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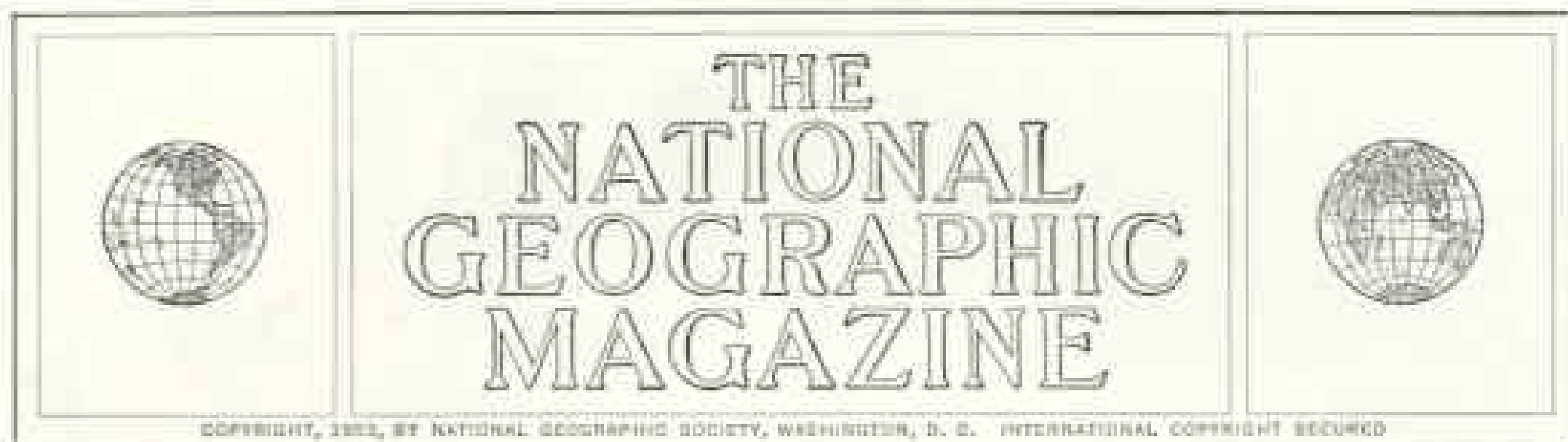
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Safari Through Changing Africa

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BY ELSIE MAY BELL GROSVENOR

With Illustrations by Gilbert Grosvenor, President, National Geographic Society

AT 3 O'CLOCK on a pitch-dark January morning, a big four-engined air liner set us down at Kano in the heart of Africa. We had boarded the plane the evening before on the outskirts of busy, cosmopolitan Rome, 2,000 miles away.

Now, before we could leave the cabin, a tall Negro dressed in khaki came aboard and sprayed us all with disinfectant. As a parting gift, the airline stewardess gave us each a box of paludrine pills and some sound advice: take one each day and we wouldn't catch malaria.

Then we stepped out into the night. Africa was cold! A chill wind blew from the desert we had just flown over, and I shivered as I stumbled toward the airport building.

It was nearly 4 o'clock before we reached the home of Mr. Kenneth P. Maddocks, the British Resident, where we were to stay while in Kano. But if Mr. and Mrs. Maddocks were upset by having guests drop from the sky at 4 in the morning, they didn't show it. They welcomed us in their wrappers and gave us hot tea and crackers to dispel the chill. We used three woolen blankets on our beds—and a hot-water bottle besides.

Only the mosquito nets draped around us—we found them everywhere we went in Africa—reminded us we were in "tropical" Nigeria, just 12 degrees north of the Equator (map, page 150).

Why We Searched a Continent

This was the beginning of a three-month 30,000-mile safari around Africa for my husband, Gilbert Grosvenor, and me.

The trip was partly a delayed celebration for our golden wedding anniversary. More important, it was a search for fresh material and new ideas and authors for the NATIONAL GEOGRAPHIC MAGAZINE.

Similar quests in other years had taken us to the ancient Inca ruins of Machu Picchu on a flight across the Andes in Peru; the chilly summits of China's holy mountain, Tai Shan, and of Japan's Fuji; Hawaii, Midway, and Wake Islands; every Province of Canada; Europe; every State of the United States; and two Russias, Tsarist and Soviet.

Africa itself was not wholly new to us. Many years earlier we had visited Spanish and French Morocco; we had drunk tea with a sheik and dined with a pasha in the walled city of Fès, the dinner served by Nubian girls jingling with bracelets on arms and ankles.

