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Ten-Color Atlas Map, Southern South America

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Argentina: Young Giant of the Far South

BY JEAN AND FRANC SHOR

National Geographic Magazine Staff

With Photographs by the Authors

WE SAT in front of a coffeehouse in Posadas, the capital of Argentina's frontier province of Misiones.

There were eight of us, six Argentines and two Americans. The Argentines were named Szychowski, O'Toole, Grounauer, Orselli, Ferguson, and Martinez. My wife Jean and I were the two Americans.

When I remarked that it seemed odd that native-born citizens of Argentina should have names that sounded so very non-Spanish, Bernardo O'Toole had a ready answer.

"It shouldn't seem strange," he laughed. "Your Congress has members named Saund, Kluczynski, Derounian, LeCompte, and Ostertag. You must remember that our two countries are very much alike. We were both colonies; we both fought for our independence. And both of us have welcomed immigration.

"You have kept the English language, and we still speak Spanish. But we are no more Spanish than you are English. We're Argentines, and quite as proud of it as you are of being citizens of the United States."

Davy Crockett, Argentine Style

We hadn't thought of it that way, but he was obviously right. And as we looked up at the faded sign over our cafe—it read YAMAGUCHI HERMANOS (Brothers)—it didn't seem at all surprising that the radio should be blaring a tune popular in Argentina at the moment:

"Pancho, Pancho Cro-kett
Rey de la Frontera . . . ."

In the months Jean and I spent in Argentina and in the thousands of miles we traveled from jungle-girt Iguazú to the ice-rimmed Beagle Channel in Tierra del Fuego, we found that the country's geography varies as widely as its people (see color supplement Atlas map, Southern South America).

We had come expecting to see a land of broad and level plains, swarming with fat cattle and lean gauchos. We couldn't have been more wrong. This country of more than a million square miles and nearly 20 million people, stretching 2,200 miles from north to south, embraces far more than its deep-soiled pampas.

From Jungle to Chilly Land of Fire

Argentina is jungle, it is river and desert, it is the bare and soaring Andes. It is a land of blue-veined glaciers and 50-mile-long lakes and the rolling hills and primeval forests of Tierra del Fuego.

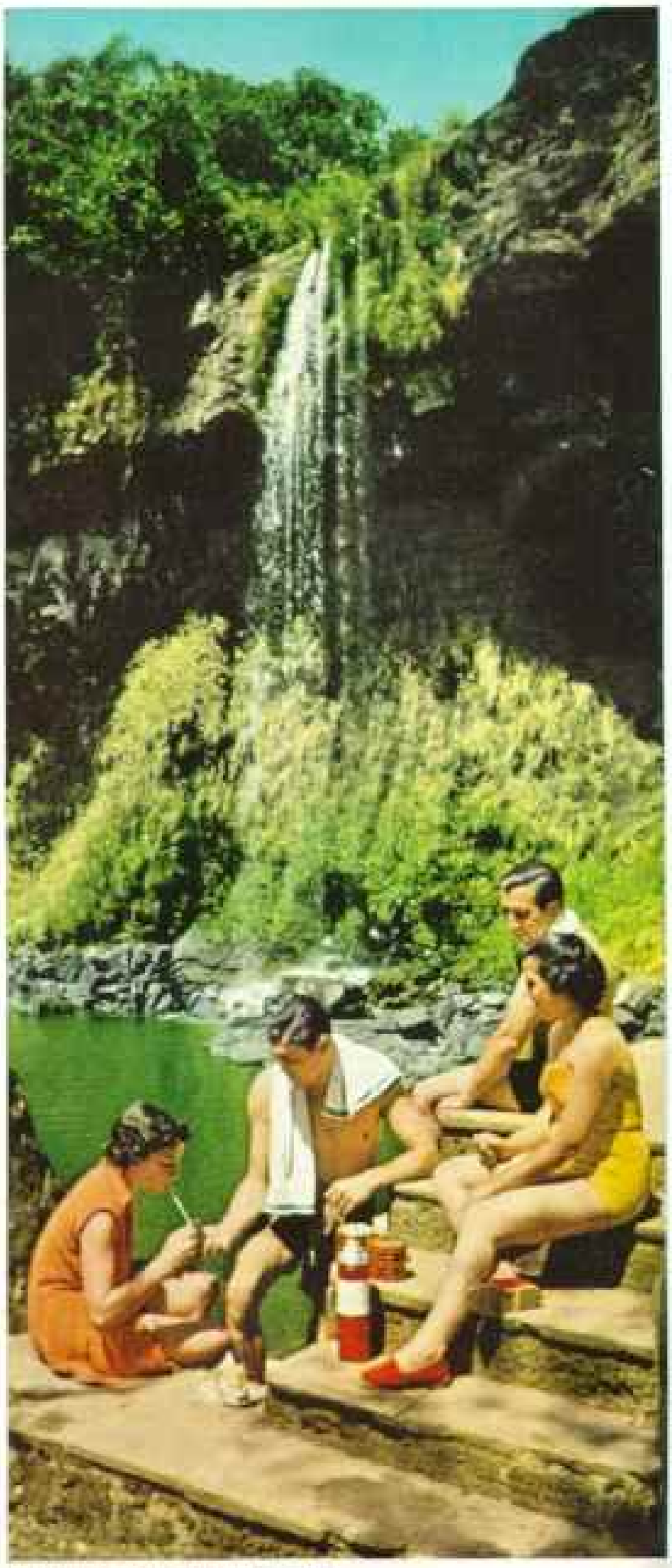
It produces a lot of beef, true. In 1956 it grazed 49 million cattle—more than two for every citizen. But it also produces tea and tung oil and wool, cotton and timber and fish. And its resources of oil and minerals, if properly developed, should become an important source of foreign exchange.

Dr. Robert Nichols, the tall, soft-spoken United States Agricultural Attaché in Buenos Aires, is enthusiastic about Argentina's possibilities. Nichols drove 17,000 miles in his first six months in the country, and what he saw impressed him.

Mammoth Iguazú Falls Roars Out of Dense Green Jungle Between Argentina and Brazil

Iguazú means Great Waters. Scores of cataracts, plunging from rocky ledges in torrents of lacy foam, make the falls one of earth's most breath-taking sights. When the Iguazú River runs high, an almost unbroken sheet of water thunders over the two-mile-wide semicircle. Here, above Devil's Throat, Union Fall marks the international border. Argentina lies at the right.

Iguazú, like Niagara, attracts honeymooners. These couples drink maté beside the Two Sisters Fall.



Kodachromes by Jean and Pierre Shor.
National Geographic staff © N.G.S.

"The agricultural potential here is very great," he told us. "With proper machinery, fertilizers, and modern methods of cultivation, Argentina could be one of the three or four leading food producers in the world.

"The soil is rich, the climate excellent. All that's needed is development."

From north to south, we saw that development taking place. We watched bulldozers clear jungle to make way for a citrus plantation, and saw dams abuilding to bring water to desert wastes. Everywhere we met people working on improving the breed of sheep, bettering methods of packing beef, developing new techniques for curing tea and yerba maté.

In an auto factory, a Nestlé powdered-milk plant, and a lumber mill, managers and workers alike proudly showed us modern machines, and even more proudly pointed to production charts that showed steady gains.

"We declared our independence 40 years after you did," a government official told us in Buenos Aires, "and for too long we stayed 40 years behind you. Now we're going to catch up."

Yerba Maté, Argentina's National Drink

With Jan Szychowski, whom we met in the Yamaguchi Brothers cafe in Posadas, we drove 40 miles over red dirt roads in Misiones Province to see the yerba maté plantation he and his family have wrested from some of the wildest country in the world.

On the way we passed creaking, high-wheeled oxcarts, the passengers shaded by umbrellas from the scorching sun. Telephone poles by the roadside were capped with the peculiar circular mud nests of the ovenbird, each with its tiny entrance hole. The countryside was rolling, with low hills in the background.

A few cattle grazed in the fields, gaunt beasts with spreading horns like the Texas longhorns of the last century.

"This northern area isn't cattle country," Jan said. "The ticks keep the animals too thin. Our big crop is yerba maté—those green bushes you see by the roadside. And recently we've been planting a lot of tea. It's a profitable crop—if the market holds up."

Argentines drink maté as the English consume tea or North Americans coffee. The dried green leaf is placed in a hollow gourd, laced with sugar, drenched with boiling water, and sipped through a silver straw called a *bombilla*. It is refreshing, mildly stimulating, and provides some of the vitamins needed to balance the predominantly meat diet of the average Argentine laborer and countryman.

We turned down a tree-lined lane and stopped in front of the Szychowski home, a ranch house covered with flowering vines. Jan's smiling wife, a son, a daughter-in-law, and a cluster of grandchildren greeted us. We drank lemonade on the shaded patio while Jan told of his half century in Argentina.

"I came with my family from Poland when I was 10," he remembered. "We landed at Buenos Aires, nearly a thousand families in one shipload, and came to Posadas by river boat. Then we rode oxcarts for four days to reach Apóstoles.

"The government was giving land free to colonists—125 acres per family, more for each son. My father received 205 acres. It was wild country. Nothing to eat and no place to buy anything, even if we had had money."

In the first year, while the colonists' crops of grain, manioc, and beans were growing, the government supplied black beans, a little flour, and macaroni. But, said Jan, the immigrants were always hungry.

"I remember the second year, when we harvested our first corn," he smiled. "We ground it by hand with a stone, and when mother baked the first fresh bread, the whole family came in from the fields to eat it hot. Nothing has ever tasted so good since. But it was four years before any of us really had enough to eat."

Polish Immigrant's Success Story

Jan's father built a mill on a near-by stream, and Jan was apprenticed to a blacksmith at 17. He was, it soon became apparent, something of a mechanical genius. He returned to the farm at 19—that was in 1909—and in his spare time built a large metal-turning lathe, forging every part with his own hands.

"I hired a peon to turn it at first," he told us. "Then I hooked it up to water power, and finally got a motor. Then I used the lathe to build a turbine, so I could operate anything I wanted to."

In the 1920's and 1930's, Jan and his brothers planted their land in rice and maté, and Jan built mills for each, both turned by his handmade turbine. With the proceeds he bought more land, and expanded his mills to serve the whole neighborhood. Today he packages and sells more than 1,300 tons of

Buenos Aires, Latin America's Largest City, Pulses with Energy

Broad, tree-lined Avenida 9 de Julio cuts through the center of the capital; its name celebrates Argentina's Independence Day, July 9, 1816. The obelisk was erected in 1936 to mark the city's 400th birthday. A Swiss chalet, a private penthouse, perches on building at right.

Mar del Plata: Queen of Argentina's Ocean Resorts

This Atlantic playground attracts almost a million vacationists during the swimming season, December to April. Summer mornings see Bristol Beach crowded with bathers. Most Argentines, unlike North Americans, swim in the early morning and keep out of the sun during the heat of the day.

The government operates Mar del Plata's casino (extreme right), only 230 miles from Buenos Aires. Gaming rooms, gymnasium, and ice rink can accommodate 20,000 guests.

Stone Sea Lion Guards Bristol Promenade

Strollers throng the breeze-swept walkway in late afternoon and early evening.

Jean and Franc Shor, National Geographic Staff

maté a year under his own brand name—La Cachuera—and has two automobiles and a light airplane for the five salesmen who distribute his product. His property and business are worth at least half a million dollars.

Jan and his wife still speak Polish occasionally, but the children know only a few words of the language. Their 15 grandchildren know only Spanish.

"My wife and I," Jan said, "are naturalized Argentines now and the rest of the family are citizens by birth. We're all proud of it. This country has been good to us."

As we drove back to Posadas and considered what the Szychowski family had created in the wilderness, it seemed to me that it was a debt that ran both ways.

Jungle Attracts Italian Settlers

Adolfo Justo Pomar, Governor of Misiones Province, told us that the Szychowski story was not unusual in this frontier area.

Early immigration, Governor Pomar said, ran heavily to Germans, Swiss, Ukrainians, and Poles, with a few Swedes. Now Italians are the leading national group, and new citizens from western Europe arrive as fast as schools and roads can be provided.

"We have room for lots more," the governor said. "Nearly three-fourths of the province is still raw jungle."

Yerba maté is the economic mainstay of the province, providing an income of more than $8,000,000 in 1956. Citrus fruits and tung oil brought another nine million.

"There has been a big boom in tea the past few years," the governor told us. "Land that costs $70 an acre can produce ten times that much income in a single year. But when all the tea plants set out in the past five years come into production, we'll be growing five times as much as our national consumption. Then we'll have to compete in already crowded world markets."

The governor is far more enthusiastic about the possibilities of paper mills. Some trees that take 45 years to mature in northern Europe reach similar size here in 11 years.

"North American investors have acquired 130,000 acres along the Paraguayan border," the governor said. "They're building their

(Continued on page 309)

Slender-domed Capitol Faces Plaza del Congreso, the Heart of Buenos Aires

One-fourth of Argentina's population lives in or around Buenos Aires. The metropolis of Good Airs is an exciting city. Porteños, as residents of the busy port are called, affectionately regard it as the Paris of the Americas. Hundreds of restaurants and coffee bars cater to crowds that throng the streets from early morning until long after midnight.

Shaded thoroughfares, green parks, and a host of monuments suggest Washington, D. C. Although its dome looms higher and slimmer, the capitol resembles Washington's. The structure contains chambers and offices of the Argentine Congress. Senate and House of Deputies meet here from May through September.

Four blocks of business buildings were razed in 1910 to create the Plaza del Congreso. The imposing monument to the Two Congresses, in front of the capitol, honors the assemblies that fostered Argentina's independence. On national holidays floodlights play over the fountains.

Four decades of civil strife followed Argentina's winning of freedom from Spain. A constitution, adopted in 1853, guaranteed civil freedoms until President Juan D. Perón revised it in 1949.

Following a military coup in 1944, Colonel Perón became Vice President and later President, ruling the country with an authoritarian grip for nine years. Perón was overthrown and exiled in 1955. His successor, Provisional President Pedro Aramburu, restored democratic processes.

Kodachrome by Eric Patel

General LeMay's Epic Flight Emphasized Friendly Argentine-U. S. Relations

Dramatizing United States air power, Curtis E. LeMay and a crew of 18 airmen last November made a record nonrefueling jet flight from Westover Air Force Base, Massachusetts, to Buenos Aires. Flying a sweptwing jet tanker on a dog-leg course out over the Atlantic and around the hump of Brazil, the Air Force Vice Chief of Staff spanned 6,350 miles in 13 hours 7 minutes.

On his nonstop hop, the first between the United States and the Argentine capital, as well as on his return flight to Washington, the general used a National Geographic map in addition to the standard navigation charts. Above, moments after landing, LeMay (second from right) troops the line at Ezeiza Airport.

Gen. Pedro Aramburu, Provisional President of Argentina, welcomes LeMay to Buenos Aires. Between them stands U. S. Ambassador Willard L. Beaulac. The visiting airman brought a greeting from President Eisenhower to General Aramburu on the occasion of Argentina's Aviation Week. Former chief of the Strategic Air Command, LeMay has served since 1951 as a Life Trustee of the National Geographic Society.

U. S. Air Force, Official (top left), Chris, Buenos Aires (lower left), and The Washington Star, Randolph Scott

Flaps Down, the General's Plane Glides into Washington National Airport

Returning from Argentina, General LeMay pointed his KC-135 Boeing jet tanker on an arrow-straight course between Buenos Aires and the U. S. Capital, a distance equivalent to that between Washington and Istanbul, or Washington and Moscow. Soaring above the wild interior of South America and roughly paralleling the Andes, he experienced turbulent weather even above 40,000 feet. His 5,704-mile flight required 11 hours 5 minutes.

Washington Monument and Jefferson Memorial, nearly two miles north of the airport, appear much closer as seen through the long focal-length lens of a Big Bertha camera. The jet-driven KC-135 can refuel a B-52 at cruising speed and at high altitude.

Handmade Alligator Bags Tempt a Shopper

Leatherworkers in Buenos Aires import most of their alligator skins from nearby Paraguay and Brazil. The artisans also fashion articles from the skins of pigs, snakes, horses, calves, porcupines, and ostriches.

Carlos Pisk, owner of this shop on Plaza San Martin, left Austria for Argentina in the 1930's.

Craftsman Cuts Purses from Glistening Skins

This luggage factory uses some 4,000 alligator skins a year. Three skins make two large bags. Smaller pieces serve for belts, billfolds, and comb cases.

own paper mill and planting 2,500 acres of trees a year. Someday paper will be one of our greatest resources."

Governor Pomar, a surveyor and engineer, was placed in charge of Misiones affairs after the overthrow of the Perón regime. In 1956 his administration's budget showed a $3,000,000 surplus.

"We don't economize at the expense of the people," he assured us. "Public health doctors are being sent to every corner of the jungle. And our principal expense is building new roads. Come back in 10 years, and you won't recognize the province."

As the governor talked, his hand darted across a wall map, pointing out a dam here, a paper-mill site there, a river port somewhere else. Yet his eyes scarcely left mine. I asked him whence came his intimate familiarity with the province.

"I should know it well," he laughed. "I spent 30 years in this jungle as a government surveyor. I made most of this map myself."

Pizza Wins Friends in Posadas

Two blocks from the governor's office Jean spotted a corner cafe that advertised pizza, a delicacy we both find hard to resist. We entered the bustling establishment, and I ordered two portions. The proprietor listened to my careful Spanish and held out his hand.

"Hi, Yank," he greeted. "What brings you here?"

Gerard Perrault is a French Canadian who has been soldier, sailor, lumberjack, and short-order cook in his 40 years. Six years ago he found himself in Posadas with five dollars in his pocket and no job.

"I bought four dollars' worth of potato chips and a nickel's worth of old newspapers," he explained. "Sold packages of chips on the streets all day long. Made enough to buy a bed for the night and my next day's supply of chips and papers. In a week or so I was a few dollars ahead—but I sure got tired of eating potato chips."

Perrault kept at his work until he had saved $100. He had planned to use that to return to Buenos Aires and live until he could find a job on a northbound ship. But the opportunities he had seen in Posadas interested him. He talked a local landlord into trusting him for a month's rent and opened his pizzeria.

"People around here seemed to be eating something all day," he smiled, "and I figured they'd like this dish. They did. In a month I had more business than I could handle."

As soon as he had enough money, Perrault sent back to Canada for his wife. They now live in a typical one-story home with a flower-filled courtyard and have three healthy sons. By working from seven in the morning until midnight, they produce a profit of nearly $1,000 a month. There are opportunities in this frontier country, obviously, for others than farmers and industrialists.

Jean and I had been interested in the fact that Jan Szychowski first came to Posadas by river boat, for we had taken the same route from Buenos Aires. But Jan came with a thousand immigrants packed on deck and in the hold. We spent one of the most pleasant weeks in our memory on a comfortable and modern vessel of ocean-going size with airy two-bunk cabins complete with plumbing.

The 2,050-mile-long Paraná River gives northern Argentina the equivalent of an additional 500 miles of shoreline and turns such inland cities as Rosario, Santa Fe, and Corrientes into busy ports. Even above Posadas, 140-foot boats ply the river with cargoes of lumber, tung oil, and citrus fruit.

There was no orchestra on our ship, but we didn't need one. The hundred-odd first- and second-class passengers provided their own entertainment. Most of the men aboard seemed to have brought guitars, and each night we crowded into the dining room and small salon for an impromptu concert.

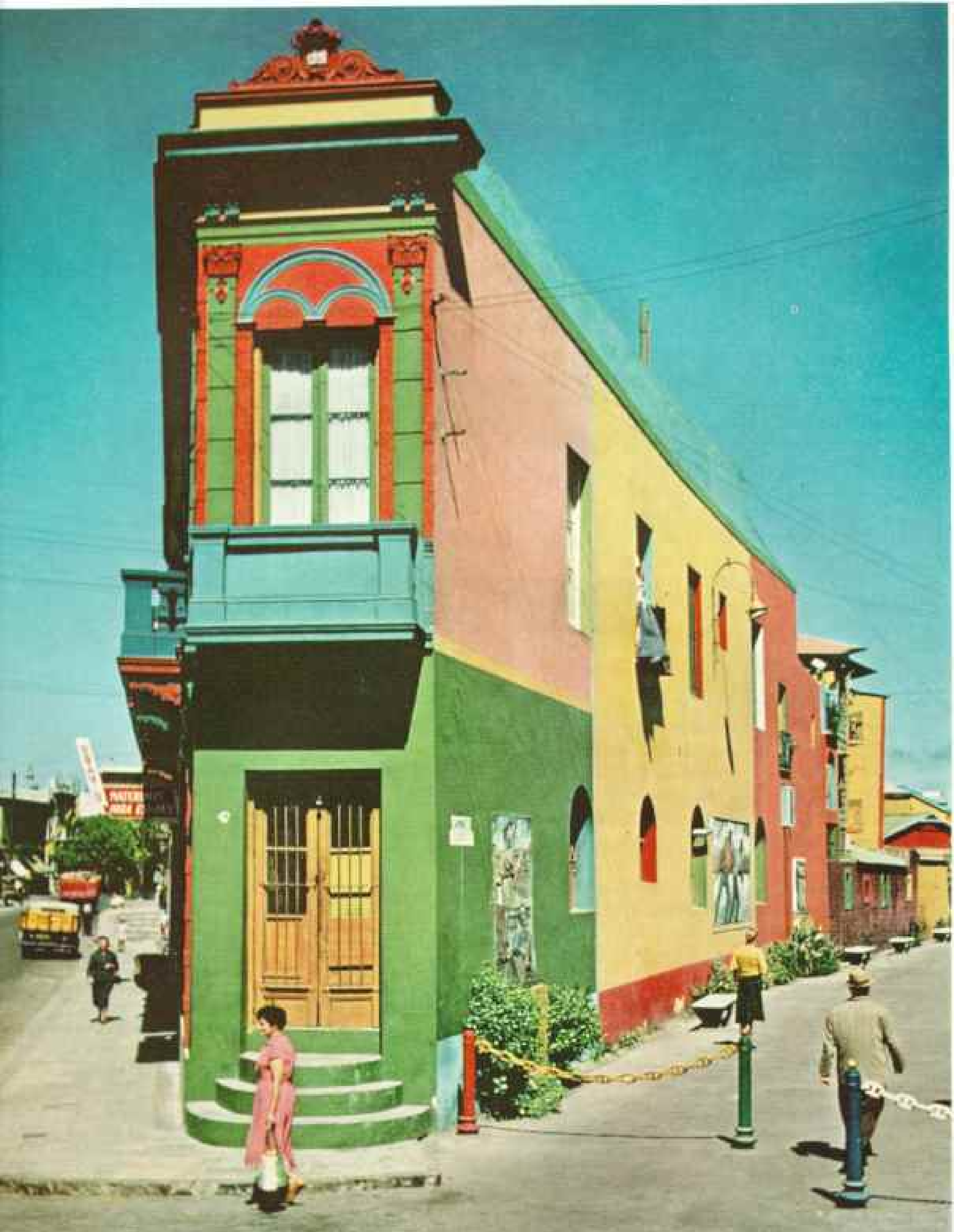
Sadness Pervades Tango Lyrics

There was much group singing, a variety of folk dancing, and the guitar-bearing males were not loath to perform solo. Most of them sang tangos, and sang them well. We were surprised to find that the words are almost always enormously sad.

"If an Argentine finds he has just gone bankrupt, that his house has burned down, his horse has been stolen, and his girl has married someone else," a Buenos Aires friend jokingly told us, "he doesn't waste time worrying. He sits down and writes a tango about it."

After the first night everyone on the ship knew everyone else, and we traveled as a family. And there was, of course, romance.

A lovely young Paraguayan girl in her early twenties was traveling alone to her home in Asunción. Every unattached man on the ship vied to sit next to her at table or stand next to her at the rail. She treated them all impartially, and confided to Jean that her real



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Pictures Enliven House Walls in Boca, a Waterfront District

Shops and even ships in this section of Buenos Aires sport vivid colors. Murals and statues here are the work of Quinquela Martín, a Boca resident. Painting on right, shown in detail on opposite page, depicts dock workers.

Boca, largely settled by Italians, retains an Old World flavor. Operatic arias float from doorways into the narrow streets; inns ring with the lively music and song of the Boquenses.

© National Geographic Society Joan and Frank Blair, National Geographic Staff, and Eric Pavel (below)

Llamas lunch from a visitor's hand in the Argentine capital's Zoological Gardens. Near vast Palermo Park, the gardens serve as a showcase for South American animals. Elephant palace and zebu temple house imported specimens.

ambition was to go to Hollywood and marry an American millionaire.

For two days the girl shadowed Jean, asking her questions about movie stars and airplane pilots and New York night clubs and beauty parlors. I had begun to think a real friendship was developing when, shortly before we reached Corrientes, she impulsively took both of Jean's hands in hers and kissed my wife on the cheek.

"You have been so sweet to me," she said. "You have taught me so much. I wish I could adopt you for my mother."

That did it! There were no more girlish intimacies. And for the rest of the trip, I noticed, Jean spent more time than usual in front of her mirror before appearing on deck.

Lucullan Feasts on River Steamer

At Corrientes we transferred to a smaller vessel. The 142-foot *Iguazú* came alongside our large craft, and passengers stepped from one to the other. The *Iguazú* was well fitted, spotlessly clean, and the food was not only excellently prepared but came on in such quantities that the stewards barely had time to reset the tables between meals.

An ordinary lunch began with a heaping platter of cold meats, sausage, fish, and chicken salad. Then came soup, usually rich and thick. A typically Argentine dish called *puchero* followed—a savory stew of chicken, beef, three varieties of sausage, chick-peas, white beans, sweet potatoes, and corn on the cob. After this light preparation came the main course—chicken or steak or roast—with potatoes and a variety of vegetables. A rich dessert usually arrived after that, and then fruit or another Argentine favorite, *dulce de membrillo*—a slice of quince jelly served with fresh white cheese.

When we could drag ourselves to the rail, we marveled at the beauty of the river between Posadas and Puerto Iguazú. The channel narrowed to less than a hundred yards, and in the clear water we could see great rocks, which kept the captain busy at the wheel. Beaches of incredibly white sand stretched into the engulfing jungle, where wild orchid plants hung from the trees.

Most beautiful of all were the clouds of tropical butterflies that constantly enveloped our vessel. Blue, green, orange, yellow, red-and-black—they came by the millions.

And even here, in the extreme northeastern tip of the country, progress was apparent. In tiny river ports we saw new cement, tung oil, and cellulose plants. Hundred-yard-long rafts

Ocean-going Ships Berth in the Shadow of Buenos Aires Skyscrapers

National Geographic Photographer Volkmar Wentzel

Miles of docks and piers jut into the muddy Rio de la Plata—the River of Silver—which links the capital with the Atlantic. Flags of many lands flutter from vessels awaiting cargoes of grain, beef, and wool. The new 42-story Atlas Building, South America's tallest, soars above the docks.

Pato, Basketball on Horseback, Demands Lightning-fast Mounts and Iron-armed Men

One of the roughest games in sportsdom, pato originated among gauchos on the pampas. Contests became so vicious that authorities banned them for years. Pato, Spanish for duck, takes its name from the ball formerly used by the cowboys—a dead duck inserted in a leather bag, with head and tail protruding.

Two teams of four riders each attempt to throw the ball—today an inflated rawhide bag with handles—into nets at either end of the field. When a player rides with the ball, he must hold it at arm's length; an opponent thunders alongside and grabs one of the handles. The tug of war often ends with the loser crashing to the ground.

To retrieve a loose ball, the rider leaves the saddle and swoops toward earth. This action took place in Palermo Park, Buenos Aires.

Ball soars toward the net.

Below: Goal!

of huge logs floated past us. The river is the highway of the jungle, and it is a busy one.

Our destination was the magnificent Iguazú Falls at the border of Argentina and Brazil, a few miles from Puerto Iguazú. We arrived during the night and went to sleep to the roar of the mighty cataracts. The sight that greeted us the next morning, after a walk over paths cleared through primitive jungle, drove all other thoughts from our minds. The 200-foot-high falls, which extend over an area of two miles, are impressive beyond belief (page 298).

Alexander Weddell, U. S. Ambassador to Argentina in the 1930's, tells a story of a visit to Iguazú by Mrs. Theodore Roosevelt, widow of the former President. Mrs. Roosevelt, Weddell was told, looked at the Iguazú cataracts and then wrote in her hotel's visitor's book: "My poor Niagara!"

There is a comfortable, old-fashioned hotel at the falls, a Mecca for Argentine honeymooners. We spent pleasant days there, photographing the roaring waters and visiting the untouched splendor of Iguazú National Park. To us, one of the most fascinating features of the cataracts was a bird, known locally as the cataract swift, which nests on the face of the cliff behind the veil of falling water and flies straight through the dashing shower hundreds of times a day.

The director of the park, Carlos Jerónimo Pérez, drove us in an Argentine-built jeep through his 133,000-acre domain, where dozens of varieties of trees and a profusion of bird and animal life are protected for the benefit of the Argentine people.

Inspired by U. S. National Park Service

"The National Park Service in the United States has been the inspiration of our own park system," he said. "We study their methods carefully and try to follow them. This is one of the last real wildernesses in the country. Last year we had nearly 10,000 visitors. I hope future years will see ten times that number."

Before we left, we—or rather, I—made one unfortunate attempt to take a picture of the falls that would be "different." No one, I guessed, had ever photographed the cataracts from the very edge—looking straight down into the abyss. The water was unusually low and looked reasonably safe.

"One can simply take off the shoes, pull up the pants, and wade across, señor," a river expert assured me. I donned a pair of shorts instead, and set out boldly. I spotted several small rock islands along the way where I could rest if I got tired.

I was soon waist deep, holding my camera high and fighting the swift current. The river bottom, I found, was covered with small, razor-sharp stones, and I was barefoot. And when I climbed on a rock to rest, swarms of small biting insects enclosed me like fog.

I never got the picture; the water at the vantage point I had chosen turned out to be well over my head. And that night, after bandaging my shredded feet, Jean counted 186 insect bites on just one of my legs—each bite with its own separate itch.

From Jungle to Sophisticated City

The plane that carried us back to Buenos Aires gave us a last spectacular view of the falls. Our pilot banked low over Union Fall, the central cataract, and the drifting mists rising in the morning sun created a perfect rainbow.

It was a shock to come from the pioneer atmosphere of Misiones into ultrasophisticated Buenos Aires. Argentina's capital city is having a boom of its own, but this is simply growth piled upon growth. For half a century *porteños*—people of the port—have called their city the Paris of the Americas, and with more than a little justification.*

The 1957 population of greater Buenos Aires is estimated by Argentina's bureau of statistics as more than *five million*. There just isn't room for that many people, and housing is at a premium. So difficult is it to find a place to live that Porteños contemplating matrimony are given a bit of advice: "First find an apartment, then look for a girl."

It is an exciting city. To visitors it appears that Buenos Aires lives in its streets. The great avenues—9 de Julio, Corrientes, Santa Fe, Córdoba—and some of the smaller streets—Florida, Maipú, and Esmeralda—are crowded from early morning until long after midnight. In summer—December, January, and February—the avenidas blossom with sidewalk cafes, and tables are at a premium. But in every month the Porteños crowd the streets of their beautiful city and greet their neighbors in the hundreds of cafes and coffee

(*Continued on page 323*)

* See "Buenos Aires: Queen of the River of Silver," by Maynard Owen Williams, National Geographic Magazine, November, 1939.

Jean and Franc Blair, National Geographic Staff © N.G.S.

Huge Sizzling Steaks Tempt Appetites at La Cabaña in Buenos Aires

Argentina, "land of the stretched belt," boasts abundant food and low prices. Virtually every citizen enjoys at least one *bifte* a day. Here a mixed grill, piled high on a charcoal brazier, includes a small sirloin, broiled chops, liver, sausages, tripe, and kidneys. Two-pound T-bone fills the plate at right. Rolls, green salad, and wine complete the course.

Wood Lots and Fruitful Fields Surround a Ranch House on the Pampas

Lakes sprinkle the grasslands of Buenos Aires Province south and west of the capital. Cattle, sheep, horses, and ostrichlike rheas browse these plains.

Eric Pavel

which lie within the vast "humid pampa"—actually an area embracing prairie, scrub forests, and low hills. Fast-growing Australian eucalyptus and Lombardy poplar trees shelter this thriving farm near the town of Dolores, one of the dozens of small clearing stations for cattle and grain that dot the plain.

Gauchos, Argentina's Cowboys, Ride In from the Pampas for Lunch

Gone are the old-time gauchos, nomadic herdsmen who roamed the grassy plains. Untamed, like the cattle they hunted, they fought a losing battle against

Kodachrome by Eric Pavel © National Geographic Society

the barbed-wire fences and railroads that transformed the wild pampas into law-abiding ranchlands. Modern gauchos, many belonging to trade unions, rope and ride for the owners of giant estates. But they preserve their predecessors' broadbrimmed hats, baggy trousers, and melancholy songs.

Barbecued Lambs, Spread-eagled on Spits, Broil for Hungry Guests of Argentina's President;

When the Inter-American Economic Conference convened in Argentina last year, Provisional President Aramburu invited delegates to an *asado*, or barbecue, at his country estate. Ranch hands spent two days cooking the meat.

Here lamb carcasses angle above the embers, allowing grease to drip into tins. Laden trays at lower left hold steaming hearts, livers, and blood pudding.

"Throw back your head, open your mouth, and squeeze!" An entertainer demonstrates the gaucho's wine-drinking technique. The more skillful the drinker, the farther away he holds the leather bottle. Novices usually wind up with dripping chins and stained shirts.

Costumed dancers performed the tango, *cielito*, *pericón*, and other gaucho favorites for guests at the asado.

Photographs by Mark Kauffman

bars and the multitude of restaurants that remain open until early in the morning.

The coffee bars are a distinctive feature of Buenos Aires. The Argentine city dweller had perfected the art of the coffee break long before it appeared in North America. Most of the bars are long, horseshoe-shaped affairs, with hundreds of tiny cups waiting invitingly around the rim. You buy a ticket at the door —black coffee costs about two cents—drop it beside the cup of your choice, and a waiter will have it filled before the ticket hits the counter. There are no stools; you drink standing.

Executives and people with more leisure drink their coffee in crowded cafes and frequently transact much of the day's business there. Despite its seeming bustle, Buenos Aires prefers to do things in a leisurely manner.

Porteños Devoted to *Futbol*

The Porteños are great sportsmen, and weekends find half the city either playing or watching polo, futbol, sailing, or *pato* (page 314). Futbol—Latin American for soccer—is really more than a sport; it is a creed in Buenos Aires. The only fight I saw in Ar-

Argentine Rancher Inspects His Far-flung Estate by Air

Few roads pierce the fertile lands and swamps of lake-dotted Corrientes Province in northeastern Argentina. Ranchers like Pablo Navajas tour their holdings in private planes, accomplishing in hours the tasks that once engaged horsemen for weeks.

Señor Navajas, owner of Estancia las Marias, grows tea and maté. Here, on the wing of a Beechcraft Bonanza, he confers with his gaucho foreman.

Navajas and His American Wife Sip Maté in Their Garden

Barbara Navajas and her husband met as students at Louisiana State University. Their estate is a Corrientes show place.

"How do you like living on a remote ranch?" the Shors asked her.

"I wouldn't trade it for any other way of life," she replied.

Kodachromes by Jean and Franc Shor, National Geographic Staff © N.G.S.

gentina was over a referee's decision on a disputed goal.

Not that the Porteños don't relish a good argument. The city's justly famed newspapers post bulletins on latest world events outside their offices every few minutes, and the streets in front of *La Nación* and *La Prensa* are usually crowded with people offering opinions on everything from cattle prices to Sputnik.

The 13-hour train journey from Buenos Aires to Córdoba takes you through Argentina's pantry. The pampas, 600 miles from north to south and more than half that distance from east to west, stretch toward every horizon in seemingly endless flatness. Dairy and beef cattle graze in the lush grass, and great fields of grain and sunflowers, grown for their oil, add color to the landscape.*

Tuition Free—Unless You Fail

The inland city of Córdoba, however, is more than the hub of a great agricultural empire. For more than 300 years it has been a center of education and seat of one of the oldest universities in the Western Hemisphere.

A Franciscan brother founded the University of Córdoba in 1613 as a theological seminary. Today, with more than 16,000 students and 1,200 full professors, it specializes in law, medicine, and engineering. With Dr. Aníbal Alberto Sanguineti, the Secretary General of the university, we spent a day visiting the venerable institution.

"The important thing is to rebuild our faculty," said Dr. Sanguineti, explaining that many of the university's most distinguished educators were forced out during the Perón regime. They took jobs in business and industry, some becoming quite successful in their new fields.

"In a way," Dr. Sanguineti observed, "that is working to our benefit. Those men have come back with a wealth of new ideas and new approaches gained in the business world. They are far better teachers."

The Argentine university system differs considerably from our own. The University of Córdoba, like all other institutions of higher learning in the country, is government supported. Anyone with a high school education can attend without entrance examinations. And tuition is free unless a student fails a course. Then he has to pay if he wishes to take it a second time.

A flight north to San Miguel de Tucumán took us over the Salinas Grandes—vast marshes of shallow, brackish water and broad plains. Tucumán itself is a center for sugarcane cultivation—an industry that made it one of Argentina's richest cities.

There are impressive evidences of those lush days during World War I when sugar prices were high and planters demanded entertainment at any price. We stayed in a hotel of decaying grandeur, with 14-foot ceilings in the bedrooms and a great inner court three stories high. Worn French furniture and tattered bedspreads of gold brocade told a story of better days.

"This was a great social center in those days," one of Tucumán's largest landowners told us. "The building next door was a theater and casino. In the season, some of Europe's greatest opera stars sang in the theater, and there was a formal ball every night in the hotel. But when sugar prices fell, it all ended.

"The casino is used now as a technical school. The hotel caters to salesmen—and there aren't many of those. But don't think the city is dying. It's just changing."

Our friend drove us to the business center, where half a dozen modern buildings were under construction.

"We're a trading center now," he explained, "and we're developing a lot of light industry. Farmers have learned to diversify their crops. We don't have the great fortunes of the sugar planters any more, but we have a sound and growing economy."

Nation Born in Tucumán

Tucumán has more to look back upon than sugar money. It was here, on July 9, 1816, that a group of determined men from the United Provinces of Argentina signed the solemn declaration of independence that gave birth to the Republic. The city is the Philadelphia of Argentina.

Tucumán is old, and looks it. Its architecture is Spanish colonial, street upon street of one-story houses, each built around a flower-filled courtyard. Streets are planted with many different kinds of trees; local residents like to joke that they can look at the leaves and tell where they are.

From Tucumán we drove north to Salta. This provincial capital is one of Argentina's loveliest cities. Set in a rich valley, with rolling hills to the east and the pre-Andean

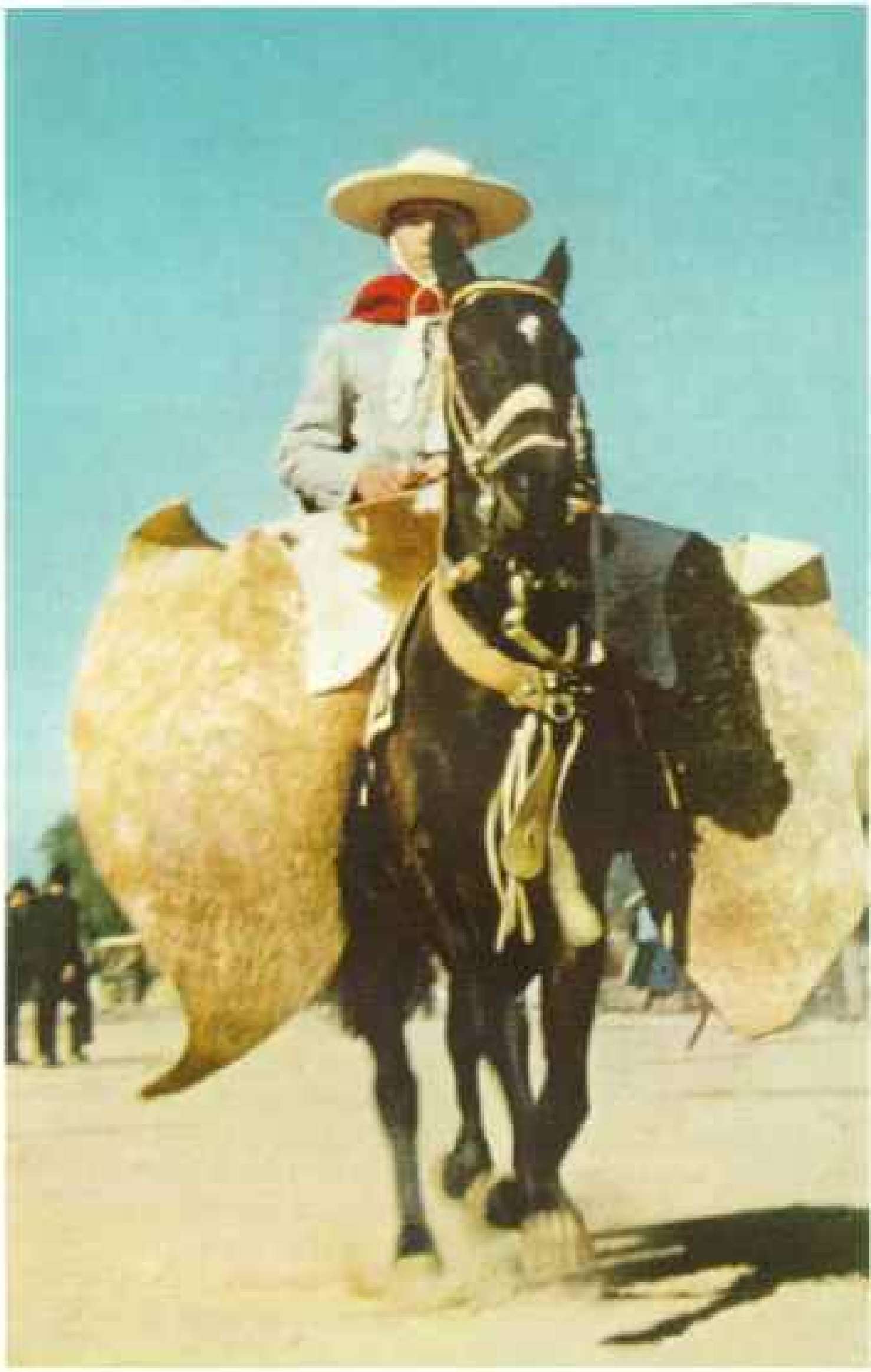
* See "Life on the Argentine Pampa," by Frederick Simpich, NATIONAL GEOGRAPHIC MAGAZINE, October, 1933.

Gauchos of Güemes Parade Through Salta's Sunny Streets in Honor of a Fallen Hero

Early gauchos ruled the pampas with a passion for liberty and a defiance of authority. Despising city people and city ways, they fought to preserve their freedom against civilizing influences. Valiant fighters, they recognized no law but strength. Civil war was almost incessant among the gaucho bands.

But during the Wars for Independence, in the early 19th century, gauchos united to face a common foe, the Spanish overlords. When a superior royalist force attacked the city of Salta in 1814, a gaucho unit led by Martin Güemes helped repel the invaders. Güemes died in another battle eight years later.

Each June, Salta commemorates the deeds of Güemes and his men with a parade. Riders in red ponchos are members of the Gauchos of Güemes Club. Wide leather fenders, called *guardamontes*, protect horses and riders in the brush.



Gauchos awaiting the start of the parade wear the traditional flat-topped sombreros.

Coin-studded Belt Holds Knife and *Bolcadoras*

Round stones or hardwood spheres, covered with leather and linked by thongs of rawhide, form the *bolcadoras*, the Argentine's counterpart of the North American cowboy's lariat. Holding one as a handle, the gaucho whirls the other two about his head and lets fly to hobble a running animal. Horsemen of the pampas take pride in their unerring aim.

Double-edged knife, or *facón*, is the gaucho's lone eating utensil. He holds a portion of meat in his left hand, seizes a mouthful with his teeth, and cuts upward with a deft sweep.

Gauchos still duel with the 18-inch blades, scorning the pistol as unmanly.

range to the west, it makes full use of its beautiful location. Much new construction conforms to the stucco-and-tile-roof tradition, and the result is an architectural unity of unusual charm (page 338).

Salta's Eyes Turned to Future

But Salta, while anxious to preserve the beauty of its past, has its eyes turned in quite a different direction. Don José Alfredo Martinez de Hoz, the Provincial Minister of Economics, Finance, and Public Works, took us in hand an hour after our arrival and gave us an enthusiastic briefing on the prospects of Salta Province.

The dynamic 31-year-old Don José, incidentally, is typical of the men playing a leading role in Argentina's government today. Son of one of the country's oldest and most distinguished families, he took a law degree with highest honors from the University of Buenos Aires, then studied at Cambridge in England, as his father and grandfather had done before him. After a tour of universities in the United States, he returned to Buenos Aires to practice law.

"When the new government asked me to take this post," he said, "I was reluctant. I had my own interests to look after. But there is a terrific job of rebuilding to be done, and everyone has to help. So here I am in Salta."

Don José and his colleagues in the Salta cabinet —all men in their early thirties—have ambitious plans for the future of the province. Their first project is development of the potentially rich oil field at Campo Grande, in the north part of the province.

"The oil is there," Minister of Government José Maria Rueda told me, "but we have to transport it. So we're starting a pipeline that will carry it to the Paraná River, where it can be shipped cheaply. More important, we want to bring the natural gas from the wells here to Salta. With that we can start an industrial center of our own."

Salta is already one of Argentina's most fortunate provinces in diversity of agriculture. Its varied climate produces corn, rice, beans, some sugar cane, and quantities of tobacco. There are

Gauchos Round Up Rheas on the Patagonian Plateau

Though called the South American ostrich, the rhea lacks its African cousin's flowing plumage. The bird runs in mixed herds with deer and guanacos. Ranchers sell the feathers to duster manufacturers.

Eric Parel

citrus plantations and rich stands of hardwood. And the lush grass of its broad central valley fattens for market thousands of cattle every year.

Perhaps the most interesting part of the province is the least productive. A trip to the broad Cachi-Pampa, stretching west into the pre-Andes at an average elevation of 11,000 feet, offers some of the most spectacular scenery to be found anywhere.

The Road of the Bishop—so called, we were told, because it was constructed so that an early prelate could visit his flock—winds first through flat agricultural country, then suddenly enters a rugged valley walled by cliffs whose colors rival those of the Grand Canyon. Mineral deposits and erosion have left great streaks of crimson, ocher, green, and gray, and a profusion of flowering bushes adds to the polychrome effect. Then the road starts to climb, and the vista around each turn is more spectacular than the last.

Juan Bornardo Rivera

Argentines Call the Ocelot the Horseman of the Trees

A forest dweller, the spotted cat sleeps by day and hunts by night. Young ocelots are sold for pets in many Argentine cities.

Millstone Abandoned on Mountain Pass

The road reaches its summit at the 12,204-foot Pass of the Millstone, which acquired its peculiar name in a most mysterious manner. At the very summit lies an enormous millstone, which must weigh nearly a thousand pounds. We asked our driver who brought it there, and why.

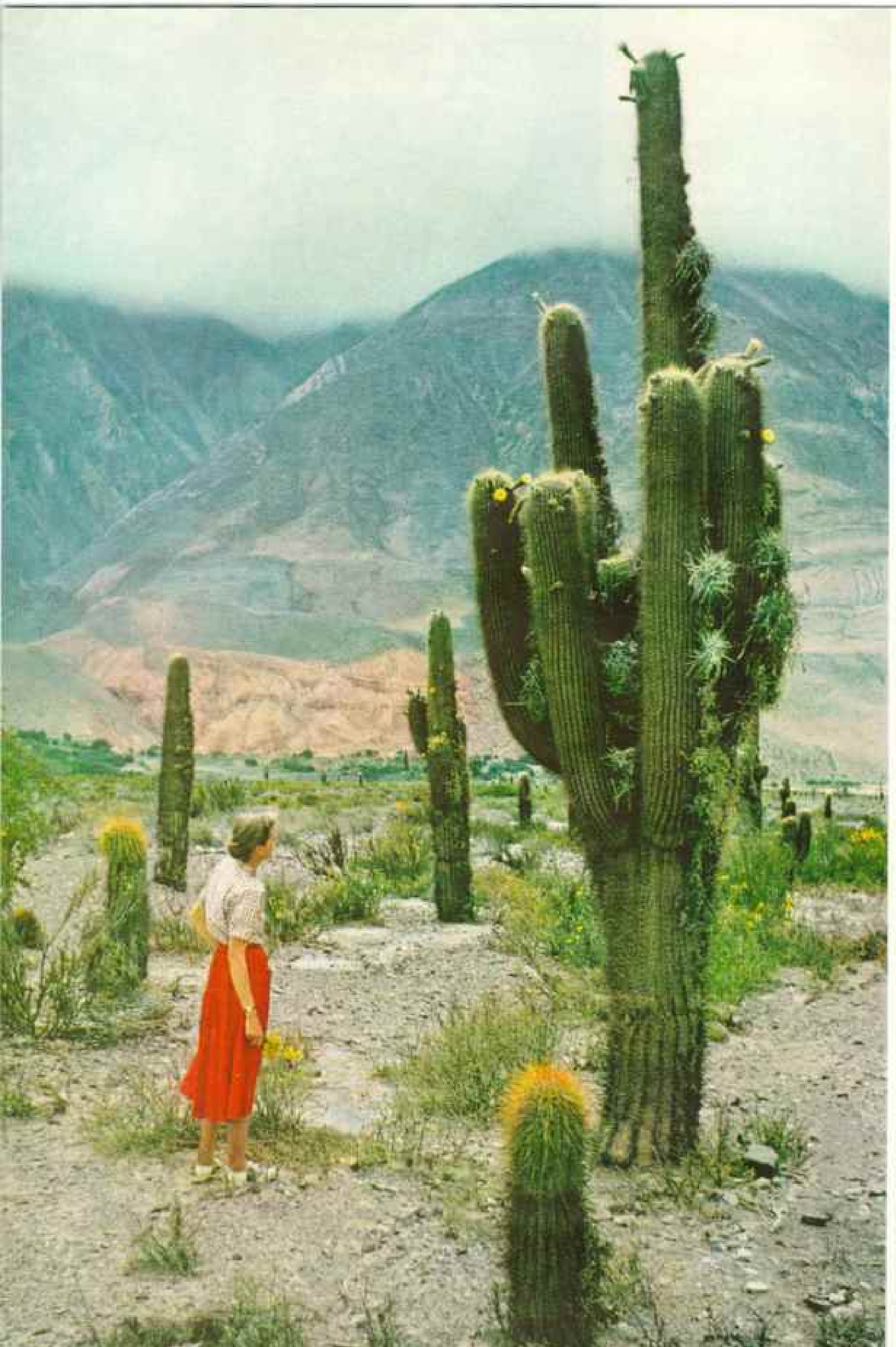
"No one knows, señor," he replied. "In my father's time it was here, and no one knew then. It has always been here."

