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Ten-Color National Parks Map in the Atlas Series

Seventy-two Pages of Illustrations in Color

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THE NATIONAL GEOGRAPHIC MAGAZINE

Heritage of Beauty and History

Want a Live Volcano? Dinosaur Bones? Buffaloes? Sequoia Forest? Americans Own These and Much More—in the National Parks

BY CONRAD L. WIRTH

Director of the National Park Service and Trustee of the National Geographic Society

THIS IS SPRING, when the snow melt makes torrents of streams, the elk think about moving from Jackson Hole to the high meadows of Yellowstone, and the Director of the National Park Service goes missing from his usual haunts in Washington, D. C.

"No, sir, he's out of town," my secretary tells the telephone. "Inspection trip, you know. Oh, no, sir, I'm sure he didn't take any fishing tackle with him. . . ."

But then again maybe he did. How can I settle an argument over whether to stock a Glacier National Park trout stream unless I see for myself how many fish are in it?

Seriously, trying to manage your 24-million-acre estate, the National Park System, entirely from a desk in Washington would be unthinkable, and none of my predecessors ever attempted it. I make no apologies for my trips to the field, even those that include an hour or two on a trout stream.

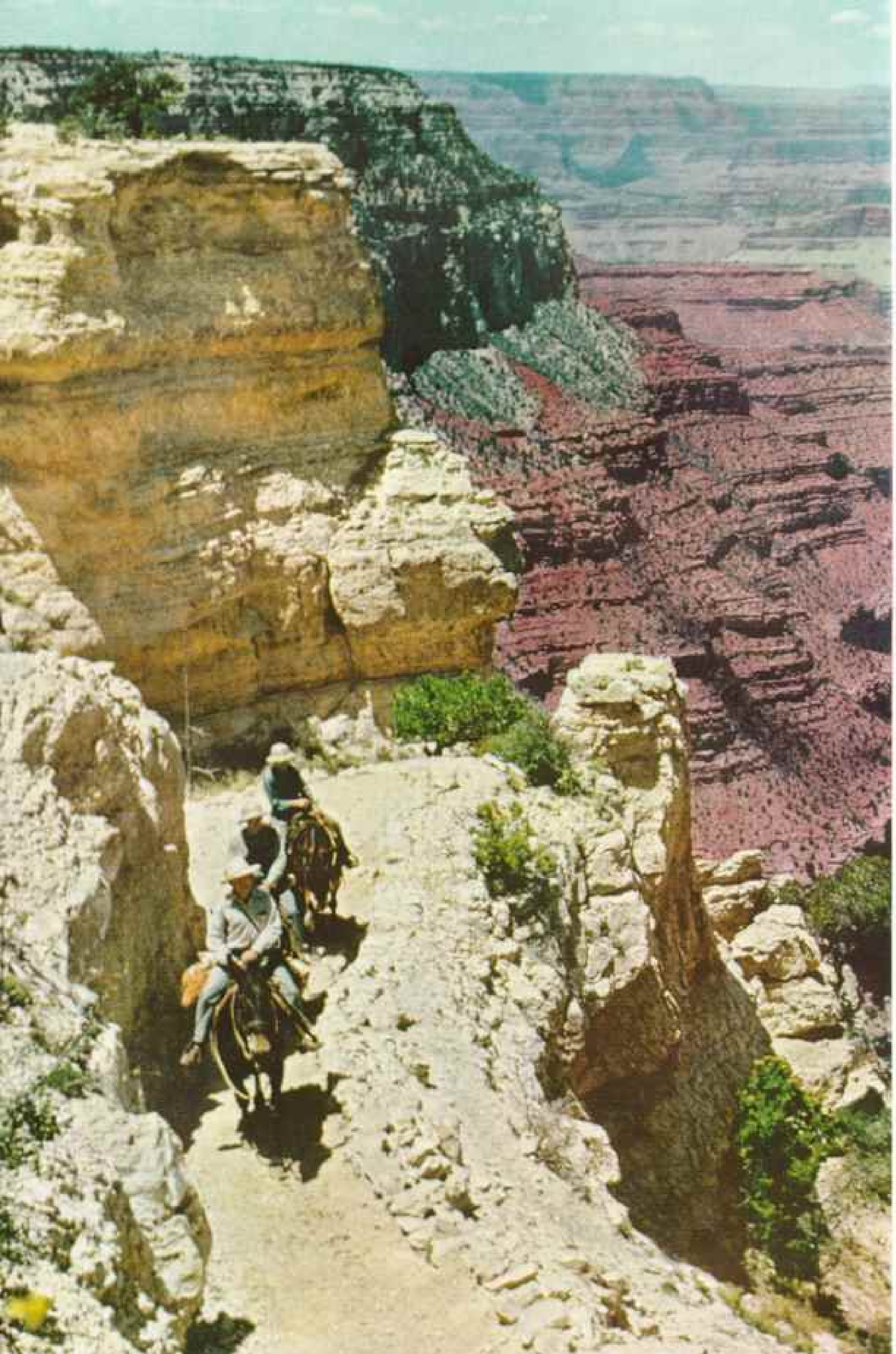
As a matter of fact, I'd be most happy to have you along on one of my swings. Let's start at Grand Canyon National Park in Arizona (see Atlas Map of the National Parks). That's where I started when I first went to work for the Park Service in 1931.

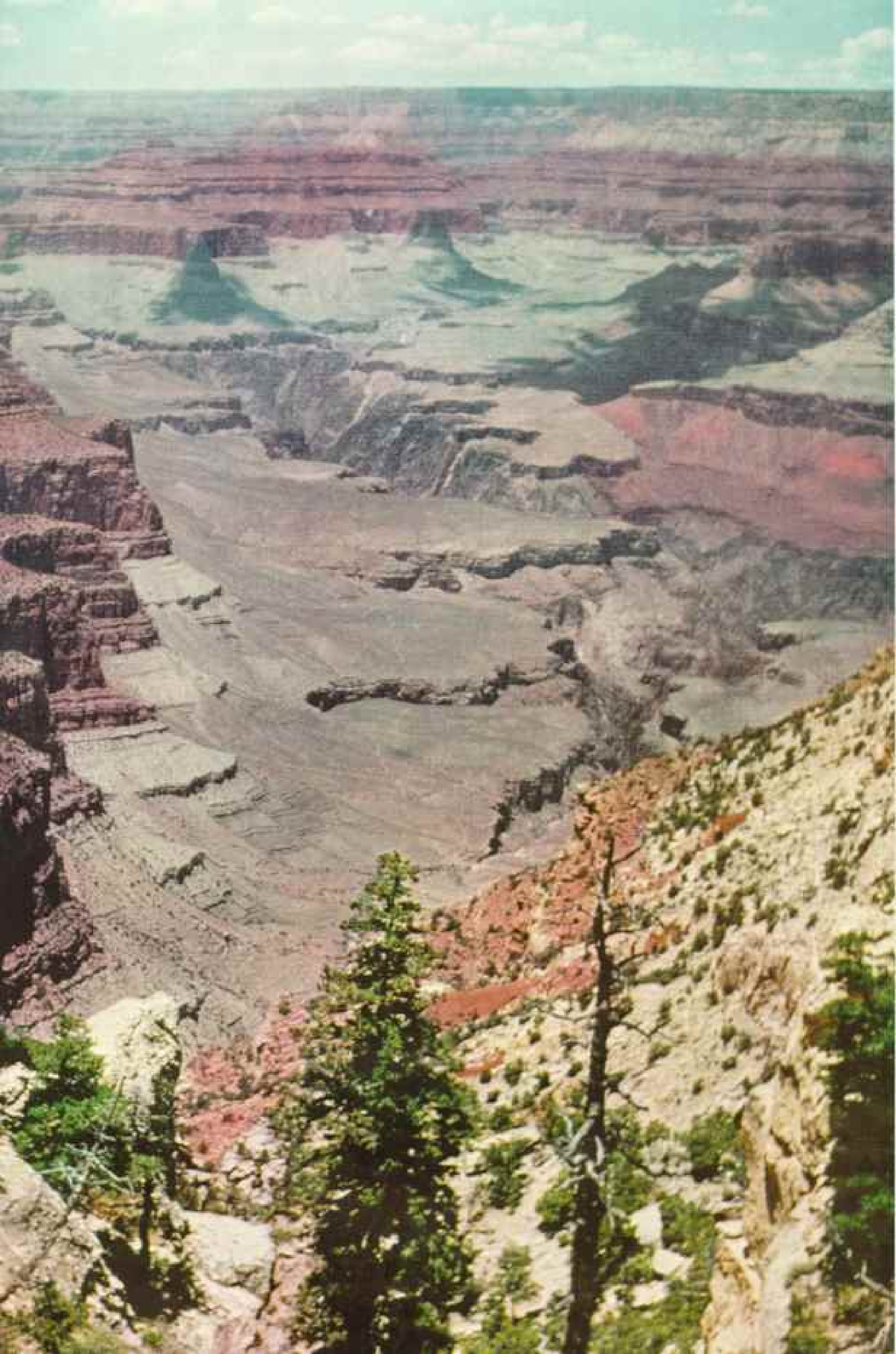
"Before you get settled behind your desk," said Horace Albright, then Director of National Parks, "you'd better find out what a park looks like. Here's a ticket to Grand Canyon."

The chief ranger met me at the train. With a scornful look at my eastern clothes, he ordered me aboard a mule parked near by, mounted another one himself, and led the way to a thrilling experience.

We went right over the rim of the canyon, down the Bright Angel Trail. No matter how hard I tried to make my mule walk close to the inside of the zigzagging, sloping path, he always stayed on the edge of a sheer precipice

FROM the multihued immensity of the Grand Canyon to the blue Atlantic exploding in white surf on the granite face of Maine, modern color photography reveals the diversity of the national parks in the outstanding series that follows. To illustrate Director Wirth's account of the vast domain he administers for all Americans, National Geographic illustrations editors pored over more than 30,000 color and black-and-white pictures, including the finest work of National Park Service members and National Geographic staff photographers. The extraordinary collection that resulted—48 pages of color, including two double-size fold-out pages, and 18 pages of black-and-white pictures—records notable highlights and captures some of the awe, wonder, and pride that the Nation's parks inspire in its people.—*The Editor.*





a thousand feet high. Not only that, but every time he saw anything edible growing out from the rock, he leaned into nothingness to snatch it.

Somehow we made it to the bottom of the gorge. We crossed the Colorado River, laden with some of the half-million tons of silt it carries through the canyon every 24 hours. We rode halfway up to the North Rim, then came back down to the bottom for an overnight stop at Phantom Ranch.

As I recall it—and believe me, I recall it—my chief impression of the park that day was conveyed to me through the seat of my inadequate trousers.

"If anybody is going to carry anybody back up to the South Rim tomorrow," I told the chief ranger as I ate my dinner standing up, "I'm going to carry the mule!"

Tomorrow, of course, was a brighter day. We rode uneventfully back up the trail, as thousands of tourists have done, and from the comfort of park headquarters I could look back upon a memorable experience.*

Dizzy Ride Recalls Pioneer Days

The greatest benefit I received from the trip was a heightened awareness of what was mine as an American. There on the Bright Angel Trail I felt a little bit like a pioneer, conquering the dangers the first settlers faced as they subdued a wild land.

I felt close to those pioneers then. My existence, I could see, was only a continuation of theirs in the pageant of the Nation's history. What they struggled to build I must help preserve. You might say I was beginning to understand where I fitted into things, not just as a Park Service man, but as a citizen of the United States.

More than likely your own first visit to a national park was quite different. Perhaps you went to Yellowstone and stood speechless as Old Faithful burst joyously into the sky.

Or you may have entered by way of Acadia National Park, where northern lights dance over the round green mountains of Maine and the Atlantic surf thunders on a granite shore (pages 648-9). I know one who came first to Gettysburg, and saw where his father's father fell, and stood by the white stone that marked his grave.

It does not really matter where you start. The important thing is for you to receive a full dividend from your visit, as I think I did. You get this dividend not only through lungs filled with clean air and eyes soothed by natural beauty, but in spirits enriched perhaps beyond immediate understanding.

Parks Bring History to Life

Myself, I don't know how to describe this ability of the parks to lift up the soul. One of the best writers on the parks, Freeman Tilden, speaks of a "fifth essence," beyond fire, air, water, and earth, and quotes the English historian Trevelyan as to what this essence is:

"The effect of natural beauty . . . is in the strict sense of the word 'incalculable,' but it is certainly immense. There are many who regard it as the best thing in life, and millions who passionately crave for it. . . .

"One of the motives for preserving . . . places of historic interest and natural beauty, is to cultivate in our people the historic sense, the vivid realization of the life of our ancestors and all the former inhabitants . . . as a reality lovingly pictured in the mind, not merely an abstraction read of in history books." †

It so happens that Grand Canyon not only helps cultivate a historic sense, but takes us

* The National Geographic Society has published so many articles on national parks and monuments that it is impracticable to list them all in footnotes for reference. For individual articles see the National Geographic Magazine Cumulative Index, 1899–1956, two volumes, $10.00. Vol. I, 1899-1946, $5.50; Vol. II, 1947-1956, $5.50. 1957 Supplement, $1.00.

† *Must England's Beauty Perish?* by George M. Trevelyan, Faber and Faber, Ltd., London.

Old Faithful Has Not Missed an Eruption in 88 Years of Observation

Once an hour, on the average, the geyser tosses a column of hot water 115 feet high or more. Clouds of steam, usually blown off by the wind, add height in this photograph. The dazzling four-minute show creates the best-known attraction at Yellowstone National Park, Wyoming, which has more geysers than any other place in the world.

Grand Canyon's strata, like pages in a book, reveal the history of the earth (preceding two pages). This mightiest of gorges, still being cut by the Colorado River, bares rocks formed a billion and a third years ago. A soldier of Spain, searching for the fabled Seven Cities of Cibola, stumbled on the mighty canyon only 48 years after Columbus reached America. The park was created in 1919. Now visitors number a million a year.

Ascending to the South Rim, riders and mules follow the Kaibab Trail.

Photographs by Walter Meayers Edwards, National Geographic Staff (opposite), and Josef Muench (pages 588-91) © N.G.S.

Yellowstone Campers Re-create the Founding of the Park System

On September 19, 1870, 15 men pitched tents on this meadow after a month-long journey through the spectacular Yellowstone country.

Braving hostile Indians and riding through early snows, the party had circled Yellowstone Lake, seen the roaring geysers of the Upper Basin, and explored the falls and canyons. This was a wonderland, they agreed, that must be preserved as a national park.

So vigorously did the expedition leaders urge the idea that within two years Congress passed the Yellowstone establishment act. The National Park System was born.

Last September author Wirth watched these park employees and Montana State University students re-enact the historic encampment (page 602).

Park Director Wirth (center) rides with Lemuel A. (Lem) Garrison, Superintendent of Yellowstone (right), and E. T. Scoyen, Associate Park Director, on an inspection tour.

National Geographic Photographer J. Baylor Roberts

far back into ages past as well. Better than any other place in the world, we believe, it tells the story of the earth during the last billion and a third years or so. The Colorado here has uncovered, at the bottom of its gorge, rocks in which scientists have never found any evidences of ancient life.

Higher in the walls geologists have discovered some of the oldest known traces of life, in the form of fossilized plants and marine animals. Even the canyon's rims are not really contemporary, for the topmost layers in this part of Arizona long ago eroded away. To see the sort of layers that once overlaid the canyon rims, we'll have to journey to three parks in Utah.

Four Parks Tell Earth's Story

Now note how these parks interlock in telling a story—in this case, the story of the earth itself. Lower rock levels of Zion Canyon in Zion National Park are about the same age as those that once formed the top of Grand Canyon. Bryce Canyon (page 610) and Cedar Breaks interlock with Zion to bring the story closer to the relatively recent era when humanity came onto the scene.

Together, I think these parks make up one of the most important museums in the world.

One time somebody asked me: "What kind of people visit the national parks?" "What kind don't?" I parried, thinking of the more than 59 million park visits last year.

Mill hands and office clerks. Tycoons and poor folk. Lawyers, doctors, and thieves. Some like flowers, some like snow and ice. Some like snakes, though most are amazed that we protect even rattlers. Everybody likes bears—except the hundred or so who each year get mauled or bitten for ignoring our warnings against feeding them.

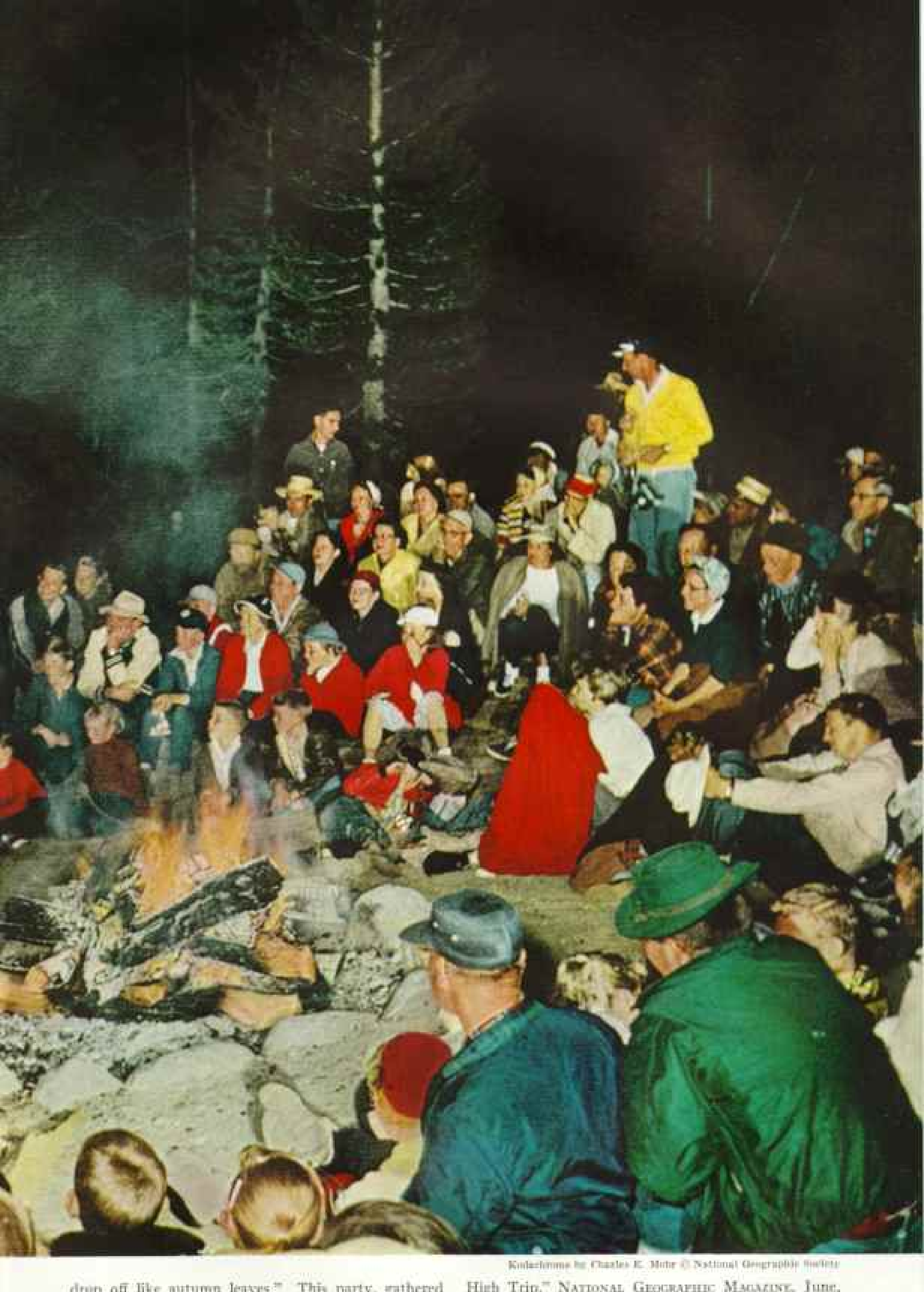
In Glacier National Park, about 7 o'clock one morning, I ran across a middle-aged couple packing their car, getting ready to leave.

"Good morning to you," I said. "How do you like the park?"

"Best of the 10 we've seen this vacation," the man replied. "But mister, please don't keep me from my packing. We have only

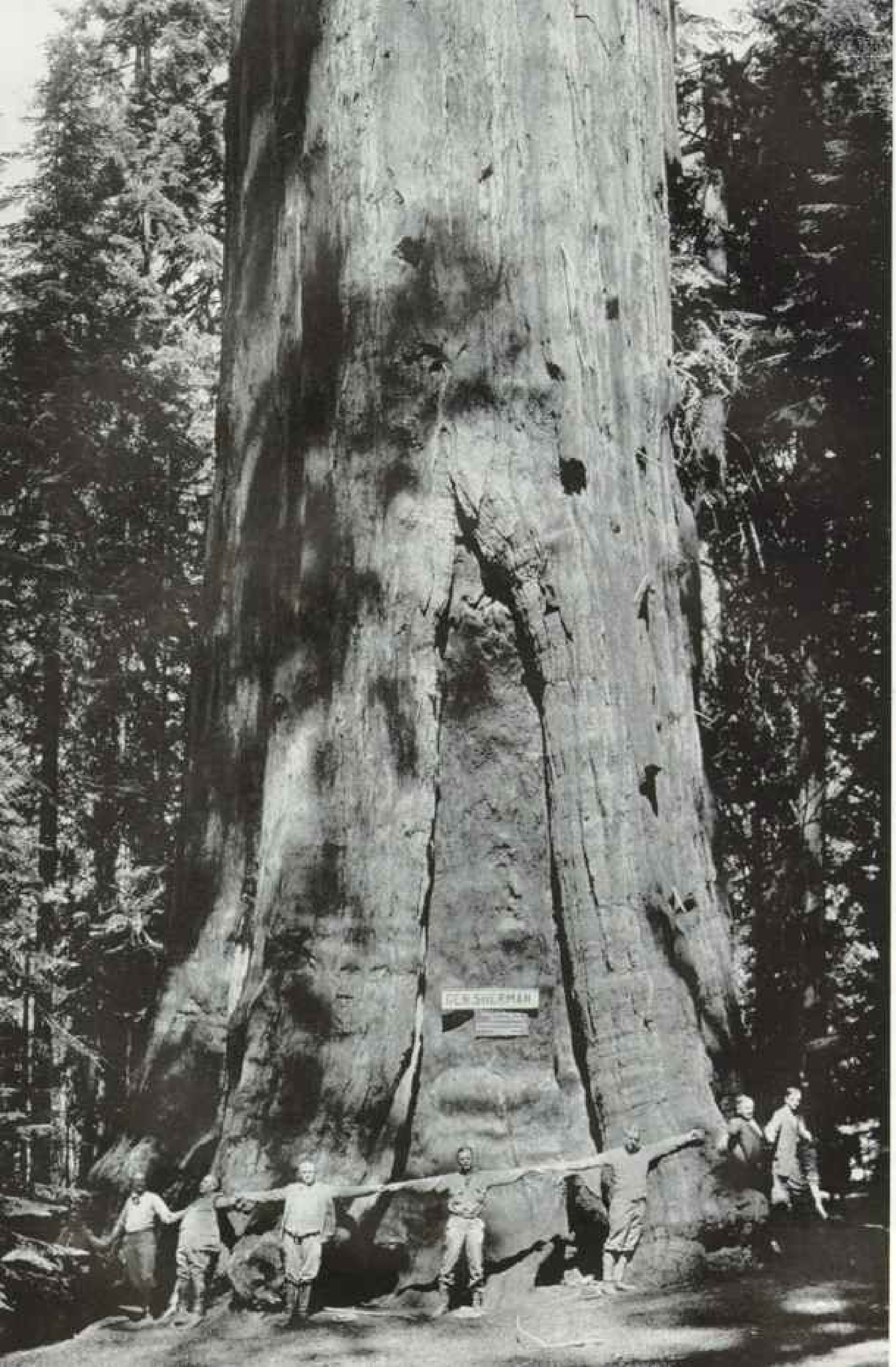
Alpine Campers in Yosemite Ring a Fire on Tuolumne Meadows

"Camp out among the grass and gentians of glacier meadows," naturalist John Muir wrote. "The winds will blow their own freshness into you . . . cares will



Kodachrome by Charles E. Mohr © National Geographic Society

drop off like autumn leaves." This party, gathered at 8,500 feet in Yosemite National Park, California, hears the ranger announce a pack trip (See "Sierra High Trip," National Geographic Magazine, June, 1954). Hikers like these swelled attendance in national parks to more than 59 million last year.



three more days of vacation and three parks still to see."

While he bustled around the car, I found out from his wife that the vacation was two weeks. The couple had arrived in Glacier the night before.

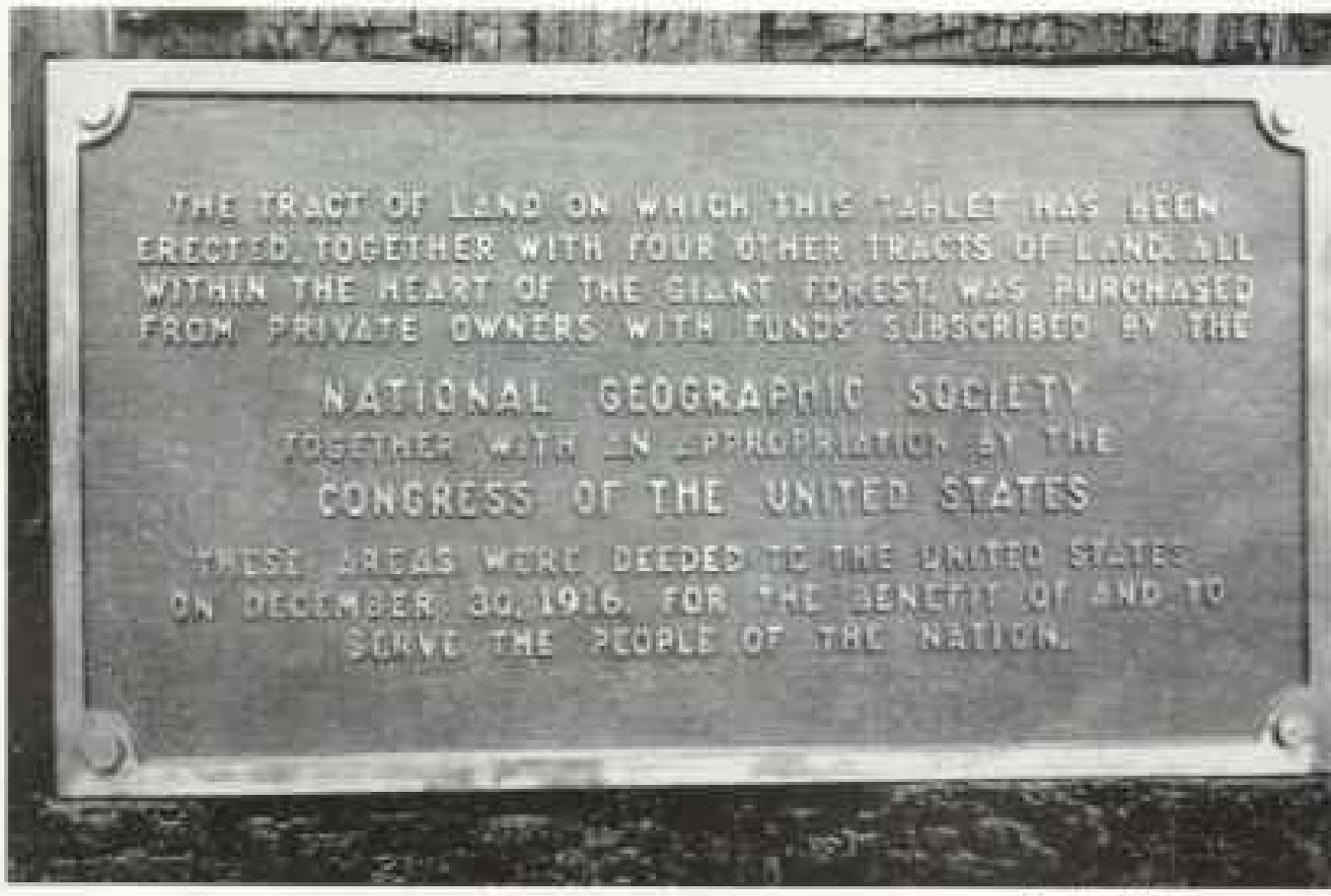
"We drove by one of those glaciers," said the wife, "and we saw Indians on the hotel lawn. This is a wonderful place."

I know that some of my friends who love the wilderness look on this type of visitor with scorn. He doesn't really see a park, they say, because he never leaves the roads.

But this couple, most likely city dwellers who couldn't tell a coyote from a shepherd dog, were having the time of their lives. I might not agree with their way of doing it, but I defend their right to pursue it. The mission of the Park Service does not include telling people how to take their pleasure.

At the same time, we feel that the parks repay close acquaintance, and we're happiest when people do not hurry through. If they do linger, they will find that we offer them every possible opportunity to get the most good out of their park experiences. Enjoyment and lasting satisfaction increase through understanding. That is why we offer the best interpretive service we can provide.

We have a fine corps of uniformed naturalists, historians, and archeologists, in addition to our ranger force. We maintain more than 100 park museums. We offer evening campfire programs, conducted walks and caravans, roadside and trailside exhibits, recorded talks a visitor need only press a button to hear, and a great deal of literature.



Lindley Eibe

This plaque commemorates joint effort by the National Geographic Society and the Federal Government to preserve a priceless treasure for posterity, Giant Forest in Sequoia National Park, California. Stephen T. Mather, a vital force in the early days of the Park Service, played a major role in the transaction (see below). Mr. Mather, who later served as a Trustee of The Society, also donated $50,000 to buy other groves in the park.

At the other extreme from the Glacier couple were two boys I met at the ranger patrol cabin on the Southeast Arm of Yellowstone Lake last summer. They had the barest amount of worn-out camping gear. Untrimmed hair and bushy beards gave them the look of old-time mountain men.

Two Months of Adventure

"How long you fellows been out?" I asked.

"Two months," said one. "And what a time we've had! A cow moose kept us treed all one night. We can tell you, I bet, where the biggest cutthroat trout in the world live. We've gained 15 pounds apiece on beans, bacon, sourdough biscuits, and fish."

They had a canoe, and they were planning to paddle around the lake in it to get back to their car. I took a look at the thing. It was more patches than canoe.

"Maybe you could take these fellows over in the motorboat," I told the ranger. "If

General Sherman, Giant Among Giants, Rules Sequoia National Park

When the Giant Forest was threatened with lumbering in 1913, Stephen Mather, then Assistant to the Secretary of the Interior, invited a group of eminent Americans to visit the grove. One of them was Gilbert Grosvenor, Editor of the NATIONAL GEOGRAPHIC MAGAZINE, who made this dramatic picture (page 611). Twenty men, fingertip to fingertip, barely encircle General Sherman's 102-foot waist. Mather stands at right of name plate. With him, left to right, are: E. O. McCormick, vice president, Southern Pacific railroad; Capt. Walter Fry, superintendent, Sequoia National Park; Ben M. Maddox, owner, Visalia, California, *Times*; and F. B. Johnstone, a Chicago attorney. At extreme right is Robert B. Marshall, chief geographer, U. S. Geological Survey. (See color photograph, pages 605-8.)

you do, find out for me where they caught those trout."

I don't know who will talk the longest and loudest about their trip, the couple at Glacier or the two boys. I'm convinced that all of them had the experiences best suited to their natures. I have faith in the ability of the parks to spray some of Freeman Tilden's fifth essence on every visitor.

Never Bluff a Ranger

Sooner or later each visitor meets a ranger. His full title is United States Park Ranger, and he is one of the key men in the Park Service. He is the visitor's friend. He meets the guest, shows him how to reach the interesting places, warns him against feeding the bears, finds him when he is lost, and deals firmly with him when he violates the regulations, which are few and reasonable.

A ranger is a man's man. He likes animals and flowers. He can spend all day on a horse and half the night on a square-dance floor. He comes in two styles, the year-round career man and the "90-day wonder," the seasonal ranger who works only during the tourist rush seasons. No matter what kind he may be, he talks facts and listens well. Don't try to bluff a ranger. I made that mistake once.

We were in the high country of Kings Canyon National Park, seeing if dude horses were damaging delicate California mountain meadows. In nature, not enough deer would congregate here to destroy the grass. But let man, the changer of nature's face, destroy the ecological balance—say by running in too many horses—and you have trouble.

We camped by a stream brimming with snow melt. Cold winds whistled through the stunted pines at timber line. I looked around at my companions stretched wearily on the ground after a hard day in the saddle, and I thought I had them sized up.

"Personally," I said, "I could go for a nice bath in that pool down there. But of course you fellows are too tired, and I don't want to go alone, so I guess I'll have to do without."

To my horror, the ranger in our party rose and started peeling off his shirt.

The icy water nearly killed me. As I said, don't try to bluff a ranger.

When the time arrives, a ranger becomes a hero—quietly, as befits a man who feels he is only doing a job he is getting paid for. Take Ranger Jack Cahoon, a seasonal who teaches school nine months of the year.

From the beach at Cape Hatteras last summer he saw a swimmer drifting helplessly to sea. A storm was raging and the surf ran high. Ranger Cahoon threw off shirt and shoes, swam out and brought the man to safety. The Department of the Interior gave him the Valor Award, its gold medal for exceptional bravery.

Three airmen parachuted from a disabled plane and landed in a part of the Grand Canyon nobody had ever reached from the rims above it. Ranger Ed Laws and Dr. A. A. MacRae, an experienced Canyon hiker, set out to descend a 550-foot sheer cliff regarded as an impassable barrier, most formidable in the canyon.

As they neared the edge, Ranger Laws noticed deer tracks converging into a single trail. The men followed the trail, and there was a dizzy path leading to the stranded fliers. Risking their lives, the pair went down and arranged to bring the aviators up.

Saving a Skier's Life

Hope had been abandoned for a skier lost 11 days in the mountains behind Badger Pass in Yosemite. Rangers Homer Robinson and Duane Jacobs refused to give up the search. They made another grueling hunt and found their skier alive.

Singly and in groups, rangers regularly risk their lives saving climbers in trouble on the heights of the Tetons and other ranges of the Rockies (page 626). Being trapped in the wilderness by raging blizzards is mere routine for Yellowstone ski patrols. The patrol ranger's wife, meanwhile, may be snowbound herself in the isolated cabin the couple call their winter home. She, too, is a hero.*

* See "Springtime Comes to Yellowstone National Park," by Paul A. Zahl, NATIONAL GEOGRAPHIC MAGAZINE, December, 1956.

Yosemite's Rivers, Gorges, and Falls Show at a Glance on a Relief Map

A place of breath-taking beauty guarded by granite cliffs and spangled with waterfalls, Yosemite Valley cuts horizontally across the middle of the map. It contains the best-known features of the park, such as El Capitan and Half Dome. Grand Canyon of the Tuolumne makes a diagonal slash in foreground. Yellow lines show roads; red lines, trails.

This map at Happy Isles Nature Center shows the 760,931-acre park's rugged character.

Kodachrome by National Geographic Photographer J. Baylor Roberts © N.G.S.

A River of Embers, Yosemite Firefall Cascades 900 Feet

In the early 1870's a Yosemite settler pushed the first hot coals off Glacier Point.

Soon the firefall was a nightly event in summer. To achieve more spectacular effects, men tried fireworks, flaming gunny sacks, even bombs.

Today the park concessioner's employee who stages the show uses the bark of fallen red fir trees. He lights a bonfire and waits until it is reduced to incandescent embers. At a signal, he pushes the coals over the cliff with a long-handled rake.

A glittering shower of sparks and flame thrills park visitors looking up from vantage points in Yosemite Valley. Nearly all the bark has burned to cinders by the time it nears the bottom of the cliff.

Nevada Fall is a pale streak at the picture's edge.

Yosemite Falls Takes a Shattering Leap into Space

In spring flood, Yosemite Creek plunges with such savage force that the earth trembles half a mile away. In August drought, all that remains is a gossamer veil tossed by the wind.

The Upper Fall, Middle Cascade, and Lower Fall plunge a total of 2,425 feet. Upper section alone is the highest free-leaping waterfall in the Nation and fifth in the world.

Snow plants (*Sarcodes sanguinea*), as fat as asparagus and as bright as red candles, light a corner of this scene.

Lost Arrow, a granite spire to the right of the falls, stood unconquered until 1946.

Photographs by Josef Muench (opposite) and Kodachrome by National Geographic Photographer J. Baylor Roberts © N.G.S.

John Kauffmann

Raccoon Visitor Checks In at Sequoia National Park

Rangers Cahoon, Laws, Robinson, and Jacobs will not be pleased that I have mentioned their names. Rangers are modest. Hundreds of brave deeds are not known to us in Washington because the rangers who perform them don't bother to report them.

Billy and the King of the Belgians

Many of our first rangers were simple outdoorsmen without much formal education. Some, like Billy Nelson of Yosemite, would be called "characters" today.

He had King Albert of the Belgians out on a pack trip. Billy was cooking under the giant sequoias of the Mariposa Grove.

"Hey, King," he suddenly shouted over the crackle of the campfire, "shoot me that side of bacon, will you?"

Members of the royal party and the Yosemite superintendent blanched. But the King gleefully threw Billy the bacon.

From then on it was "King" and "Billy" in conversation between the two men.

School for Rangers

Present-day rangers are college men and have more polish, but are just as good in the wilds as their predecessors. Last fall, furthermore, we started a special school for new rangers in Yosemite (page 617).

When they graduate, after three months of intensive training, they know Park Service regulations, traditions, and objectives, how to look after a horse and their own smart olive-green uniforms, how to fight forest fires and hunt for lost people, and how diplomatically to keep visitors from picking the flowers. They also learn the history of the National Park System.

It is the history of an idea that came to fruition at a campfire in Yellowstone on the night of September 19, 1870. I had long known the story, of course, but it came really alive for me last fall, when I saw the scene re-enacted by park personnel and students of Montana State University on the original spot (page 592).

The boys looked authentic in their period costumes, and the horses and pack mules were genuine down to their whinnyings at sight of the audience assembled on a grassy meadow. So were the natural noises real—quavery voices of owls on the steep wooded slope of

(*Continued on page 611*)

FOLLOWING PAGES FOLD OUT.

"Within These Plantations of God, a Decorum and Sanctity Reign"

Emerson's words capture the spirit of the Giant Forest in Sequoia National Park, California. When the poet visited the big trees, John Muir urged him to camp under them, saying: "You are yourself a sequoia. Stop and get acquainted with your big brethren." But the aging Emerson declined. Here a family cooks supper. To protect the shallow roots of sequoias, park officials now discourage visitors from camping near the trees.

Autochrome by National Geographic Photographer J. Baylor Roberts © N.G.S.

The General Sherman: Earth's Biggest Living Thing

The 3,500-year-old giant looms 272 feet, as high as a 25-story building. Its trunk alone contains enough wood to build a good-sized village.

National Park Mountain, the greedy sound of a trout sucking in a grasshopper, the distant song of a coyote.

While the campfire danced under the starry sky, the men discussed what should be done with this country they had been exploring for nearly five weeks. In the group sat Gen. Henry D. Washburn, Surveyor-General of Montana Territory; Nathaniel P. Langford, vigilante law enforcement officer who later became Yellowstone's first superintendent; and 2d Lt. Gustavus C. Doane, U. S. Army.

At first they argued about staking personal claims, but Cornelius Hedges, a judge in Montana Territory, demanded that Yellowstone's unique natural beauty not be owned by a few individuals. "I feel it should be a national park," he said.

The other leaders agreed, and promised to urge the proposal as vigorously as they could. These men kept their word, and such was their prominence that Congress passed the Yellowstone establishment act two years later.

I know of nobody today who seriously questions the wisdom of that Congressional decision. Further, each succeeding Congress and every Presidential administration since 1872 has strengthened and added to the concept proclaimed around the Yellowstone campfire. President Eisenhower and the present Congress are no exceptions. They have given strong support to the national parks, even though such support costs a lot of money.

Early Visitors Captured by Indians

Curious visitors started coming to the first national park right away. Sometimes they had more adventures than fun.

Some of Chief Joseph's Nez Percé Indians attacked and robbed two parties of tourists in 1877, but left them their scalps. I wonder what these good folk would think could they come back to the parks today and see Indians serving as rangers, fighting fires, working as hotel bellhops, or staging the Hopi dances at El Tovar Hotel in Grand Canyon!

Yellowstone became a huge success, and Congress created more parks. Sequoia, Yosemite, and Mount Rainier came into the new system of "pleasuring grounds," as they were first known, before the turn of the century.

The year 1906 saw passage of the Antiquities Act. It permits Presidents to make national monuments of historically and scientifically interesting places by simple proclamation. This important law has given the Nation about half its National Park System. It was conceived originally to protect the Indian ruins of the Southwest from souvenir hunters.

When a Lawyer Ran the Parks

The Park Service was created as a bureau of the Department of the Interior in 1916. Until that time Interior had been running parks as a sort of extra chore. Most of the work fell to W. B. Acker, an assistant attorney for the department. He performed it with devotion, but since he had only limited time and facilities, he could not please everybody.

One of his critics was Stephen T. Mather of Chicago, owner of a borax fortune. Mather wrote his old college friend Franklin K. Lane, Secretary of the Interior, and said he thought the department was doing a pretty poor job with the parks.

Retorted Lane: "If you don't like it, come and run the parks yourself." Mather accepted.

One of the first men to whom Secretary Lane introduced him in Washington was Gilbert Grosvenor, then Editor, later President, and now Chairman of the Board of Trustees of the National Geographic Society. Dr. Grosvenor enthusiastically supported Mather's plan for a specialized Park Service, helped write the legislation that created it, and guided The Society to a friendship with the parks that is as firm today as it was in the beginning.

In 1915 Dr. Grosvenor went on a camping trip Mather arranged in California's Sierra Nevada for some influential people he hoped would help sell his park ideas (pages 596-7).

Golden Castles Overhang This Trail in Bryce Canyon, Utah

Created in 1928, Bryce Canyon National Park preserves a veritable city of sculptured figures, domes, spires, and temples in a strip 20 miles long. Here park naturalists guide hikers along Navajo Loop Trail. Many parties number 100 strong.

Horses ford Big Thompson River in Rocky Mountain National Park, Colorado (next two pages). Raw beauty of the great Front Range of the Rockies distinguishes this park, established in 1915. Amid glacial meadows and evergreen forests rise 65 named peaks exceeding 10,000 feet. Through them winds a cloud-drifted highway, one of the Nation's highest.

Kodachromes by William Belknap, Jr. (opposite) and National Geographic Photographer Kathleen Revis © N.G.S.

PRECEDING PAGES FOLD OUT.

National Geographic Photographer J. Baylor Roberts

San Francisco Designers Shape New Buildings for Olympic National Park

By 1966 the Park Service expects to play host to 80 to 100 million people a year. To accommodate the flood while preserving the natural beauty of its show places, the service two years ago undertook Mission 66. This 10-year, $800,000,000 project aims at increased visitor facilities, extended trails and roads, and enlarged park staffs. These experts, scanning blueprints for Olympic park, Washington, work in the service's Western Design Office.

Horace Albright, who still serves on the Park Service's advisory board, was a member of the party.

Last summer, while I was in Sequoia National Park attending a meeting of the board, Horace proposed to show me the spot where Mather and Grosvenor, scorning tents, pitched their bedrolls on the forest floor beneath a giant tree and likely talked half the night about the proposed Park Service.

We never did find it. At least we knew that the scene was the Giant Forest. Money contributed by the National Geographic Society helped the Park Service acquire this magnificent grove of ancient sequoias.

Recently The Society gave us Russell Cave in Alabama as a national monument. Here the Smithsonian Institution excavated Indian campfire ashes 9,000 years old.* It is one of the few properties in the park system that memorialize North American man from the time of his arrival here from Asia, between 15,000 and 37,000 years ago, and the time he built villages in the Southwest, about the beginning of the Christian Era.

In 1933 President Franklin D. Roosevelt consolidated under our care a whole host of national monuments, military parks, memorials, and cemeteries previously administered by the War Department and the Department of Agriculture. Two years later Congress passed legislation authorizing the establishment of National Historic Sites, and 23 areas have now been so designated by Secretaries of the Interior.

Among the responsibilities we assumed in the thirties was the park system of Washington, D. C. It contains 792 pieces of property, including the Washington Monument (page 661), the Lincoln Memorial, Rock Creek Park, parts of the Chesapeake and Ohio Canal, and so many statues I've lost count.

We have the White House on our books, too. We don't tell the First Lady how to run her household, of course, but we keep the gardens neat and the lawns mowed.

Today the Park Service looks after 24 million acres of land in 181 units scattered through mainland United States, Alaska, Puerto Rico, Hawaii, and the Virgin Islands. Yellowstone was the first park; Russell Cave is the newest. Katmai National Monument,

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "National Geographic Society Presents Russell Cave to the American People," by Melville Bell Grosvenor, and "Russell Cave: New Light on Stone Age Life," by Carl F. Miller, both March, 1958; and "Life 8,000 Years Ago Uncovered in an Alabama Cave," by Carl F. Miller, October, 1956.

Lichens Spread Gold on the Bark of These Trees

A strange combination of algae and fungi, lichens do not suck the sap of big conifers but subsist on food and moisture extracted from the air. These golden staghorn lichens grow on western white pines in Lassen Volcanic National Park, California. This park preserves Lassen Peak, the only recently active volcano on the United States mainland.

Rising 10,466 feet at the southern end of the Cascades, the mountain erupted violently in 1914 and 1915. Tongues of glowing lava crept 1,000 feet down the slopes, while the fiery blast felled trees more than three miles distant. Melting snows caused destructive mud flows.

In sharp contrast to the devastated area, Lassen park embraces sparkling lakes and majestic evergreen forests among its 105,022 acres. The park was established in 1916.

Youngsters in Lassen park learn to identify birds with an electric quiz board. When a wire is touched to a bird's name on a list and another to a brass tack beneath the right picture, an electrical circuit is completed and a light shines atop the board.

Photographs by Charles K. Mohr

The "New Look" in Park Architecture: Yellowstone's Canyon Village Lodge

First development built during Mission 66, this new guest center lies within earshot of Yellowstone's thundering falls. Visitors stay in 500 motel-style units clustered beneath tall pines. The lodge, a split-level structure that stretches a city block, houses a dining room, cafeteria, lounge, photo studio, and gift shop.

with 2,697,590 acres, is largest; the House Where Lincoln Died in Washington, D. C., the smallest.

Only 29 areas bear the official designation "national park," but I often use the word "park" in its generic sense, to cover any of the units. Scenic values primarily distinguish about a third of the 181.

The others stand as milestones in the history of man or, in a few cases, indicate how our planet looked when there was no man on earth, but only huge reptiles and strange vegetation. For example, part of Dinosaur National Monument graphically tells a story of the earth before humans came, while Independence National Historical Park in Philadelphia helps record events of the Revolution and early days of the Republic.

Attributes often overlap. Grand Canyon has scenery, history, and, as we have seen, prehistory. Death Valley in California epitomizes this country's desert lands and their unique inhabitants, but it is also very beautiful to look at.

There is no use having fine parks if we do not keep them that way, and that is why the Park Service has launched its Mission 66 program, most comprehensive the parks ever had. To understand the need for Mission 66, let's go to Yosemite, where Billy Nelson flouted protocol, and stand by the road in Yosemite Valley, heart of the 760,951-acre park in California (pages 598, 600-1).

"More than 7,000 cars, carrying maybe 25,000 people, are in the valley today," the superintendent tells us.

"The tent people are overflowing the camp grounds. The park visitors who like easier living have taken every hotel room and every cabin. Fishermen stand shoulder to shoulder in the streams. Traffic crawls bumper to bumper on the road up to Glacier Point.

"Connie, they are mashing the valley flat—God bless 'em."

Right there is our big problem. Creating our Park Service in 1916, Congress bade us "conserve the scenery and the natural and historic objects and the wildlife therein and . . . provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

How do you "conserve" the natural things with 25,000 people milling about on 4,500 acres? You could do it by fencing the people out, but what happens to the "enjoyment"?

From the very beginning the Park Service has been protecting the fragile and irreplaceable, but, at the same time, it has been building facilities for people, things like roads, trails, hotels, campgrounds, and information centers, so the people can come and enjoy the wonders we protect for them.

For some years it had been getting more and more obvious that the use-versus-preservation conflict in the park system was not being successfully solved. In 1925 the parks drew 2,054,000 visits. Last year there were more than 59 million!

Furthermore, we estimate that by 1966 we'll be having somewhere between 80 million

Bloodhounds Lead a Mock Search at the Yosemite Training School

Training equal to years of field experience is crammed into the service's 12-week course conducted twice yearly in Yosemite Valley. Another Mission 66 project, the school indoctrinates new park employees, including rangers, naturalists, historians, and archeologists. A dog-food company of Oakland, California, lends its crack bloodhound team to demonstrate search and rescue.

National Geographic Photographer J. Baylor Roberts

Kodachrome by Ralph Gray, National Geographic Staff © N.G.S.

Sands airlifted by wind and trapped by the Sangre de Cristo Range (left) roll like stormy seas in Great Sand Dunes National Monument, Colorado. Vagabond dunes build crests up to 800 feet, highest in the inland United States.