But the Africa we were to see now was a continent where slaves, camels, and medicine men are disappearing. In their places we found jeeps and trucks, hydroelectric plants,

The Author

The daughter of Alexander Graham Bell, Elsie May Bell Grosvenor grew up in a world of new ideas and expanding geographic frontiers. She was born in London at the time when Dr. Bell was demonstrating his recently invented telephone to Queen Victoria. Her first transatlantic passage came when she was but a few weeks old, on the Bells' return to the United States. She was seven when she was shipwrecked with her family aboard a coastal steamer off Newfoundland. Later she studied in France and Italy, traveled in England and Norway, and in Japan, in 1898, was presented to the Empress.

When Miss Bell was married (1900), her distinguished father was president of the then pioneering National Geographic Society. The year before, her future husband—young Gilbert Grosvenor—had been made editor of its little journal, the NATIONAL GEOGRAPHIC MAGAZINE, and for the next half century and more was to devote his life to furthering The Society's projects and publications.

Mrs. Grosvenor has always taken a deep interest in The Society's activities. She designed its flag, with its stripes of brown, green, and blue, symbolizing earth, sea, and sky. She has read hundreds of manuscripts for The Magazine and examined thousands of pages of proof and tens of thousands of photographs.



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Chiefs of Northern Nigeria Gather at Kaduna for the Opening of Parliament



Nigeria's new constitution gives its people greater self-rule. In Northern Provinces they exercise it through a House of Chiefs and an elective House of Assembly. Below: Chiefs in robes, turbans, and *fezes* await the session.





✧ The Author, "Window-shopping" in Kano Market, Scans a Display of Kola Nuts

Nigerians chew kola nuts as Americans chew gum. The vendor (seated) spreads his stock on a mat. Wind-borne dust hangs like fog in the distance. A tall Tuareg veils his face, conforming to a male custom of his tribe.



modern hospitals—and, of course, airplanes, which are the real taxicabs of modern Africa.

All night the cold wind howled. When we awoke, we looked out the window at a view as English as it was African. We were in the British official quarter, outside the old walled section of the city of Kano. Its little English gardens and Government-owned houses are neat and modern. The officials are only temporary residents and must move out all their belongings even when going on their biennial vacations. They never know what house they'll come back to, since houses are extremely scarce in Nigeria.

Our pretty young hostess was also English, the daughter of the well-known scientist, Sir John Russell. Before her marriage she had been London editor of the *Junior Britannica*. The Maddockses' extensive library on Africa's birds, animals, and people showed their deep interest in the country Mr. Maddocks helped govern. Their books also helped us identify African birds and beasts we were to see.

As soon as we had finished breakfast, Mr. Grosvenor, Mr. and Mrs. Maddocks, and I started out to explore old Kano. From reading, I knew that its history went back at least a thousand years. It was a caravan crossroads in medieval times and today is still a busy trading center.

Dust Storm from the Desert

As we drove through the city, we got our first taste of the harmattan, the dry, all-enveloping dust-laden wind which sometimes blows in from the Sahara. For the next several days it stung our eyes and faces and gave a weird, unreal effect to everything we saw. Its murky haze colors all my recollections of Kano; it also colored many of the pictures my husband took of the city (pages 147, 149, 153, and 156).

We went through one of the entrances cut in Kano's massive 40-foot-thick mud walls, built centuries ago, and quickly lost ourselves in a maze of winding, narrow streets. More surprising to me were the houses that lined the streets: they were built of mud! They have palm-trunk supports for roofs and doorways. A few were whitewashed or painted; some of the fancier ones were decorated with intricate patterns. Many were getting new layers of mud and native cement.

Spouts of tin or terra cotta jutted like guns from the rooftops.

"They're gutters," explained our sight-seeing host, "to carry off the floods of the rainy season.

"It's the dry time now," he continued, "when careful householders do their repairing and replastering. If they don't get around to it before the rains come, their clay walls will

eventually melt down and they'll find themselves living in a mud puddle!"

We got out of the car at Kano's big, bustling market place and were quickly swallowed up in a noisy crowd. Customers and merchants elbowed each other and us. There were tall, ebony Hausas and lighter Fulani with bearded faces. Everywhere small naked children wandered, along with inquiring goats, donkeys, sheep, and chickens.

Livestock was only part of an amazing variety of merchandise. We saw fine leather goods, metal jewelry, and bright, bizarre prints nudging empty bottles and old razor blades. We also saw—and smelled—dried fish; next to freshly slaughtered meat lay piles of grain, salt, and spices. Kola nuts, chewed for "lift," seemed to be popular (page 147), and so were cosmetics used by local belles to darken their eyelids and henna their nails and hands.

Many of the wares were spread out on the bare ground, with only a thatch or bamboo cover to keep off the sun. Others were displayed in "shops," rows of cavelike mud stalls.

Desert Riders Wear Indigo Cloth

Kano is famous for its cloth, woven of locally grown cotton, and for its brilliant blue dyes brewed from the wild indigo plant. We saw both in the market. In open vats dyers were dipping and rinsing lengths of white cotton cloth which came out in shades of blue from pale to deepest indigo (pages 158, 159). Near by, other workers beat the material to give it a metallic luster.