Beyond the summit the Cachi-Pampa stretches for nearly 30 miles. One sees little grass, only an occasional adobe shack, and no trees. But as far as the eye can see there is a veritable forest of giant cacti—many were in flower when we saw them—twisted into fantastic shapes. Some of the plants are more than 30 feet tall, and even the small ones are twice the height of a man (page 330).

These plants are useful, too. In the adobe inn in the town of Cachi where we lunched, the floors, doorsills, beams, and a good deal of the furniture are made of cactus wood.

Beautiful as was our journey to Cachi, a drive to the little village of Humahuaca near the Bolivian border proved equally spectacular. South of San Salvador de Jujuy the road twisted over rolling hills and through dense forests. Yellow wild orchids hung from the trees, and butterflies swarmed across the road. Then, north of Jujuy, we came out into a great open valley with bare countryside on either hand, broken only by an occasional cactus or desert shrub.

Humahuaca looks like a setting for an Argentine version of the movie *High Noon*. Its few straight streets of red dirt are lined with one-story adobe-and-stucco houses of identical pattern, set wall to wall. Most of the people we saw in the streets were Indians, many of them from across the Bolivian border. Dressed in brilliant reds and greens, and carrying their babies across their backs in ham-



mock-like shawls, they added a note of color to the scene.

Friends in Buenos Aires had described Jujuy itself as a "primitive mountain village." We were pleasantly surprised to find it a modern, attractive city of about 50,000, with one of the finest resort hotels in Argentina, complete with swimming pool and a spectacular view over the city (page 333). The fact that a flock of geese wandered over the paved terrace and a stray donkey nibbled at the striped umbrellas beside the swimming pool didn't detract from our enjoyment.

Jujuy's proudest possession is the pulpit in its cathedral, a magnificent example of woodcarving bearing the date 1599. Tradition holds that the work was done by Indians under the direction of Spanish priests. Hundreds of figures stand out in relief, unimpaired by the passage of centuries.

Christmas Celebrated at Outdoor Altar

We were in Jujuy for Christmas, and the ceremonies in front of the provincial capital's ancient cathedral were among the most impressive we have ever experienced. We drove into town just before midnight on Christmas Eve and found the spacious public square crowded with thousands of worshipers. An altar had been set up in the cathedral courtyard, and the whole area was floodlighted.

The great wooden doors of the cathedral were open, and from our vantage point half a block away we looked down the long aisles to the candlelighted reredos, massed with brilliant flowers. The Bishop celebrated the Mass at the outside altar, and a public address system carried his sonorous voice out across the square.

Poncho-wrapped gauchos, well-dressed couples, Indians with babies on their backs, all knelt together beneath the palm trees and hibiscus bushes. The breeze was heavy with the scent of honeysuckle. On the hills behind the cathedral people were shooting fireworks, and the skyrockets arched against the stars, bursting brightly above the soaring floodlighted towers.

Christmas dinner at our hotel was an international affair. Argentina's largest lead and zinc mines are in the northern end of Jujuy Province, and a number of foreign technicians had come in for the holidays. An English couple, a German engineer and his Australian wife, a French geologist and his wife and three children shared our meal with a pair of young Argentine honeymooners.

Bariloche a Perfect Vacation Spot

It was getting too hot for comfort in northern Argentina, so Jean and I decided to do what every Argentine hopes to do in the hot summer—pay a visit to San Carlos de Bariloche, in the Andes near the Chilean border. We interrupted our flight only long enough for a brief visit to Mendoza and an auto trip to the impressive Christ of the Andes (page 343), and then took a local airline to Nahuel Huapi National Park, in western Patagonia.

Argentines like to refer to the park and its lakes and mountains as "the Switzerland of Argentina." If anything, they underrate its attractions. Certainly no area of Switzerland—nor, I think, of the world—has more unspoiled natural beauty. And few hotels we have visited can compare with the Llao Llao at Bariloche for comfort, service, and architectural charm.

The director of the park is a sun-tanned, handsome man in his mid-forties who wears clothes reminiscent of the American West, complete with string tie. He has devoted most of his adult life to the nation's parks, but though he has been at Nahuel Huapi only since 1953, it has obviously become his abiding love.

Señor Ernesto Enrique Saint Antonin looked out over the rolling lawns of the Hotel Llao Llao, bright with bed after bed of multicolored flowers, and gestured toward the blue waters of the 40-mile-long lake and the mountains beyond (page 341).

"It took a double stroke of luck to turn this area into a park," he said. "In fact, it very nearly didn't become Argentine at all."

At the turn of the century, Señor Saint Antonin explained, Chile and Argentina were involved in a border dispute which included the whole area where the park now lies. Both sides agreed to arbitration by Edward

Like Giant Candelabra, Flowering Cacti Spike a Barren Valley

Semiarid northwestern Argentina reminds the traveler of Arizona. The desolation of this high desert above Humahuaca is broken only by an occasional hut or grazing sheep. People of the area use the woody skeletons of cacti for furniture, floors, and window frames. Delicate blossoms of the pasacana cactus appear in October, the Southern Hemisphere's spring.

All Kodachromes by Jean and Franc Shor, National Geographic Staff © N.G.S.

Folk Dancers Perform in an Outdoor Ballroom

Flutes, drums, and guitars accompany Los Arrieros de Yavi, a group specializing in the old-time dances of Jujuy Province. Their movements bear striking resemblance to those of North American square dancers.

Here, on Christmas Day, Los Arrieros entertain guests on the terrace of the Hotel Alto de la Viña, near San Salvador de Jujuy. Tree-bordered fields of wheat, maize, and sugar cane edge the Rio Grande in the valley below.

Flutes, played like mouth organs, are bundles of hollow reeds, each pipe a note higher or lower than its neighbor. The men wear homespun ponchos and trousers, hand-knitted socks, and sandals. Felt hats are the style with women, too (above).

Versatile musician blows a plaintive melody on his cow-horn trumpet while beating the drum hanging from his wrist.

VII of Great Britain, and Argentina was awarded the land.

"The Argentine negotiator was Francisco P. Moreno, Director of the Museum of Natural Sciences at La Plata," Saint Antonin went on. "For his services, the government gave him 25,000 acres of land here in the mountains. He deeded it back to the government, on condition that it be made into a park. That was in 1903. Today we have 1,868,000 acres of the most beautiful country in the world. Last year about 100,000 people came here."

The area has everything to gladden the vacationer's heart: magnificent scenery, swimming, boating, mountain climbing, skiing, fishing that ranks with the world's finest, and an ever-growing number of fine hotels.

We could happily have spent weeks proving its various attractions, but the rest of Patagonia and Tierra del Fuego lay ahead of us, and time was growing short. I called at the local office of Argentine Airlines to get passage to Comodoro Rivadavia, on the southern Atlantic coast.

South to Tierra del Fuego by Taxi

This government-owned airline is one of the busiest in the world, and reservations are hard to come by. Even armed with a government priority from Señor Adolfo Lanus, press secretary to Provisional President Pedro Aramburu, I was told it would be two weeks before Jean and I could fly to Comodoro Rivadavia.

It was obviously impossible for us to wait two weeks for a plane, pleasant as such a delay would have been. I consulted the manager of the Llao Llao. He had a simple solution.

"Take a taxi," he said. "I can find one that will make the trip in two days."

"But it's almost 500 miles," I protested. "It would cost a fortune."

"Not really," he answered. "True, it will be more than the cost of a plane ticket, but cheaper than a lost two weeks. And you will see a great deal more of the country."

He was right. We did. We also, I think, ate a good deal of it. As our 1936 Ford sedan rolled south and east across the arid plateaus of Chubut Province, the dust poured through the floor, the windows, and the rattling doors. But we passed herds of wild guanaco and great flocks of sheep and kept our eyes open constantly for the rhea, or South American ostrich.

I had about given up hope of seeing any; then we had a flat tire. Jean and I left the car and started up the road to stretch our legs. Suddenly a round, brownish pile of sticks and brush not 30 feet away raised itself a couple of feet in the air on ungainly legs, extended a scrawny neck, and took off at a smart clip. From then on we saw dozens of the preposterous birds (page 328).

We stopped at a country inn for lunch at noon of our second day, and encountered a young sheep rancher who had two of the big birds, newly killed, in the back of his truck.

"I get a dollar a pound for feathers," he told us, "and the legs are good to eat."

As we talked with the young hunter, the wind whistled so we had to shout to make ourselves understood. We asked him whether such a gale was normal.

"It is in Patagonia," he laughed. "Here it is so strong that we put our windmills in the cellar!"

He may have been exaggerating a little bit, but we did notice that few of the towers on which windmills were mounted stood more than six or eight feet above the ground.

Oil-town Beach Swarms with Ducks

Comodoro Rivadavia is an oil town, and the last 20 miles of our road unrolled through a forest of oil derricks. The town itself lies directly on the Atlantic, and the waters off its rocky beach were swarming with wild ducks and gulls.

A long day's drive along the seacoast brought us to San Julián, a snug harbor where Drake and Magellan wintered. We arrived at dinnertime, and had planned to leave at dawn the next morning for Río Gallegos. But when the hotel proprietor found that we were Americans he gave us the warmest of greetings.

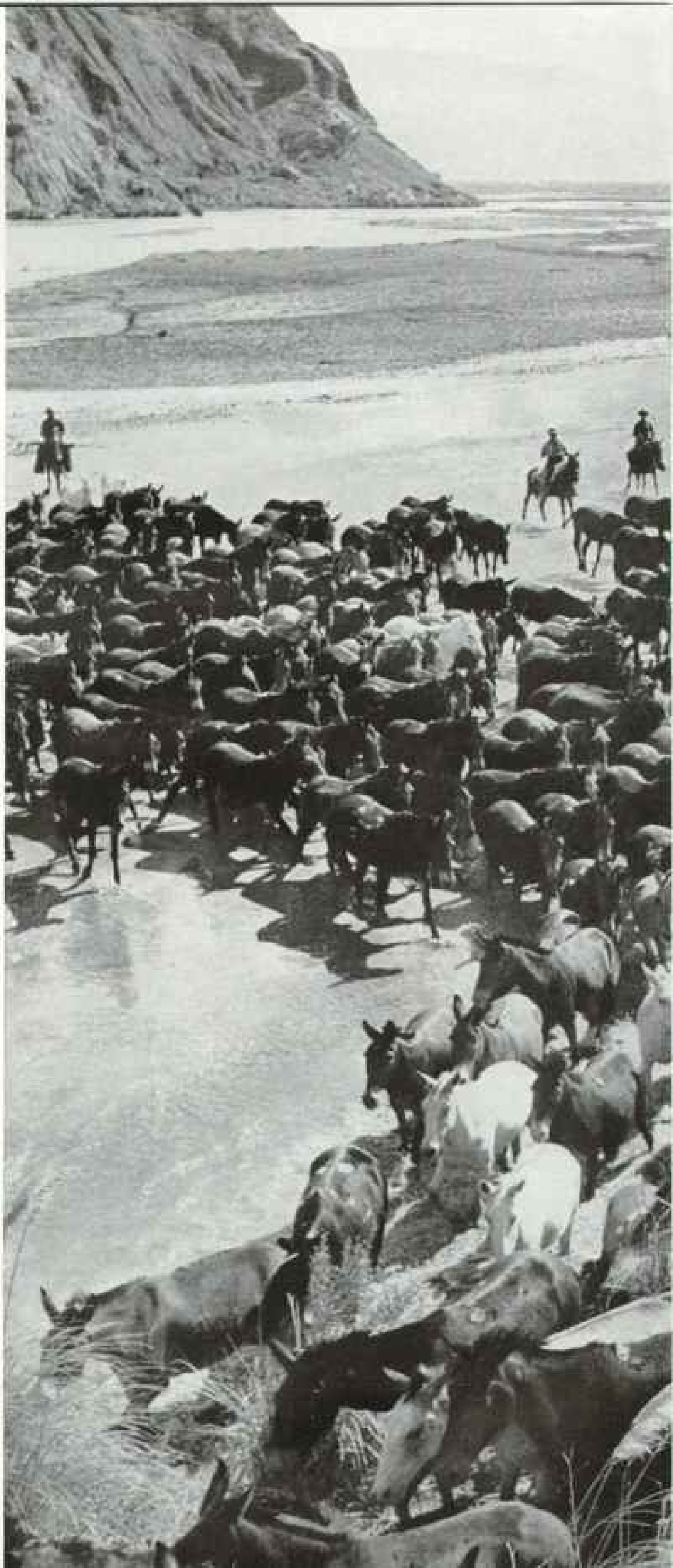
"We don't see many of you down here," he said. "You must meet *our* American."

He addressed a coffee-sipping customer.

Vicuña-fur Blankets: Light, Soft, and Warm—but Expensive!

Wild vicuñas are small cousins of the domesticated llama and alpaca. Hunted for their soft wool and fur, they face extinction. Jean Shor examines a blanket made of strips from the underside of the neck. The quoted price—$100—is only a fraction of that asked in New York.

Fox furs line the wall in this shop in Jujuy. Scarfs and ponchos fill the shelves. Mannequin wears the black derby popular with Indian women of near-by Bolivia.



Rangemen Drive Horses and Mules Across River in the Calingasta Valley

Spanish colonizers took the horse to South America. Their mounts, descendants of finely bred barbs and Arabs, ranked among the best in Europe, and only the fittest survived the long, cramped voyage.

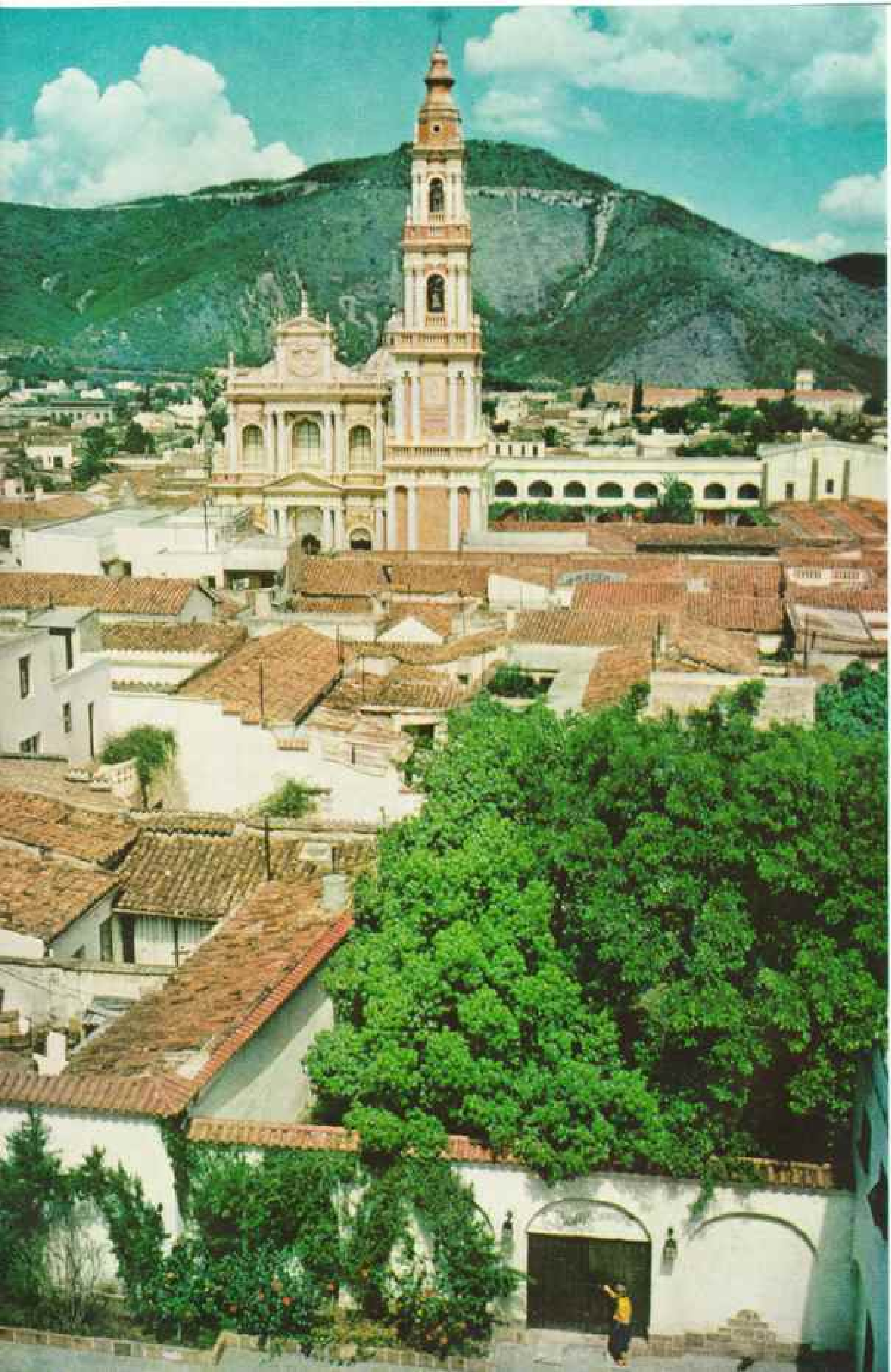
When the conquistadors clashed with Indians on the pampas, many horses strayed loose and multiplied in the rich grasslands.

By 1850 so many wild horses roamed the pampas that settlers looked upon them as nuisances. Ranchers rounded up tremendous herds and slaughtered them for their hides and tongues.

Argentine horses, strong and remarkably agile, cover immense distances without tiring. They can travel unshod across the roughest terrain and endure the severest weather without shelter.

The Argentine Army purchased these animals from a cattleman. Gauchos herd them toward the town of San Juan in the foothills of the Andes.

Hans Hamm



"These people are Americans," he said. "Our American will want to meet them. Tell the boys to find him."

"Our" American arrived in five minutes, a tall young Texan who introduced himself as John H. Hall, manager of the Swift meat-packing plant a few miles outside of town. He joined us at our table.

"I've been in Argentina nine years," he told us, "and I come down here seven months each year to manage our *frigorifico*. From February until May we handle from ten to thirteen thousand sheep a week. Come out to the plant for a Patagonian breakfast in the morning, and I'll show you around."

A Patagonian breakfast turned out to be a trencherman's dream. It began with grilled lamb kidneys, progressed to fried eggs and double mutton chops, and ended with scrambled eggs, toast, and large cups of steaming coffee. When we were able to stagger from the table, John showed us around and told us about the sheep business in Patagonia.

Sheep Driven 300 Miles

"There are some 20 million sheep in Patagonia," he said, "and the meat business is really a by-product. Wool is the principal export. Normally it takes seven to ten acres of land to keep one sheep. Right now it takes even more, for we've had a drought here for five years and the grass is sparse."

The Swift plant, John told us, draws sheep from a tremendous area. Some come from nearly 300 miles away, driven on foot an average of nine miles a day for more than a month. Some of them, after the long trek, are so thin they are fit only for canning and sausage.

"Mutton from the better animals is frozen and shipped to England and Russia," John went on. "Skins are baled and sold in England and the United States. Kidneys, livers, and hearts all go to England. The brains are popular in France."

British immigrants were responsible for the early settlement of Patagonia, John said. Many came from the Falkland Islands, bought sheep in Bahía Blanca far to the north, and drove their flocks for as long as two years to reach their new estancias.

"For years everyone down here spoke English," he added, "and until the late 1920's the pound sterling was the general medium of exchange. Many of the big estancias are still English-owned."

We drove straight across Patagonia, almost to the Chilean border, to meet one of those families. On the shores of iceberg-filled Lake Argentino we found the Estancia Lago Roca, a transplanted bit of England.

Corriedales Perfect for Patagonia

We sat before a pleasant fire in a spacious living room and reveled in tea and hot scones and homemade strawberry preserve while John Atkinson, a wiry, tweed-clad man in his sixties, told us of his 50-year struggle to turn this rugged country into a profitable farm.

"I was 16 when I came from Hull," he said, "and I worked for a while on a relative's farm. But I wanted a place of my own, and in those days land here was open for the taking.

"I claimed some government land in 1910. I had only a few sheep, and the pumas and foxes got most of those, but little by little I got the wild animals under control. Thirty years ago I brought in my first Corriedales, and now I have a little better than 6,000 of them. Their resistance to cold makes them the perfect animal for this country."

Today Atkinson leases 25,000 acres of government land, clips some 60,000 pounds of wool a year, and sends 2,000 animals to slaughter. He keeps only three shepherds; 15 beautifully trained dogs do most of the work.

Atkinson's charming wife Constancia showed us the prize ewes and rams in their breeding stock (page 349).

"It's amazing what selective breeding does to improve the quality of the flock," she told us. "Ten years ago we clipped an average of 7½ pounds of wool per animal. Today we get 10."

The Atkinsons had the fright of their lives a few years ago when the huge Moreno Glacier, which protrudes into Lake Argentino (page 346), completely dammed one end of the 60-mile-long lake. The water level behind the glacier rose more than 50 feet above normal and inundated nearly a million acres of the

Church of San Francisco Soars Above the Red Tile Roofs of Salta

This ranch-country center in northern Argentina retains the charm of Spanish-colonial days, despite its position on the Pan American Highway. Its countryside holds rich deposits of silver, gold, lead, copper, and oil. Cerro San Bernardo, in background, becomes a goal of pilgrims during religious festivals, when many climb a footpath marked with stations of the cross.

Gardeners cut a bouquet for Jean Shor on the grounds of Hotel Llao Llao.

Andean Peaks Frame Flower-decked Shores of Lake Nahuel Huapí

Argentina's lake district, in the heart of the Andes, rivals the Alps and Rockies in scenic splendor.

Nahuel Huapi, 40 miles long and 5 miles wide, stretches fjordlike arms far in among the jagged cliffs. Its Araucanian Indian name means Tiger Island; tribesmen who ruled the region until the 1880's named it for *el tigre*, in this case the jaguar.

Fishermen on the lake sometimes reel in rainbow trout weighing as much as 25 pounds. Skiing draws crowds during winter and early spring. Gardens and golf course of Hotel Llao Llao rim this inlet. Mountains at the end of the lake rise in neighboring Chile.

Gauchos drive shorn sheep along a road bordering the lake. Dogs guarding the flock need only an occasional command.

surrounding land. Each day for three years the water rose a fraction of an inch.

"We were out every morning checking the water level," Mrs. Atkinson told us. "When the ice finally gave way, the water was only a few yards below our house."

Land of Fire Teems with Game

The drive from Lake Argentino to Rio Gallegos, cutting diagonally across the southern end of Patagonia, would drive a sportsman mad. Fat hares by the thousands lope lazily across the road. Flights of snipe and plover flash overhead. And the fields are literally alive with flocks of upland geese, nibbling what little greenery they can find. So plentiful and destructive are the hares and geese, in fact, that they have been declared national plagues, and ranchers and hunters are allowed to exterminate them by any means.

Our ultimate goal was Ushuaia, southernmost town in the world until this distinction was pre-empted not long ago by little Puerto Williams, 28 miles away in neighboring Chile. Ushuaia lies on the southern shore of the Land of Fire—the island of Tierra del Fuego.* And on the way we hoped to visit Viamonte, halfway along the coast near Rio Grande, the estancia of the almost legendary Bridges family, first permanent European settlers of the island.

But first we had to cross the Strait of Magellan.

"The Chilean National Oil Company has an old American landing craft that makes the trip once a week from Punta Arenas," a Rio Gallegos customs official told us. "If you get there on the right day, and if they have room, you might make it."

We decided to chance it. We acquired a new taxi with an intrepid driver—four others refused to risk their precious cars on the dangerous strait—and skirted the shoreline to Punta Arenas, in neighboring Chile. At the oil company offices we met the British-born manager, Mr. Edward Hunter. There was a landing craft going the next day, he told us, but the company seldom carried private passengers.

"Still," he smiled, "we can't leave you stranded here after you've come all this way, can we?" And he not only arranged for our passage but found us a room in a town where people were sleeping on couches in hotel lobbies, and took us to the hotel in his own car to make sure we did not lose our way. Someday I shall elaborate on Shor's Law of Travel: Hospitality increases in geometric proportion to one's distance from civilization.

Our good luck held. Next afternoon the famous strait was almost pondlike in its calm. We passed the five hours on deck watching skeins of pintail ducks and other species file overhead. We landed at Porvenir, spent the night in a comfortable country inn under a covering of guanaco pelts, and late the next afternoon arrived at Viamonte in time for another typically British tea.

Viamonte Shears 43,000 Sheep

The estancia was a busy place when we arrived, for it was shearing time and 43,000 animals had been driven in for their annual clip. The yield, we were told, would be about 350,000 pounds—worth well over $150,000 on the world market.

The history of Viamonte and of the Bridges family's other estancia, Harberton, has been told in E. Lucas Bridges' book, *Uttermost Part of the Earth*, which Jean and I regard as the most fascinating travel and adventure volume we have ever read. It's the story of a single English family, beginning with a missionary and his wife, who came in 1871 to make their home among savages and preach the gospel, and continuing through their children and grandchildren to the present day. Their courage and enterprise are almost beyond belief.

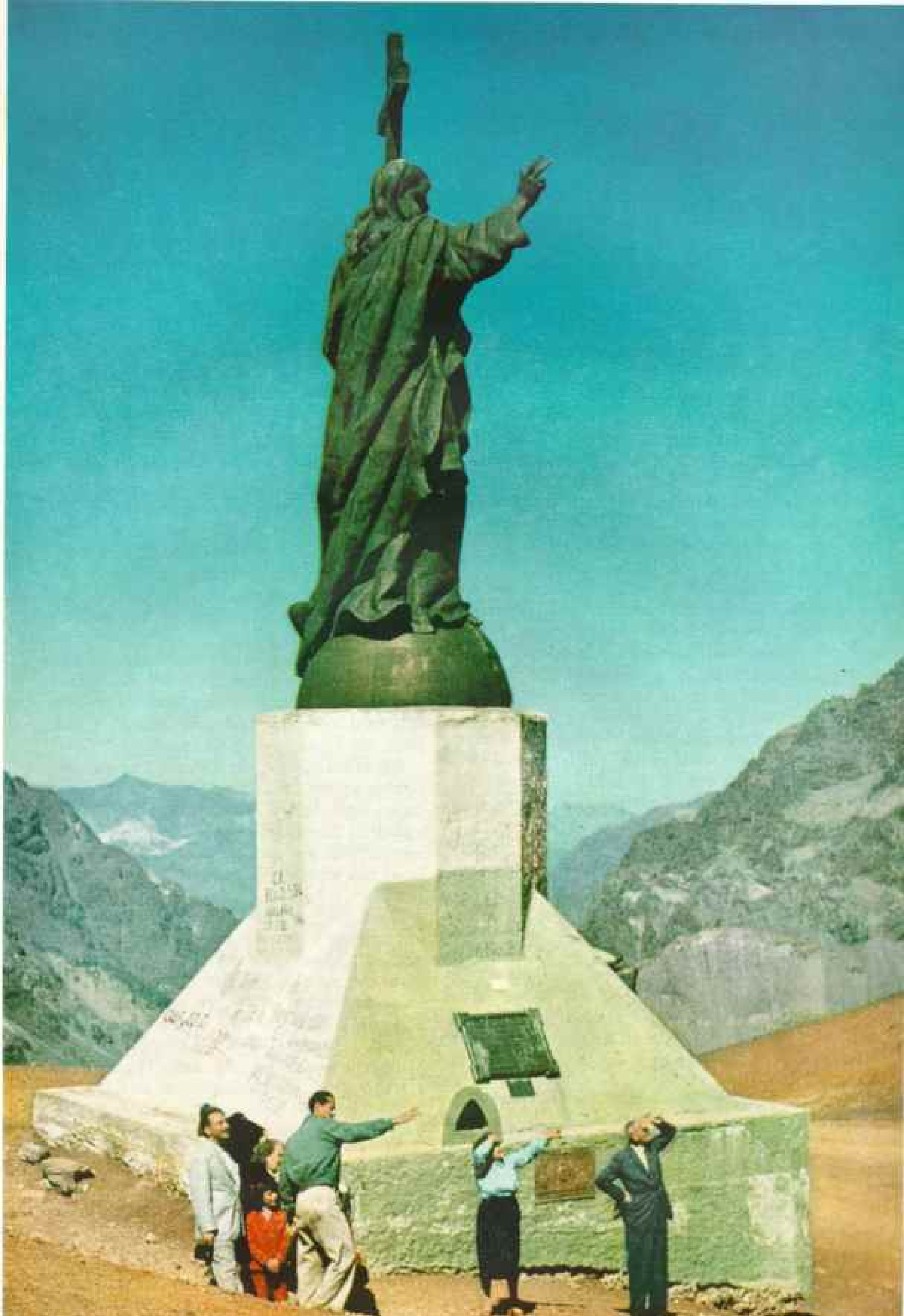
Thomas Bridges, the slight Englishman who founded the family dynasty on Fireland, as he called Tierra del Fuego, was more than a missionary; he was a scholar of unusual attributes. He not only learned the languages of the Yahgan and Ona Indians he found on the island; he reduced the Yahgan tongue to a phonetic alphabet and produced a monumental dictionary of the language.

Bridges and his Fuego-born sons and daugh-

* See "Atlantic Odyssey: Iceland to Antarctica," by Newman Bumstead, National Geographic Magazine, December, 1955.

Christ of the Andes Pledges Peace Between Chile and Argentina

Set above the frontier's La Cumbre Pass, the statue was erected after the pact of 1902. Says an inscription: "Sooner shall these mountains crumble into dust than Argentines and Chileans break the peace which at the feet of Christ the Redeemer they have sworn to maintain."



ters spent their lives bringing civilization to the island they had chosen for their home. Today Tierra del Fuego has prosperous towns and villages, and its estancias produce millions of pounds of mutton and wool every year. Roads are being built to make Ushuaia more accessible by car; already a trickle of tourist traffic has begun. It is a remarkable monument to one man's courage and vision.

We were entertained in the big, comfortable family home by Mrs. Bertha Bridges Reynolds, daughter of Thomas. With an agility that belies her 78 years she presides over the family table and still takes an active part in the management of the estate.

"Life is certainly easier now than when I was a girl," she told us. "I remember when I was 8 and Will was 11—that was in 1887—father sent Will and me into the forest to watch our wild cattle for the summer. We couldn't get dependable help, and we couldn't afford to lose those cattle.

"We spent four months living in a tent and eating nothing but pancakes and berries. It didn't seem to hurt us—we both gained weight.

"Then Will trapped a wild goose, and we looked forward to a real meal. We weren't very good cooks; so we decided to boil it and have soup first, and then the goose."

The bird was boiled, but while the soup was cooling some of the cattle strayed, and the children ran off in pursuit. While they were gone, an aunt arrived to check on their welfare, the first visitor in weeks.

"She saw that greasy soup and thought it was dishwater," Mrs. Reynolds laughed. "When we came back she had thrown it out, goose and all. I've never been so unhappy since."

Mrs. Reynolds's son Robert and Thomas Lawrence Bridges, another grandson of the founder, manage the estates today. But, ironically, white-men's diseases have almost wiped out the Indian tribes their grandfather came to Christianize.

Scenery Wonderful; Road Awful

The country between the Bridges home and Ushuaia is magnificent, covered with virgin forests, broken by rolling hills and snow-capped mountains, crossed by 65-mile-long Lake Fagnano. But the road, not yet formally open, was unspeakable. It took us 14 hours to negotiate the 125-mile journey; at one point we had to be towed over a mountain pass by a road-building machine (opposite).

Our welcome, however, made the trip worth while. Capt. Aurelio C. Lopez de Bertodano, Commandant of the Argentine Naval Station in Ushuaia, couldn't understand how we had got there when we appeared at his door early the following morning.

"I knew you were coming," he said. "But there has been no plane for a week. How did you get here?"

"By taxi," we told him.

"Impossible," he insisted. "The road is not completed. It is impassable."

"Not completed, yes. Impassable, no," I replied, and introduced him to our driver.

Certificate Rewards Intrepid Driver

The captain, who speaks excellent English, has a sense of humor. He had a secretary prepare an official-looking document certifying that Marco Cvitanic, our driver, had piloted the first taxi into Ushuaia. He presented it in a formal ceremony, and Marco departed for the rough ride back to Rio Gallegos happy in the knowledge that he was a 20th-century pioneer.

Ushuaia was a pleasant conclusion to our Argentine journey (page 350). We were quartered in a snug Navy cottage, with a fireplace that used so much wood Jean insisted it had given the Land of Fire its name.

We sailed the Beagle Channel, named for Darwin's sturdy little vessel, and ate delicious crabs fresh out of the stormy water. We walked in the hills under the beech tree called "lenga," which covers much of southern Fireland, and we saw whales spouting in Ushuaia Harbor.

When the Argentine Navy plane that was to return us to Buenos Aires arrived, we were genuinely sorry. But snow had already crept down the sides of the hills around the town, and once winter arrives, air transport is undependable. It was time to leave.

Back in Buenos Aires, packing for the airplane which would return us to Washington, D. C., in a day, we discussed what we had seen. I asked Jean how she would sum up Argentina in a single sentence; or, at the most, a paragraph.

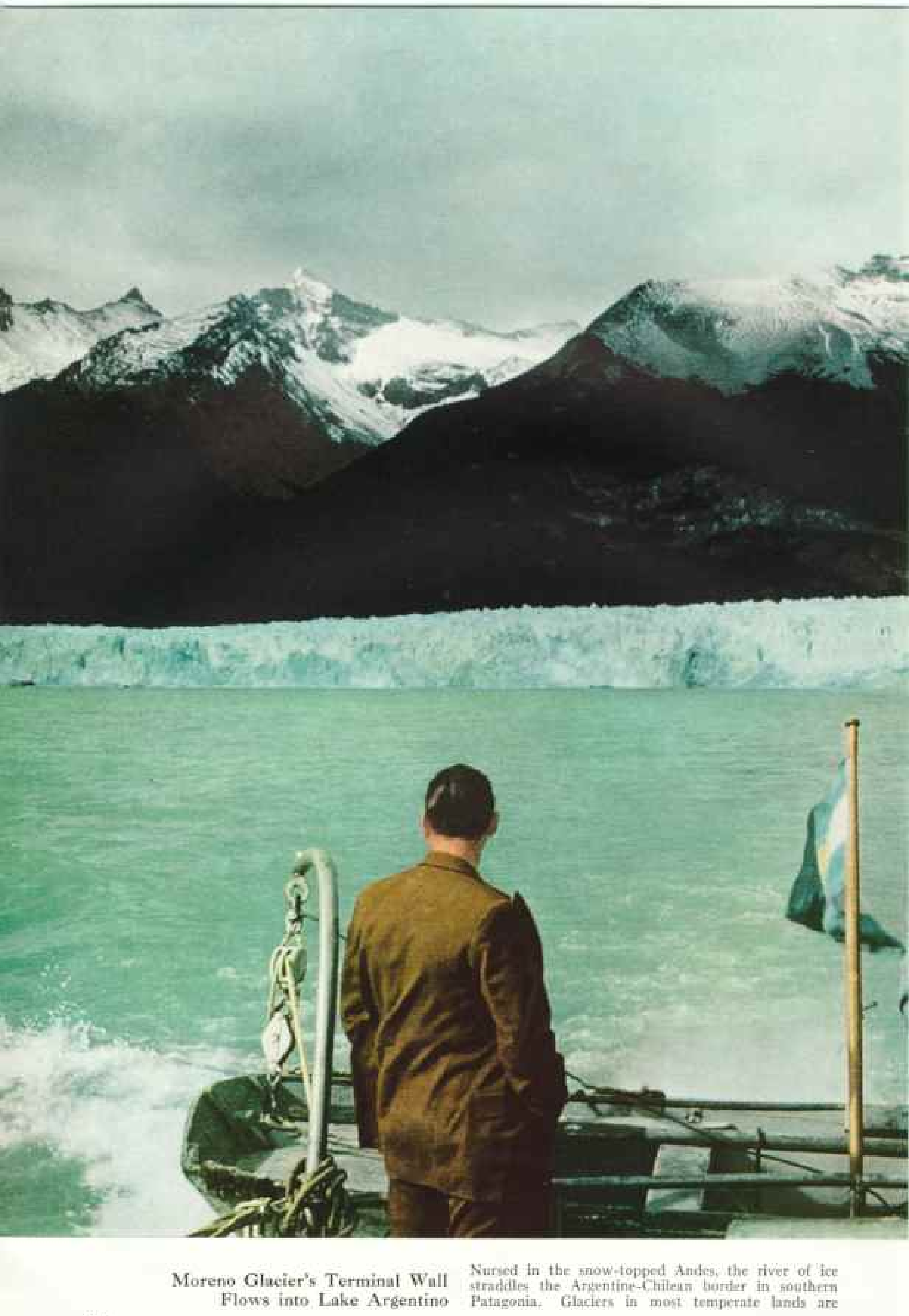
"It's impossible," she answered. "I could have done it before I got here. But now that I've seen how much of it there is, and what an incredible variety of people and geography and climate it has, I know better.

"There is only one way to believe Argentina. That is to see it."

All Kodachromes by Jean and Franc Shor, National Geographic Staff © N.G.S.

Gale-swept Tierra del Fuego, Argentina's southern tip, presents a calm day. This land of spectacular peaks, glaciers, and countless lakes possesses a wild and lonely beauty. Driftwood from Lake Fagnano feeds the fire for a picnic lunch.

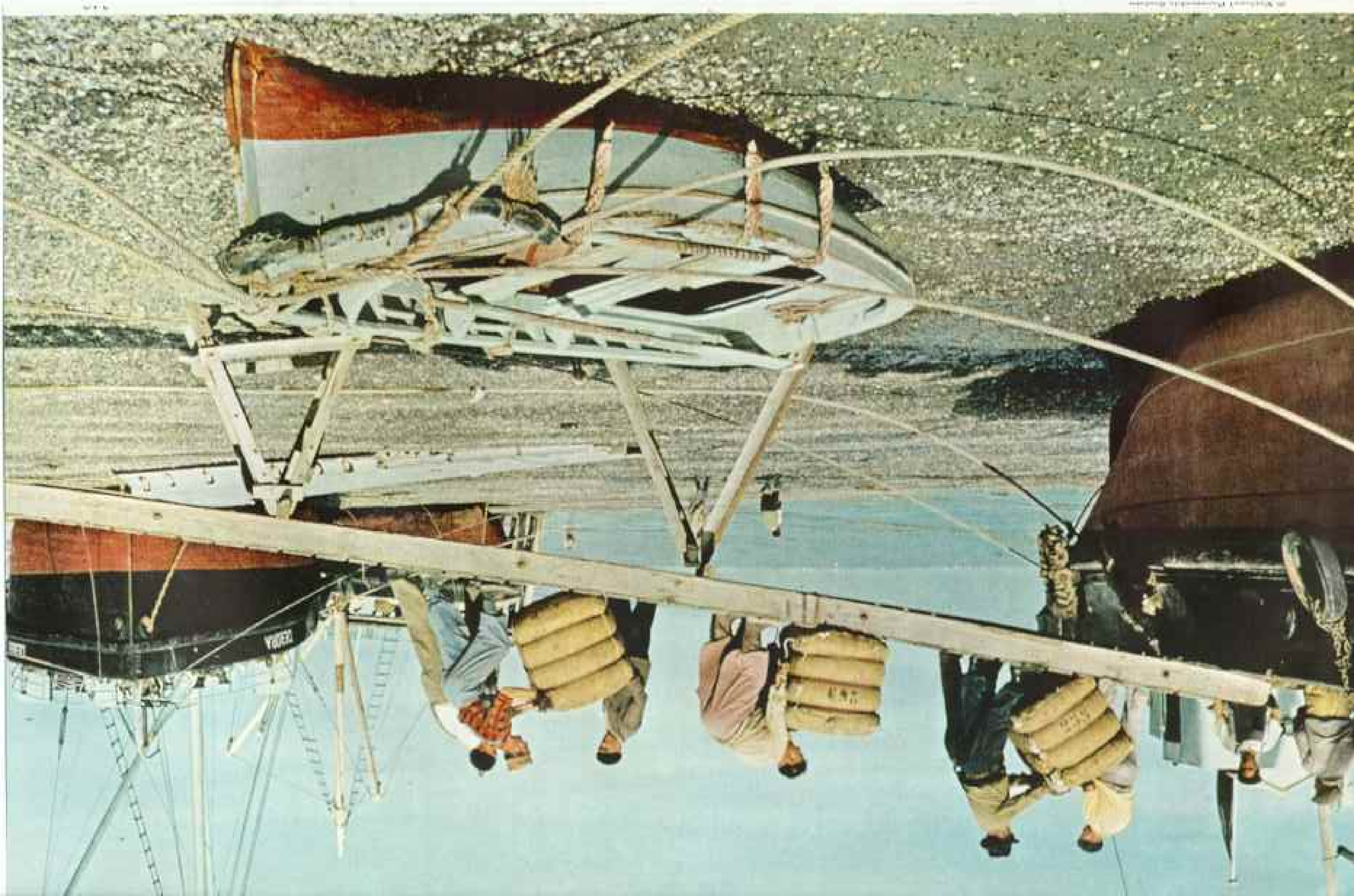
A bulldozer pulls the authors' car over muddy Garibaldi Pass. Maps often showed roads where none existed. Driving south from Rio Gallegos, the Shors crossed the Strait of Magellan on a World War II landing craft converted to a ferry.

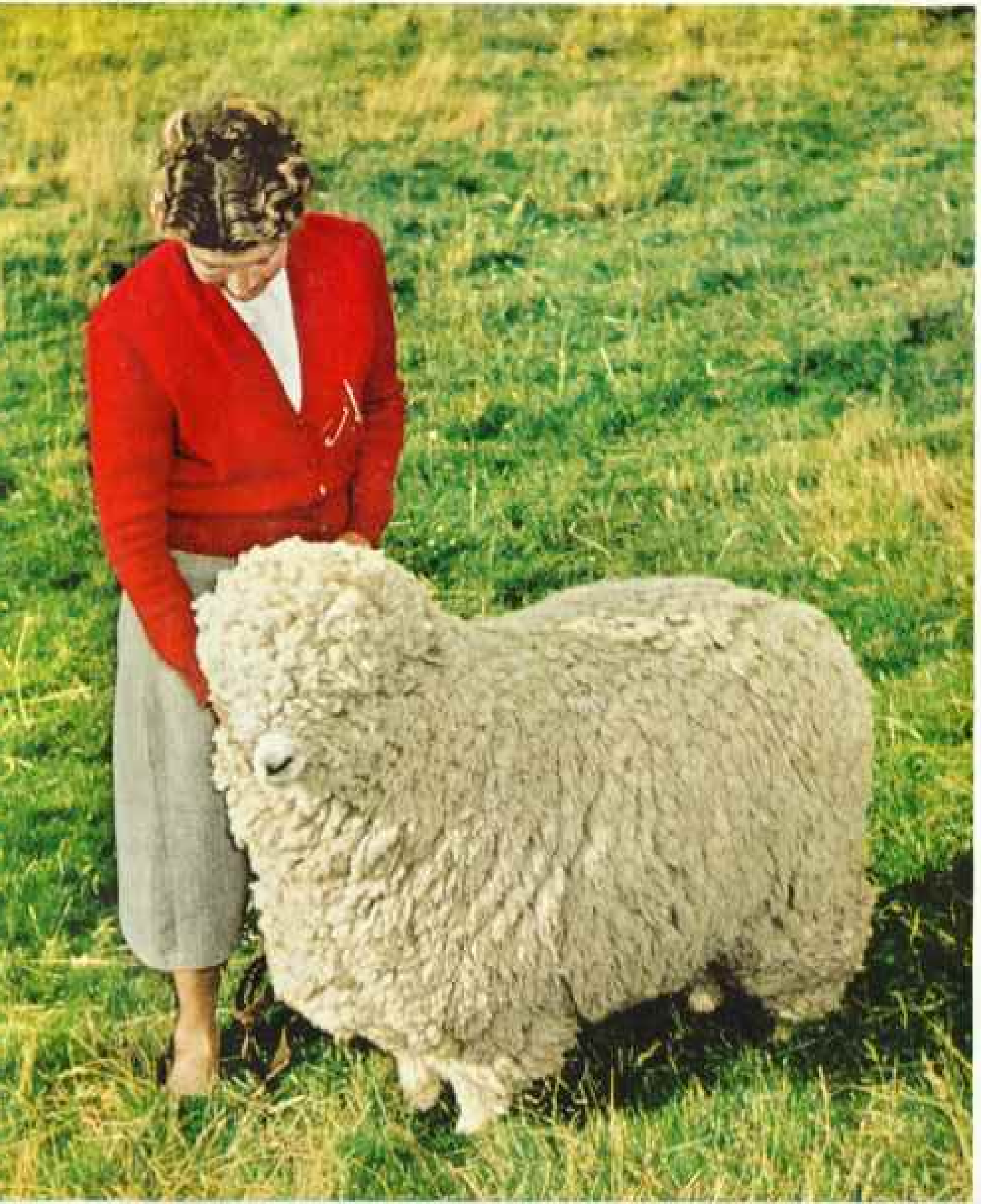


Moreno Glacier's Terminal Wall Flows into Lake Argentino

Nursed in the snow-topped Andes, the river of ice straddles the Argentine-Chilean border in southern Patagonia. Glaciers in most temperate lands are

retreating; Moreno is advancing. An Argentine National Park Service launch carries visitors close to the sheer ice wall, which is 100 feet high in places. At intervals masses of ice break loose with thunderous roars and fountains of spray. A skeleton forest of charred trees cloaks the slope at right.





Ships Lie Dry in Río Gallegos Harbor, Where Tides Vary as Much as 38 Feet

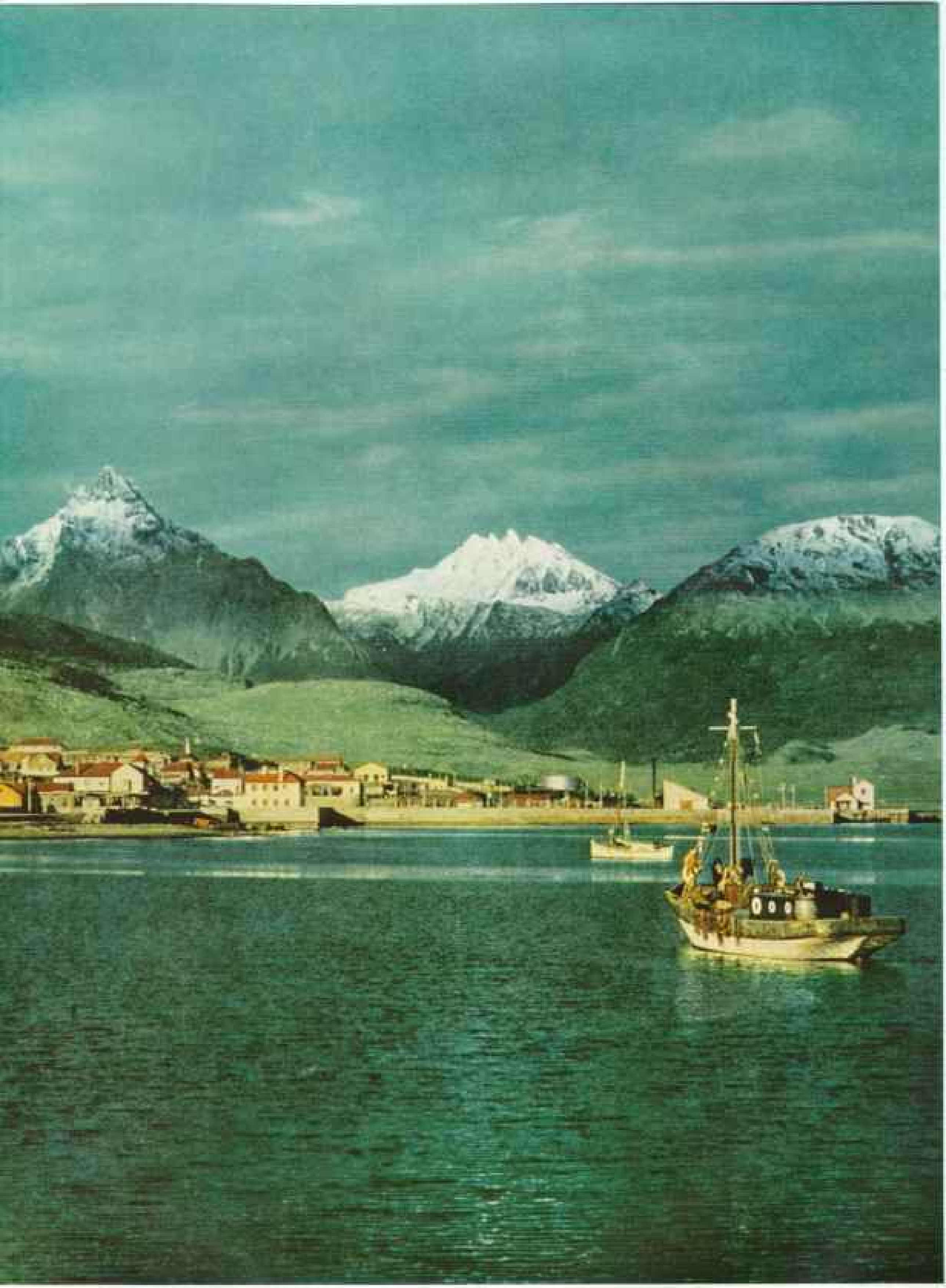
Hawsers secure vessels to pilings; anchors and chains lie exposed on the pebble-strewn riverbed. This South Atlantic coastal steamer takes on bales of wool for Buenos Aires.