Winter's ermine frames the blue of Crater Lake, Oregon. Carbon-14 tests on a burned tree buried under pumice show the crater was formed by explosion of Mount Mazama about 4500 B.C. The 1,966-foot lake is the Nation's deepest.

Jack Breed

Prehistoric Indians decorated these canyon walls in Dinosaur National Monument on the Colorado-Utah border, site of the Nation's richest deposit of dinosaur fossils. Mr. Wirth inspects the pictographs.

and 100 million visits a year. Truly the parks are being loved to death.

The President and Congress accepted Mission 66 enthusiastically. In operation almost two years, it will end in 1966, the service's 50th anniversary year. That's why we call it Mission 66. Already we have completed Stevens Canyon Road in Mount Rainier National Park, a job begun in 1931. Yellowstone has its brand-new Canyon Village (page 616). Grand Teton has a new campground with ingenious parking places for trailers at Colter Bay. Yorktown and Jamestown in Colonial National Historical Park, Virginia, have modern visitor centers.

But Mission 66 is much more than the physical improvements program it appears at first glance to be. The building is just a means to an end. Mission 66 includes adequate park staffs, better use of the system for the benefit of more visitors, better interpretation, and, above all, thorough safeguarding of park wilderness, most prized element of even the most heavily used park.

While the work is going on, you'll have to put up with a few inconveniences. But when all is completed, you will find the parks better than ever. Our goal is a National Park System worthy of the Nation for many years to come.

A fine new Mission 66 building is in Dinosaur National Monument, which sprawls across the Utah-Colorado line along the Green and Yampa Rivers. We had it include a part of the "quarries" of dinosaur bones that form the main feature of this area; visitors walk through it and see the bones still in the rocks where the big reptiles were found.

Dinosaur represents still another rung in the ladder of time that begins in the depths of the Grand Canyon. No human ever saw the owners of the bones in their living state, for these dinosaurs died before men lived.

In addition to the bone quarries, the monument pays dividends in the form of magnificent canyon scenery and thrilling rides down the swift Yampa River in small boats.*

The first time I made the run the current was swift, the spray flew, and I thought I was doing something mighty dangerous. My companions, experienced rivermen, just laughed.

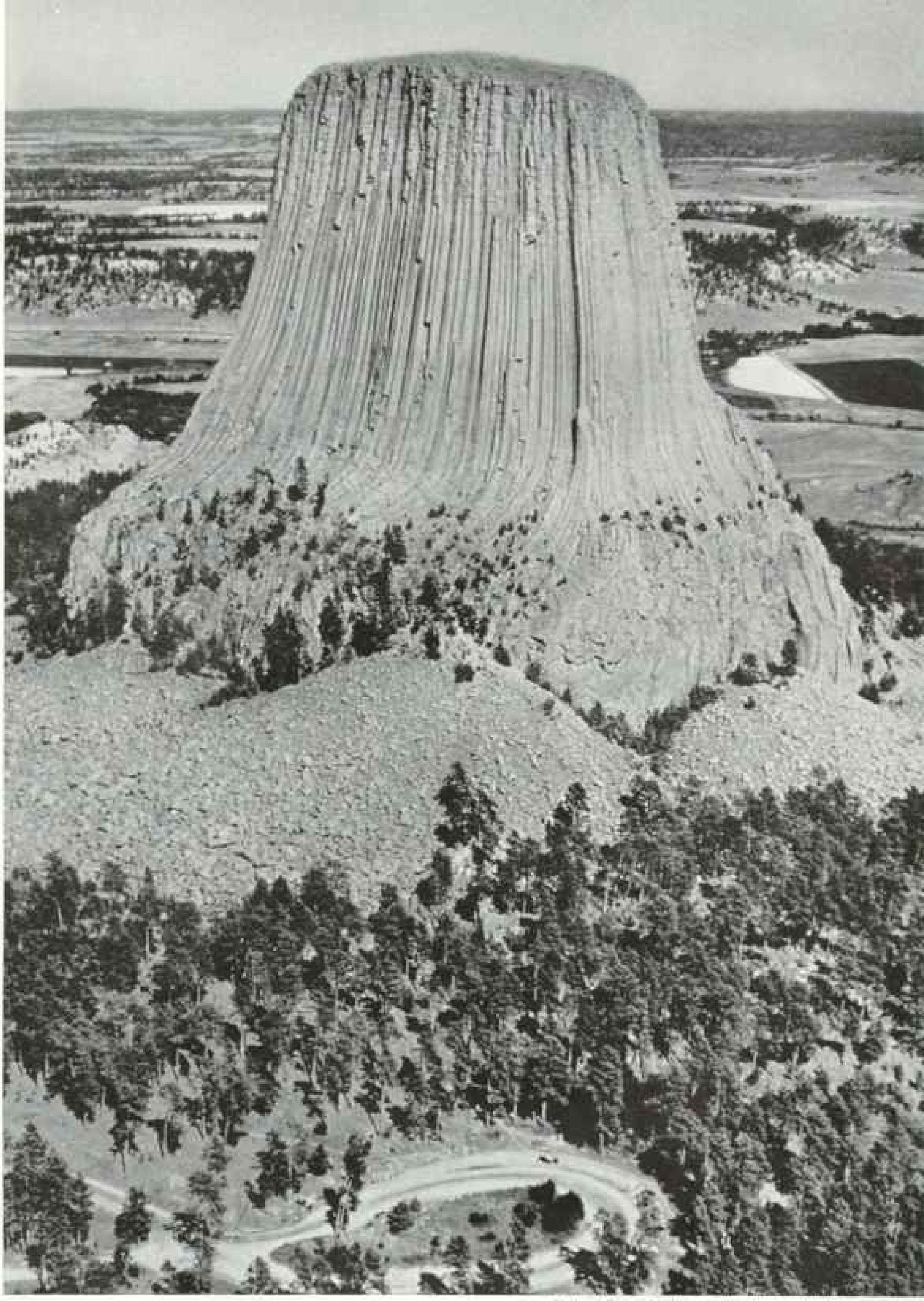
"Shucks," they said, pointing to the rapids beside which we had pitched our camp, "even a silly goose can shoot this stretch."

Sure enough, a flock of Canada geese was coming down the white water, bobbing like tumbleweed. When they reached a still pool, they took wing and went honking back upriver. Later I looked out over the water and there they were, happily shooting the rapids again. Next morning, when we went on our way, I thought the river ran less fast.

24-Year Drought Routed Pueblo Indians

From Dinosaur to Mesa Verde National Park in the southwestern corner of Colorado is a few hundred miles in distance but millions of years in time—from the age of reptiles to the age of man. Archeologists tell us Mesa

* See "Shooting Rapids in Dinosaur Country," by Jack Breed, NATIONAL GEOGRAPHIC MAGAZINE, March, 1954.



National Geographic Photographer Bates Littlehales

Devils Tower, a Bunyanesque Stump, Looms on the Wyoming Plains

Formed from molten rock, this fluted wonder was uncovered by more than a million years of erosion. In 1906 President Theodore Roosevelt declared it America's first national monument. Many climbers have attained the platform summit 857 feet above the parking circle.

Verde dates from about A.D. 1, when primitive Indians wandered in, saw a land then verdant and suitable for farming, and settled down for a stay of 1,300 years.

At first they lived in the shallow natural caves common in this part of the country, and then in simple pit houses with crude roofs. Their descendants progressed to the building of great masonry and adobe pueblos.

The most recent Mesa Verde Indians made beautiful pottery and feather-cloth garments. They fashioned jewelry of the local turquoise and wove colored designs into cotton cloth. They developed a rigid social structure and a highly ritualistic religion.

The decline began for them A.D. 1276, as established by the tree ring calendar.* Drought set in and lasted 24 years. The people moved away; nobody much saw the mesa again until the 1880's, when cowboys wandered in and spread news that attracted serious archeologists.

Indians Lived on Dizzy Heights

I love these ruins. I stand on Park Point at the top of the mesa, and I know I stand where bronze warriors once kept lookout for nomadic enemies raiding in over the rough country to the south and west or the hazy mountains to the north and east.

I look over the edges and see the cliff dwellings stuck like swallows' nests to the yellow sandstone. I can imagine Indian women grinding corn in the very metates that now rest in glass cases at the headquarters visitor center, and I can see fat children playing in the dust near low walls that keep them from falling hundreds of feet onto the canyon floor.

The visitors who follow rangers up dizzy ladders and steep rock steps to Balcony House or Cliff Palace command my admiration (page 642). They take the attitude that if the Indians climbed around like goats, they can do it too, and they rarely panic.

Indians, past or present, fascinate park visitors. The staff at Mesa Verde claims it gets a record number of questions, although the rangers at Aztec Ruins, Bandelier, Tuzigoot, Walnut Canyon, and the other Indian sites say the same thing.†

If the American Indian didn't mind living on the side of a sheer cliff, he did show signs that he feared the deep, dark places of the earth. We have found but few indications that he ventured very far back from the mouths of any of the park system caves.

That reminds me of Carlsbad Caverns in New Mexico. This is our biggest underground wonder; in fact, it is one of the world's largest caves. Only about 23 miles of it have been explored. We know it has three general levels, the lowest 1,100 feet deep.

The things visitors see defy description: the Big Room, a mile and a quarter around and 285 feet high in places; the King's Palace and Queen's Chamber with gleaming stone draperies and curtains; tremendous stalagmites such as the Giant Dome, thousands of years old.

Although a prehistoric Indian lost a sandal in the cave entrance long ago, Carlsbad was not explored by white men until 1901, when a cowboy investigated what looked like a dense cloud of black smoke pouring from the foothills of the Guadalupe Mountains. The smoke, he discovered, was millions of bats, and they were coming out of Carlsbad Caverns.

Mammoth Cave Has Stygian Rivers

Water made Carlsbad by dissolving limestone; actually an ancient, buried coral reef. Unless water flows in still unplumbed depths, Carlsbad has stopped growing. Mammoth Cave in Kentucky, on the other hand, has underground rivers we know about; we can be sure it is still undergoing some change.

Wind Cave, South Dakota, is our only cave

* See "Secret of the Southwest Solved by Talkative Tree Rings," by Andrew Ellicott Douglass, NATIONAL GEOGRAPHIC MAGAZINE, December, 1929.

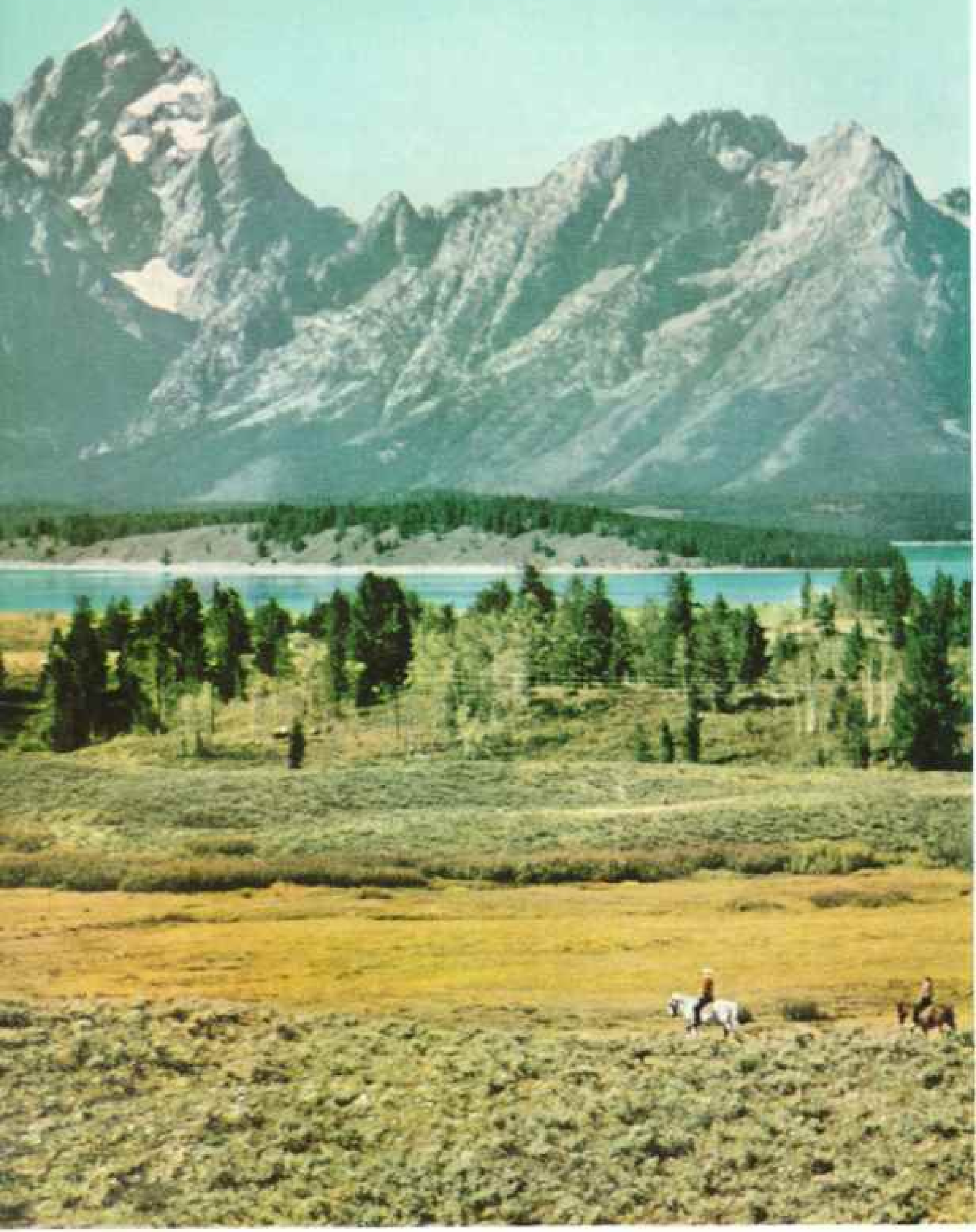
† See the National Geographic Society's color-illustrated volume *Indians of the Americas;* also "Ancient Cliff Dwellers of Mesa Verde," by Don Watson, NATIONAL GEOGRAPHIC MAGAZINE, September, 1948.

A figure out of the old West, Col. Idaho Ellison (opposite, above) greets a visitor to Jackson Hole in Grand Teton National Park, Wyoming. He entertains dudes with tales of fighting on the Mexican border, driving a stagecoach, and acting in Western movies.

Grand Teton has more than 130 miles of trails. Horseback riders favor the Lake Trail that follows the base of the range on the horizon. Highest point in this view is Grand Teton.

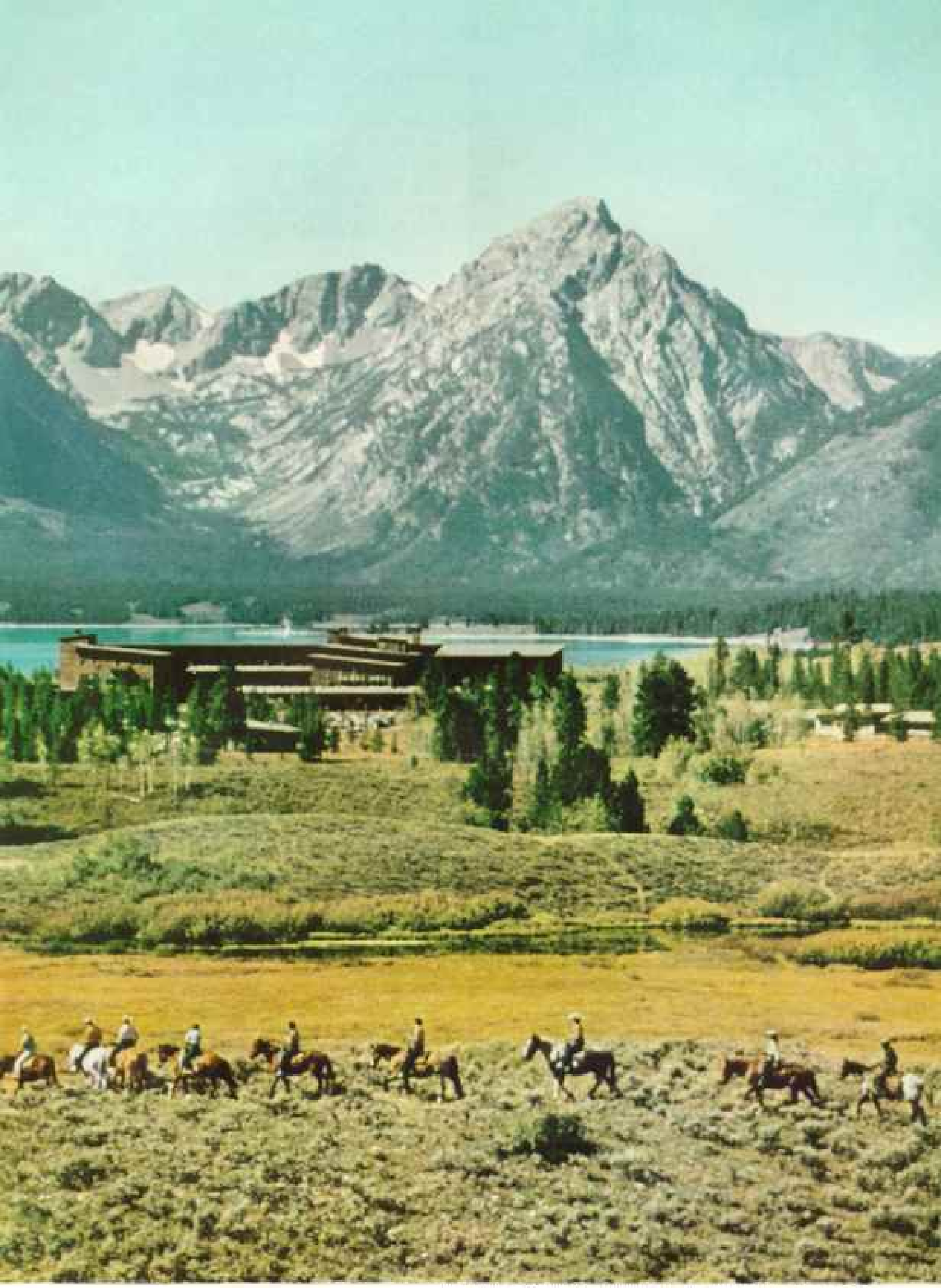
Braced against swirling currents, Derek and Karen Craighead cast for trout in the Snake, the "Mad River" of old-time mountain men. Labrador retriever stands guard. French trappers named the distant Tetons for a fancied resemblance to a woman's breasts.

Kodachromes by National Geographic Photographer J. Baylor Roberts (above) and John Craighead © N G S.



Spires of the Tetons Pierce the Heavens Above Secluded Jackson Hole

Established in 1929, Grand Teton National Park lacked the lakes and valley of Jackson Hole—the natural setting for its mountain splendor. Conservation enthusiast John D. Rockefeller, Jr., saw the need



Kodachrome by National Geographic Photographer J. Baylor Roberts © N.G.S.

and set about acquiring private holdings in the basin. In 1950 the park was enlarged to include valley lands; 30,000 acres were the gift of Rockefeller-supported Jackson Hole Preserve, Inc. This conservation foundation built Jackson Lake Lodge (center) and helped develop more modest guest facilities at near-by Colter Bay and Jenny Lake. A Bureau of Reclamation dam raises Jackson Lake's natural level.

with boxwork. To make these formations, water deposited calcite in intersecting limestone cracks, then dissolved out the limestone to leave the calcite veins crisscrossing like the walls of a honeycomb (page 645).

Wind Cave National Park also has 28,059 acres of range and forest land on which the buffalo roam and the antelope play, to say nothing of the prairie dogs. Farmers and stockmen have waged war on prairie dogs so long and so effectively that the pert little rodents have become almost extinct on the ranges they inhabited in such vast numbers in the old days. At Wind Cave they live under protection as part of the natural scene.

For the sassiest prairie dogs in the National Park System I nominate the ones at Devils Tower National Monument in Wyoming (page 621). There they stand begging beside the road in a well-drilled line. I have seen people ignore the striking Tower entirely and spend the day feeding the prairie dogs.

If we want to see truly wild animals, we'll go to Alaska, where the influence of man has been felt the least. Mount McKinley National Park, which contains the highest mountain on the North American continent, offers a varied assortment of wild creatures.*

* See "Wildlife of Mount McKinley National Park," by Adolph Murie, National Geographic Magazine, August, 1953.

(*Continued on page 635*)

Climbing "Victim" Rides a Stretcher Down a Mountain's Rocky Face

Thousands of climbers gather in Rocky Mountain National Park each summer. Longs Peak attracts the largest throngs. Accidents are rare, but rangers must be prepared to bring down the injured with all possible speed. Here, at a training session, a four-man rope team practices an alpine traverse across a deep ravine.

National Geographic Photographer Kathleen Revis

Using rope as brake, a summer fire lookout rappels down a precipice in Mount Rainier National Park. Rappelling, dangerous though it appears, is the mountaineer's safest descent on sheer cliffs.

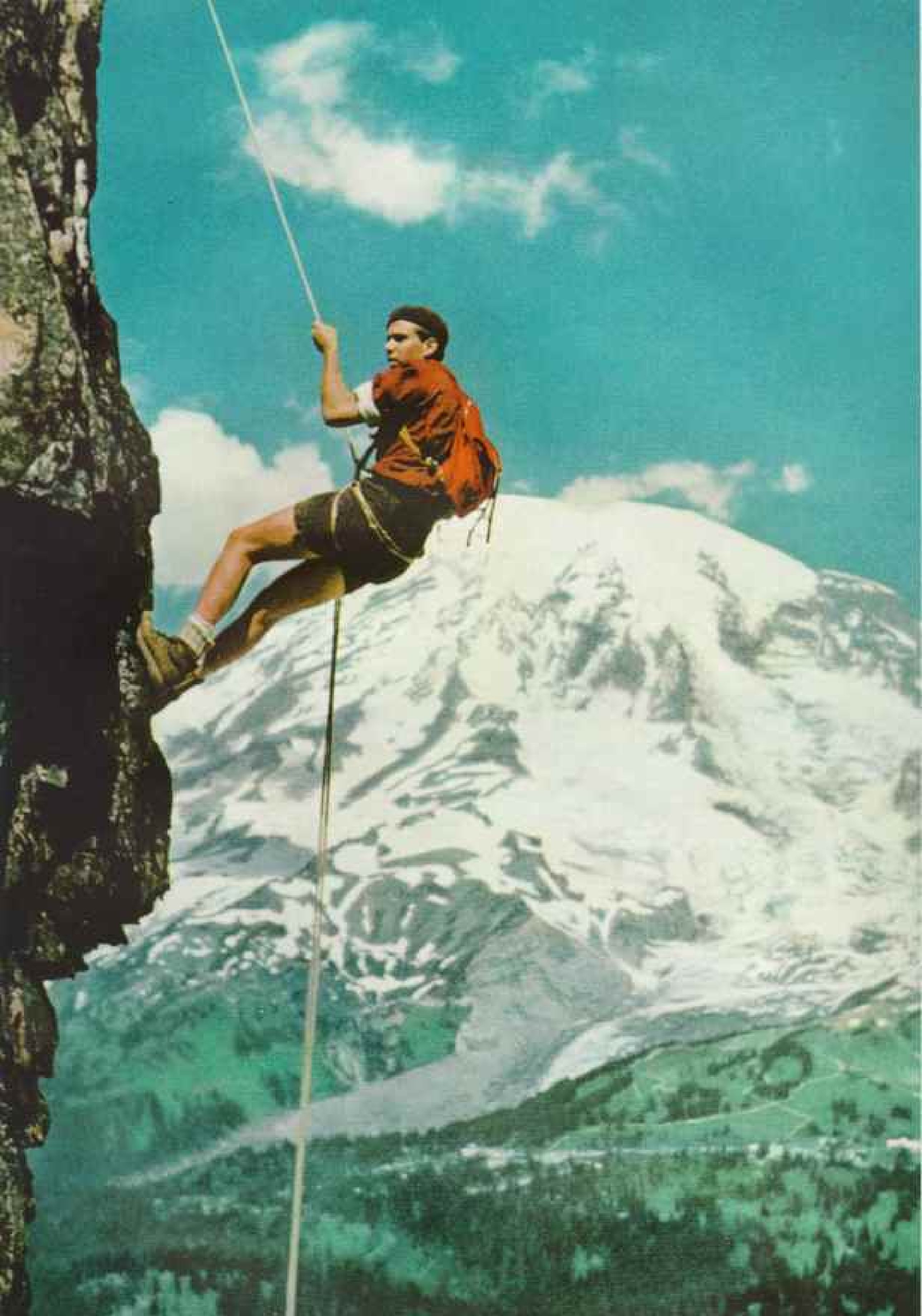
Mighty Mount Rainier, from a base in Washington's rugged Cascade Range, lifts its crown 14,410 feet above sea level. On clear days residents of Seattle, 60 miles northwest, can see the snowy giant.

Kodachrome by Ruth Kirk

Pages 628-9

Wind and water hollowed this fairyland grotto in Paradise Glacier on Mount Rainier, whose flanks support more glaciers than any other peak in the United States. Filtered sunlight tints the walls a luminous blue.

Kodachrome by Ray Atkeson © National Geographic Society



Nets Dip Silver Smelt in Olympic National Park

Of all U. S. parks, only Olympic, on the northwest thumb of the State of Washington, embraces both snow-capped mountains and ocean beaches. Massive peaks provide some of the continent's finest alpine scenery, yet no point lies more than 60 miles from the sea.

When the Pacific's high spring tides wash the park's narrow, 50-mile-long coastal strip, smelt ride in on the surf to spawn in the sand. Fishermen capture thousands in scooplike nets.

Even Rooftops Spring to Life in the Lush Olympic Woods

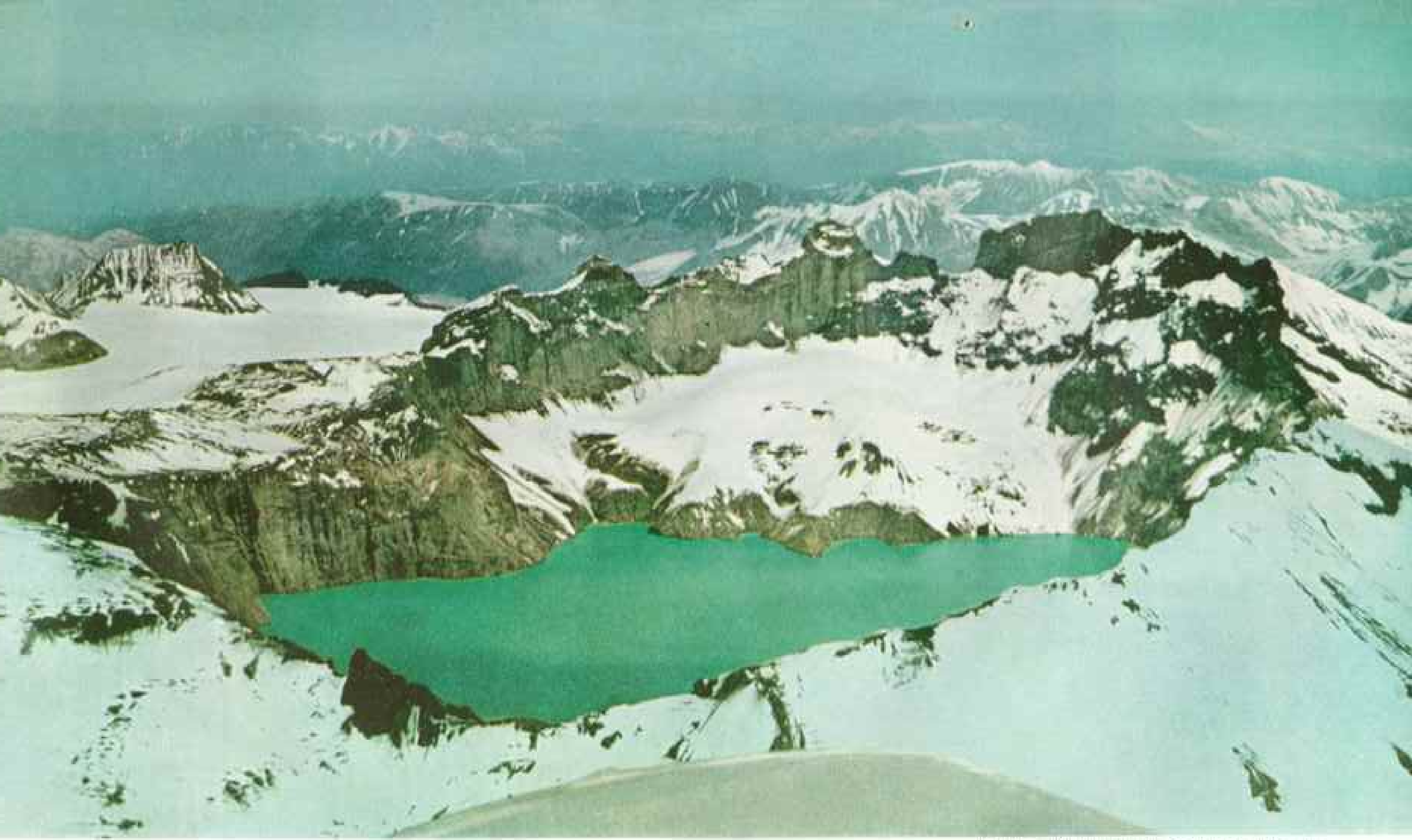
Biologist Paul Zahl, his wife, and two youngsters lived nearly three months in the primeval wilderness while exploring the peninsula's forests, lakes, and needle-spined ridges. (See "In the Gardens of Olympus," NATIONAL GEOGRAPHIC MAGAZINE, July, 1955.)

Ferns and mosses grow atop this log cabin in the depths of Soleduck forest.

Luxuriant rain forests, nurtured by 12 *feet* of rain a year, cloak many of Olympic's deep, twisting valleys. Dense stands of giant Douglas fir, western hemlock, Sitka spruce, and red cedar thrive here.

Mosses upholster fallen trees with green velvet. Oregon oxalis and bead-ruby carpet the floor.

Kodachromes by Paul Zahl and Charles E. Mohr (both) © National Geographic Society



Kodachrome by Gilbert Grosvenor © National Geographic Society

A jade lake laps Katmai Crater in the heart of Alaska's Katmai National Monument. Violent explosions blew off the mountain's top in 1912, leaving a hollow 2½ miles wide. President Woodrow Wilson proclaimed the region a national monument in 1918, after a series of National Geographic expeditions explored it. Here a baby glacier on the crater wall (center) creeps toward the lake.

Sprawling Haleakala Crater in Hawaii National Park could almost swallow Manhattan Island. Cinder cones (as in the center) dot the 19-square-mile depression. Clouds drift across the crater. Haleakala last erupted two centuries ago. The park embraces both Haleakala on the island of Maui and the Kilauea-Mauna Loa domes on Hawaii.

Mountain Goats Leap a Six-foot Chasm in Glacier National Park

Hundreds of mountain goats roam this high wilderness. Digging nonskid hoofs into the rock, they scramble up and down the cliffs. Cousins of the agile European chamois, they are not true goats. Both sexes wear black, spikelike horns. Billies weigh as much as 300 pounds.

When this nanny spotted photographer Sharpe, she bounded effortlessly across the gorge leading to Sperry Glacier. An instant later her kid made the leap with equal ease.

Sixty-odd glaciers and 200 lakes nestle amid the craggy peaks of the Montana Rockies in million-acre Glacier Park.

Perched on the heights, a billy keeps watch on the world. Like other creatures of the park, he is off limits to hunters.

Kodachromes by Grant Sharpe (above) and Wilford L. Miller

The Barren Ground caribou live here, and in no other park. So do the Toklat grizzly bear; the Alaska moose, largest of its kind; the timber wolf; and the Dall sheep, kin to the Rocky Mountain bighorn. These animals need wilderness for survival (pages 636-7).

Mount McKinley furnishes a fine example of the way in which animals live together successfully under the stern laws of nature. Here is a lesson in ecology that helps us in other parks where man and his civilization disturb the natural balance more than in McKinley.

To put it in its simplest terms for brevity's sake, wolves eat caribou, ground squirrels, and Dall sheep, whichever is most readily available. But men also like to hunt Dall sheep, and in the late thirties the rivalry between men and wolves over the sheep became intense. We don't allow hunters in national parks, of course, but the animals cross boundaries as they please.

The men came to us. "You're protecting the wolves so well," they told us, "that they're overrunning the country. They're killing your sheep and ours too."

We undertook a study that eventually revealed a fairly simple explanation. The Dall sheep were declining not from wolf depredations, but from poor grazing that was due to a prolonged spell of adverse weather.

Meanwhile caribou, creatures with mysterious migratory ways, were not staying in the park as much as they usually do. The other principal wolf food, ground squirrel, is always hard to dig out in the winter.

So the wolves had to prowl far and wide to

Splash of Paint Signs the Death Warrant for a Sick Saguaro Cactus

A virulent rot threatens destruction of southern Arizona's spectacular cactus forest in Saguaro National Monument.

Park Service naturalists, fighting to save the desert sentinels, order diseased plants chopped down to help safeguard the healthy giants.

Charles W. Herbert, Western Way

A Bull Moose Wades Wonder Lake Below Majestic Mt. McKinley

Once threatened with extinction by hunters, the Alaska moose now roams in ever-increasing numbers through the spacious sanctuary of Mount McKinley National Park.

Giant of the deer family, the bull moose stands 6 to 7 feet at the shoulder and weighs more than 1,400 pounds. Antler spread may exceed six feet.

Mount McKinley, principal scenic feature of its namesake park, rears its snowy head 20,320 feet above sea level, highest point in North America.

Morton J. Wood

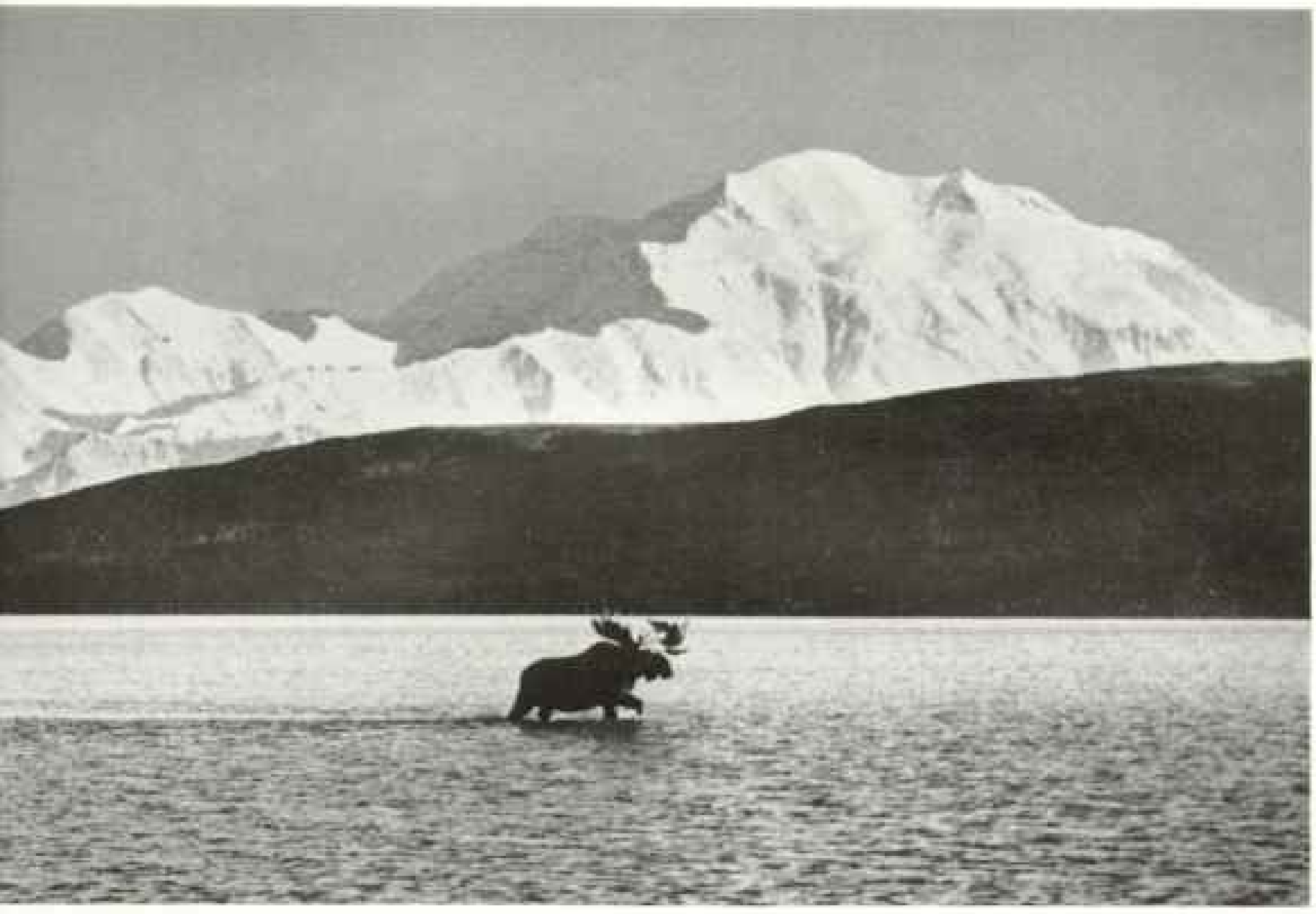
Warren P. Steenbergh

Toklat grizzly, named for Alaska's Toklat River, pads across lowland tundra in Mount McKinley park. Rarely seen, the beast betrays its presence by the craterlike holes it leaves in its search for ground squirrels.

A male Toklat may measure nine feet from nose to tail and weigh as much as half a ton. Surprisingly agile despite its enormous bulk, the humpbacked, dish-faced creature is cautious, even timid. It will seldom attack man unless provoked.

A young visitor meets Tame Tillie the fox, a resident of Mount McKinley park. Other inhabitants include the gray wolf, rare wolverine, coyote, mink, marten, lynx, and Dall sheep. More than 80 kinds of birds nest in this wilderness.

The park is open to visitors from May through October.



Richard Peard

eat, and people mistook a few fast-ranging, hard-to-catch animals for whole packs. As a matter of fact, the wolf population had actually dropped.

Since then the weather has changed, the grass has come back, and the sheep have increased, all in the normal, if sometimes slow-moving, course of natural events. We expect the wolves to increase too. We hope so. To have true wilderness, we must have all the parts of an ecological pattern.

Volcanoes Erupt Unseen

Now I want to fly you over Katmai National Monument, country so wild that until just a few years ago, when we put our own explorers in, the most reliable information we had on the area came from quarter-century-old records of seven National Geographic Society expeditions, five of them led by Dr. Robert F. Griggs.*

Here even such cataclysmic events as volcanic explosions can take place unheard and unseen. A mountain erupts. Smoke and ash drift over some settled parts of Alaska. A military plane then goes in to see what happened, but, by the time it arrives, the volcano may already have started to simmer down.

A concessioner has built comfortable camps on the area's blue lakes within recent years. Guests come in uneventfully by seaplane, the only way they can get there unless they want to walk.† My own most recent inspection flight was unusual in that it almost ended in disaster.

Five of us made a full load for the aircraft. We flew first into the Valley of Ten Thousand Smokes. Earth's inner fires were banked; only a relatively few steamy plumes rose from the desolate wilderness below us.

Climbing in tight circles, we headed for the top of Mount Katmai. We made it, and looked down into the green lake that never freezes, even in the toughest winters, because of the volcanic heat in its depths (page 632).

We started away. Suddenly I found myself actually bumping the ceiling of the plane. My companions, our cameras, and all the loose gear banged about in the cabin as though weightless.

Later the pilot told us we had struck a violent downdraft and dropped entirely out of control for 2,000 feet.

"I leveled off only a few hundred feet above some of the wickedest rocky terrain I ever saw," he said.

On the way back to King Salmon Airport, I thought of the endless variety of the National Park System. Here in Katmai, had we crashed, only a prowling fox or bear might ever have found us. Inside the Statue of Liberty—yes, that's a national monument too—I could not even have tripped and fallen; somebody would have caught me before I hit!

I never say one park is "best." If I did, I would make the superintendents of the other 180 mad enough for mutiny. Therefore, instead of comparing Katmai with our other spectacularly eruptive property, Hawaii National Park, I'll just say they are different.

Fiery Streams Turned by Bombs

Where Katmai's volcanoes are wild things, Hawaii's Kilauea, Mauna Loa, and Haleakala are fairly well domesticated. The first two, the most active ones, are on the island of Hawaii. Haleakala, believed nearly dead, is on Maui (page 633).

Science has been studying them all for many years and knows when they are about to get dangerous. Volcanologists' warnings generally enable people to get out of the way of their fiery lava flows, although fields and villages have to stay where they are and take their chances.‡

Bombing from the air twice tamed Mauna Loa. Lava flows endangered the city of Hilo in 1935 and again in 1942. The bombs diverted the fiery streams.

Kilauea's most murderous outbreak took place in 1790, and that was really an accident. A little army of native Hawaiian sol-

(Continued on page 647)

* See, in the National Geographic Magazine: "Our Greatest National Monument," September, 1921; "Valley of Ten Thousand Smokes," February, 1918; and "Valley of Ten Thousand Smokes," January, 1917, all by Robert F. Griggs.

† See "Alaska's Warmer Side," by Elsie May Bell Grosvenor, National Geographic Magazine, June, 1956.

‡ See "Photographing a Volcano in Action," by Thomas J. Hargrave, National Geographic Magazine, October, 1955.

Rainbow Bridge, World's Largest Natural Arch, Soars Across a Dry Creek

Because it stands deep in the canyon country of southern Utah, one of the Nation's most remote and inaccessible areas, few visitors see the salmon-pink colossus. Almost as long as a football field and wide enough for a two-lane highway, the arch would top the United States Capitol. President William Howard Taft in 1910 proclaimed it a national monument.

Rotogravure by Ralph Gray, National Geographic Staff © N.G.S.

Ektachrome by Josef Muench (above); Kodachromes by Ralph Gray (opposite, above) and Edwards Park (below), National Geographic Staff © N.G.S.

Shaggy giant yuccas stud Dagger Flat in Big Bend National Park, Texas. Land of pink deserts, piñon-clad hills, and forested mountains, Big Bend hugs the Mexican border where the Rio Grande makes a sweeping U-turn. Congress established the park in 1944.

Hundreds of rock-hard trees litter Petrified Forest National Monument, Arizona. This tree, a pine, is called Broken Bridge; one section forms a keystone arch.

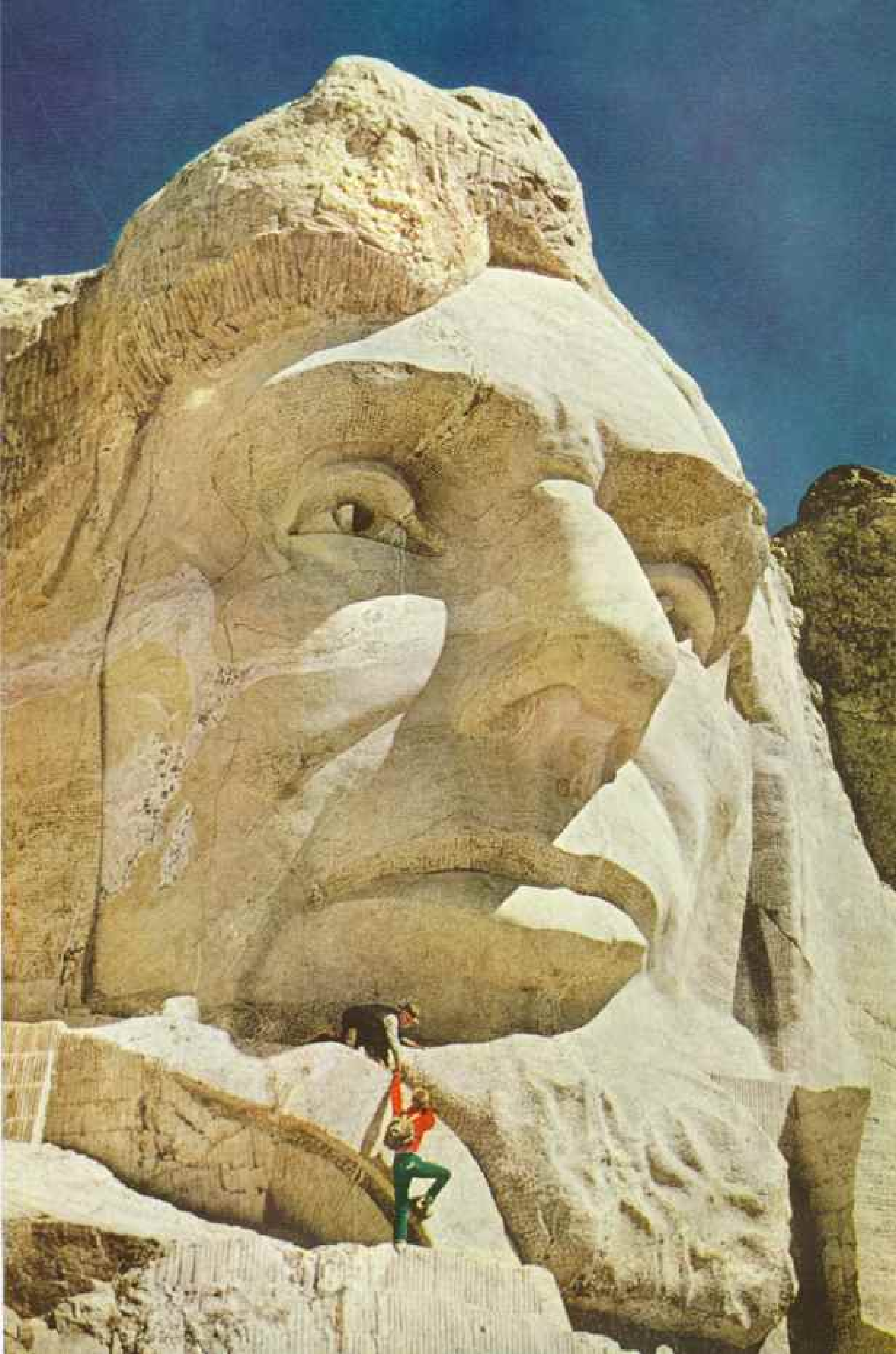
Below: Young visitors attempt to decipher eight-century-old Indian petroglyphs on Newspaper Rock, Petrified Forest. Father prefers a paper he can read.

Cliff Palace, a Mesa Verde Cave City, Endures Beneath a Sandstone Roof

Seeking protection from their enemies and the elements, Pueblo Indians of southwestern Colorado filled the cave with stone houses piled story upon story.

Kodachrome by Margaret Durrance from Rapho Guillumette © National Geographic Society

On the mesa top above their homes they planted crops and hunted game. A 24-year drought in the 13th century compelled them to abandon farms and cliff dwellings. The National Park Service preserves this marvel of masonry. Its guides show visitors some of the 200 living rooms and 23 kivas.



A riot of green in humid Fern Cave contrasts with desert-dry landscape only a few feet overhead. Lava Beds National Monument safeguards these northern California wonders.

Lincoln's Granite Likeness Looks Down from Mt. Rushmore

Washington, Jefferson, Lincoln, and Theodore Roosevelt stand visible for 60 miles from the top of this 5,725-foot mountain in South Dakota's Black Hills. Lincoln's face measures 60 feet from chin to hairline.

Sculptor Gutzon Borglum and his son Lincoln blasted and tooled for 14 years to create the images. More than 800,000 visitors a year stand in awe before the shrine. Mount Rushmore is one of a dozen areas designated as national memorials.

Delicate calcite veins lace the limestone walls and ceilings in Wind Cave, a national park on the southeast flank of the Black Hills. The rare boxwork formations, found in only a few of the world's caverns, are colored in soft, warm hues. Strange wind currents give the cave its name. When the barometer is falling here, winds blow out of the cave; when it rises, they blow in.

Kodachromes by National Geographic Photographer Bates Littlehales and Charles F. Moir (above) © N.G.S.

Anhinga, the Snakebird, Spears a Fish

Going—going—gone! After stabbing the bream, a female anhinga in Everglades National Park, Florida, takes the catch ashore, shakes it violently, and gulps it (right). Anhingas swim with body submerged while head and neck extend like a periscope.

Kodachromes by Frederick K. Truslow
© National Geographic Society

diers happened to be marching past some six miles away. Kilauea wiped them out with a blast of hot gas. Prints of their bare feet survive in solidified ash.

Islanders call Halemaumau, the crater of Kilauea, the "drive-in volcano." A highway runs almost to the edge of the bubbling, steaming pit. The visitor runs his car onto a handy parking lot, then walks the few steps to the brink of eternity. Between him and eternity, however, stands a stout wire fence.

If the livelier volcanoes are acting up, you can fly over to Maui and take a horseback ride into somnolent Haleakala and see the silversword, one of the rarest plants on earth. Before the Park Service took over, visitors who did not realize the silversword grew nowhere else dug it up and took it home in such quantities that it nearly became extinct. Our protection saved it, as it has saved rare plants and animals in other parks as well.

Early Parks Carved from the West

Established in 1916, Hawaii is one of the fairly early big parks. All the early ones on the mainland, unlike Hawaii, came out of tracts of land already owned by the Federal Government. That put them all in the West, for the simple reason that the East never has had any substantial amount of public domain.