We saw veiled Tuareg horsemen wearing robes of this deep-blue cloth. Other pieces might add allure to the wardrobes of Kano's harem favorites. Later, in another Nigerian city, I recognized the typical metallic blue in the turbans of prominent native rulers.

We saw almost no women. Kano's ladies are kept well hidden from the profane gaze of outsiders.

Yet change is coming. An elementary school has been established for the long-neglected Moslem girls. It is attended by members of the Emir's own household. The faces of the few women we did see were uncovered, despite the fact that this is a Moslem city.

There was even an ultramodern touch while we were there—a strike by Nigerian railway engineers.

We saw many pyramids at least 30 feet high made entirely of bags of peanuts awaiting transportation south (page 154). They are a leading export of the country; others are tin, palm kernels and palm oil, cocoa, hides and skins. Altogether, Nigeria's exports totaled more than \$350,000,000 in 1951, a foreign trade built up during the last 40 years.

(Text continued on page 154)



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Illustrations by Gilbert Grosvenor

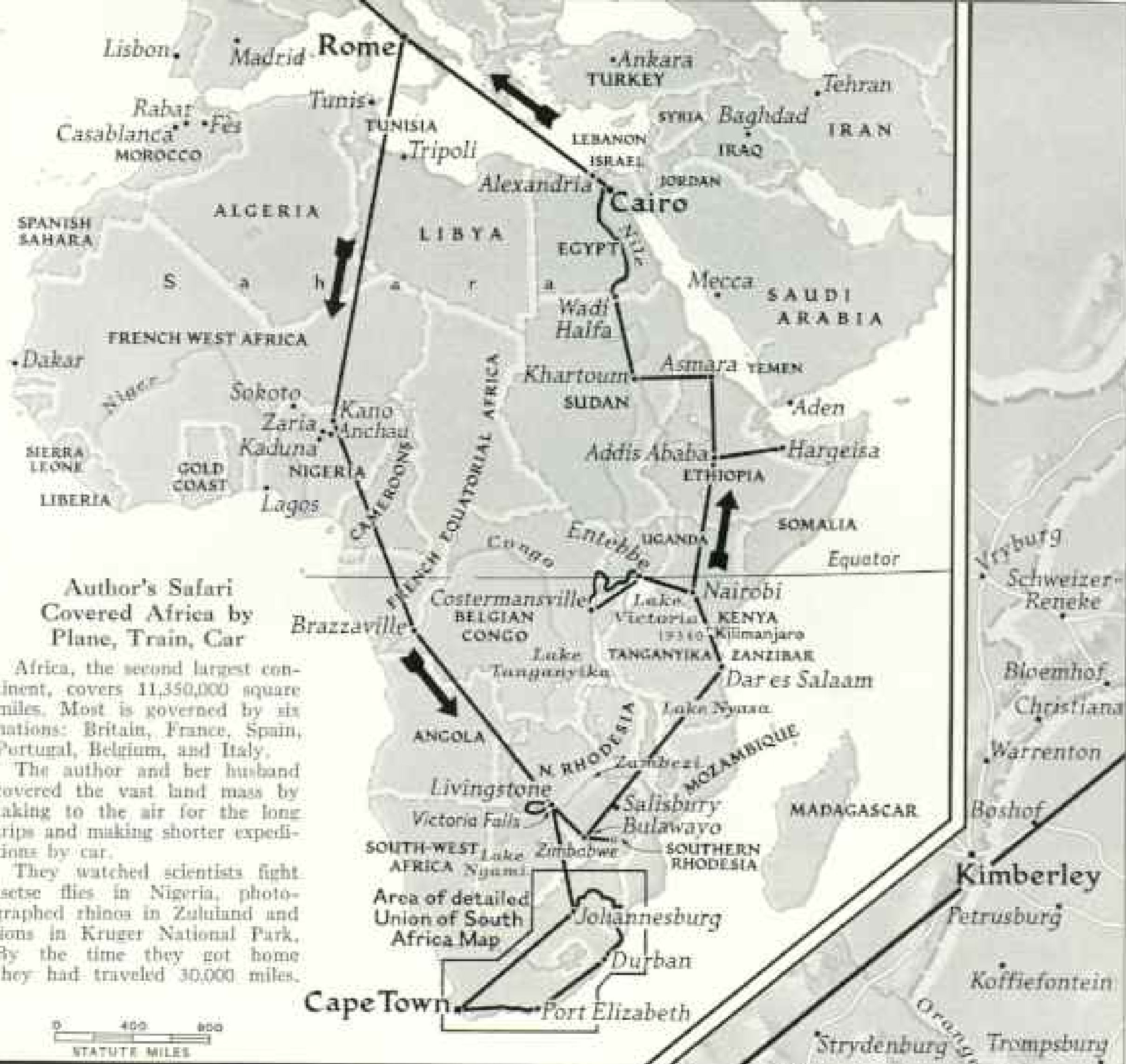
↑ **Market-bound Nigerians Enter Kano Through a Massive Adobe Gate**

Kano boasts a written history extending back nearly 1,000 years. Today the city is northern Nigeria's metropolis, with 101,000 people. A high mud wall pierced by 15 gates encircles the oldest section. Donkeys and pedestrians, but few vehicles, may use this portal.