Sheep ranches cover much of Patagonia's vast, thorny plain. Mrs. John Atkinson exhibits Polly, her prize Corriedale sheep, at the Atkinson ranch near Lake Argentino. The Atkinsons graze 6,000 sheep on the 25,000-acre estate; their herd yields 60,000 pounds of wool a year. Wool hides all but the nose and feet of 15-month-old Polly, a champion of two Patagonian shows.

Thick fleece of the Corriedale ranks among the world's best.

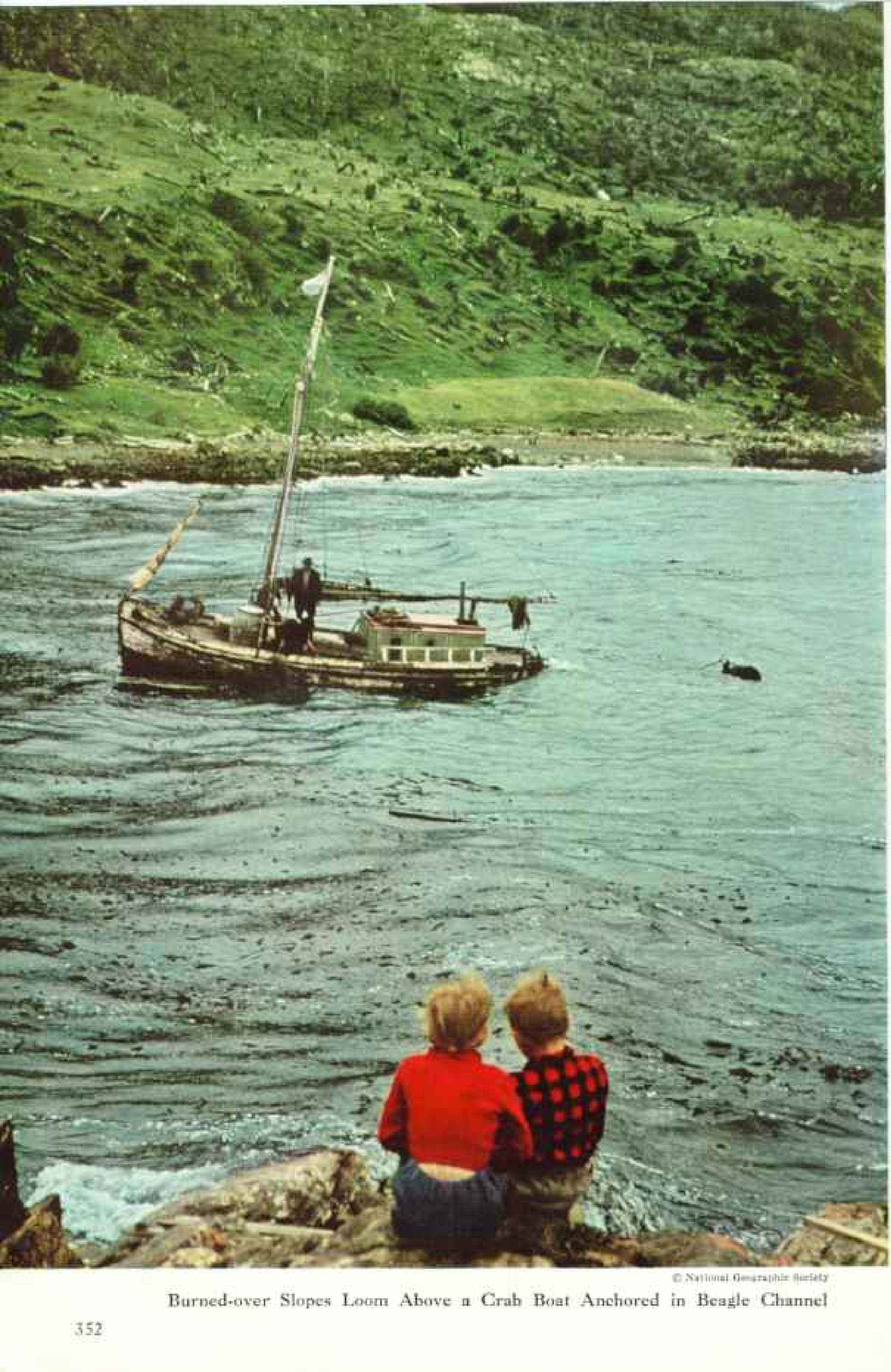
Setting Sun Kindles Ushuaia, Long the World's Southernmost Town

Tierra del Fuego—Land of Fire—belies its name, for bone-chilling dampness and furious winds plague these lonely islands. Shivering Indians who dwelt along



© National Geographic Society

the coast kept bonfires blazing day and night; discoverer Ferdinand Magellan named the region for their chain of flames. Ushuaia, though small, contains churches, hotels, movie theater, and radio station. Now the town has a neighbor even farther south, Chile's Puerto Williams, 28 miles away.



Burned-over Slopes Loom Above a Crab Boat Anchored in Beagle Channel

Fast-Changing Nations North of Cape Horn

"WHAT is the farthest south town in the world?" might well be a question on a quiz program.

"Ushuaia, Argentina," most geography experts would answer confidently, for that is the town shown farthest south by standard maps and reference works.

But geography is ever-changing, and a new town spot—Puerto Williams—appears even farther south on the National Geographic Society's latest Atlas map, SOUTHERN SOUTH AMERICA.*

This lonely dot on one of the hemisphere's frostbitten island toes represents some 350 Chilean men, women, and children who live only 680 miles from Antarctica's Palmer Peninsula. This community has grown up around Chile's new Navarino Island naval base, but also boasts a small sawmill and trading facilities for the island's sheep ranchers. Of course Ushuaia, population 2,500, remains the metropolis of this stormy region near Cape Horn (page 350).

Yet this up-to-date answer to a geographic quiz question is only one of many changes.

In Argentina alone about a thousand place names have been changed since the overthrow of President Juan D. Perón in 1955. Of these, scores involved the word "Perón": La Pampa Province, for example, was named Eva Perón, and Chaco was Presidente Perón. On the new map, not a single Perón remains.

Second in Build-your-own Atlas Series

This new full-color supplement showing the virile and growing nations north of Cape Horn enables The Society's 2,225,000 members to add a second map to the budding home atlas begun with the one that supplemented the January GEOGRAPHIC.

Though the map's area stretches from the Tropics to the Antarctic's edge, it mainly embraces the Temperate Zone—roughly the Southern Hemisphere's equivalent of the latitudes in which the vigorous peoples of the United States and Canada live.

Open spaces abound, yet the map contains, too, the continent's three largest cities: Buenos Aires, São Paulo, and Rio de Janeiro.

Even longer than Argentina, Chile stretches north and south as far as from the Panama Canal to Montreal. Yet the nation's mainland width varies from 220 miles in the north to a mere 9 miles in the south, making this the world's most linear land.

Mount Aconcagua, in western Argentina, tops everything in the Western Hemisphere, surpassing North America's Mount McKinley by more than 2,500 feet. The Andean giant now bears a new official elevation of 22,834 feet, 201 feet lower than previously determined, as a result of a 1956 expedition from the School of Engineering of the University of Buenos Aires. Mount Aconcagua punctuates the upper right corner of the inset (C) showing the Valparaíso-Santiago area.

Another change on the map marks a new depth found in Bartholomew Trench, a narrow oceanic gorge just 40 miles off the Chilean port of Antofagasta. Scientists from Woods Hole Oceanographic Institution in Massachusetts recorded there in 1955 a depth of 26,160 feet, or nearly five miles.

New Roads, Airports, Oil Lines

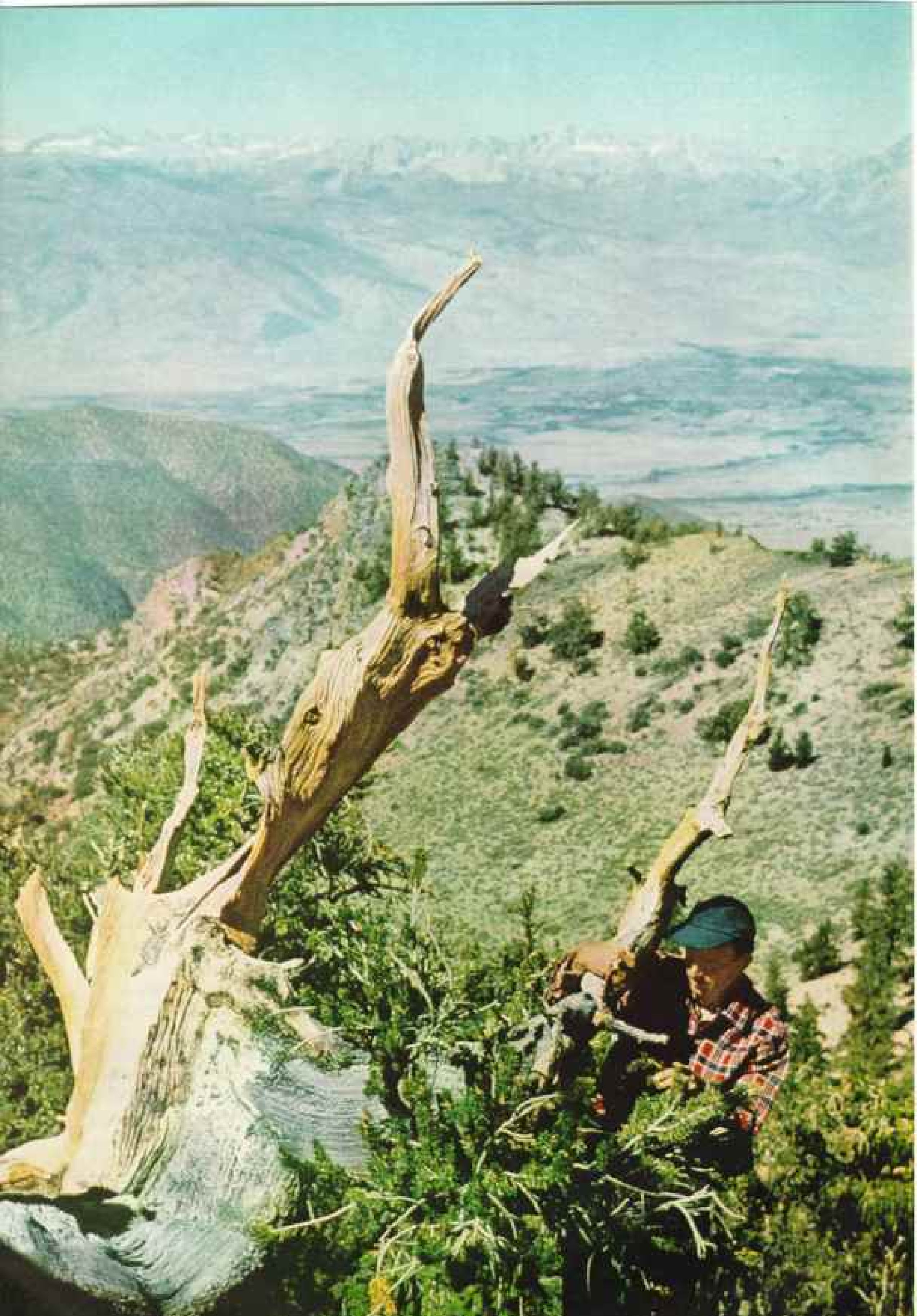
Veined by South America's growing road network, the new map traces main arteries of the Pan American Highway System in heavy red lines. A line of red dashes across southern Paraguay indicates the ambitious road-building project that will connect Asunción with Brazil's booming state of Paraná.

Other symbols of progress can be read in the red stars for scheduled airline stops, and the tiny derricks and dot-strung lines denoting oil fields and pipelines, found chiefly on the Argentine-Bolivian border and in the Chilean section of Tierra del Fuego.

Uruguay, smallest South American republic, is shown wedged between its broad neighbors, Brazil and Argentina. An inset (A) gives greater detail of Uruguay's popular beaches. Also shown is a famed navigational hazard off Montevideo: the Nazi pocket battleship *Graf Spee*, trapped here and dramatically scuttled in December, 1939. Across the Río de la Plata, another inset (B) shows in detail Buenos Aires and its environs.

Far down near Cape Horn part of the historic strait that bears the name of the great navigator Ferdinand Magellan is paralleled today by a railroad. Shown on the map as a solid black line, it connects Río Gallegos and Río Turbio coal mines. Some 900 miles from Antarctica, this is the world's most southerly railroad.

* Members may obtain additional copies of the new Atlas map, SOUTHERN SOUTH AMERICA, by writing to the National Geographic Society, Washington 6, D. C. Price, postpaid to all countries, 50¢ each. The price of the larger supplement maps remains 75¢ on paper, $1.50 on fabric. All remittances payable in U. S. funds.



Bristlecone Pine, Oldest Known Living Thing

By Edmund Schulman

Dendrochronologist, Laboratory of Tree-Ring Research, and Associate Professor of Dendrochronology, University of Arizona, Tucson

With Photographs by W. Robert Moore, National Geographic Staff

ONLY recently we have learned that certain stunted pines of arid highlands, not the mammoth trees of rainy forests, may now be called the oldest living things on earth.

Microscopic study of growth rings reveals that a bristlecone pine tree found last summer at nearly 10,000 feet began growing more than 4,600 years ago and thus surpasses the oldest known giant sequoia by many centuries (page 364).

California continues to hold the championship, for the newly discovered world's oldest tree also grows in the Golden State. It stands in the Inyo National Forest, in the White Mountains of east-central California (map, page 361).

Many of its neighbors are nearly as old; we have now dated 17 bristlecone pines (*Pinus aristata*) 4,000 years old or more, all in the White Mountains and 9 of them in the area we came to call Methuselah Walk (page 356).

Ancient Dwarfs Look Their Age

These oldest pines are now but living ruins. Their trunks, 10 to 30 feet high, are little more than eroded stumps. Yet each possesses its life line, a few inches wide, of bark-covered growing tissue leading from partly bare roots to a thin crown of branches. And each still is able to produce cones occasionally, as it has for well over 4,000 years.

After studying a photograph of one of these trees, a friend of mine remarked enthusiastically, "Don't you wish we could all live to be that old?"

To this his wife replied, "Who wants to be 4,000 years old, if she looks like that!"

But beauty is as beauty does, and to me as a climatologist the bristlecones look good indeed. The history preserved in their annual layers of growth should eventually give us a unique record of past climatic changes.

Potentially of far greater importance is the fact that the capacity of these trees to live so fantastically long may—when we come to understand it fully—perhaps serve as a guidepost on the road to the understanding of longevity in general.

20 Years' Research Led to Discovery

But how had we come to find Methuselah Walk and the other groves of four-millennium trees? How could we be certain they were really so ancient and so full of significant tales about the climates of the past?

The story really begins some two decades ago, when I began hunting long-lived trees in the course of climatic research at the University of Arizona. There Dr. A. E. Douglass long ago had found that trees of certain species show marked variation in ring width, reflecting wet and dry years. This is especially true of the Rocky Mountain Douglas fir and some of the pines.

When cores are taken with a simple instrument (page 370) and growth rings are carefully checked against those in many neighboring trees, it is possible to trace the missing rings, extra rings, and other irregularities in growth and so to date the rings exactly.

By matching the pattern of wide and narrow rings in the inner part of old trees with corresponding patterns in timbers cut by prehistoric Indians, the scientist can determine when these ancient peoples built their pueblos.

Thus, in the 1920's, three notable National Geographic Society expeditions led by Dr.

Bristlecone Pine, 40 Centuries Old, Sustains Life amid Its Own Ruin

Abraham walked the earth when this tree was thrusting its first tender roots into a rocky crevice two miles high and rearing a slender stem. Racked by wind and erosion, the pine trembled on the brink of death. Yet it endured, recording time and weather with its annual growth rings.

Here, in California's White Mountains, the author's assistant, M. E. Cooley, examines this bristlecone's one living branch. At its base a single narrow strip of bark protects growing tissue. Erosion has polished the dead wood. Distant snow peaks of the Sierra Nevada wall off Pacific Ocean moisture from Owens Valley and the White Mountains.

Kodachromes by W. Robert Moore, National Geographic Staff © N.G.S.

Living Monuments on Methuselah Walk Rival the Great Pyramid in Age

Pinus aristata, the bristlecone pine, seems to survive because of adversity. All the older individuals in the White Mountains are found near 10,000 feet in a dry, rocky wilderness. Denied spurts of youthful growth,

© National Geographic Society

such trees cautiously add no more than an inch to their girth in a century. With so little tissue to nourish, they can afford to shut up shop almost entirely during lean years. In such times they may produce no cones and lay down no rings except on narrow strips of the stem. Dr. Schulman gave the name Methuselah Walk to this part of the White Mountains after discovering here the oldest known living trees.

Douglass determined the age of Pueblo Bonito, New Mexico, in what is now Chaco Canyon National Monument. These expeditions pushed back the Southwest's historical horizon to more than 800 years before Columbus.*

The Indians naturally preferred tall, straight young trees for building timbers. They rarely bothered with the gnarled veterans that here and there clung to a dry sandstone ledge.

Driven, however, by an entirely different need, we began sampling such "worthless" veterans. We were looking for old trees whose growth rings might give us a longer and more sensitive history of past droughts.

Underprivileged Trees Live Longest

At once it became evident that precisely under such difficult living conditions trees not only showed the expected high sensitivity to rainfall, but were able to live far beyond the normal life span of more "fortunately" located individuals of the species.

There came a day when we could point, for example, to an inconspicuous Douglas fir clinging to a narrow ledge near Mesa Verde National Park headquarters and say: "That slender tree only 20 feet high began its life about A. D. 1375. It has seen several generations of Douglas firs, like those now bordering the creek bed below, grow to magnificent size and then rot and die, while it remains sound to the core."

And later it was a thrilling experience to find, sample, and date a cliff tree in Navajo Canyon near by with a life span reaching back to the time of the cliff dwellers of Mesa Verde, abandoned forever about A. D. 1290.

An 860-year ponderosa pine in Bryce Canyon National Park, a 975-year piñon pine in central Utah, and other grand veterans gave us continuous tree-ring histories of annual rainfall much longer than we had once thought possible. But after many years of hunting and sampling old trees throughout the semiarid West, it began to seem that we were approaching the absolute age limits for rain-sensitive dwarf trees in this region.

Then, at the very end of the summer field season of 1952, an entirely unexpected find opened up new possibilities. Sampling a stand of old Douglas firs above Sun Valley, Idaho, we found an alpine-type limber pine with one side completely dead. The core from this tree could not reach center but seemed to have an unusual number of rings.

That night with the aid of a flashlight at our camp below, I cut a surface on the sample and examined it more closely. I was astonished to find that the 16-inch core contained some 1,400 years of datable growth rings. Later we found that this limber pine was almost exactly 1,650 years old.

But it was in the 1953 field season that the dazzling possibilities of new and fantastically long records of year-by-year rainfall in alpine trees became apparent.

Prof. Frits W. Went, of the Earhart Plant Research Laboratory at the California Institute of Technology, joined me on another visit to the unusually old pines of Sun Valley, and we spent most of one day in cutting down, for detailed laboratory analysis, the 1,650-year pine discovered the preceding year. The next day, with the help of the Forest Service, we piled much of it into our truck and took off for Pasadena, where I was working at Caltech on a year's leave from the University of Arizona.

On our homeward drive we detoured into the White Mountains of California, to check on a rumor that old trees existed there. Often such rumors had turned out to be unfounded. But not this one!

"Patriarch" a Mere 1,500 Years Old

In this portion of the Inyo National Forest a multiple-stemmed bristlecone pine tree some 37 feet in over-all circumference near the base had been reported some years earlier by the local ranger, A. E. Noren, who had named it the Patriarch (page 362). We sampled the Patriarch and found it to be about 1,500 years old, but with the typically insensitive ring growth of upper timberline.

More exciting was our discovery that on drier sites near by lived 1,500-year-old bristlecones—upper-timber-zone trees—which were better recorders of drought years than even the Sun Valley limber pines.

Sampling the stem of a very old bristlecone pine, however, proved quite a problem, for many of them are completely unorthodox in shape. Instead of the familiar circular cross section, these trees are distorted so greatly that often it is a major puzzle to locate the early portion of the stem. The strip of living tissue in an old, eroded stem may now be growing in a direction at right angles to its direction a millennium ago.

How was I to get a complete sample from bark to center in such a tree? The available borers were not designed to go around a bend!

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

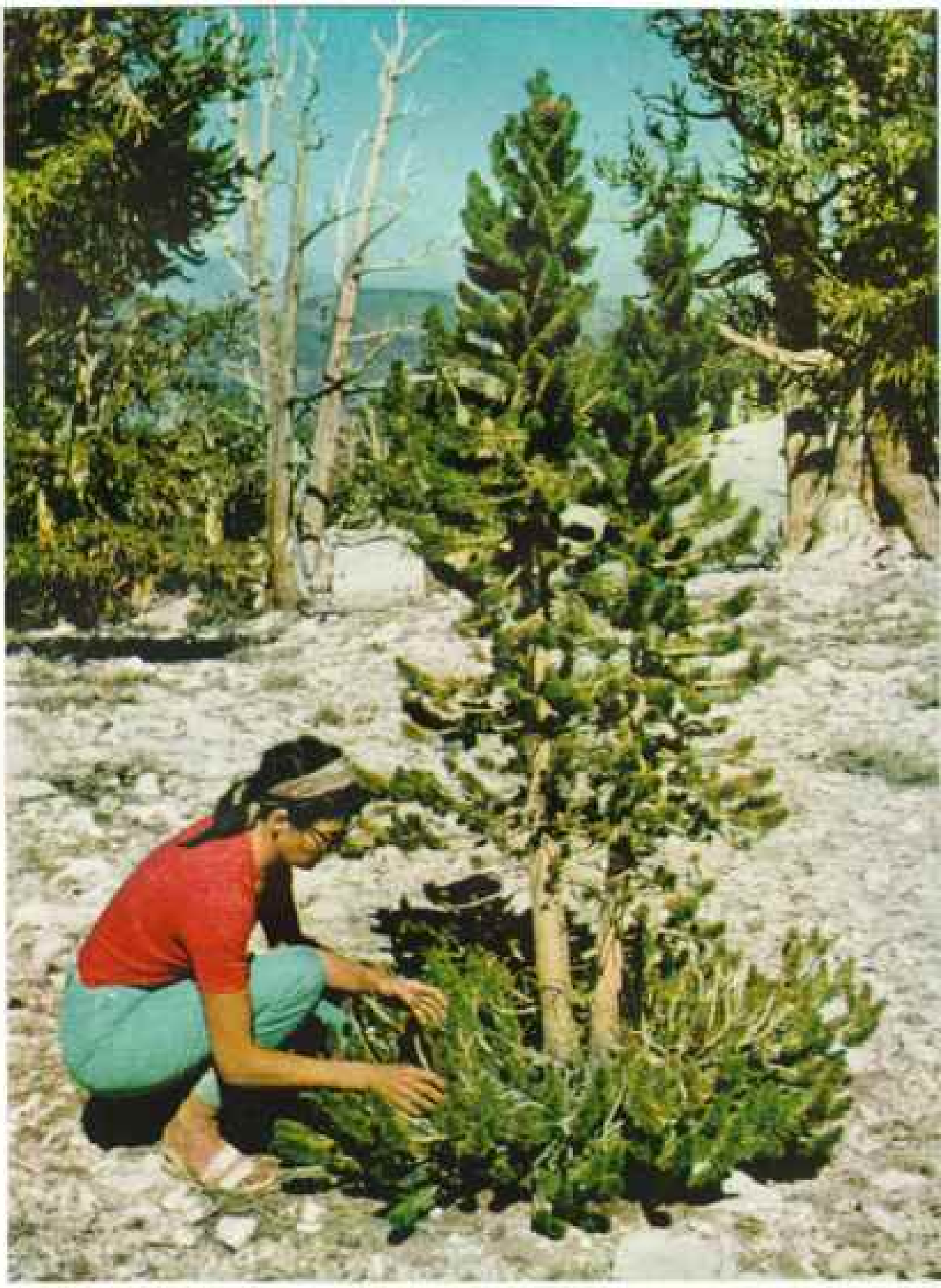
Green Wreath Encircles a Youngster of 50 Years

Two stems vigorously compete for the lion's share of the tree's nourishment. During drought the branches growing at the base may be first to wither; next the weaker of the two stems may die. The stronger may finally drop all except one limb to sustain a thin trickle of life. Or all may live on for centuries and produce a grove-like cluster such as the Patriarch (page 362).

Three Crops of Cones Ensure Fresh Progeny

Dry brown fruit are last year's issue. This season's purple cones stand within a month of maturity. Creamy male cones at branch ends will pollinate young female cones for next year's offspring.

Bristle-tipped scales of the fruit give the tree its name.



California's Arid White Mountains, Home of the New-found Methuselah Trees; Bristlecone

The tree itself offered the solution, for we could get a *series* of borings around the stem, first through the bark and then through successively older parts of the eroded area. In the long dead and dry but very resinous wood our live-tree borers worked! These cores were consistent enough in ring-width patterns to be dated by overlap matching, just as the rings in the pueblo beams were matched and dated against rings in living trees.

Laboratory study of the collection of drill cores obtained in 1953 soon convinced me it would be desirable to sample representative stands of bristlecone pines all the way from

Pines Grow Only in the American Southwest

California to Colorado, and this was done.

By 1956 we knew for a fact that we had here trees in the 4,000-year-plus class, incredible though it seemed. We also knew that bristlecone pine trees were able to reach highest ages and greatest growth sensitivity at the western limit of their range. Nowhere have trees yet been sampled which approach the top ages of more than 4,500 years found in the White Mountains region of the Inyo National Forest.

In the more extensive groves of bristlecone pine in that range, trees of all ages can be found, but on the driest and most adverse sites it is easier to find a very old tree than a very young one! Even the slender little stem which looks like a sapling may show several hundred annual rings on the few inches of core from bark to center (page 365).

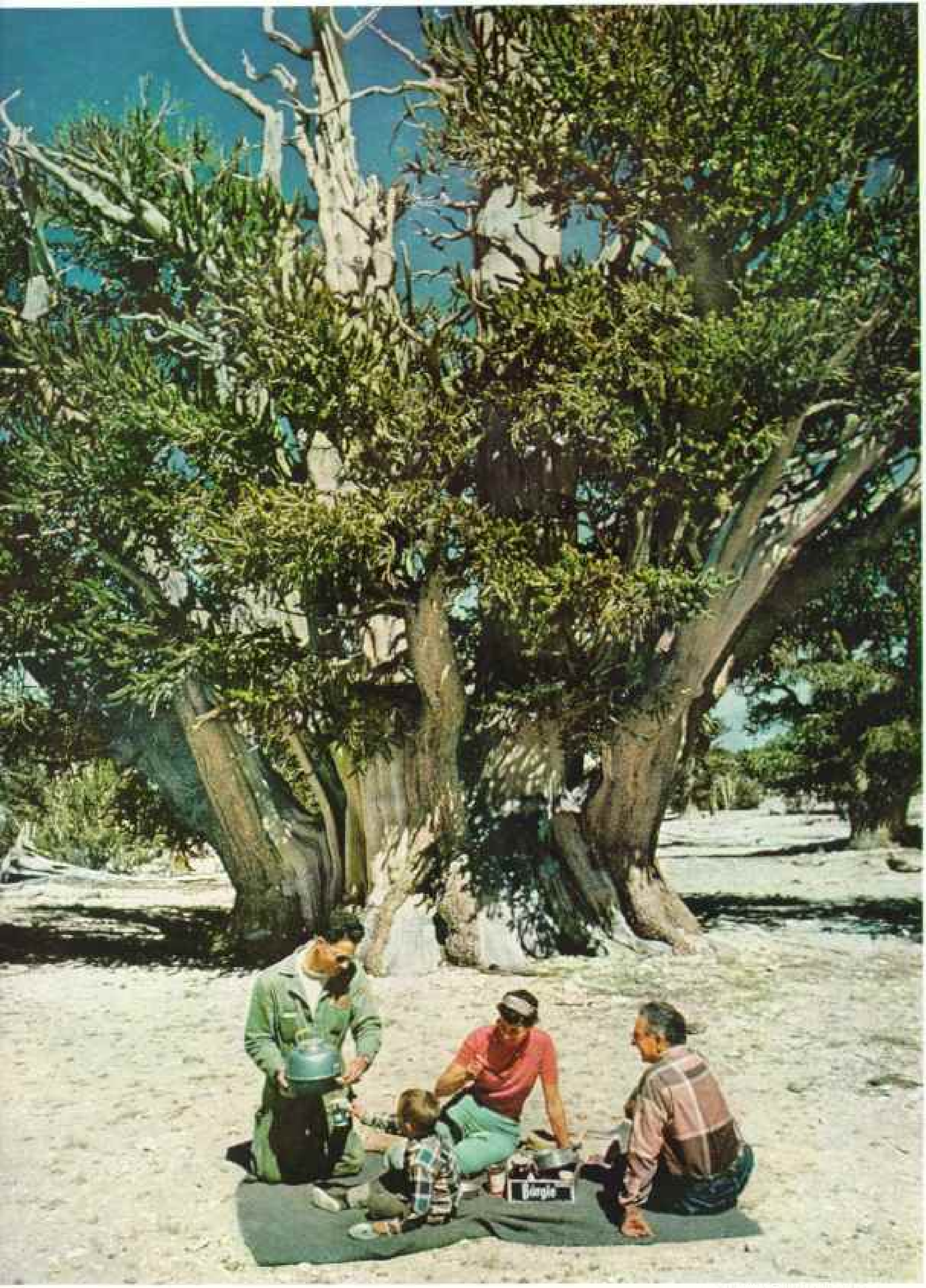
In 1956 we sampled what we thought would be plenty of White Mountain bristlecones to get our precise dating back into the earlier millenniums; we had already carried it back to A. D. 250. But we picked up only about 200 years during the following winter's laboratory work, and could go no farther. We had hit what we began calling the "B. C. barrier."

Methuselah Walk Found in '57

Many more samples were needed, and thus we planned a major field survey for the entire summer of 1957 in the driest parts of the White Mountain bristlecone forest.

As in 1956, this was made possible by a grant from the National Science Foundation. I had the valuable assistance of geologist M. E. Cooley, nicknamed "Spade," and just where we had hoped to find it, we came upon Methuselah Walk.

Here was a marvelous combination of the conditions apparently favorable to the great longevity we were looking for: the farthest limit of the dry forest edge, outcroppings of calcareous rock, and little rainfall—probably



Largest Bristlecone Combines a Grove of Trees with One Root System

The Patriarch is not the oldest pine in Inyo National Forest; its age is a mere 1,500 years. Favorable conditions allowed it to attain a circumference of 37 feet, yet the top failed from starvation. The author (right) and friends break their tree study with a picnic.

no more than 10 inches a year. These were just the trees we needed to date the bristlecone chronology of rainfall well into B. C. times.

After weeks of work along Methuselah Walk we found ourselves thinking of these oldest individuals as tending to belong to one of three rough types, or forms. There was the "massive slab" type, like Pine Alpha (page 371). There were many of the "eagle's aerie" type, with numerous spreading snags. And, finally, there was the "pickaback" type, which we have found nowhere else.

The pickaback is a type of old bristlecone pine which can usually be sampled almost or right to its heart in a straight line through the small strip of remaining bark, if one starts low in the stem. Yet above this, near eye level, there are several separate stems. These are joined in what seems to be pickaback fashion, and it is easy to see three such stems as a Junior-Dad-Granddad sequence.

Microscopic examination of the first cores from one of these trees, which we soon got to calling the Great-granddad Pickaback, was another of those exciting events which this rich species can so bountifully provide.

Great-granddad Proves Oldest of All

We had broken our lonely camp, an hour by foot from Methuselah Walk, and driven along the plateau some miles to the White Mountain Research Station, now principally under the direction of the University of California at Berkeley. Here were good companions, welcome bunks—and a well-stocked freezer!—at over 10,000 feet.

That evening I had our long cores from Great-granddad under the lens, and as I dated

Four Thousand Years March Across the Face of This "Pickaback" Pine

As a sapling, about 2000 B. C., the tree formed the ring near the point numbered 1. Point 2 indicates growth about 500 B. C., when the Persian Darius was mobilizing to fight the Greeks. Charlemagne's survivors were quarreling over the pieces of his Holy Roman Empire when the bristlecone laid down the ring at point 3, now precisely dated A. D. 828. The outermost ring at 4 grew in 1957, the year the tree was cut for study. This is part of the tree from Methuselah Walk (page 366); its lower surface shows an unbroken series of rings.

A Short Spike Marks the Heart of the Oldest Known Living Tree

This pine has survived more than 4,600 years; missing rings make precise dating difficult. Dr. Schulman calls it a pickaback tree because new growth has mounted the old through the ages. Here he grasps "Great-granddad," the primary stem. "Granddad" (center) shows a hollow. "Dad," the next layer, is dying. Bark-covered "Junior" (right) keeps the tree alive.

Coring Tool Extracts Capsuled History from a 700-year-old Dwarf

Surrounded by larger trees, this bristlecone pine eks out a meager living. Three-inch-thick trunk and three-foot height are all it has to show for centuries of struggle. Dr. Schulman's corer will leave no permanent hole in the bark; the tree's resin heals such wounds.

Seed from an Old Pine Grows as Vigorously as That from a Youngster

Dr. Frits W. Went, in charge of the Earhart Plant Research Laboratory at California Institute of Technology, holds baby pines he grew from the cones of a 100-year-old and a 1,500-year-old tree.

By varying growth conditions artificially, Dr. Went hopes to learn whether old bristlecones differ basically from young ones.

the outer centuries of rings and then went on to a quick count of the earlier rings, unusually crowded even for bristlecone, I felt excitement rise; for we were rapidly piling up the centuries. And when I got to within one inch of the inner end of our cores, I fairly shouted at my colleague working across the table.

"Spade, we've got a 4,000-plus tree with the center present!"

This was the first of all our four-millennium trees which had not eroded past the center.

More exact work later showed that the Great-granddad Pickaback had begun growth more than 4,600 years ago. Thus it stands right now as the oldest known living thing (page 364).

To determine the life history of this strange pickaback form of tree, we hardened our hearts and, at the very end of the field season, cut down a similar but somewhat younger specimen for detailed study. Spade and I lugged the bulky logs out of the canyon on a stretcher. After a five-hour struggle, we got them to our car and headed for home.

With polished surfaces to study, we found that Junior, the youngest stem, was not at all a direct low branch of Dad. On the contrary, for far more than a millennium one of Dad's primary branches remained suppressed near the ground, its twigs producing offshoots which in turn produced others in an innumerable succession.

At last, about A. D. 800, one of the newest offshoots was freed, perhaps by the dying away of Dad's branches above, and it soon became the dominant and eventually the sustaining stem-branch of the tree. And this was how Dad got started, too, some 1,500 years after the birth of Granddad, the original seedling, about 2000 B. C.

"But Don't Touch General Sherman!"

Of course, *Sequoia gigantea*—the "big tree" of California—has long been considered the oldest living thing. Its tall relative, the coast redwood, *Sequoia sempervirens*—despite its ever-living name—attains ages only roughly half or two-thirds as great, with a maximum around 2,200 years.

More than 45 years ago the rings on hundreds of giant sequoia stumps throughout the heavily lumbered Sierra Nevada forests were measured by Ellsworth Huntington and his crew of woodsmen. Three thousand or more annual rings could be counted on four of the stumps.

Later, more exact ages were derived after a detailed cross-comparison of the rings in these trees by Dr. Douglass. On the oldest one, which had been cut down in 1892, the earliest ring dated at 1307 B. C. This oldest precisely dated sequoia must have sprouted about 1320 B. C.; it was 3,212 years old.

But what about that burned-out old sequoia snag on which John Muir counted some 4,000 rings, back around the 1880's? Alas, no one could later find the stump and verify the count. Muir himself emphasized that the rings were very distorted in many places. And in his day the science of precise ring dating was still undeveloped. One hesitates to question that grand observer, yet there is a disturbing gap in age as compared with the oldest exactly dated sequoias.

And what of the large standing sequoias?

Some years ago I got permission from Col. John R. White, then superintendent of Sequoia National Park, to take increment borings in living sequoia trees. "You're welcome to sample any other tree in the park," he said, "but don't touch General Sherman!"

Since the standard borer is barely long enough to get through the General's bark, this was not a serious restriction. Besides, Dr. Douglass had studied this tree's growth by sampling burned areas in it decades ago, and had estimated its age at possibly 3,500 years.

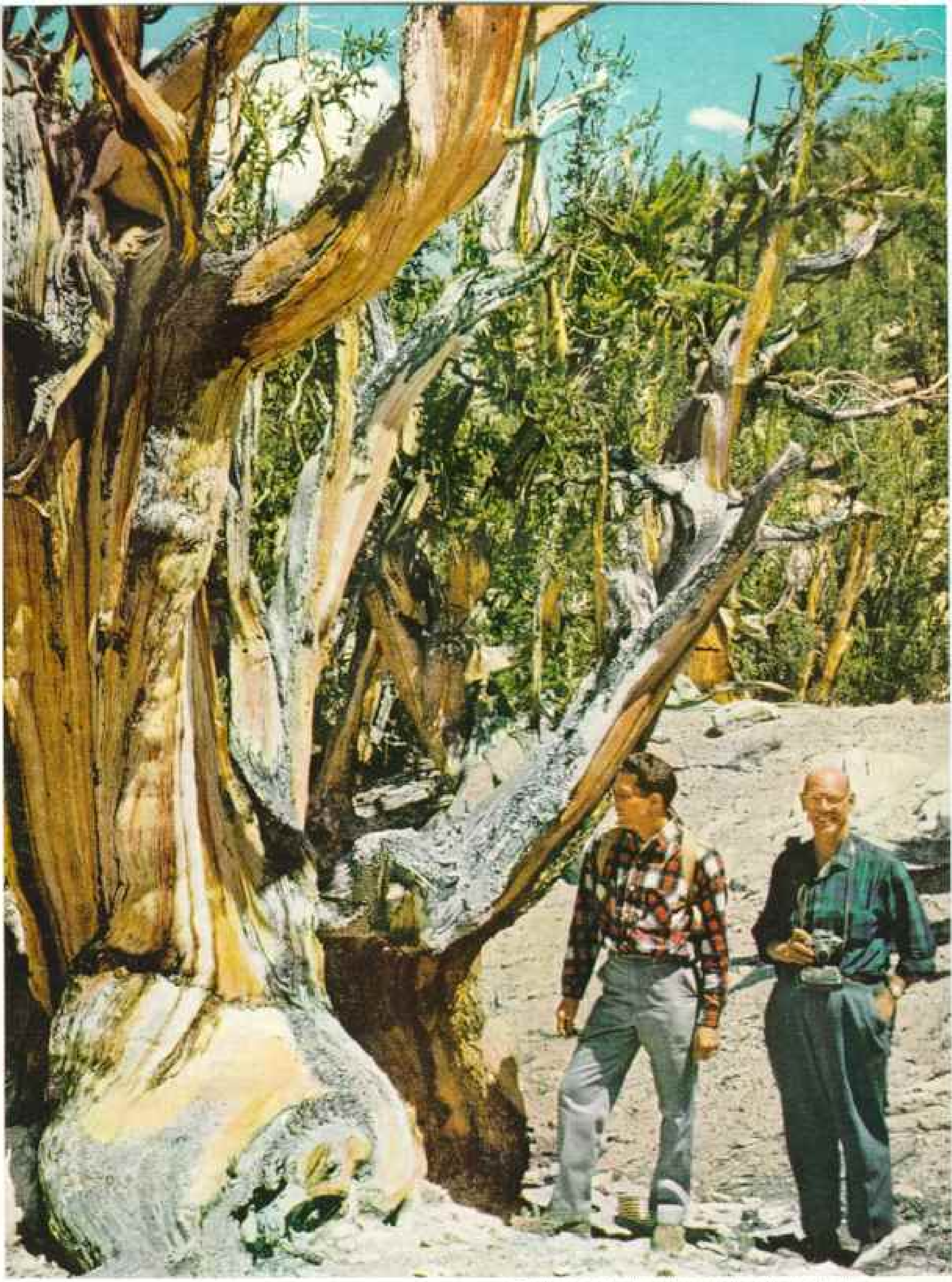
Sequoia May Win in the End

Our borings indicated that in this species the biggest trees are likely to be the oldest. Until deep borings are made in the biggest ones, we will not know whether any living sequoia is older than the oldest that have been cut.

In *potential* life span the giant sequoia seems to come back into first place, for the General Sherman Tree and most other mammoth sequoias appear to have little or no decay. Barring accidents like out-of-balance toppling or a series of great fires, mature sequoias living now could well be living still, in their protected parks, in A. D. 5000.

By that time the oldest living bristlecone pines will surely have long since gone. For these oldest pines have in a certain sense been dying for two millenniums or more. They now possess only a narrow strip of their once complete bark and the growing tissue beneath it. True, the dying-back of this life line is exceedingly slow, and several of them seem good for at least five centuries still. But they probably cannot live much more.

It is curious, and perhaps significant, that the oldest bristlecone pines and the oldest giant sequoias are neighbors separated by



Kodachrome by Edmund Schulman © National Geographic Society

Wind-blown Sand and Ice Give Dead Wood the Luster of a New Board

Among trees of the upper timber zone, the bristlecone shares with the limber pine the only known ability to record rainfall by the size of its rings. This 3,000-year-old added rings so faithfully and accurately that Dr. Schulman uses it as a key to date other trees. The forest is so resinous that its exudations gummed the camera lenses of W. Robert Moore (right), veteran chief of the National Geographic Society's Foreign Editorial Staff.

only a few score airline miles. About the same distance away, in Yosemite National Park, stand millenniums-old trees of still another species, the western juniper. John Muir, before the turn of the century, put the age of the gnarled giants above Yosemite's Tenaya Lake at 2,000 years, and our own studies of these and the junipers near Sonora Pass not far to the north suggest a maximum age of at least 2,500 years. Does California have a kind of maximum-age monopoly?

Although trees of various other species throughout the world have been estimated to reach ages in the thousands of years, none has yet been definitely verified by careful study to be in the 3,000-year class.

In 1943 I had a chance to see the magnificent cypress in the churchyard of Santa Maria del Tule near Oaxaca, Mexico. It inspires enthusiastic overestimates of age. But if we judge by the growth on a wind-felled branch, measurements of increase in girth of the stem, and the plentiful underground water supply, an age estimate of 1,500 years is probably very optimistic, even if this is not the triplet tree it is believed to be.

Mere Size Does Not Mean Age

During a forest sampling survey in the southern Andes some years ago, I made an effort to find the oldest *Fitzroya*, locally called "alerce," a wet-forest tree very similar to our coast redwood. Some of the alerce we sampled were found to be in the 2,000-year class—a respectable age, certainly, but only about half the reputed maximum.

One is tempted to suggest a general rule: if a very large tree, anywhere in the world, grows in a flattish area and its roots tap very moist soil most of the time, then it probably does not have the age to which its size seems to entitle it.

It appears that there exist throughout the world two general categories of very old trees. One consists of the giants favored by plenty of water. In the other are battered dwarfs managing to eke out a minimum living in a very adverse environment. And the oldest dwarfs outlive the oldest giants, at least today in the American West.

Can the bristlecone pines tell us something about the causes of great longevity in trees? We do not yet know, but there are promising leads.

In an open grove of old bristlecone pines many of the trees are full of heart rot and some are only shells. But here and there is one that is almost or entirely sound, and it is older than the others. Always this sound tree is extremely resinous. Perhaps the chemistry of the resin in the oldest individuals is different from that in the average bristlecone. Or it may be merely the especially heavy concentration of resin that has enabled the tree to ward off decay.

In the oldest bristlecones, growth has been exceedingly slow almost from the very first year, in contrast to larger but younger pines, which show fairly fast growth in the early decades of life. Does this indicate anything more than the fact that the oldest pines are found only on the most difficult sites?

Would the seeds from an eroded old bristlecone pine tree germinate? Near such an old pine stood a slender but tall young tree we found to be just over a century old. Perhaps it was a descendant of the old one. We collected cones from both. Later, Professor Went processed seeds from these trees in his controlled-environment laboratory. And sturdy though tiny seedlings from the old as well as the young trees appeared (page 365).

Some of the old trees have been adding only an inch or less of rings per century throughout their long lives. There is something a little fantastic in the persistent ability of a 4,000-year-old tree to shut up shop almost everywhere throughout its stem in a very dry year, and faithfully to reawaken to add many new cells in a favorable year.

Like a brief visit of a reporter to a new country, our sampling of a thousand bristlecone pine trees is far from enough to get the whole story. And with each field trip these very rich trees have given us more questions than answers.

Maybe we cannot hope to find bristlecone pine trees very much older than those we have found already, for the days of the oldest studied are obviously numbered. But when research has been carried far enough in these Methuselah pines, perhaps their misshapen and battered stems will give us answers of great beauty.

Like Battered Derelicts on a Beach, Living Driftwood Clings to a Cliff

These two bristlecones have been neighbors more than 40 centuries. The author's corer points to the spot where earth once covered the roots of one. Erosion cut away the limestone, leaving the exposed base to die. Roots on the upper side of the slope keep the tree alive. Another face of the far pine appears on page 354; green branch testifies that sap still flows.

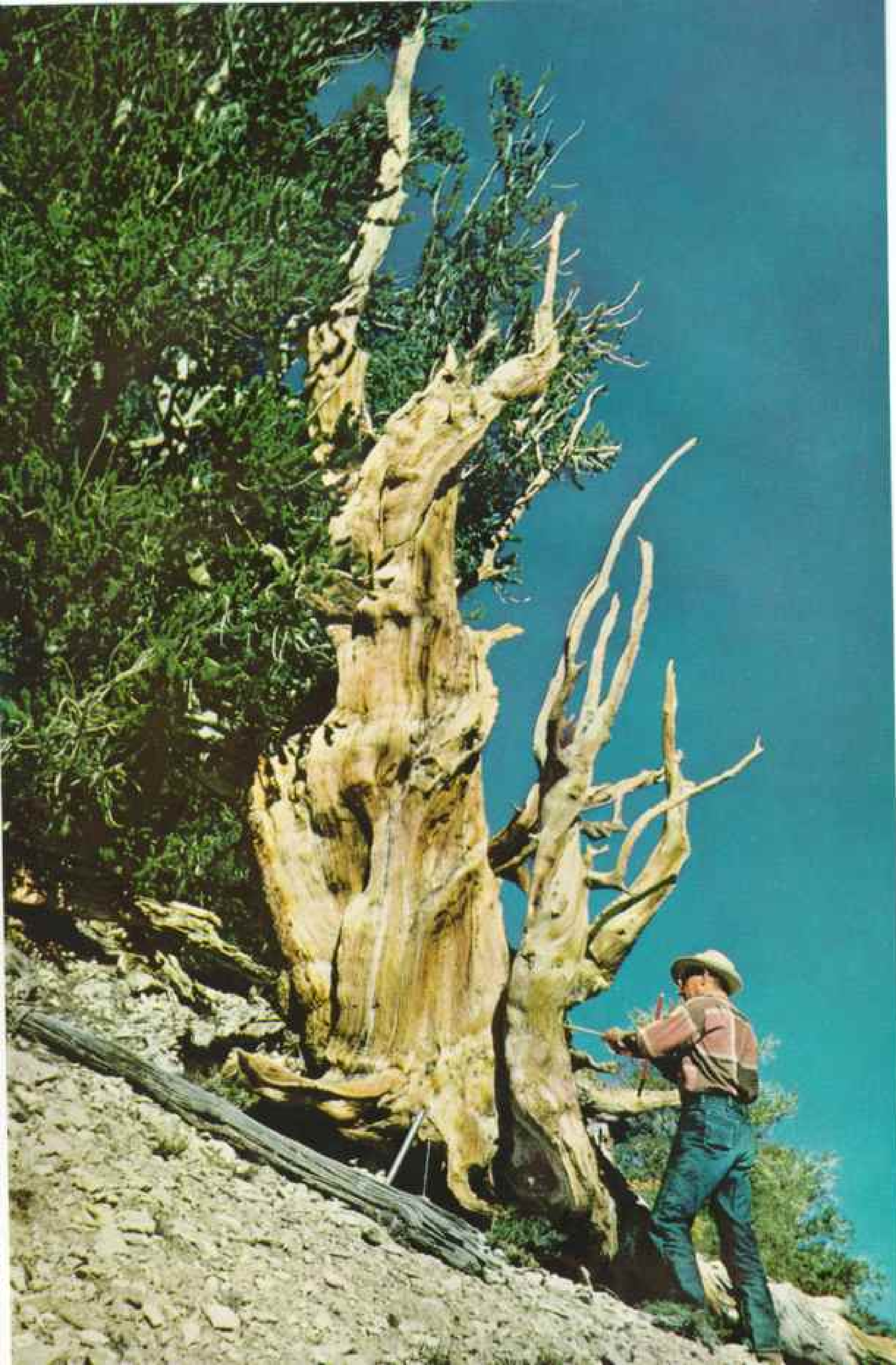
All Kodachromes by W. Robert Moore, National Geographic Staff © N.G.S.