When it came time to create eastern parks, private owners held the land from which parks could be made. Congress declined to buy any with taxpayers' money. Private philanthropy then stepped in.

Wealthy men showed the way. Substantial folk from Boston and New York with summer homes on Maine's Mount Desert Island felt they had something too wonderful to be enjoyed alone. So they unselfishly gave their property to the Nation, and Acadia National Park joined the people's estate.

The Rockefeller family's magnificent contributions to the park system began at Acadia. John D. Rockefeller, Jr., donated the properties necessary to round out the Federal holdings. A family gift of $5,000,000 to match State and other contributions helped establish Great Smoky Mountains National Park in Tennessee and North Carolina, the most visited of all the national parks (page 656).

We owe Linville Falls on the Blue Ridge Parkway to Mr. Rockefeller, and he contributed thousands of acres in Jackson Hole for Grand Teton National Park (pages 622, 624).

His son Laurance, who became a National Geographic Trustee late last year, gave us our newest national park, Virgin Islands, a tropical playground of white beaches and blue water dedicated in 1956 (pages 654-5).

These are some of the major Rockefeller contributions to the Nation's parks. There have been many others. In both a quantitative and a qualitative sense, the Rockefeller family has been the greatest single private benefactor of the park system.

Thousands of Donors Gave Seashore Area

Foundations established by Mrs. Ailsa Mellon Bruce and Paul Mellon—the Avalon and the Old Dominion—donated half the purchase price of the 28,500-acre Cape Hatteras National Seashore Recreational Area on the Outer Banks of North Carolina, the only such property we presently possess. The State of North Carolina gave the other half, which means that every one of its citizens played a part in this generous act.

The foundations also gave us the money for studies designed to show us where we or the States can acquire other seacoast areas before all United States shorelines pass into the hands of private resort developers.

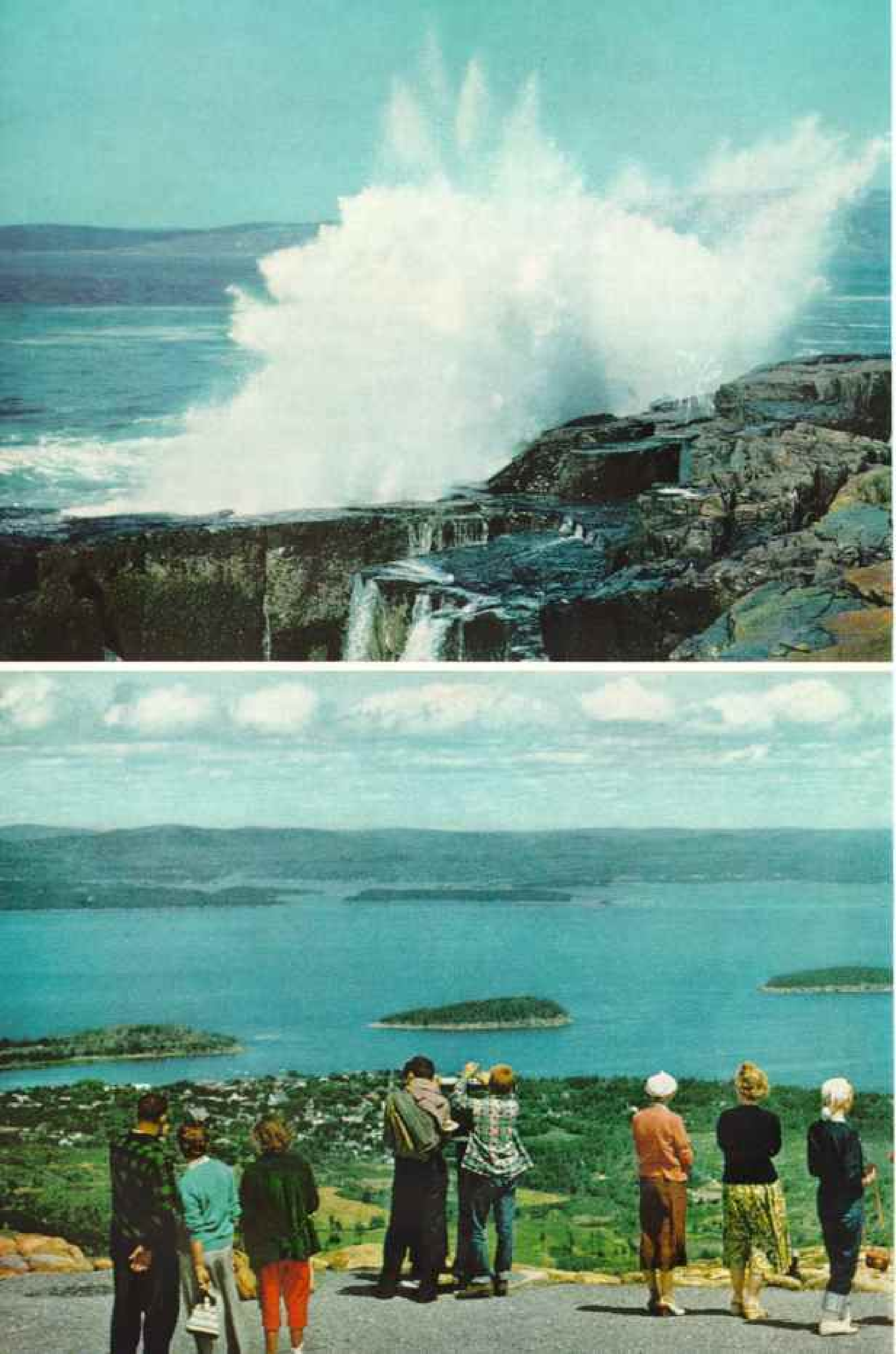
Several parks given by States happen to be on the itinerary of our current inspection trip. One is Big Bend National Park on the Mexican border. We have the State of Texas to thank for these 708,221 acres of glorious desert-mountain scenery (page 640).

Back in the late thirties, I pounded a lot of saddle leather in Big Bend as I helped solve land planning problems. "Uncle Everett" Townsend often rode with me. He was one of the park's prime movers.

At various times Texas Ranger, State legislator, and old-time county sheriff, he spun me many a yarn about Apaches, Western bad men, and Mexican smugglers who used to infest this wild, hot country.

Better than the stories, though, I remember the taste of the barbecued goat meat Mexican ranchers hospitably furnished us. Good at first, it lost its appeal for me after being heated over on the third or fourth day. Neither did I care overmuch for the "eggnog" made of goat's milk and fiery tequila, but of course that is a matter of personal taste.

Mexico has plans for establishing its own park just across the Rio Grande from us. We would like that, for then we could work out arrangements with Mexico for another inter-



Surf Bursts Like an Artillery Shell Against Acadia's Granite Shore

Tang of brine and seaweed mingles with the perfume of evergreen and bayberry in Acadia National Park, oldest in the East. Here, in millenniums past, the coast of Maine gradually sank and blue tongues of the Atlantic poured into valleys, lapping mountains rounded by long-vanished glaciers.

This wave batters Schoodic Peninsula, the park's small mainland appendage. Mount Desert Island, where most of Acadia lies, looms across Frenchman Bay.

Visitors to Mount Desert Island stand atop 1,530-foot Cadillac Mountain and survey the Porcupine Islands, tops of drowned hills. The famous old resort town of Bar Harbor hugs the shore at left.

Samuel de Champlain, exploring for France, named Mount Desert in 1604, 16 years before the Pilgrims landed at Plymouth Rock. Nine years later England's Virginia colonists raided the island, opening the long Anglo-French struggle for North America. Mainlanders began vacationing on the island in Civil War times. Philanthropists gave the park lands to the Nation in 1916.

Kodachromes by National Geographic Photographer B. Anthony Stewart (lower) and Paul G. Fassnacht, Jr., National Park Service © N. G. S.

national, across-the-border park like the one on the Montana-Canada line.

We call that one Waterton-Glacier International Peace Park, and it is made up of the Canadian Waterton Lakes National Park and our Glacier National Park. People cross the border at will, symbolizing the good relations between the United States and her neighbor to the north.

Big Bend is one of the park system group of living desert museums that includes Death Valley National Monument, where "Death Valley Scotty" built his fabulous castle and the borax traveled by mule team; Saguaro National Monument at Tucson,* home of a magnificent stand of saguaro cactus (page 635); and Organ Pipe Cactus National Monument, also in Arizona.

The President Refused to Sell

Shenandoah, second national park in the East, came as the welcome gift of Virginia. It was quite a chore rounding up the land, for on it lived hundreds of proud mountaineers who built their own log cabins and could shoot a squirrel in the eye from as far away as they could see him.

One owner wouldn't sell. No native mountaineer was he, but former President Herbert Hoover. "Take it as a gift," he said, and deeded over his Camp Rapidan, where he fished and rested during vacations from the White House.

In the fall the hardwood forest along the famous Skyline Drive blazes with red and yellow of changing leaves. The park staff that must handle traffic has no trouble believing that a third of the country's population, including the inhabitants of Washington, D. C., live within a day's land journey.

Senator Harry Flood Byrd of Virginia, when he was governor, played an important part in the drive to acquire enough land for Shenandoah. He is a real parks enthusiast and has been my companion on more than one wilderness trip.

One time I had him on a hike in Glacier.† We came to a sign reading "4 Miles to Pinnacle Wall." We walked for two hours, then came to another that said: "3½ Miles to Pinnacle Wall."

The senator flopped down beside the trail. "How in the world do you measure distances here?" he panted.

"We have a bicycle wheel on a stick, with a meter hooked to it," replied Park Superintendent Jack Emmert. "Ours is right old, and I guess there's some slack in the gears."

"Go get a new one," said the senator. "I'll personally see to it there's an extra $1.50 in the next Park Service appropriation to take care of it."

I guess the senator delivered. The sign was fixed the last time I was in Glacier.

Jungly Hammocks Dot the 'Glades

Everglades National Park, gift from Florida, is a subtropical water wonderland, a place of mystery. Strange hammocks, islands of rank vegetation, stud its flat expanses of waving marsh grass.

I can imagine thin smokes rising from these hammocks—campfire smokes of the Seminole Indians who once roamed this region. Never defeated by the United States although thousands of soldiers hunted them through the 'Glades, the Seminole no longer live inside park boundaries, but visitors sometimes see them going about their own business, wearing their brightly colored clothes.‡

We'll go into Everglades by boat, for that is the only way large parts of it can be reached. As we follow a dark stream winding through the tangled jungle, something plops into the water from the bank.

"Muskrat," you venture.

"No. Otter. It's plentiful in the park," says the superintendent.

Grass ripples in a natural clearing.

"One of the rare crocodiles?" you ask.

"No, alligator. I saw the blunt nose. But we do have crocs in the salt-water parts of the park."

Countless thousands of birds make trees appear covered with snow, or rise in dense clouds. They are water birds of numerous kinds—egrets, wood ibis, herons, roseate spoonbills, and many others (page 646).

Panthers lurk somewhere in here, we know; this is one of their last stands in the eastern United States. Snakes slither about in the jungly undergrowth.

Guns once roared night and day in the 'Glades. Plume hunters brought the American egret to the verge of extinction; the National Audubon Society stepped in just in

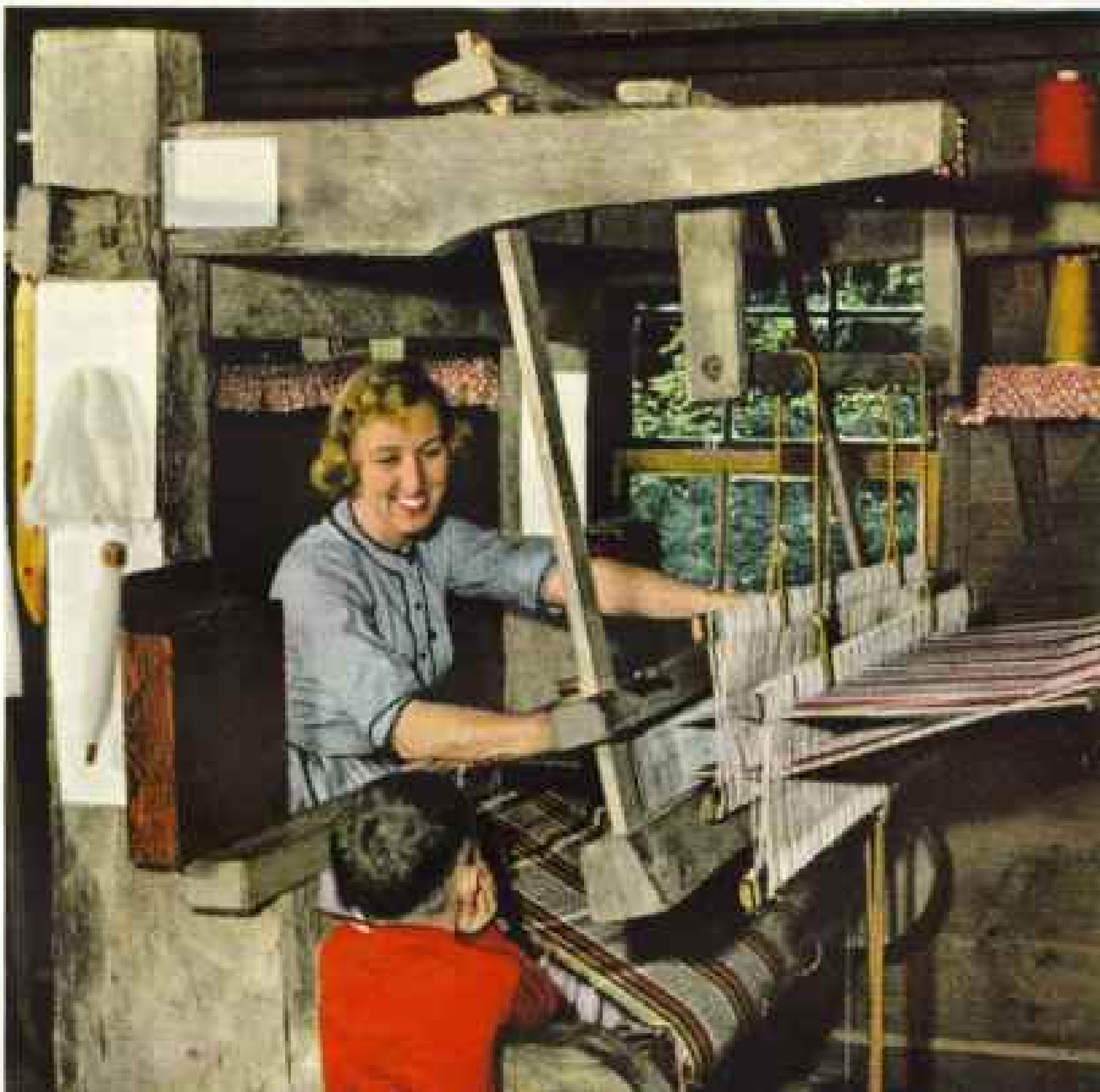
* See "Saguaro Forest," by H. L. Shantz, National Geographic Magazine, April, 1937.

† See "Many-splendored Glacierland," by George W. Long, National Geographic Magazine, May, 1956.

‡ See "Florida's 'Wild' Indians, the Seminole," by Louis Capron, National Geographic Magazine, December, 1956.

Weathered Mabry Mill on Blue Ridge Parkway Runs by Water Power

Riding crests of the Appalachians between Shenandoah and Great Smoky Mountains National Parks, the Nation's most used scenic highway last year drew millions of motorists, despite unfinished stretches. The National Park Service maintains roadside rail fences, a pioneer's bear-proof pigpen, and clay-chinked log cabins to remind visitors of a way of life fast vanishing from the southern highlands. Years ago Mabry Mill served as a community center for the village of Meadows of Dan, Virginia.



A 100-year-old hand loom weaves cloth from flax grown in a back-yard plot near Air Bellows Gap, North Carolina.

Kodachromes by
M. Woodbridge Williams,
National Geographic Staff © N.G.S.

W. P. Alston, National Park Service

Black Bear and Frolicking Cubs Give Camera Fans a Treat in the Smokies

"DANGEROUS. Bears are wild animals, even though they appear tame. Don't feed or tease them; keep a safe distance." So warn the Park Service signs in big, bold letters, but each year a hundred or so careless visitors are clawed or mauled by the bruins. More than 250 black bears inhabit the wilderness area of Great Smoky Mountains National Park.

time.* Commercial demand for hides endangered the alligators and crocodiles.

Gunners shot baby manatees for their veal-like meat. Farmers sought to drain the life-giving water to make croplands. Collectors even decimated the wild orchids.

Now this place is a park; rangers warn the hunters away, and your children's children will enjoy it in its primeval state. I strongly suspect they will have to come in by boat, as we did. As long as the Park Service holds it, roads should end where the mysteries of the Everglades begin.

Not all gifts to the park system are on the scale of Acadia or Everglades. We're indebted to hundreds of individuals for smaller contributions. Large or small, every gift has been welcome; they are a sure sign that the people of the Nation value their parks.

Everglades is a nature park, and so are the others we've visited thus far—even the Indian ruins, for the Indian lived close to nature and rarely upset its delicate balance. Now we'll visit some landmarks of American history, and I hope you'll note how they are neatly

* See "Saving Man's Wildlife Heritage," by John H. Baker, NATIONAL GEOGRAPHIC MAGAZINE, November, 1954.

grouped to commemorate important periods.

Among the early explorers in the Southwest, a Spaniard named Oñate left his "Kilroy was here" message in the soft stone of a New Mexico cliff in 1605. Before him, Indians had doodled on the same cliff; after him, people bound for the California Gold Rush left their marks. Now we treasure the place as Inscription Rock in El Morro National Monument.* But times have changed. The modern visitor we catch carving up this or any other park is in for a bad time!

Castillo de San Marcos at St. Augustine, Florida, dates from 1672. The Spanish built it to hold back the restless British settlers to their north. We have monuments to those settlers too—Fort Frederica, Georgia, built to repulse possible Spanish attack from the south; the Lost Colony of Fort Raleigh, North Carolina; and Jamestown, Virginia, site of the first permanent English settlement in this country.†

Independence National Historical Park in Philadelphia is a sacred place. Independence Hall, home of the Liberty Bell, stands as the heart of the park. In this very building the early leaders signed the Declaration of Independence, heard George Washington accept command of the Continental Army, and adopted the Constitution (page 658).

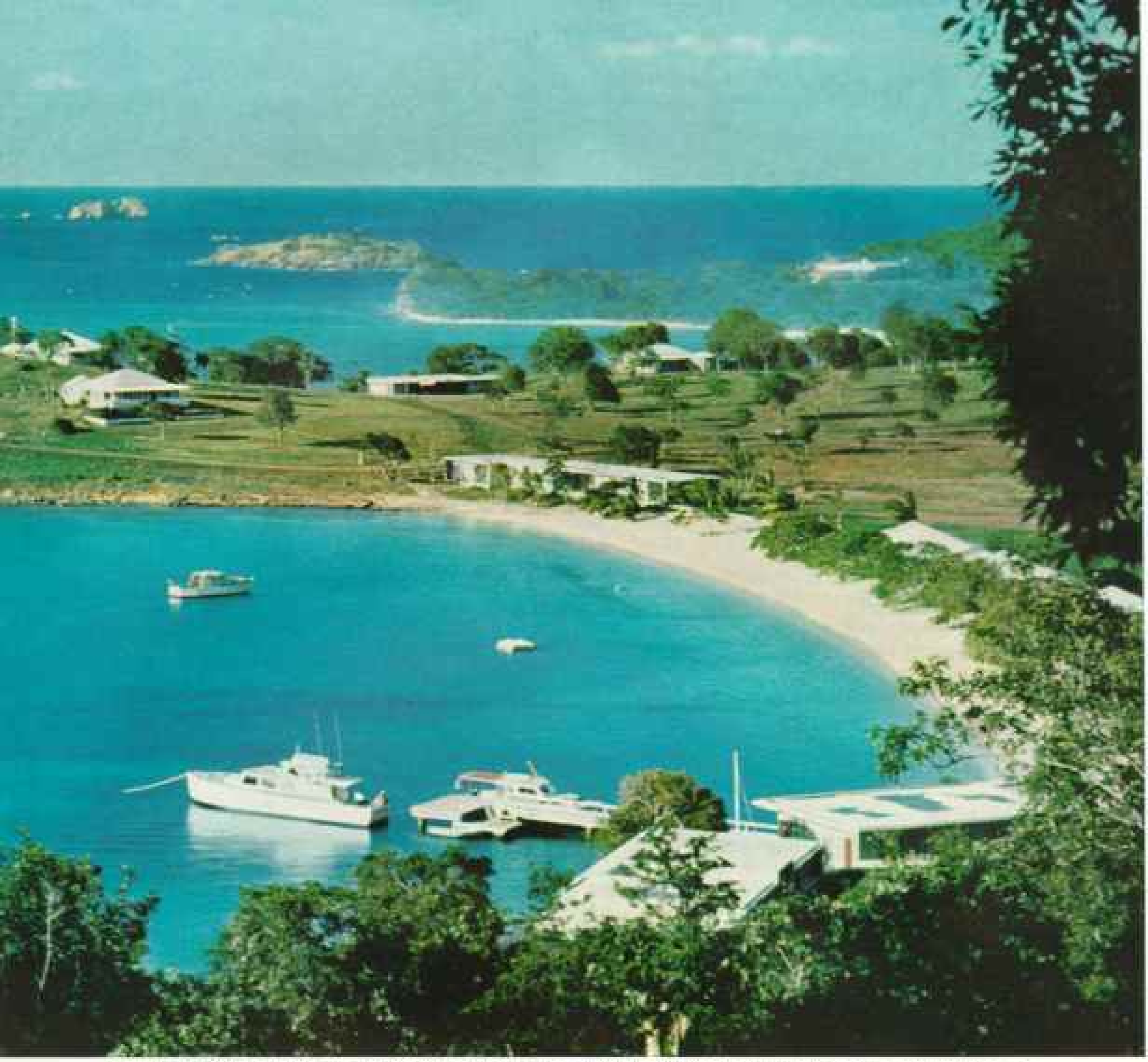
* See "El Morro: Story in Stone," by Edwards Park, National Geographic Magazine, August, 1957.

† See "Captain Smith of Jamestown," by Bradford Smith, National Geographic Magazine, May, 1957.

Rogue Bear, Banished for Bad Manners, Flees His Wheeled Prison

When a bear becomes a chronic nuisance around campgrounds or highways, rangers live-trap the offender. A section of corrugated culvert pipe, baited with honey-soaked bread, serves as trap. The captured animal, head daubed with red paint to identify it, is released 20 or 30 miles away in another section of the park. A ranger, armed with an ax handle, frees this black bear on the Nez Perce Creek fire road in Yellowstone park.

Kenneth Fink



Kodachrome by Melville Bell Grosvenor (left, below) and Ektachrome by Sam Falk, Jackson Hole Preserve, Inc. © National Geographic Society

Caribbean Shangri-La: Virgin Islands' Caneel Bay Plantation

Virgin Islands National Park, America's 29th and newest, spreads across most of 19-square-mile St. John Island, a region of unspoiled natural beauty and primitive charm with a soft climate that varies only six degrees from winter to summer.

St. John is accessible only by boat; visitors ferry four miles across Pillsbury Sound from the neighboring island of St. Thomas. Caneel Bay Plantation, the tiny isle's principal guest facility, can accommodate 140 beside this curved, uncluttered beach.

Dedication ceremonies for Virgin Islands National Park on December 1, 1956, saw Laurance S. Rockefeller (left on platform) present a deed for 5,000 acres of St. John's green hills and white beaches to Secretary of the Interior Fred A. Seaton (center). Mr. Wirth completes the trio. Mr. Rockefeller, a National Geographic Society Trustee, made the gift on behalf of Jackson Hole Preserve, of which he is President. Photographers ring this handstand in the port village of Cruz Bay.

In Congress Hall, Washington was inaugurated for his second term as President, and here, too, he delivered his last formal message to Congress. Near by stand Carpenters' Hall, in which met the first Continental Congress, and the old First Bank of the United States. Here, too, is the site of the house in which Benjamin Franklin lived and died.

The park, still unfinished, owes its existence to close cooperation between the Federal, State, and city governments, and private organizations. Each has done what it could; who holds the land titles is of no importance.

We have similar arrangements at other historic sites, and we have other cooperative duties, assigned us by Congress. We help States and local communities plan their own park systems, the thought being that if we all work together, we will wind up with one big nationwide system in which all units interlock to fill everybody's needs.

Clouds Flow in a Niagara of Mist; Great Smokies Live Up to Their Name

More people visit Great Smoky Mountains National Park than any other, but comparatively few get off the paved roads. Only Cherokee Indians and a handful of mountaineers ever made homes in the mysterious world of rainy heights and tangled rhododendron thickets.

The Smokies themselves form such clouds by deflecting warm winds upward to cooler heights, where moisture condenses into billions of droplets.

We cooperate with scientific organizations, such as the Smithsonian Institution and State universities, in excavating archeological sites threatened by the building of new dams, pipelines, or highways. We help other Federal agencies plan recreational uses for lands under their primary jurisdiction; Lake Mead, Arizona and Nevada, is an example.

Other things about the Park Service might surprise you. We are the country's largest manufacturer of museum exhibits; we use the product in visitor centers, formerly called museums.

In Hawaii we struggle to save the nene (pronounced nay nay) from extinction. The nene, in case you didn't know, is a little brown goose that hates to fly. It spends its life walking about on the slopes of Mauna Loa.

Zoos Get Free Bears

In the Nation's Capital we operate a big police force, the United States Park Police. Some of its members are more like rangers than policemen and patrol their beats in Rock Creek Park on horseback.

We stock zoos with surplus elk and bears which have formed the habit of associating too closely with people (pages 652, 653). We do this free. We conduct no businesses ourselves, but we do have under contract some 150 private concessioners who annually furnish upward of $40,000,000 worth of goods and essential services to park visitors. But this is getting off the subject of historic places.

Our Revolutionary period sites include Morristown, the battlefields of Saratoga and Kings Mountain, and the scene of Cornwallis's surrender at Yorktown. A few years ago a park superintendent showing the present Lord Cornwallis around Yorktown was having difficulty finishing his sentences.

"These are the guns of the French battery that wiped out—well, uh, these are genuine French guns, made in France," he would say, and start for the next point of interest.

The visitor ended any embarrassment by quoting the reply his brother, a captain in the Royal Navy, made when an American asked him if he was related to "the Lord Cornwallis who lost the Colonies."

"Yes," came the answer, with a twinkle, "I am a distant descendant of the man who *founded* the United States!"

Our best known War of 1812 monument is Fort McHenry in the harbor of Baltimore, Maryland. Here Francis Scott Key wrote "The Star-Spangled Banner." Every year the bombardment that inspired him is re-enacted. A Coast Guard vessel lights the night sky with the "rockets' red glare."

Cumberland Gap National Historical Park marks the westward route of such pioneers as Daniel Boone. Scotts Bluff National Monument in Nebraska and Fort Laramie in Wyo-

M. Woodbridge Williams, National Geographic Staff

ming stand on the old Oregon Trail. Rangers can show you ruts worn deep into the earth by covered wagons.

Custer Battlefield lies peaceful today beneath the Montana sun. The rangers there can tell you how Custer and some 200 of his men fell beneath the guns and arrows of whooping Indians.

The park system contains the major Civil War battlefields and cemeteries — Chickamauga, Shiloh, Vicksburg, Gettysburg, Antietam. We have Fort Sumter, where it all began, and Appomattox Court House, where it ended. We are restoring Harpers Ferry, made famous by John Brown's raid.

Years ago I helped buy the land for Manassas National Battlefield Park in Virginia. I was there when a very old man got out of a car with a New York license plate and joined a group being lectured by an employee of the historical society which then owned the grounds.

"On that little hill," said the lecturer, "the New York troops fought a fierce 15-minute engagement and then retreated."

"'Tain't so!" shouted the old man, waving his cane. "They didn't retreat. They dropped their guns and run like all getout."

"The history books don't say so," retorted the caretaker.

"Durn the history books. I ought to know what happened. I was one of 'em. I run right by where you're standing and I never slowed down 'til I hit the Potomac, neither!"

A dozen or so sites commemorate the Nation's progress in science, industry, religion, and the building of a modern society. Mount Rushmore National Memorial in the Black Hills of South Dakota has turned out to be one of the most popular in this group. Here colossal faces of Washington, Jefferson, Lincoln, and Theodore Roosevelt, carved in solid granite, form a moving and inspiring spectacle (page 644).

The Edison family donated the Edison Laboratory National Monument in New Jersey to the United States. We have a memorial to the Wright brothers at Kill Devil Hill, North Carolina, where the first successful airplane flight took place. The Adams Mansion and library in Quincy, Massachusetts, where lived four generations of a family that furnished two Presidents, was a gift from the Adams family.

Some Goals for the Future

The humanities group fails to tell the whole story and cries for expansion. As time goes on, we hope to locate more of these worthwhile monuments.

Another thing I'd like to see accomplished is the elimination of private ownership inside park boundaries. I don't say that everyone with an inholding is a bad neighbor, of course. But owners do change for one reason or another, and we seek full protection for your estate against such intrusions as juke joints, neon signs, and sawmills.

We could improve our park interpretation. Ranger campfire talks no longer fill the bill; there are too many people to reach this way alone (page 594). We plan to put up more interpretive markers at points of interest, and we're trying devices that deliver a talk when a visitor pushes a button.

One day I hope we'll round out the park system with more seashore areas and possibly a few more full-sized parks, although I don't believe we'll ask for many of the latter. We don't have a grasslands national park, for example, and I'd like to see one established out in the prairie country somewhere.

And now I think it's time to wind up our trip. It wasn't as extensive as I should have liked, but at least you saw some samples, and maybe you'll go out and see the rest on your own. Maybe, too, you've reached some conclusions as to the value of the parks. Maybe you agree with me that they are a necessary and valuable part of the country and its national life.

Once in a while we hear somebody say that the National Park System "locks up" valuable resources. Almost always the charge comes from someone who wants the park forests logged, or their mountain meadows opened for grazing, or dams built in their valleys.

Well, to all such we say, "Yes, the parks are locked up—to you." But to everybody else we say, "No, the charge is untrue, the parks are *not* locked up. Come, use, and enjoy them."

The use we have in mind is the noblest to which they could be put. Parks exist to strengthen bodies, refresh minds, uplift the spirits. They enrich leisure, and I believe that the way Americans use their ever-increasing leisure will determine, more even than how we work, what kind of Nation this will be fifty or a hundred years from now.

"A Visit Inspires Love of Country"

Stephen Mather thought visiting parks was well worth while, and since he said it better than I ever could, I'll just let him sum it up for me:

"Who will gainsay," Mather said, "that the parks contain the highest potentialities of national pride, national contentment, and national health? A visit inspires love of country; begets contentment; engenders pride of possession; contains the antidote for national restlessness.

"It teaches love of nature, of trees and flowers, the rippling brooks, the crystal lakes, the snowclad mountain peaks, the wildlife encountered everywhere amid native surroundings. He is a better citizen with a keener appreciation of . . . living here who has toured the national parks."

Independence Hall, Home of the Liberty Bell, Stands Misted in Snow

The United States began life in this hallowed shrine, heart of Independence National Historical Park, Philadelphia. Here the Declaration of Independence was signed and the Constitution written, and here George Washington accepted leadership of the Continental Army. The National Park Service, the State of Pennsylvania, Philadelphia, and private organizations joined hands to create the park and restore its historic buildings, including Congress Hall (not shown). By 1966 their investment will total at least $35,000,000.

Super Associations by National Geographic Photographer J. Baylor Roberts © N.G.S.

Kodachrome by Samuel W. Matthews, National Geographic Staff © N.G.S.

Bombs Bursting in Air at Washington Monument Proclaim the 4th of July

Begun in 1848, the marble memorial to the first President stood for years as an ugly, unfinished stub on the Mall in Washington, D. C. Army engineers completed the job in 1884. Today the National Park Service administers the monument.

More than 32 million visitors have taken the elevator or climbed the 898 metal steps to see the National Capital and its environs from the eight observation windows.

New floodlights installed last winter deliver an estimated 142,000,000 candle power. Powerful new aircraft warning lights were installed above the windows.

Newspaper reporters regard the obelisk as an inexhaustible mine of curious fact. One writer discovered a mouse in residence.

The 81,120-ton structure has settled some six inches since the first measurements were made. Heaters and dehumidifiers prevent condensation from falling as rain inside the shaft during sudden temperature changes.

Coins, camera lenses, and marbles sometimes fall from the windows. Major-league catchers have caught balls deliberately dropped 504 feet from window to ground.

At least two visitors have descended the stairs on their hands. One man took advantage of a temporary scaffolding to jump over the tip.

In good weather as many as 150,000 spectators crowd the grounds to watch the annual Fourth of July fireworks. Frank Davito, an expert, has supervised the show for some 35 years without a casualty more serious than a spark burn.

The Tidal Basin mirrors the monument and a bursting mortar bomb.

New Ten-Color Map Unfolds an Invitation to Roam the National Parks

WITH spring in full stride and summer vacation plans in the making, the National Geographic Society distributes to members a timely supplement to their May Magazine—a 10-color recreational map showing the national parks, monuments, and shrines of the United States and adjoining Canada.

Like an engraved invitation to travel, this latest addition to the new Atlas Series unrolls a continent-wide display of scenic, historic, and scientific wonders preserved for all time for the people's enjoyment and benefit.

This is really two maps in one, for its reverse side carries enlargements of a dozen of the most visited parks, with roads, trails, railways, ranger stations, buildings, waterfalls, and other points of interest.

Red-letter Places to See

Many members will use the new map to follow in imagination the personally conducted tour of United States parks provided by Director Conrad L. Wirth in this issue's 78-page leading article. With its aid, thousands no doubt will plan trips to take in as many of these wonderlands as possible. All are urged to retain this map—and its companions in the Atlas Series—for preservation as part of a valuable home atlas (page 732).

Red dominates this colorful map—the red-letter names of national parks, monuments, battlefields, memorials, and recreation sites. Indexed for quick location are all sites under Park Service administration in the United States, and 68 preserves in Canada.

In addition, eight hallowed shrines not under the National Park Service are located in red because no such map would be complete without them: Mount Vernon, Valley Forge, Monticello, Lincoln's New Salem, Ticonderoga, The Alamo, San Jacinto, and Tippecanoe.

Roads appear in a salmon red that blends but does not conflict with the deep red used for names. Special double-line symbols emphasize the growing number of limited-access freeways and toll roads, which now permit unbelievable time savings for the motorist.

Until the moment the great lithographic presses in Baltimore began to print 2,442,000 copies of this map, The Society's cartogra-

phers included new information to make it as up to the minute as possible. Here members will find the five-mile bridge which now unites Michigan by spanning the Straits of Mackinac. New tunnels burrow beneath the harbors at Baltimore and at Hampton Roads, Virginia. Canadians are speeding the completion of their Trans-Canada Highway, shown in a heavier line than the other roads of the Commonwealth.

Four of the most scenic and memorable drives bear the arrowhead insignia of the National Park Service, which proudly administers them: George Washington Memorial Parkway, from Washington to Mount Vernon; Skyline Drive and Blue Ridge Parkways, with their marvelous vistas, southwest of the Nation's Capital; and the historic Natchez Trace Parkway in Mississippi, under construction but growing day by day.

Many new splotches and ribbons of blue emphasize another way in which man is altering geography, for these are artificial lakes. Shown here for the first time on a National Geographic Society map are Tiber Reservoir in Montana, Table Rock Lake in Missouri, and Lewis and Clark Lake on the South Dakota-Nebraska border.

An Obliging Buck Stops Traffic in Yosemite National Park

Vacation meccas steeped in beauty and history, the 183 United States national parks, monuments, and shrines lure millions of new visitors each year. Millions more pay return calls.

In many of the larger parks, wildlife proves perhaps the greatest attraction. Creatures of the wilderness roam free and unafraid through these scenic sanctuaries. When a deer or bear strolls down the highway, motorists jam on the brakes and spill from their cars. The resulting roadblocks, nicknamed animal "jams" by tolerant rangers, are an everyday sight in Yosemite, Yellowstone, the Great Smokies, and other preserves.

National Geographic Photographer J. Baylor Roberts

General Sherman Tree Picture and Additional Maps Available

Members who have admired the four-page photograph of the giant General Sherman sequoia which unfolds between pages 602 and 611 may obtain special full-color prints on heavy paper, ideal for framing, by writing to the National Geographic Society, Department M, Washington 6, D. C. Price $2 each, postpaid to all countries. Dimensions are 29⅛ by 13¼ inches, including ample borders.

Additional copies of the new National Parks Map may be ordered from The Society at 50¢ each, postpaid. All remittances are payable in U. S. funds. The price of the larger supplement maps remains 75¢ on paper, $1.50 on fabric.

Mountains, so important in a recreational map, stand out in brown tones. A dotted red line marks the Continental Divide, plainly labeled at several points.

Large-scale Guide to 12 Parks

Whatever the interest of the visitor, the reverse-side "close-up" maps will serve as reliable large-scale guides to the dozen popular parks they depict. Here, for example, one can find Old Faithful or Artist Point in Yellowstone, locate the General Sherman Tree in Sequoia, or follow the Appalachian Trail winding down through Shenandoah.

Supplementing the 12 close-ups, three other drawings further enlarge the Yosemite Valley, in Yosemite National Park, the General Grant Grove and the Giant Forest in Sequoia, and Canyon Village in Yellowstone.

Thus this map makes a wonderful traveling companion as well as a permanent addition to each member's growing atlas of the world.

Sand in my Eyes

BY JINX RODGER

The Unusual Story of an Adventurous Couple Who Crossed the Strife-torn Algerian Sahara by Car

THERE ARE several ways to reach the Sahara, depending upon the bank balance, boldness, and backbone of the traveler.

You can fly from Algiers and within a few hours be riding a camel through the palmeries of El Goléa or sitting atop the high dunes of In Salah. You can start by train from Algiers or Oran to Colomb Béchar, then hook a ride with a friendly trans-Sahara truck going south—if you don't mind squeezing into a confined space and hearing your teeth rattle for a week or a month.

We drove, surrendering our car and ourselves to one of the most punishing trips on earth: more than 4,000 miles in 90 days. And for the Sahara, that's speeding.

My husband had crossed the Sahara twice before, during World War II, over compass routes of his own from Chad to Benghazi and then back again through Kufra Oasis to Khartoum. The Sahara beckoned, as it does to anyone who has ever fallen under its spell. And so, naturally, he had to return.

I went along as ballast. Besides, I had a curiosity about the Sahara. Was it really so hot, so full of sand, so silent, so empty, so big and wide and terrifying, so beautiful?

George had nearly died of thirst on his second

Veiled Tuareg tribesman, symbol of mystery in the Sahara, shrouds all but his eyes from the world.

Sahara crossing; so this time he made sure we were well equipped. I thought the trips to hardware shops and garages would never end. There was always something else absolutely vital; life depended on it.

He chose his vehicle with care—the newest model Land-Rover station wagon with four-wheel drive, oversize tires, double roofing and air-conditioning ventilators, extra gas tanks, short-wave radio, and heater (we needed that, too). We called her *Mzuri*, which is a Swahili word meaning "very good."

Into her we packed, repacked, and packed again, until, at last, everything had its place and nothing rattled, nothing budged. My typed list of contents—for customs officers—went on for four pages.

We spent three weeks in Paris battling for visas and permits. They were not easy to get, for the war in Algeria was in a very black period. In fact, all traffic leaving Algiers for the south was regularly attacked by well-armed bands hiding out in the mountains. So we decided to bypass the usual route and creep in from Morocco instead. The Sahara itself, we were told, was safe.

Journey to the Sun

We left Paris at the end of a cold January, and our defrosting journey to Morocco gave us time to prepare ourselves for the sun-baked days ahead. With each mile south the world became warmer and brighter.

Spring had already come to Tangier by the first week in February. We sat in an Old World English garden, correct even to its perfectly pruned rosebushes, and drank iced lemonade. Below us the sea sparkled in the sunlight, and we watched the big white ferry-boat that had brought us glide smoothly back toward Gibraltar and Europe.

Iced lemonade, the sea, the continent of Europe. Those three things haunted me over and over again in the weeks to come. Would we ever hear again the cooling clink of ice against a glass? Watch little fishing boats dancing on the water? Or glimpse the faint outline of Europe across the Strait of Gibraltar from the lush gardens of Tangier?

Roads in Morocco are very good. Mzuri kept up a steady 50 miles an hour, and in two days we were in Ujda, on the Moroccan frontier near the Mediterranean. There we were to change course and head due south to Colomb Béchar, which is in Algeria and on the very brink of the Sahara (map, page 680).*

Paved Road Ends in Rutted Tracks

At the hotel in Ujda we asked, "How's the road?"

"Excellent!" said the receptionist, an amiable Moroccan. "Paved all the way."

"Used very often?" we prodded.

"Of course," assured our genial friend. "Trucks go down every day."

So we bought a few loaves of French bread, a jug of wine, and some Camembert cheese for our lunch, and started at dawn next day.

For the first 120 miles we sped along on a smooth paved road and even passed a few vehicles. Then the surfaced road disappeared. It split up into a number of rough dirt tracks that wound through rocky ravines, low, sweeping hills, and dried-up riverbeds.

Our Shell Oil guidebook told us to follow the railway that connects Colomb Béchar with Ujda and Oran on the coast; so follow the railway we did. The trail got steadily worse. There was no traffic and no indication that any traffic had passed for quite some time. There was no frontier post either; no signboards, road markers, or gas stations.

Finally we arrived at a large and imposing

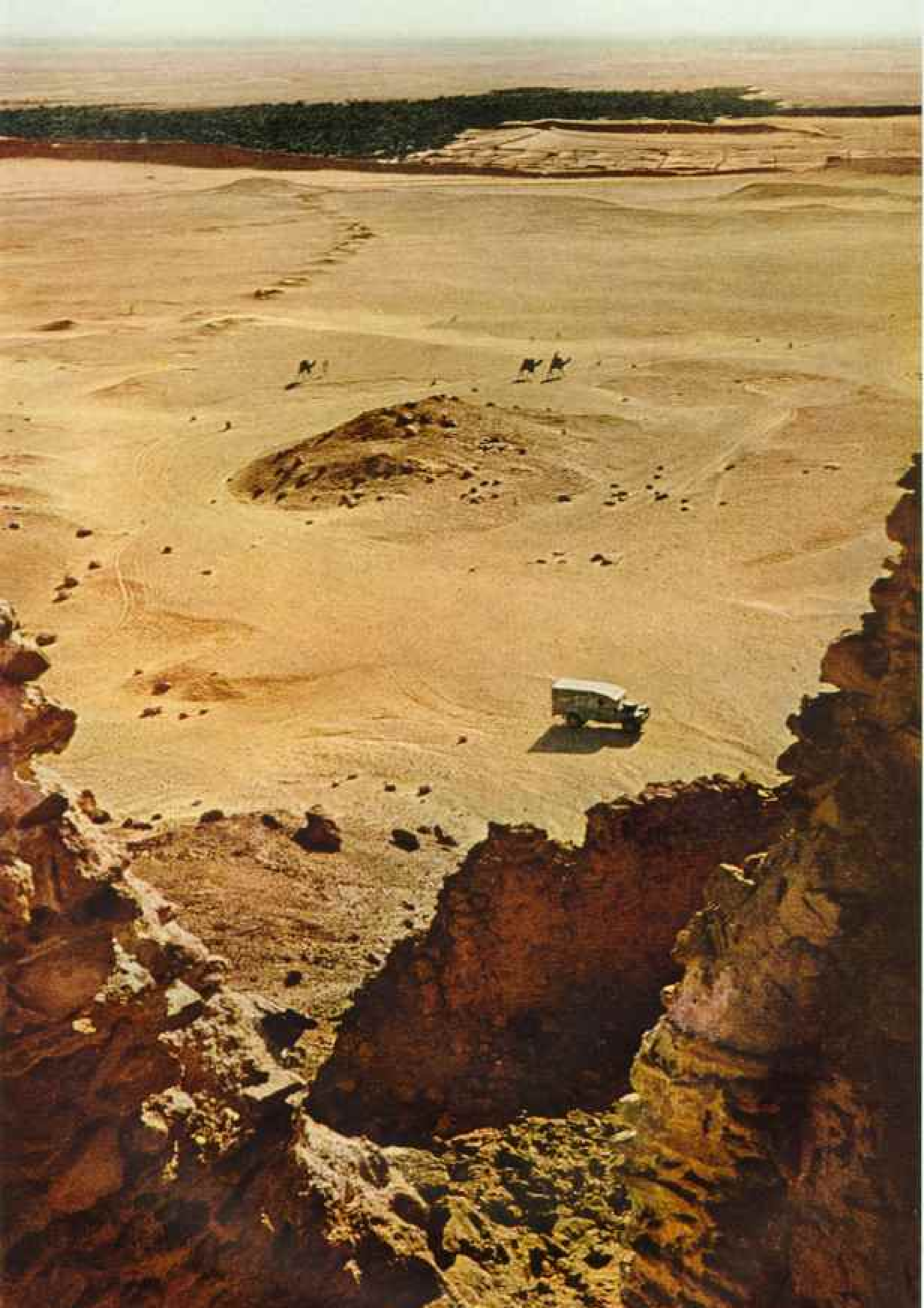
* See "From Sea to Sahara in French Morocco," by Jean and Franc Shor, National Geographic Magazine, February, 1955.

Station Wagon and Camels Pass a Crumbling Hillside Fort in the Sahara

Exploring North Africa for three months, George and Jinx Rodger drove their English Land-Rover more than 4,000 miles across some of the world's most punishing terrain. In hill country near the Moroccan-Algerian border, terrorist bands made traveling a nightmare. For many lonely miles the Rodgers had no military escort; once, in convoy, they narrowly escaped death from a land mine (page 704).

Berbers, North Africa's pre-Arabic settlers, built the 15th-century fortress from which the picture was taken. Cameleers in center skirt an oasis near the village of Reggane. Beyond sprawls the Tanezrouft, a vast and formidable desert-within-a-desert known as the Land of Fear and Thirst.

All Kodachromes by George Rodger, Magnum



Camping on the Desert: the Land-Rover Yields Every Convenience

Between isolated supply points the Rodgers carried three weeks' extra water, food, and gasoline in event of breakdown. Their station wagon, equipped with four-wheel drive, outsize tires, short-wave radio, and an insulating double roof, proved "as reliable as a camel." Here, at dawn, Mrs. Rodger breaks camp.

monument to Gen. Jacques Philippe Leclerc, standing where he died in a plane crash 10 years ago. George was with Leclerc in French Equatorial Africa during World War II and knew him well. We stopped to photograph the monument and have a late lunch.

On our map the Leclerc monument was clearly marked near the Moroccan-Algerian frontier. Reassured that we were on the right track, we packed up our picnic box and continued south. The country seemed terribly deserted. We passed through two small native villages, but they were deserted, too, the houses in ruins.

"Guess there's no water here," I said. "The people have all gone."

Then we passed a French military post surrounded by barbed-wire entanglements and ringed by broken glass. Machine guns bristled from sandbagged ramparts. No one stopped us, or even appeared to notice as we rumbled by.

Although we followed close by the railway tracks, there were no trains all day. It seemed strange until we noticed that one of the bridges was down.

"How did that happen?" I asked.

"Looks like dynamite—or a land mine," said George. He seemed rather grim.

We reached Colomb Béchar at sunset, a bit gritty and sore, and went immediately to the police to report. The officer in charge asked us where we came from. We told him. He said we couldn't have come from Ujda, because there was no convoy that day.

George said we didn't come by convoy, we came alone.

Arab host pours mint tea, traditional desert drink, for the Rodgers at Adrar. In sandstorms he unwinds the end of his headcloth and wears it as a veil.

Mattocks Fly to the Beat of a Drum Like the Beaks of a Fabulous Bird

Water, not man, rules the Sahara. Where moisture is totally lacking, lifeless barrens cover thousands of square miles. Wherever water lies near the surface,

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green oases spring from the sands. This crew digs an irrigation ditch not far from Timimoun (page 694), whose palmery rises in the distance. The foreman keeps time by shouting a chant and tapping a drum. Scrub growth, the desert firewood, survives by sinking its roots to water many feet below.

"You *what!*" the officer asked, horrified. "Didn't anyone stop you?"

"We didn't see anyone," said George, "except a few of your soldiers."

"Our soldiers?" shouted the officer. "How do you know they were *our* soldiers? They were probably rebels in French uniforms. It's lucky you weren't shot!"

Then he remembered his manners and offered me a chair. "Well, well," he said. "You were lucky, madame. You were lucky." He went on to tell us that we had just come through one of the most dangerous areas and that the hills around the monument to General Leclerc were infested with rebel bands, known as the *fellaghs*. We told him we had spent two hours over our lunch at the monument, and his sunburned face turned pale. Then, offering us a cigarette, he stamped our passports and asked where we were heading.

"Touring the Sahara," we said.

"Ah, good. Things are quieter in the south. But you must wait for the next military convoy. Don't try going alone."

