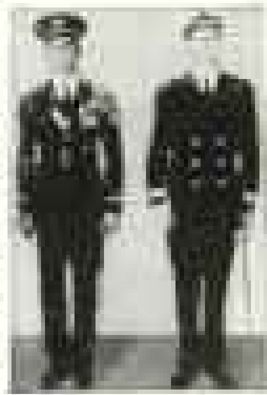

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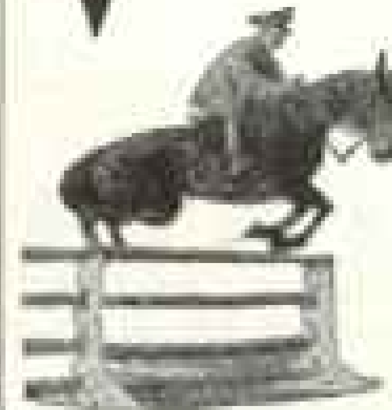

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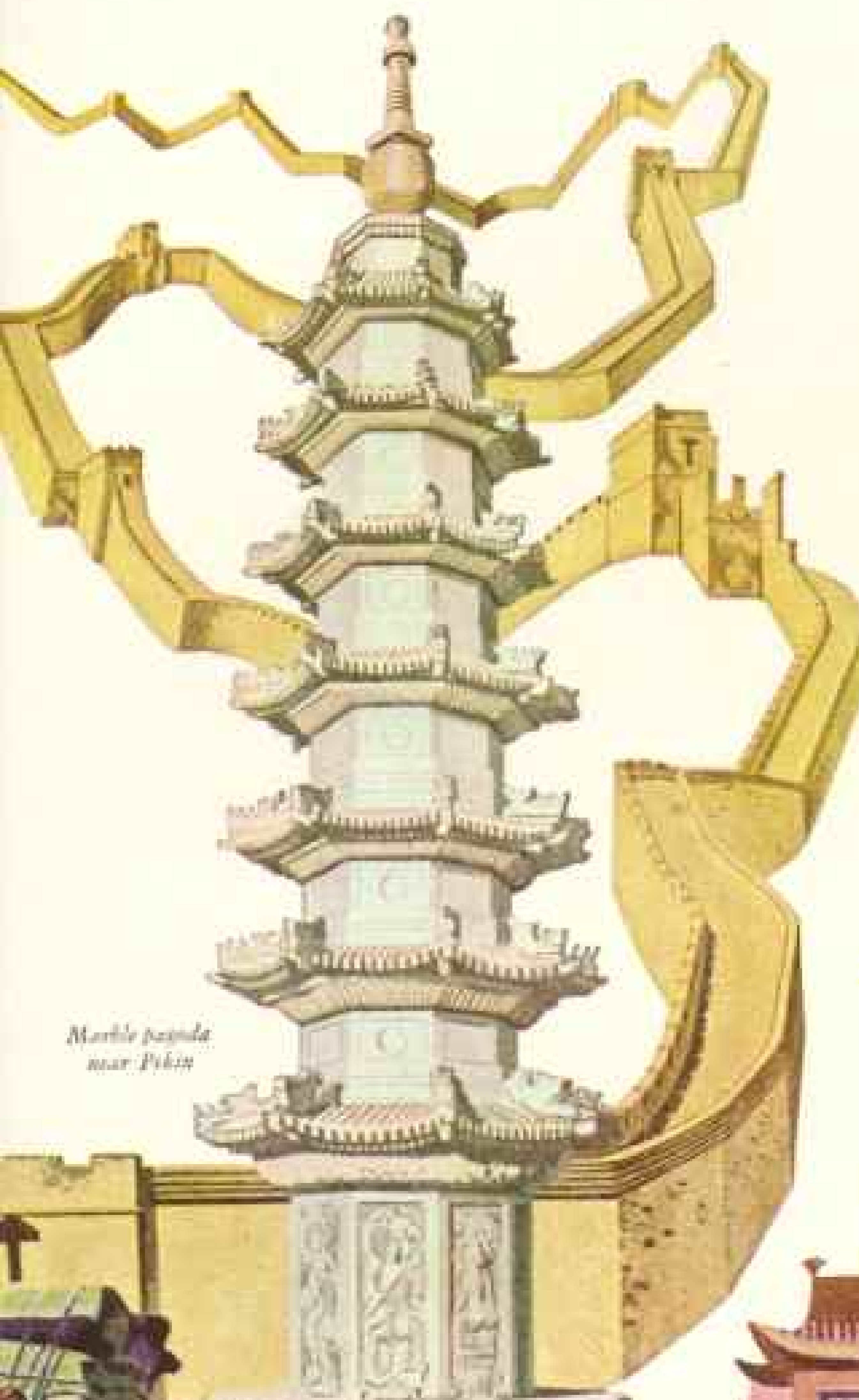

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