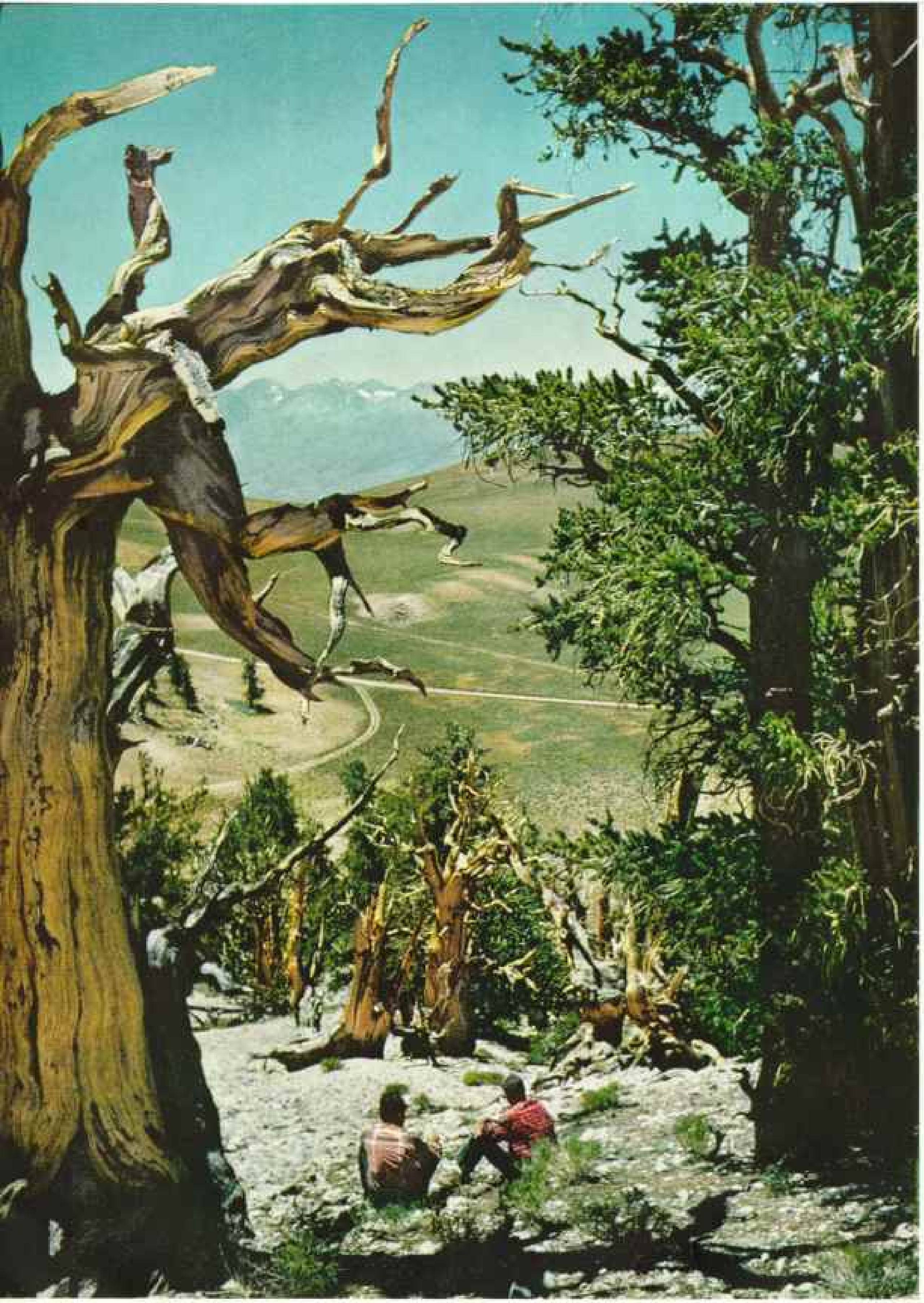
Dr. Schulman reads history with a microscope. His assistant glues and ties a pencil-slim tree core into a troughed stick. When the glue hardens, the mounted core will be shaved with a razor and swabbed with kerosene to make its rings distinct under the lens.

Swedish borer cuts an unbroken core from the heart of a tree. Crosspiece is used to twist the thread-tipped instrument into the wood. Dr. Schulman withdraws the core remover, retrieving the sample intact. Some bristlecone pines require special borers up to 40 inches long.

Pine Alpha Yields Another Core to Solve the Enigma of Its Life

This bristlecone is named for the initial letter in the Greek alphabet because it was the first certified to be older than 4,000 years. Many chapters in its story still await revelation. Its distorted growth precludes the simple sampling—a single core from bark to heart—possible with most trees. Scientists had to take cores at different angles and match rings in parts of cores that overlapped one another.





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A Ghost of the Forest Lifts Bony Fingers to the Sky. Sierra Nevada Rises in Distance

Calypso Explores an Undersea Canyon

Bobbing on 5½ Miles of Anchor Line, the Famed Research Vessel Probes the Secrets of the Atlantic's Romanche Trench

By Capt. Jacques-Yves Cousteau

Leader, National Geographic Society–*Calypso* Expeditions

With Illustrations by Staff Photographer Bates Littlehales

THREE days off Africa's Ivory Coast, the sea rough and the wind gusty, we approach our invisible target: a depression where the ice-cold floor of the mid-Atlantic plunges to 25,354 feet. Here in the fabulous Romanche Trench we mean to anchor our research ship *Calypso*, like an angler's bobbin, on a 5½-mile nylon cable no thicker than your little finger, and to explore with the camera's bleak eye depths far greater than any yet plumbed by photographic man.

But first we must find our trench.

Position Fixed with Grain of Salt

François Saoût, my executive officer, is not optimistic. Shifting his inevitable cigarette farther to one corner of his mouth, he stares from the bridge across the waste of gray water ahead of us and says:

"I trust, captain, you have brought along your rabbit's foot. The axis of this gulch of yours, it runs parallel to our course, you know. And the trench is only a few miles wide. In short, we can sail alongside it with the greatest of ease and never know it's there. Agreed?"

"Agreed."

I know well enough the risks. The French survey vessel *La Romanche* accidentally came upon the trench in 1883. Later expeditions, their astronomical navigation hampered by the Equator's belt of clouds, fixed its location with a grain of sailor's salt. And the same difficulties make us no more certain of our own precise position.

We could spend many hours tracking down the trench—and we do not have any hours to spare. Two weeks is our allotment for the whole venture, with six days of this total sacrificed to our voyage out from Abidjan in French West Africa and back (map, page 390).

I step down to the chartroom. It is only 4:30 in the morning, but my wife Simone and my son Philippe have joined *Calypso*'s officers grouped around our depth recorder. On the screen in front of them sound waves bouncing off the ocean floor are tracing a profile of the bottom as we pass over it.

I glance at the graph; we have left the monotonous 13,000-foot plain and are ascending the rugged foothills of the Mid-Atlantic Ridge. The stylus indicates a height of 9,000 feet.*

Suddenly diver-technician André Laban cries out: "Look! We're going down!"

It is true. Our ship churns on steadily and serenely through the swells of the southeast trade winds, but we have so identified ourselves with the instrument's jagged portrait of the sea bed that when the silhouette tilts downward we feel a kind of uneasy vertigo. The depth readings spell out the story unfolding in the darkness below: 15,750 feet; 16,100; 16,450 . . . .

"Is this it?" Philippe asks excitedly. "Are we entering the trench?"

Laban shakes his head, his eyes riveted on the plunging graph. "Perhaps. Too soon to tell. The odds . . . really, it would be absurdly good luck."

Sound Waves Trace Abyssal Trough

Yet our fortune holds. The readings continue to increase until we are cruising over a floor that averages 23,000 feet beneath the waves. For six hours we feel our way along this vast ravine, our eyes rarely straying from the recorder.

And then, slowly but markedly, the bottom begins to rise. The moment has come to check our position, to determine whether or not we have been splitting the backbone of the trench or traversing one of its slopes.

I shout my orders to Saoût on the bridge.

"Right rudder. Ninety degrees."

Calypso veers to starboard and, spellbound, we watch the wall of the trench soar upward sharply on the chart.

* See, in the National Geographic Magazine: "Exploring the Mid-Atlantic Ridge," September, 1948; and "New Discoveries on the Mid-Atlantic Ridge," November, 1949, both by Maurice Ewing.


CE SOIR
Grande fête
sur la fosse de la
ROMANCHE

Calypso Celebrates the Deepest Anchorage Ever Achieved

On July 29, 1956, the French research vessel dropped anchor in the 25,000-foot-deep Romanche Trench, which straddles the Equator in mid-Atlantic. This extraordinary feat exceeded by more than a mile all previous deepwater anchorages. *Calypso*'s cruise was conducted under the auspices of the National Geographic Society, the French Ministry of National Education, and the National Museum of Natural History in Paris.

Crew members gather around a sign announcing the victory celebration. Capt. Jacques-Yves Cousteau (in white shirt, left) poses with his wife Simone and son Philippe. Dr. Harold E. Edgerton, Professor of Electrical Measurements at the Massachusetts Institute of Technology and designer of *Calypso*'s deep-sea cameras, stands at far right.

Captain Cousteau (opposite, lower) uses a headset and ship's depth recorder to chart the floor of the Romanche Trench.

Plaster scale model of the trench, its depth exaggerated, takes shape on board *Calypso*.

Kodachromes by National Geographic Photographer Bates Littlehales (above and right), Philippe Cousteau (below), and Harold E. Edgerton

"Full turn," I tell Saoût. "Let's locate the other bank."

The ship circles and churns back along its track. The bottom recedes again, then climbs in swift, precipitous steps. No doubt about it, in making this cross section of the trench we can see that we have been in the middle of it all along, from the point at which we entered its eastern opening to this western terminus, 70 miles away.

So far, so good. We have found our trench; the next problem is to anchor in it.

Only a sailor can appreciate the lunacy of what we have proposed. In all the world's maritime history, no skipper has ever seriously suggested dropping his hook into nearly five miles of water.

True, the German research ship *Meteor* put down a steel cable to 18,000 feet, and during the previous summer we anchored our launch off the coast of Greece at a depth of 14,000 feet, to the consternation of local fishermen.* But no one has ever tried to tether a 360-ton vessel at depths like these on a mere nylon thread.

Weightless Rope Poses a Problem

Anxious to confront at once some of the curious difficulties that would face us, I had arranged for a dry run at 6,000 feet on our way out to the trench from Abidjan (page 380). It turned out to be, to say the least, educational.

If you wish to make the flukes of your anchor dig into the sea floor and hold, it's clear that you must drag them with lateral force across the bottom until they catch. In modern times this lateral force has always been assured by the sheer weight of the anchor chain. Payed out in a long curve, the heavy chain holds down the anchor's stock and aligns the flukes so that they can get a firm grip on the bottom.

But it is quite impractical for us to use a heavy anchor chain or cable. You can imagine how thick and cumbersome such a line would have to be at its base simply to support its own 5½ miles of ponderous length. Instead, we are experimenting with a ⅜-inch nylon rope of great tensile strength. Its specific gravity approximates that of the sea water in which it is immersed, which means that for practical purposes it is weightless once it goes under.

Thus our line itself will exercise no horizontal force on the anchor. On the contrary, it will leave the anchor standing right on its head, and the ship's drift will merely pull it straight up and free of the bottom.

When I first thought of this hazard, my mind turned back to the ancient anchor stock we had salvaged from the 2,200-year-old wreck of a Greek argosy off Grand Congloué.† The seamen of old had met this same quandary; their anchor lines were mere hemp, about as weightless as ours.

Ancient Anchor Provides the Answer

What had they done? They had made their anchor flukes of wood and their stocks of lead. Result: the massive crossbar, or stock, dragged along the bottom, forcing the lighter flukes to remain cocked on edge, poised to gouge into the sea bed or crook around any obstacle.

We must, I decided, humbly follow this ancient precedent. We cannot use wooden flukes, but why not attach about 100 feet of heavy, old-fashioned chain just above the 200-pound anchor, then a 350-pound lump of pig iron, and then another 100 feet of strong steel cable? This shouldn't put too great a strain on our winches, but it should add force to the stock's lateral pull.

A good theory. But when we put it into practice, we let down the line too fast, the anchor dropped more slowly than the pig iron, twirled itself about the chain, and got altogether fouled up. Then, when we had payed out more than enough line to reach the bottom, *Calypso* steamed slowly ahead to draw the rope taut and exert a diagonal drag on the anchor.

Water Resistance Defeats *Calypso*

We had not appreciated how great is the nylon's resistance to being pulled through the sea. The line, bellied out and pressing against the water, acted as if it were looped about a pulley. *Calypso*'s horizontal hauling was simply converted into an upward thrust, the anchor swung clear, and we were adrift again.

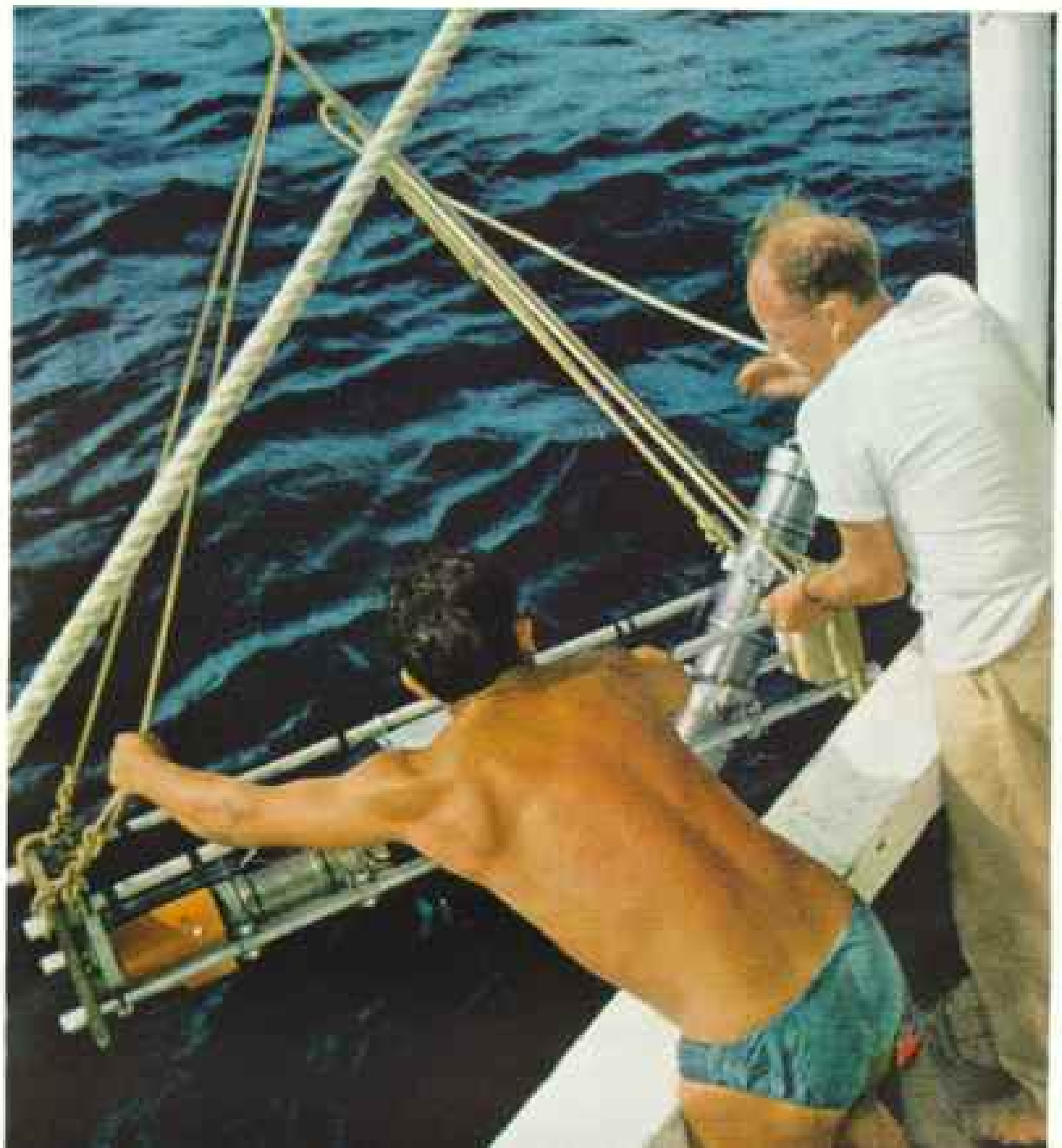
Now, poised over the trench itself, we are forewarned against such mistakes. Dr. Harold E. Edgerton, our electronics wizard from the

* See, in the National Geographic Magazine: "Exploring Davy Jones's Locker with *Calypso*," by Capt. Jacques-Yves Cousteau; and "Camera Under the Sea," by Luis Marden, both February, 1956.

† See "Fish Men Discover a 2,200-year-old Greek Ship," by Capt. Jacques-Yves Cousteau, National Geographic Magazine, January, 1954.

Ship's Launch Serves as a Radar Buoy

Once astride the Romanche Trench, *Calypso* had only 24 hours to "sketch" the 70-mile-long crevasse with sonar. To obtain a fixed point for navigational reference, the ship transferred its nylon anchor line to the launch. A metal target screen atop the boat could be "seen" by radar 8 miles away.



To photograph the 4½-mile deep, Dr. Edgerton designed an automatic camera in a steel-tube housing capable of withstanding pressures of 8½ tons per square inch. Here, assisted by diver Albert Falco, he lowers the camera (right). The horizontal canister holds lighting equipment.

National Geographic Photographer Bates Littlehales © N.G.S.

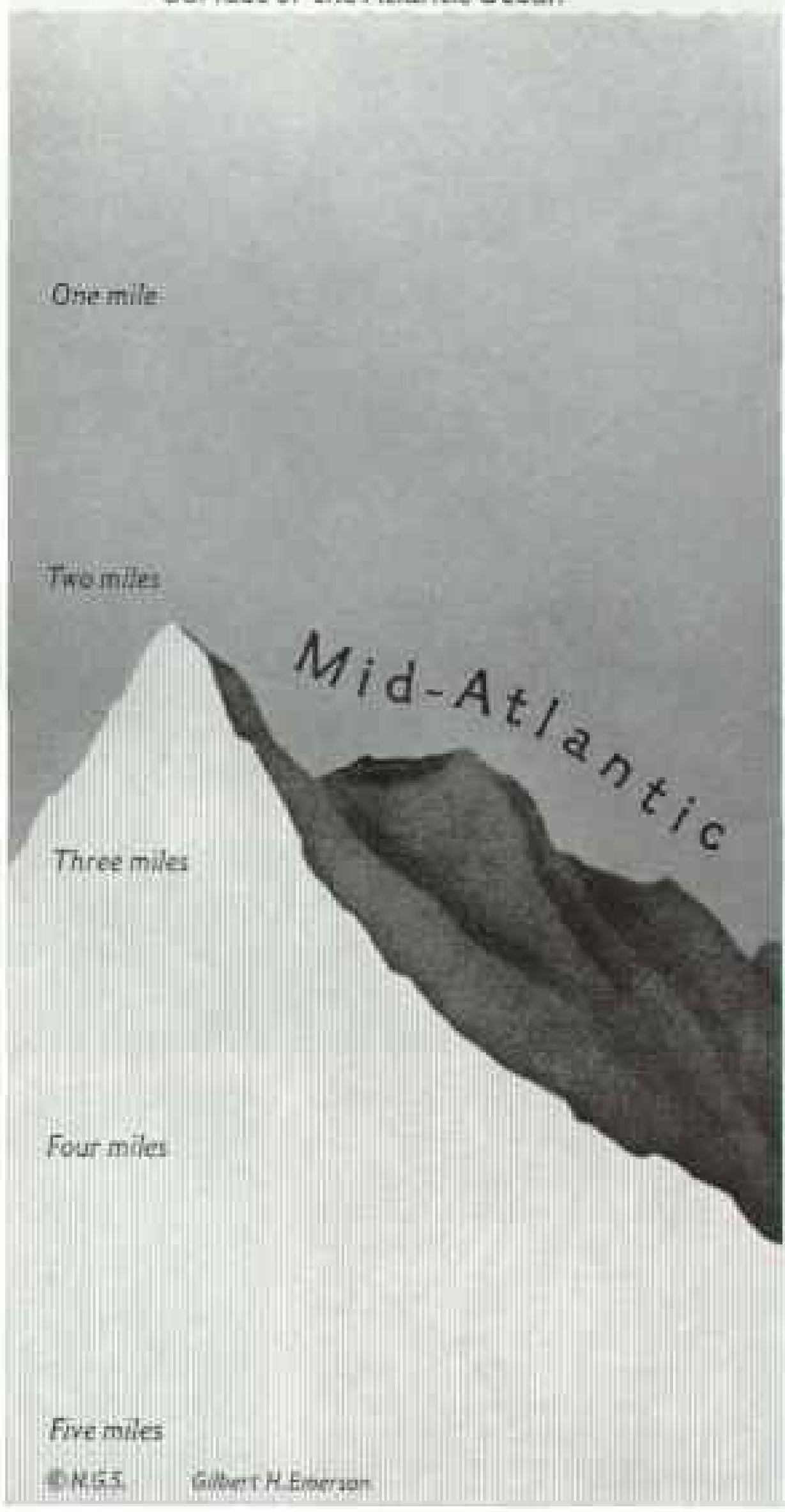
Calypso Scans the Romanche Trench with the Help of Sonar and Radar

The research ship's brilliant achievement, anchoring at 24,000 feet in the Romanche Trench and exploring the bottom, is shown in this cross-section diagram.

Calypso (right) drops anchor in the trench, lowers the Edgerton deep-sea camera, and photographs the ocean floor (pages 382 and 389). Current bows the dangling camera line but draws the anchor line taut.

Raising the camera, the ship transfers its anchor line to the launch (arrow) and proceeds to explore the depths with sonar, whose waves bounce off the bottom and return to the ship's listening devices (center). Computers, translating the speed of return into fathoms, give the depth more accurately than the nylon line.

Radar sightings on the launch, a fixed navigational reference, establish the ship's position.



Massachusetts Institute of Technology who dreamed up this idea of a weightless cable, stands by the drum with me to keep an eye on the lowering of the anchor.

We are using a two-stage winch system—one 30-horsepower winch to haul the line up, absorbing its tension, and a smaller one to pick up the slackened rope from the first drum and wind it around a second. If we were rashly to reel in the nylon cable directly and coil it under tension upon a single drum, each taut layer would apply such inward pressure to the layer beneath it that our drum might collapse.

Color Changes Every 1,600 Feet

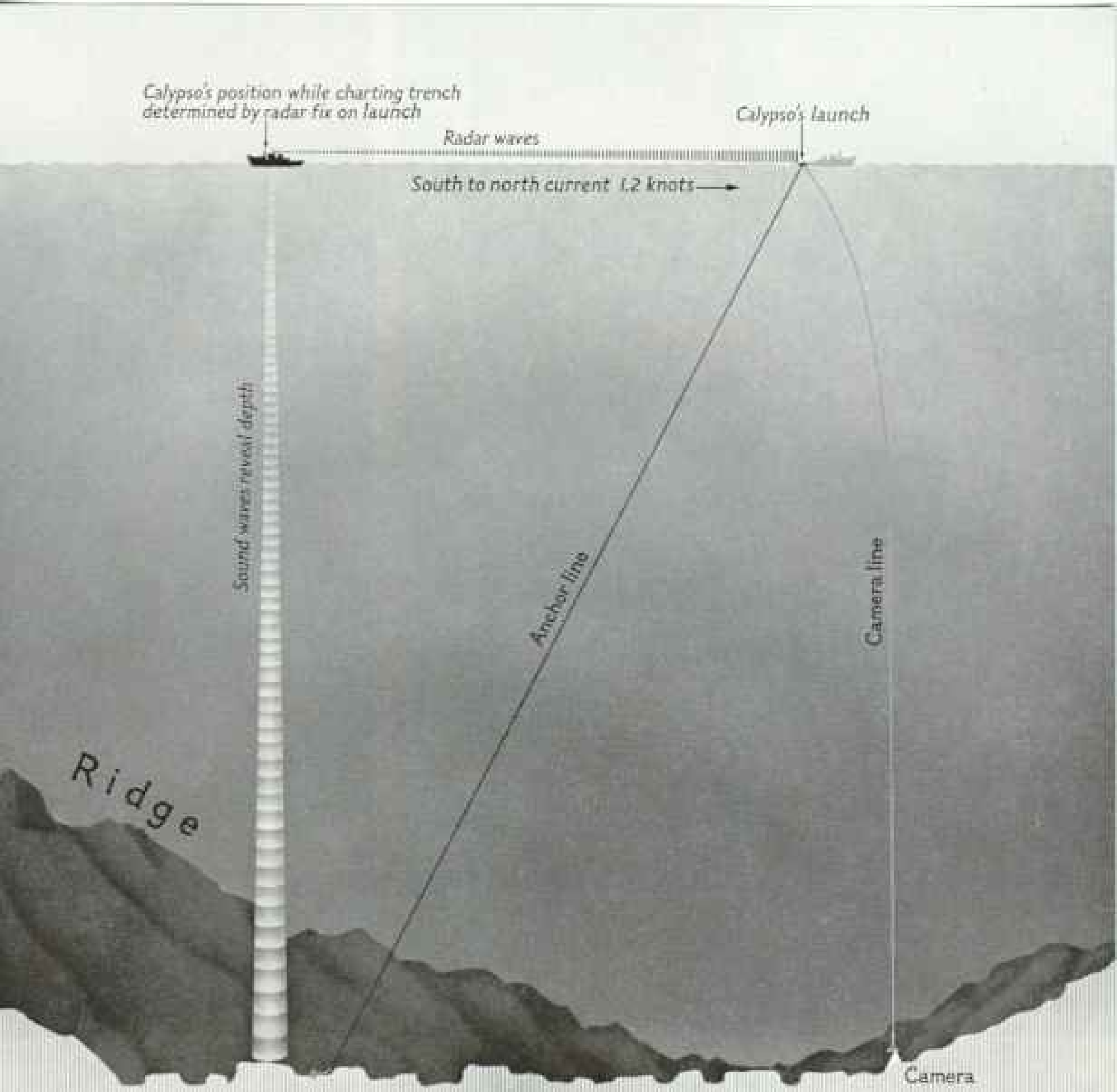
Keeping *Calypso*'s stern in the wind, I take my post on the afterdeck, transmitting my orders to the bridge by the intercom and receiving periodic readings of the echo sounder. From the drum, built to our specifications in Abidjan by native ironsmiths, the nylon cable runs out to a crane and block. The anchor, the chain, the pig iron, and the steel cable go over the side. Cautiously we begin to lower them.

The glistening nylon, developed by the Samson Cordage Works of Boston, wears a different hue every 1,600 feet; it's easier this way to keep track of how much we have payed out. Octave Léandri, at the brake, handles his machine with the sensitive touch of a fisherman playing a belligerent salmon on a lightweight trout line.

As fathom upon nylon fathom slips soundlessly into the deep, however, the braking job becomes easier and easier. After some two miles of rope has spun out, the pig iron and anchor are having a tough time just pulling the line through the water.

With *Calypso* frisking restlessly about in the grip of a strong current and a 15-knot wind, we maneuver with the help of both engines to keep the cable descending in a clean vertical line. Then, after it has fallen steadily for two hours and a half, we sense that the anchor has hit bottom.

The relaxation in tension is noticeable at once. We start the long, reluctant task of paying out more line, fathom after fathom, to secure the proper angle to impale the anchor



flukes. It takes us an exhausting four hours.

Then I have to make a difficult guess. With such a wind and such a current, what pull will *Calypso* exert on the line? There are no tables to which one can refer; I must draw simply on the experience of my years at sea.

In order to get our anchor at a sufficient diagonal to hold, we must pay out as much line as possible, but we must keep 500 feet on the drum as a reserve; then there is 29,500 feet out, which with eight percent stretch means a practical length of 31,860 feet.

"Stop the engines!" I tell Saoût.

The subdued pulse of *Calypso*'s mechanical heart ceases to beat. In the sudden hush we hear the waves slapping against the ship's wooden flanks. The sea seems to be flowing past us like a river. Anxiously we check the graph on our depth recorder; any change will betray a drift.

The needle remains steady at 24,600 feet. Undeniably, if implausibly, we are now at anchor in 4½ miles of water—the deepest anchorage ever achieved by seafaring man.

Merry Crew Spears Squid at Night

The crew is jubilant. On the afterdeck we stage an impromptu celebration, with songs, toasts, and mock-heroic speeches (page 374). Bates Littlehales, our National Geographic

Thin Strand of Nylon Connects *Calypso* with the Bottom

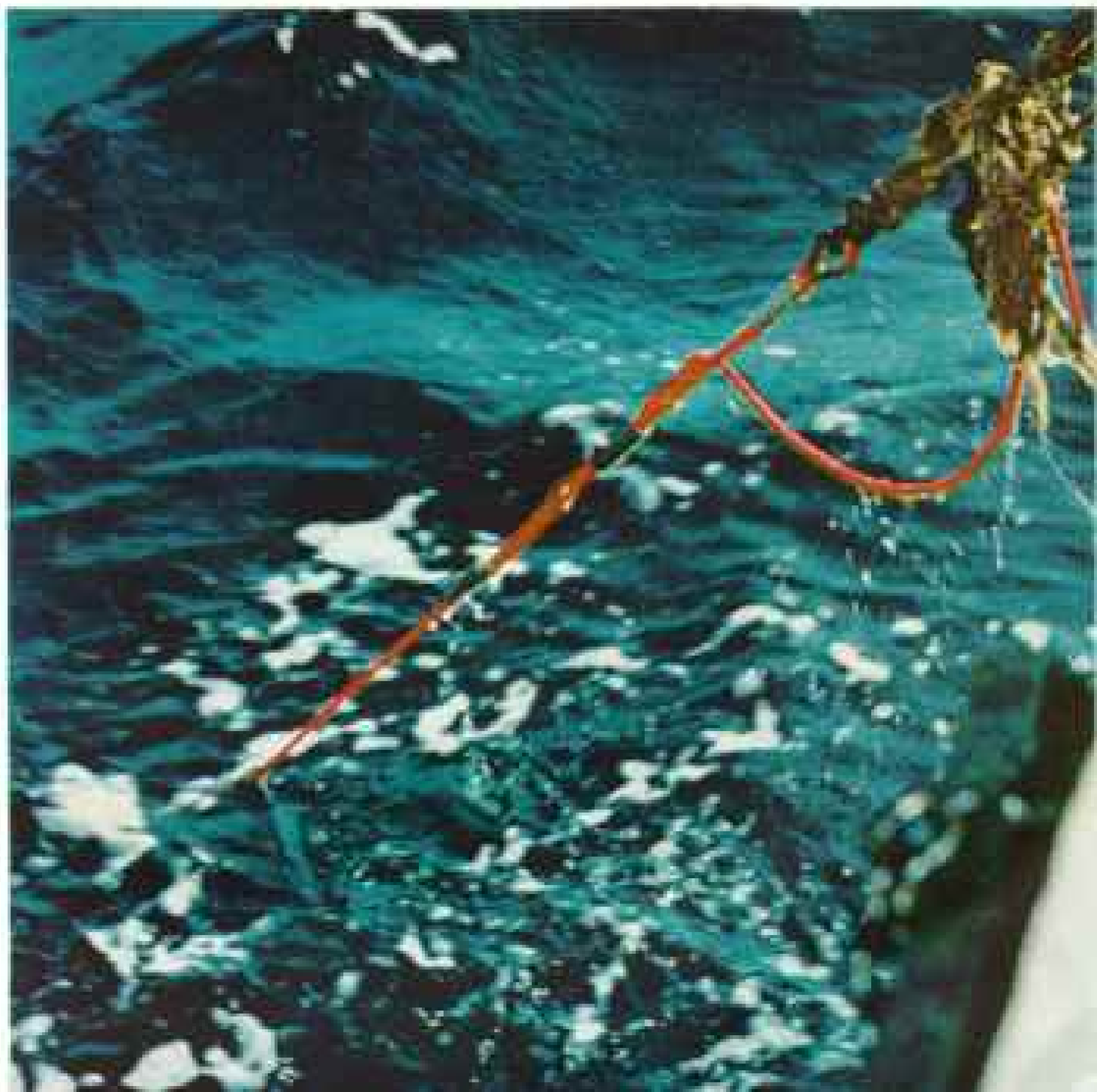
For its 5½-mile-long anchor line, *Calypso* used specially developed ⅜-inch-thick braided nylon in place of cumbersome steel cable or chain. The nylon's specific gravity, about that of water, made the immersed line almost weightless.

Opposite, above: Dr. Edgerton watches the line, variously colored to indicate lengths, as it reels from the drum in a trial anchoring en route to the trench. Second drum holds line for the deepwater camera.

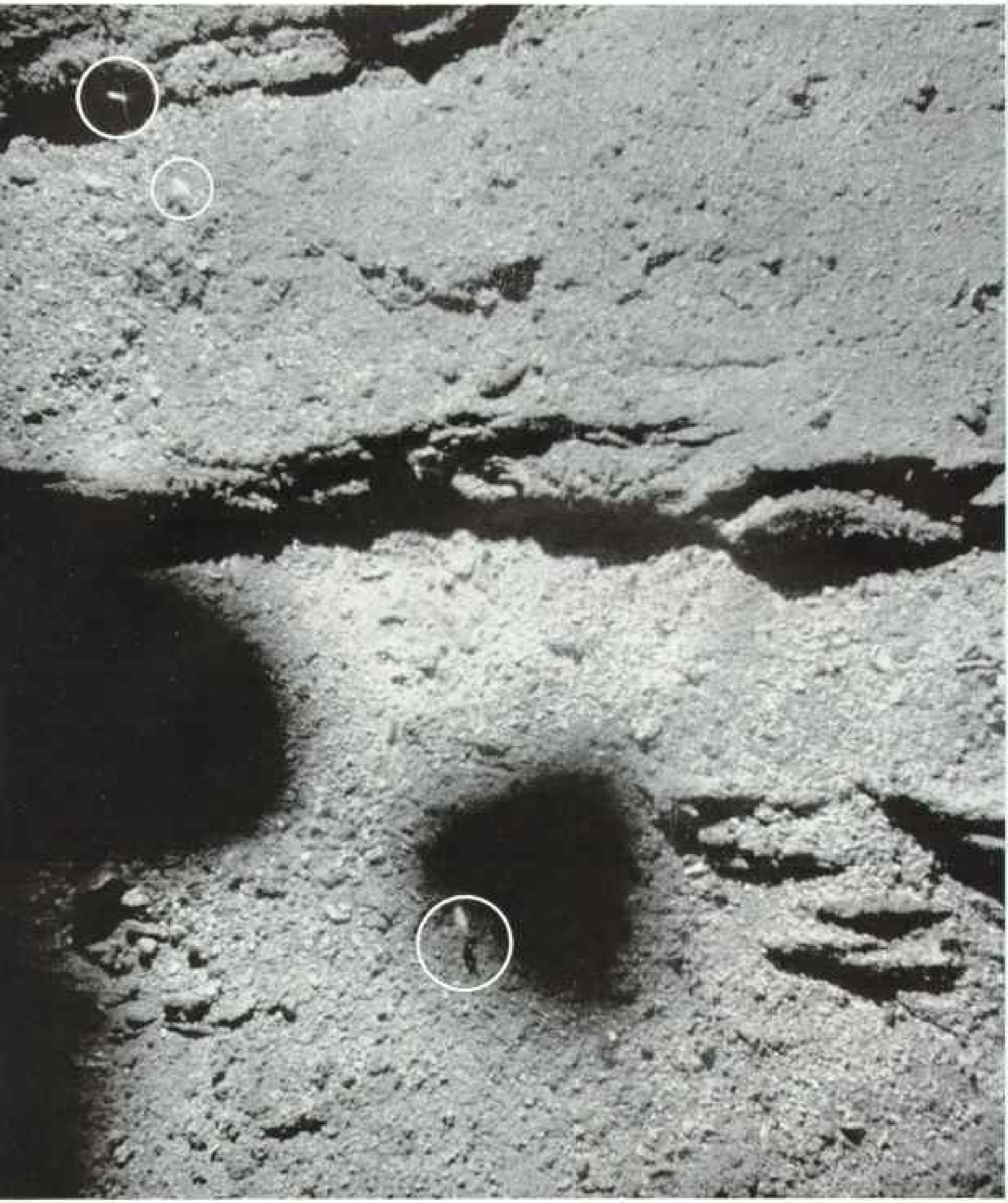
Opposite: Crewmen make fast the line, leaving a scant 500 feet on the drum.

Above: Captain Cousteau directs line handlers during actual anchoring in the trench. Men take in slack after the anchor has touched bottom at a depth of 24,600 feet.

Right: Secured by a shackle, the nylon holds *Calypso* against a 1.2-knot current and a 15-knot wind.



National Geographic Photographer Bates Littlehales (above) and Harold E. Edgerton © N.G.S.



Edgerton Camera Unlocks the Secrets of Life 24,600 Feet Deep in the Sea

This remarkable photograph, man's deepest view of the ocean, shows the floor of the Romanche Trench. The electronic flash reveals about nine square feet seemingly terraced by submarine landslides or water currents. Thick ooze covers much of the ocean bottom at lesser depths; scientists were surprised by the fresh appearance of these irregularities, suggesting erosion. Several whitish organisms (circled) appear, verifying that life exists even in the deepest abysses. The animal at upper left seems to have filamentlike legs or feelers. Mud clots on the camera window cause the dark blotches.

Harold E. Edgerton

Cracked lens guard demonstrates the crushing weight of water at a depth of 4½ miles. The 1½-inch-thick glass plate withstood a test immersion to 14,000 feet, but cracked in the starlike pattern when it was sent deeper to photograph the floor of the trench. Fortunately, no water seeped in to damage the camera, which Dr. Edgerton designed and built with aid from the National Geographic Society.

staff photographer, gets out the guitar he bought at Douala, and several of our divers emerge with African "zithers" and drums (page 394). Bates's efforts to translate American cowboyese into French are greeted with enthusiasm, even if "Un Chant de la Plaine" has a slightly different flavor from "Home on the Range."

Exhausted, I retire to my cabin. But not for a night of unbroken slumber. Again and again merry cries from the deck bring me to consciousness; the boys are spearing squid by the light of dim lanterns hung about the ship. The squid, jet-propelled and surprisingly agile, have surfaced to catch flying fish.

Philippe Gaffs a Four-foot Squid

My son Philippe is very proud; he has skewered the biggest squid of the lot—a slack creature four feet long (page 396). For several days the crew dines with delight on this marine delicacy. I try a little, too, but reluctantly. For me, a strip of rubber hose would be as palatable.

In the morning, though wind and current have been nudging *Calypso* insistently, the ship is still firmly anchored. We relax a little and begin gradually to appreciate in our new leisure all that it means to be moored in mid-

"Papa Flash" Gives Ashanti Tribesmen a Camera Lecture

Dr. Edgerton, a veteran of several *Calypso* expeditions, earned the shipboard name for his photographic skill. When the vessel called at Abidjan, Ivory Coast, he and the crew entertained these fishermen.

Shipmates get acquainted. Bulle, the Cousteaus' dachshund, nuzzles Douala, a mona monkey named for the Cameroons port where diver Jean Delmas bought her. The monkey, whose fierce attachment to Delmas became a shipboard joke, sulks on her master's shoulder.

National Geographic Photographer Bates Littlehales (above) and Harold E. Edgerton © N. G. S.

Atlantic, the sole stationary point in a watery world of flux.

We stare over the side in fascination at the swirling current. Dropping corks over the stern, weighted with bits of lead to keep them just below the surface, we clock them as they drift past the bow. Surprisingly, the current runs south to north at an average velocity of 1.2 knots; its force added to that of the southeast trades is formidable.

A rich oceanic life is borne along on this tide. Nudibranchs in brilliant blue hues propel themselves majestically, like tiny Chinese dragons (page 392). Medusae, all manner of planktonic animals, and fish of the open sea pass by on parade before the delighted eyes of our ship's biologist. It is a rare opportunity for all, the kind of chance that usually comes only to unhurried adventurers like the raftsmen of Kon-Tiki.

Pressure: 5½ Tons to the Inch

But we have work to do. Our next task is to see if we can photograph the floor of our trench.

Edgerton, known to *Calypso*'s company for several summers as "Papa Flash," has brought with him a camera newly housed in a tempered stainless-steel casing that will withstand the horrendous pressures of the trench—a good 5½ tons to the square inch. To insulate the delicate instrument against the shocks of travel, he has wadded its crate with two dozen M.I.T. student caps of bright magenta. Distributed among the crew members, they give a curiously jaunty air to our bronzed and bearded divers.

We have no other two-capstan system available for lowering the camera, but since the weight and tension on its thinner nylon rope will be much less than that on the anchor line, we are not perturbed. Into the brine go the camera, its powerful electronic flash, and the transducer mounted above it which will signal the approach of the bottom and allow us to focus it nine feet from the sea floor (page 377).*

The camera itself has been set for a two-hour delay. When this period of lowering has elapsed, it will begin automatically to take four exposures every minute. We listen to the regular tick-tick of the transducer, picked up by our underwater listening devices.

When the camera has reached a mere 15,000 feet the transducer's signal suddenly weakens. We hold a quick huddle.

"Harold! Now we're blind! What should we do?" I ask. "Haul the camera up?"

Harold scratches his chin, doing some mental arithmetic. "No. If we bring it up, check it, and send it down again, it'll cost us about seven hours. We'll have to gamble. Keep the winch rolling."

Silent, the camera resumes its descent into sunless space. Half an hour later the rope slackens; contact has been made with the sea floor.

Porthole Cracked by Deep Sea's Grip

Then for three hours we patiently bounce the camera up and down, hoping against hope that some of the 800 exposures will occur at the right height and moment. All we know is that somewhere in the void 24,600 feet below, Harold's electronic gear is presumably exploding flashes of light every quarter minute into depths dark since time began.

By evening the camera is once more on deck.

"Great guns," exclaims Harold. "Look at the porthole!"

A star-shaped crack scores the thick glass pane protecting the camera's lens (page 383). Quickly Harold takes the instrument apart and checks it for leaks.

"Dry as a bone," he says with a sigh of relief. "And isn't the pattern of the break beautiful! Here, Jacques, you keep the pane. It will make a wonderful paperweight."

But a question remains. Did the glass break before or after the camera started shooting? We must contain our impatience. The developing of film, like the scrutiny of scholars, cannot be rushed.

Pictures Elicit Reckless Praise

It turns out that we have indeed been lucky; our bag is two clear pictures. We have bettered by more than half a mile the previous record for deepwater photography.

Though in artistic composition the pictures may lack much, scientific friends take a sharp interest. In time they begin to pass unpublished prints around, biologist to oceanographer to geologist—and from Copenhagen to San Diego.

Soon these select and cautious men are choosing carefully husbanded words to describe the pictures. Expressions range from a restrained "remarkable" through "so un-

* See "Photographing the Sea's Dark Underworld," by Harold E. Edgerton, National Geographic Magazine, April, 1955.

Palm Tree and Anchor Hold *Calypso* Fast off São Tomé

To explore the specimen-rich waters near this Portuguese island in the Gulf of Guinea, the ship moored off the beach and ran a stern line ashore. *Calypso*, flying the Tricolor of France, rides beside slopes thatched with coconut palms. Divers worked from a ladder at the stern.

Naturalist Maurice Denizot probes for specimens among corals dredged from the bottom. Bushlike formations are gorgonians, relatives of reef coral. Red-orange *Tubastrea* corals lose brilliance out of water when pigments oxidize.

Brilliant wrasses and snappers (opposite, lower) form a carousel around a gorgonian 80 feet below the surface. Another wormlike gorgonian lies in foreground. Red animals on the bottom are spiny oysters, *Spondylus*.

School of surmullets browses above banks of coral and sponge 65 feet down.

National Geographic Photographer Bates Littlehales (top) and André Laban (bottom) © N.G.S.

Harold E. Edgerton

Photographs of the Romanche Trench Pass Under the Magnifying Glass

The Edgerton photographs, studied by outstanding oceanographers and biologists, have given priceless information on the topography and life of the sea's lower regions. Here they are examined by Dr. Henry B. Bigelow, Professor Emeritus of Zoology at Harvard University and former Director of the Woods Hole Oceanographic Institution. Dr. Edgerton stands by.

usually interesting" . . . then warm to a reckless "extremely great importance" and even an awed "we are amazed."

What elicits such comment? The first picture reveals an ocean bottom of granular texture. Here we see pebbles worn smooth by the emery of time; but here, too, are angular fragments of rock—chips and chunks, perhaps of basalt with corners still sharp, guesses one geologist. They and the finer material remind another scientist of debris found in gullies of the Rocky Mountains. Irregular cracks strike across this bit of ocean floor, rocky layering, ledges visible even to minute fissures (page 382).

The slight blur—here—was it caused by the jarring of the camera upon the rock-strewn bottom? And why are these outcroppings not covered by the thick sedimentation so often found at the bottom of the sea? Photographs gain added importance from features they do not record.

Is the ocean floor scoured clean by currents? Most improbable at this depth. After all, we see no ripple marks. Possibly undersea landslides account for the terraces. Or could it be solifluction, a slow, downward creeping of wet soil, common on land in arctic regions but rarely attributed to submarine earth?

Life Abundant 4½ Miles Down

Our evidence and speculation lead us further. Is the trench geologically new? Perhaps. This small patch of bottom, illumined by a strobe's fleet flash for but a moment in all history, poses a riddle on the flux of continents and seas.

The scientist squints and runs his finger across the glossy surface of a print. A whitish speck swimming just above the sea bed; unfortunately, quite impossible to identify. Here are others—four in all!

If these white creatures are dubious, possibly their shadows can tell us more. The shaded silhouette suggests the outline of a crustacean; we are not certain, for those very lines could be coincidental cracks in the rocky background.

But we are veering from the obvious and astonishing fact: that in these crushing deeps there is abundant life—that in waters once considered barely habitable and all but foodless, weighting each square inch with 5½ tons, Mother Sea yet harbors some of her varied offspring.

The second photograph (below) catches quite clearly the portrait of a brittle star. Among rocks of varying shade (are some of them manganese nodules?) it nestles, phlegmatic, untwinkling, but the first sea star ever to be photographed at anything like this depth. Its asterisk shape seems apt; our brittle star is a living footnote on the existence of life everywhere in the sea that the camera has been able to peer.

Bad Luck Plagues Second Try

We turn our attention to the sonic transducer. It is apparent that pressure has knocked out its transformer. Harold replaces it, and we ready ourselves for a new photographic assault the next morning.