Dynamite Hurls Geysers of Sand Above the Desert as French Oil Geologists Sound

During the next few days we sat in the hotel, to the tune of $25 a day, and waited. Colomb Béchar was like a huge military camp. Soldiers with machine guns guarded every street corner, most Europeans went armed, houses were surrounded by barbed wire and sandbags, and there was a curfew every night. The fellagha occupied the hills all around, and each night we were treated to a loud symphony of gunfire and mortar shells buzzing over the hotel.

Prices were atrocious. We had to pay $20 to the local iron founder for a pair of sand tracks, resembling small ladders. I complained bitterly about the price, suggesting we do without. But George said we might be happy to pay $100 for sand tracks if we got stuck. He was right, of course. We used them the very next week.

There were still last-minute details to arrange. Every private motorist must put up a bond as a sort of rescue insurance. In theory, this system works well. Travelers leaving one desert outpost for another must report their arrival and departure to the military authorities, who in turn telegraph to the next post ahead. If they fail to appear within 36 hours, a search party is sent out. The bond pays for the search.

The Sahara can kill, and kill quickly. Men have been known to die of thirst within eight hours of their last drop of water. Travelers are warned: Always carry at least 50 quarts of water more than you think you will need. If stranded, STAY WITH YOUR CAR. Don't start walking off for the horizon and hope to find help. Chances are you'll never make it back. Besides, in case of an air search, your vehicle is easier to spot than you are.

There are other regulations, all of them sensible. You must carry food to last a week, enough spare gasoline to take you half again as far as your destination. Four-wheel drive vehicles are recommended; trailers are prohibited.

Then there is the matter of money. There were no banks in the Sahara, and merchants and hotel owners would not accept dollars or travelers checks. Colomb Béchar's two banks were the last we would see until we came out of the desert. Therefore we carefully calculated how many Algerian francs we would need for our journey and, to be on the safe side, doubled the amount. It was barely sufficient, for the one month we estimated our journey would take stretched to three.

A Green Land Dries to Desert

We were impatient to get going; so it was frustrating to wait on the very brink of the Sahara while the convoy formed. However, it gave me a chance to find out a little about the mysterious land before us.

The Sahara, I discovered, has been a desert for countless eons, its recent geologic history occasionally punctuated, however, by periods of abundant rainfall. The last of these rainy periods occurred some 10,000 years ago, about

the Depths with Seismographic Instruments

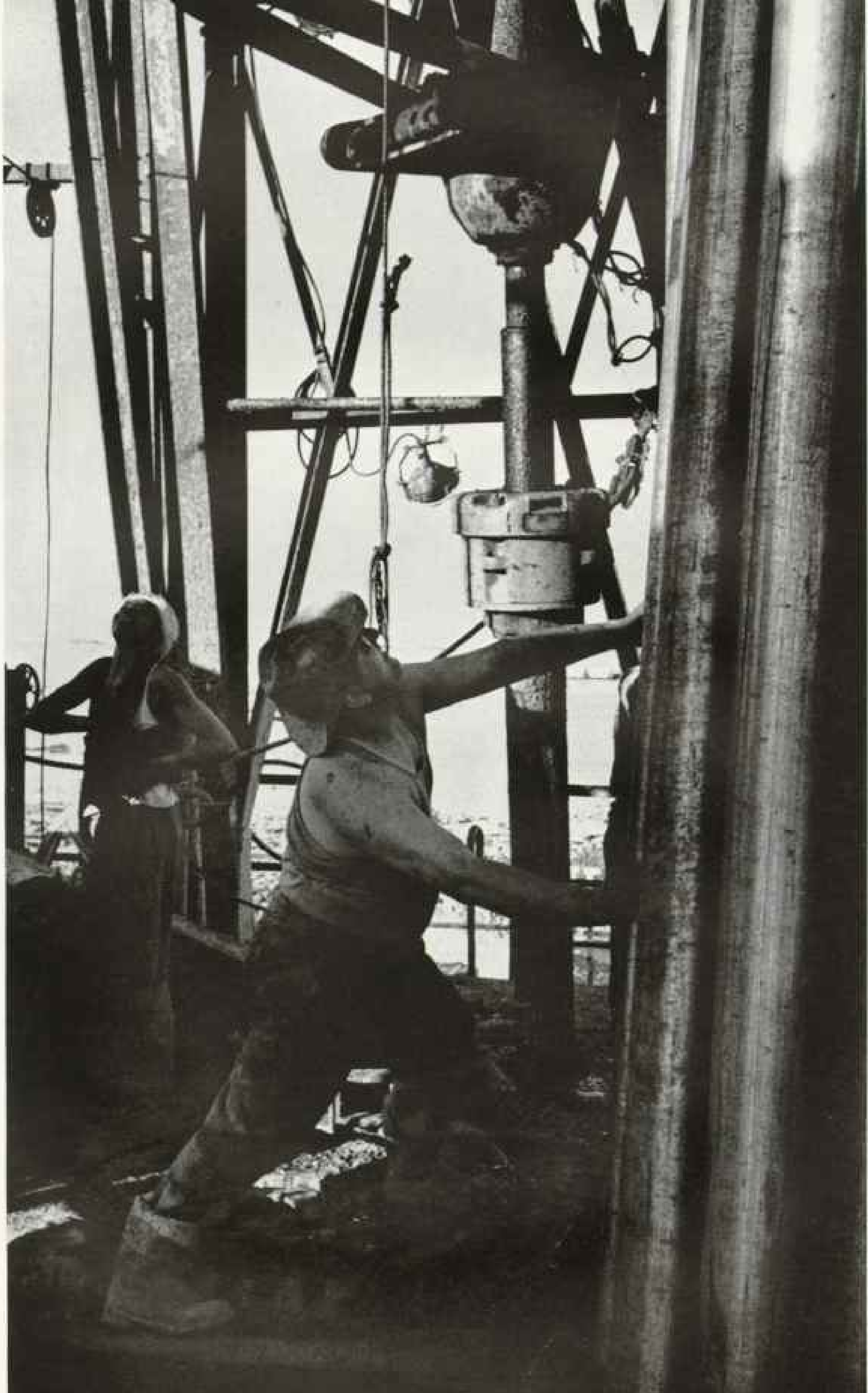
Oil derrick looms like an aviation beacon above the desert at Tirechoumine, a drilling camp. French crews work around the clock to tap petroleum pools. Production, estimated at 10,000,000 tons a year by 1960, may supply a third of French needs. But Algerian rebels vow to stop all shipments of oil.

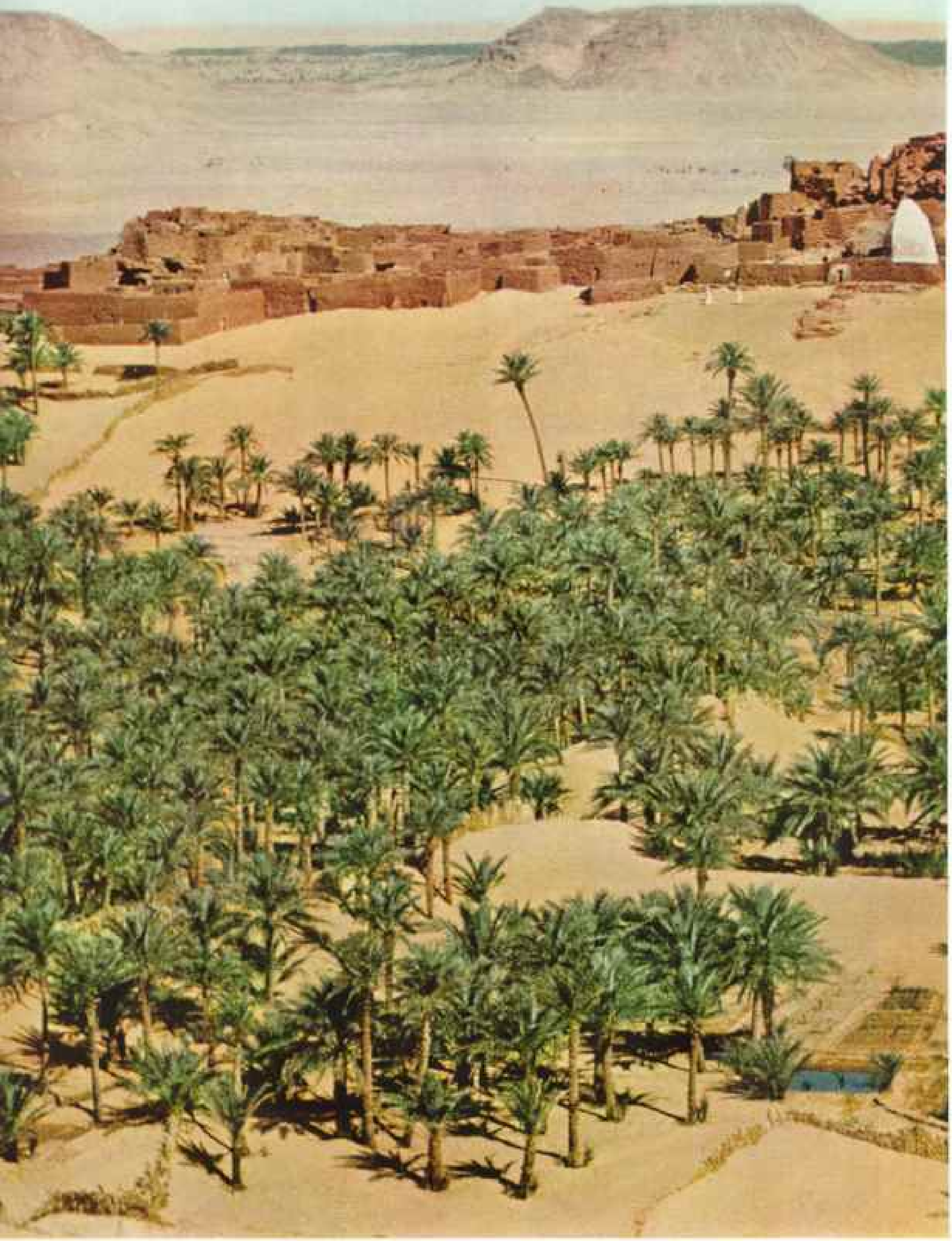
Camp mascot rides his master's shoulder in a dining tent in the Erg Chech, a vast sea of shifting dunes. Existence is so rigorous that oil companies discourage family life and hire few men past the age of 35. Heat and monotony present the greatest discomforts. Advantages are elaborate menus, high pay, and occasional air conditioning.

Riggers at Tirechoumine Pull a Drill from the Borehole of a Well

Countless obstacles face Sahara oilmen. Prospecting crews venture into regions not fully explored. Pools lying as deep as two miles demand months of drilling. Summer heat, rising above 130° F., often prostrates workers.

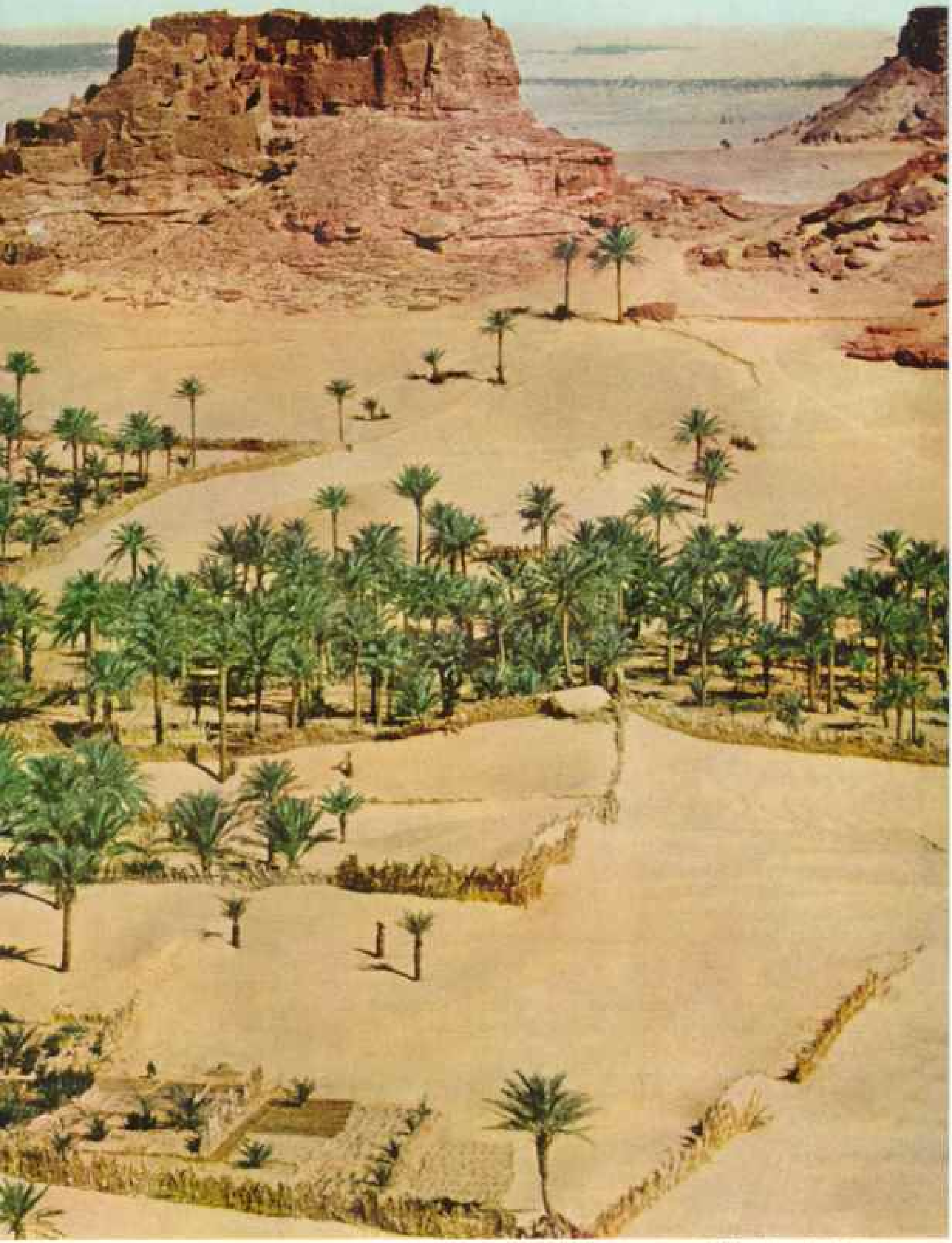
Shortage of pipelines, roads, and railroads results in some wellheads standing capped and idle. Existing routes, threatened by sabotage, require heavy guard.





Date Palms Lift a Feathery Canopy Above Blazing Sand Near Timimoun

Oases, sanctuaries of the desert, range in size from single wells or pools with a few trees to vast, irrigated palmeries and gardens stretching 40 or 50 miles. So precious is the watered land that none is given to



house sites, which occupy less valuable acres in the sun-baked outskirts. This view shows irrigation reservoirs and low picket fences designed to protect palms from ever-shifting sands.

A modern mud-walled village and white, beehive-like tomb huddle beyond the trees. A ruined Arab fort climbs the butte in center. Distant mesas suggest scenes in the southwestern United States.

French Troops Scramble for Cover at the Threat of a Rebel Attack

George Rodger, in a convoy south of Colomb Bechar, Algeria, took the photograph through the windshield of his car. French officers called off the alert when suspicious figures on a distant hilltop proved to be loyal scouts rather than native guerrillas (opposite).

the end of the Ice Age in Europe and America.

At that time much of the Sahara was a land of forests, fertile plains, and abundant rivers, populated by cave dwellers who hunted with flint-tipped arrows. They drew pictures on cave walls and carved them on rocks—pictures of themselves hunting, of their cattle and dogs, of elephants, giraffes, hippos, and lions (page 698).

Eventually the long rainy period came to an end. Slowly the region dried out. Rivers dwindled, and, unable to reach the sea, formed lakes that evaporated and left great salt deposits. Vegetation shrank, animal life died out. Winds scorched the trees and plants and blew them away, then dried the soil and blew that away, too.

Today the Sahara—an Arabic word meaning "desert"—covers 3,500,000 square miles, nearly 500,000 more than the United States. It stretches roughly from the Atlantic to the Red Sea, from the Atlas Mountains to the Niger River basin. Its mountains are gigantic, its riverbeds dry, its remnant lakes solid salt, its forests petrified, and one-sixth of it is a shifting sea of sand.

Life in the desert clings to the oases, scattered like a broken chain of emeralds across the golden sand. They nourish forests of date palms, maintained by constant irrigation; the land is measured and taxed not by area but by the number of its trees. The oasis of Ouargla, 350 miles south of Algiers, is said to contain a million palms. And at Timimoun the palmeries string out for 40 miles. Wherever an oasis is found, there people live.

Convoy Rolls South Under Guard

Word came at last that the convoy was about to leave for the south. We reported dutifully to the police, to the military, and to the government authorities, where we signed endless forms and answered endless questions—where we were going, why, for how long, next of kin, grandmother's name, and so forth.

Our military escort formed shortly after dawn on a crisp, cool morning. It consisted

of eight armored cars and 50 young French soldiers armed with machine guns. As Mzuri was the only private vehicle, we were given the honored position, fourth in line, immediately behind the ambulance. Following us were 60 or 70 heavy trans-Sahara transport trucks, bound for Beni Abbès, Timimoun, Adrar, Reggane, and points south.

The convoy moved slowly at first, winding through low-lying hills that could hide a sudden ambush by the fellagha. Then we came out on a wide, flat plain and speeded up.

Dust. Within minutes we were covered with it—fine, powdery dust that crept in the windows and doors and settled on everything. We sneezed, choked, and breathed with difficulty. It was even more difficult to see, for the vehicles ahead churned up dust as thick as a smoke screen.

Nearing hill country again, we stopped seemingly every mile or so while the troops jumped out and deployed on either side of the road (opposite). During one such halt, while the soldiers ran with guns at the ready for the embankments on either side of the road, I glanced up at the cliffs that towered around us, then gave a gasp.

"Men with guns!" I stuttered.

George grabbed the binoculars for a closer look. "They're armed all right," he said.

We watched our troops advance slowly up the hillside, moving toward four sinister figures outlined on the highest cliff. The truck drivers stood in tight, silent groups. Everyone was tense as we waited for the first shot.

Suddenly a shot rang out. I jumped, then headed for the ditch. George kept his glasses trained on the hillside.

Then he laughed. "Relax!" he said. "They're on our side. One of the boys took a shot at a gazelle."

"You're on Your Own Now"

Fifteen miles south of the military post at Abadla the convoy halted for the last time. The young lieutenant in charge got out of his vehicle and came over to us, his face grimy with dust and sweat.

He pointed ahead to a vast expanse of stony desert, its horizon unbroken by tree or hill or dune.

"You're on your own now," he said. "No fellagha to worry about in that. Bon voyage," he grinned, "and don't get lost."

The escort turned around and made a dusty trail back toward Colomb Béchar. The truck drivers got out and crept under their vehicles to eat and sleep in the shade.

Then we drove away, with all the Sahara spread out before us under a cloudless sky.

Free! We felt like two kids playing hooky from school. Mzuri purred gently, and I think she felt liberated, too. She bounced along the stony track at a steady 30 miles an hour toward the main road.

Two main routes lead south from the Saharan Atlas across the Algerian desert. Most used at the moment is the Tanezrouft Piste, which reaches all the way to the Niger River. The second route, more or less parallel to the Tanezrouft, is the Hoggar Piste.

The first route is easier on the vehicle but extremely dull. The Hoggar road is rougher, sandier, but far more scenic. We used both, crisscrossing on two east-west connecting routes and sampling just about every bump, washboard, corrugation, and drift of sand in the Algerian Sahara.

Keep off the Roads—It's Smoother

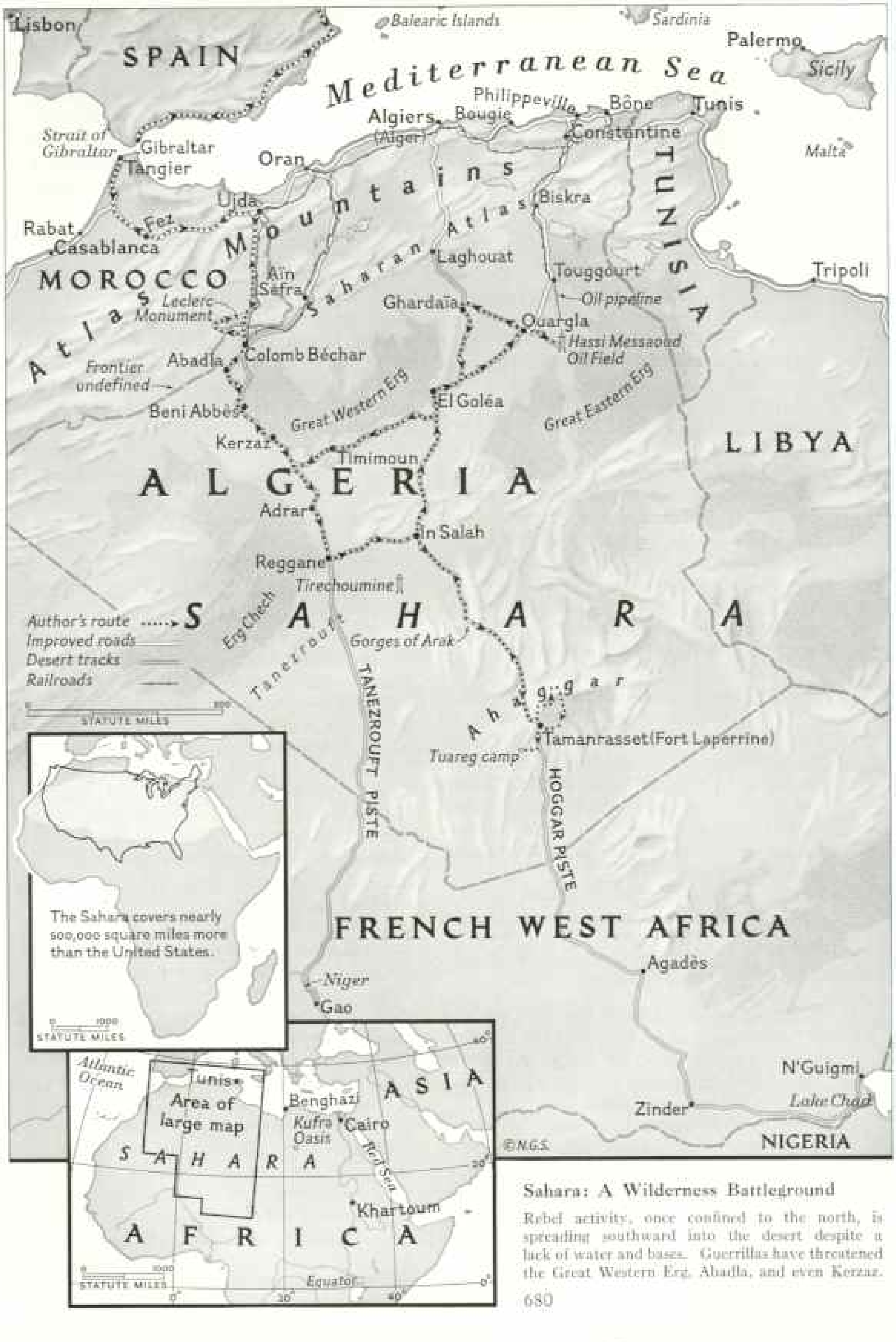
Barely 600 miles of paved roads existed in the Algerian Sahara. But now that the French have discovered several important oil fields, the government has begun an ambitious program of road building (page 683).

Within 10 years, we were told, crossing the Sahara might be as easy as driving across the United States.

Unfortunately, while ambitious dreams are being blueprinted by road engineers, upkeep on the existing roads is sadly neglected. Meanwhile, more and more heavy trucks lumber over them, cutting ruts ever deeper and creating washboards that would shake a standard car to pieces in a week.

After a few brave attempts to *gardez la piste* (keep to the road)—strongly recommended for anyone new to the desert—we found that the best system was to avoid the track altogether and take to the open desert, using the piste merely as a guide.

This often proved easier on Mzuri but full of potential dangers: soft sand, rocks, or *fesh-fesh*, the peril of perils—a dust fine as talcum powder and treacherous as a bottomless swamp. If you stick in fesh-fesh, too bad. Standard procedure is to empty the car completely, shovel down deep in front of each wheel, fill the holes with rocks (if there are any rocks), lay down sand tracks, put the vehicle in four-wheel drive, let in the clutch slowly, and hope.



Sahara: A Wilderness Battleground

Rebel activity, once confined to the north, is spreading southward into the desert despite a lack of water and bases. Guerrillas have threatened the Great Western Erg, Abadla, and even Kerzaz.

The only other solution is to wait for a larger vehicle to come along, hitch yourself behind with a stout cable, and let it pull you out. But in the Sahara you may have to wait two weeks before you see another vehicle.

Sahara routes are, on the whole, well marked. The main "roads," with their deep corrugations resembling ocean waves, are not hard to follow. Stone cairns are placed so that as soon as you catch up to one, another should, on a clear day, be plainly visible on the horizon. This works fine until you run into a sandstorm.

Driving in a sandstorm is a terrifying experience. Sahara veterans don't usually try. They stop and wait for the storm to blow itself out. Since desert sandstorms may last several days, you must be prepared to sit for quite a time; therefore, the extra water, food supplies, and gasoline.

Good books are also recommended.

Truck and Driver Stalled Eight Days

One day, on a particularly wicked stretch of "main road" between In Salah and El Goléa, we found a stalled truck loaded with drilling equipment for an oil camp up the line. A young Arab driver climbed out as we pulled up and rubbed the sleep from his eyes.

He told us he was *en panne*—broken down. His companion had hitched a ride back into Algiers for spare parts.

"Do you have water?" we asked. This is always the first question when meeting someone en panne in the desert.

"Yes," the boy assured us. "Plenty."

He said he had plenty of food, too. A passing truck had left some only that morning.

"Isn't there anything we can do?" we asked.

"Yes," said the boy, looking hopeful. "Do you have a newspaper?"

Fortunately we had. It was two weeks old, but in the Sahara that is still very much up to date. He accepted it with great joy, saying he had already sat there for eight days and didn't really mind very much except that he had nothing to read.

Wherever we drove in the Sahara, two things impressed me vividly.

Invariably I had the feeling of driving uphill, no matter how flat the terrain or how many hills we descended. The desert seemed to slope forever upward until, at last, sand met sky. Surely, one day, if we could only get up enough speed, we would catch up to the horizon and ascend into Heaven.

Secondly, the piste always seemed much better early in the morning and just about impossible at the end of the day. Then muscles were sore, nerves taut, eyes strained, and we were convinced that one more jolt would be more than we or Mzuri could bear.

Hardy Hiker Refuses a Ride

When it was possible to lift our eyes off the immediate track ahead, or the cairn markers in the distance, what else was there to see? On our first day out of Colomb Béchar we saw three gazelles and a bustard. On our second day we passed a truck and saw a few migratory birds in the distance. On the third day we caught a glimpse of a lizard.

On the fourth day we met a man—walking. We gave him water and a loaf of bread. He thanked us, drank the water, wrapped the bread in his flowing white robes, and refused the ride we offered. Where he came from and where he was headed we did not know. But he was 75 miles from the nearest oasis.

Sometimes we found tiny desert flowers sucking whatever moisture there was from the sand. Plant life is sparse in the Sahara, but scrub grasses, tamarisk trees, Sodom apples, and a form of melon that camels eat grow in dried-up riverbeds. Once we even saw early-morning dew collected on the bud of a small yellow flower growing by itself.

And nearly always there were flies. It didn't matter how far we were from the nearest well or oasis or camel caravan; when we stopped for lunch, flies would appear within minutes. Where they came from, how they found us, I do not know. By the end of our picnic sometimes a hundred flies would be swarming around us.

Land-Rover Charges Eight-foot Dunes

From day to day the scenery changed. We might start out on a rough and stony plateau and, after six or seven hours, when we were getting restless, we'd suddenly see dunes ahead, or an outcrop of rock. Bumping along on rocks and stones was monotonous, but when we reached soft sand, the drive became exciting.

We never knew when we were going to get stuck. George's policy was to charge the sand heap lying over the piste at full speed, with left hand poised to change to four-wheel

Bottomless Sand, Curse of Travelers, Stalls a Diesel Truck

Desert driving demands the skills of navigator, geologist, mechanic, and salvage operator. Any breakdown in a remote area could bring death by thirst.

Truck crews carry steel tracks or ladders to give traction in the sand, often as fine as talcum powder. Tires, equipped with a shallow tread to ease steering, sometimes carry flanges on sidewalls for added support.

drive without losing momentum. It worked very well. We zoomed over drifts sometimes eight feet high and usually got through. If we didn't, we brought out shovels and sand tracks and got to work.

Ports in the Desert Sea

The worst areas for driving are near the ergs, vast regions of dunes. The three largest in Algeria are the Great Western Erg, the Great Eastern Erg, and the Erg Chech. Nothing lives in these desolate worlds of drifted sand—not a beetle, a blade of grass, or, strangely enough, even a fly.

After a big dose of desert, it was a welcome relief to spot an oasis. No two are alike. Each has its own characteristic architecture, irrigation system, fort, market place, and inhabitants.

Only a few oases remain today truly Saharan. Most of them have changed during the past few years, since the discovery of oil and minerals.

An invasion by engineers and geologists in jeeps and power wagons has brought rapid changes to the sleepy settlements. Oil companies are building air-conditioned offices and houses beside squat mud buildings. You see many more swimming pools and tennis courts decorating the cool palm gardens, and transport planes fly in fresh meat, fruit, vegetables, and cases of champagne.

Most of the Sahara is controlled by a military government, and each oasis is the capital of an administrative area known as an arrondissement. In a picturesque fort *le capitaine* reigns supreme, acting not only as governor, judge, mayor, and town planner, but also pinch-hitting as architect, hydraulic engineer, sanitation officer, agricultural adviser, and keeper of the roads.

These officers volunteer for their positions and go through a long period of training and apprenticeship. They are mostly young men, vitally interested in the country and its people. They wear colorful uniforms—black or white baggy desert trousers and the famous blue cap called the kepi. Each capitaine is supported by one or two assistants, a doctor, and sometimes an officer with a special knowledge of local dialects.

Le capitaine was the first person we called on at each new oasis, to say we had arrived safely and to have our passports and papers checked. A native guard would guide us, dusty and bedraggled, into a cool, dark room,

its walls decorated with woven rugs and skins of gazelles and its floor of clean brushed sand.

After a standard waiting period of 10 minutes, le capitaine entered, whisked off his kepi *bleu*, and showed us to chairs. Still standing we said, "*Bonjour, mon capitaine. Nous sommes arrivés,*" and then sank down exhausted.

France Invests in the Sahara

In spite of the fierce nationalistic uprisings farther north, the desert population remained loyal to the French. The French in turn were making a great effort to help these primitive, indolent people and keep their support.

Each oasis has schools where French, Arab, and Negro children study and play together; there are hospitals and clinics, workshops and manual training classes, experimental gardens, and agricultural advisers eager to help landowners. The government has built new wells, improved age-old irrigation systems, and provided each town with safe drinking water, community baths, and laundries.

France has had little return so far for the millions of francs she pours into the Sahara each year. She has only recently finished a pipeline from the new oil field at Hassi Messaoud north to a railhead. Other than what little oil has yet come out, the chief products of the Sahara are dates and livestock, and few of either are actually exported.

In the shade of the palm trees grow other staple crops such as wheat, barley, sorghum, maize, a few vegetables, and sometimes cotton, henna, and tobacco. In fact, almost anything will grow if there is water. In the carefully tended gardens of the military posts we

Tractors, Trucks, and Asphalt Roads Conquer the Sahara

Paved highways, once nonexistent in the desert, are following discovery of oil. French engineers plan to link fields with a 700-mile road network in the next few years. This crew lays special heat-resistant asphalt for the first strip, a 26-foot-wide, 185-mile-long road between Ghardaïa and El Goléa. The Rodgers' Land-Rover was the first private vehicle to cross it.

Dunes at Kerzaz Lift Knife-edge Crests Forever Honed by the Wind

Sand dunes, some nearly 1,000 feet high, cover a sixth of the Sahara. Arabs use 10 different words to describe their various shapes and sizes. These dunes lie in the Great Western Erg.

were astonished to find roses, nasturtiums, geraniums, and violets bravely shooting up out of sandy beds.

Different Hue Marks Each Oasis

Beneath the fort, where the French Tricolor flies from the tallest tower, is a Sahara town consisting of mud-brick houses with thick walls and usually no windows, to reduce heat and light. On the flat rooftops each family keeps its scrawny chickens, pigeons, goats, and sheep; there Arab women, seldom seen on the narrow streets, sit in the evenings.

The color of the mud buildings varies from oasis to oasis. Adrar is brilliant red-orange, In Salah burnt ocher, El Goléa sandy colored, and Timimoun a vivid, deep red (page 694). In Beni Abbès all the houses are whitewashed, helping to give it a reputation as the cleanest town in the desert.*

Contrary to popular belief, it does rain in the desert, though rarely—perhaps once or twice a year. A two-day soaker would literally melt every settlement in the Sahara. Doctors told us that their busiest time occurs during torrential rainfall, when houses collapse on the inhabitants.

One soon picks up Arabic expressions in wandering through the narrow streets and market places of the oases. It is possible to keep up quite a lengthy conversation with the local inhabitants if your vocabulary includes only two Arabic phrases: *La bes*, the standard greeting, meaning "no troubles" or "no pain," and *Ilham'dilla*, "Praise be to God."

When you meet an Arab, you start the ball rolling with the first "La bes." He answers, "Ilham'dilla." You say, "La bes, Ilham'dilla." He says, "Ilham'dilla, La bes." The longer you keep this up, the politer you are

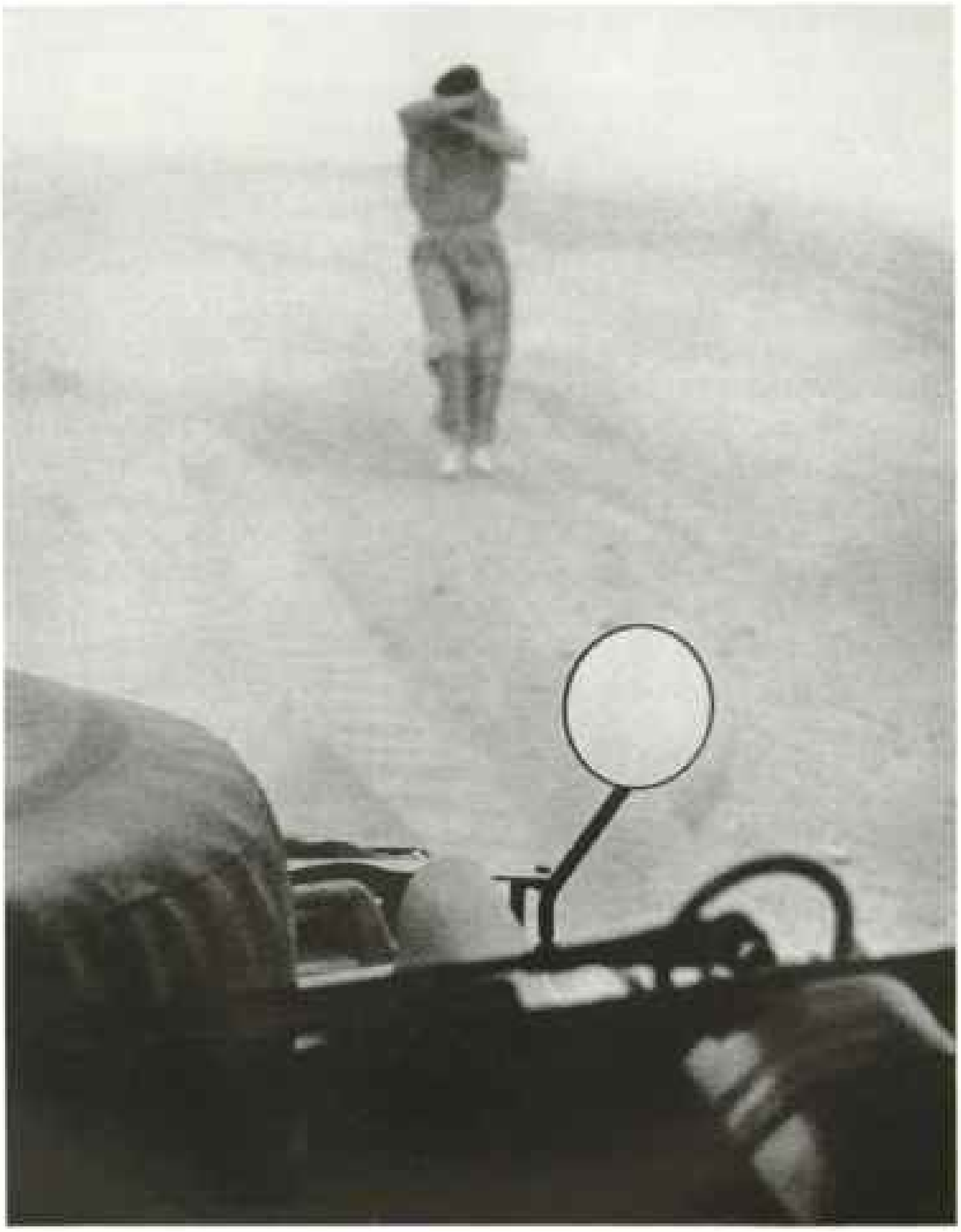
Arab boys know how to say, "*Donnez-moi cinq francs, s'il vous plait*," or "*Donnez-moi une cigarette, madame*." It is almost impossible to walk anywhere in an oasis without being followed by a dozen urchins, each shouting these entreaties over and over again.

I asked a small boy what he would do with the money if I gave him five francs. He said he would save it to buy a gold wrist watch. And if persistence has anything to do with it, he should have a dozen gold watches by now.

While we were quite happy to reach an oasis after several days on the piste, I was

* See, in the National Geographic Magazine: "Oasis-hopping in the Sahara," by Maynard Owen Williams, February, 1949; and "Trans-Africa Safari," by Lawrence Copley Thaw and Margaret Stout Thaw, September, 1938.

Lashed and blinded by a sandstorm, George Rodger gropes his way to the Land-Rover. Sudden winds, as fierce as ocean gales, whip the desert, turning day into dusk, stalling vehicles, erasing roads, and choking breath. Many a traveler in such a storm has lost his way and died of exhaustion.



just as happy to get out of it again and back to camping. It meant that we ate better, slept better, and had a few homey comforts that no desert hotel can provide.

Setting up camp was a tiring business after driving all day over appalling roads, but we soon got it down to a system. Within an hour the beds were made, kettle boiling on the stove, pressure lamp alight, table set for supper, laundry drying, drinking water set out to cool, and the radio tuned in to BBC for the evening news broadcast.

But the best part of camping in the Sahara is sleeping out under those extraordinary desert stars, which surely seem bigger and brighter than anywhere else in the world. We took a tent but never used it, for rain never caught us in the open desert at night. After dark the wind usually calmed down, even if it had been blowing at gale force all day.

Fury of the Sahara Strikes

During the first few weeks we found out quite a lot about the Sahara, obeyed all the rules, and managed to keep out of trouble. Even the weather was kind: sunny and not too hot during the day and cool at night—cool enough to warrant three blankets over our sleeping bags.

Then our luck began to change. The Sahara became moody.

In Adrar we ran into our first real sandstorm. It went on for three days—three long, weary days when there was no alternative but to stay inside our dark hotel room and wait.

Outside, it was impossible to see more than 10 yards through the mass of swirling sand. It reminded me of a London pea-soup fog, except that this was also hot and gritty. Inside, sand carpeted the floor and settled into our clothes and cameras, even into our beds. We ate sand in all our food and drank it in our water. It got into our hair and into our eyes, and I wept big, sandy tears.

On the fourth day the wind stopped and we went on to In Salah, which has a reputation for having some of the worst sandstorms of the Sahara. But although all the residents there expected at any moment to be smothered by the dreaded *vent de sable*, the air remained calm.

During the lull we wanted to go on to Tamanrasset (Fort Laperrine) while the tracks were free of sand. Our month's visa for Algeria had now expired, however. The commandant, a capitaine with 10 years of Sahara experience, promised to radio Algiers on our behalf and ask for a two-month extension.

The route to Tamanrasset is one of the most scenic in the Sahara and perhaps one of the most interesting of all Africa as well. From In Salah it took us three days to cover the 450 miles, although we could have done it in two if we hadn't stopped so often to look and wonder.

At the Gorges of Arak, almost halfway, we found a small military post. Sheer rocky cliffs tower so high on either side that the tiny fort is shady and cool. A French Camel Corps lieutenant and 40 Tuareg soldiers operate from there.

In Arak we met a young French archeologist, Henri Hugot, who has spent the past 10 years exploring the Sahara by camel or on foot. He has made some startling discoveries close to Arak. He showed us relics of a once-flourishing civilization—remains of ancient villages, Berber tombs and inscriptions, bits of broken pottery, human skeletons, bones of animals, stone tools and grinding implements, and fascinating pictures of wild beasts engraved on the rocks.

The riverbed that winds through the gorge was dry and arid and the country completely deserted. No one has lived there for 2,000 years.

Land of the Veiled Men

As we drove on toward Tamanrasset, rocks of every possible shape, size, and color spilled across the desert. The road wound slowly upward, until at last we entered a strange world of jagged peaks and gigantic boulders with not a tree in sight. This was the fantastic Ahaggar, or Hoggar, a mountainous region in the center of the Sahara with peaks jutting some 9,000 feet into the air. The coloring at sunset was magnificent, but there was something grotesque about the shapes of the rocks that made me shudder.

We had heard and read stories about the remote oasis of Tamanrasset and its fabulous veiled tribesmen (page 693). But the town was dusty and drab and seemed almost deserted. A few veiled men with their goats and donkeys shuffled silently over the sand, and a handful of children watched with wide-eyed curiosity as we drove by.

At the hotel we were shown a tiny room furnished with two rickety beds, a chipped metal table, and two metal chairs. We recognized the table and chairs; they were the same

in all hotels in the Sahara. Someone must have bought them cheap at a gigantic sale and shipped them all to the desert.

The tall bellhop who helped us unload Mzuri told us dinner was served at eight. We asked where the showers were. He showed us, but added that there was no more water. It was turned on for only two hours a day, and we were 10 minutes late.

No Light, and a Bath in a Bucket

The hotel was wired for electricity but was still in total darkness well after sunset. We asked when the lights went on, and the boy said they didn't. The power plant was en panne—and had been for six months.

We asked for a lamp, but they were all being used in the dining room. He had no more candles. So George unpacked our pressure lamp, a spare jerry can of water, and a bucket, and we de-sanded ourselves as best we could.

The next morning we were summoned to headquarters. Le capitaine wanted to ask us some questions.

He eyed us with suspicion and asked why we had come to Tamanrasset. "Your visas have expired," he said pointedly.

We explained that the commandant in In Salah was handling our extensions himself and had promised to radio Tamanrasset to that effect.

"I have received no such message."

We reminded him that communications were slow in the Sahara. We often got to a place days before the messages we had sent announcing our arrival time. Le capitaine was not amused.

"I have no alternative but to hold your passports and papers," he said, "or perhaps you had better return to In Salah."

We told him we had come all this way, more than 1,000 miles, to meet the Tuareg and visit the mountains of the Ahaggar.

"You won't find many Tuareg in Tamanrasset," he said. "They have moved south in search of pasture."

"Perhaps if we go south, too, we might find them," we suggested.

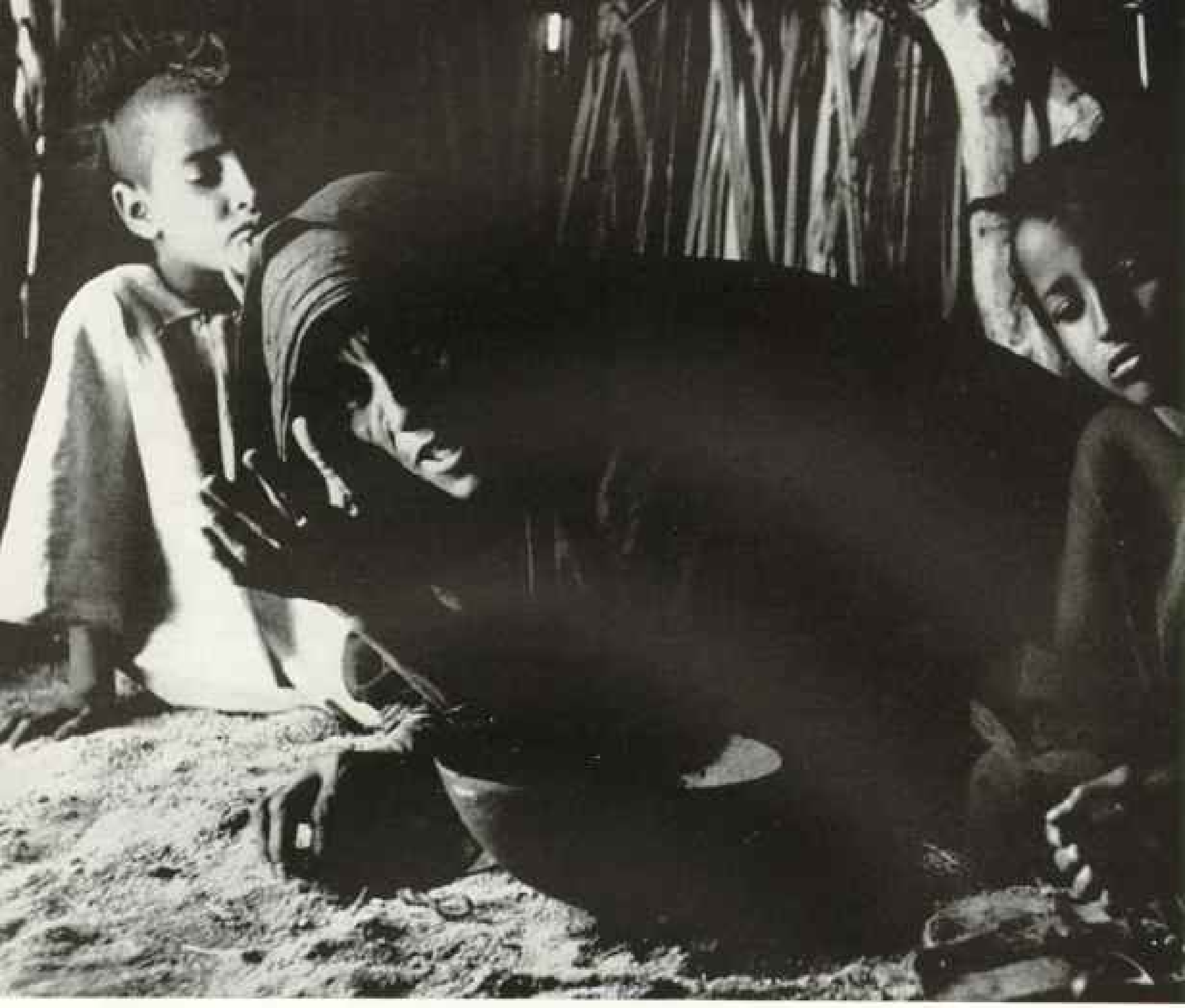
"It is doubtful," le capitaine replied. "Besides, you would have many difficulties. The Tuareg do not speak French—even less, English."

There seemed no sense in prolonging the discussion. But as we got up to leave, le capitaine unexpectedly consented to let us take the tourist route through the Ahaggar if we promised to return in three days.

"You will need no one with you," he said. "Just follow the tracks. There are no Tuareg

Nurse's First Problem: Remove the Veil

Modern medicine serves Tuareg patients in this hospital at Tamanrasset, operated by Roman Catholic sisters and the French military government. Tuareg diet and sanitation encourage tuberculosis, trachoma, and dysentery.



living in the mountains; so you won't need an interpreter."

We spent three days in the high rocks and cliffs of the Ahaggar, where we baked during the day and very nearly froze at night. And on our return le capitaine told us we might remain in Tamanrasset, but he would keep our passports until the extensions arrived.

Tuareg Prince Leads Way to Tribe

The Tuareg had definitely moved south in search of better grazing for their flocks. We were about to give up trying to find them when we met the local schoolmaster, M. Claude Blanguernon, an authority on Tuareg life. He introduced us to one of his former students, a tall, handsome Tuareg noble with the awesome name of Beuh Ag Ahmed.

Beuh spoke excellent French and had once accompanied M. Blanguernon as far as Algiers by plane. So he was familiar with Europeans and their strange habits. He said his cousins were camping not far from "Tam." He would go with us in our Land-Rover, and we should be prepared to spend a night or two camping with the tribe.

Never had Mzuri carried such a distinguished passenger. Beuh sat bolt upright, his long body clothed in flowing indigo robes, head swathed in a crisp white turban, and face veiled so that only his eyes and nose remained uncovered. His eyes were carefully made up with kohl, a mascaralike desert ointment. His hands were slim and graceful and his arms as smooth as a woman's, with not a trace of muscle.

Yet there was nothing effeminate about Beuh. Something about his expression, the way he moved, the way he used his hands, showed his proud warrior background from the days when the Tuareg ruled the desert and were feared by all.

Soon we had turned off the main route south and were bouncing over rocks and stones. Then we followed a *oued*—a wide, shallow watercourse of gravel and sand, dry as a bone.

George changed to four-wheel drive, and we inched along, expecting at any moment to bog down.

Whenever the wheels spun, Beuh shouted, "*Avancez—vite! Vite! Avancez!* This is a good camel—it goes everywhere!"

Somehow we plowed through the oued. Then, just as the sun set, strange figures resembling hooded phantoms in the fading light came out of the shadows to meet us. Soon a dozen Tuareg men crowded around, examining the Land-Rover and greeting Beuh with great affection.

Four Glimpses of a Tuareg Matriarch: She Believes the Veil Is for Men

This elderly widow received the Rodgers for tea in her camp south of Tamanrasset. Smiling and gesturing, she invited them to attend the name-day feast of her granddaughter, who stood in direct line of succession. Like all Tuareg women, she winds her robe in the form of a hood rather than the veil affected by men.

Few societies give more freedom and respect to women than the Tuareg, nomadic Berbers of the desert. In contrast to many of their Arab sisters, who are often secluded from birth, Tuareg women regard themselves as men's equals, marry at will, speak in council, and even serve as heads of encampments. Wives go where they please, hold property, teach, and govern the home. Tuareg children assume the rank of their mothers and look on maternal uncles as next of kin.

We shook hands with each in turn and went through the lengthy "La bes, Ilham'dilla" routine. Then we were sitting cross-legged on hand-woven rugs around the fire while a servant brewed pots of strong mint tea. There wasn't a woman in sight. The men reclined on the soft sand and spoke quietly among themselves. Beuh had a chance to explain some of the mysteries of his people.

Caravan traders and several explorers spread stories about dangerous tribes of "Blue Men" who lived in the mountain cliffs and ravines of the Ahaggar and terrorized the central Sahara with their camel and slave raids and tribal wars. When the French penetrated the Sahara, they attempted to make these caravan routes safe from Tuareg raids, and finally subdued the tribesmen early in the 20th century.

Tuareg means "lost souls," a name given them by their traditional enemies, the Arabs. The Tuareg, however, call themselves "*imochagh*"—the free ones. An offshoot of the Berbers, they have their own language and an alphabet made up of 23 simple and 13 compound letters.

Women have an extremely important place in Tuareg society. The line of succession is purely matriarchal, and they are almost the only women of the Moslem world who do not wear veils.

Veils Protect Men's Souls—and Faces

Why are the men veiled and the women not? This is a disputed question, but Beuh told us that Tuareg men wear veils "to protect their souls." Since soul and breath to them are identical, it is not difficult to find a physical explanation. The dryness of the desert and the fierce sand winds cause nasal trouble. The veils conserve the breath's moisture, acting as air conditioners; they also protect faces against wind and sand.

Sadly, the Tuareg people are slowly dying out in this area. Today they number only about 10,000. They make a living from herds of cattle, goats, and sheep, traveling from one pasture to another by camelback. They breed their handsome white camels for sale and dig salt to exchange for millet, tea, sugar, and cloth for their flowing robes and veils.

Early the next morning Beuh arrived to take us to several Tuareg camps in the vicinity. At each camp we went through the tea-drinking ceremony—three glasses at each camp. It was all we could do to swallow the potent black, sickly-sweet brew, which gave me a violent headache and made me dizzy.

Campfire of the Hooded Phantoms

Gradually word got around to Beuh's widespread family that he had brought strange white visitors with him. At each new camp we found a large crowd, and at sunset the entire family had assembled at the last camp, including all the wives and cousins and uncles and aunts we had met before. We sat cross-legged around a great fire surrounded by hooded phantoms and their shy, robed women.

For the first time we had a chance to study the women. Their skin was almost white and their features strikingly handsome. They wore long silver earrings, heavy bracelets, and anklets of intricate design. Around their necks hung strings of leather charms.

Beuh took us inside one of the large semi-permanent Tuareg huts, made of reeds on dried stick supports, to introduce us to the matriarch of the tribe, an old, wizened lady with beautifully expressive hands. She was drawing pictures in the sand and paused to look at us with great dark eyes. Then she smiled and signaled us to sit down on the soft sand carpet (pages 688-9).

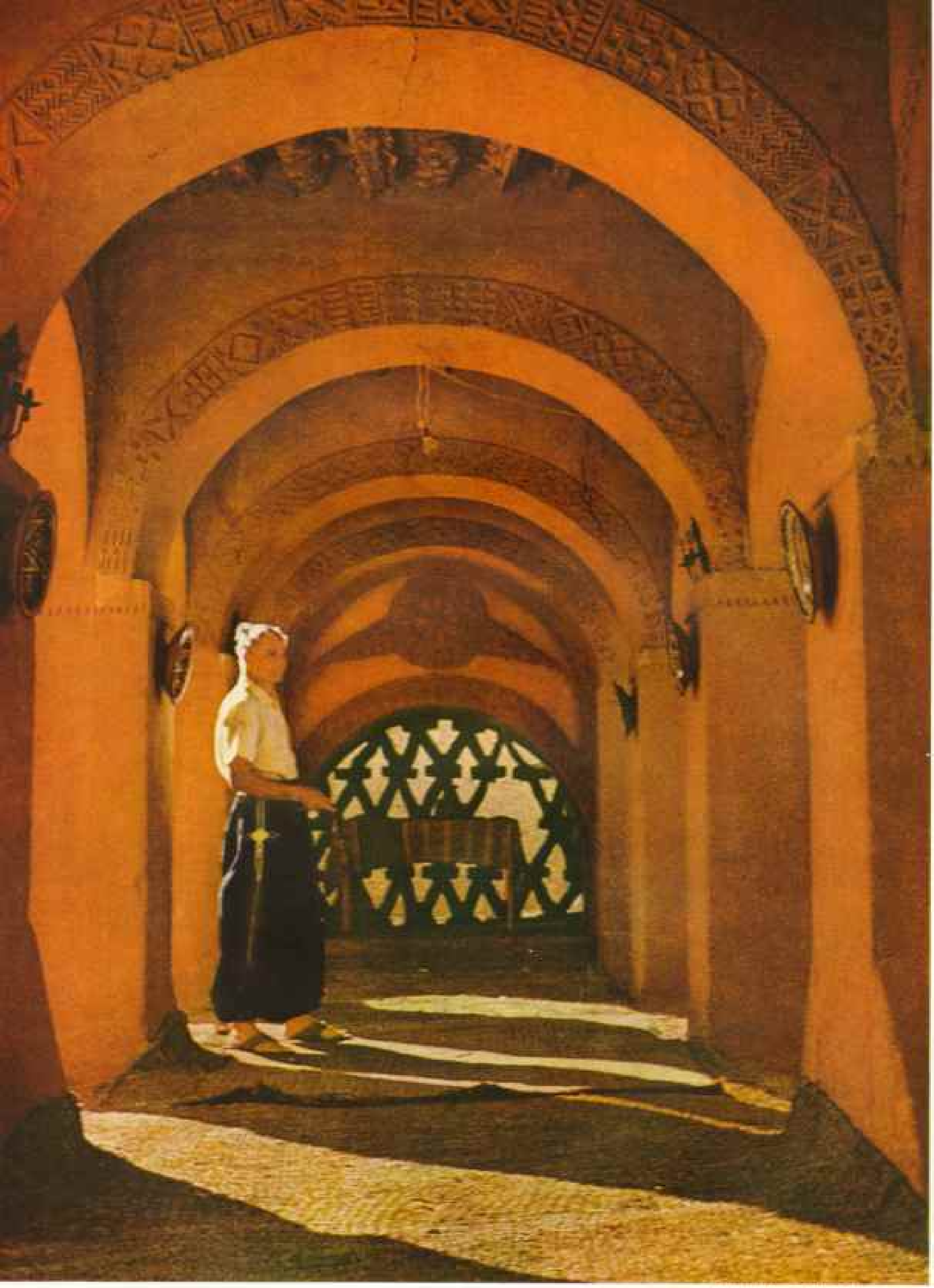
We sat, and Beuh left us alone with the old lady. Tea was brought in, and we sipped it slowly, smiling and nodding to our hostess to express our appreciation. Although we could not speak the same language, there was a feeling of communication. Later Beuh told us we had won her approval, and she would like us to attend a Tuareg feast later in the week in honor of her granddaughter.

(*Continued on page 699*)

Swathed in Veils, a Tuareg Noble Sits His Milk-white Camel

Mystery long shrouded the Tuareg, veiled and dark-robed tribesmen who once terrorized the desert, raiding, killing, enslaving. Caravaneers feared and hated marauding bands, whose warriors rode superbly and owned the finest camels in the Sahara. Pacified by the French, the Tuareg today earn a living as herders.

This pureblood Tuareg balances skillfully atop a richly ornamented wood-and-leather saddle. His traveling kit includes blanket roll, rifle, grain bag, and striped leather quirt, the badge of aristocracy. Urging his mount ahead, the rider presses a foot against the neck and tugs on the rein, a single thong passed through the camel's nostrils.



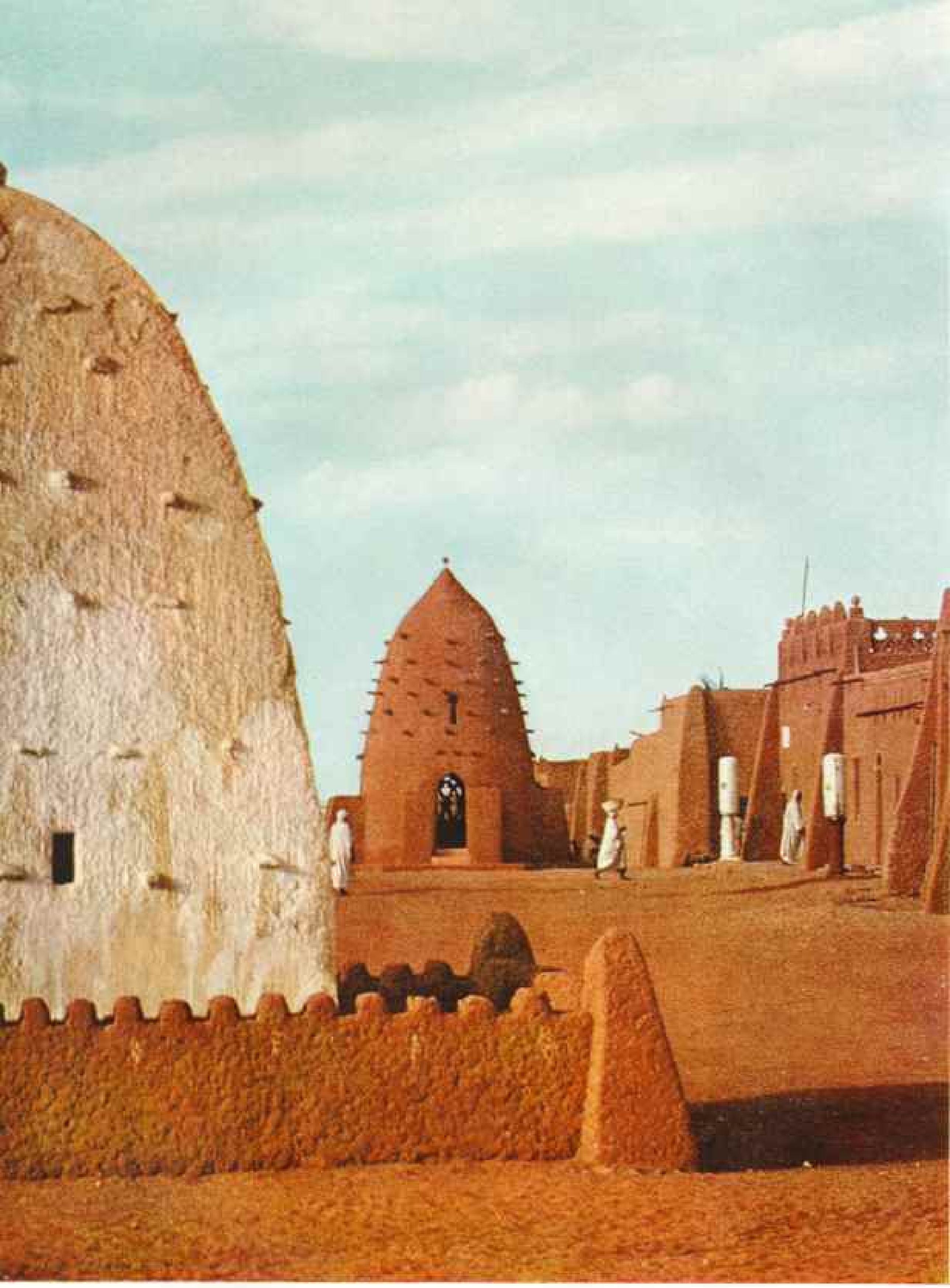
Sunlight Kindles the Red Mud Arches of a Hotel at Timimoun

George Rodger wears desert traveling costume: open sandals, baggy trousers, and short-sleeved shirt. Natural pigments in the adobe give the hotel its name, the Red Oasis.

Using the Hind Leg as Leash, a Servant Leads a Sheep to Market

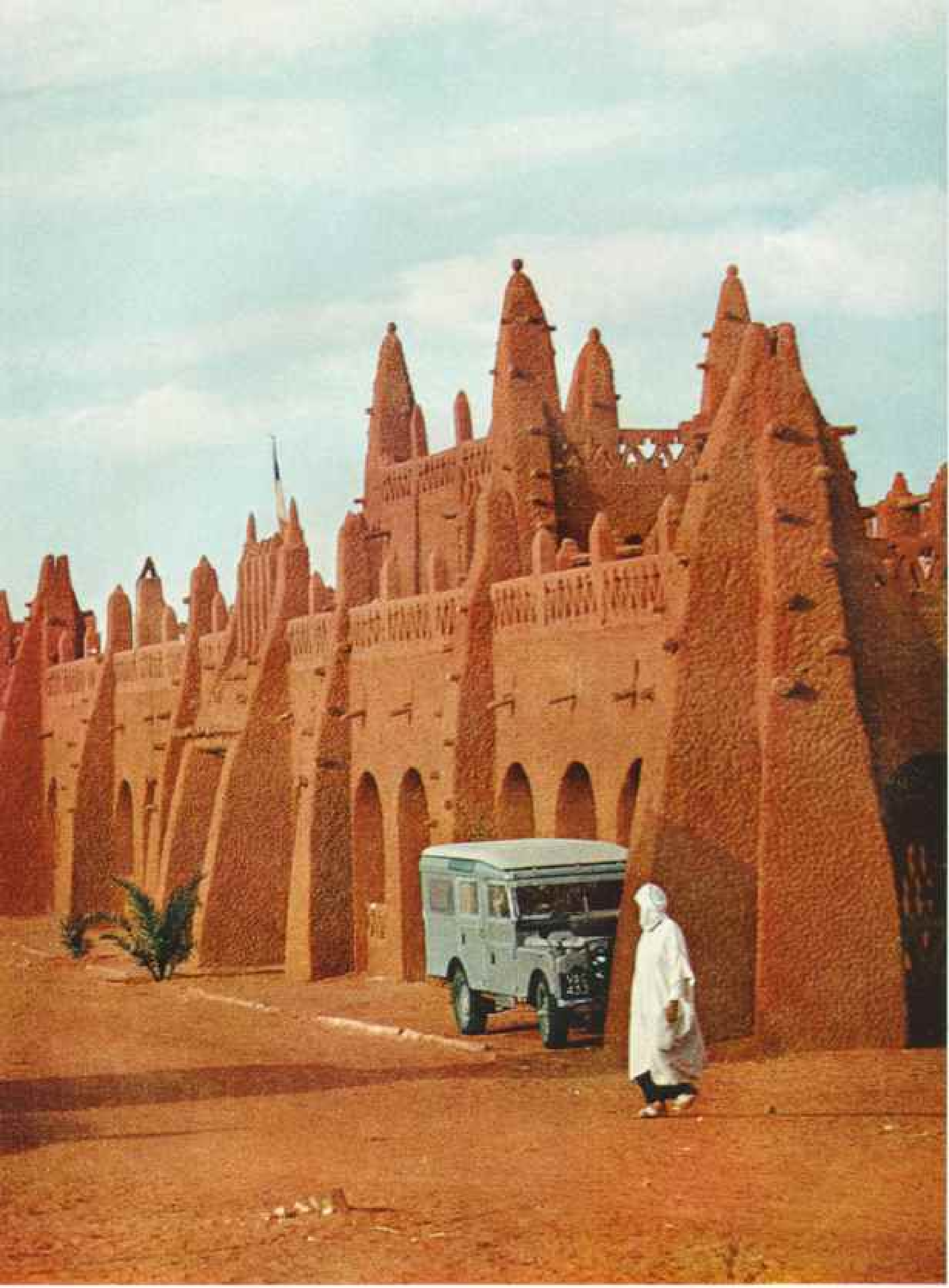
Tuareg families, forbidden by the French to keep slaves, pay other people to tend their flocks and do household chores. Here veiled men lounge against adobe walls of Tamanrasset in the Ahaggar mountains. Servants do not always wear the veil.

Snowshoelike sandals, essential to the desert dweller, give support on the finest sand. Thick rawhide soles protect feet against scorpions, thorns, and sand fleas. Tuareg men, occasionally suffering deep cuts on the soles of the feet, sew up the wounds with needle and thread. Sores seldom fester, for desert sunlight and heat discourage bacteria.



Red Mud Walls of Timimoun Bristle Like a Fortress of a Thousand Guns

Saharan architecture, a marvel of mud brick and palm-log girders, seals out heat and sunlight with thick roofs and nearly windowless walls. This view



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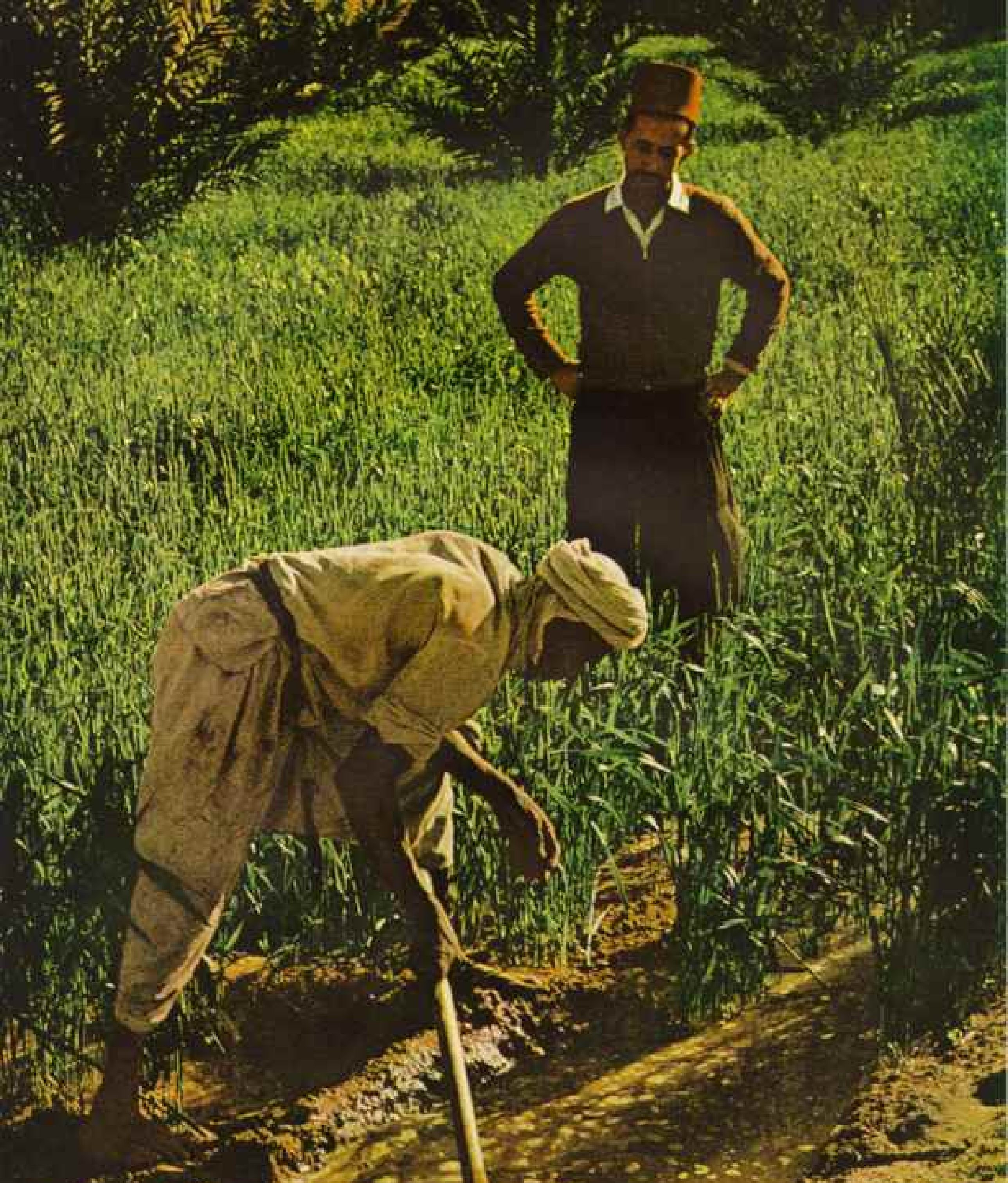
shows reinforcing beams protruding from adobe walls. Earthen fence on the left surrounds the whitewashed tomb of a Marabout, or Berber holy man. Another tomb rises at the end of the street. The French Tricolor surmounts a hotel. Land-Rover and gasoline pumps offer modern contrast.

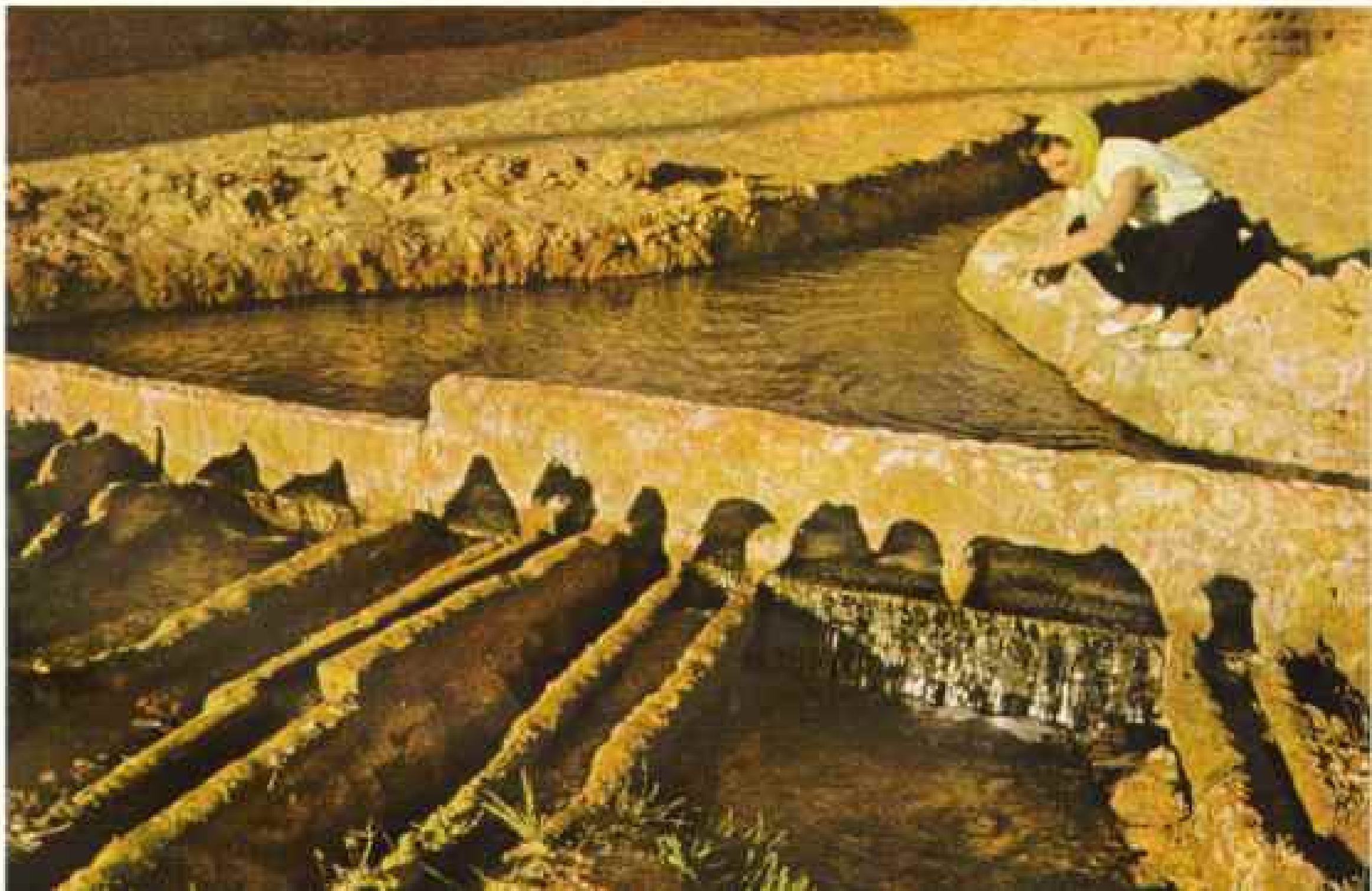


Like Blood Pumping Through an Artery, Water Brings Life to a Desert Crop

For strictness, no law of the Sahara matches that pertaining to water rights. Flow from wells and reservoirs is so precious that it may be apportioned in fractions of hours. Here, in Adrar, a landowner (wearing tarboosh) oversees the irrigation of his wheat field.

Well shafts in endless ranks mark underground drainage tunnels at Adrar. Romans in Libya about 200 B. C. built similar labyrinths, now called *foggara*, to collect subsoil water for irrigation. Workers descend these maintenance shafts to clean the centuries-old system.

Sluice gate, suggesting a snaggle-toothed comb, divides and distributes water from the foggara. Landowners purchase rights by the widths of the arches, which stonecutters chisel to precision. A single rivulet may cost $2,000.



Fossilized Trees Proclaim the Sahara's Vanished Plenty

Rainfall, occurring in cycles during the Ice Age, eventually diminished, leaving arid plain in place of tropical forest. Whole stands withered and died. These petrified trunks lie beside the route from Adrar to In Salah.

Stone Age Gallery Endures on a Cave Wall Near Tiechoumine

As late as the 2d century after Christ, North Africa's teeming wildlife brought Roman expeditions in search of animals for the imperial games (See "Roman Life in 1,800-year-old Color Pictures," NATIONAL GEOGRAPHIC MAGAZINE, February, 1957). Prehistoric artists carved these silhouettes, which suggest hyenas, water buffaloes, and gazelles. A French engineer chalks the outlines.

The feast took place on a stormy day with great thundery clouds half concealing the highest rocky peaks of the Ahaggar. Beuh eyed the sky with a practiced eye. "It won't rain," he said, "but there will be much wind."

We arrived at the encampment at noon and were ushered into the "big house," its floor covered with rugs. Only men attended the banquet; not a woman or child was in sight.

The feast commenced with three glasses of the inevitable tea. Then a servant came in with a large tin platter of couscous—millet ground very fine, seasoned with lamb broth, dried vegetables, and spices. Another followed with a roasted sheep.

Everyone was given a large soup spoon, and we helped ourselves from a communal bowl. A servant tore the lamb into small pieces with his fingers and placed them in holes we had made in the couscous. Fresh hot broth was poured over the lamb. It was by far the best meal we had had since entering the Sahara.

Meanwhile the women were having their own celebration. At about 5 o'clock, after a siesta, we walked half a mile toward the east, and as we came closer, we heard them singing and clapping their hands. A dozen young girls wearing fresh robes of dark indigo took turns beating a large drum.

They all wore their finest jewelry, and their faces were elaborately made up. Older women, some dressed in white, others in blue, swayed to the rhythm, chanting and singing. We watched a tiny baby, almost smothered in indigo cloth, gravely clapping his hands to the music.

Wild Dance in a Howling Gale

It had been a particularly hot day and strangely still, with not a breath of air. Suddenly a wind of almost gale force hit us, blowing sand into our eyes and whipping the flowing robes of the Tuareg into even more fantastic shapes. The singing and drumming increased in volume. Men, women, and children danced wildly. And then the celebration was over. The wind died down at sunset, and everyone filed back to his camp.

Our return journey to In Salah, by way of Tamanrasset, passed without incident. Great drifts had piled over the piste, and the tracks we had taken three weeks previously were now so deep in sand that we had to make a wide detour.

When we reported to le capitaine, he told us the sandstorms had come at last; we had arrived during a lull. Our extensions had been approved by Algiers, and we were given permission to remain another two months in the Sahara.

That night I had great difficulty sleeping. It was wickedly hot and ominously still. Climbing to the flat roof to get a breath of air, I noticed that the stars had disappeared and there was a strange glow in the sky.

We were up well before dawn next morning to get an early start on the long, sandy track to El Goléa. I had no appetite for breakfast and could hardly swallow the dry bread and *café au lait*. My head ached, and my nerves were on edge.

"What is the matter?" I asked George at last. "Am I catching some strange disease?"

But George had been studying the weather outside. "Watch this," he said. He touched my hand, and I jumped about a foot in the air. "Static electricity. I don't think we'll get very far today."

Sandstorm Relieves Tensions

Abruptly, the sandstorm broke. The wind rose steadily, and sand swirled from the streets and tore away in clouds. We went back to our room.

And with the wind, my headache and nervousness calmed down. That evening my malady was explained. I learned that it was a common Saharan complaint before a violent storm. The static electricity in the air, the closeness, and the extreme dryness cause fever, headache, nausea, nervousness, and tension. European women are especially susceptible, but even the inhabitants are affected. When the storm breaks, most symptoms disappear.

The storm continued through the night, which is extremely rare, and on to the next day and the day after that. Finally, on the morning of the fourth day, we decided to risk the piste in spite of a murky sky.

The sandstorm followed us all the way to El Goléa, 250 miles north. There we sat four days more waiting for the sky to clear. When it did, we continued north, toward Ouargla and Ghardaïa. The sandstorms followed.

At one spot the wind came up again like a tornado, and we were engulfed in driven sand. We drove Mzuri into the lee of some rocks for shelter, but even with the windows closed, the inside soon filled with choking dust.

We sat five hours listening to the howling of the wind. I had our box of canned goods

ready, quite prepared to dole out rations of sardines for breakfast, lunch, and dinner for the next several days, when suddenly we saw a car break through the Stygian gloom.

A military road engineer in a Dodge Power Wagon was headed home on leave after a year spent in the remote desert. He told us not even the Sahara's worst sandstorm could stop him! He was followed by another truck with an Arab driver. He agreed to let us join him, put us between the two trucks, cautioned us to keep our eyes glued on his tail light, and off we went.

The next three hours were a nightmare. All we could see was his dim rear light—not the ground or anything around us. How he found his way, we never discovered. He must have had a homing instinct.

And when we got to Ouargla it was raining.

It is not supposed to rain in Ouargla in April, but it was raining, nonetheless, in heavy, cold torrents. An Algerian guard at the outskirts of the oasis stopped us to look at our papers. He seemed frightened and wanted to talk to someone.

"First these sandstorms!" he said. "Now rain. What is going to happen next?"

Floodwaters Maroon Sahara Travelers

We stopped for the night in Ouargla and continued on to Ghardaïa the next day. There was no more sand in the air; the rain had cleared it. But the sky was ominously black and the wind still gale force.

Just before nightfall we came into sight of the town. Visions of hot baths and good food danced before our eyes, because Ghardaïa has one of the best hotels in the entire Sahara.

Flash Floods at Ghardaïa Turn a Dusty Riverbed into a Millrace

This striking photograph catches a once-in-a-lifetime occurrence, a major flood in the Sahara. Violent rains in the Saharan Atlas and a dam that burst caused this torrent; it blocked north-south traffic across the desert and marooned the Rodgers' station wagon for a week (below). The flood having passed its crest, this crowd watches a truck try the first crossing. Raftsmen at right ride an emergency ferry made of oil drums.

However, there was a broad oued to cross—with a river now running down the middle of it, not more than 50 yards wide and about 18 inches deep. A truck was stuck in the middle, and the drivers were working to get it out. We gave them our sand tracks and shovel, and when they were clear we tried our luck.

Mzuri did well at first. Then she went down a deep hole. The water splashed over the hood and killed the engine. George got out, knee deep, to dry the plugs and distributor with a cloth, and we noticed the water rising rapidly. The floorboards were awash when he finally got the engine going again, but we surged through to dry land without further mishap.

Then we discovered we weren't across the oued at all but on an island. The main stream was still ahead, with Ghardaïa on the other side. Already the water was several feet deep and absolutely impassable. With several stranded trucks keeping us company, there was nothing to do but settle down for the night.

It was a night to remember. The torrent rose at alarming speed; by 2:30 in the morning, only a foot of dry land remained to us. In the headlights the swirl of black water was frightening.

At dawn it began to subside almost as fast as it had risen, and by full daylight ran only eight or nine feet deep (left).

It was Easter Sunday. We sat in Mzuri all day, shivering in our sweaters and duffel coats. Finally a group of Mozabite youths led us on foot over a two-mile detour and across a narrow bridge into town. We arrived with only the wet clothes on our backs; the hotel's central heating and hot showers were welcome indeed.

A week passed before we could rescue Mzuri. Even then the main channel was too deep in mud and water for her to cross, and it took 15 miles of roundabout driving to reach town.

From Mud and Cold to Parching Heat

There was no more rain, and even the sandstorms subsided temporarily. But there was heat. We first noticed the heat on our return to El Goléa, and thence across the southern rim of the Great Western Erg back to Colomb Béchar. The alternative route for leaving the Sahara was straight north to Algiers through rebel-held mountain country, reportedly more dangerous than the route we had chosen.

We had to change a tire, and after only half an hour's strenuous exercise in the sun we felt weak and spent. The thirst that followed was incredible. We drank quarts of water, and still we were thirsty. Finally we decided to ration ourselves to a cupful an hour to acclimatize ourselves for what was to come.

In El Goléa, while Mzuri was being refueled

Arab Women with Heavy Timbers Balanced on Heads Trudge Through the Oasis of In Salah;

Advancing Dunes Threaten to Engulf the Palmery

for the 250-mile run to Timimoun, a tubby garage attendant warned us to "*faites attention*" because several drivers on that route had been *égorgé*—which meant, quite simply, that their throats had been cut. How we were to "pay attention" to being "égorgé," we didn't know.

We were 14 difficult hours on the track from El Goléa to Timimoun, and saw neither friend nor foe.

Timimoun Gives a Tense Welcome

Timimoun lived up to all expectations. It was a perfect desert oasis, unspoiled and truly picturesque. The deep-red coloring of the soil contrasted vividly with the white Marabout tombs. Military headquarters was a toy model of a fort, and the walls of the red mud houses bore hand-carvings in rich design (pages 692, 694). The other guests at the Red Oasis Hotel were friendly and sociable. We sat up late talking Sahara talk: roads, oil, sandstorms, and, inevitably, the rebels.

"Where are you going?" we were asked.

"Colomb Béchar," said George. "And then Morocco."

There was a moment of silence. Someone cleared his throat. The hotel proprietor quickly suggested a drink.

Then it started. Did we know about the rebels? Did we know they were moving slowly south—toward the Great Western Erg, toward Abadla and Kerzaz, perhaps even Timimoun?

Yes, we knew, we said, but we had to get out of the Sahara some way, and there were only two possible routes: via Colomb Béchar—or via Algiers.

"*Bien sûr,*" everyone agreed. "There are only two routes." So we changed the subject.

We were truly sorry to leave Timimoun. But now the summer heat was on, the rebels were ahead of us, and we decided to get out of the desert at all speed.

Before entering the danger area, we took a few precautions. With black tape we lettered out a large U.S.A. on each side of Mzuri. And to make sure the rebels wouldn't mistake us for a French military vehicle, we mounted the Stars and Stripes from a fender.*

* Mrs. Rodger is American; her husband, British.

We reached Kerzaz safely, 150 miles around the south rim of the erg, and there we found the military busily putting up barbed-wire entanglements. When we had last gone through Kerzaz, it had been a sleepy little fort with only one administrator and a few native guards. This time there were French troops camping all around, and tension hung in the air.

We left at dawn for Abadla, feeling decidedly jittery. The 170 lonely miles took us through rugged hill country where the rebels had staged a raid the previous Sunday. But again we met neither friend nor foe. The land was absolutely deserted.

In Abadla almost a hundred heavy trucks were lined up, waiting to be conducted into Colomb Béchar. Our military escort was twice the size of the one we had before. Mzuri, again the only private vehicle, looked very smart with her flag snapping in the breeze.

The convoy moved slowly. I was jumpy and expected trouble with every bend through the hills. But we negotiated the rugged terrain without a single shot being fired.

Then we were within sight of Colomb Béchar. I unclenched my fingers and unbraced my feet and was saying happily, "Well, honey, we made it!" when my words were lost in a terrific explosion.

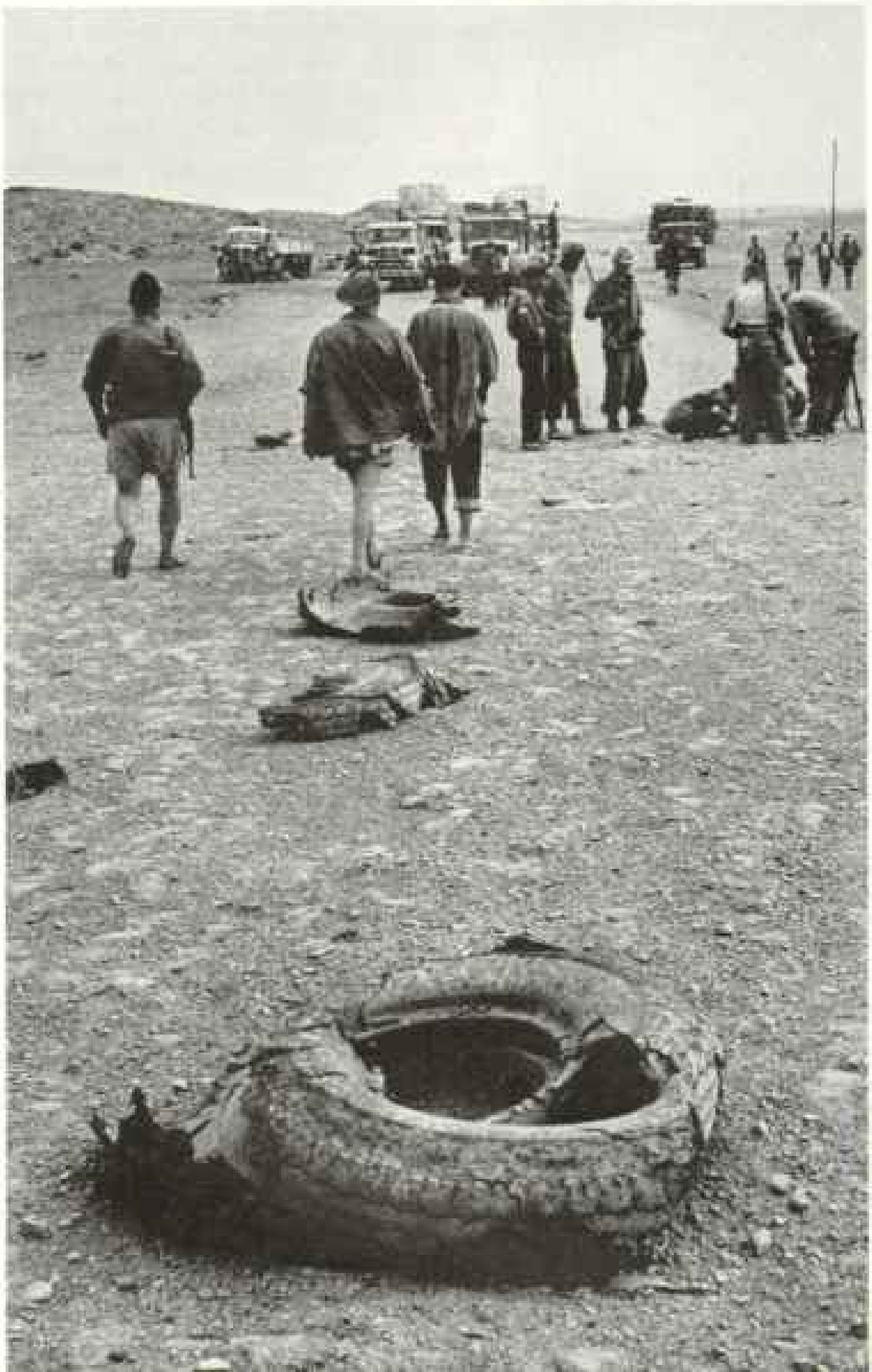
George skidded to a standstill as troops ran for the hills to ward off the expected attack. I crouched down inside Mzuri, my eyes shut, my hands over my ears.

Then George told me. The truck immediately behind us had run over a mine. The armored car, troop carrier, and ambulance had passed over it safely, and so had we. But the fifth vehicle in line touched it off. The truck was damaged, but luckily no one was injured.

That was the first we had heard about land mines, but in Colomb Béchar everyone was talking about them. There were mines on the roads leading out of town in every direction, including the route we intended to take to Morocco.

This was the latest terrorist movement of the rebels. The first mines had been laid only a month previously, but already a dozen vehicles had been blown up.

We tried to get what



Ruined Tires of a Wreck Say: "Land Mine!"

Returning to Colomb Béchar after three months in the desert, the Rodgers drove over a rebel mine but failed to detonate it. A trailer truck close behind touched off the charge, which demolished a wheel and scattered cargo along the highway (above). Drivers and guards examine the debris.

information we could, but it was conflicting and contradictory. We talked to the police, to the administration, to the military. Everyone told us the same thing: "The roads are mined—but we don't know where."

We were in a trap now, and I was sick with worry. After three long, exhausting months of desert travel, were we to remain indefinitely in Colomb Béchar, only hours away from freedom?

"We must get out," I said. "There must be a way."

George tried to talk me into flying out, saying that he would come alone, somehow, with Mzuri.

"Desert you now?" I flared. "After all we've been through!"

Perilous Return to Safety

Two days and two sleepless nights we waited, and finally decided to chance the road. It was only 45 miles to Morocco. And I did not want to spend another 24 hours in Colomb Béchar.

When we took our car papers to the Algerian customs officer, he was very helpful. "Good luck," he said. "You'll need it."

Another government official was just as helpful.

"Au revoir," he said. "Better you than me."

We left at dawn, after padding the floor of Mzuri with sandbags against possible mines. Our flag was well secured, and we kept our fingers tightly crossed.

The first 15 miles were easy, for we could slip out into the open country and drive over the flat desert. Then we neared the hills and were forced back on the road. We drove slowly, watching for rocks and, at the same time, watching the road for any signs of a mine. If there were footmarks, a hole in the ground, or suspicious traces, we stopped. Then George got out and investigated on foot, clearing away the loose gravel with his hands to see if a mine was hidden beneath.

I kept my eyes on the hills and the speedometer. Only 30 more miles—29—28 miles to freedom.

For the first time I knew the silence and fear of the desert. I was frightened as I had never been before. The track into Morocco had never been heavily traveled, and since the first mines were laid, all traffic had stopped. There were only George and I and valiant Mzuri plodding through the dust and sand, with the horizon glimmering before us and the oppressive hills hemming us in.

We knew there were rebels in the hills. They were watching. We could feel it.

"Faster, Mzuri, faster!" I murmured to myself. "Only 20 more miles, only 20 more miles."

And then we stopped again because George saw footprints in the sand. He walked slowly ahead, following them across the road.

Was it a trap? I dared not look at the hills above. "Do something—do something!" I told myself. I grabbed the Thermos jug and poured us each a cup of water. George got back into Mzuri.

"Find anything?" I asked.

"Nothing," he said.

We moved forward slowly, and automatically I braced myself for an explosion. Nothing happened.

"If there *was* a mine—we missed it," George grinned.

The miles ticked by, slowly. Because of the danger, we detoured around the General Leclerc monument, and I gasped with relief when we reached a French military post. They gave us an armored escort over the last few miles to Morocco and, perhaps because we had our fingers crossed, we got through.

As we passed the frontier, we waved goodbye to our escort and to months of sandstorms, dust, flies, floods, and rebels.

We uncrossed our fingers and urged Mzuri on, faster and faster, back to Tangier, to Spain, to France, and finally to England, the land where she was born.

And in all that vast distance, I never once looked back.

Epitaph to a Journey

As we waited to be cleared through customs at Dover, an old man came over to us. He wore a battered sailor's cap and chewed on a pipe. He walked around Mzuri several times and studied her with a practiced eye. Then he flicked some dust off a back window and peered inside.

"Have a nice trip?" he asked.

"Why—yes," I said.

"Been far?"

"The Sahara," I answered.

He looked at me curiously for a moment, then slowly shook his head.

"Lady," he said. "There's only one place worse than where you came from—and you can't get there until you die."

Mysore Celebrates the Death of a Demon

By Luc Bouchage

"IT all began here, on Chamundi Hill," said our palace escort. Then he told the strange story of Dasara, one of India's oldest, most colorful festivals.

For years, he related, the people had suffered under Mahishasura, a monstrous king with the head of a buffalo. No one was strong enough to challenge him. Then came the goddess Durga wielding weapons with all her ten arms. For nine days she fought the wicked demon, and on the morning of the tenth day she finally slew him.

Ever since, this triumph of Good over Evil has been celebrated throughout India.

At our feet as we listened lay the beautiful white and sand-colored city of Mysore. The waning sun cast a faint copper glow. Temple bells, shrill and incessantly tinkling, seemed to announce that tomorrow would bring Dasara, Festival of Ten Days.

Our official car bearing the Maharaja's double-headed eagle wound its way back down to the city. At his invitation we had come—the photographer Ylla and I—to record the pomp and grandeur of this glittering festival.*

Opening of Festival Set by the Stars

The 10-day celebration began next morning precisely at 10:02, a time chosen as the auspicious moment according to the stars. At that instant the Maharaja, barefoot for religious reasons but resplendent in gold-embroidered tunic, diamonds, and rubies, ascended his throne for a durbar, or princely reception.

Guns boomed, ancient silver trumpets sounded, and a military band blared in the courtyard below. Dasara was officially under way.

Earlier we had witnessed the emergence of the state elephant from its abode next to the palace. Preceded by a group of mounted lancers, palace guards, and a pipe-and-drum band, flanked by a retinue of standard-bearers, the magnificently caparisoned beast came out at a stately but springy gait.

Then came the state horse with its own retinue. A splendid albino stallion with rainbow-decorated tail and flaming-red eyes, it seemed inhabited by some genie.

More elephants and more guards joined the procession as it marched across the vast courtyard to the Somesvara Temple, where the animals were blessed.

Though we saw this procession each morning and evening, it never lost its impact.

As the evening procession returned to the palace, the guards lighted multicolored flares. Amid the resulting sparks and smoke the state elephant and in turn the state horse stopped directly under the throne to pay honor to the Maharaja. From a silver platter the elephant scooped up a mass of flower petals with its trunk to shower them high into the air. The horse bent his thin forelegs on a green cushion and pressed his brow to the ground (page 711).

Trumpets blared anew and the throng packing the enormous courtyard cheered loudly.

Royal Ladies Peep Through Curtains

I looked at the upper gallery, where the royal ladies in seclusion can watch and not be seen. Here and there a curtain would part and a shy face appear, seeking a better view than that afforded by the slits in the screens.

"What must they be thinking of you up there?" I asked my neighbor in the visitors' gallery, a charming lady from northern India in a sari of light blue and gold.

"That I am depraved or very lucky—or both, perhaps!" she answered.