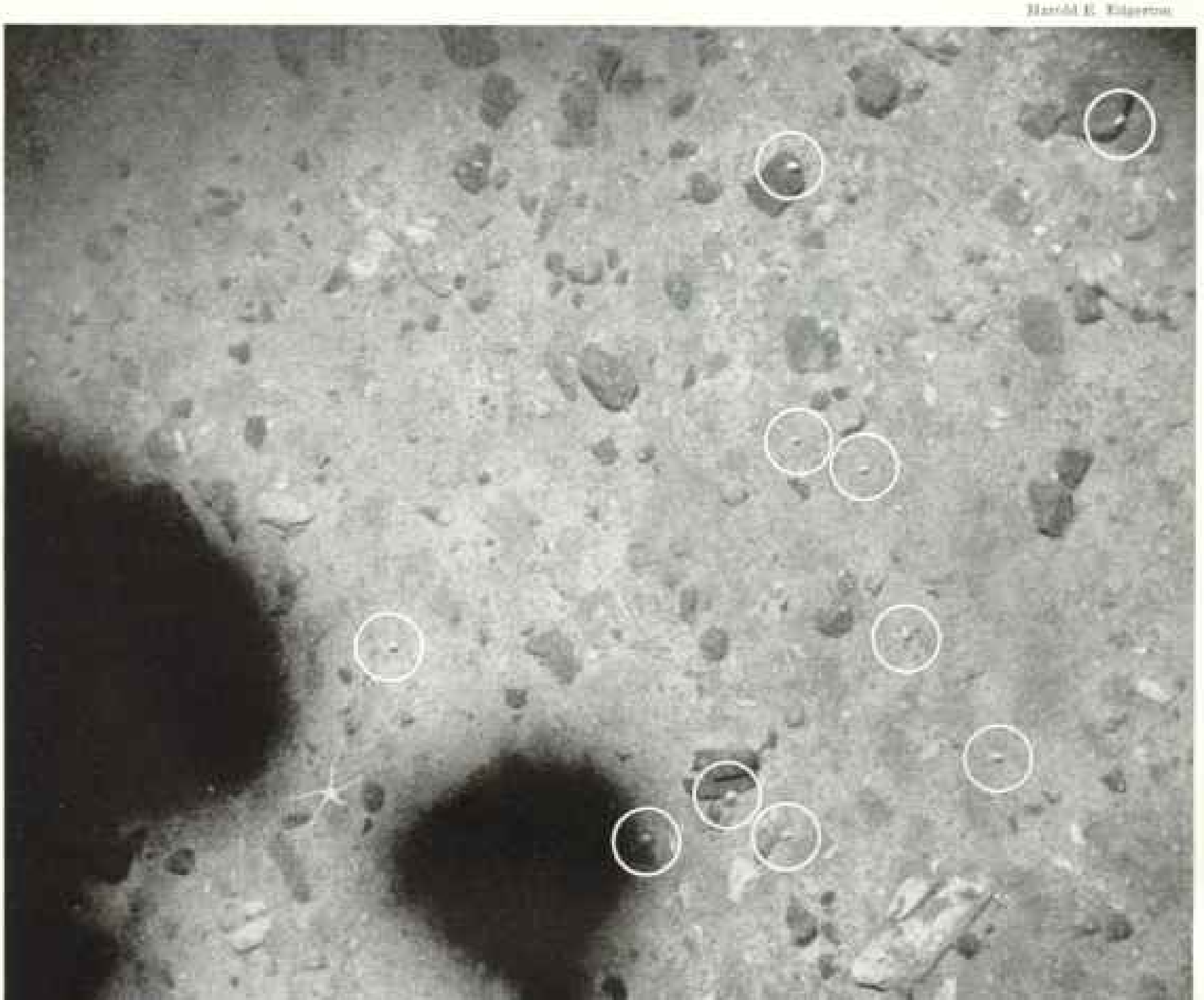
Our luck is going sour. The substitute transformer blows just like its predecessor, and an error of computation by one of our seamen makes us stop the camera cable at too early a stage.

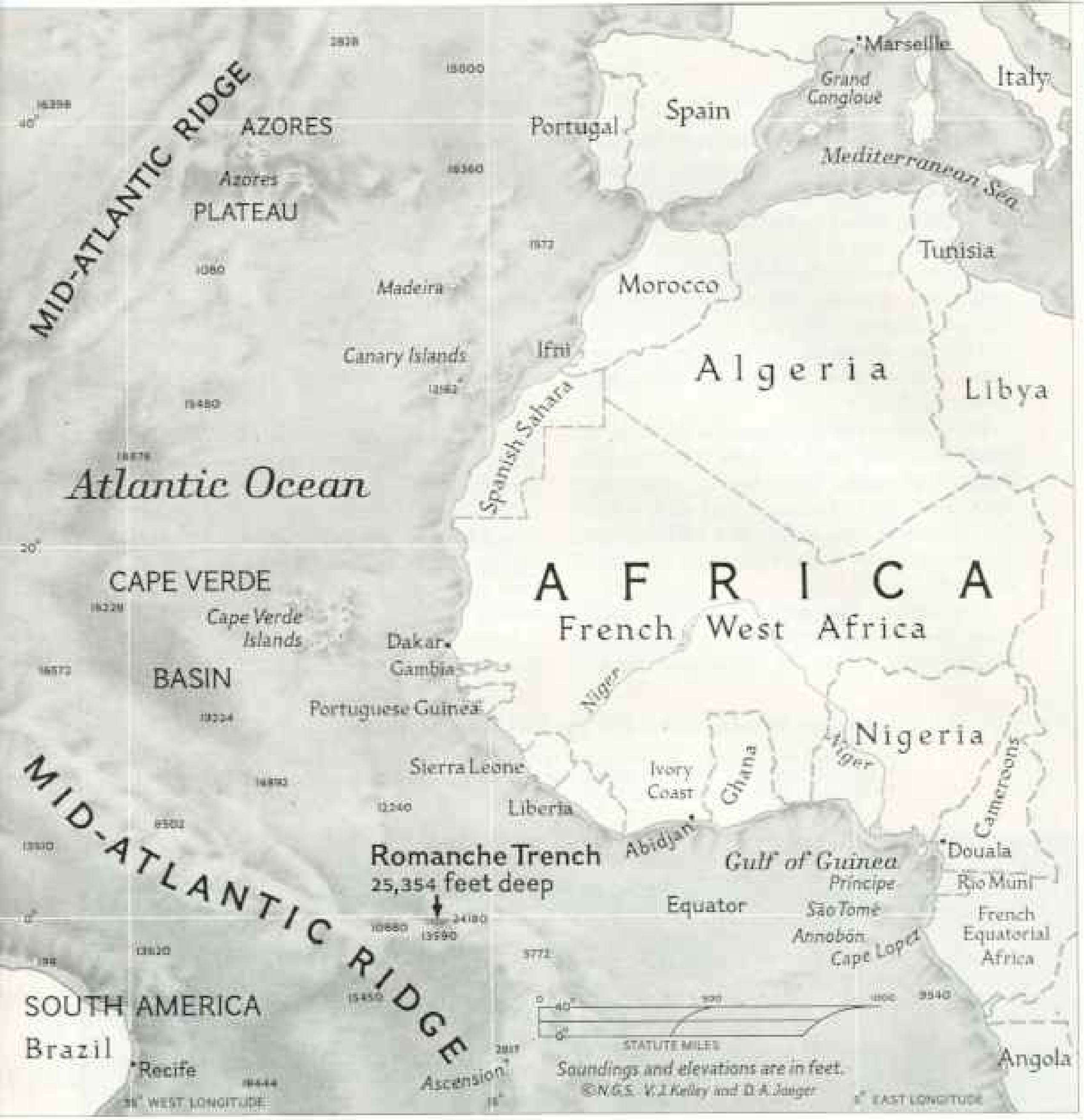
Saoût notes that the nylon left on the drum is of a different color. Has the camera really

Angular Pebbles Litter the Trench's Ice-cold Floor

A brittle star appears between two mud blots at lower left. Small unidentified animals (circled), showing white under the electronic flash, cast shadows on the bottom. Living organisms have never before been photographed at such a depth (24,600 feet).

Harold E. Edgerton





For 70 Miles the Romanche Trench Gashes the Floor of the Atlantic

This deep crevasse lies off the Mid-Atlantic Ridge, a submerged mountain range mapped in 1947-8 by the Woods Hole Oceanographic Institution and the National Geographic Society.

reached the bottom? We have no choice but to let it begin clicking off pictures and hope for the best.

Camera Records Planktonic Life

Fortunately, though the developed film reveals no amazing sea monsters, it does give us a unique photographic record of the planktonic life suspended about 600 feet above the bottom. Marine biologists in France are still analyzing this series of prints, fascinated by the relative richness of living creatures in this Stygian underworld.

Calypso has already been host in the spring to a distinguished team of French scientists. Led by Dr. Jacques Forest of the National Museum of Natural History in Paris, these biologists and botanists, oceanographers and entomologists have come aboard in early May with their trawls and seines and thermometers and, for two months, have converted our ship into a seagoing laboratory.

Their main theater of operations has been the Gulf of Guinea—a quadrangle astride the Equator formed by the Niger Delta, the port of Douala, Cape Lopez, and the island of Annobón. It is a part of the Atlantic known only sketchily to science.

Dr. Forest deploys his forces on three fronts. Land parties, armed with nets and bottles, jounce in jeeps through the virgin forests and cacao groves of Principe (page 395) and trudge the volcanic uplands and coastal fringes of São Tomé.

The oceanographers busy themselves taking scores of bathythermograph readings, collecting some 600 samples of sea water, and releasing more than 3,000 *cartes de courant*—plastic-encased cards with a return address —which, like floating bottles, can be used to reveal the sea's drift.

Specimens Litter *Calypso*'s Deck

Meanwhile the marine biologists fish the waters beneath *Calypso*'s keel; the deck is littered with dripping piles of their glistening treasure-trove.

It is arduous work, seven days a week. But not such a bad life. The scientific trawls provide the cook with excellent shrimps; Aqua-Lungers bring up plenty of fish. The island of Annobón furnishes goats—one of which jumps overboard and has to be chased by *Calypso* herself.

"Two months is a short time, really," reports Forest. "But we are able to make a very important collection. Very rich." The hydrologists are happy; they have made observations of the thermal interchange of the waters in the Gulf of Guinea, and the biologists have acquired what is almost an embarrassment of riches—150 species of fish, 140 species of sea worms (including nearly all known west African forms), more than 200 species of crustaceans, plus sponges, gorgonians, mollusks, corals, algae, starfish, and sea urchins galore (pages 386 and 393).

Launch Serves as Radar Target

It may take these scientists as long as three years to evaluate the results of their work. Fortunately, we ourselves do not need to wait that long to perform and evaluate our researches at sea. Our next and immediate task is to explore the trench with our depth recorder. It may not be an easy task, but at least we will know very soon the degree of our success.

The first step is to moor *Calypso*'s specially equipped launch for use as a radar target (page 377). In gingerly fashion Snoût and his men pass the anchor line out to it from our ship and secure it. The little aluminum craft bobs up and down in the swell quite debonairly; to us mariners there is something a trifle eerie in the sight of such a tiny vessel tethered in the open sea to a floor 4,100 fathoms deep.

With our engines at quarter-speed we cruise back and forth along the Romanche, confident in having the launch as a stable reference point. Hours of painstaking astronomical observation have established its exact position: 0° 10′ S, 18° 21′ W.

The stylus of our depth recorder traces a continuous outline of the buried gorge. In cross section it appears as a blunted V. The northern flank rises at an angle of about 25°; the southern, climbing at more than 30°, soars to within 8,500 feet of the surface. The floor, two to five miles wide, appears corrugated with giant steps some 300 to 600 feet high (diagram, page 378).

Our deepest reading matches almost exactly the maximum figure recorded here in 1948 by the Swedish oceanographic vessel *Albatross* —25,354 feet.

This is all very specific, but scientists still scratch their heads and wonder, for the trench, they say, really shouldn't be there at all. The rest of the world's great deeps invariably occur near continental coasts or strings of islands; the same titanic pressures that pushed the land up pushed the deeps down. However, the Romanche lies in a belt of seismic activity. Perhaps it is related to the upthrust of the Mid-Atlantic Ridge.

Shocking News Interrupts Research

For 24 hours *Calypso* rolls and pitches down the length and breadth of the trench. On deck many of our crew busy themselves with their hobbies; a passion for mechanical gadgets has swept the ship. But, in the control room, Edgerton and I work furiously, living in a blizzard of charts and depth data, while Laban and Christian Carpine are busy molding a plaster model of the trench as fast as we get the data from the sounder, under the angry eye of the surgeon. It is his plaster of Paris they have purloined for the job (page 375).

We are nearly finished when suddenly tragedy strikes from afar. A radio message tells us that Bill Edgerton—Harold's son and an honored member of *Calypso*'s company on previous voyages—has lost his life off the Massachusetts coast while testing an experimental underwater rebreathing device.

Numb with grief but a scientist still, Harold

insists that the work of exploration go on. We brush aside his protests, retrieve the cable from the launch, and start the winches. The anchor, fouled on some rock, will not budge.

"Haul away!" I order. "We have no time to play games."

The capstans strain, the nylon stretches fearfully taut, and then—bang!—the line parts at the block with the crack of an elephant gun. The vivid rope recoils, swirls briefly in the sea, and disappears.

"All right," I say to Snoût. "To Dakar. Full ahead."

Sea Still Guards Many Secrets

A fortnight later, after flying with Harold to Massachusetts, I rejoin *Calypso* off the Portuguese island of Madeira. We dive one day along the rocky coast, and Philippe makes a discovery. Protruding from the sand are scores of curious crooked canes, brown and thin and bent into the shape of swaying question marks.

They seem to grow from the sandy ocean floor, as many as 20 to a square yard, and they cover sizable areas around the island.

"Weeds," thinks Philippe at first, but these are provokingly elusive weeds. We glide nearer to investigate, but as we approach closer, the weeds begin to disappear, retracting shyly into the sand. When we are within a few feet, they have shrunk from sight. Only after we have long passed by do they emerge once more.

Puzzled, we come to the surface and debate. What are these creatures? A majority thinks they are a kind of worm. Alone, diver Albert Falco says they are fish; he has observed their tiny eyes and minute mouths. Günther E. Maul, curator of the island's municipal museum, cannot give us the key but is so interested he asks us to try to collect samples by all means.

We try to dig in the sand. But the strange creatures bury themselves so fast and so deep that, to our regret, we have to use dynamite. A limited explosion gives us several specimens, and Mr. Maul identifies them with astonishment as *Heteroconger longissimus*. These curious eels, about two feet in length and in diameter about like a pencil, have rarely been caught. In a quarter of a century, marvels Mr. Maul, he has taken but two specimens, found swimming in the harbor. The creature burrows, we observed, tail first; its canelike crook, where we note the mouth, is always turned to face the current.

What rite of nature is this fish performing as it stands upon its tail, weaving back and forth on the ocean floor? On what does it feed? Only divers can bring such enigmas to the attention of science.

It is something for us to ponder, especially in the light of Bill's untimely death. We have explored, we have charted, we have probed with our electronic eyes, and we have let a little light into the blind depths.

But the watery floor of our silent world is still covered with question marks.

Miniature Dragon Explores Its Custard-cup Prison

Captain Cousteau's crew was fascinated by the outlandish creature, which was netted among swarms of organisms surrounding the ship above the Romanche Trench. Scientists identified the captive as a nudibranch, *Glaucus radiatus*, a rarely caught blue mollusk named for its fanlike appendages. Released in the dish, the animal turned endless somersaults in its attempts to escape.

Harold E. Edgerton

Biologists pore over specimens dredged from the waters off São Tomé. In two months they collected and classified 150 species of fishes, 140 species of sea worms, more than 200 species of crabs, shrimps, and hermit crabs, and innumerable sponges, corals, mollusks, gorgonians, sea urchins, and algae.

A priceless find. This nephropsid, shown actual size, is a relative of the Norway lobster. It is the first of its kind known to have been recovered in west African waters. Deep-red coloring gives the creature the appearance of having been boiled.

Young crab, found in dredged-up coral, rests on a 50-centavo piece. The expedition collected nearly 130 species of crabs, some of which may prove new to science. The coin bears the arms of Portugal. Worth about two cents, it is common currency in São Tomé and Principe. Magnification: three diameters.


CALYPSO

Cloud-drenched Peaks Overhang *Calypso* at Principe Island

Principe, like its sister São Tomé, exports cacao, coffee, copra, and palm oil. Despite the wealth of marine specimens in its waters, the island has only a meager fishing industry. *Calypso* calls at the town of Santo Antônio.

Scientists climb Principe's hills (lower) to explore virgin forest. Principe and São Tomé, summits of submarine peaks, are extensions of a mainland range in the Cameroons.

Crewmen tune up for a shipboard symphony (opposite, lower) with instruments bought at west African ports. The orchestra includes drums, guitars, broomstick flute, and a yard-long "zither" with gourd resonator. The ship's insigne, painted on the funnel, shows the legendary sea nymph Calypso with a dolphin.

Rainbow Runner Makes Its West African Debut

An expedition "first" was this specimen of *Elagatis bipinnulatus*, hitherto unknown in these waters. Dr. Jacques Forest (right), a marine biologist of the National Museum of Natural History, Paris, and leader of *Calypso*'s scientific party, examines the fish with fellow biologist Claude Maurin. A deadly black cobra fills the jar in foreground.

Philippe Cousteau Lifts an Inky Prize

A favorite shipboard pastime was the spearing of large squid that rose from the Romanche Trench at night to feed on flying fish. The record catch, a four-foot-long monster, went to the captain's son, a diver from the age of 4½. Philippe wears one of the M.I.T. student caps given to the crew by Dr. Edgerton.

National Geographic Photographer Bates Littlehales (above) and Harold E. Edgerton © N.G.S.

Rare Birds Flock to Spain's Marismas

The Roadless Swamps and Pasturelands of Sunny Andalusia Offer Sanctuary to Europe's Disappearing Wildlife

By Roger Tory Peterson

With Photographs by the Author

DON MAURICIO, a handsome young man of six feet three, talked to us of birds, for birds are his hobby. As the elder son of the González family, whose sherry empire centers around Jerez de la Frontera, he has access to most of the estates and wild lands in Andalusia.

"For birds you must go to the 'Coto,'" he said. "I will arrange it."

From that conversation came my acquaintance with one of the most fascinating corners of Spain—Las Marismas, the marshes near the mouth of the Guadalquivir River.

Treasure House of Spanish Wildlife

Europe, with its ever-expanding human populations, has little room left for wildlife. Nevertheless, remnants of wilderness where unusual birds can be found still exist. There are the island of St. Kilda off Scotland, two sanctuaries in the Netherlands, the banks of the Hortobágy River in Hungary, and the Camargue at the mouth of the Rhône in southern France.*

Of these, the Camargue is perhaps the most famous bird paradise. But Las Marismas has an even greater wealth of wildlife.

On a detailed map you will find, southwest of Sevilla, a great, roadless triangle—450 square miles of grass, mud, and water. Flooded by winter rains, dried out by midsummer, these vast marshes are hemmed on the seaward side by a belt of dunes, scrub, and pastureland from one to eight miles wide and about 40 miles long (map, page 402).

Between the swampy wilderness and the sea lies the Coto de Doñana, a game preserve of Spanish aristocracy made famous half a century ago by the writings of the naturalist Abel Chapman. The family of Don Mauricio González holds title to much of the land in this 67,000-acre preserve.

In this place of blazing sunshine I was to live in a *palacio* used as a hunting lodge by practically every Spanish ruler back to Philip IV in the 17th century. It had its own bull ring; we held no bullfights, but I did use the bathtub of the late Alfonso XIII when the other one in the lodge was in use.

We looked for herds of wild camels which once roamed the marshes, but although we saw plenty of boar and deer, no camels appeared. Herds of cattle wrecked our peace of mind with the sight of their sharp horns and trampled our camera blinds with their great hoofs. And at El Rocío I saw a colorful fiesta honoring a statue of the Virgin Mary which devout Andalusians believe lay for centuries in a hollow tree, hidden from the eyes of Spain's Moorish conquerors.

Above all we saw birds—squacco herons and rare masked shrikes; black vultures, the largest birds of prey in Europe; breathtaking flights of rosy-winged flamingos; red kites, which etched the skies of Elizabethan England but now barely hold their own against the egg collectors in mountain valleys of Wales; and the Spanish imperial eagle, of which heart-rendingly few individuals still exist. On the near-by hills ranged great bustards, the last of these turkey-sized fowl in southern Europe.

Guadalquivir Bars Wheeled Traffic

The broad, brown Guadalquivir, which flows into the Gulf of Cádiz, is the great barrier stopping wheeled traffic to the Coto. At Bonanza, the river port for Sanlúcar de Barrameda, we loaded our gear into a sturdy boat moored below the stone pier. There was a lot of it, for to maintain oneself on the Coto and the Marismas requires the preparations of an expedition.

Flocks of avocets, stilts, gray plovers, curlews, and other waders along the muddy banks enlivened our short journey upriver against the flow, turgid with silt collected on the stream's 400-mile trip from the Sierra de Cazorla. A collection of horses and mules awaited us at a pier on the far bank. We put ashore to start an 18-mile trek.

* See "The Camargue, Land of Cowboys and Gypsies," by Eugene L. Kammerman, National Geographic Magazine, May, 1956.

Horse-drawn Boats Carry Ornithologists Through Andalusian Marshes

One of the world's finest bird sanctuaries, a 450-square-mile stretch of desolate swampland, lies near the mouth of the Guadalquivir River on the southwest coast of Spain. Las Marismas—the Marshes—offer a refuge to some 200 species of European birds, some of them extremely rare.

The author, with ten other naturalists, participated in a recent field trip to the Coto de Doñana, a barrier of sandy scrub and pastureland walling off the marshes from the Gulf of Cádiz. Here members of the expedition, in shallow-draft duckboats hitched in tandem to the tail of a tow horse, glide through beds of white water-crowfoot. Half-wild cattle watch suspiciously in the distance.

British ornithologist Gerald Jamieson (center), assisted by his wife and a local *guarda*, erect a blind near Lake Santa Olalla to photograph the purple heron (right). Their companions in the water clear a field of vision for the camera. Collapsible blinds enabled expedition members to photograph the shiest subjects from distances of a few feet.

Purple heron builds its nest of reeds stacked out of reach of water. Rarely photographed, the bird is slenderer and warier than most of Europe's eight other herons. Striped serpentine neck identifies the species.

Watercolors by Eric Hosking (right) and Roger Tory Peterson © N.G.S.

Our way led at first through groves of stone pines—straight-shafted trees with pompon heads, also characteristic of the Mediterranean coast. Only the camp of a charcoal burner, with its symmetrical mound of sticks emitting a curl of blue smoke, gave sign that humans lived hereabouts. Azure-winged magpies flew through the trees in noisy flocks. The birds, suggesting the California jay in color, have one of the strangest distributions in the world: Upon heading east from Spain, the bird watcher does not find them again until he reaches the Orient.

On this preserve game was far more abundant than I had seen it anywhere else in Europe. We saw as many as 108 fallow deer in one herd. Wild boar, red deer, otter, badger, lynx, mongoose, and genet all live here. A wolf was killed as recently as 1951.

James Fisher, one of eight British ornithologists in our party, remarked that the Coto gave him a picture of what wild England must have been like 400 years ago.

"I half expect King Henry the Eighth to ride by," he commented.

Pine woods gave way to white, wind-driven dunes. Our straggling party had the look of a caravan in the midst of the Sahara. Not a trace of vegetation survived on these blistering wastes where only sand grouse live.

A light rain came off the sea. What had started as a hot ride became a chilly one. Darkness fell, and our horses plodded on, intuitively following a path we could not see.

115 Species Recorded in One Day

Now we were in cistus scrub, a great plain covered by low bushes. Stone curlews flew over, giving their lonely cries. Dimly against the night sky we sensed rather than saw an irregularity on the horizon, the clump of eucalyptus in which stood our destination, the royal hunting lodge. For what seemed a long time it came no closer and then, suddenly, the massive walls of the palacio rose before us.

Inside, the antlers of scores of stags lined the long dining room, and photographs of past hunts decorated the walls. In these storied halls we totted up our bird lists each evening and made plans for the following day. Our total list eventually swelled to 173 species; on one day alone, May 3, we had the unusual experience of seeing no fewer than 115.

That memorable morning we woke to the song of Bonelli's warbler and other northbound migrants outside our window. The cork oaks near the palacio and the oases in the dunes were alive with warblers, flycatchers, shrikes, and other small travelers. We counted at least 200 pied flycatchers within a space of 400 yards. Golden orioles and blue rollers perched in the cistus.

We deduced what had happened: Untold thousands of songbirds, striking an easterly wind in their passage across the Mediterranean, had drifted off course. Over the Coto they sighted the Atlantic Ocean and instinctively landed to reorient themselves. It was on this day that we discovered two masked shrikes, the first authenticated record of this rare bird in Spain.

Herons Glamorize Spanish Marshes

The glamorous members of this bird paradise, as far as my English friends were concerned, were the herons, for in Britain there are only two resident species, the common gray one and the rather rare bittern. Here in the Coto we found eight of Europe's nine species; only the great white heron, or egret, of eastern Europe was absent.

During the morning hours and again late in the afternoons, little flocks of from 10 to 30 white herons—cattle egrets and little egrets—traded to and from their feeding grounds in wavering ribbons.

How these herons had increased! On a visit four years earlier, we estimated 4,000 birds, most of them nesting in one sparse grove of cork oaks. Some trees held more than 100 nests in their twiggy branches. Dominating all were several huge nests owned by the local storks, who rattled their bills whenever they greeted each other (page 408).

Since then the owners of the Coto have instructed their *guardas* to keep a close watch on the rookery so that the birds can bring their young to wing. This vigilance has paid off, for when we visited the herons this second time, we found they had expanded to three colonies totaling about 14,000 individuals.

In April, 1952, cattle egrets were first observed in Massachusetts and New Jersey. These African natives had never before been recorded in North America. They originated from colonies mysteriously established in British Guiana and Surinam. Thousands nest today in the southeastern United States.*

* See "A New Bird Immigrant Arrives," by Roger Tory Peterson, National Geographic Magazine, August, 1954.

Tawny Manes on Cattle Egrets Herald the Mating Season

Ornithologists believe that cattle egrets, natives of Asia, Africa, and southern Europe, may be the only birds within historic times to emigrate to the American mainland without human aid. Scattered bands, thought to have been helped by winds across the 1,770 miles of ocean between Africa and South America, established a new home in British Guiana and Surinam. Spreading to the United States, cattle egrets have now colonized the southeastern seaboard, and individuals have ventured as far north as Newfoundland. Frequent attendants of domestic herds and big game, the birds garner insects flushed from underfoot by their hoofed companions. In payment, the egrets warn of approaching danger by taking flight.

These mates share nesting duty in the Coto de Doñana sanctuary. The birds grow brownish plumes and crests at breeding time, thus earning their British name, the buff-backed heron.

Crest Erect, a Jittery Subject Contemplates Retreat

The cattle egret's crest serves as an emotional barometer, springing upright in a bristling crown when the bird is alarmed or angry. This nest owner protests the photographer's intrusion.

Las Marismas Refuge Shelters Birds from Two Continents

The sanctuary lies along a great flyway across Europe and Africa. Few birds reside the year round; most use the marshes as a nesting ground or a way station. Some make round trips between South Africa and Scandinavia by way of the Strait of Gibraltar.

A day or two before our arrival one of the colonies in the Coto had been raided by egg thieves who rushed in and cleaned out the nests while an accomplice lured the gamekeeper away. It was only a temporary setback, for within a few days the birds partially recouped their losses with fresh eggs.

The little egrets with black bills and yellow feet, graceful counterparts of North America's snowy egrets, occupied between 2,800 and 3,500 nests. Night herons and buffy-plumed cattle egrets had close to 4,000 nests between them. There were between 60 and 90 pairs of the little squacco heron (page 404). Forty big gray herons had nests in the branches of two huge cork oaks.

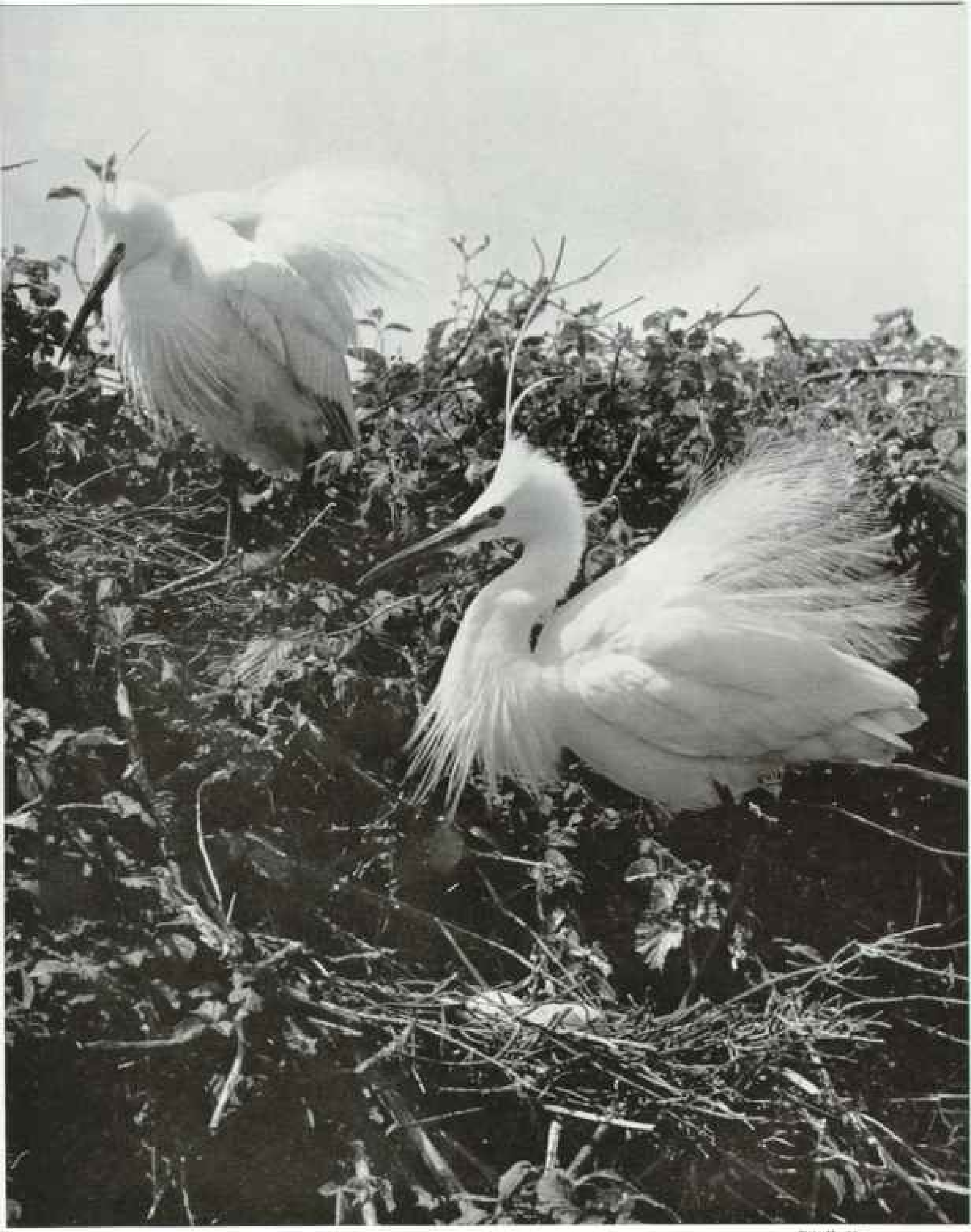
Cuckoos Harass Nesting Magpies

Magpies, the same species seen in the western United States, occasionally stole heron eggs. But they in turn were having a tough time because of the large numbers of great spotted cuckoos. In this part of Spain, these parasitic specialists lay their eggs only in magpie nests.

The hustle and bustle of the heronries, the clamor and clatter, were beyond description. From everywhere came the "wulla-wulla-wulla" of little egrets, exactly like the love notes of snowy egrets in Florida rookeries. The enraptured birds erected their long crests and raised filmy plumes in dazzling cascades of beauty (opposite). Cattle egrets, whose yellowish bills blushed bright pink at the moment of greeting, also raised their plumes and hackles in a ritual repeated whenever there was a change-over on the nest (page 401).

Other birds dropped down to the ooze at the edge of the colony to hunt sticks. These they presented to their partners with great ceremony. The demonstrations led to thieving in bird paradise. Let a nesting bird turn its back for a moment, and its home was apt to shrink a bit. It was much easier to pilfer sticks from unguarded nests than to find new ones—maybe more fun, too.

During the heat of the day, from noon to about four o'clock, activity in the colonies subsided. Many of the cattle egrets were dancing attendance on the herds out on the marshes, but as the sun began to descend, long strings of birds returned from all points of the compass to drop like snowflakes onto bushes already white with their fellows.



Eric Hosking

With a Flourish of Finery, Little Egrets Change Guard over Their Nest

An estimated 6,000 little egrets, Europe's counterpart of America's snowy egret, inhabit the Coto de Doñana's three heronries. Though they have the protection of gamekeepers, poachers often make raids on their eggs.

Lacy dorsal plumes, once the delight of milliners, caused the bird's near extinction in many countries. Protective laws and a shift in fashions halted the slaughter.

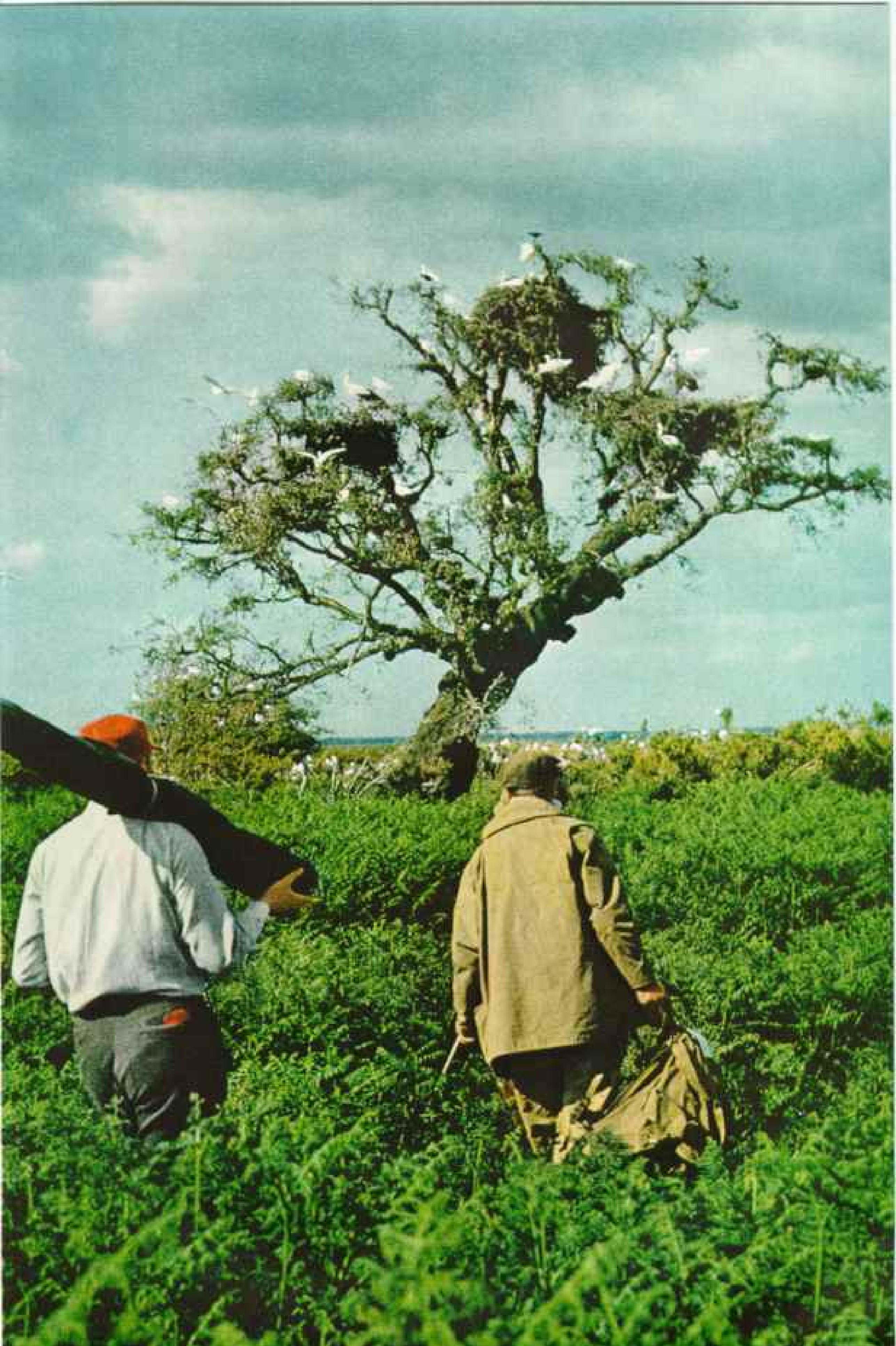
This nesting pair displays the summer headdress with its two antennalike plumes. Exchanging duties, the birds salute each other with a "wulla-wulla-wulla," their love note.

Ruby eye and gossamer crest identify the night heron. Markings on males and females are so similar that birds themselves cannot distinguish one another's sex at sight. Recognition ultimately occurs in an elaborate courtship ceremony.

Nesting Storks and Egrets Blossom on the Branches of a Cork Oak

Pandemonium reigns as photographers approach with blinds and cameras. A jackdaw surveys the confusion from the treetop.

Squacco heron in dingy summer plumage fixes an imperious eye on intruders. Although its plumes are varying shades of tan and buff, the bird in flight appears pure white. This photograph by Dr. Roger Tory Peterson is believed the first in color.



Night herons, meanwhile, flocked out. This last hour of the afternoon was by far the best for photography. Not only were colors warmer and the shadows less harsh, but the colony bubbled with activity from then until dark.

A month after we were there, Spanish ornithologists visited the colonies in the Coto and discovered a bird they thought might be the West African reef heron. After photographing it, they collected the specimen to verify its first appearance in Europe. Its exact identity remains uncertain.

Field Marshal Turns Bird Photographer

Eric Hosking, one of England's top bird photographers, had brought with him nine of his fine gabardine photographic "hides" (page 398), but I felt that my own blind of burlap was better suited to the Spanish heat. I must admit that Eric's were fancier; they had everything but hot and cold running water. We set them up well in advance near nests we wanted to photograph, so that the birds might become completely accustomed to them.

With six photographers in the party, 10 blinds proved none too many, and there was a scramble every day for first choice. For 10 days Field Marshal the Viscount Alanbrooke, England's great soldier who was Chief of the Imperial General Staff in World War II, was with us. During this period we settled the matter by letting him pick first. He is an exceptionally capable amateur ornithologist, and spent long hours in the blinds just as we did, enduring the same steam baths that came when the sun rose to its zenith.

One day Hosking and I worked near each other. I was concentrating on a night heron. The heron was dead sharp all right, but in the background two cattle egrets made ugly, out-of-focus white spots on the ground glass.

If I made a strange noise, I thought, perhaps they would move. So I tried a low, cow-like "moo-oo-oo." The cattle egrets jumped, the phlegmatic night heron stayed, and I got my picture.

"It's not cricket to disturb the birds with strange noises," scolded Eric.

Great Gray Shrikes: Masked Hunters and Devoted Parents

In courage and aggressiveness, few birds rival the thrush-sized shrike. Small birds may provide a meal. Even hawks and eagles give nesting pairs a wide berth. The author saw these great grays, largest of the shrikes, feed lizards and small mammals to their young, who usually gulped them whole. Frugally, they often store their prey on the spikes of a thornbush. When they are not hunting, these predators may spend the time singing.

Eric Hosking

I could think of only one retort to my English friend.

"Every day at 4 p.m.," I said, "I hear from the direction of your blind the pop of a cork and the 'glug-glug-glug' of tea being poured from a Thermos. Is that cricket?"

A snort was my only answer.

Far out on the marshes we often saw a line of white dancing in the heat waves. Through the glasses the line resolved itself into countless birds—the flamingos of the Marismas.

Unlike their cousins of the West Indies, these are not bright pink, but whitish with just the faintest shade of shell pink over the body.* However, the wings, concealed by the scapulars and flank feathers when the flamingos are at rest, erupt into bright vermilion when the birds take flight.

Unnatural History Laid to Rest

There are few definite records of flamingos nesting in Spain during this century. Because of disturbances, the sensitive creatures rarely managed to raise any young, and Don Mauricio told me that since 1946 they do not seem even to have tried. It is thus something of a mystery how they maintain their numbers. I imagine the Spanish colonies are made up largely of overflow from Africa and the Camargue.

It was here in the Marismas that Abel Chapman disproved a 200-year-old belief. William Dampier, whose rescue of Alexander Selkirk from the island of Juan Fernández provided the inspiration for the story of Robinson Crusoe, had found nests of flamingos on the Cape Verde Islands. The buccaneer-naturalist described them as high, conical mounds upon which the females sat astride, like so many feathered cavaliers. Few challenged his description, which for two centuries was accepted as authentic natural history.

Then, in 1883, Chapman found a nesting colony in the Marismas. He literally killed a mule in reaching it, so thick was the quagmire. He and a companion managed to get within 70 yards. At that distance his glasses showed him the sitting birds with their long red legs definitely doubled under their bodies, the joints projecting beyond the tails. Thus the Dampier myth was laid to rest.

Chapman's feat with the flamingos was matched that same spring by his discovery of camels living a semi-aquatic life on the marshes. They had been brought in from the Canary Islands as work animals in 1829 and later abandoned.

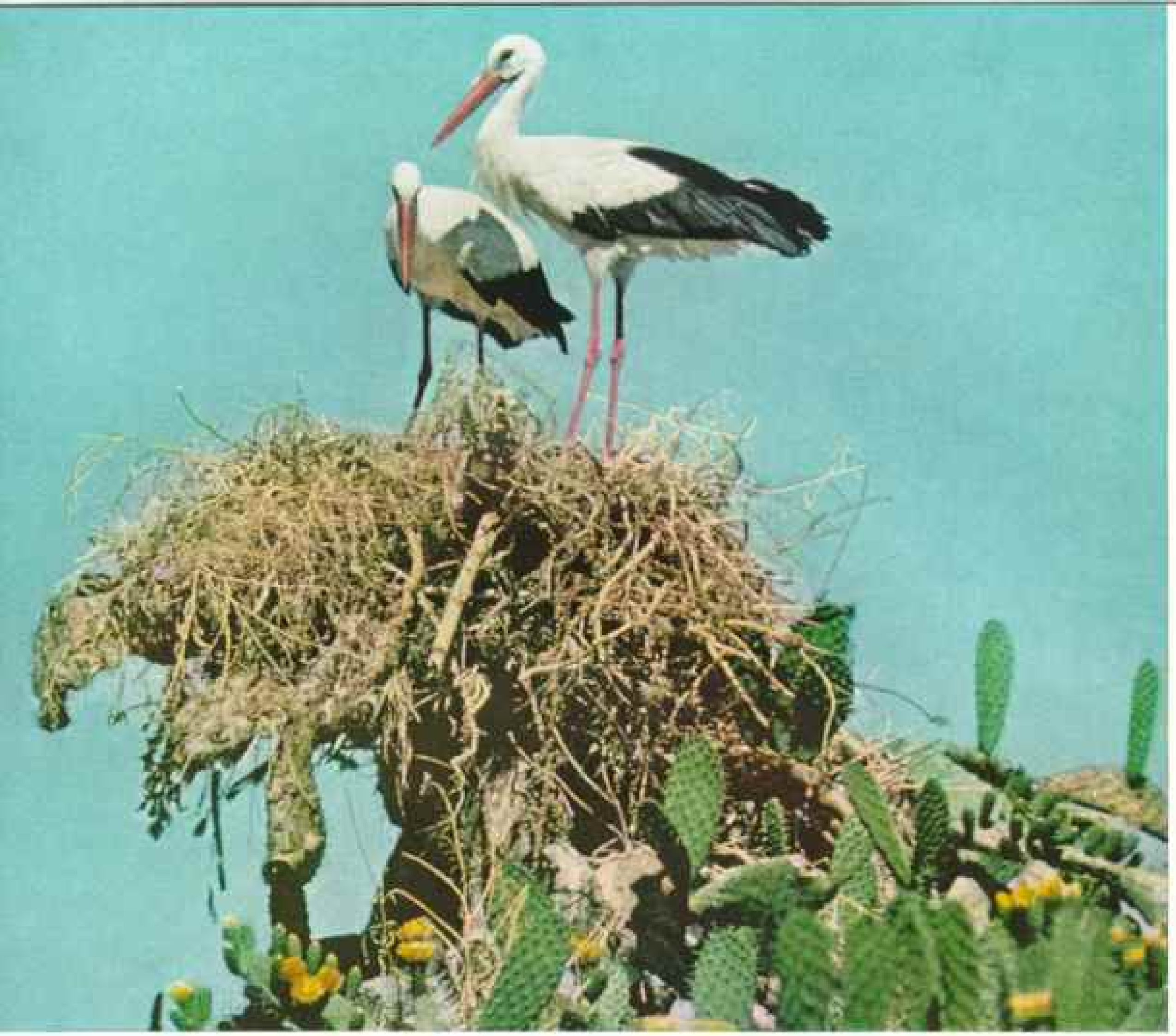
For more than a century the herd bred and maintained itself in a wild state, seemingly owned by no one. Then, in 1951, the farmers rounded up the *camellos* and put them to the plow. Another picturesque bit of marshland life was gone.

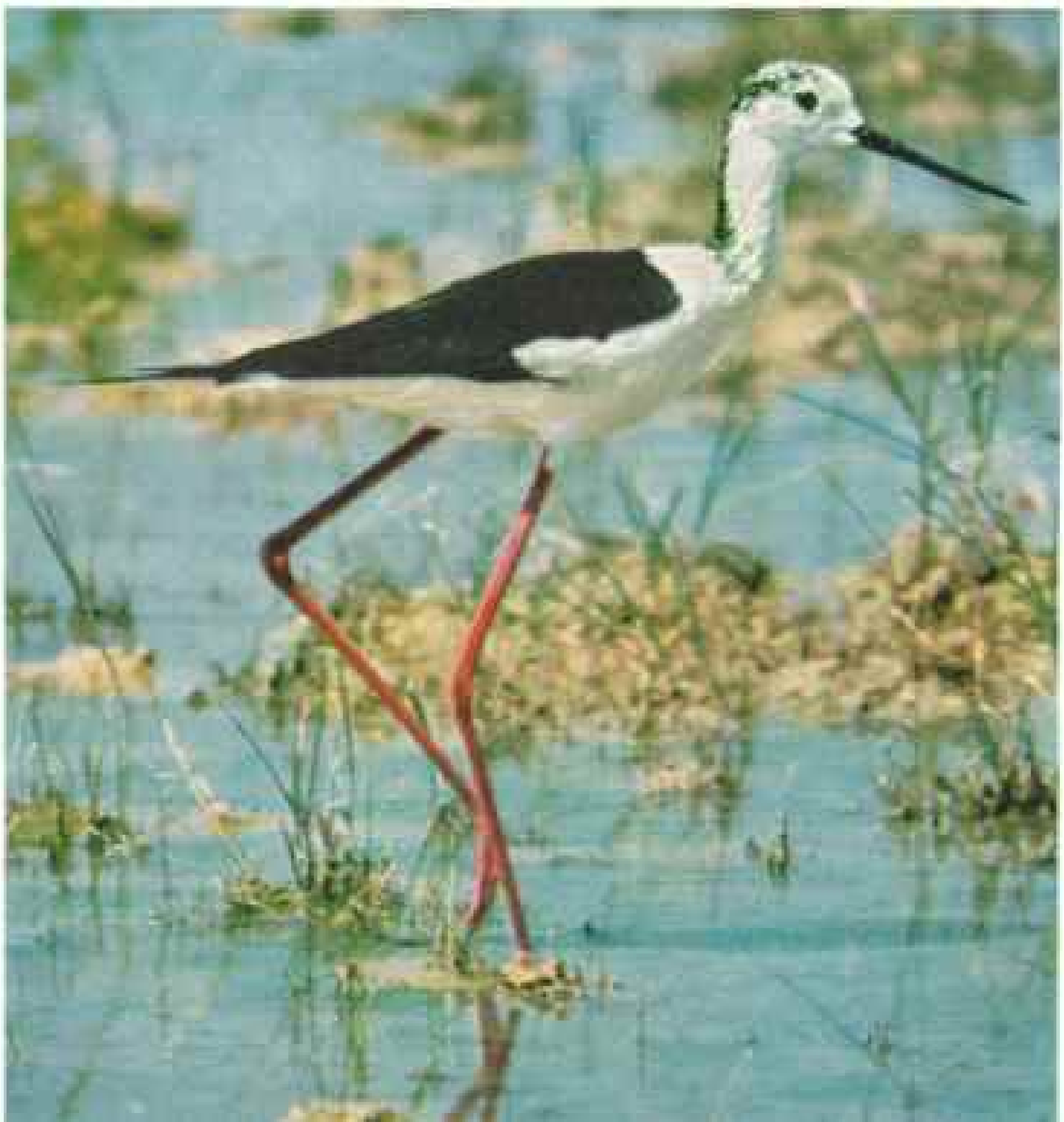
Day by day we witnessed the annual drying

Dr. Roger Tory Peterson, an ardent bird watcher since the age of 11, is an internationally known ornithologist. His own paintings enrich his field guides to American and European birds, translated into several languages. Here, in the Coto de Doñana, he uses a Bell & Howell movie camera mounted on a Borden gunstock and takes aim through a Nydar gun sight. Leica still camera hangs from a neck strap.

The Author Aims His Camera Gun

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Ballerinas in Pink," by Carleton Mitchell, October, 1957; "Flamingos' Last Stand on Andros Island," by Paul A. Zahl, May, 1951; and "Flame-Feathered Flamingos of Florida," by W. A. Watts, January, 1941.





Sober Storks Keep House in a Cactus Patch

Sedate walk and unhurried flight give the birds a patriarchal bearing. Mating pairs shed their dignity, affectionately coughing, hissing, and clacking bills. These white storks guard their jumbled home atop a stand of prickly pear. Returning to the same nest year after year, they make repairs simply by adding to the tangle of grass, sticks, and earth.

Black-winged Stilt Forages on Pipestem Legs

One of the fussiest of feathered housekeepers, the stilt shakes muddy feet before entering the nest. Elongated bill and legs fit the bird for deepwater feeding on insects and vegetation. Leg joints, seemingly reversed, are actually heels. The true knees are hidden by abdominal feathers.

of the countryside. Muddy islands emerged, to be brightened briefly by the bloom of yellow hawkweed and other wild flowers. Pratincoles, big-eyed, swallow-shaped shore birds with red "lips," laid their three well-camouflaged eggs on the dried mud. Stilts, black and white with ridiculously long carmine legs, and avocets, white and black with bluish legs and upcurved awl-like bills, nested on tussocks above the muddy water. Redshanks preferred drier locations shielded by tufts of grass.

Great flocks of migrant shore birds still passed by on their way to northern Europe. From our blinds we could see dunlins, gray plovers, turnstones, ringed plovers, and many others pottering about.

The stilts and other resident waders were close to the point of hatching when a stiff wind from the southeast pushed the waters of a springtime lagoon onto the grassy Puntal. The water level rose six inches in an hour or two. When Eric Hosking and I rode back across the flats, we saw little distraught companies of stilts and redshanks flying this way and that. Thousands of birds must have lost their eggs or chicks.

Most of this quagmire would be dry by late June. The bright green of the sedges would turn to brown, and the water would disappear from all but the deepest channels and pools. But by that time the crop of young birds would normally be on the wing, and the marshes would be abandoned to the semiwild cattle pawing up the powdery soil in clouds.

Adder Invades Photographer's Blind

Forty pairs of purple herons, maroon and purple-gray (page 399), nested in the reed beds near Santa Olalla, a fresh-water lake frequented also by rare white-headed ducks. To examine the nests, ornithologists James Ferguson-Lees and John Parrinder had to swim in muddy water infested with voracious leeches four inches long.

Determined not to interrupt his photography, Eric Hosking made no protest when a horned adder crawled into his blind. The two stayed together in amity for several hours.

Except for this and a few other small adders, we saw no snakes in the Coto, but lizards scurried over the hot ground everywhere. A pair of gray shrikes (page 406) fed whole five-inch lizards to their young! It sometimes took several minutes for the tail tip to disappear down the gaping throat.

During the second week of May there was a great hatch of midges. Countless millions of these ephemeral insects rose from the marshes in smokelike columns. An emergence of dragonflies followed within a day or two. Each twig tip of every bush supported a small red dragonfly. When we looked into the setting sun, millions of back-lighted wings turned the landscape to silver.

While the dragonflies were busily dining on the midges, parties of bee-eaters maneuvered with swallowlike grace to capture the dragonflies. With their jade-green breasts, canary-yellow throats, and burnished gold backs, the bee-eaters are second in brilliance to no European birds except the little kingfishers. Everything about them is attractive: their pleasant summery notes, their gregarious habits, and their smooth-sailing flight as they hawk for dragonflies.

Snares Set at Bee-eaters' Doors

Like kingfishers, bee-eaters nest in banks. At Jerez we found their colonies honeycombing sandbanks. The marvel was how they avoided extermination, for boys had put little wire nooses in every hole we examined.

Here on the Coto there were many bee-eaters about, but not a sandbank within miles. Where were the nests? Then we discovered the little birds digging tunnels into the flat center of a sandy meadow. While one of a pair sat on a dried cow chip, the other industriously scraped out the burrow with its bill and feet, sending out a jet of fine sand as it worked.

One pair perched on the horns of a bleached skull. This was too good a picture to miss, so we set up a blind. Late in the morning a large herd of cattle moved across the field. They examined the installation, most of them cautiously, but one or two temperamental black bulls showed some annoyance, I thought, and I fully expected them to trample the blind with me inside. Then one of the keepers came racing across the plain on his gray Arab, and the herd fled before him.

The cattle attract to the Coto a bird becoming more and more uncommon in the inhabited portions of Europe. This is the griffon vulture, with an eight-foot spread of wings, that on fine days wheels in the blue from the Pyrenees to Gibraltar.

I once saw three of them in the Tarn Gorges of southern France, the first to be recorded there in some years. The French say these

Guide carries his shoes while leading a horse across the Coto. Green and watery in early spring, the marshes (background) turn brown in summer.

Red kite, photographed in color for the first time known, feeds a pair of half-grown young. To reach the nest of this rarely photographed bird, the expedition built the elaborate tower shown at right.

Scaffolding Raises a Blind 40 Feet to Overlook the Red Kite's Nest

In order not to alarm the birds, work on the tower was restricted to one hour a day. The tree is a cork oak, whose bark supplies bottle stoppers, life preservers, and shoe soles.

big vultures were commonplace in southern France at one time, but when laws requiring the burial of dead livestock were enacted, the *vautours* soared across the Spanish border.

The Coto, except for the wind-driven dunes, is monotonously flat, but 75 miles away, across the watery Marismas, the blue ridges of the Serranía de Ronda stand out from the haze. From the gorges and high cliffs the vultures set out when the wind is in a northerly or easterly quarter to search for carrion on the Coto.

It would appear that to photograph vultures one need only find a carcass. In 1952 Guy Mountfort and I hauled a dead doe to the foot of a gnarled cork oak. It was evening when we placed it there, and our Spanish horsemen skillfully built us two blinds in the bracken.

Everything seemed perfect. But though we entered the blinds at dawn and stayed until sunset, not even a kite came to investigate.

Our chances for vulture pictures looked brighter in 1956, for a party of 27 griffons and five of the rare black vultures patrolled the Coto for several days. Once we saw a wheel of from 50 to 70 Egyptian vultures, small white ones with black wing tips.

This time we found a dead cow. With a tractor we dragged the bloated animal to dry ground and set up our blinds. Day after day we waited. The stench became intolerable. Only one vulture, an Egyptian, appeared.

Then one day, without too much hope, Guy Mountfort and I flushed several vultures from the stripped and sun-dried backbone of a deer —scant fare for even the hungriest scavenger —and set up a blind. Less than twenty minutes later, Guy had nine vultures of three species, including three blacks, before his lens (page 415).

Vultures Soar on Rising Thermals

The black vulture, unlike the North American bird of the same name, is close to the size of a condor; it is the largest bird of prey in Europe and, strangely, nests almost without exception in pine trees. There cannot be more than a handful in Spain, whereas the rock-nesting griffon is numerous from one end of that sunny country to the other.

Wind direction and thermals have a lot to do with the presence or absence of these feathered undertakers over the marsh country. But one can always see vultures at the old town of Arcos de la Frontera, perched high on a cliff and centuries ago a stronghold against the Moors (page 418). Here each sunny afternoon fifty or sixty griffon vultures ride the updrafts amid a wheeling, chattering assembly of 200 or more lesser kestrels, which look much like American sparrow hawks.

Hosking and I engaged a big black Mercedes car and a chauffeur to go from Jerez to Arcos. Mauricio González came with us, for he knew where we could see the vultures at their best. This was a balcony perched precariously on the side of the cliff; here we could meet our quarry on their own level.

It was about four in the afternoon, and already many of the big griffons were tucked back under the ledges of the cliff. One by one the condorlike birds launched forth again into the wind, filing by at eye level.

Camera Gulps Film at $9 a Minute

My camera gun was ideal for taking slow-motion pictures (page 407). Sometimes, with the film racing through the camera at the rate of $9 a minute, the birds veered suddenly off in midshot. But when they dropped their legs like landing gear and plummeted across the cliff face, I got some of the most thrilling action shots I have ever taken.

Nowhere have I seen a richer variety of resident birds of prey than on the Coto. Abel Chapman, remembering British gamekeepers who killed all "vermin," wondered why it was that here, where he often saw as many as 20 birds of prey in the sky at one time, there was an abundance of small game. Today, some wildlife technicians believe that predators do not harm the hunting, but rather cull the surplus, the diseased, and the foolish, thus assuring a vigorous game population.

One day, while exploring the dunes near the sea, Fisher and Ferguson-Lees discovered the aerie of a peregrine, or duck hawk, on the top of an old Moorish watchtower. The nest contained young. That same day we saw five kinds of eagles—imperial, golden, short-toed, Bonelli's, and booted—at least three of which were breeding in the vicinity.

Our greatest hope was to photograph the Spanish imperial eagle, a big black fellow with broad white shoulder straps. There can be few of these magnificent raptors left in the world, and I suspect most of them have their headquarters at the edge of the Marismas.

Seven young ones had been banded by José A. Valverde in 1955. The keepers who had accompanied him took us to half a dozen aeries in cork oaks and stone pines, but all were empty. It is possible that the bitter winter of

Eric Hosking

Polka-dot Crest and Prison Stripes Give the Hoopoe a Gaudy Ensemble

"Hoop, hoop, hoop!" Hoopoe earned its name with its hooting call. Black-tipped feathers give the erected crest the look of a jeweled crown. This fellow carries a lizard to its young in an abandoned beehive. "Our Spanish guides," says the author, "insisted the hoopoes were untidy nesters and smelled bad. We, however, noted no undue odor." Despite this bird's misleading resemblance to a woodpecker, hoopoes have no close relatives.

Eric Hosking

Ignoring Danger, a Kentish Plover Broods Speckled Eggs on the Ground

The bird's name belies its habitat; uncommon in England, the Kentish plover haunts the European shoreline. The same species, known to Americans as the snowy plover, ranges the Gulf coast. "These little nesters were very confiding," says Dr. Peterson. "It was no trouble to photograph them. Frequently their eggs were crushed by horses or browsing cattle."

1955-56 had upset the reproductive rhythm. Certainly it was not lack of rabbits, for we saw many, and it would appear that the dread rabbit disease myxomatosis had not reached this part of Spain.

We arrived at the last nest near sundown. Sitting above the mass of sticks in the crown of a cork oak was one of the proprietors in person. At our approach it flew, attended by a flock of 50 heckling jackdaws.

One of the men scrambled up the tree monkey style. Balancing on the fragile limbs, he reached into the nest and lifted a ball of fluff. "*Muerto*," he called. The young eagle was dead.

The Red Kite, Britain's Rarest Bird

If this was a sad adventure, our dealings with the kites were happier ones. Wherever we looked in the blue sky over the cistus plains and above the marshes, we could see sable wings, always one or two birds, sometimes as many as a dozen. Most of the flyers were black kites; nearly every large cork oak held one of their nests. When we set up our blind amid the bracken to photograph a low one, we were able to get some fair pictures. But then, when we saw a red kite sailing with his black cousin, we knew we were about to see a dream come true.

In Britain, the red kite is perhaps the rarest bird regularly breeding today. Once it may have foraged in the gutters of London, as black kites still do in Cairo. Now no more than eight or ten pairs still survive in remote mountain valleys of Wales. Fewer than half of these bring off young each year, in spite of the efforts of a group formed with no other purpose than to preserve these birds. The oölogists, a die-hard and resourceful breed in Britain, still get some of the eggs.

Therefore when we located a red kite's nest 38 feet up in a cork oak on the Coto, the incomparable Hosking regarded it as the chance of a lifetime. He would build a pylon blind, he announced, a tower with a hide on top. He had built many such towers, including one nearly twice as high as this one to

the nest of a hobby, a small European hawk. But he was in England then, and there were carpenters and materials handy. Here we were in a wild area with almost no tools.

This did not stop Eric. Back at the palacio he spliced eucalyptus poles together until he had four 40-foot shafts to support a platform pieced together from an old sherry crate.

Next morning we hauled our gear and ropes to the foot of the tree, where for exactly one hour everyone worked feverishly hoisting the poles into place. Each day for five days we worked on the blind, and always for just one hour—no more—so that the birds would not be too disturbed (page 411).

Kites Ignore the Camera's Click

Finally the blind was rigged. It was unthinkable that anyone but Eric should get first chance. We sent him up the wooden ladder at nine o'clock one morning, with all hands wondering how the shy birds would react to the sound of his camera shutter only 12 feet from their nest.

We called back at six in the evening. Eric was jubilant. He had taken more than 200 shots, and the birds showed no concern whatever. In fact, he said, the female spent most of the day sitting beside the nest, preening her feathers most nonchalantly.

The male arrived, and the two leaped into the sky. Eric watched them lock claws and tumble, apparently for the sheer joy of the breathless rush.

My turn finally came, and I climbed the rude ladder at 8:45 in the morning, hauled up my cameras and tripods, and parked my lunch bag with the unleavened bread, eggs, fried fish, chocolate, and sherry.

At 9:12 by my watch the female came in with a small rabbit. Side by side the two fledglings waited in patient anticipation while the mother carefully tore off shreds of flesh and as carefully offered them in her beak (page 410).

By late afternoon the wind had become so strong that I feared the guy ropes would not hold. I had visions of myself crashing from

Hungry Vultures Linger Beside the Dwindling Carcass of a Deer

Soaring birds, endlessly scanning the ground and spying on one another, may be drawn 50 miles to a kill. This photograph catches three species at a meal. Black vulture (left), Europe's largest bird of prey, rivals in size North America's largest aerial predator, the California condor. Smaller guests at the feast are griffon vulture (center) and Egyptian vulture.

(Luc Hoogstraten)

the treetop perch, cameras and all. But I finished my film, the sun dipped away from the nest, and at 6:30 I climbed down from the blind, now leaning at a crazy angle, to rejoin Eric safely on the ground.

At breakfast one day Mauricio made an announcement.

"I have instructed my men to take you out on the Marisma de Hinojos," he said. "The boats will be ready as soon as you have finished eating."

We assembled at the marsh edge, where four low duckboats awaited us. Antonio Chico knotted the tail of his horse to a rope attached to the first boat. Then a second boat was attached to the first.

The other two boats similarly obtained for their motive power a gray horse ridden by Pepe, a young Spaniard straight from a Goya portrait. In this manner 11 of us were pulled across watery wastes that occasionally lapped above the horses' knees (page 399).

Everywhere the marshes were alive with birds. Hundreds of terns flickered in the heat haze on the horizon. The majority were black terns, the same species we know in the marshes of the United States. Whenever our convoy invaded their colonies, the birds strafed and dive-bombed us.

In lesser numbers were the whiskered terns, smoky-gray birds with dark-red bills. We passed through two or three of their colonies among reeds in deeper water. Coots and moor hens slid shyly from their soggy platforms. Little grebes took just enough time to pull a few wisps of vegetation over their eggs before they left.

Red-and-white Gown for Fiesta Time

On a muddy island where we stepped ashore to stretch our legs, we put to rout a herd of a hundred cattle. An assembly of birds at the edge of the water commanded our attention. The telescope revealed not only the usual stilts, avocets, and lesser waders, but also several slender-billed gulls, all adults. These small gulls were new to us, and we considered them a rare find.

By this time the sun was beating down with all its Spanish fury, and we began thinking of shelter. Our guides must have been thinking of the same thing, for now, on the horizon beyond the straining horses, we could see a low rise of ground where the family of gamekeeper Manuel Espinar lived its lonely life.

Here on this sandy bar out in the middle of nothing were several *chozas*, thatched houses exactly like those Abel Chapman knew. A hedge of tall opuntia cactus sheltered a small vegetable garden from the winds which sweep across this treeless landscape. A rufous warbler dodged into the protective cover, but I was unable to flush it again.

We ate our lunch in Manuel's home. Chickens wandered in and out the open door and picked crumbs from the earthen floor. Two pairs of swallows darted in to feed their young in nests over our heads.

A lovely gown of white and red hung from the rafters. Señora Espinar explained that her elder daughter would wear it at Whitsuntide, when pilgrims would gather from far and near to pay homage to the Virgin of El Rocio.

Miraculous Image Discovered in Swamp

Espinar decided we should have a preview of the fiesta at El Rocio. Playing a three-holed flute and a drum simultaneously, he beat out a stirring, haunting rhythm while his two young daughters danced the flamenco-style *sevillanas rocieras*.

Next week the whole family would mount their horses and mules and make the long trek across the Marismas to El Rocio, where the pious—along with those who simply like to dance—would hold high celebration for three glorious days.

Seven hundred years ago this part of Spain was but newly won from the Moors and subject to constant raids from across the border. During the various alarms, religious relics and treasures were sometimes hidden for safety and then the hiding places forgotten.

Two centuries after the Moors had lost the region, a shepherd near Almonte, northwest of the Marismas, was led by the barking of his dog into a swampy thicket. Peering into the hollow trunk of an old tree, the Andalusians believe, he saw the carved figure of a Virgin of rare beauty. When he reported his find, it was decided to build a shrine dedicated to Nuestra Señora del Rocio —Our Lady of the Dew—on that very spot.

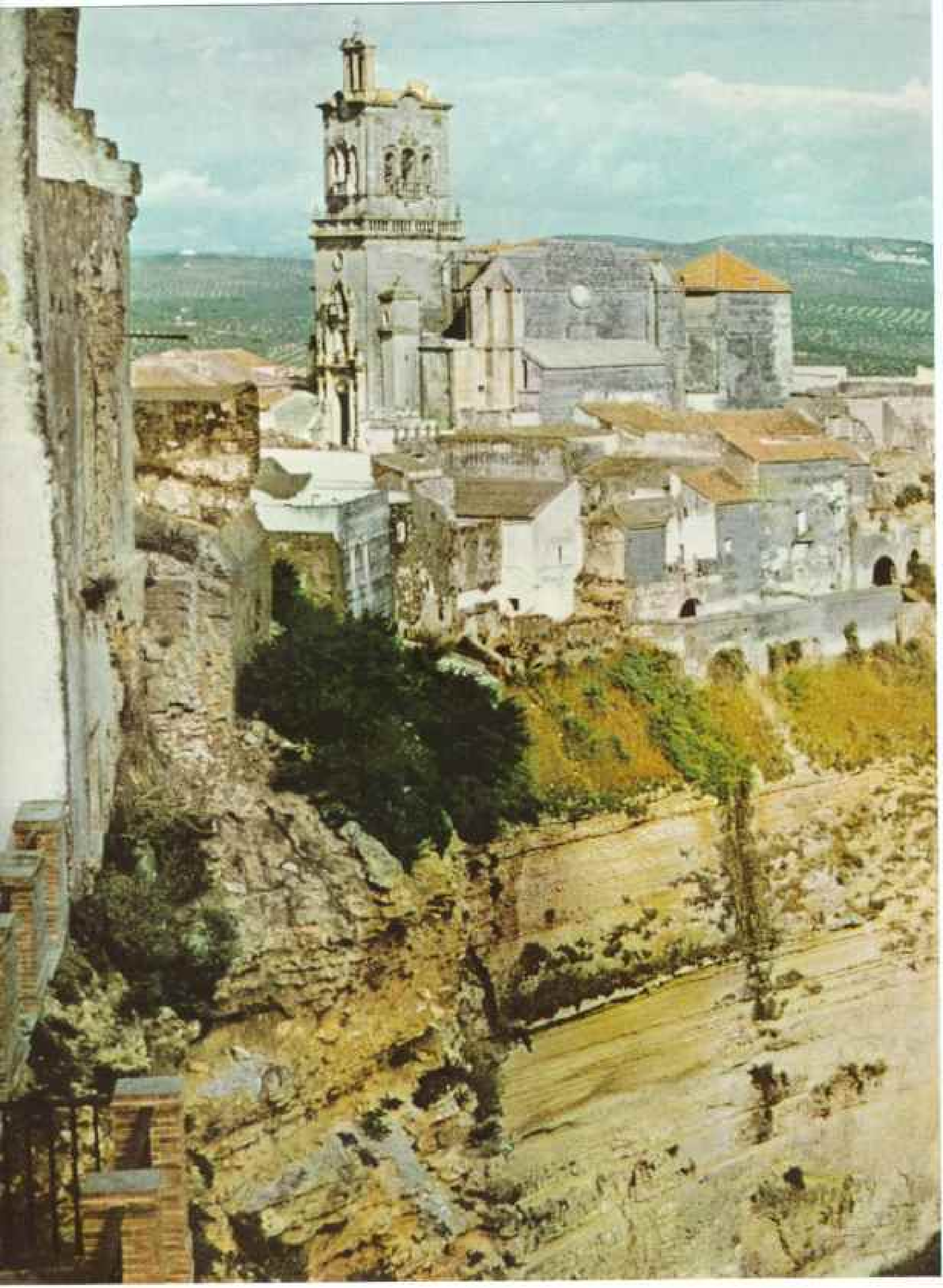
Miracles were ascribed to this Virgin, including the escape of the inhabitants of Almonte from the plague of 1649-50. Replicas of the statue were made and presented to the surrounding villages. It is from these towns and villages that the fraternities of pilgrims journey across the wilderness each Pentecost,

(*Continued on page 425*)

Kodachrome by Roger Tory Peterson © National Geographic Society

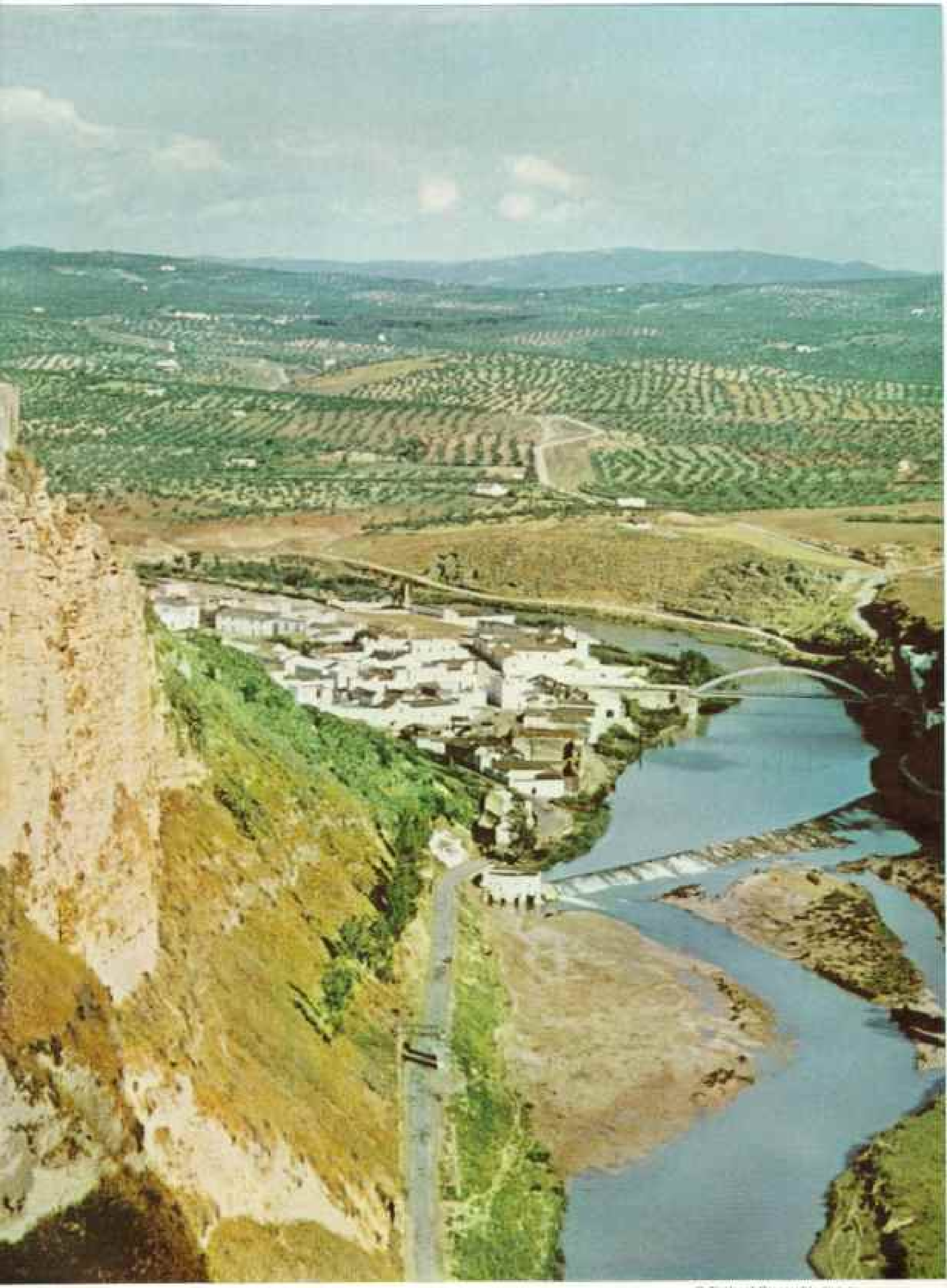
Singing and Clapping, Pilgrims Ride Burro-back to an Andalusian Festival

To witness the annual celebration honoring a centuries-old statue of the Virgin, the author visited the hamlet of El Rocio. Costumed girl rides a pillion, a pad behind the saddle.



Sandstone Cliffs Lift Arcos de la Frontera High Above the Guadalete River

Ancient Iberians, Carthaginians, and Romans used the sheer-walled bluff as a natural fortress. Parish church of San Pedro caps the skyline. The modern



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section of the town lies at river level. Olive groves sketch green patterns on the floor of Guadalete Valley. Caves in the face of the precipice serve as roosting ledges for scores of griffon vultures and lesser kestrels. Birds effortlessly launch themselves into space on thermal updrafts.

Ornate Shrine and Covered Wagons Embellish El Rocio's Festive Parade

Caparisoned bullocks stand hitched to a richly adorned pavilion bearing a replica of the famous Virgin of El Rocio. Visitors in modern dress and marchers in

Kodachrome by Eric Hosking © N.G.S.

costume await the start of the three-hour ceremony. Wagons, transporting celebrants and singers, call to mind the prairie schooners of the American West. The parade ends at the shrine of the Virgin, where drivers urge their bullocks to kneel in homage. An arbor along the line of march shelters spectators.

Fiesta-goers Use Streets as Dance Floors

El Rocío's festival combines reverence and gaiety. Simultaneously with the religious rites, merrymakers seize the town for a three-day celebration. Tireless dancers in Andalusian costumes prance and spin to the rhythm of drum and handclap. Fireworks and strolling musicians make sleep all but impossible.

Covered wagons drawn up side by side wall in the dancing throng.

Snapping Fingers Keep Time with One-man Band

Pilgrims and revelers travel miles for the Whitsuntide celebration. Many come from Sevilla, a five-day journey by ox cart or burro.

El Rocío, all but deserted the rest of the year, overflows with guests. Lack of beds presents no problem, for few celebrants take time to rest.

The one-man performance on flute and drum is a regional specialty.

Eric Hoskins (left) and Roger Tory Peterson © National Geographic Society

Boots Stamp, Skirts Swirl in the Lively Sevillanas

A festival favorite is the flamenco-style *sevillanas rocieras*, a four-part dance performed by couples. Strenuous as well as graceful, it calls for lightning movements and perfect timing.

This couple executes a step to the rapid cadence of drum and flute. The man wears the wide-brimmed hat of Andalusia. His partner has a gypsy dress with tight bodice and flaring skirt. Pictures of the Virgin adorn hatbands.

Young performer in a beribboned gown mimics her elders.

bringing their own effigies to pay homage to the original.

Four of us stayed on for the fiesta while the rest of our party went back to England. It was a Friday night; the celebration would start the following day.

At dusk, standing at my balcony window in the palacio, I heard the beating of drums. There was singing and the sharp clapping of hands, and soon in the half darkness I could see a line of horses and mules.

Behind each *caballero* sat a wife or a sweetheart riding a pillion (page 417). All wore the traditional dress that we associate with Andalusia but seldom see. The drummer thumped out the peculiar rhythm that Manuel Espinar had used, and I saw Espinar himself, playing his flute in a minor strain.

Pilgrims Surge into Tiny Town

The dancing and singing warmed up soon after dinner, and in the front hall downstairs couples were twirling and singing to the accompaniment of the drums. Fascinated, I stayed up until midnight and then turned in because I wanted to accompany the pilgrims on the morrow.

I might as well have stayed up. Several times a group of cavaliers strumming guitars and singing with great spirit marched down the long hallways, pounding in turn on every bedroom door. Each time I had to down a copita of sherry before I was allowed to return to my pillow.

At daybreak the drums were beating again. Looking from my balcony, I saw little pods of pilgrims already departing along the trail across the Coto to El Rocio, 12 miles away.

El Rocio was bursting at the seams. A thousand horses and their riders had already arrived in the little collection of white buildings surrounding the tile-walled shrine, and more were pouring in hourly. Bullock-drawn wagons had come over the winding roads on the northwest side of the Marismas from a score of towns and hamlets. Two teen-age girls told us it had taken five days for their caravan to make the journey from Sevilla.

Oxen and mule trains reminiscent of the American West pulled cartloads of singing señoritas, smiling duennas, and attendant squires. Riders exhibited their horsemanship. Horses curvetted and reared. To the thumping of tambourines, the clacking of castanets, hand-clapping, and singing, the pilgrims converged on the eucalyptus-shaded assembly ground. Each town took its place—not by alphabet or by importance, but in the order of antiquity.

At four o'clock the bells of the church announced the start of the three-hour procession. Each group, led by its first citizens mounted on fine horses and bearing timeworn banners, paraded along the avenue to the church. Double-yoked oxen wearing fabulously embroidered headgear drew ornate carriages containing the replicas of the Virgin (page 420). While the big bells rang, the town delegations presented themselves at the door of the shrine.

The evening was given over to dancing. Everywhere in town, in every building and patio, dozens of couples wheeled and pirouetted to the clapping of hands, the beat of drums, and the wail of fifes. One persistent refrain—*ole! ole! ole!*—was repeated over and over (pages 422-4).

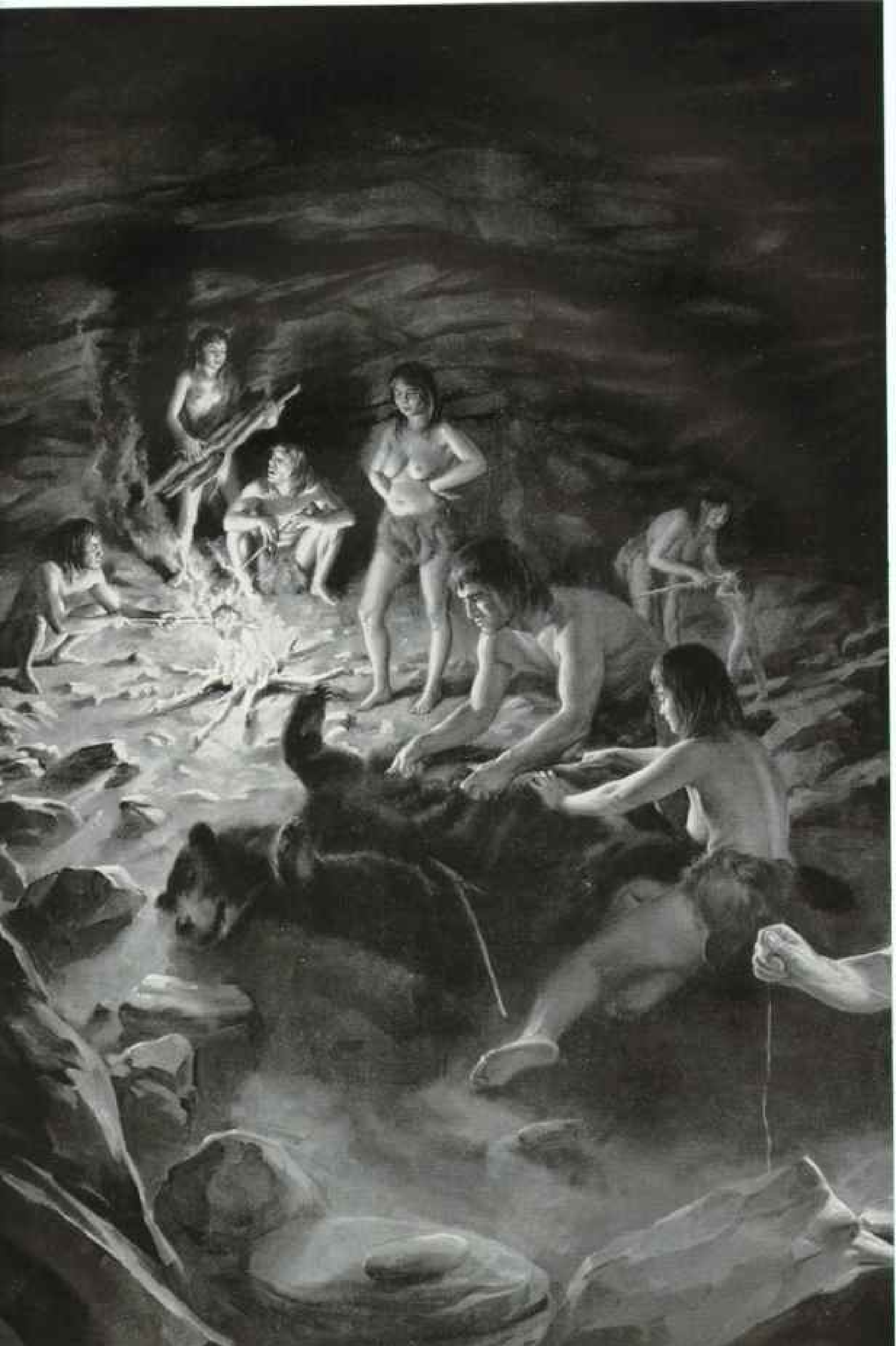
Rockets Light the Way Home

There would be two more days of this celebration, but we went back to the palacio that night. The full moon shone white on the walls of El Rocio as we climbed into the trailer. Roman candles and rockets lit our path as we took the sandy road toward home.

Whenever we stopped to listen to the night sounds, we heard the hollow knocking chant of the red-necked nightjar, a sort of whip-poorwill. Nightingales sang from ferny thickets. A liquid "wet-my-lips" indicated that the quail had just arrived from Africa. The wailing "coo-ree" of a stone curlew broke the stillness of the moon-bathed cistus flats.

It was four in the morning when we pulled into the palacio. Our exhausted driver must have dozed an instant, for as we approached the gate, the big wheels left the road, and we ploughed through the fence. No one was hurt.

But it woke Pepe, who lay curled up on the floor of the trailer. Waking, he picked up where he had left off—*"ole! ole! ole!"*



RUSSELL CAVE:

NEW LIGHT ON STONE AGE LIFE

Latest Excavations Show the Cavern Was Inhabited Nine Thousand Years Ago

By Carl F. Miller, *Leader, Smithsonian-National Geographic Russell Cave Expeditions*

HE WAS short, naked, and desperately afraid. He ran, bending over to make himself smaller, sensing not so much by sound as by hunter's instinct that an enemy was close behind. Suddenly a stone-tipped shaft buried itself, with a stabbing pain, in the muscles of his back.

The warrior stumbled on, hid, and somehow escaped. Then he dragged himself, half paralyzed, back to the sanctuary of his dark, vaulted cave home on an Alabama mountainside, and there he died.

No grave was dug for him. His body, with the stone spear point still in his back, was simply laid on the cave floor and covered with earth and refuse. Life went on around his resting place, as it had for thousands of years and would for thousands more.

This Stone Age American lived and died about 1000 B. C., when David was bringing the Kingdom of Israel to greatness. Yet the slain hunter was a comparative latecomer to the great limestone cavern where his family laid its campfire, ate, and slept. For at least 6,000 years before his lifetime, that opening in a wooded ridge near the present Tennessee border had sheltered primitive men, women, and children.

The remarkable story of Russell Cave in

Alabamians of 8,000 years ago work by firelight in Russell Cave, oldest known home of man in the southeastern United States. To reconstruct the scene, artist Peter V. Bianchi used such clues as a bone lamp and fishhook found on the spot (pages 429 and 435). Actually, the people in this imagined scene may be "overdressed." Archeologists found no evidence that they wore even these scanty garments.

Jackson County, Alabama, has continued to unfold during the second season of excavations under auspices of the National Geographic Society and Smithsonian Institution.*

Layer by layer, as we have delved downward into the cave's floor, we have read from bones, tools, weapons, and ashes of ancient fires a unique record of life on this continent.

In our first season's work, the oldest campfire we discovered proved, by radiocarbon testing, to have burned about 8,000 years ago. Now another hearth uncovered 23 feet down has been tested for carbon 14 and dated as 9,020 years old, plus or minus 350 years.

We have collected as well nearly two and a half tons of artifacts, the discarded odds and ends of an ancient people's life and livelihood. These have given us a more complete knowledge of the people of Russell Cave, though we still face a mystery about some of its very early inhabitants.

We uncovered tools and implements of a type never before found in the southeastern United States. They resemble closely objects of early human cultures in the Far North. Just how and why they came to northeastern Alabama we do not yet know.

Russell Cave was first investigated as a possible home of prehistoric man by members of the Tennessee Archeological Society in 1953. They unearthed stone points, bone tools, potsherds, and Indian ornaments in profusion. Suspecting they had made a major discovery, they notified the Smithsonian Institution's Bureau of American Ethnology, which, in turn, interested the National Geographic Society in the find.

To preserve the site for scientific study, The Society purchased the cave and surrounding 262-acre farm from the owners, Mr. and Mrs. Oscar Ridley, and has made liberal research grants to further the work there.

Our original dig was a 30-foot-long trench along one wall of the huge cavern. The second year we excavated a new section parallel to the mouth of the cave, meeting the earlier trench in a deep L.

Hunter Took to His Grave the Missile That Killed Him

Like a detective sifting debris for clues, the author brushes earth from a skeleton buried about 3,000 years ago; he determines that the cause of death was the white-quartz spearhead near the spine. A later caveman dug into the grave and tossed away the skull (page 432). Spear and arrow points on notebook were found near by.

Illustrations by National Geographic Photographer Bates Littlehales

* See "Life 8,000 Years Ago Uncovered in an Alabama Cave," by Carl F. Miller, National Geographic Magazine, October, 1956.

In this new area, as in the old, our team of local coal miners and college and high school students worked downward in one-foot steps within squares marked by wooden stakes. Each handful of dirt went through wire-mesh screens or was kneaded by hand; anything found was put in a paper bag marked with the exact square and depth. As each bag was filled, another took its place.

Within the first few inches of the present cave floor we found, as we had the year before, relics of Indian life at a time when European colonists were still struggling for footholds on the eastern seaboard. These people, of the so-called Mississippi culture, date from about A. D. 1500 to 1650.

Pottery Marked with Wooden Paddles

Pottery unlike any found the previous summer bore markings left by small, carved wooden paddles pressed against the soft clay. The Chickamauga Cherokees marked their pottery that way. Since the pieces we found all came from one 5-foot square, we could surmise that a small band of Cherokees, or perhaps only a single traveler, camped in Russell Cave just long enough to break a cooking vessel, and then moved on.

Through the next 4½ to 5 feet we again uncovered the floor-by-floor record of generations of Woodland peoples, who preceded the Mississippian era. Bone needles and awls, stone arrowheads, fishhooks, ornaments of pierced mussel and periwinkle shells—all told their mute story.

Imagine with me for a moment Russell Cave as it was then, the home of these stalwart Woodland people.

Each morning the rising sun pours light into the yawning mouth of the great cavern, 107 feet wide and 26 feet high, facing east across the valley at its doorstep. Just below flows the clear, cold stream of Dry Creek, which turns and disappears into the mountainside through an even larger cave next door.

The men soon depart into the forest that rolls away endlessly in all directions. With bows and arrows, stone-headed spears and axes, they hunt deer, bear, wild turkey, raccoons, rabbits, turtles, and snakes. If hunting is poor, they scour the woods for berries and nuts. Growing plants for food, if known at all, is extremely primitive. Why farm, when the forest holds food for the taking?

While the hunters are away, the women and older girls squat at work. Animal-hide canopies stretched between wooden posts keep off dripping water.

Bone Lamp Dispelled the Cave's Gloom

To make torches, Archaic people hollowed the foreleg bones of bears and packed them with bear fat. Painting on page 427 shows such a lamp in use. Constant handling gave the artifact an enduring polish.

The women moisten clay, already cleaned by working it through loosely woven baskets, and roll it into long, supple ropes. These they coil in spirals to shape wide-mouthed jars, some as large as five gallons in capacity. They pinch the coils together to join them and smooth the sides by hand (page 437). Decoration is added to the neck or shoulder of a jar by pressing with carved paddles, basket mesh, or crudely woven cloth. Sometimes they may scratch a design with pointed stones or bones, or paint the pottery with a slurry of red hematite in water. Then they place the jars atop glowing coals to harden.

Other women weave sleeping mats from rushes and cane fibers, scrape bear hides with sharp-edged stone dressing knives, or sew leather bags from supple deerskins. Their smoothly polished bone needles have small,

Russell Cave's Rocky Vault Preserves the Story of Ancient Americans

As big as an auditorium, the limestone cave yawns from a mountainside in northeastern Alabama.

In two seasons of work here National Geographic Society–Smithsonian Institution teams have dug 32 feet into the cave floor and 9,000 years back in time. Stout wire fences protect their discoveries from curiosity seekers.

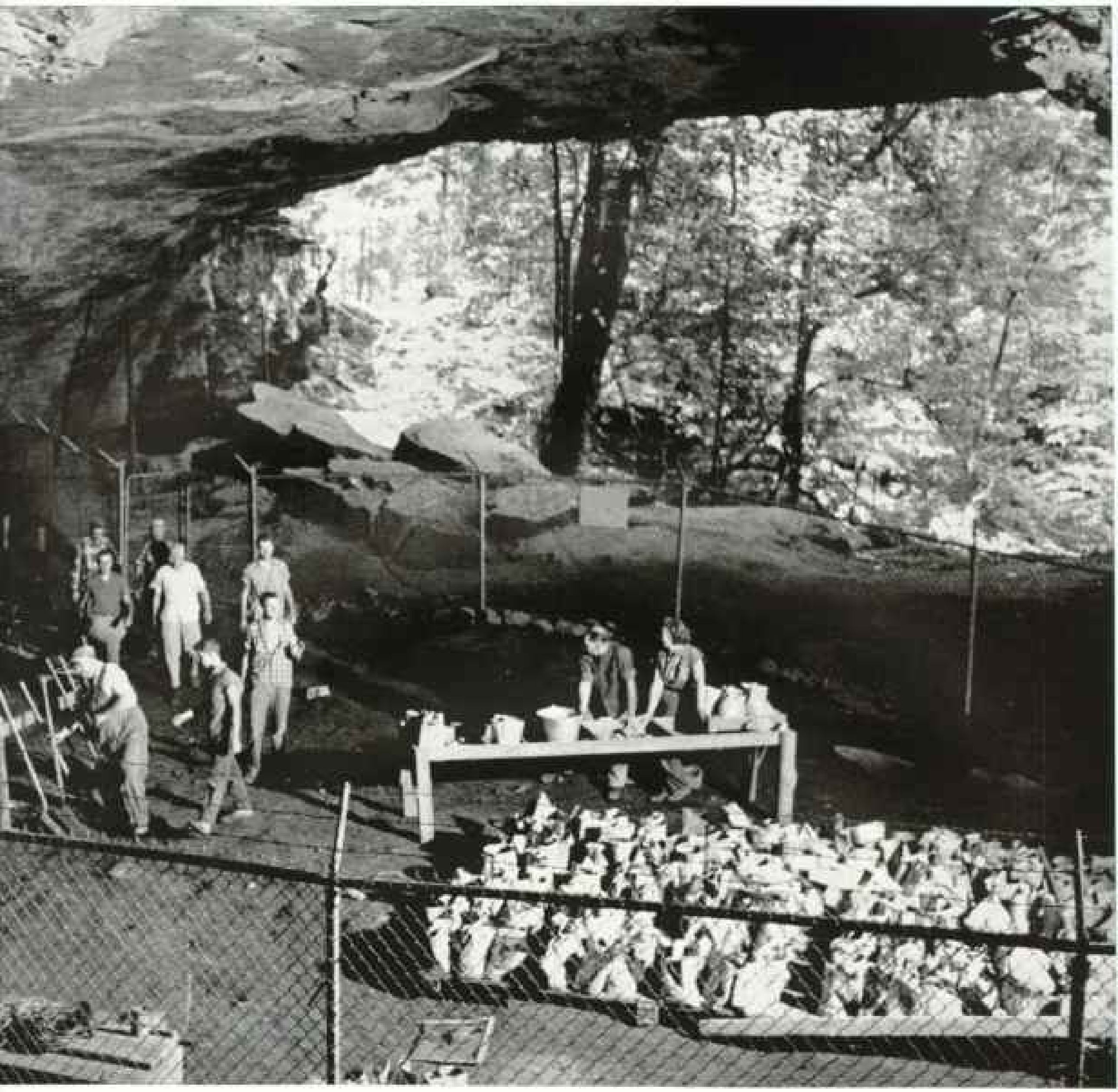
Ladder of time marks each foot of the dig. Most recent Indian remains, only a few inches deep, date from about A. D. 1650. Oldest discovery, the charcoal of a smothered fire, came to light 23 feet down, or 10 feet beneath the lowest sign. Radiocarbon tests have dated it as 9,020 years old, plus or minus 350.

straight-sided eyes, through which they thread animal sinew or gut.

Naked children dash hither and yon about the mouth of the cave, playing the boisterous games of youth. As sunset nears, the men return to divide their kill. If the hunt has been good, no one will go hungry.

Soon each family gathers around its fire to eat, laugh, and boast of the day's experiences. Then the hubbub in the cave gradually dies. Only the glow of dying embers testifies that humans are here, asleep.

Generation after generation this life goes on. Whenever the stench of gnawed bones and piles of rubbish becomes too much for even these untidy people, the women bring in basketfuls of earth and spread a clean new floor. Thus they preserve, for archeologists of the future, a lasting record of their way of life.



In some eras the cave dwellers were better housekeepers, digging pits as storage cupboards for their belongings and as garbage dumps. Some of the pits we found had floors lined with rough limestone blocks, while others were of hard-packed earth. All have proved rich in ancient artifacts, broken pottery, animal bones, and other rubbish of flesh-and-blood folk.

My wife Ruth, who works with me in this fascinating unraveling of ancient American history, came upon two stone axheads unlike any found before in Russell Cave. One was shaped and notched only crudely. The other, fully grooved to fit a notched wooden handle, obviously took long hours of work (page 436). Its maker had chipped and pecked away at the hard rock, smoothing and polishing, and finally had sharpened his weapon to a keen edge.

It must have constituted real wealth to its owner. A primitive man might buy himself a wife by offering such an ax to a girl's father, as the artist depicts on page 437.

We discovered also two hairpins of polished bone, shaped with definite heads like large nails. Thus we can guess that some of these Woodland people were not content with unkempt mops of hair that hung down their backs and around their faces. The pins could have held a sizable coil of hair neatly in place at the nape of the neck.

Infant Buried Near Slain Hunter

At the 4-foot level, in the Early Woodland period, we found the skeleton of a baby. It was so little that it must have been newborn or born dead. Someone had dug a small pit, placed the infant curled on its side in the

hole, and refilled the grave with earth slightly darker than the surrounding soil.

Twenty-five feet away, at the same level, Ruth came upon an adult male, or what remained of him. When we uncovered his skeleton, the skull, neckbones, right collarbone, and upper right arm were missing.

At first I thought he might have been the victim of a gruesome dismemberment while still alive. The taking of heads for skull trophies was not unknown among southeastern Woodland peoples. But the large number of bones that were missing and the grave itself eventually told the story (page 428).

Apparently some later cave dweller, while digging a pit, chanced upon the buried hunter. Not knowing who he was and probably caring less, he simply tossed away the skull and other bones and went on digging.

Very carefully we scraped and brushed the earth away from the part of the skeleton that remained. My wife was the first to notice something else unusual.

"Carl," she said suddenly, "this man was killed!"

Close beside the backbone lay a large projectile point chipped from white quartz. The spear or dart tip had been driven into the body from behind. From its upward angle, it had struck while the man was hunched over, probably running away in the manner we have described. It had either severed or pressed against a major nerve channel along the spine, and must have left his legs completely or partly paralyzed.

No Weapons Left with Indian Dead

Neither in these graves nor in a third at the 9-foot level, where a much older cave man lay on his right side with his knees drawn up to his chest, did we find anything buried with the dead. No ornaments, trophies, or weapons were found with the skeletons, or containers that might have held food or water for the journey to the hereafter.

Perhaps the cave dwellers' possessions were too few and valuable to be relinquished by the survivors, or perhaps all possessions were owned in common, not by individuals.

By the time we had dug down to the 5-foot level, we lost all traces of pottery. Hence we knew that we had gone beyond the Woodland period into the time of Archaic Man, who knew neither the making of pottery nor the bow and arrow.

As his chief weapon, Archaic Man used a primitive spear-throwing device called an atlatl. We found two broken sections of deer or elk antlers that had been cut and shaped like large crochet hooks. These were designed to be lashed to short sticks and the base of darts or spears fitted into them (page 434).

Such hooked throwing sticks gave the hunter great leverage and power for hurling his shafts of wood or stiff reeds, tipped with sharpened bones, antler tines, or stone points. Still used by the Tarascan Indians of Mexico, the atlatl takes its name from the language of the Aztecs, whose prowess with the spear thrower founded an empire.

At 6 feet the nature of the soil changed abruptly to a wet, sticky orange-colored clay. It clung to our shoes, trowels, and shovels, requiring us thereafter to knead each handful, like heavy dough, to find objects buried in it.

New Type of Artifacts Uncovered

It was in this clay that we began finding human artifacts unlike anything ever before discovered in the southeastern United States.