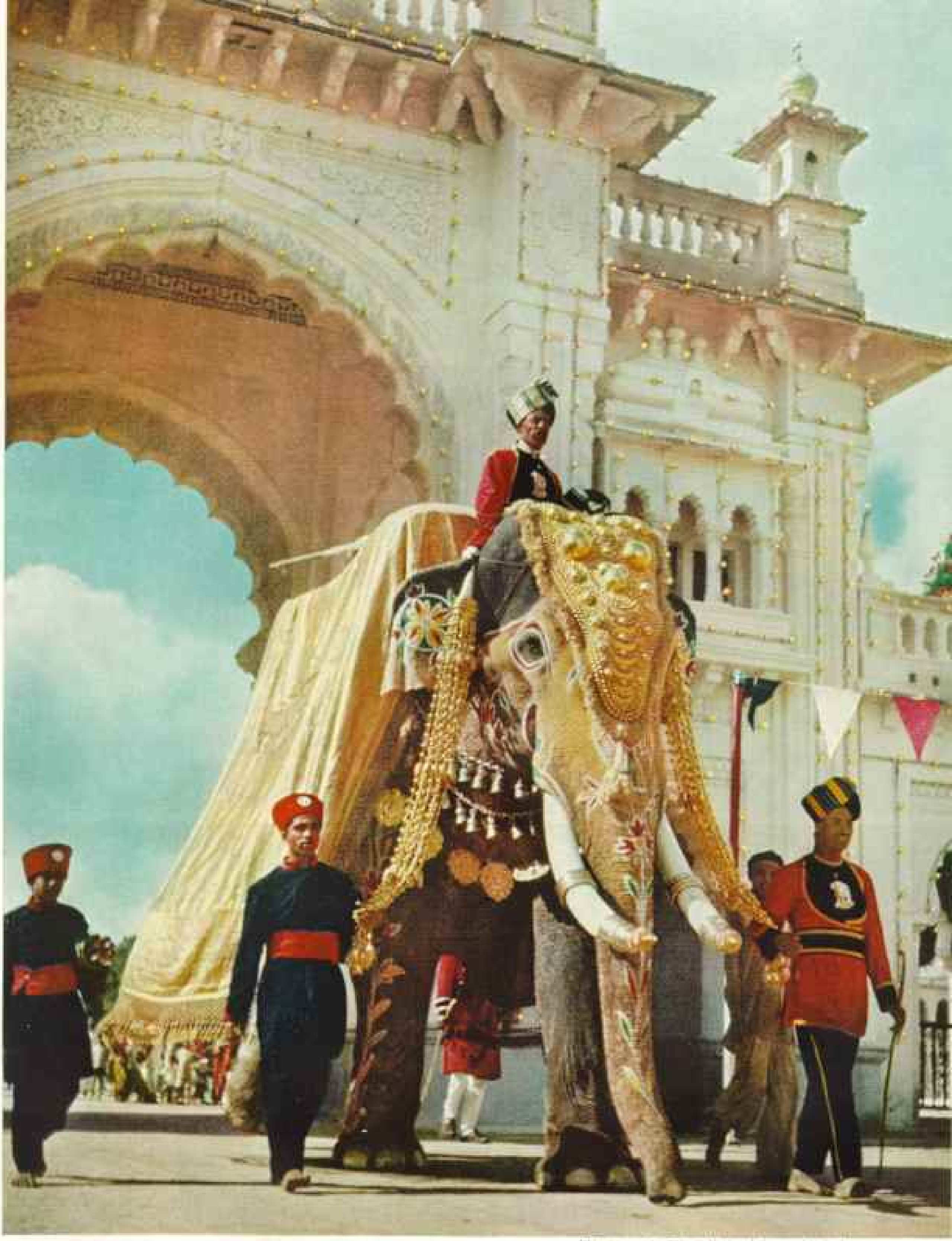
Every night a different entertainment in the palace courtyard delighted the people—a display of horsemanship and lancing technique to the strains of Viennese waltzes; a ritualistic bout with long sticks, to the rhythm of a drum; a traditional drama by actors on stilts.

Outside the palace walls the city teemed with India's version of carnival pitchmen—fakirs, snake charmers, and one jewel peddler who advertised "Original Cultured Diamonds!"

Sometimes, towering above the motley pattern of the populace and scattering it as they came, four or five elephants would appear, their huge legs, trunks, and flapping ears still covered with brilliant decorations. A troop of delighted children would skip excitedly behind and accompany them to the city pump to see the paint washed off.

(Continued on page 711)

* This series of color photographs by the Vienna-born American photographer Camilla Koffler, professionally known as Ylla, was one of her last. Shortly after completing it, she fell from a jeep while photographing a bullock-cart race south of New Delhi and died within a few hours.



Ektachrome by The © National Geographic Society

Painted Elephant with Gold-capped Tusks Sweeps Through a Gate in Mysore

When autumn brings an end to the rainy season, all India celebrates Dasara, the famous Festival of Ten Days. In the southern state of Mysore this religious fete reaches a peak of magnificence with lavish receptions and exhibitions, and processions of sacred animals resplendent in paint, jewels, and brocades. Gates and buildings of the palace blaze with some 300,000 lights. Here the Maharaja's royal elephant proceeds to a durbar, or princely reception.

Pipers Lead a Tusker Too Regal for Riders

During Dasara, gay throngs crowd the streets of Mysore city to watch sword dancers, clowns, and fireworks, and to drink in the pomp and pageantry. Each day they view the spectacle shown here, when the state elephant, most venerated animal in the royal stables, is taken to Somesvara Temple.

Gilded toenails and silver anklets adorn the beast's legs. Jeweled sword and shield emblazon the forehead. The seat is sheer ornamentation, since not even the Maharaja rides the state elephant.

A two-headed eagle, long the emblem of Mysore, is painted on the trunk. This bird seems to be related in mythology to the roc, the gigantic creature whose claws carried Sindbad the Sailor in the *Arabian Nights* tale.

Musicians play drums and bagpipes adapted from Scottish models.

Members of the honor guard at left raise a ceremonial umbrella and pike. Man in white trousers, long coat, and gold-striped turban wears Mysore's prescribed court dress, including a 10-foot sash.

Cosmetics and vegetable dyes beautify an elephant. Paints are washable so that the animals can be freshly decorated for each day's festivities.

Artists exaggerate eye lines and make bright flowers grow on legs and trunk.

Forehead crescent symbolizes Siva, the Hindu god whose wife Durga once fought a terrible buffalo demon for 10 days. This battle and Durga's eventual victory are the occasion for the Dasara celebration. To Hindus they represent the triumph of Good over Evil.

Baby elephant accompanied his mother in all Dasara parades because she refused to leave the stables without him. To keep him quiet during rituals, mahouts offered bribes of sugar cane. Too restless for formal adornment, he wears only eye make-up and stray dabs of paint.

© National Geographic Society

Snowy Mount with Gilt Hoofs and Gemmed Bridle Carries the Maharaja

On the morning of the 10th day, the Day of Victory, the Maharaja rides forth from the palace to preside over feats of arms. Tradition favors white chargers for the Mysore stables. Shaded palace windows shield ladies of the royal household who stay in seclusion during Dasara.

Mysore was once a most warlike state, and the festival of Dasara possessed from the first a strongly military flavor. To get the blessing of Durga, the warriors of Mysore would assemble a cross section of their armament and have it duly blessed. This custom survives vividly in the Puja of Arms.

Today, however, it has been widened to include the gear and tackle of men's peaceful pursuits. We watched not only swords but grain flails trundled past the palace for the Puja ceremony. Oddly, when we returned from photographing the event, we discovered our own jeep wreathed in flowers. It, too, had received its Puja.

On the tenth day excitement ran high. Consulting the stars, the palace pundits had divined that the most auspicious moment for starting the final parade would be 4:16 p.m. Workmen had slaved over a complicated scaffolding at one side of the palace; from it the Maharaja's golden howdah would be lowered onto the back of his chosen elephant. Ranga, one of the oldest, handsomest, and most respected beasts in the royal stable, was the one so honored.

Minutes ticked by. Suddenly—boom! The first gun of the 21-gun salute broke the silence. At the northern gate four mounted camels appeared, ungainly yet nobly disdainful. Behind them marched elephants, lancers, palace guards, army troops—and with them detachments of police, Boy Scouts, and delegations of civic groups.

Overhead the skies darkened ominously. More cavalry came, more elephants—and finally Ranga, swaying proudly with his princely charge.

A few drops of rain, a drizzle, then a drenching downpour. It didn't seem to worry anyone. Thousands of palace lights gleamed, their brilliance doubled in the mirrorlike puddles. Ranga, unperturbed, strolled at the same measured gait.

A tall stepladder on a wooden ramp was wheeled up to Ranga's flank. As though it had been the brightest of nights, His Highness stepped down from the howdah and, picking his way across the damp red carpet, disappeared into the palace.

Dasara, dignified and stately to the end, was over.

Jeweled Saddle Empty, the State Horse Kneels Before the Maharaja

Dasara crowds assemble daily in the palace courtyard to watch the most sacred of Mysore's horses pay homage to His Highness, who is regarded as the representative of the goddess Durga. A cushion protects the legs of this albino stallion from the flower-strewn pavement.

Hatchetfish, Torchbearers of the Deep

Photographs and Text by Paul A. Zahl, Ph.D.

OUT OF the memory of my deep-sea fishing days in the Mediterranean swims a peculiar silvery fish half the length of my little finger. Its mouth opens like a cavern. Its globelike eyes telescope upward, not ahead. Its underside glitters with rows of light-producing beads.

Along a legend-rich shore in the Strait of Messina, we found hundreds of these hatchetfish (*Argyropelecus*) cast up by depths-scouring tidal currents. And flapping helplessly near the surface or tossed up on pebbly beaches were viperfish, needle-jawed dragonfish, deep-sea shrimp and squid, and microscopic plankton.

These miniature sea monsters, captured within sight of the fabled Rock of Scylla and the whirlpools of Charybdis, suggest the fearful forms of ancient Greek lore.

But it was not their shape alone that fascinated us. Many carried torches on bellies and sides—light organs that glow brilliantly in the blackness of the underwater world.

The function of the lights remains a puzzle. Are they lures? Are they signposts for species or sex recognition? Or are they merely lanterns? Biologists have speculated for years.

We could shed no light on the mystery, for we had no means of descending into the fishes' black haunts. We could depend only on the generosity of the strait's extraordinary currents, which brought hundreds of abyssal creatures to the surface and to our nets.*

Transferring them to tanks of running sea water, we made the first color photographs of these deep-sea dwellers.

Since then, in the bathyscaphe, Lt. Comdr. Georges S. Houot has dared to drop into the Mediterranean's abyss and there to spy on some of the very species delivered to us by Messina's upwelling tides. His exciting story is told in the following pages.

* See "Fishing in the Whirlpool of Charybdis," by Paul A. Zahl, NATIONAL GEOGRAPHIC, November, 1953.

Patches of silvery pigment gleam on head and body of *Argyropelecus*, the hatchetfish (enlarged 5 times). A miniature monster in harlequin mask, it points bulging eyes upward. Gaping, cavernous maw testifies to the capacity of this fierce predator.

Luminescent organs glow like lustrous jewels on the thin belly of the hatchetfish. The shimmering pink photophores illuminate ocean's depths around the globe. From the bathyscaphe Lt. Comdr. Houot often saw these fish, "their undersides sparkling like torches."

Siphonophore, a jellyfish, seems to beckon with pale pink fingers. Deadly tentacles trailing below paralyze prey coming within reach, then pull the victim into the pulsating body. Bathyscaphe pilot Hoppt saw hordes of siphonophores during his Mediterranean dives.

These color photographs were made by Dr. Paul A. Zahl in the Strait of Messina, where upwelling currents bring deep-sea creatures to the surface.

Sad-faced crustaceans, no bigger than grains of wheat, dart in the sea. Reddish eyes peer from almost transparent bodies (here enlarged 8 times) that shine an unearthly purple. A form of plankton, these animals drift in countless billions, food for multitudes of marine creatures.

Plankton-filled water, so familiar to bathyscaphe divers, has been described by Capt. Jacques-Yves Cousteau as a living soup, "a purée of tiny organisms."

Deep-sea shrimp, like many tenants of the ocean's black abyss, exhibit fragile, glassy bodies suggesting ice-carved figurines. Red chromatophores, or color cells, spot these shrimp (magnified 4 times). Black popeyes wave on stalks.

Four Years of Diving to the Bottom of the Sea

Globe-eyed Sharks, Fish with Stilts, Undersea Deserts, Avalanches, Powerful Currents—the French Bathyscaphe's Record-holding Pioneer Pilot Tells of 59 Trips to the Black Abyss

By Lt. Comdr. Georges S. Houot

With Electronic Deep-sea Camera Photographs by the Author

THE RED LIGHT has just come on at the corner of the Boulevard de Strasbourg, in the heart of Toulon; I stop my car in the line of vehicles. It is eight o'clock in the evening, and I am driving home for dinner with my wife and son.

End of a humdrum working day? My glance roams over my neighbors sitting at their wheels, but my eyes do not see. My thoughts are elsewhere, in another world, strange and fascinating, which only a few privileged persons have seen, which none of these evening drivers knows.

Only a few hours ago I was off the coast, 7,500 feet under the sea. Yet no one looks at me; I bear no visible trace.

A bare four years ago, what a noise such a dive would surely have made in the press! What a distance we have traveled since then! Today no one attaches any importance to it, and there will be no big headlines in the papers tomorrow, not even a paragraph. No one will know that I have just descended to the bottom of the sea for the 59th time.

New Era of Research at Great Depths

Thus does the modern world quickly become accustomed to what only yesterday seemed impossible. It does not occur to anyone to say that a Super Constellation has just crossed the Atlantic; yet is Lindbergh so old? It is the same with the *F.N.R.S. 3*, the French Navy's underwater exploration vessel, better known as "the bathyscaphe." What is a dive down to 7,500 feet when the machine has already descended to a depth of 2½ miles?

Four years ago, in the National Geographic Magazine, I wrote, in concluding the description of a 13,287-foot dive, "From now on, the bathyscaphe belongs to science."*

The years which have since elapsed have fully confirmed this prophecy. Assisted both by the National Scientific Research Center and by the French Navy, the *F.N.R.S. 3* has dived regularly. Without fanfare, in the silence of pure research, it has opened a new technique for scientific study at great depths.

Lt. Pierre Henri Willm, engineer, surrendered his place in the bathyscaphe's spherical gondola to men of different scientific branches. For the first time in history, biologists have been able to observe abyssal animals moving in their environment at a depth of more than a mile; geologists have seen the exact appearance of the ocean deeps. Our searchlights regularly pierce this darkness, enabling man at last to say, "I have seen the bottom of the seas."

For we see very well through our porthole. As soon as the passenger leaves the surface, his gaze is turned toward the outside. He is fascinated by the spectacle that passes before him, for it lets him know what the bathyscaphe's stability would otherwise cause him to forget: that he is descending.

Like Sitting in a Drawing Room

Often I have been asked whether the impression is the same as in an elevator. Each time I reply with a categorical no. In an elevator, motion is felt; in the bathyscaphe's sphere, only the control instruments and the view of the outside world enable one to know whether he is ascending or descending.

I generally keep the machine's speed of descent at about four to six feet per second, a comfortable rate for observing the animals closely. At this speed the *F.N.R.S. 3* does not give the passenger the slightest sensation of motion, not the smallest vibration. One could easily believe himself in a drawing room, if the engineers had not been compelled to sacrifice comfort!

During the first 650 to 1,000 feet of the descent the gradual fading of sunlight still permits one to realize that he is in the liquid mass. But lower down the impression changes. Here reigns eternal night—deep, absolute darkness unknown at the surface.

In this black but transparent mass the beams of our searchlights show millions of

*See "Two and a Half Miles Down," by Lt. Comdr. Georges S. Houot, National Geographic Magazine, July, 1954.

small particles, looking like snowflakes, in equilibrium in the water. The passenger must make a mental effort in order to understand that if he is seeing this snow ascending, it is because he himself is descending.

At lower levels these particles are small drifting animals, mostly crustaceans, all generally known as plankton. Without doubt there are other particles of organic matter among them, bodies of dead plants and animals, debris of all kinds which is descending slowly toward the ocean depths.

During the course of this article I shall be forced to refute some ideas that may still be held concerning the marine world. I begin at once by opposing any belief that the density of plankton regularly decreases with depth. Our searchlights, set to shine vertically

Tossed by the Choppy Atlantic, Deep-diving Bathyscaphe Awaits a Tow

This tiny two-man craft, the French Navy's *F.N.R.S. 3*, has explored the depths of Mediterranean and Atlantic for more than four years. The name stands for Fonds National de la Recherche Scientifique, the Belgian research fund which helped construct the craft. No other man-carrying device has ever matched the record two-and-a-half-mile depth it reached in 1954. Here, seamen from a tender scramble over the bathyscaphe, helpless when surfaced.

from above, give a good idea of the density of the plankton.

Professor Francis Bernard, of the University of Algiers, attempted an estimate of these small organisms during dives he made in 1955 and 1957, but for the moment it is not possible to deduce laws from this. For me, who am not a plankton specialist, this snow merely constitutes a backdrop for larger, more important, as well as prettier, animals.

First of all, there are the *Argyropelecus*, or hatchetfish, with their undersides sparkling like torches (page 713); then certain Siphonophora, which resemble long, fragile filaments; actually they are colonies of animals which live clustered together (page 714). There are medusae of all kinds, in particular *Solmissus* and *Solmaris*, delicate, fragile laces which slowly wave their arms.

In addition to these known and identifiable species there are strange creatures, some of which no biologist yet knows—in particular, gelatinous masses of different shapes, some similar to American footballs, others grouped in strings like small eggs. All are so fragile they are invariably destroyed, torn to pieces, as soon as captured in plankton nets.

Suddenly, rapid streaks, long and slender and very brilliant, pass into the shafts of light; we are about 2,000 to 2,500 feet deep in the domain of the *Paralepis*.

Clarma Service des Armées

Columbuses of the Deep Receive Congratulations from President René Coty of France

President Coty commends the two French naval officers, Lt. Comdr. Georges S. Houot (center), the author and bathyscaphe's pilot, and Lt. Pierre Henri Willm, engineer of *F.N.R.S. 3*, at an international nautical exposition in Paris. Both have been awarded membership in the Legion of Honor for supervising construction of the bathyscaphe and piloting her to record-shattering depths.

Upright Citizens of the Sea

Far be it from me to say that these animals were unknown! But it took the dives of the *F.N.R.S. 3* to learn that these fish, about eight inches in length, maintain themselves in the water in a vertical position (page 727).

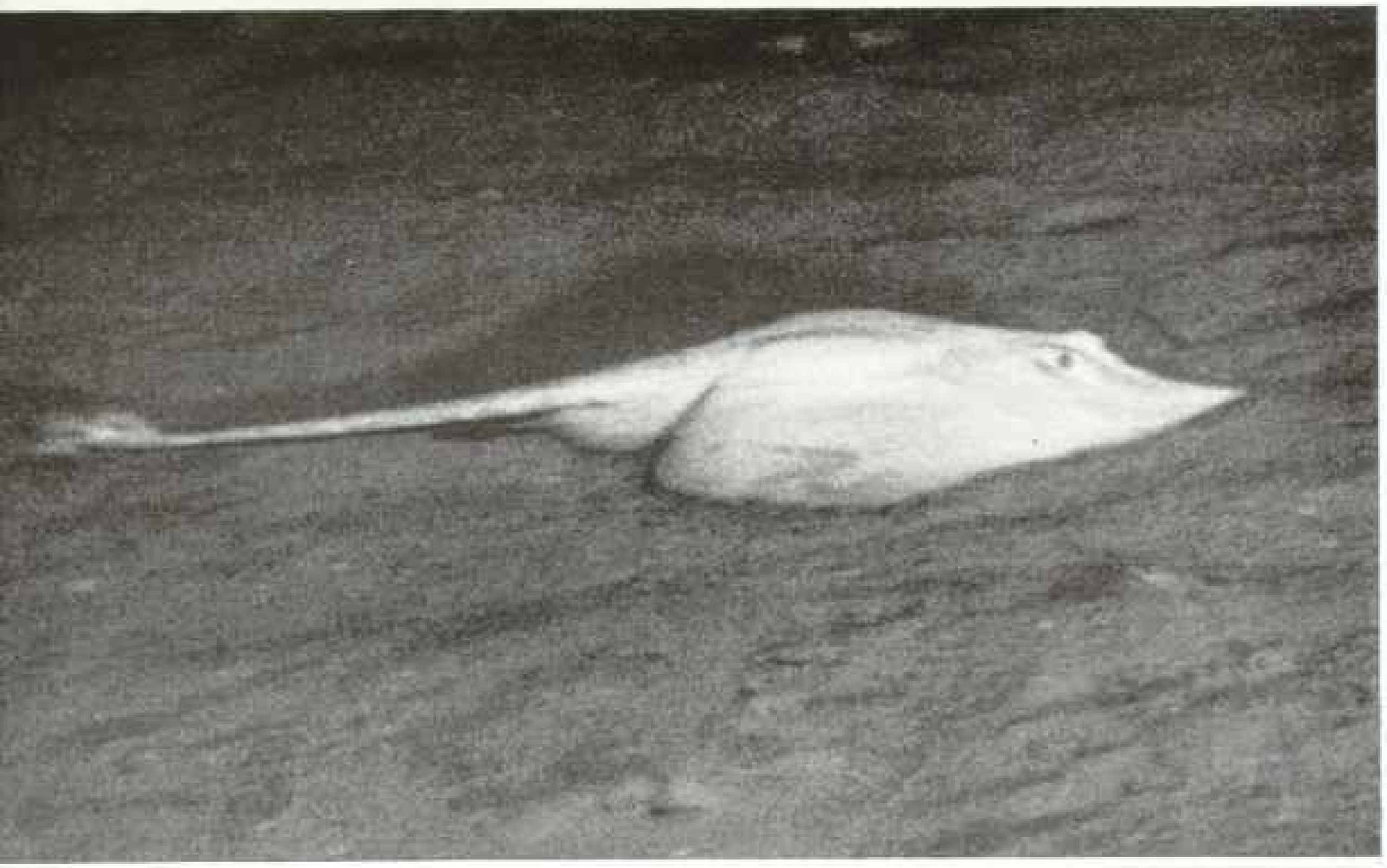
Shall we ever know the reason for this strange posture? Erect on their tails, they come from the depths to meet the bathyscaphe, then swerve abruptly and dive head downward. Sometimes certain ones remain almost motionless in front of the porthole, stiffly erect like asparagus.

I have even captured two of them—not intentionally, it is true! I think they dart vertically too fast toward our machine, so they cannot brake in time and strike against our hull. With a little good luck (for us) or

Like a Spaceship Landing on an Unknown World, *F.N.R.S. 3* Nears Bottom

The painting on the next two pages depicts the bathyscaphe as it explores the depths of Setúbal canyon, off Portugal, notable for its plantlike animals. The submarine drifts through eerie darkness, its searchlights bathing a surrealistic rock garden. Feather-shaped pennatulids and shrublike gorgonians, forms of soft coral, carpet the sea floor and festoon the boulders. Fauna and rocks were seen on separate dives. Spiny dogfish sharks with bulbous white eyes (page 729) and a deep-sea skate (page 720) circle beneath jellyfish waving graceful arms.

Painting by Michael Ramos © National Geographic Society



Goblin of the Depths, a Beak-nosed Skate Hugs the Desertlike Sea Floor

Commander Houot encountered this two-and-a-half-foot skate (*Raja*), relative of the ray, effortlessly soaring across the ocean bottom 7,200 feet down (page 727). Ignoring the bathyscaphe, the creature glided to a landing beside the gondola and leisurely posed in profile.

bad luck (for them) they become entangled in our cables, where we find them on our return to the surface.

And so the descent proceeds slowly. Gloom reigns in the sphere, and above the shoulder of my passenger I see the porthole, a blue, luminous disk. A dim little lamp on my left enables me to distinguish vaguely the outlines of the various instruments and illuminates the dial of our vertical-speed indicator. A flashlight is always within reach, and from time to time I can throw a beam on the depth indicator.

Ballast Controls Speed of Descent

At regular intervals I press the control button of the ballast electromagnets. By thus releasing small quantities of shot, I control the speed of the machine. I can even stop it completely, suspended in mid-water, if my passenger so desires.

A brief glance at the gauges assures me of the perfect equilibrium of pressure between the gasoline and the sea. A check of the CO_2 dosimeter and another of the oxygen release are sufficient to assure me that all is well. Thus I remain absolute master of the machine, although seated with a notebook on my knees.

My passenger, stretched out at my feet on a foam-rubber cushion, eye riveted to the porthole, takes notes by the feeble glow of my lamp and comments aloud, for my benefit, on what he sees. Soon he will have a specially designed magnetic tape recorder—completely automatic and unaffected by background noise—and can dispense with his notebook.

From time to time my passenger presses a button. A vivid flash illuminates the porthole: he has just taken a photograph. We have two cameras and four electronic flashes, developed, thanks to the generosity of the National Geographic Society, by Professor Harold E. Edgerton of the Massachusetts Institute of Technology, who has revealed in The Society's Magazine the secrets of his marvelous instruments.*

When we approach the bottom, I start the echo sounder, which gives me our exact height above the ocean floor and enables me to make

* See "Photographing the Sea's Dark Underworld," by Harold E. Edgerton, National Geographic Magazine, April, 1955.

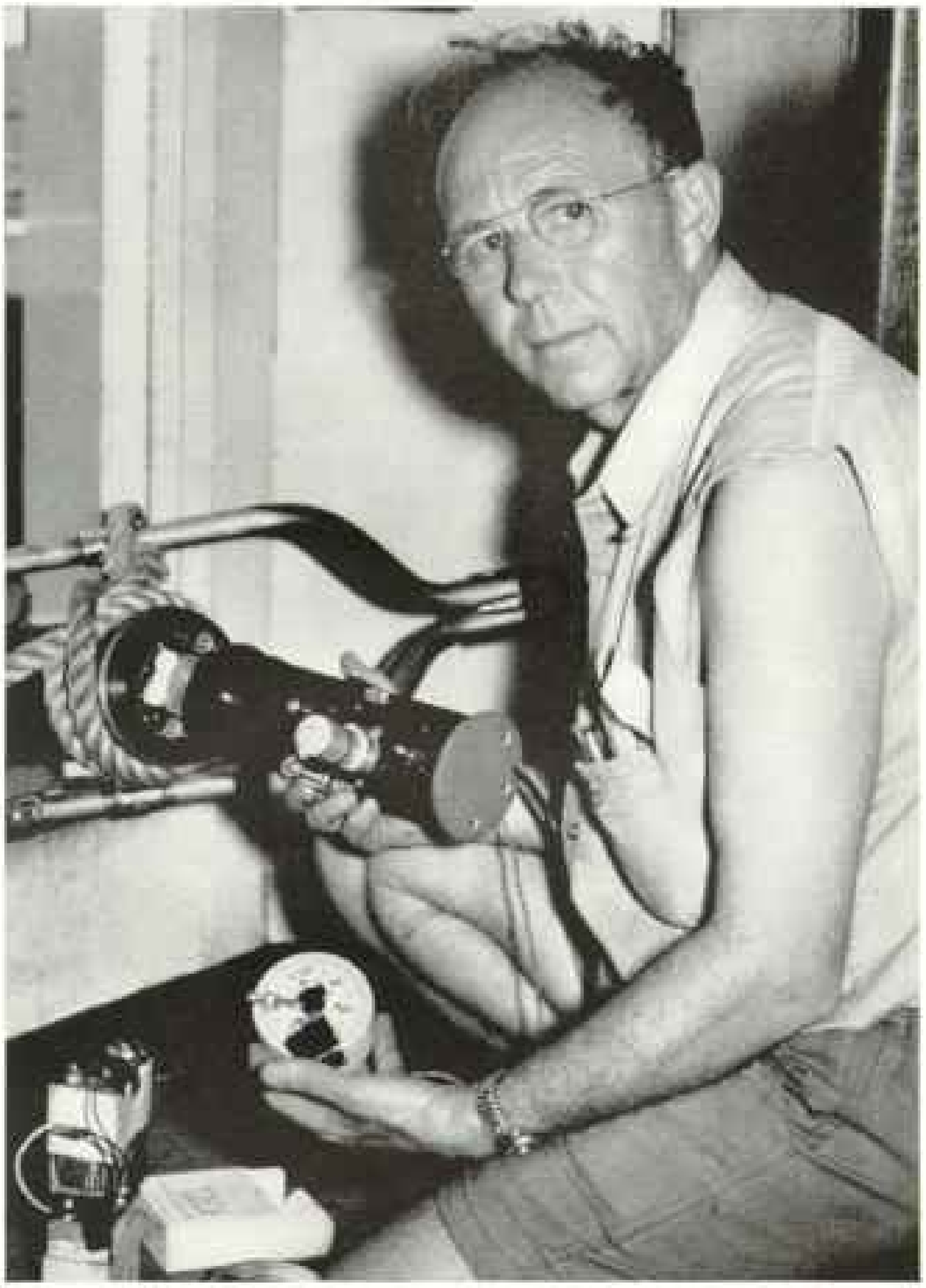
what an aviator would call an instrument landing. This is the most critical moment of the dive; it is necessary to make contact with the bottom at very slow speed. There are two dangers to be avoided: mire, from which it would be very difficult to extricate *F.N.R.S. 3*, and a projecting rock, which would damage the machine.

I must admit that landing on the bottom is always exciting. It is regaining contact with the ground; it also means reaching the destination, the goal!

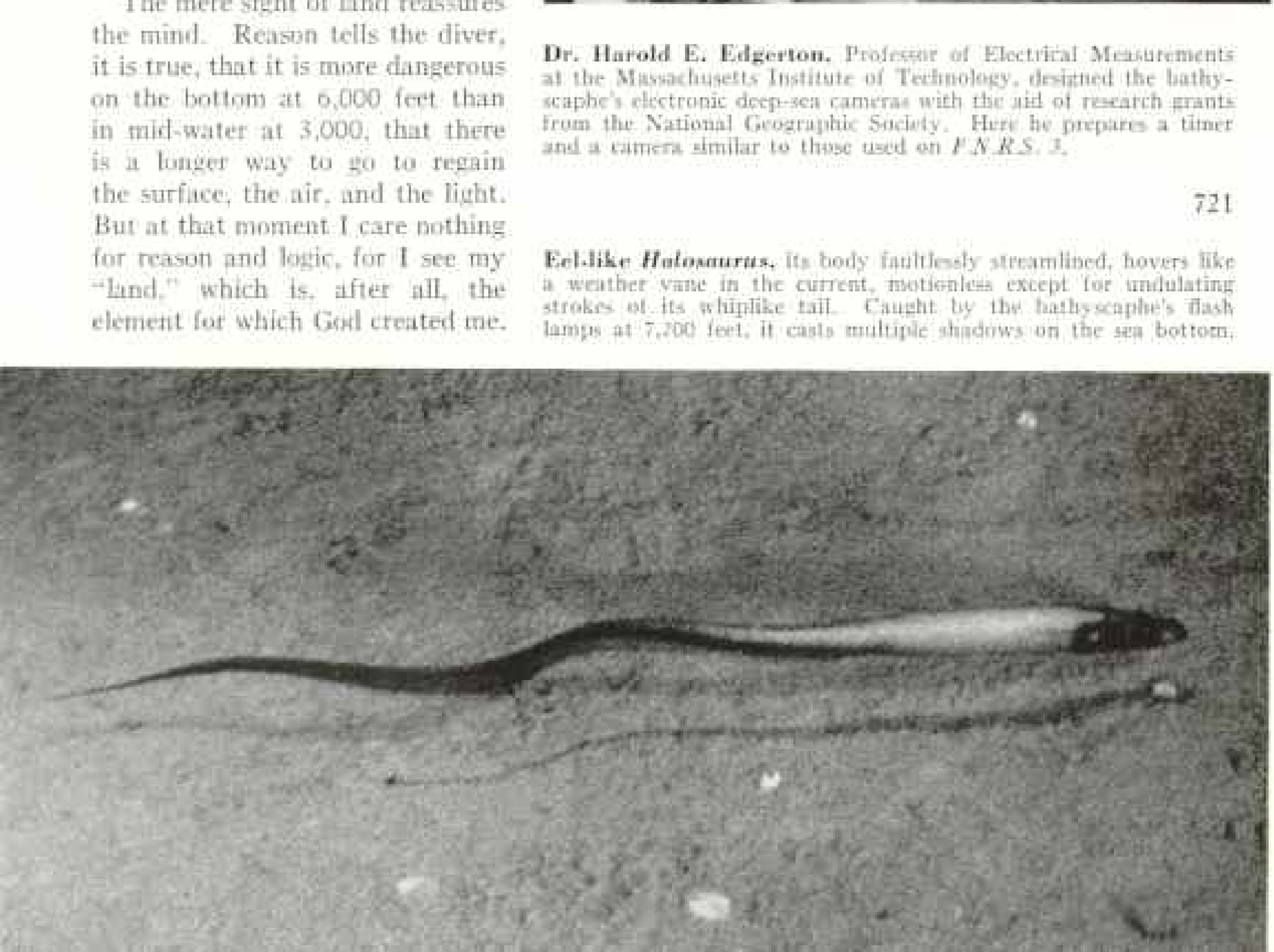
Vastness of a World Not Ours

However accustomed one may be to these dives, he cannot help a certain feeling of distress during the descent through the enveloping waters. Though the searchlights illumine a small part of the liquid mass, one feels behind the black wall the immensity of the oceans, the vastness of this world which is not ours, where we cannot live. The occupants of the bathyscaphe play at being fish, perhaps, but they are not fish and never will be fish.

The mere sight of land reassures the mind. Reason tells the diver, it is true, that it is more dangerous on the bottom at 6,000 feet than in mid-water at 3,000, that there is a longer way to go to regain the surface, the air, and the light. But at that moment I care nothing for reason and logic, for I see my "land," which is, after all, the element for which God created me.



Dr. Harold E. Edgerton. Professor of Electrical Measurements at the Massachusetts Institute of Technology, designed the bathyscaphe's electronic deep-sea cameras with the aid of research grants from the National Geographic Society. Here he prepares a timer and a camera similar to those used on *F.N.R.S. 3*.



Eel-like *Halosaurus*, its body faultlessly streamlined, hovers like a weather vane in the current, motionless except for undulating strokes of its whiplike tail. Caught by the bathyscaphe's flash lamps at 7,200 feet, it casts multiple shadows on the sea bottom.

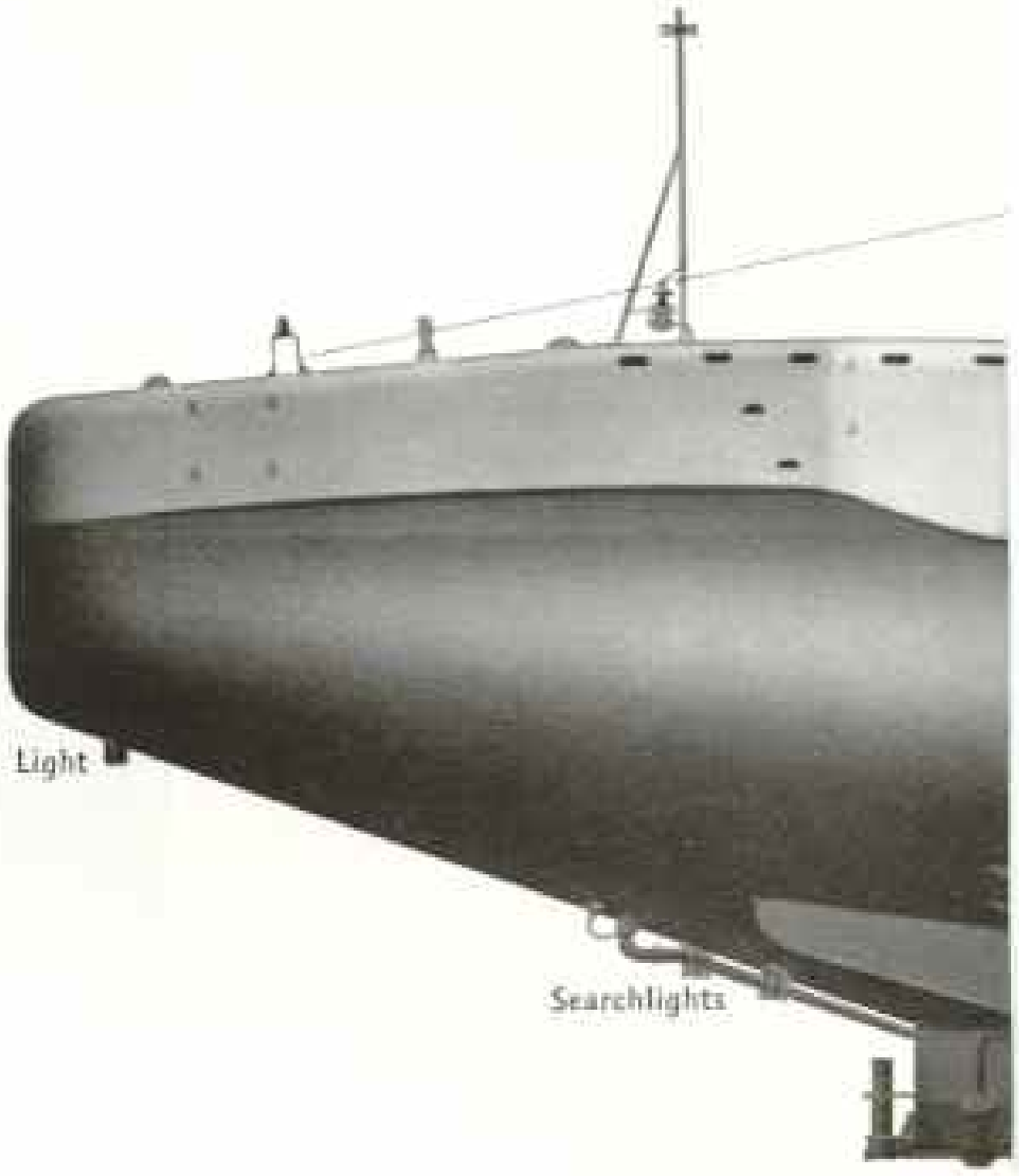
Bathyscaphe, an Underwater Balloon, "Soars" to Ocean Depths

Just as lighter-than-air gas gives buoyancy to a balloon, so lighter-than-water gasoline buoys the bathyscaphe, whose name comes from the Greek *bathy* (deep) and *skaphe* (boat). An opening in the bottom (1) permits sea water to enter the thin "gasbag" hull, equalizing pressure inside and out.

Unlike the hull, the 12½-ton gondola of thick cast steel resists enormous water pressures. At record depth, weight on each square yard is that of some 50 locomotives, yet the two-man crew inside works at sea-level conditions.

To dive, crew enters through air lock (2), which is then flooded with sea water, adding weight and starting descent. Pilot may check the dive by releasing driblets of bird-shot ballast (3). Conversely, to accelerate descent, weight is taken on by releasing small amounts of gasoline which are replaced by heavier sea water.

Near bottom, the 33-foot chain (4) touches down. When sufficient weight of links rests on ocean's floor, the ship hovers in equilibrium. To rise, shot is jettisoned, and the chain is released from an electromagnetic fastener (5).



Drawn by Rolf Klep © National Geographic Society

I have seen thus the bottom of the Mediterranean off Toulon and off Nice, and I have seen the bottom of the Atlantic off Dakar and off Lisbon and Setúbal in Portugal.

Even though I may disappoint the reader, I cannot hide from him this truth: The bottom of the sea at great depths is not beautiful but consists for the most part of vast expanses of mud. I have tried the most varied types of sea bottoms within the limits accessible to me: flat regions, submarine plains, and the coastal clefts geologists have named "submarine canyons."

Eerie Echoes from Unseen Walls

It is in the last instance that the spectacle is the strangest. The abrupt slopes of the walls of the canyons (30 to 45 degrees sometimes) are visible from far off because they reflect light. Since the strongly illuminated mud usually exhibits rather light tones, grayish or yellowish, one has the impression of being in high mountains and gazing down at a field of snow. It does not require much imagination to feel that one is going to get out, put on skis, and slide down the slope!

Once, off Toulon, this feeling of sitting on a mountain was accentuated by a phenomenon well known to Alpine climbers—the echo.

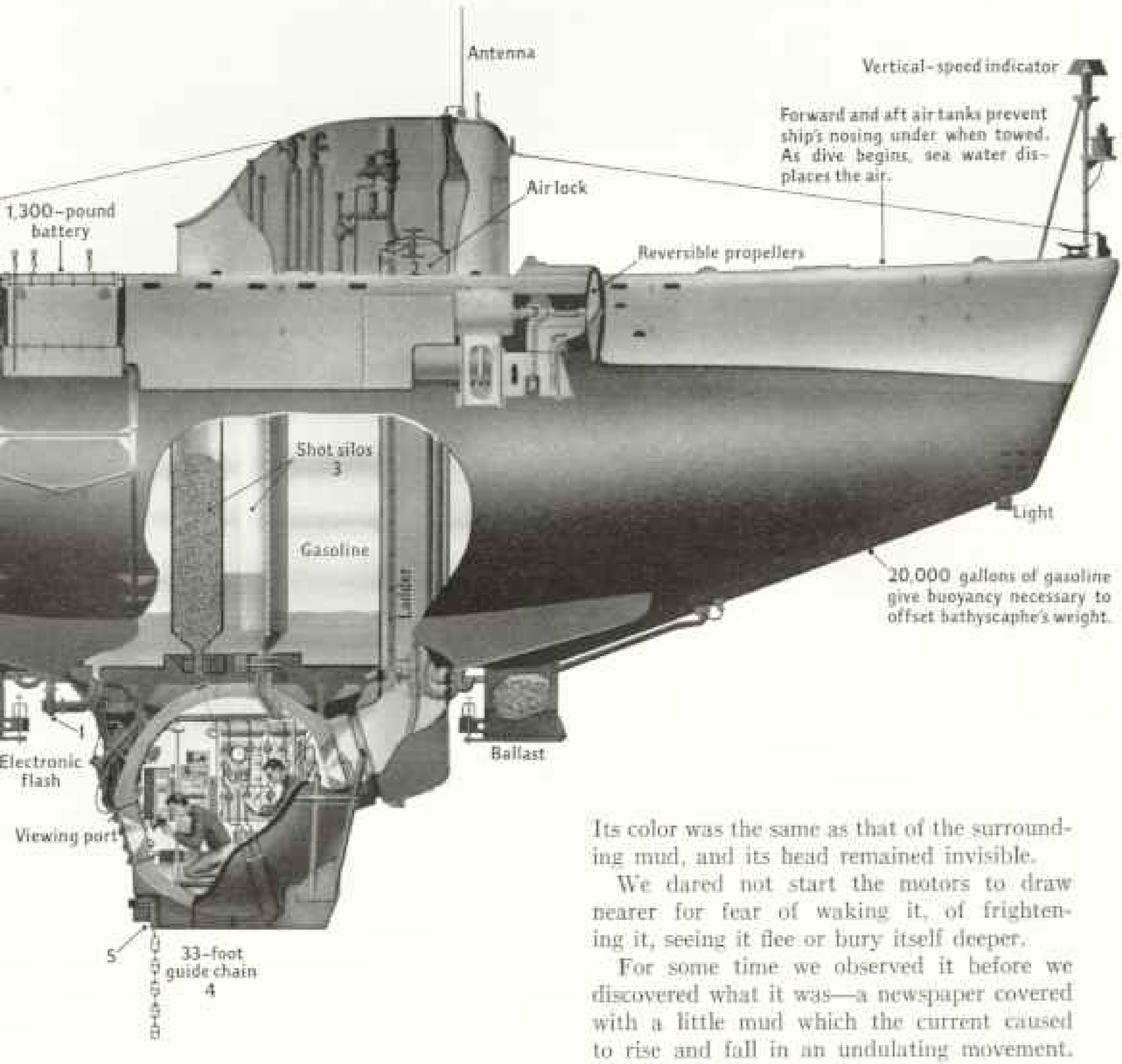
The explanation is simple: I was communicating by ultrasonic signals with the *Elie-Monnier*, the escort boat which was waiting for me on the surface. With headphone on I was listening to the replies coming from above, and I was surprised to hear each of the Morse dots and dashes reflected back numerous times by the walls surrounding me.

I must say that for me the phenomenon was stranger, more impressive even than for the mountaineer. Enclosed in my little sphere and having only my porthole, I did not see these walls and only divined their presence from this echo. I felt hemmed in between invisible walls, very close by and seeming to me still closer. Since sound travels five times faster in water than in air, the various echoes followed closely upon one another.

The most distressing feeling, when one hears such echoes, is that there may also be a wall overhead—that the bathyscaphe, in landing, may have glided under an overhanging rock.

A more frequent phenomenon, and unfortunately more troublesome, disturbs dives in the canyons: underwater avalanches. The contact of the bathyscaphe or its guide chain with the canyon wall, or even the release of a few pounds of ballast, detaches small lumps of mud. Carried along by their own weight, they begin to roll down the slope.*

* See "Diving Through an Undersea Avalanche," by Capt. Jacques-Yves Cousteau, National Geographic Magazine, April, 1955.



Other lumps are detached, and a full-fledged avalanche is set in motion. Enormous dark clouds rise above the bottom of the sea. We then find ourselves plunged into such darkness that our searchlights are powerless to penetrate it, and we can only wait until the whirling clouds are dissipated. If the sea current is weak, this may take 15 minutes or even half an hour (page 726).

One avalanche was so violent that the cloud was still just as dense at the end of an hour. We decided then to leave the bottom to get out of the disturbed area. It was necessary to rise nearly 1,000 feet to find clear water.

Dives onto flat bottoms are, of course, calmer; they are not lacking in picturesqueness, nonetheless. I remember one day when our attention was attracted by a strange, very flat animal about 18 inches long, half submerged in the mud and breathing slowly. Its "breast" rose and fell with each inhalation. Its color was the same as that of the surrounding mud, and its head remained invisible.

We dared not start the motors to draw nearer for fear of waking it, of frightening it, seeing it flee or bury itself deeper.

For some time we observed it before we discovered what it was—a newspaper covered with a little mud which the current caused to rise and fall in an undulating movement. To our regret, we could not read its name; what an advertisement it would have been!

Piles of Debris, but No Treasure

During other dives I have found gunnery shells, a can of preserved goods, pieces of planks, and steel cables. I know, of course, that such things must often end by resting on the sea bottom, but that does not prevent me from being quite startled to discover them there. I should prefer finding an ancient wreck, one of the famous galleons filled with gold, but my luck has not yet reached that point.

I have seen rock only twice in these four years of diving. The first time was in 1954, off Toulon. I was taking a representative of the French Press Agency for a dive, and I was hoping to show him some specimens of deep-sea fauna. For this purpose I had chosen on the map a nice flat bottom, 7,500 feet down, marked "muddy sand."

Bowell Walker, National Geographic staff

Gazing Through the Gondola's Cyclopean Eye, Houot Triggers His Cameras

The interior of the sphere, 6½ feet in diameter, serves as the vessel's bridge, lookout station, engine room, passenger cabin, photographic studio, and laboratory. A friend, amazed at the mass of equipment jammed into the compartment, once observed, "It seems you have everything worked out nicely but comfort." Here the bathyscaphe's pilot and master, surrounded by controls and cables, tests the Edgerton cameras.

Imagine my surprise when I landed on the edge of a vertical cliff, a fine naked rock without a trace of life! I should have liked to change station, but I hesitated. I was afraid of the black, gaping hole that I guessed was there where the rock ended. I have never been afraid while descending from the surface to the bottom, but this time, with such a precise reference mark, I asked myself with distress what the darkness hid. Some rocky crevice in which we might become wedged?

Finally I made up my mind and started the motors. The *F.N.R.S. 3* glided gently, remained suspended a few seconds above the void, and slowly began to descend along the completely vertical wall. Sixty-five feet farther down it landed on a field of mud.

The second time was in 1956, at the bottom of the Setúbal canyon. Great blocks of rock projected from the mud, and sponges clung to their vertical walls.

If these fields of mud presented themselves to our view outside the water, they would be called "deserts" on geographic maps. They

are due, in my opinion, to a very simple phenomenon: the total absence of vegetation. It is hardly necessary to recall in this connection the old axiom: "Vegetation means chlorophyll and chlorophyll means sunlight."

Beginning at a depth of about 1,300 feet it is always night; below this depth, therefore, there is no longer any vegetation. But fortunately for the passengers in the bathyscaphe, these deserts are inhabited by a varied fauna.

My most frequent passengers are biologists. Some are interested in plankton, others in the fauna at the bottom, still others in fish living in mid-water. But can I be reproached for continuing, after four years, to look for a more "touristic" character in these dives? Though I listen with the greatest attention to the enthusiastic observations of my passengers during the three to four hours required for the *F.N.R.S. 3* to descend to 6,500 feet, for my part I prefer the larger animals that we see at the bottom itself.

There are, first of all, the dogfish of the great depths, the largest of the animals seen thus far through the porthole.

It would be an exaggeration to assert that dogfish come to pay us a visit at each dive, but I have seen them off Toulon as well as 13,287 feet deep in the Atlantic. It is easy to see from photographs that these small sharks resemble rather closely their relatives at the surface, but their eyes are very big and globular, like two hemispheres bulging from their heads (page 729).