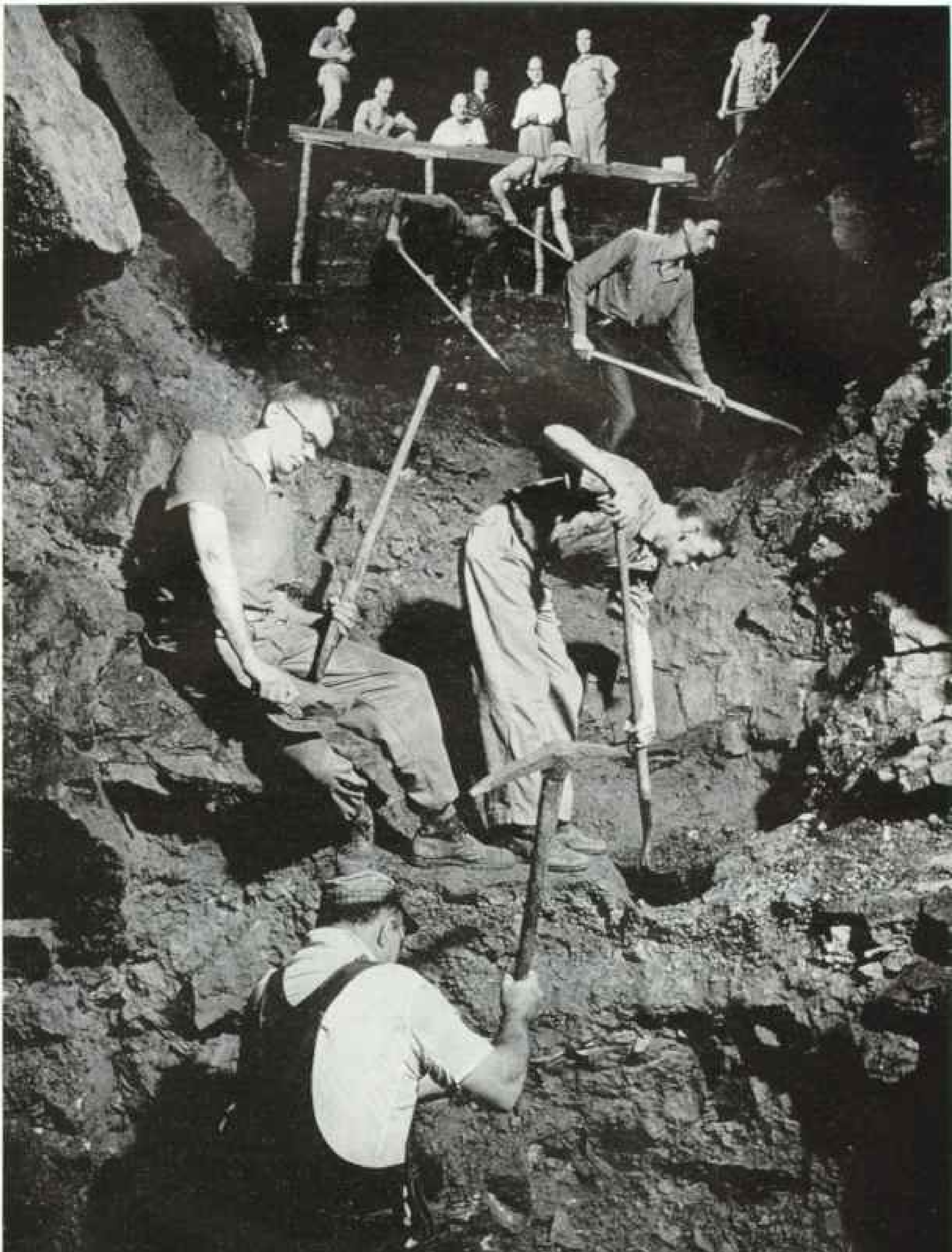
One was a new type of fishhook, unlike those carved by the later Woodland peoples from single bones, such as the toe bone of a deer. The older hooks, from the Late Archaic, consist of two pieces of either bone or wood. They are made to be lashed together by animal sinew or plant fibers into a hinged V (page 435). Once the hook was in a fish's mouth, any pull would force it to open wider and thus plant itself more firmly.

This ingenious device resembles, more than anything else, fishhooks used by much more northern early Indian people and later by the Eskimos. We found other implements that bear this same strange kinship to more northern cultures.

Two polished humeri, or upper foreleg bones, of large bears were unearthed from the same cultural level. Each had been cut cleanly, the edges rubbed smooth, and the inner spongy matter scraped out (page 429).

Bear fat could then be stuffed into the closed tube, as well as some sort of wick. This little torch would flicker with a long-lived smoky flame, giving the cave man light he could carry around like a candle.

What long-forgotten forerunner of Thomas Edison thus gave his people a new means of illumination, no one will ever know. But by the end of the Archaic cultural period—perhaps 5000 B. C.—man had risen to a stage where he could think out such an invention,



Cavern Explorers Cut a Giant's Staircase into the Prehistoric Past

Coal miners and college students carved this step trench, using trowels and brushes, picks and shovels, and even dynamite. The author (at left on platform) shows the dig to Park Service archeologist John Corbett; Conrad Wirth, Director of the National Park Service; Mrs. Miller; and Lyman J. Briggs and Melvin Payne of The Society's Research Committee.

actually make the device, and reap the results of his thought.

We can imagine the Russell Cave inhabitants crouching on their haunches after dark, talking to one another in guttural monosyllables while their lamps flickered in the gloom (page 427). So often were these particular bear-bone tapers used and handled that even today their surfaces shine as if waxed, and the bone has turned a rich amber.

Folsom Man Roamed Alabama

How did such artifacts, heretofore found only much closer to the Arctic, come to be made and used as far south as Russell Cave?

During the last Ice Age, as we reconstruct migration routes of the earliest Americans, there was a slow but steady movement of Paleo-Indians, or Early Man, eastward across the continent.*

We suspect that these wandering hunters roamed the region around Russell Cave 10,000 years ago and more. Folsom Man, so named for the discovery of his delicate and skillfully fluted weapon points near Folsom, New Mexico, in 1926, left similar relics of his passing within a few miles of Russell Cave in both Alabama and Tennessee.

Later there were movements of peoples of Archaic culture both north and south along the Appalachian Mountains. Those coming south may have brought customs, tools, and tool-making methods from the Far North. In a curving region around the southern end of the Appalachians, in what is now Alabama and Georgia, these northerners met people from the West and South.

Our discovery of jointed fishhooks, bear-bone lamps, and small knife handles made of grooved bear teeth, as well as such devices as the atlatl, suggests that Russell Cave lay in this ancient meeting ground. It thus gains added significance as a key archeological site, offering greater understanding of ancient human movements in North America.

In our first year's work, less than 14 feet beneath the present cave floor, we found charcoal evidence of human life dating back more than 8,000 years. As we passed this

* See "Ice Age Man, the First American," by Thomas R. Henry, NATIONAL GEOGRAPHIC MAGAZINE, December, 1955.

Giving the Arm More Leverage, Atlatl Hurled Spears Farther and Faster

Aztecs used and named the atlatl, which in North America long preceded the invention of the bow and arrow. This notched deer antler capped the end of a short throwing stick that crumbled to dust long ago. A warrior fitted the butt of his spear into the notch and whipped his guided missile into the air as if by catapult. The pointed bone in hand tipped the shaft. Atlatl at right shows the bone's hollowed end.

level and went deeper the second year, we worked in constant anticipation of still older finds, artifacts such as Folsom points, that would prove the presence of Early Man in the cave.

Disappointingly, our finds grew fewer and fewer the farther down we progressed. The deepest point we found, at the 16-foot level, showed enough similarities to points of the Folsom period to permit it to be attributed to Early Man himself. We knew, therefore, that this level represented the beginning of Archaic culture and the end of the earlier Paleo-Indian period.

Campfire Burned 9,000 Years Ago

Below that we found only chips of chert, suggesting that stone tools might have been made in the cave during this older era. Interspersed with the chips were many animal bones, either whole or broken, and specks and lumps of charcoal to hint that man inhabited the cave so long ago.

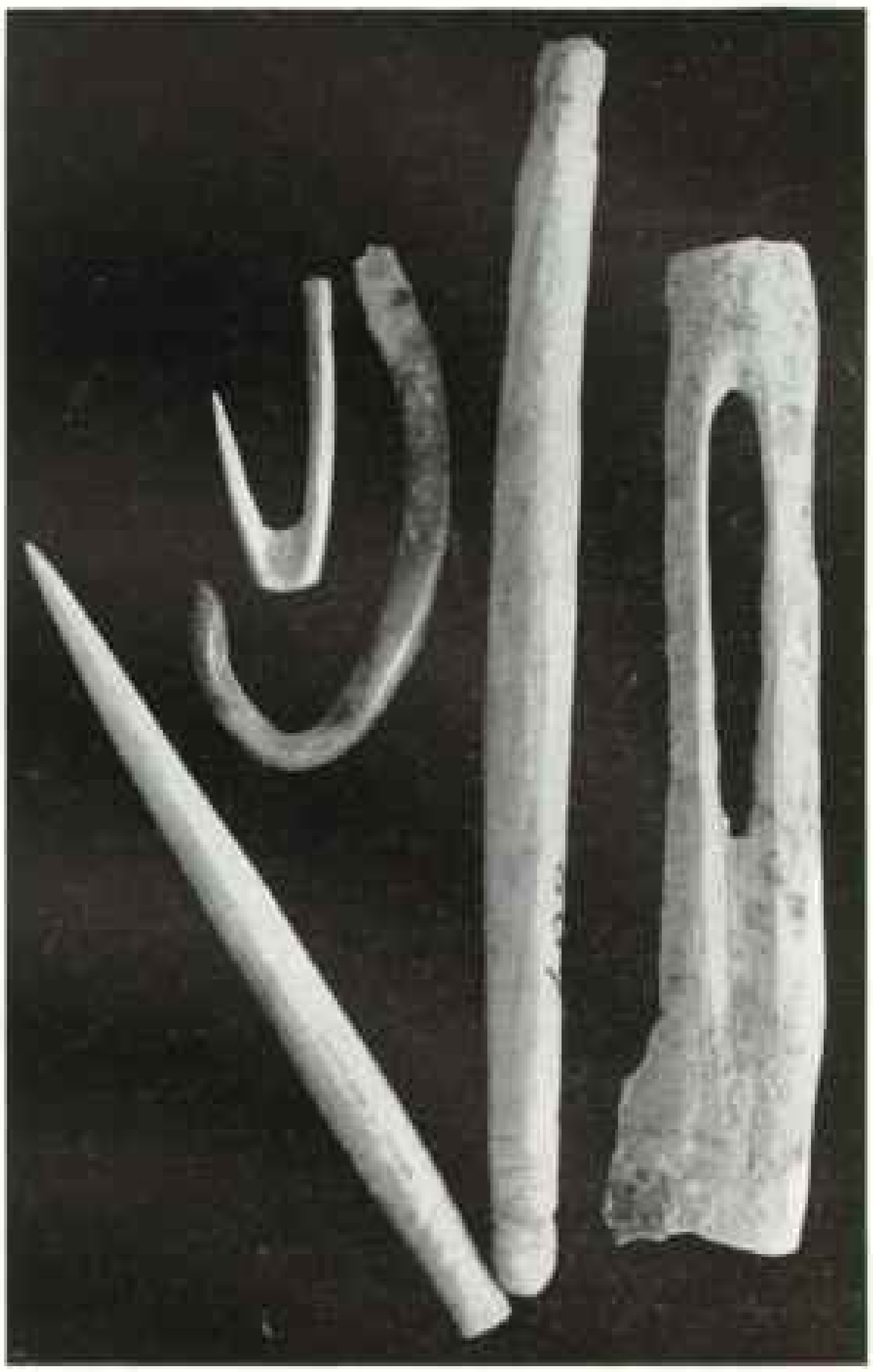
Then, at 23 feet, we found a small pocket of charcoal next to the north wall. Using trowels and brushes with great care, I gathered as much of this charcoal as possible, sealed it in a quart fruit jar and wrapped the jar with aluminum foil to shield it from any airborne radioactive contamination.

I sent the sample to the radiocarbon laboratory of the University of Michigan at Ann Arbor, as one of the first of the new Russell Cave findings to be tested. There Professor H. R. Crane determined that the charred embers had burned some 9,000 years ago.

Thus our record of human occupancy of Russell Cave was extended back well within the era of Early Man. No other archeological site in the southeast has yielded a layer-by-layer cross section of continuous human life over so long a period.

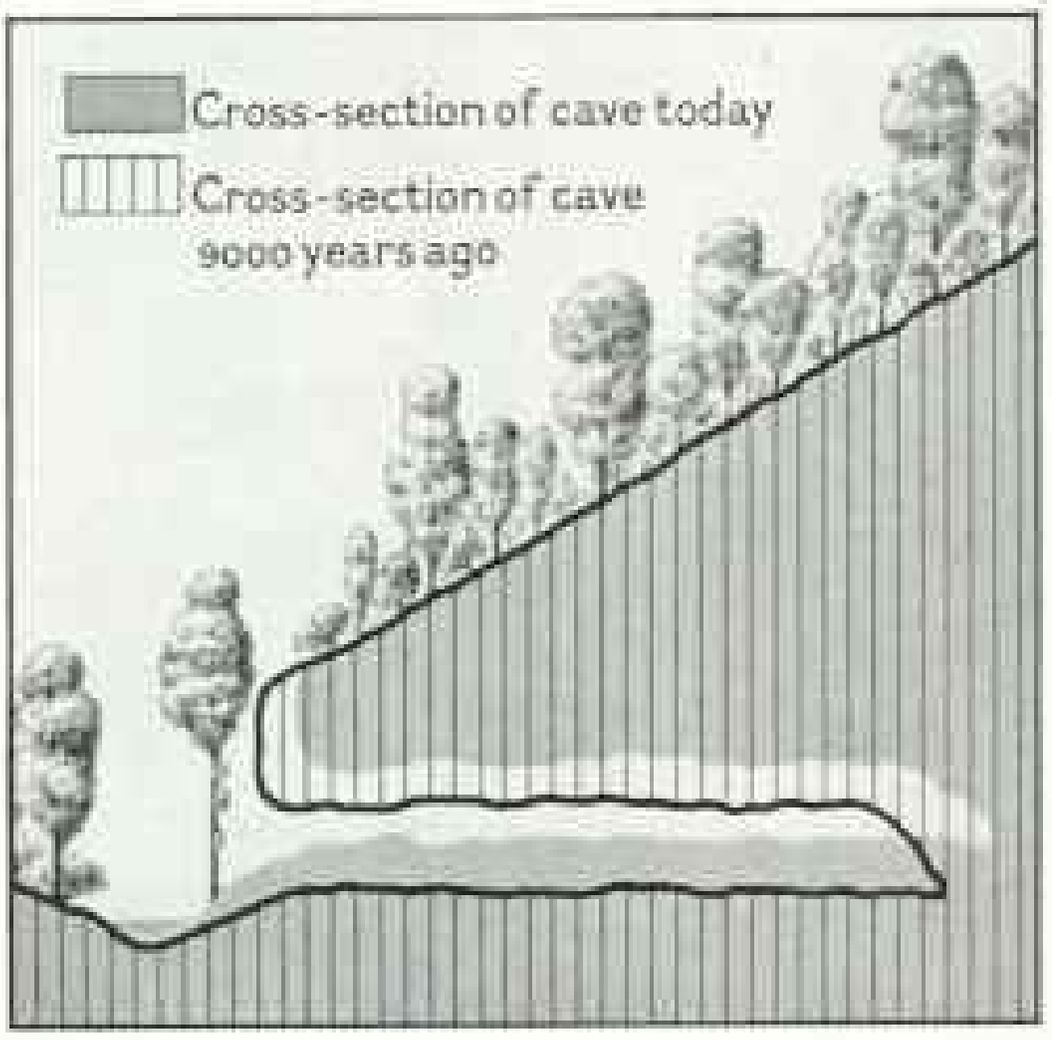
As we probed deeper into the story of those thousands of years, again and again we struck limestone slabs and jumbled blocks that had fallen from the roof of the cave. They must have been a danger to those ancient cave dwellers a million times more fearsome than as if all the plaster on your living room ceiling were to drop in on you some evening. Yet each time we found the signs of later occupancy covering the rock falls.

These slabs prevented us from probing with long rods for the original floor of the cave. We had to break many of them by dynamite as we dug downward. John Vinson and Fred (Red) Blansett, members of our team of experienced coal miners, knew just how to ex-

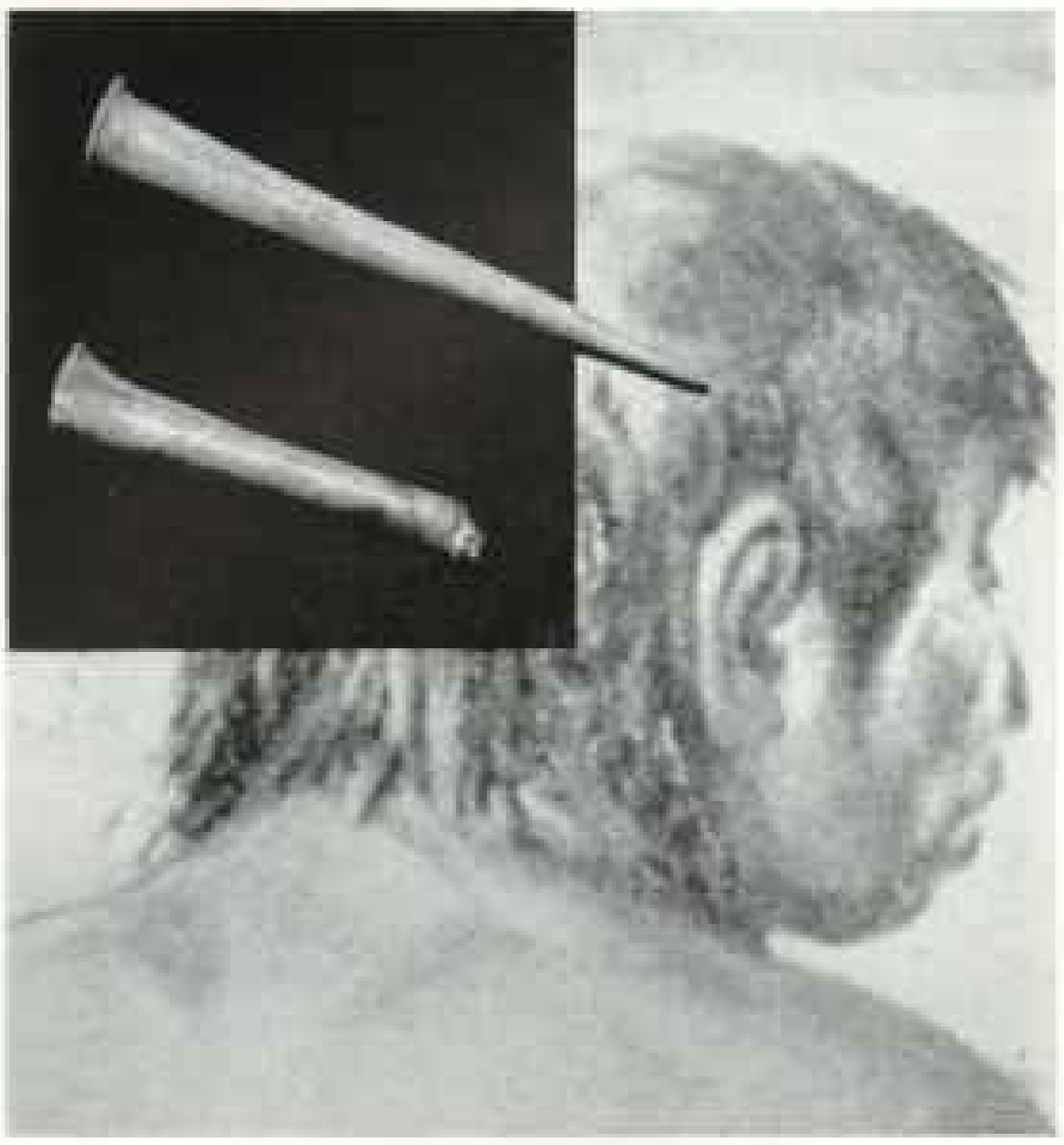


Hinged Fishhook Puzzles Science

Large two-piece hook, once lashed at the base to form a V, resembles those made by Indians and Eskimos of the North. Its discovery as far south as Alabama raises new questions about early migrations across the North American Continent. Later Woodland peoples slotted pieces of deer bone, as at right, then ground them into smaller, one-piece hooks.



As the roof fell, the floor rose. Limestone slabs from the ceiling and debris from human occupation lifted the cave's level 23 feet in 9,000 years.



Bone pins held shaggy hair back from the face. These pins, worn by women in the painting, were found in Russell Cave at the Woodland level.

Stone axheads show a wide gap in craftsmanship. Crudely flaked, notched variety (upper) took far less work than the carefully shaped weapon shown below and opposite. The groove around its neck fitted a notched wooden handle.

plode their charges to reduce the rock to manageable sizes without damaging the dig itself.

Whenever possible, we set off our blasts at the end of a working day, to allow the acrid fumes to dissipate overnight. The morning after our most powerful dynamiting, we were hard at work removing the rubble when a thunderous rumble of falling rock made us duck instinctively.

Hidden Chamber Abuts Russell Cave

But the rockfall was not within the cave, nor was it outside and above us on the mountainside, where several visitors to our digging were standing. One woman, in fact, was terrified for fear all of us in the cave had been buried. The slide seemed to have occurred just beneath her feet.

A hidden chamber must abut Russell Cave within the mountain, we realized. Rocks disturbed by our blast of the previous day had given way in an unseen slide.

When we tapped on the cave's north wall, a distinct hollow sound returned to us. Excitedly we cleared away more of the dynamited rock and found the rock face beginning to slope away from us, undercutting at a sharp angle. We thought we had found an opening, when the wall again dropped off vertically.

Farther and farther we dug, and still we found no mouth to the blind cavern. Finally, at 32 feet, we struck water. There was little chance of continuing without pumping equipment. Since our digging season had also run out, we gave up reluctantly for the year.

Though we still do not know how much deeper the deposits of Russell Cave may extend before we reach an original floor, the bones, tools, weapons, and ancient fires we found have already provided ample reward for our labors.

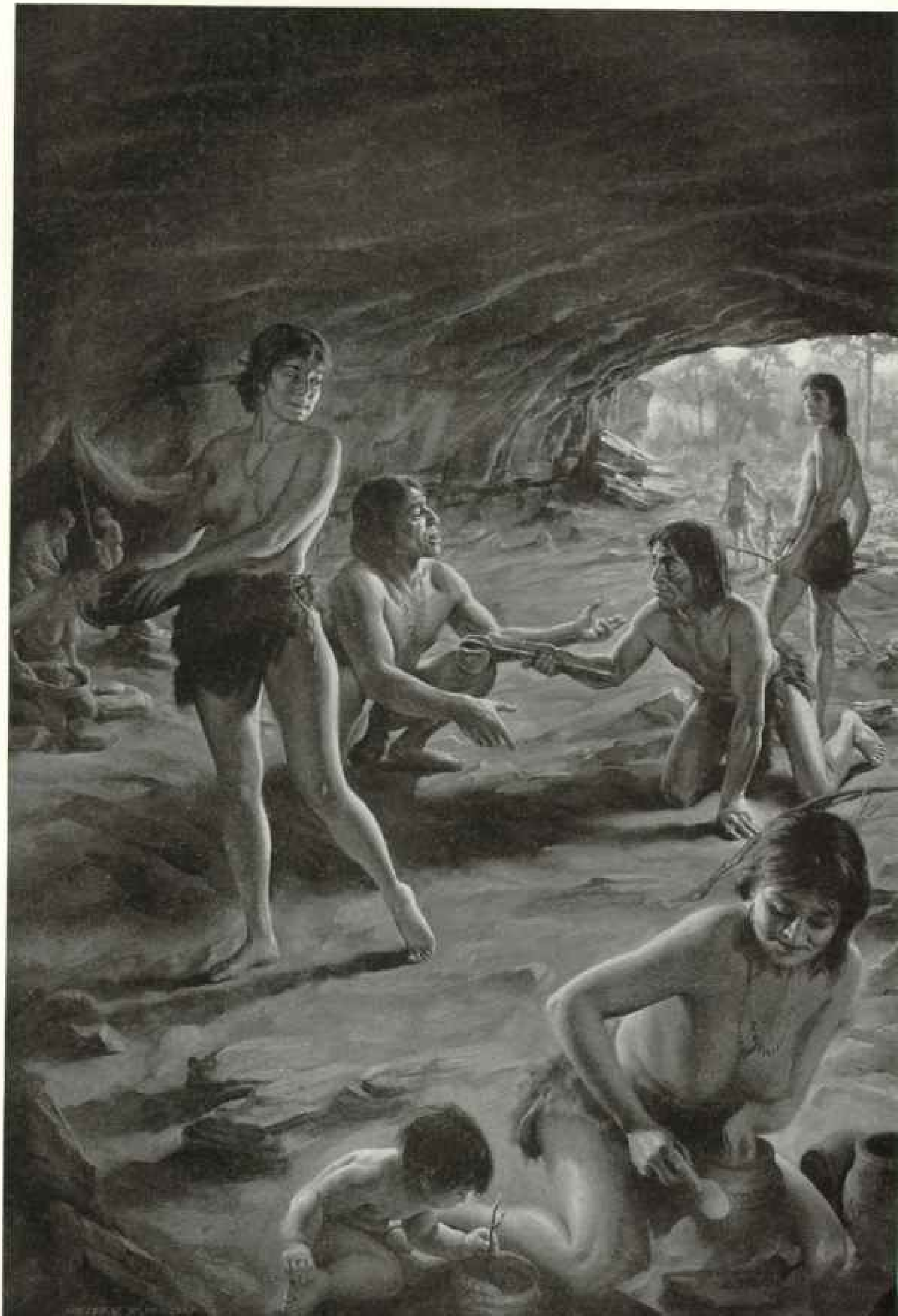
We have proved the cave a unique timetable of human existence in North America. Whether or not we find even older relics of Early Man, we have gained new understanding of forgotten Americans who lived, slept, and died in Russell Cave so long ago.

Young Cave Man Offers His Treasured Stone Ax as the Price of a Bride

Re-creating a scene from the Woodland era, the artist depicts a suitor bargaining with his prospective father-in-law. Eavesdropping, the girl brings a basketful of clay for her mother's pottery making. Bow and arrow carried by the hunter succeeded the atlatl as the chief weapon of Woodland times. Hides stretched between poles ward off dripping water.

The artist has painted these cave people in scant attire; the author believes they wore no clothing at all.

Painting by Peter V. Bianchi © National Geographic Society



National Geographic Society Presents Russell Cave to the American People

By Melville Bell Grosvenor

President and Editor, National Geographic Society

I AM HAPPY to announce to members of the National Geographic Society that Russell Cave—a cross section of 9,000 years of American prehistory—has been presented by your Society to the people of the United States for preservation as a national archeological monument.

Official steps have been taken to make the cave a part of the National Park System, said the Honorable Fred A. Seaton, Secretary of the Interior, in thanking and congratulating The Society "for its generous and farsighted offer."

To the officers and trustees of the National Geographic Society, and I am sure to members everywhere who have followed the reports of these fascinating excavations in their Magazine, this assurance brings profound satisfaction. It guarantees the conservation and wise development of this unique treasury of archeological knowledge for the education and enjoyment of future generations.

For this happy result much credit should go to our friends of the Smithsonian Institution—notably to its Secretary, Dr. Leonard Carmichael, and Dr. Matthew W. Stirling, who brought the cave to the attention of The Society's Research Committee as a worthy subject for investigation, and to the expedition leader, Carl F. Miller.

Almost at once it became apparent that here was a discovery of major importance, and to safeguard the cave the National Geographic Society in 1956 purchased the entire 262-acre farm on which it is situated.

Now the site containing this limestone cavern in Jackson County, Alabama, where Early Man's campfires flickered at least 90 centuries ago, will take its place in the National Park System alongside other priceless possessions to whose preservation your Society has been privileged to contribute.

"For more than 40 years the Park Service and The Society have worked together to preserve America's priceless heritage," National Park Service Director Conrad L. Wirth recalled recently. Among specific examples he mentioned the Valley of Ten Thousand Smokes in Alaska, Carlsbad Caverns and Pueblo Bonito in New Mexico, and the giant sequoias of California.

"Russell Cave," he observes, "has taken a unique place in the treasury of America's past. And now, thanks to the vision of the National Geographic Society, it will rank high among the treasures being safeguarded for America's future."

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

JAN - 9 1958

Dear Dr. Grosvenor:

It is a great pleasure for me to thank and congratulate the National Geographic Society for its generous and farsighted offer to donate to the people of the United States, Russell Cave, Alabama, and adjacent acreage suitable for its establishment as a national monument.

The continuous and unique record of human occupation of Russell Cave for over 9,000 years makes this site one of the most important scientific archeological areas east of the Mississippi River.

The Advisory Board on National Parks, Historic Sites, Buildings and Monuments, considers Russell Cave to be of national significance. Upon the Board's recommendation and that of Director Conrad L. Wirth of the National Park Service, the Department of the Interior has initiated those official steps required to bring about the establishment of Russell Cave as a unit of the National Park System.

It is a great privilege to cooperate with you and the National Geographic Society in achieving so important an undertaking.

Sincerely yours,

Fred A. Seaton
Secretary of the Interior

Dr. Melville Bell Grosvenor
President, National Geographic Society
16th & M Streets, N.W.
Washington 6, D.C.

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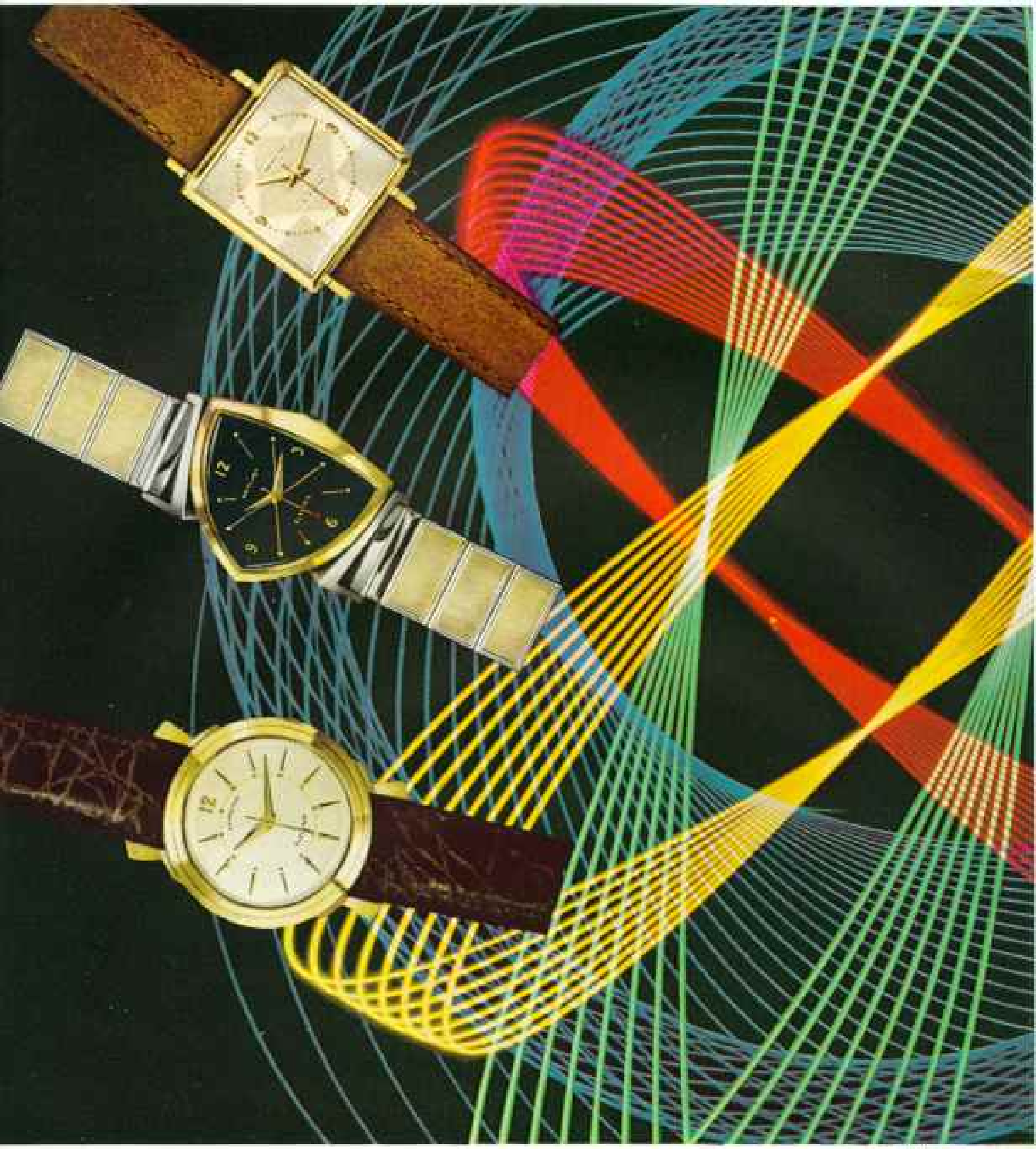

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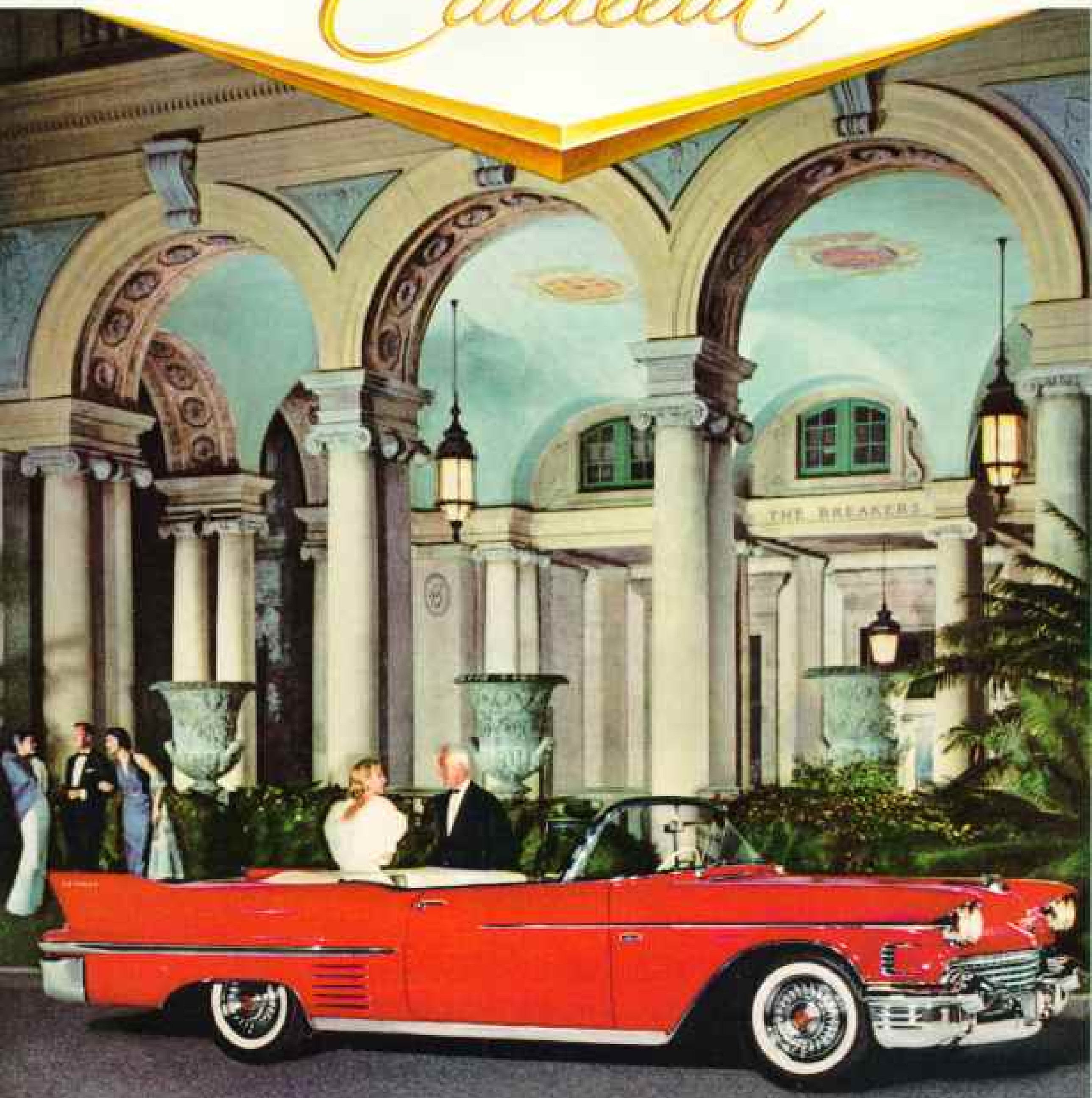
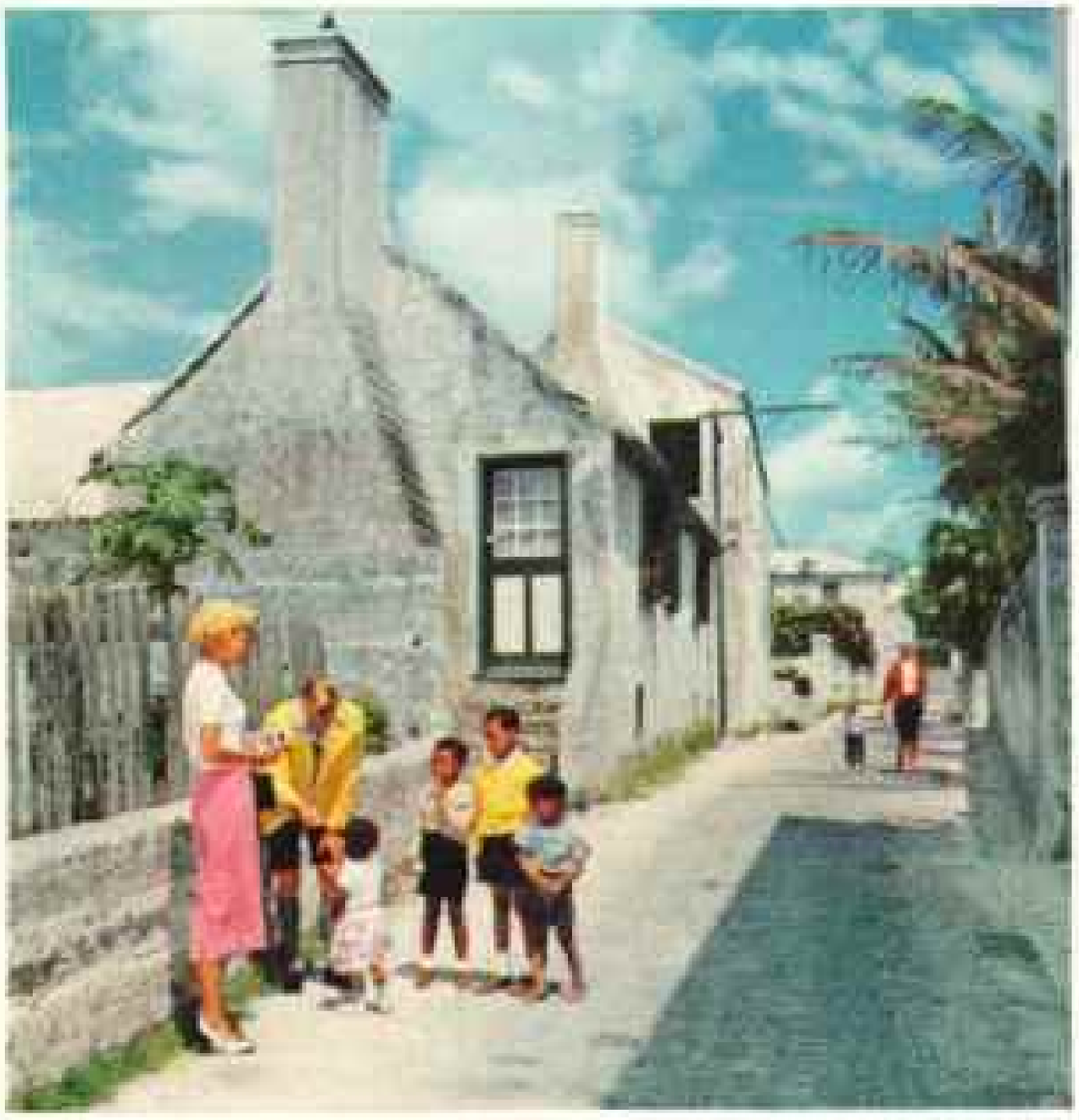


FIRST CORRESPONDENT REACHES SOUTH POLE

At the Pole, marked by a ring of oil drums, National Geographic staff man Thomas J. Abercrombie, 27, unfurls The Society's sea-earth-sky flag. First press representative on the spot, he lived and worked for weeks with Paul Siple's bearded "natives"—first men to winter at the Pole (see next month's GEOGRAPHIC).



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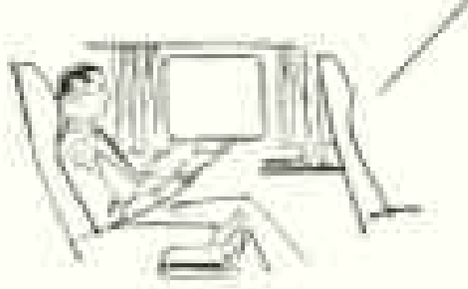

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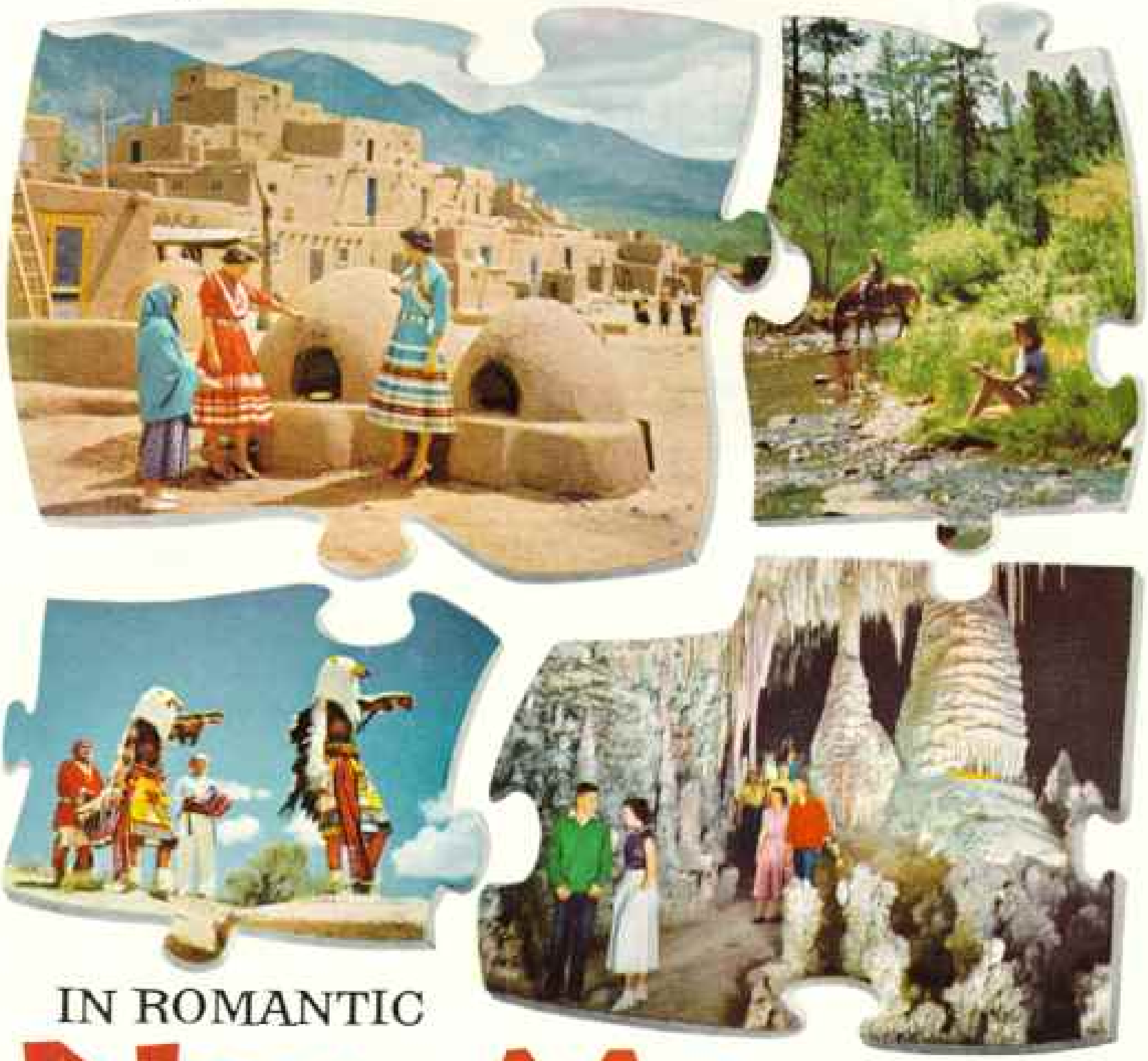

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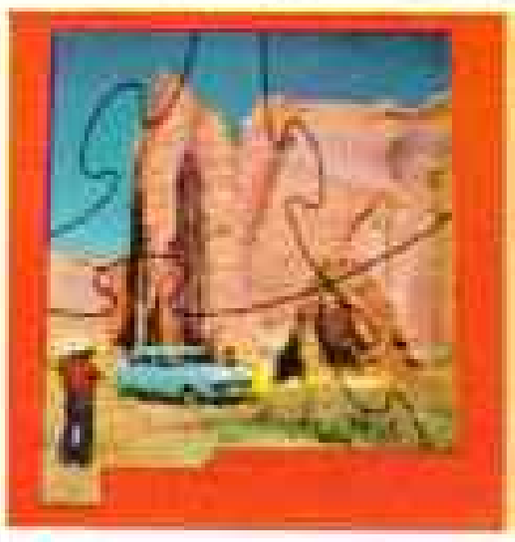

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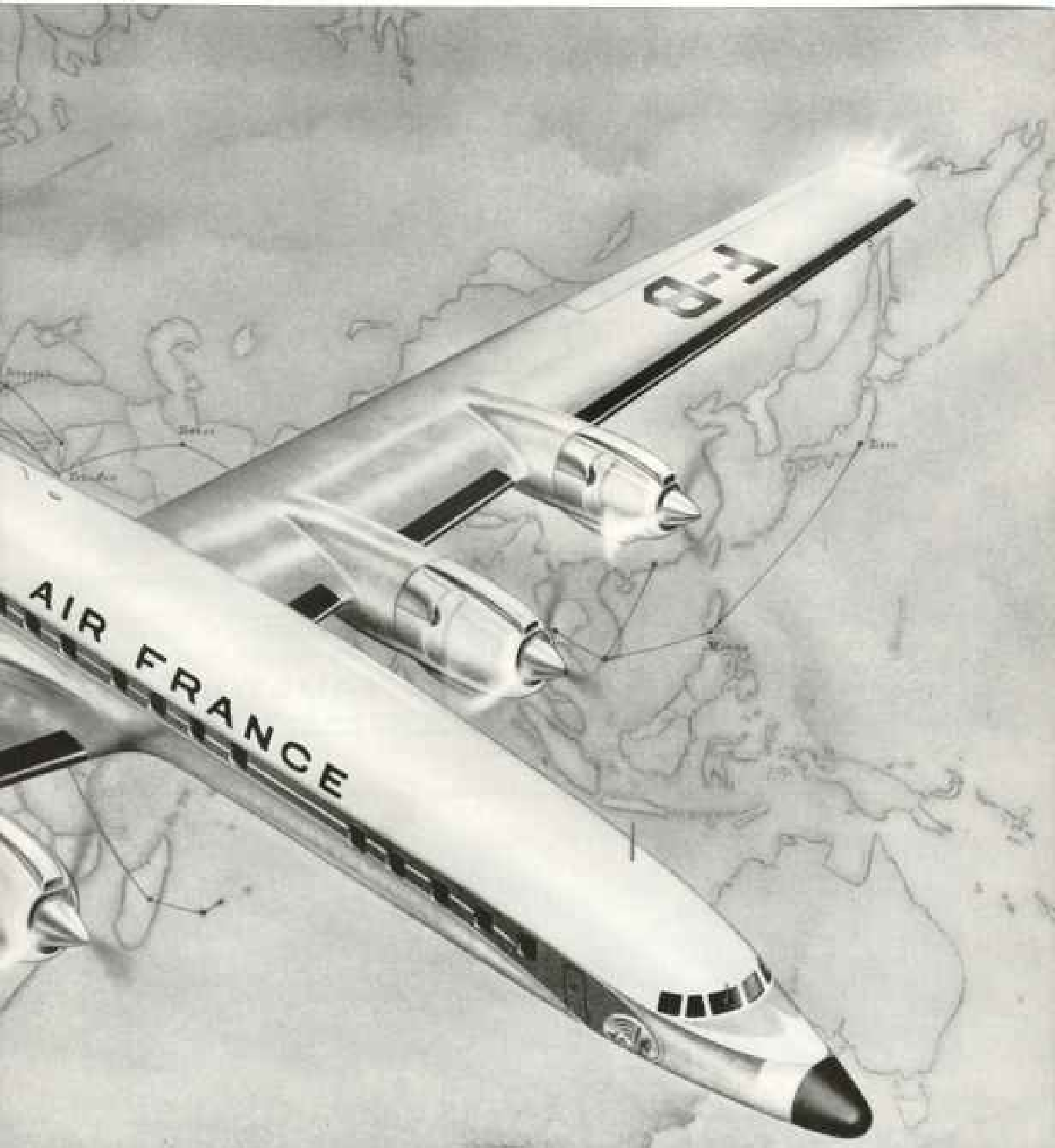