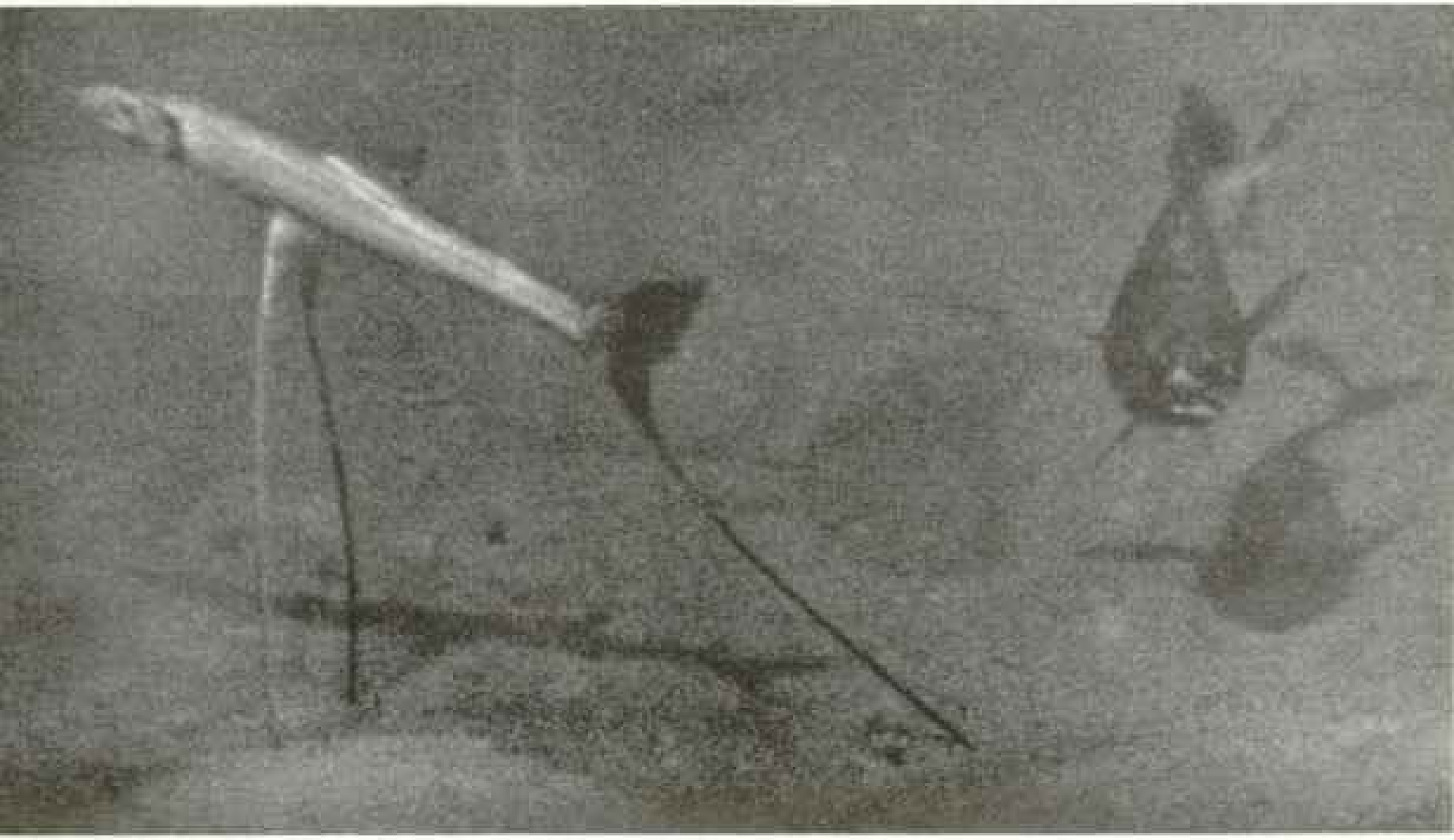
In regard to this subject, I digress and ask a question. Are abyssal fish blind? These animals have lived for millions of years in the realm of eternal night and appear to be totally insensitive to light. They pass back and forth in the beams of our searchlights, and they suffer the flare of our electronic flashes without the least tremor, whereas one would expect them to be blinded by such a vivid light.

Are we to believe that they have another means of detection, some apparatus of the radar or sonar type, the submarine analogue of the obstacle detector of bats?

For my part, I am absolutely convinced of this, never having seen them collide with the smallest obstacle, with only one exception—an exception, however, which does not invalidate the rule.

***Benthosaurus*, Its Fins Serving as Legs, Hops Across the Ocean Floor**

Examination of dredged-up specimens had convinced scientists that *Benthosaurus* trails its long pelvic fins and tail appendage as feelers. But observations from the bathyscaphe proved that the fish hops or rests on its extremities as if they were legs. This picture catches a subject at 7,000 feet. *Haloporphyrus*, a "double-tailed" fish, cruises at right.



This happened off Toulon during a dive made in 1954 with Comdr. Philippe Tailliez of the Undersea Research Group. We had equipped the *F.N.R.S. 3* with a trap, a large wire basket resembling a bird cage, to catch small fish. On the bottom, at 7,000 feet, a very beautiful ray drew near us and passed several times in front of the porthole in a slow and majestic glide. The trap was lying on the bottom, and the ray had passed beside it several times when suddenly, drawing still closer, it collided head on with the trap.

The contrivance, a few pounds in weight, bounded back a yard under the violence of the shock, while the frightened animal made a veritable loop the loop and fled at full speed. We never saw it again.

Is it not possible that the ray's detecting device was thrown off by the metal netting that reflected only feebly the wave emitted?

Prudence is imperative in such a new field, and I can speak only of what I have seen. In addition to these seemingly blind animals I see through the porthole, are there perhaps other fish which flee in the face of this intolerable light? How can I be sure? I have tried several times extinguishing all light for a long while, then taking photographs, thinking that the animals would not have time to disappear during the short duration of the electronic flash. The result was always zero.

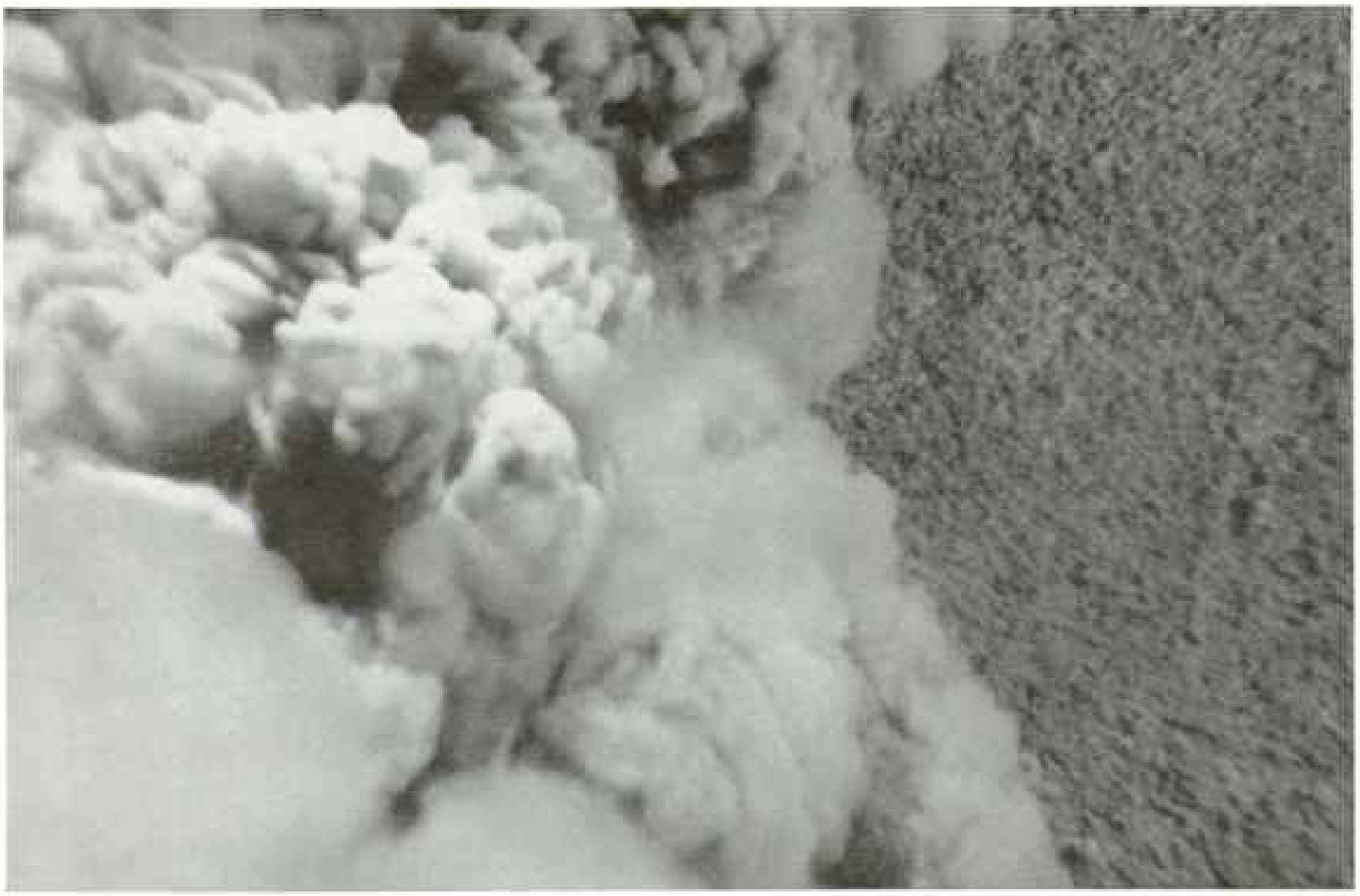
A Fish That Stands on a Tripod

It was in the depths of the Mediterranean that I encountered that most curious of fish, the *Benthosaurus*. Only two or three specimens were known before the bathyscaphe, caught in the Indian Ocean or in the Pacific. Its presence in the Mediterranean is still denied by specialized manuals.

The *Benthosaurus*'s strangeness derives from the existence of three long filaments prolonging the pelvic fins and the tail, and more particularly from the use this animal makes of these filaments. I do not wish to take a stand against the biologists who attribute to

Submarine Thunderheads Billow from a Treacherous Avalanche of Mud

A dramatic and terrifying episode in bathyscaphe's saga occurred in 1957 when the author and a scientist passenger collided with the wall of an undersea canyon near Toulon. The shock set loose an avalanche of silt, engulfing the bathyscaphe in yellow fog. The divers feared they were trapped, but after an hour of chilling wait they worked the ship upward through nearly 1,000 feet of murk to the surface.



these filaments a tactile purpose, but I can affirm that the fish use them as supports—as legs! I have never observed them in any other posture than sitting on their three projections. I see them on the bottom, "legs" wide apart, the head a little higher than the tail, the nose into the current, without moving, like a statuette on a mantelpiece (page 725).

I saw several in September, 1957, during a dive with Professor Bernard. One of them was almost under the sphere. I caused the bathyscaphe to rise and redescend; I even released ballast shot almost on its back, but it did not budge. If the fins had not been moving slightly, I might have believed it stuffed!

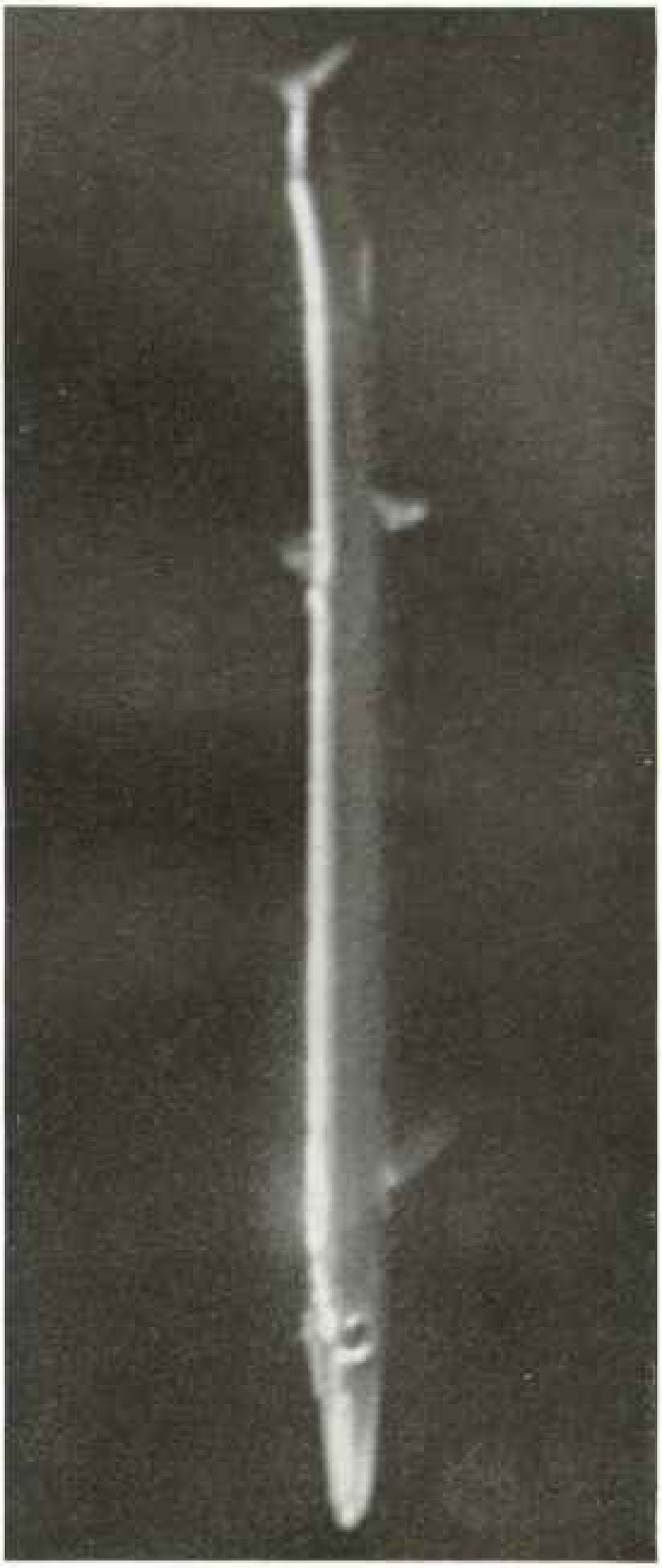
Fortunately, I brought back some photographs. Otherwise, who in the world would ever believe in the existence of a fish with legs?

According to the late Prof. Léon Bertin of the National Museum of Natural History in Paris, this discovery constitutes a veritable revelation for science. Nor was this the only one. Accompanied by Professor Théodore Monod, I saw in the Atlantic, a mile down, a giant crab, the carapace of which measured nearly 20 inches in diameter and which this scientist considers as still unknown. We were able to bring back a photograph, but, unfortunately, a poor one and quite insufficient for certain identification.

Likewise, in September, 1956, off Lisbon, when I had Dr. Mario Ruivo of the Instituto de Biologia Maritima as passenger, a large skate came and stopped in front of us at about 7,200 feet and remained there for a long while (page 720). It was light in color, but bordered with black. Its species is unknown. How many surprises does the sea hold in store for us?

More frequently we observe easily identifiable animals: the *Haloporphyrus* with supple, delicate dorsal antennæ (page 725); the great stone bass, calm and curious; the *Halosaurus* with long undulating tails (page 721); the stomiatoids with ever-gaping mouths. Allow me to observe in passing that it will be necessary to find simpler, yes, more pleasing names for all these animals, if we wish one day to offer them to housewives!

Biologists now know the joy of seeing all these fish move in their own environment, fish which they have never drawn near except in the form of corpses preserved in bottles of formaldehyde. And yet we sometimes experience moments of deep discouragement.



Paralepis, a Silvery Javelin, Lives in a Vertical World

The bathyscaphe often encounters these slender creatures in the abyssal blackness, darting up and down in lightning spurts like a high-speed elevator or drifting slowly beside the gondola, "stiffly erect like asparagus" (page 717). This one has just made a full turn from a head up to a head down position.

A creature of the middle depths, *Paralepis* is found chiefly between 2,600 and 3,200 feet. The author inadvertently brought back two specimens, entangled in the bathyscaphe's cables.

Acrobatic shrimp, its long antennae arched like butterfly wings, swims on its tail 2,000 feet down in Setúbal canyon.

Like wind-driven leaves, a cloud of shrimplike euphausiids swirls about the porthole. Such swarms, attracted to the bathyscaphe's searchlights, occasionally block observations throughout an entire dive. This cloud in the Atlantic off Portugal was the densest the author had ever seen.

If there are curious animals at the bottom of the sea attracted by our luminous bathyscaphe, there are others in whom our machine arouses no interest.

Some pass too quickly or too far away, or remain at the limit of the illuminated area, going and coming, seeming to taunt us. The atmosphere in the bathyscaphe at such times becomes explosive!

"What's it doing?"

"It is coming nearer, it comes nearer. . . . No! It is going away again. . . . Ah!"

"Well, what does it look like?"

"I can't see well enough. . . . There, it is burying itself in the mud: I can see only its tail . . . There it is again. . . ."

We try every possible means to attract it, yells, calls, but all in vain. A little spotted dogfish thus showed his contempt for us off Lisbon. He remained motionless seven or eight yards from us, atop a little mound, the tail turned toward us. Too far, unfortunately, to be photographed.

Sensible people to whom I reported this mischance said to me, "But you have motors!"

Dogfish with Eyes Like Milky Globes Prowl the Ocean Floor

Such deepwater sharks inhabiting the realm of eternal night appear to the author to have lost the power of sight. "They are insensible to our lights," he says. "They have not the slightest reaction to the searchlights and flashes. This is why I believe they are blind." Commander Houot thinks they may detect obstacles by means of sound echoes, in the manner of bats (page 725). This creature scouts the bottom of Toulon Canyon at 7,500 feet.

True, but I should like to know who, while shut up in a tank with a top speed of less than a mile an hour, would try to pursue a hare to photograph it? Is it not the wisest course to wait patiently until the hare comes voluntarily and places himself in front of the tank in the camera's field of view?

The matter is certainly much simpler when we have to do with stationary fauna, which are very beautiful but unfortunately very rare. I have encountered some only once, at the bottom of the Setúbal canyon in the Atlantic off Portugal, at about 5,500 feet: Dark-red pennatulids and orange gorgonians covered the ground at the rate of at least one colony per square yard. For once the bottom had lost its desert aspect, for these colonies of animals could easily be taken for finely serrated flowers (painting, pages 718-719).

I know that it would be very interesting to bring back samples of deep-sea animals for study; so we are looking for instruments with which to catch them. I have already tried simple, conventional methods. For instance, I have attached to the hull of the bathyscaphe lines fitted with baited hooks. In the Mediterranean I attempted, perhaps too greedily, to hook some dogfish. How disappointing to my fisherman's pride! These dogfish came, explored the mud in search of the bait, which they swallowed voraciously, and then, without further ado, spat out the hooks! Undiscouraged by this experience, I changed the hooks, twisting them skillfully so that the barbs would be certain to take effect, and began again. But during this new dive the dogfish did not come. I saw only *Haloporphyrus* or *Benthosaurus* and a few large shrimp, all of which nibbled daintily at the bait without touching those big pieces of pointed iron which were manifestly not edible.

I had no further opportunity, and my attempts stopped there.

Light Draws Cloud of Shrimp

It should be rather easy to catch the small shrimplike crustaceans called euphausiids, for because of their intense, positive phototropism they rush in masses into the beams of the searchlights, to the point of becoming very troublesome.

During the first dive in Portuguese waters on August 8, 1956, a cloud of these little animals besieged us as we were approaching 2,000 feet, and never left us. They continued to whirl about in front of the porthole during our whole stay at the bottom—2,500 feet. The only way we could get rid of them

was to turn off the searchlights, which, it will be admitted, does not improve visibility! As soon as the light returned, the cloud rushed in again at great speed.

In addition, these little shrimp swirled in a compact mass, plunging toward the bottom like dive bombers and darting upward again after leaving a small imprint on the bottom and stirring up a cloud of mud. My companion and I were very unhappy behind our porthole and finally left the bottom, disappointed, without seeing much of anything.

Meanwhile the shrimp, still happy and excited, continued to escort us, evidence of a faithful friendship, almost to the surface.

Some big shrimp, on the other hand, the kind of charming pink animals that we take pleasure in finding on our plate at the beginning of a meal, live apart; they are nonetheless interesting to observe. They customarily swim on their backs (who will ever explain why?), trailing their long antennae bent toward the rear. In this posture they resemble skiers gliding down an invisible slope.

One of them afforded us a lot of amusement one day. Our movements along the bottom had brought us by chance in front of a pile of ballast shot left by the bathyscaphe, and upon this pile a big shrimp, its legs in the air, was blissfully scratching its back. The best comparison I can think of is a young dog rolling over on a pile of gravel. Perhaps animal habits are not so far apart, whether on the surface of the earth or in the darkness of the abysses!

Strong Currents Sweep Depths

One of our discoveries—I do not hesitate to use the word—is the existence in great depths of very strong currents at times. We have not yet made true measurements; in fact we are still trying to put the finishing touches on some current meters that are simple, sensitive, and sturdy—qualities that are difficult to reconcile. However, there are things seen that do not deceive, and they are numerous.

As soon as the bottom has been reconnoitered and I know there is no risk, I station the bathyscaphe by means of the sphere's supporting chassis. Immobility is then complete, and we immediately see all the animalcules that constitute the plankton flow past in the beam of our searchlights. This veritable materialization of the current can be improved by releasing a small amount of ballast, which on falling raises a cloud of mud.

Watching the disappearance of this cloud is sufficient to give an idea of the speed and direction of the current. The larger animals themselves sometimes aid us. The *Halosaurus* are frequently seen holding themselves stationary with respect to the bottom, noses facing the current while their tails undulate, like fresh-water fish in the current of a river.

If the current is strong enough, I use it as a means of locomotion. The bathyscaphe, resting on its guide chain, is then carried along one or two yards above the bottom. Observation is excellent, the field of view greatly enlarged, and the method very simple. I cannot recommend it too highly to bathyscaphers, who are always limited by the capacity of their storage batteries.

Animal Burrows Riddle Sea Bottom

Another discovery concerns the appearance of the bottom itself. Logic would have it that the sediments, which have accumulated slowly for millions of years, be absolutely smooth. I do not say flat—since we know that there are mountains, valleys, and hills—but smooth.

Well, this is not at all the case. At one time the mud is riddled with little holes; at another it reveals little cones, veritable volcanoes in miniature, about 15 to 20 inches high; and still again wide, gaping holes which Prof. J. M. Pérès of the University of Aix-Marseille is pleased to compare to rabbit burrows (and I prefer to leave to him the responsibility for this expression, since I have already had a little embarrassment, in 1954, from having seen some footprints!).

These upheavals can be due only to burrowing animals—cephalopods, crustaceans, or even fish. We have attempted for four years to accumulate information on this subject. At the mouth of the Setúbal canyon, almost a mile deep, the mud stirred in front of us and continued on till lost from sight, as if an animal were making its way under the surface. The path followed by the mysterious animal remained imprinted in relief on the ground.

Another time a *Trachyrhynchus scabrus*, a large animal with an elongated, flattened nose bent slightly upward and a mouth like a vacuum cleaner, disappeared from sight in a strange way. It seemed as though he vanished on contact with the bottom as if he had burrowed in. But this happened too rapidly and too far away for us to be certain.

In addition to this scientific work—which

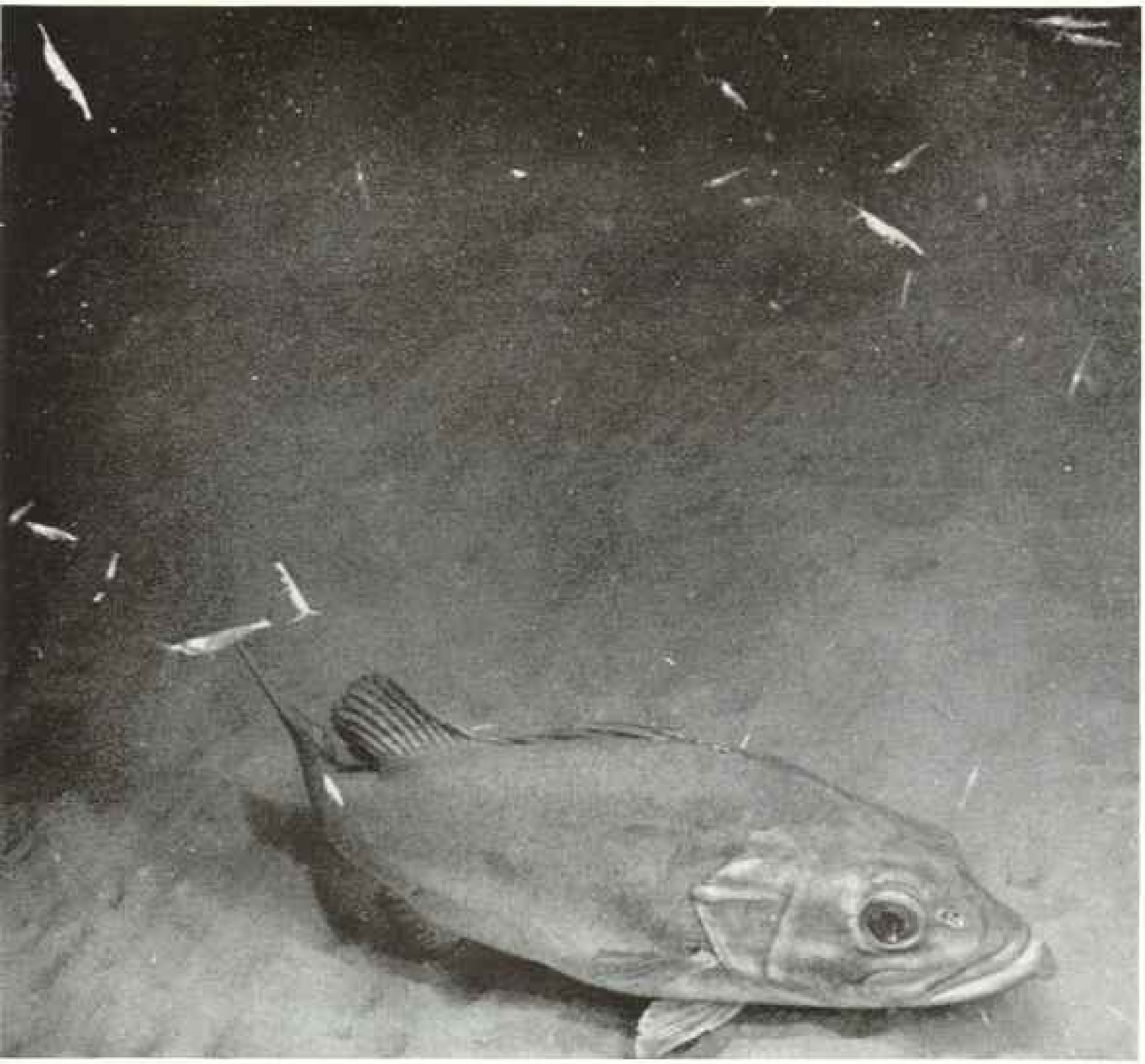
also has its sightseeing side—there is less spectacular work that requires delicate instruments. It is not enough to see; it is important to make measurements in a number of fields (speed and propagation of ultrasounds, temperature, concentration of oxygen and hydrogen, etc.) and to take samples of water.

The work is slow, the ocean is immense, and bathyscaphes are few in number—only two in all the world as yet. But the door is open. A dive is no longer an exceptional feat reserved for a few bold persons; 26 descents have been made by biologists. The *F.N.R.S. 3* has proved its safety; it has also proved its robustness by making some distant trips—to Dakar in 1954, to Lisbon in 1956, and even to Paris in 1955.

It has proved its usefulness and dedication to science. Is this not perhaps its greatest merit: to have launched a new branch of scientific research, to have finally opened up the world of the abysses to man, haunted for centuries by the mystery of the sea?

Other equipment will come, better perfected, more powerful, which will pursue this work and, thanks to the knowledge accumulated, will enable the incalculable wealth of the marine world to be exploited for the greatest benefit of humanity.

Shrimp escort a grouper across the rippled bottom 1,600 feet down in the Mediterranean. Scientists believe it to be *Epinephelus aeneus*, a common food fish. The author found marine life in the Mediterranean far less abundant than in the Atlantic.



New Folio for Binding Atlas Maps Offered by the National Geographic Society

By Melville Bell Grosvenor, D.Sc.

President and Editor, National Geographic Society

IN ANTWERP, four centuries ago, there prospered a merchant named Aegidius Hooftman. "Among his countrymen, there were few more wealthy . . . and none . . . equalled him in mercantile capacities"—so wrote his apprentice in later years.

One reason for Hooftman's success was that he used maps. Consulting them, he chose the shortest, safest routes for his merchandise. But we can imagine the shambles of his office! He collected nautical aids of all kinds and "bought all the Geographical maps that could be had"—immense maps that thwarted efforts to unroll them, small ones that strained the eyes and were easily misplaced.

Though he "spared no pains to obtain honest profits," Hooftman at last grew weary of the confusion. He commissioned a young illuminator named Abraham Ortelius to compile maps of uniform size "together in a book which might easily be handled." This task led Ortelius to 10 years' research—and, in 1570, to his magnificently fashioned *Theater of the World*, the first modern atlas.

All of us who use and enjoy maps can sympathize with Hooftman; we have had similar difficulties ourselves.

But today there is no need to spend a large sum for an atlas, as Hooftman had to do; we can build one for ourselves by carefully preserving the maps of the new Atlas Series now being distributed to members of the National Geographic Society all over the world as supplements to their Magazine.

The National Parks Atlas Map, third of seven to be issued this year, reaches members with this May Geographic. The series will total more than fifty in all, with a combined value exceeding $25.00.

How Members Build Their Own Atlas

To protect this collection and to give the maps their maximum usefulness, The Society has spent a year developing a handsome Atlas Folio, now available at the lowest possible cost (page 734).

With this folio, members will discover a fascinating family activity—building an atlas and using it as it grows. The Society sends the materials; each member-family supplies the enthusiasm and the willingness to follow the simple directions.

One result of this partnership between The Society and its members is that your maps will

Simple directions show members how to mount maps in the Atlas Folio. The only implements needed are a moist sponge and some old newspapers. Here a boy thumbs through the gummed septums, or tabs, stitched into the folio spine. Septum 13 will carry the National Parks Map, marked "Atlas Plate 13."

Atlas Folio Brings Together Maps and Families for a Fascinating Hobby

A sponge dampens the glue on septum 13. For easy identification, the glued surfaces are tinted light blue. Newspapers are arranged to keep all other septums dry.

Pressing down on the dry side of septum 13, the boy affixes the folded edge of his National Parks Map. When the glue is dry, this map will spread the full width of a double page. The hinged mounting, like those of 16th-century atlases, keeps vital portions of the map from disappearing into a stitched binding.

be hand-mounted in the manner of the atlases of Ortelius's time.

Each map "floats"—unbroken by stitches or staples—across the double width of the open book. Atlas plates are not split in the center; vital portions of the map do not disappear into the binding. The folded edge of each page is glued to a strip which is already stitched into the backbone of the binder—a manually hinged binding like those of the most expensive commercially produced atlases today.

In other times, a prince might offer a whole town for a single artfully made volume. In those days of generous patronage, the craft of bookbinding reached its most luxurious heights. Surviving atlases of the 16th and 17th centuries now bring thousands of dollars from collectors.

Member-families, sharing in the arts of Ortelius, will find values just as great. As they affix maps in their folio, families can talk, read, and wonder about the maps themselves.

Maps Take Us over World Horizons

Astonishing things happen to people who handle maps and think about them. Young Christopher Columbus was a seller of maps. His own wares stimulated his dream of sailing west.

The boy Sebastian Cabot wondered over the sailing charts of his navigator father. And as a man he himself redrew the landfalls with his own New World discoveries.

A youthful Virginian, working as a surveyor, developed habits of precision and hardihood. Those qualities did well by George Washington—and by the regions he had charted.

Miguel Cervantes languished in a prison cell, but his imagination knew how to soar. "Journey over all the universe in a map," he wrote, "without the expense and fatigue of traveling, without suffering the inconveniences of heat, cold, hunger, and thirst." And those words became part of his immortal *Don Quixote*.

Today, in the dawning Age of Space, new meaning enriches a "journey over all the universe." The need for accurate maps—and for men to use them—is vital. Man prepares for interplanetary travel. And, ironically, the face of his home planet becomes still more important. Imagine the crew of the first spaceship—and the trust those men will place in their charts when homeward bound.

Nor is the planet Earth completely conquered. Thirsty deserts await the device which can freshen sea water and bring the sands to life. Oceans are ready to be plumbed explored, and mined of unassayed riches.

Maps will be redrawn. And for the young map hobbyist of today, new horizons and opportunities will open up.

"Picture of the Whole Known World"

Here, then, is a bridge between romantic past and adventures still unwritten. Each of these Atlas maps is as timely as modern techniques can make them. Specially designed type faces make even the smallest place name easy to read. Boundaries, airports, highways, railroads, canals, oil fields, even pipelines—10 colors show them in current detail. And all Atlas maps will be the same functional size, 25 by 19 inches: small enough for easy handling, large enough to permit a generous scale and wealth of detail.

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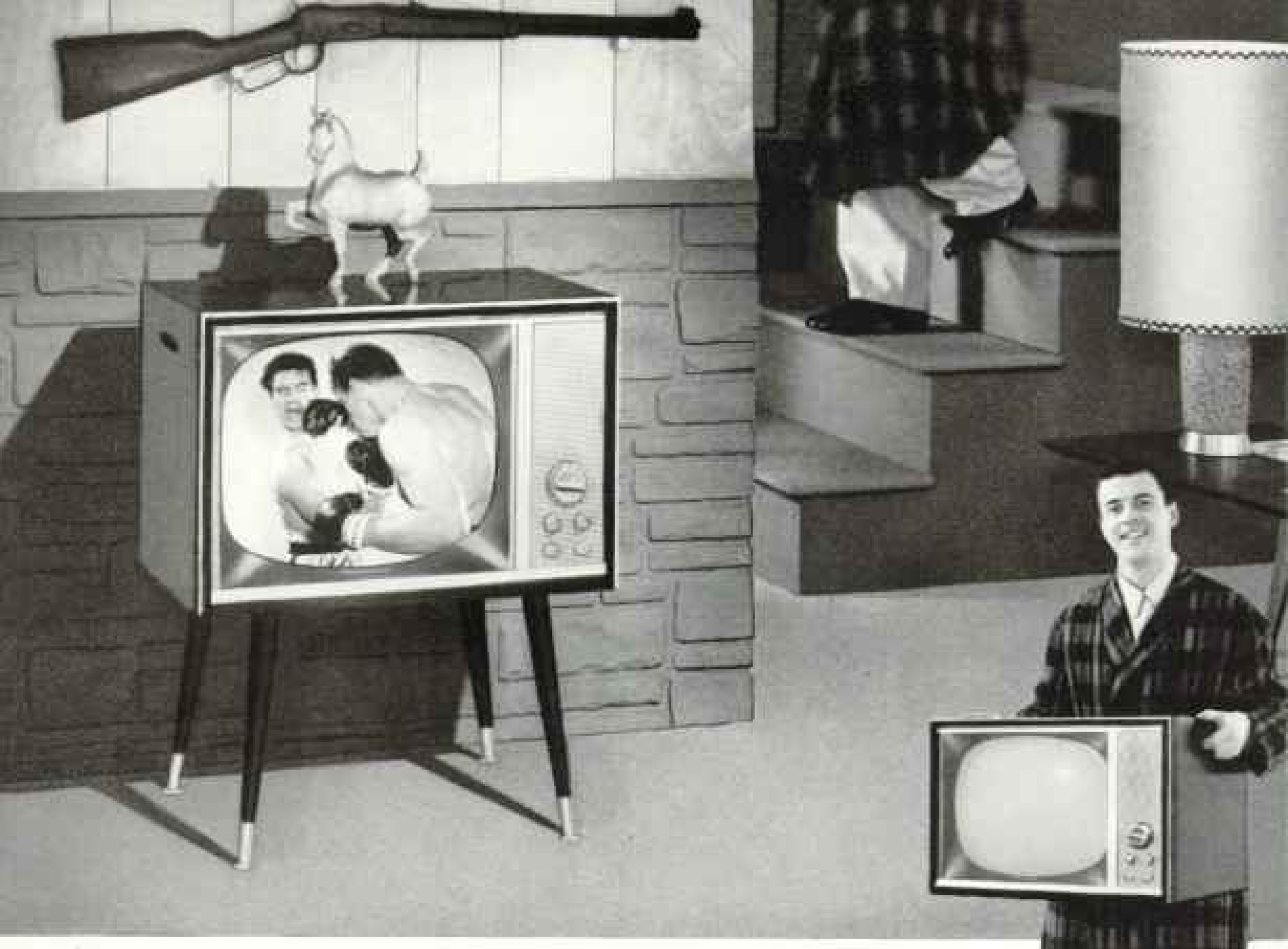

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To catch Glacier National Park's Citadel Mountain mirrored in St. Mary Lake, Miss Kathleen Revis rose before the morning breeze. No one else was stirring, so to give foreground interest, she set her Leica for delayed action and entered the picture. Like all Geographic photographers, Miss Revis travels to far places. From the Rockies and Quebec to literary shrines of England and Scotland, she has made some of the Magazine's finest photographs. Example: pages 612-613.

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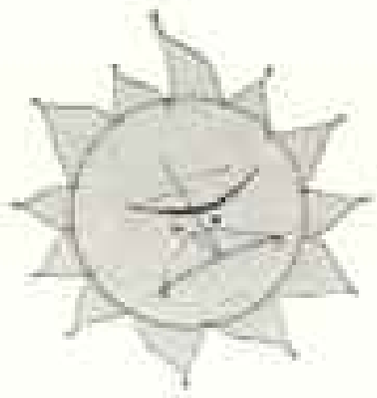

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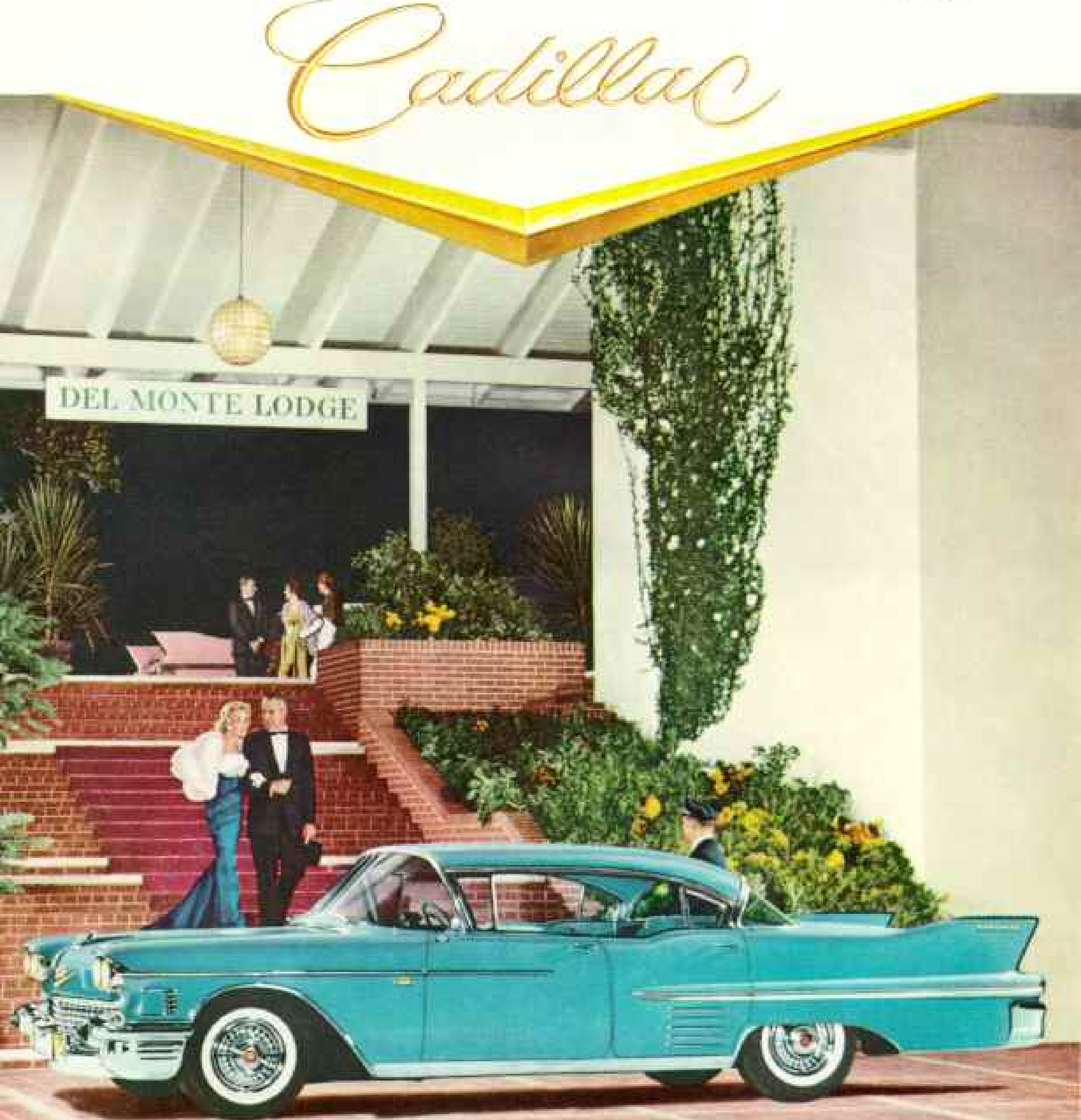

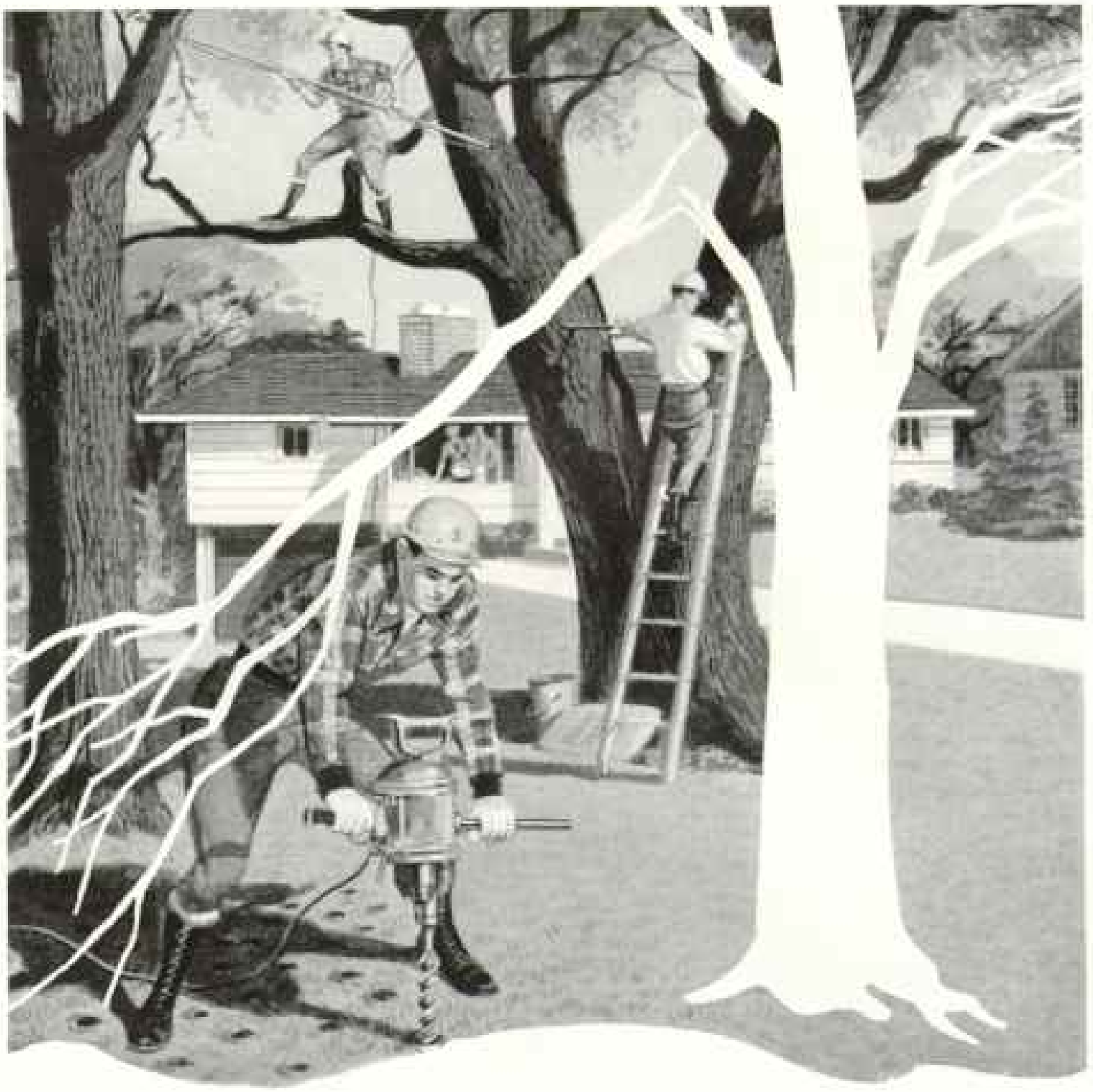

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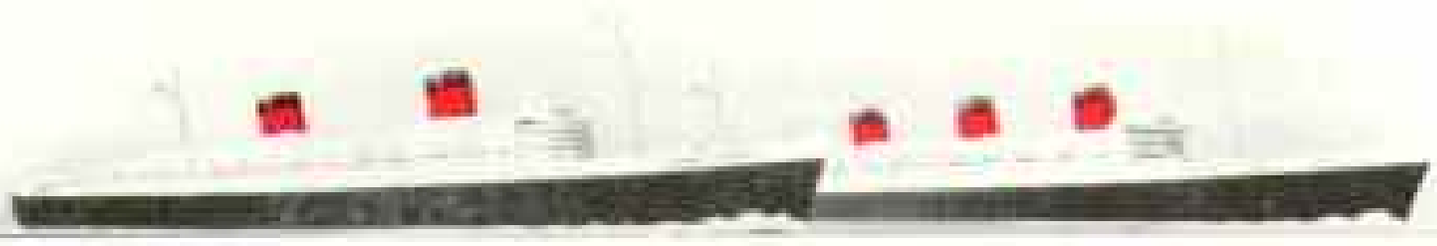

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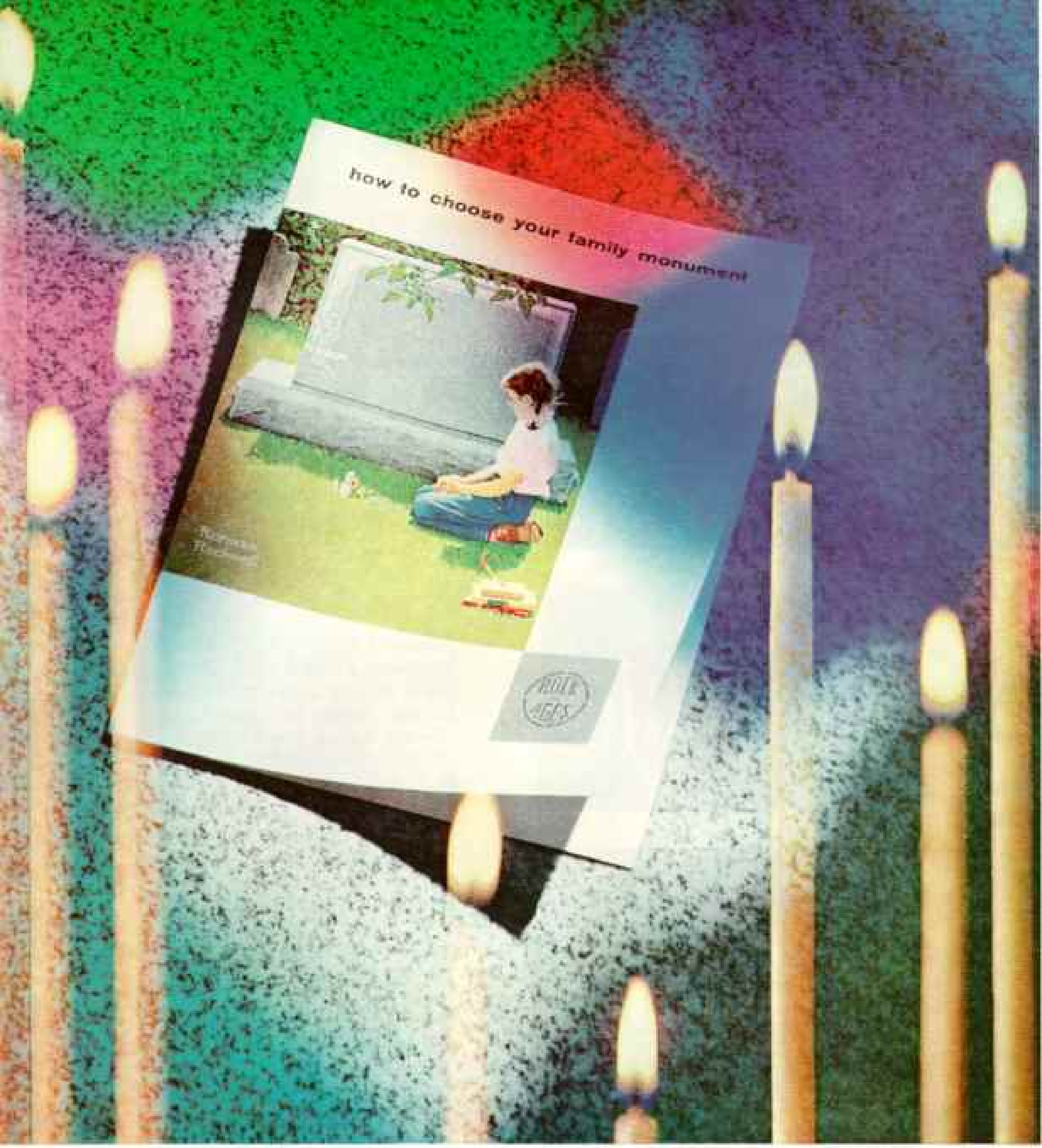

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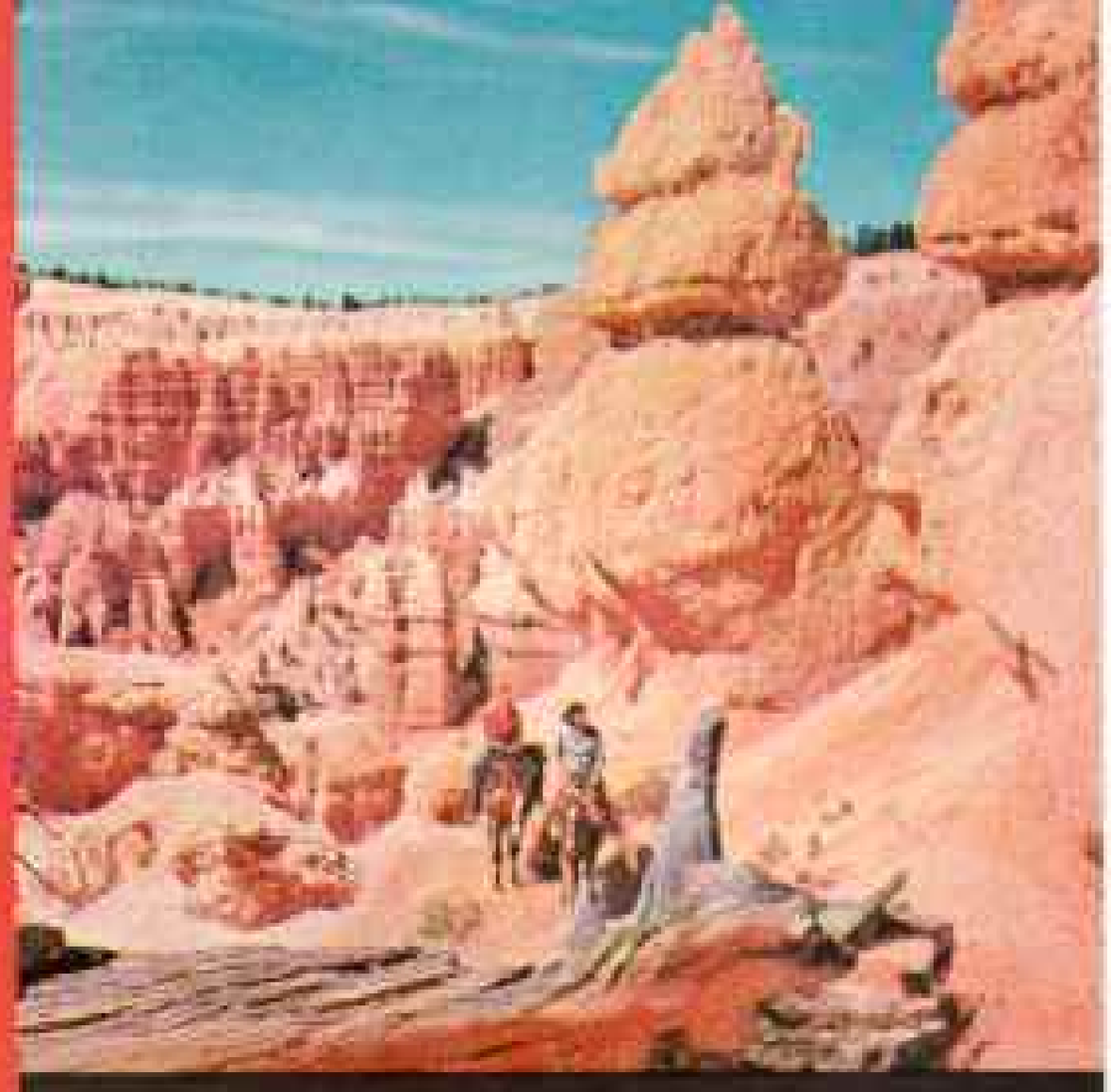

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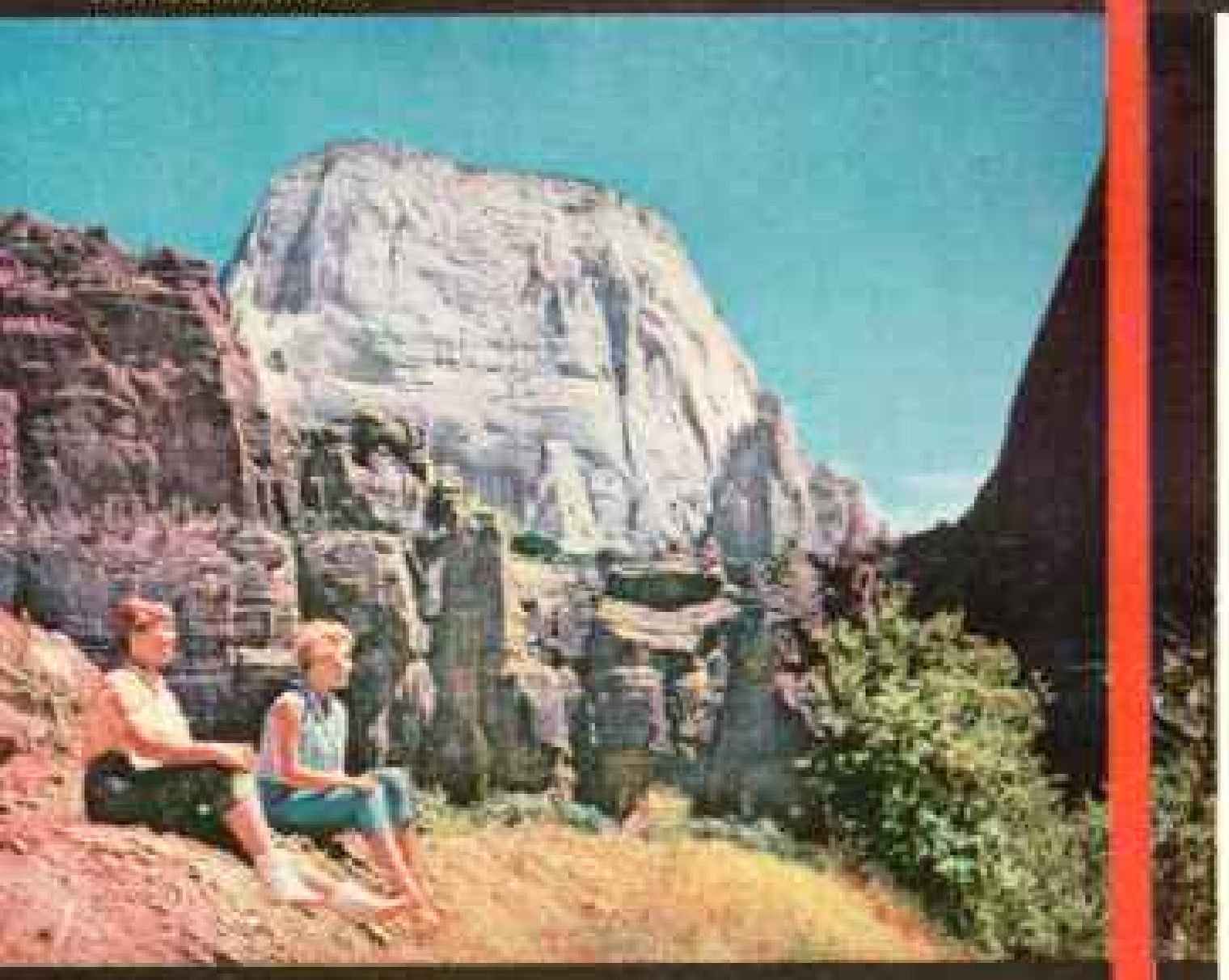

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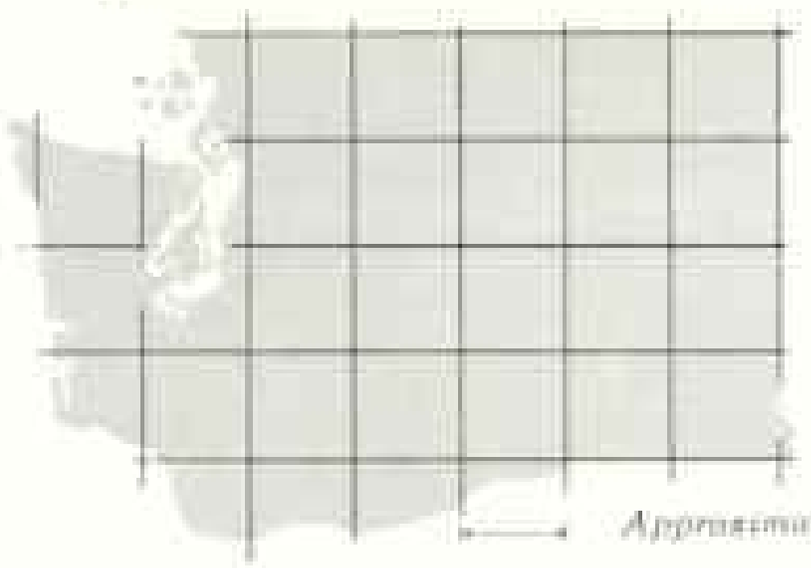

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friendly **WASHINGTON** A State OF HAPPINESS

HERE IS THE NEW ARGUS C-44

...its ability goes far beyond its price

The talented new Argus C-44 with f:2.8 Cintagon lens and new turret viewfinder attached. Surrounding it are its accessory 100mm Telephoto and 35mm Wide-angle lenses.

The new Argus C-44 is indeed an astonishing camera — it fairly bristles with features you look hopefully for in other cameras costing hundreds of dollars more.

For example . . . It is the only camera at or near its price that offers you the versatility of interchangeable lenses on a lightning-fast bayonet-type mount. It brings you the convenience of a quick-computing, lens-coupled rangefinder-viewfinder . . . the precision of an f:2.8 Cintagon lens and 1/300 shutter.

That is not all. This new C-44 for 1958 is equipped with a split-second thumb lever film advance that lets you take pictures as fast as you can flick your thumb and trip the shutter.

Would you like more? The remarkable C-44 even goes so far as to give you a rapid film rewind crank that fits down into the frame, pops up when you're ready to use it, lets you reload your camera in a twinkling. *All* these features are built-in, and all are included in the price.

And there is an exciting new accessory: a variable-power turret viewfinder (shown on camera). This instrument shows you the full-size picture which each accessory lens takes. Cost: $24.95.

It all adds up to this one last thought: you ought to get your hands on the talented new Argus C-44—soon. The price is $99.95.

C-44 ACCESSORIES:

100mm Telephoto Lens: $59.50. 35mm Wide-angle Lens: $56.50. 50mm f:1.9 Cintagon Lens: $89.50. L-44 Clip-on Exposure Meter: $17.50 with case. Flash: $9.95. Case: $12.50.

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YOUR PRIDE WILL PERK UP *whenever you're seen in your* **'58 CHEVROLET.** *One look at those low, wind-whisked lines and you know you're bound to be noticed. And you'll find still more to be proud of in the quick, sure way Chevy responds to your touch.*

There's just something about Chevy's low, straining-at-the-bit beauty that makes people sit up and take notice. And the way this Chevrolet *moves!* It's got quick-sprinting power and a reassuring way of keeping its poise, even on sudden dips and curves.

Another big reason you'll be prouder of a Chevy is that it's the only honest-to-goodness *new* car in the low-price field. There's a new X-built Safety-Girder frame . . . new Turbo-Thrust V8* . . . a choice of new standard Full Coil suspension or a real air ride.* Cars just don't come any newer!

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New Frigidaire Wall Ovens with drop-leaf doors!

Open—for sturdy set-down space!

Drop-Leaf Door Double-Oven!

Matching Fold-Back Surface Units!

All the way down—for up-close, no-reach cleaning!

There's more to these new ovens than meets the eye!

- **Spatter-Free Broiling!**
- **Automatic Cooking Controls!**
- **Holiday Meal Capacity!**
- **Double and Single Oven Models!**

Almost too beautiful to be used—but this new Frigidaire Sheer Look Wall Oven cooks as good as it looks . . . automatically! Smart new Drop-Leaf Doors provide set-down space for safe parking of heaviest roasts, or swing down *all the way* to let you step up close, clean every corner easily. Each door is supported by two aircraft-type cables, capable of holding up to 1000 lbs. each!

Talk about capacity! You'll cook the largest turkey or whole meals with ease. New optional rotisserie holds and turns even a 20 lb. ham. Exclusive new Radiant-Wall Broiler Grill "char-broils" steaks just the way you like . . . *so spatter-free you'll broil 100 times without cleaning the oven!* A new Meat Tender Thermometer lets you dial the "doneness" in roasts. Automatic Cook-Master bakes, roasts, or barbecues while you're miles away. Single and double oven models available in satin chrome or four Frigidaire colors. Glass door optional in some models.

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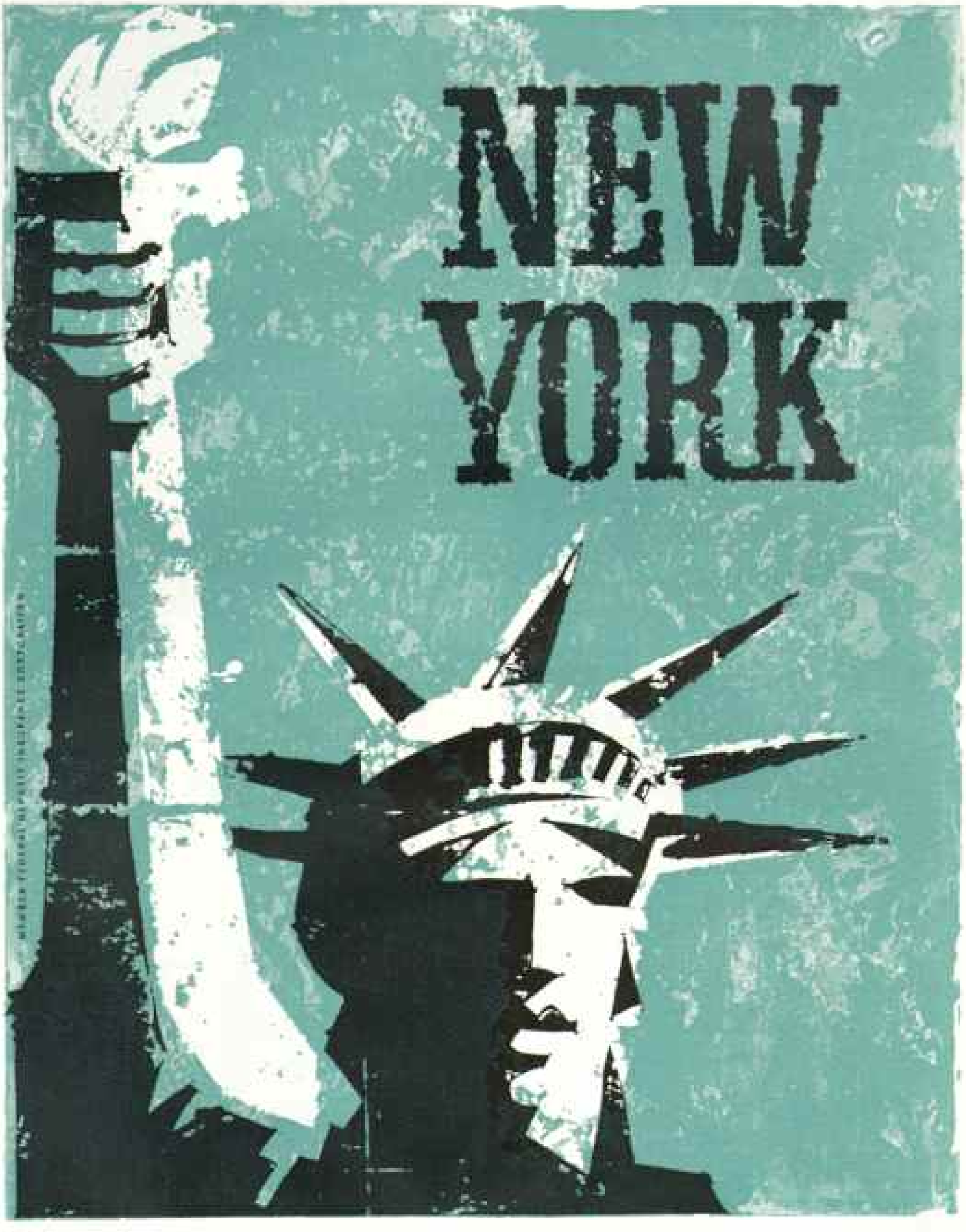
GM '58 FRIGIDAIRE *Built-in Appliances*

FRIGIDAIRE Division, General Motors Corporation, Dayton 1, Ohio



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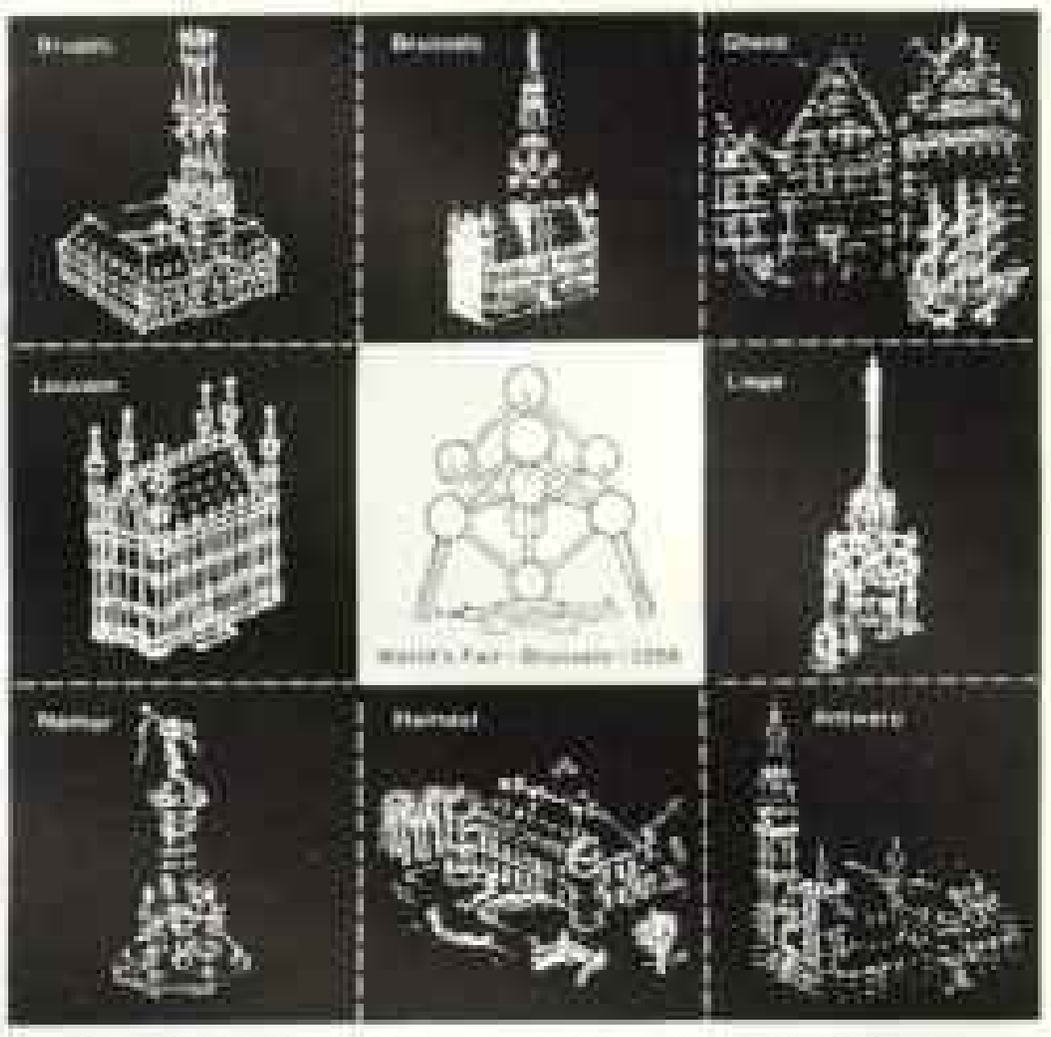

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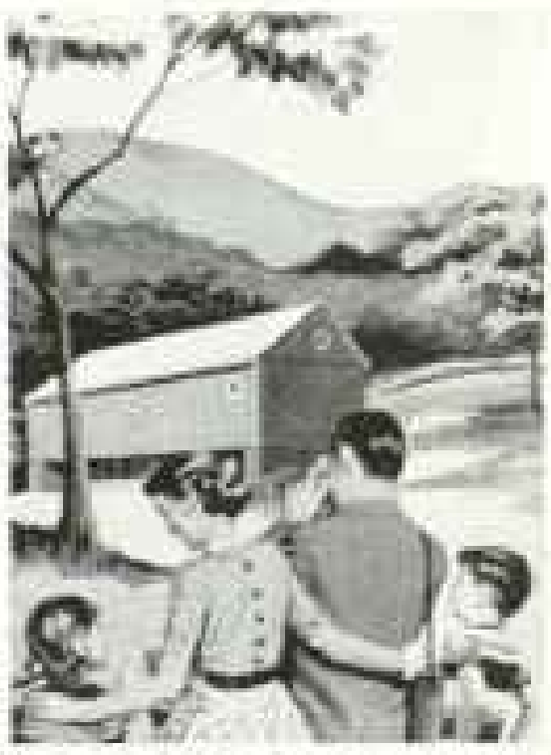

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The strange case of the shark's teeth

. . . and some important facts about yours

Had Mother Nature made the same provisions for our teeth as she did for the shark's, good dental health would be no problem at all.

For when a shark loses a tooth, a new one soon grows in its place. Once we lose a tooth, however, it is gone for good.

Yet, the second set of teeth which Mother Nature gives us is strong and durable enough to last a lifetime . . . if given proper care. Unfortunately, too few of us do so.

Proof of our neglect comes from the American Dental Association. It reports that only 40 percent of all Americans get reasonably adequate and regular dental care. The rest get emergency care or none and one out of 7 adults has never been to a dentist. Moreover, the number of cavities in children's teeth is unbelievably high.

There is more to be gained from regular dental care than simply keeping the teeth clean, bright and healthy. For when decay strikes, when gums become diseased, when abscesses form at the roots of the teeth . . . a center of infection is established from which germs may enter the blood stream and cause disease in other parts of the body.

Even the smallest break in the enamel can pave the way for infection in the interior of a tooth. The dentist can usually detect such trouble by X-ray examination and check it before serious damage occurs.

If you see your dentist regularly, eat a well-balanced diet, and keep your teeth clean; your chances will be far better to keep most of your teeth most of your life.

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Scotts Bluff National Monument, Nebr., where covered wagons halted on the Oregon Trail.

Come stand in history's wagon tracks

They're really here at Scotts Bluff, deeply rutted into the red clay of the Oregon Trail, little changed since the wheels of the covered wagons cut them *a hundred years ago.* Here, at this welcome landmark, the pioneers rested, fixed the wagons and saw to the seed-corn . . . for ahead lay the challenging Rockies and the scalp-lifting Indians who threatened the way to the fertile Northwest.

There's enough pioneer history at Scotts Bluff to keep a small boy wide-eyed for days. *This was Indian country* . . . the warpath of the Sioux, Arapahoe and Cheyenne. In the frontier museum, you'll see relics of the Trail, vivid dioramas, paintings by a pioneer artist that bring alive the terror of an Indian raid, the whip of a sudden prairie squall, the thundering hooves of the buffalo herd. Not far away is old Fort Laramie where the U. S. Cavalry galloped out to rescue ambushed wagon trains.

Scotts Bluff and the wagon tracks have been preserved as reminders of the fearless determination that pushed back our frontiers. It's good to know *this courage still pulses strong* in the hearts of Americans.

* * *

FREE TOUR INFORMATION If you would like to visit Scotts Bluff, or drive anywhere in the U.S.A., let us help plan your trip. Write: Tour Bureau, Sinclair Oil Corp., 600 Fifth Avenue, New York 20, N. Y. — Also ask for our colorful National Parks Map.

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SINCLAIR
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Milton Caniff, creator of "Steve Canyon," did not create the United States Air Force as many suspect. But it seems safe to say that he is its chief unofficial spokesman—through his widely popular comic strip.

Milton Caniff

Walt Kelly has more fun with words than almost anybody, also has more books to his credit than any other comic strip artist. No true *Pogophile* would dare be caught without the complete "Pogo" 5-Foot Shelf.

Walt Kelly

"Li'l Abner's" daddy, Al Capp, is probably the only man ever to invent a national holiday. "Sadie Hawkins Day" began in his comic strip, is now celebrated annually by 50,000 groups—colleges, youth groups, whole towns.

Al Capp

Sheaffer's Snorkel Pens, from $10 to $75.

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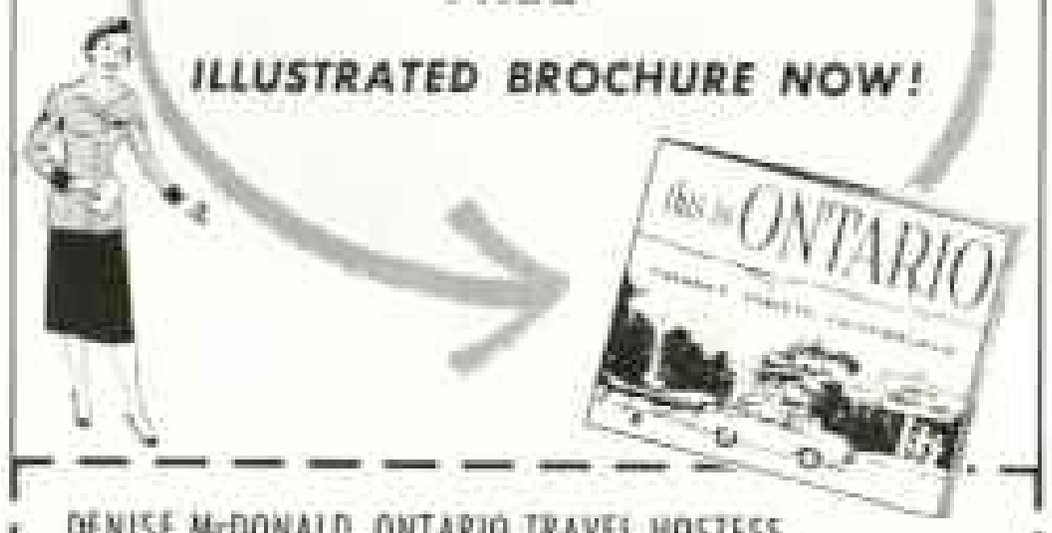

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Treat yourself to the world's longest, most spectacular Scenic Dome ride as "The Canadian" winds through the Canadian Rockies on its transcontinental route. From high in the Scenic Domes of Canada's only stainless-steel Scenic Dome streamliner you'll thrill to the breath-taking view of Canada's unspoiled natural beauty. And aboard "The Canadian" you'll find the accommodations superb, the service unexcelled. You may travel tourist or first class—coach seats reserved at no extra fare.

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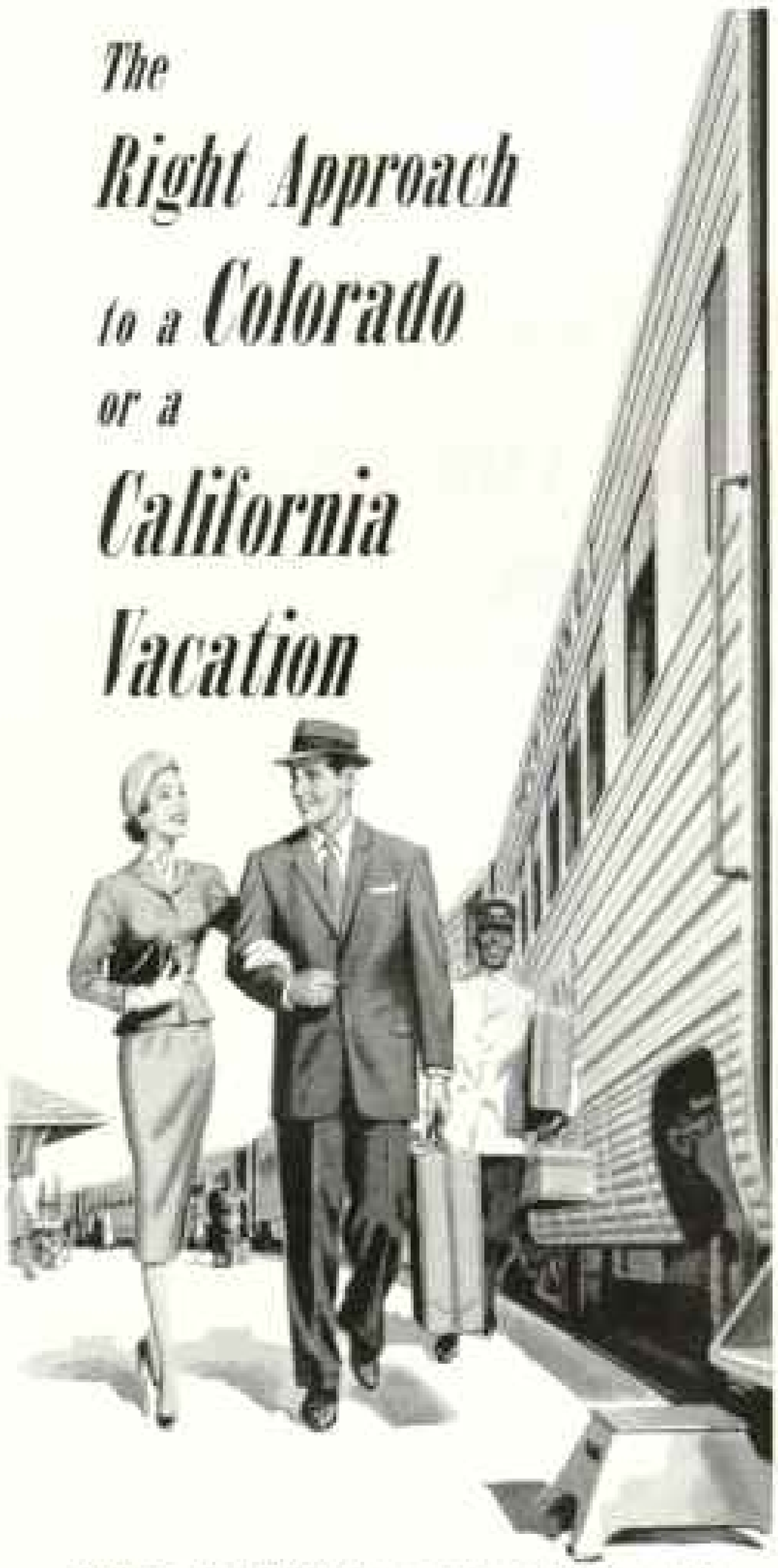

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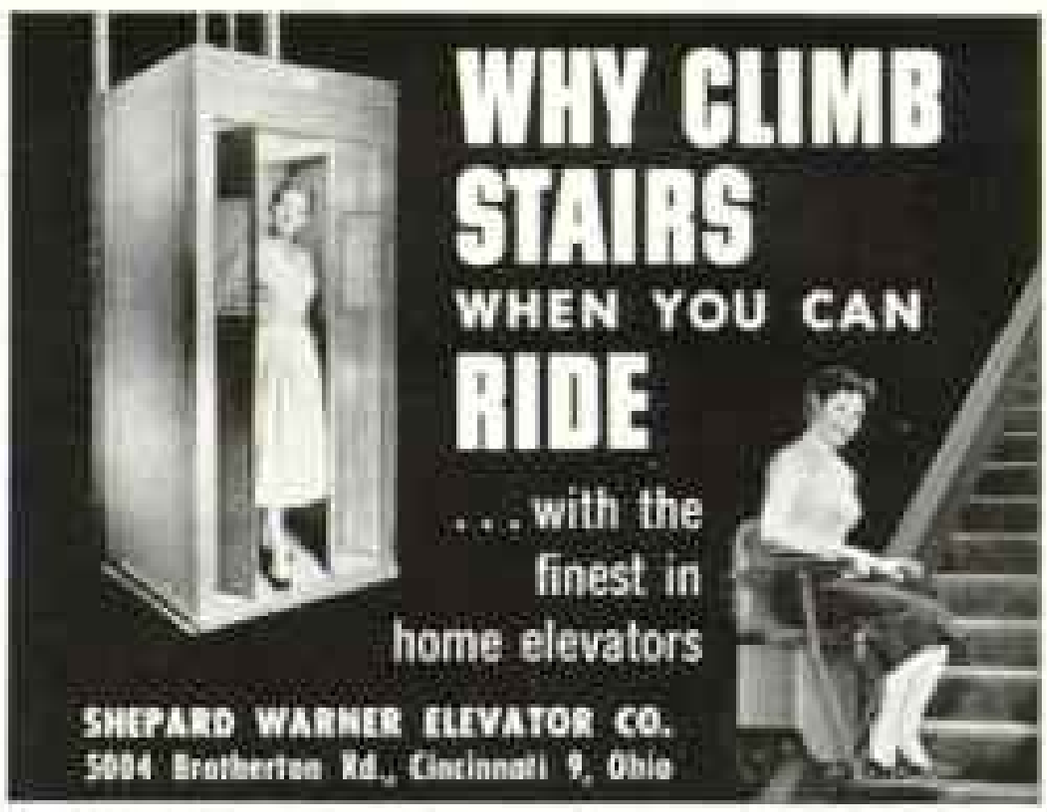

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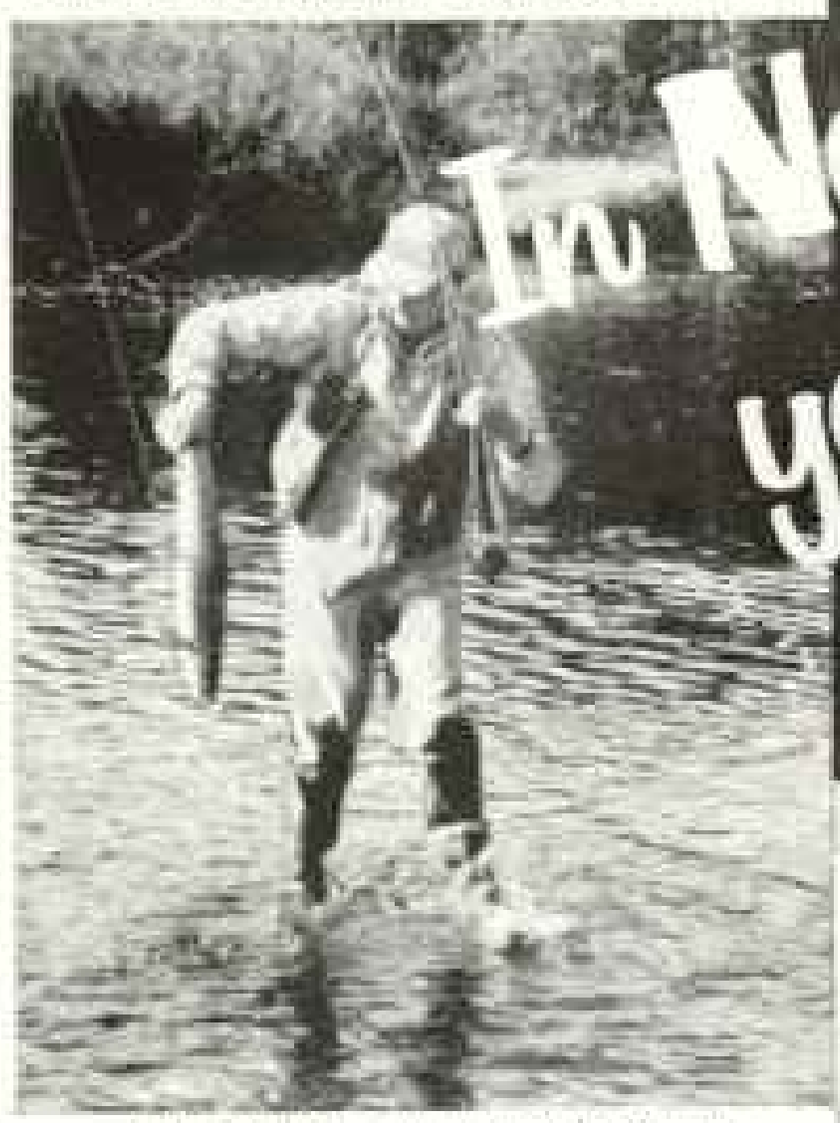

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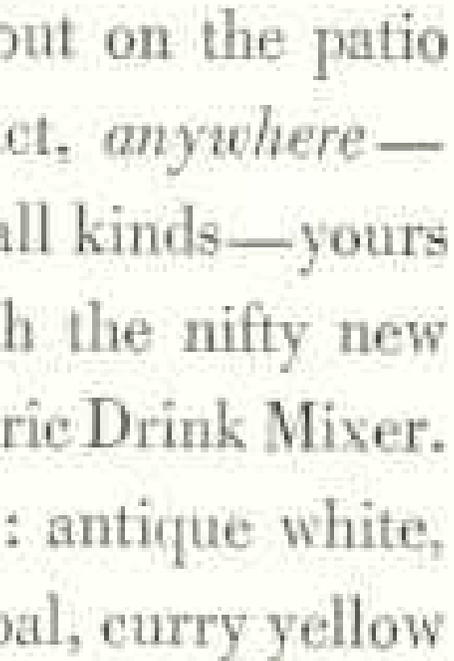

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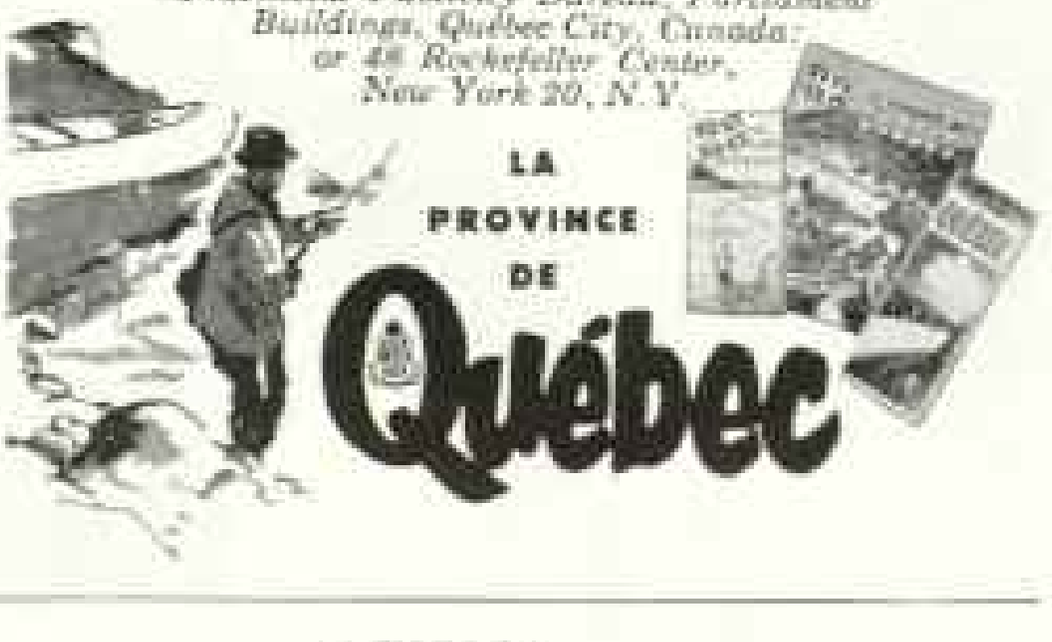

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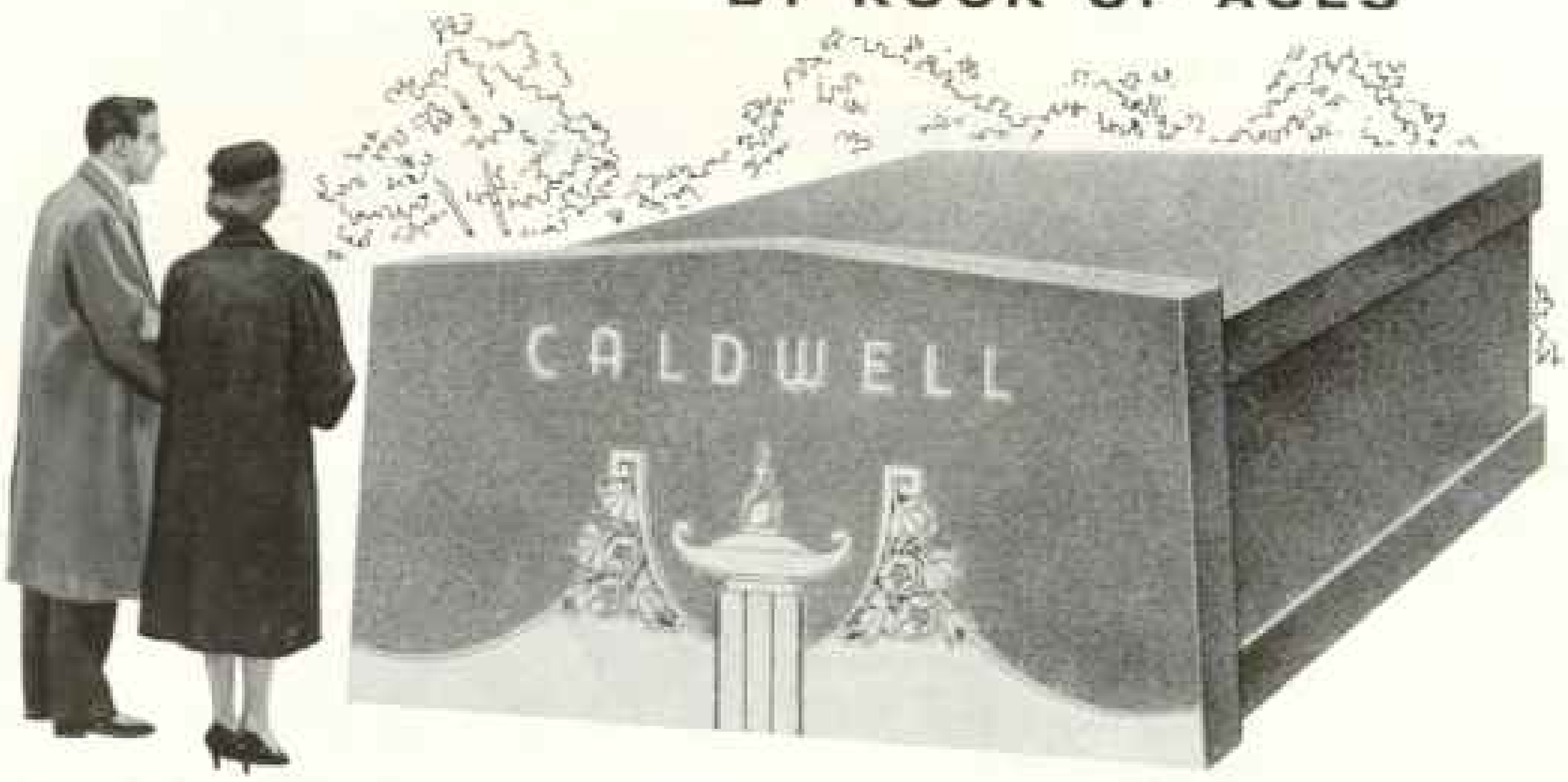

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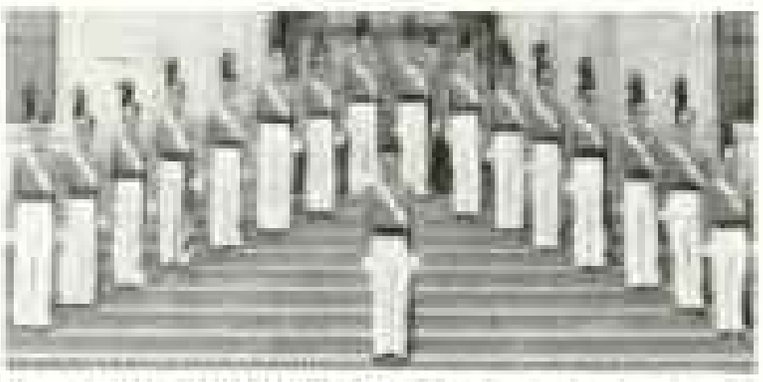

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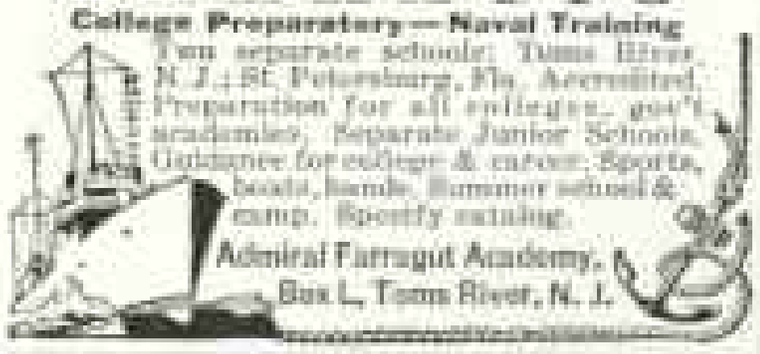

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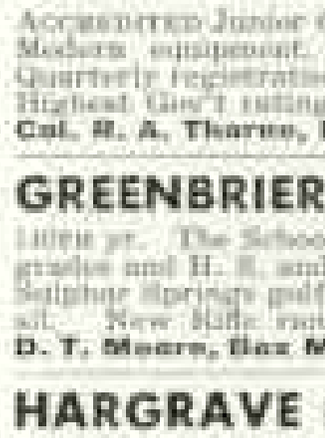

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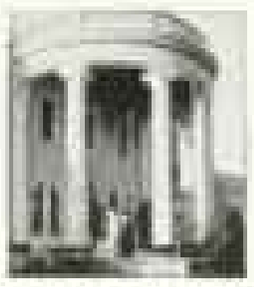

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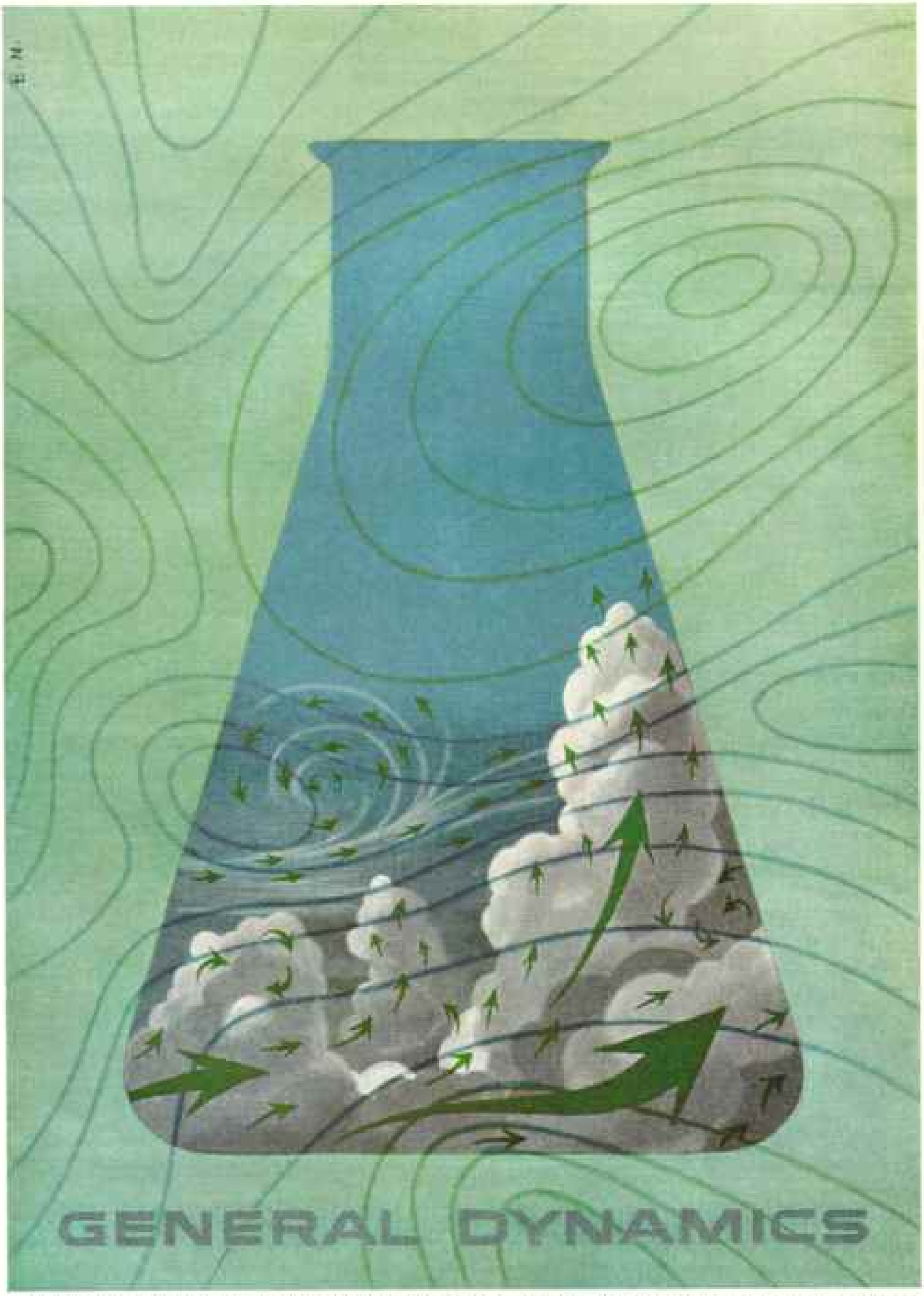

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