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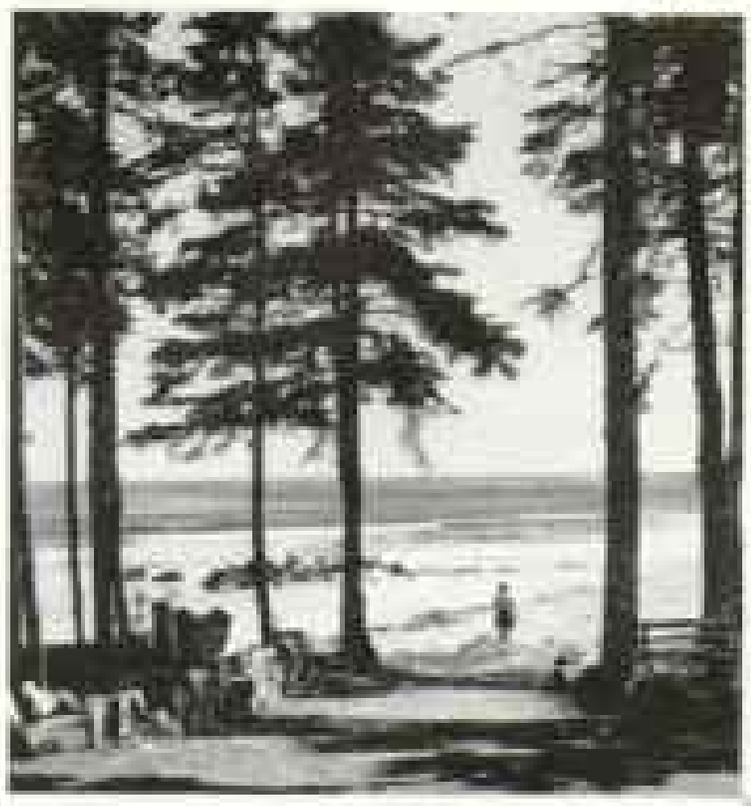

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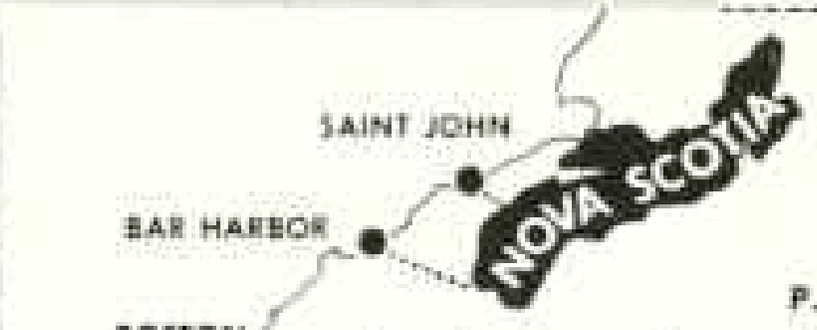

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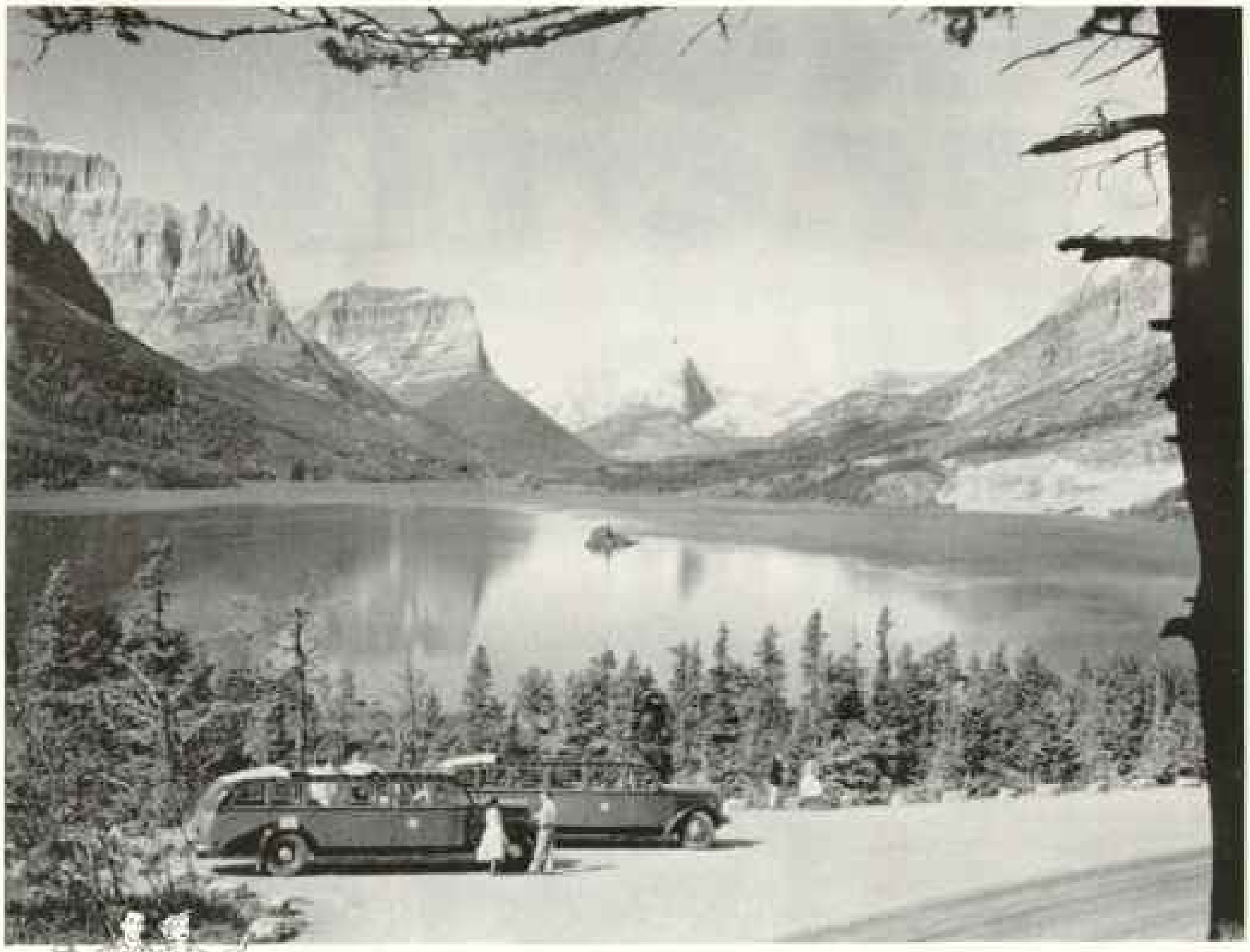

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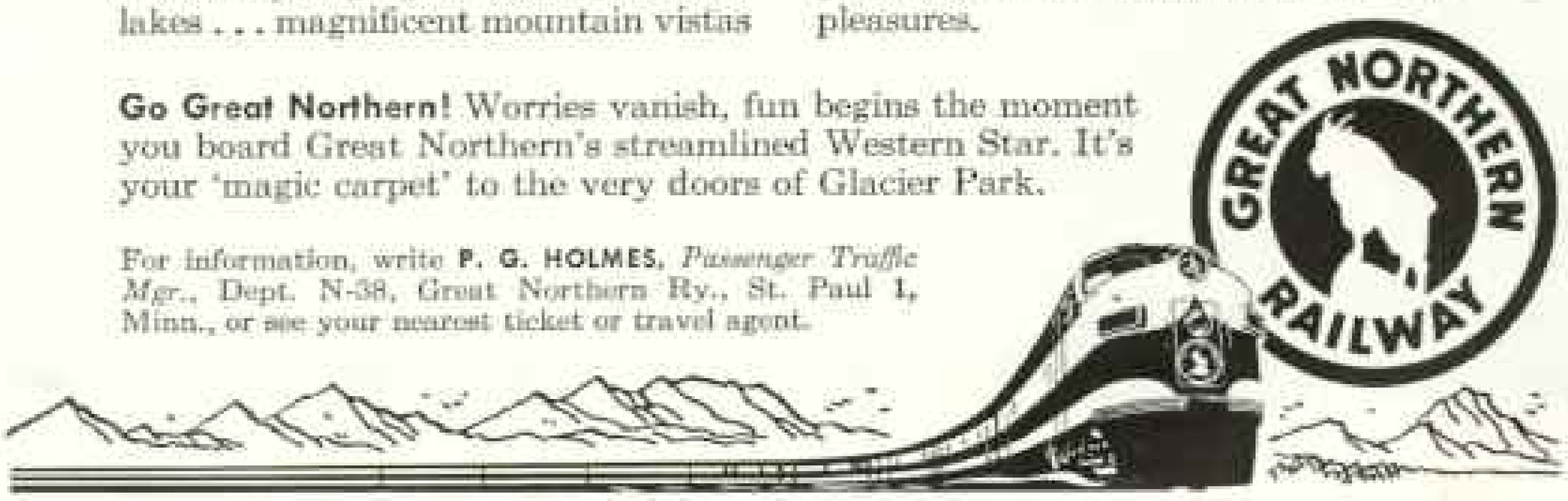

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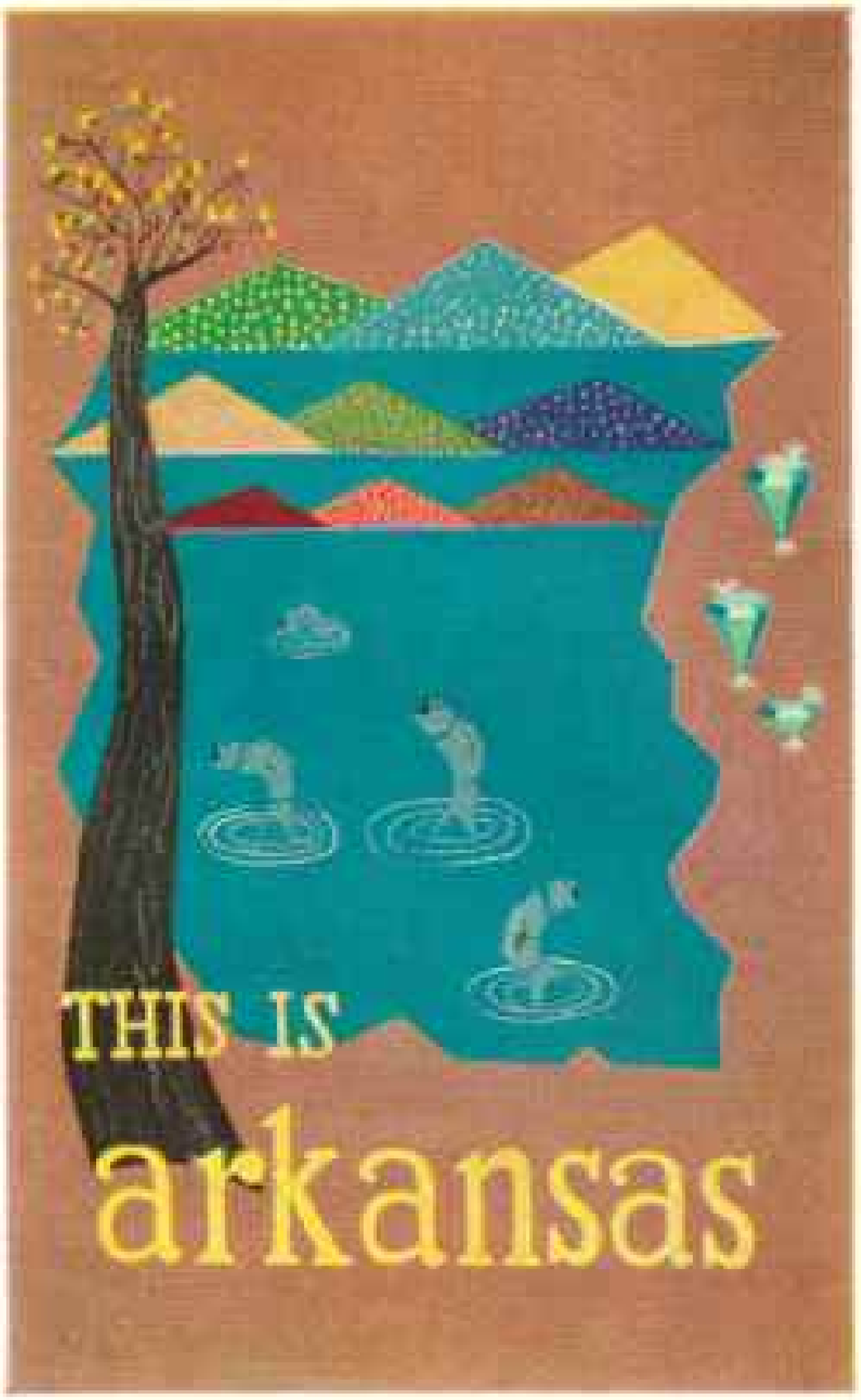

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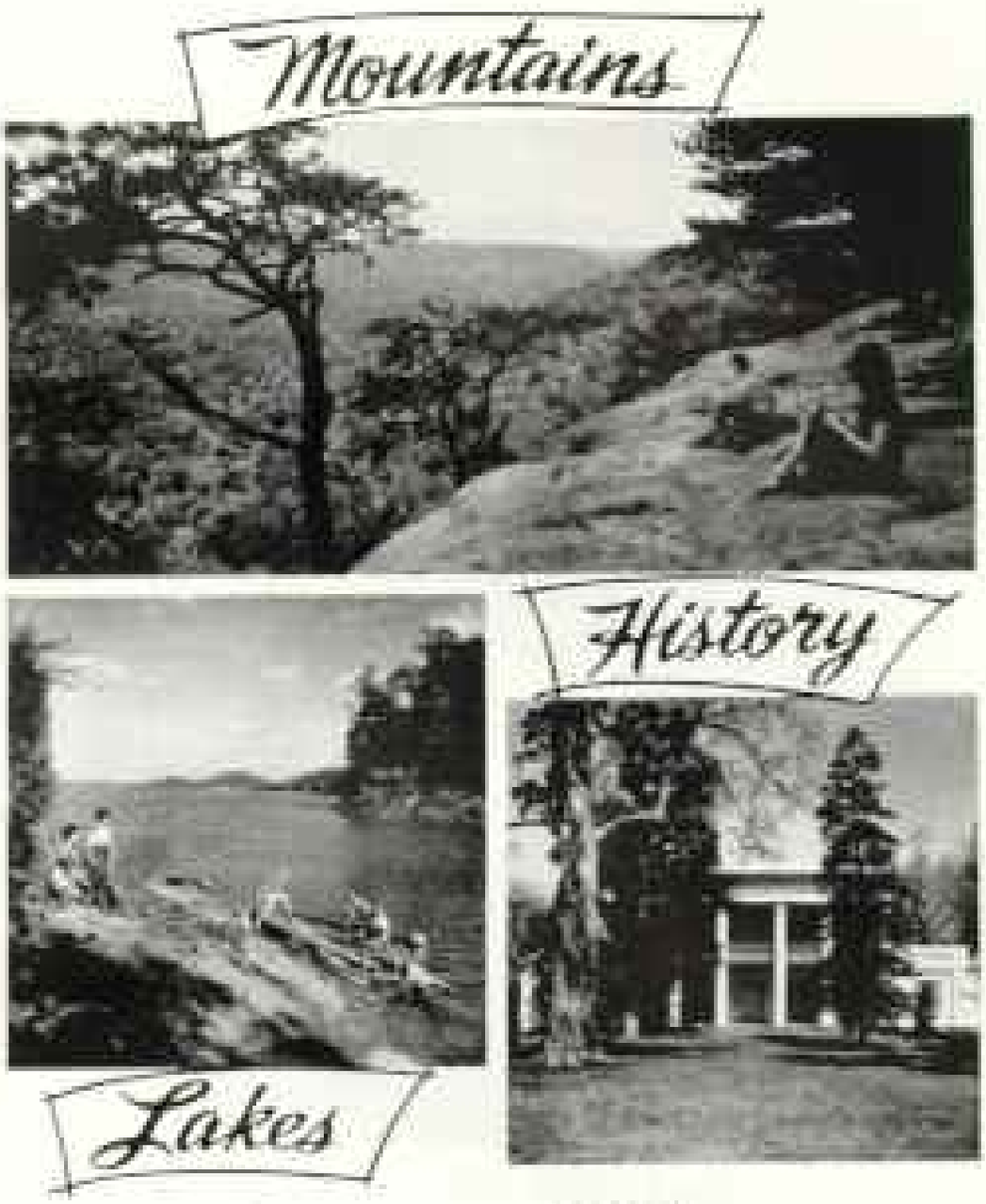

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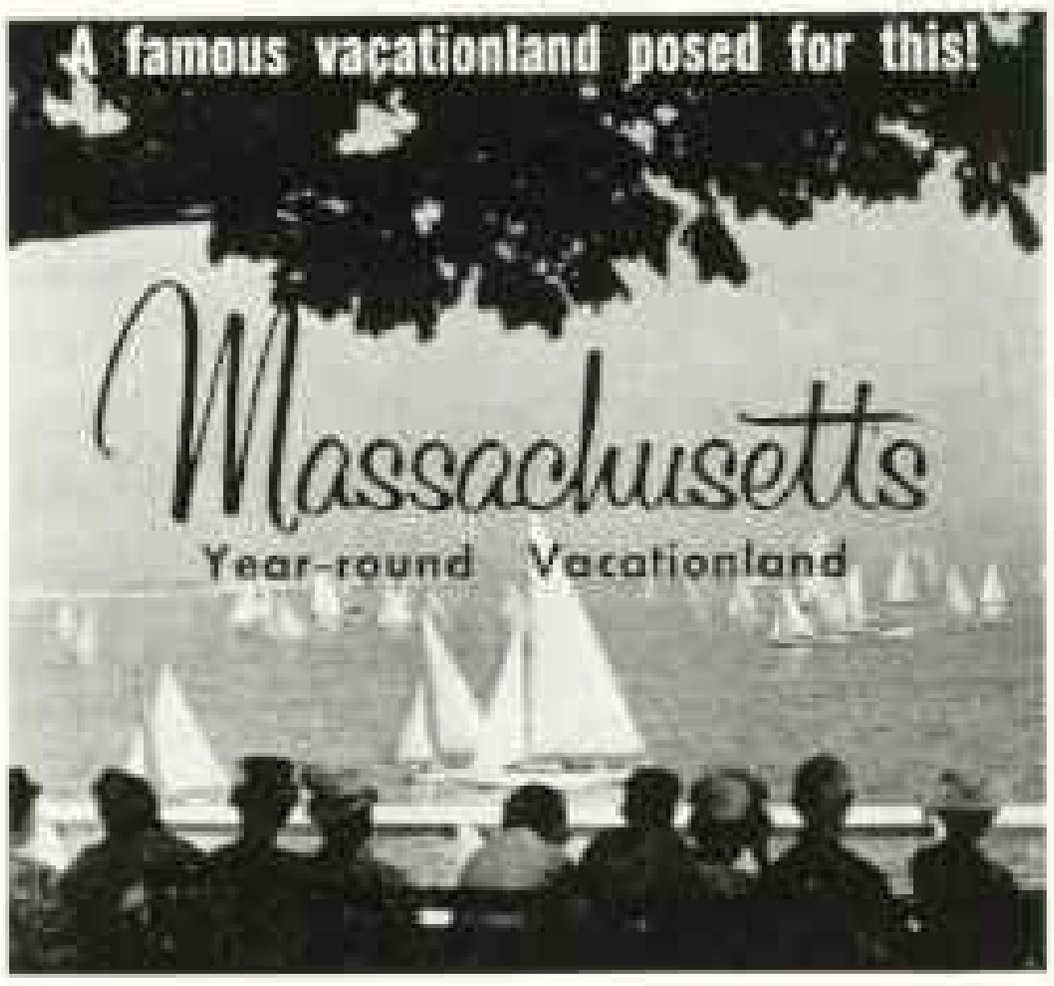

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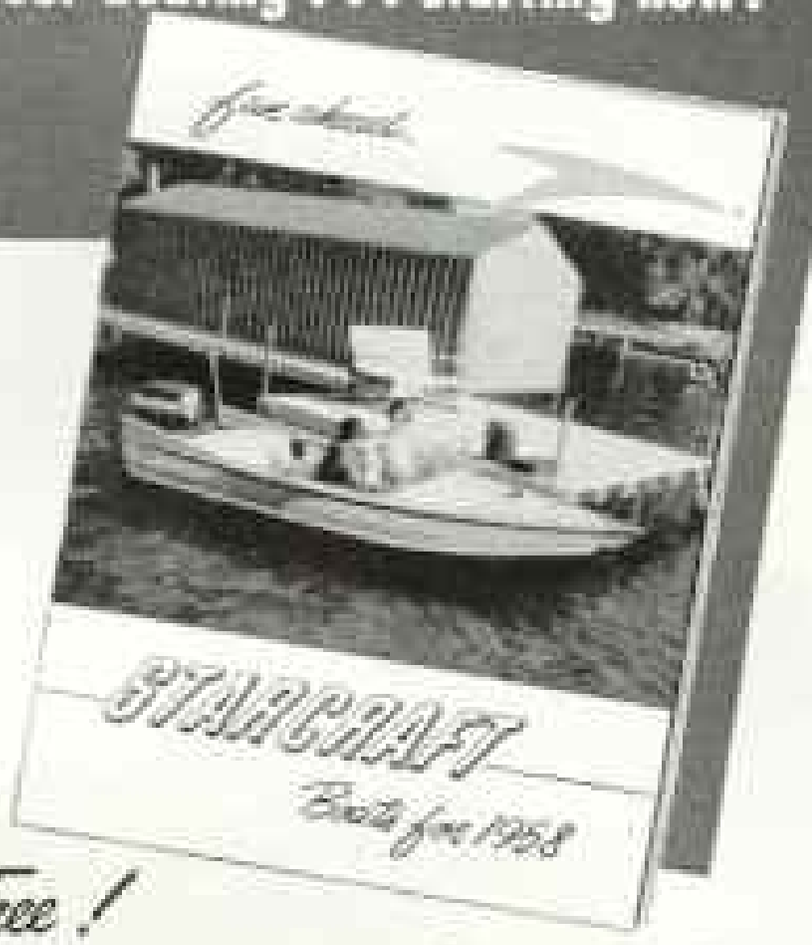

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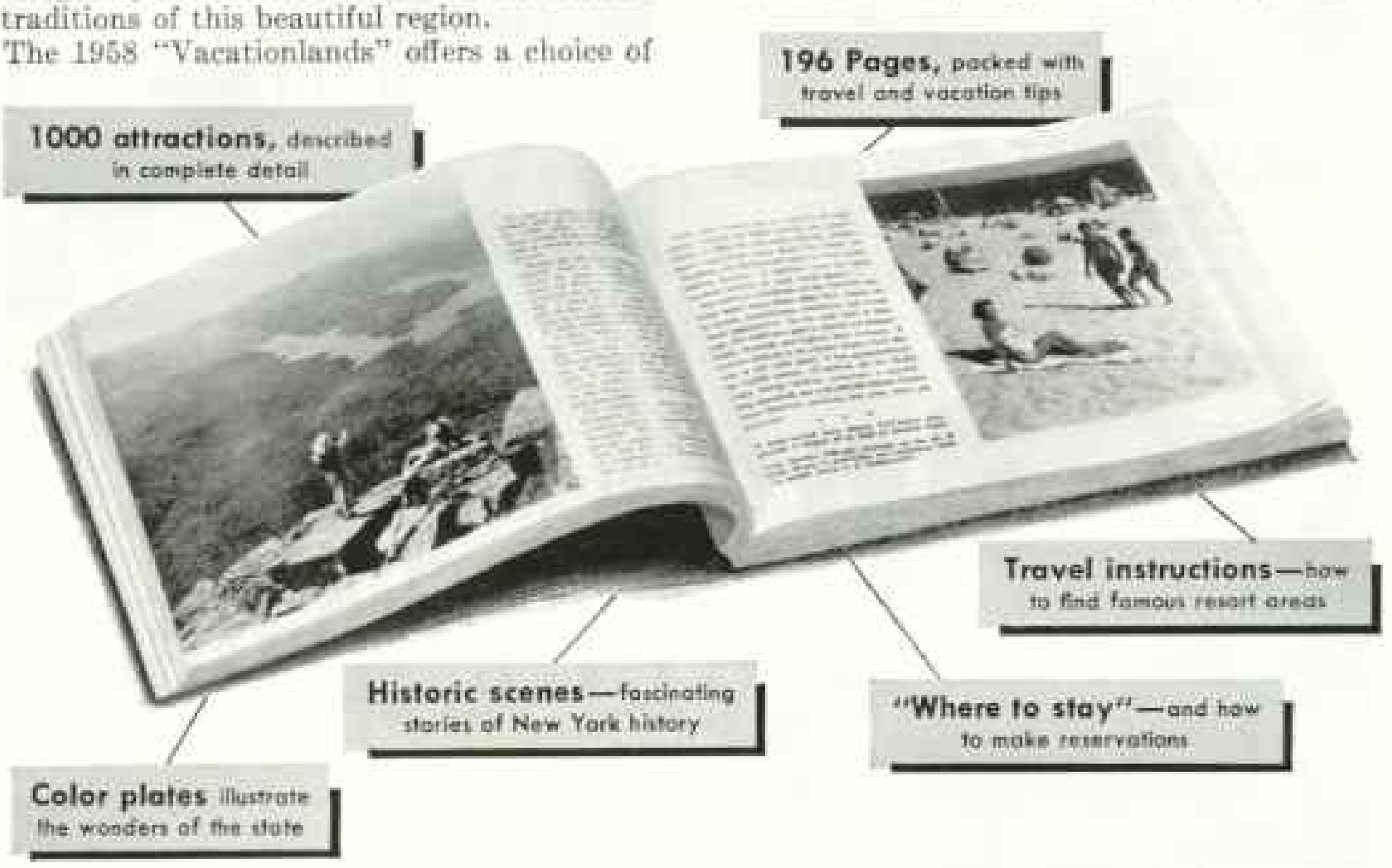

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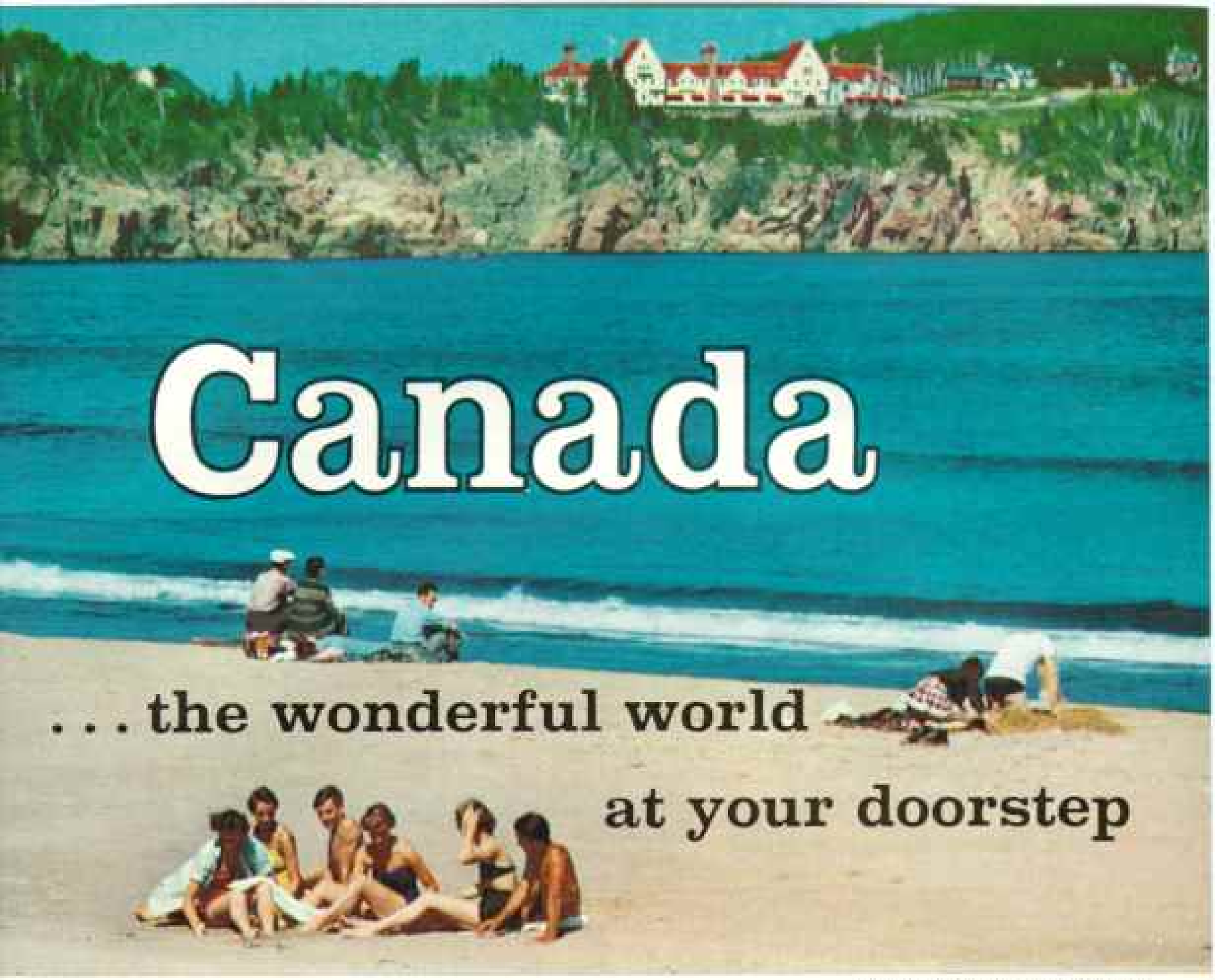

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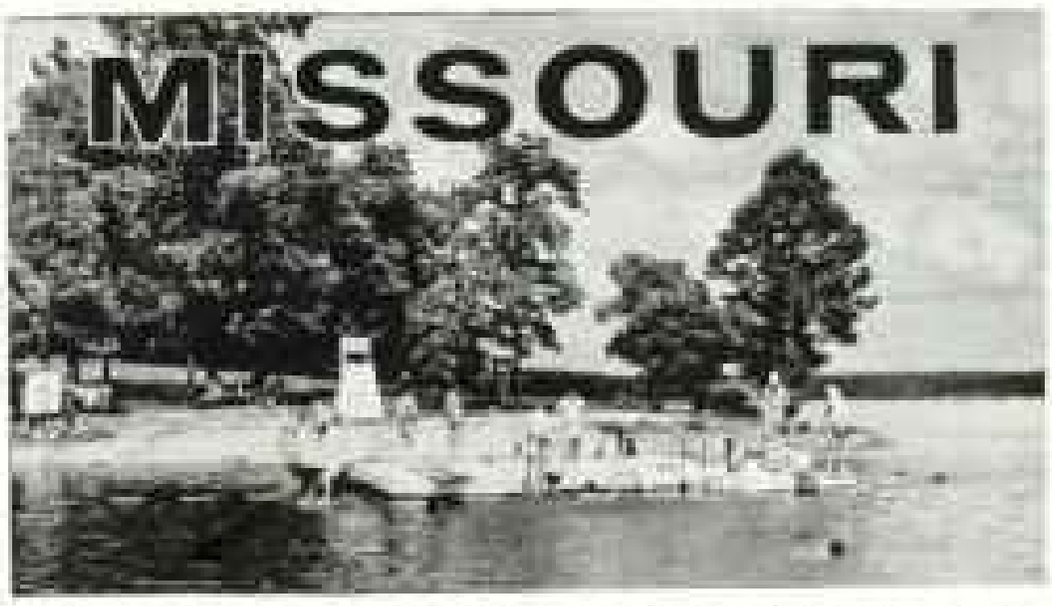

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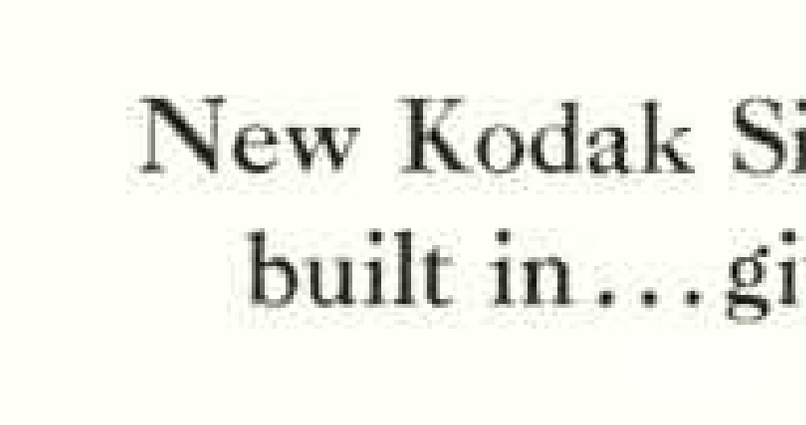
This fine 35mm camera takes the guesswork out of exposure with a built-in photoelectric meter. It has the new, simplified Light Value System . . . a fast, superbly sharp *f*/2.8 lens . . . and single-stroke film advance lever. Ask your photo dealer to demonstrate this new camera. With flasholder and two reflectors, it's only $82.50, or as little as $8.50 down. Also see the Kodak Signet 30—the same camera, without exposure meter and flash equipment—for $55. (Prices are list, include Federal Tax and are subject to change without notice.)



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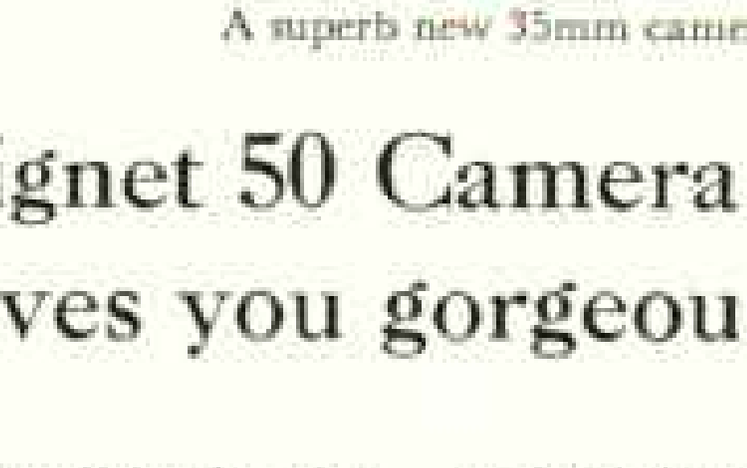

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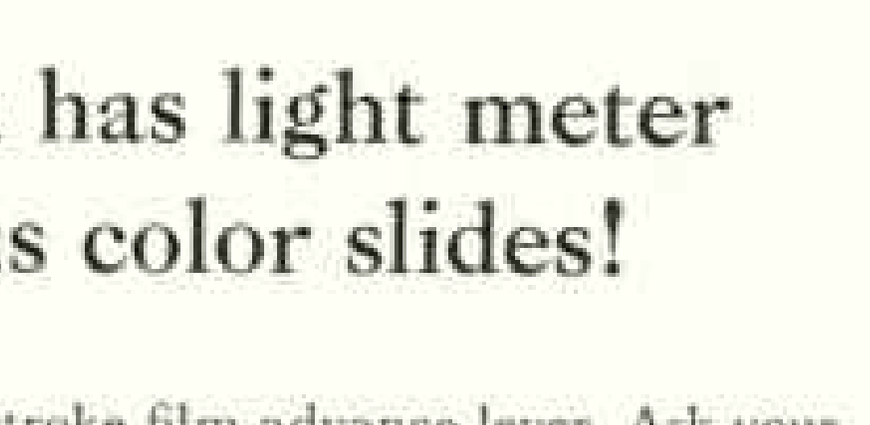

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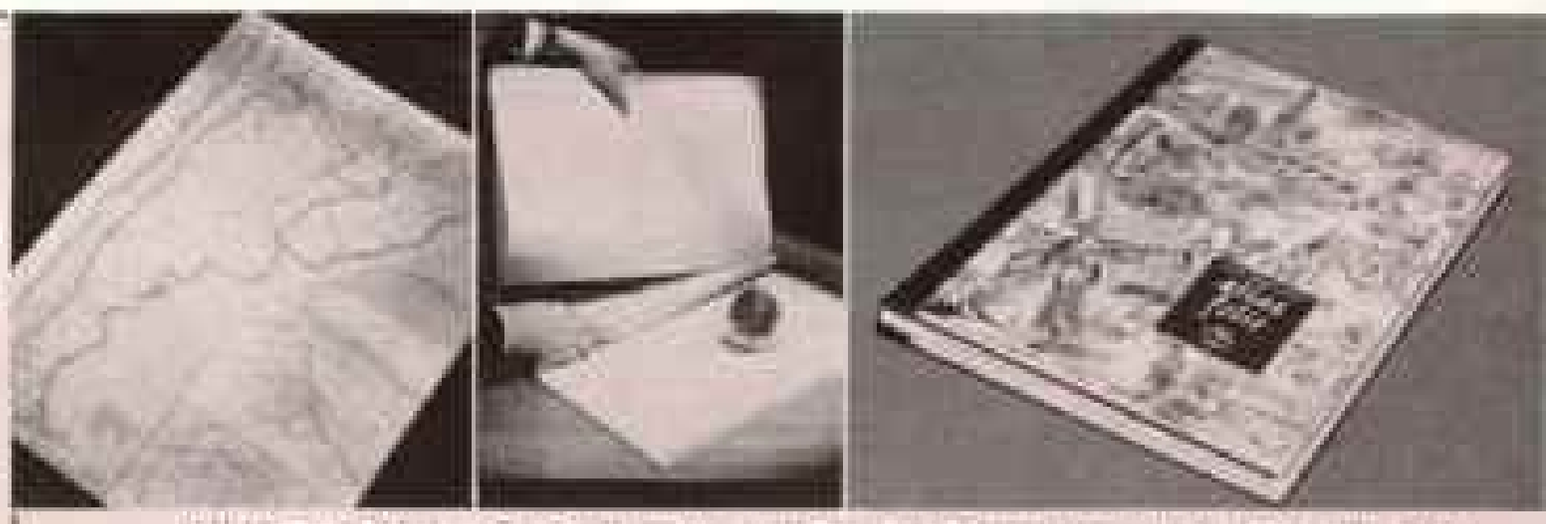

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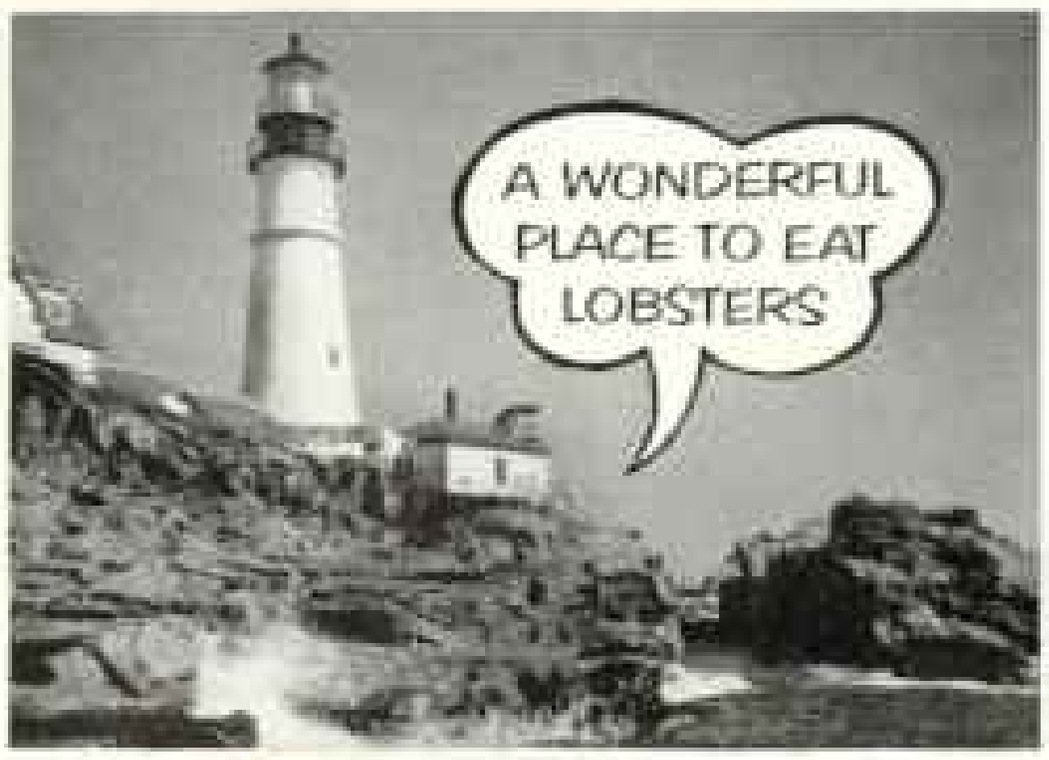

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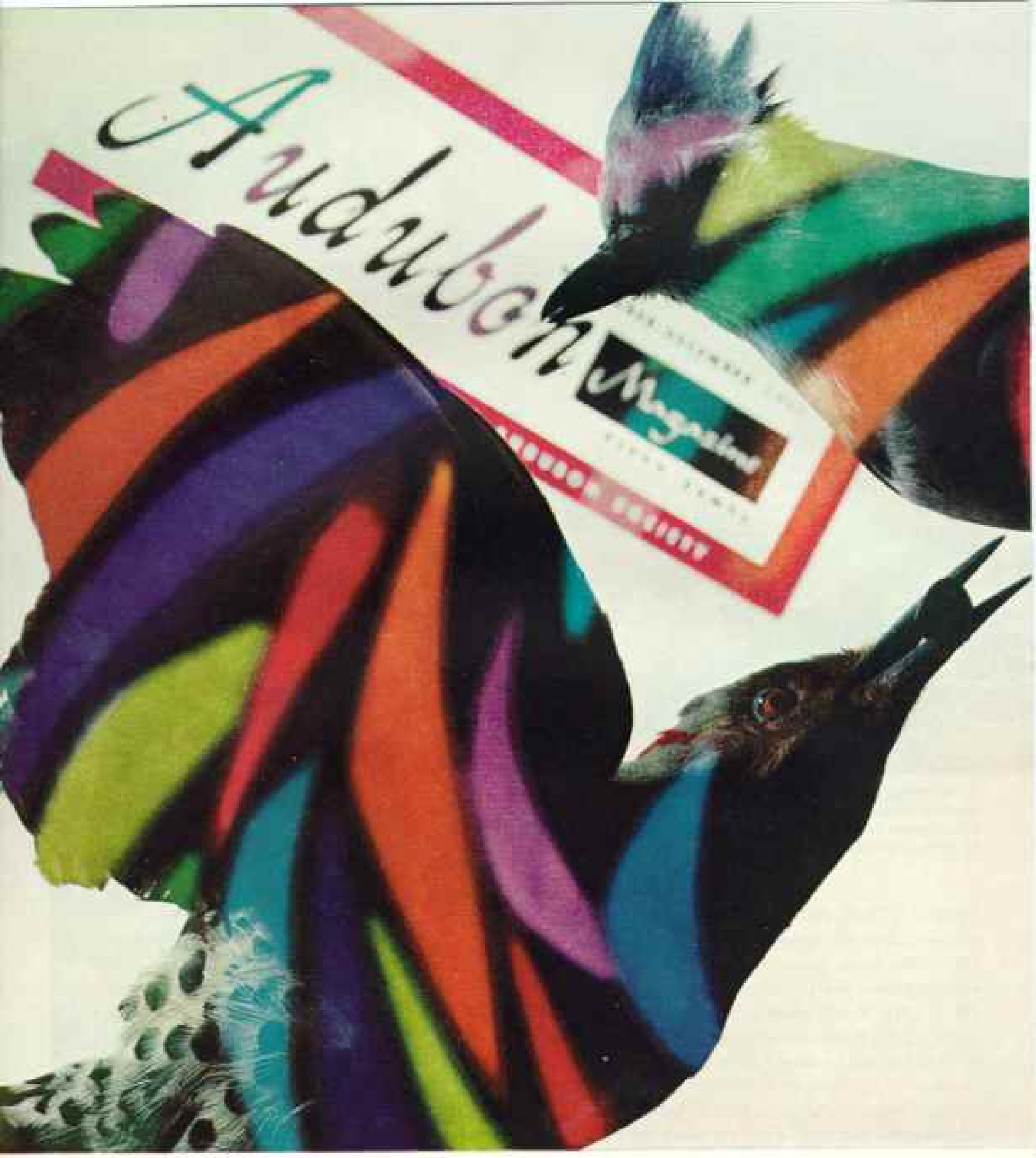

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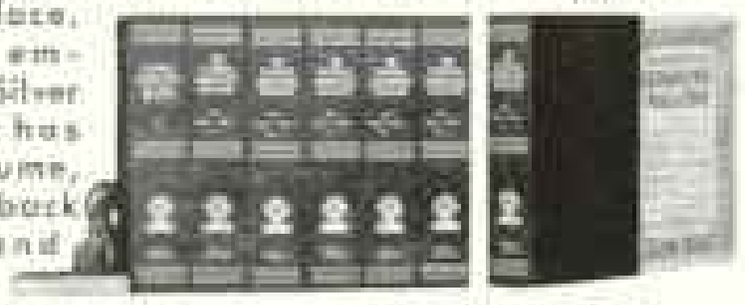

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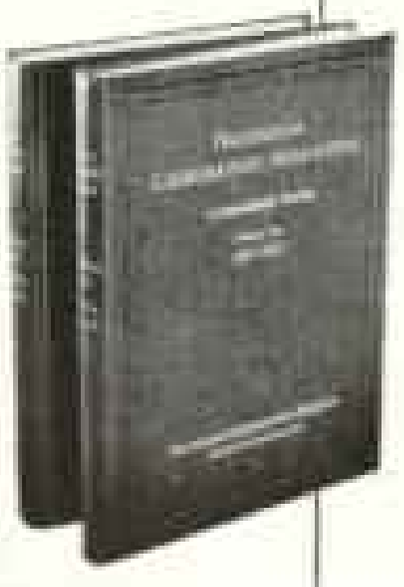

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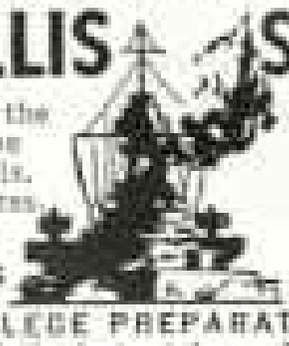

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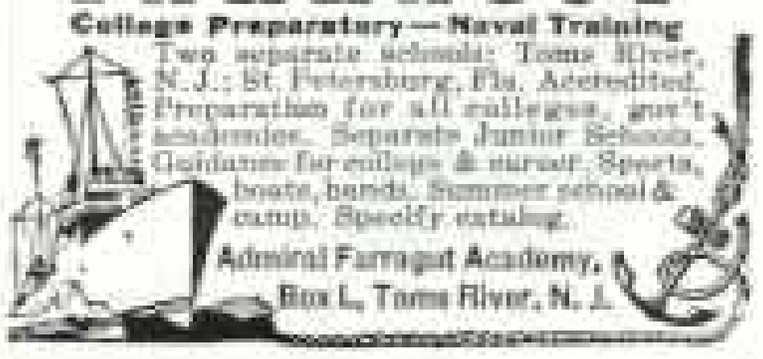

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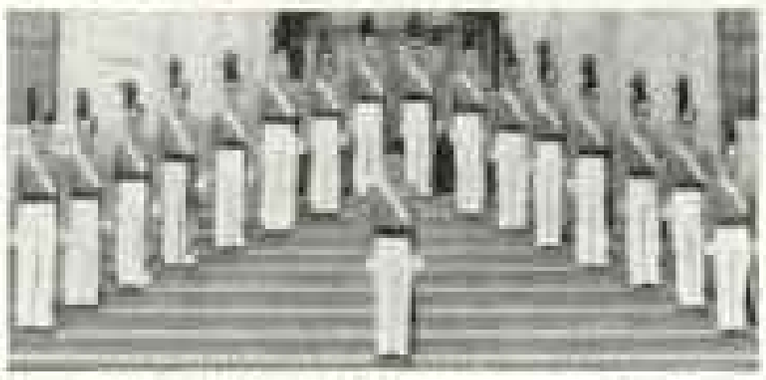

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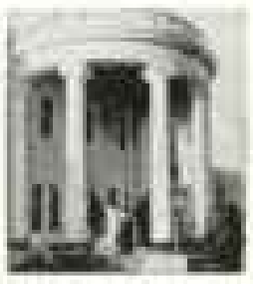

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