↓ **Nigeria's Largest Open-air Mart; the Author Shops for Cloth**

Sprawling Kano market attracts 20,000 people daily. Merchants, afoot or in stalls of thatch or mud, hawk an infinite variety of wares. The cloth salesman (left) quotes a price in Hausa, his native tongue. The author finds a topcoat comfortable in "tropical" Nigeria.





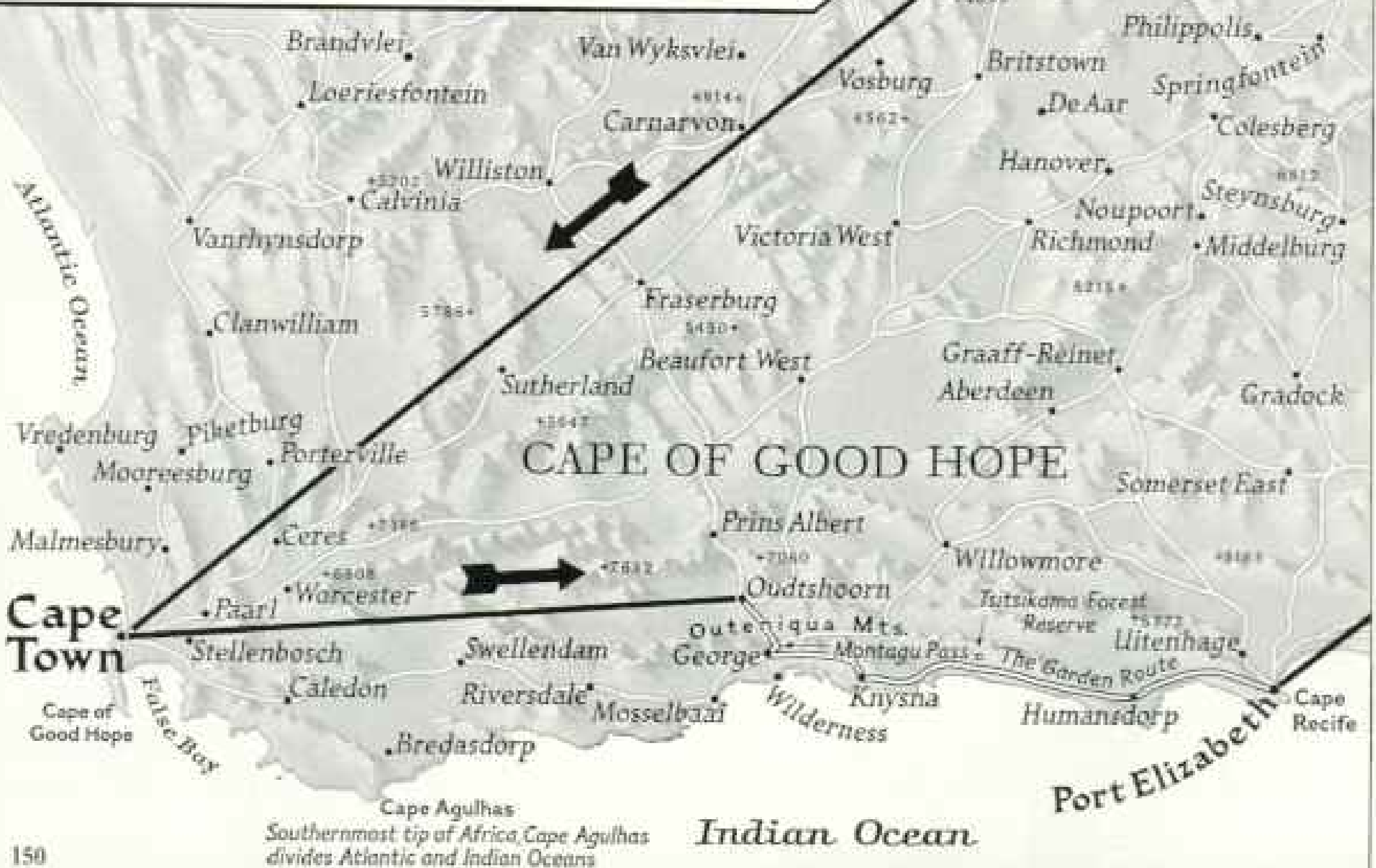
Author's Safari Covered Africa by Plane, Train, Car

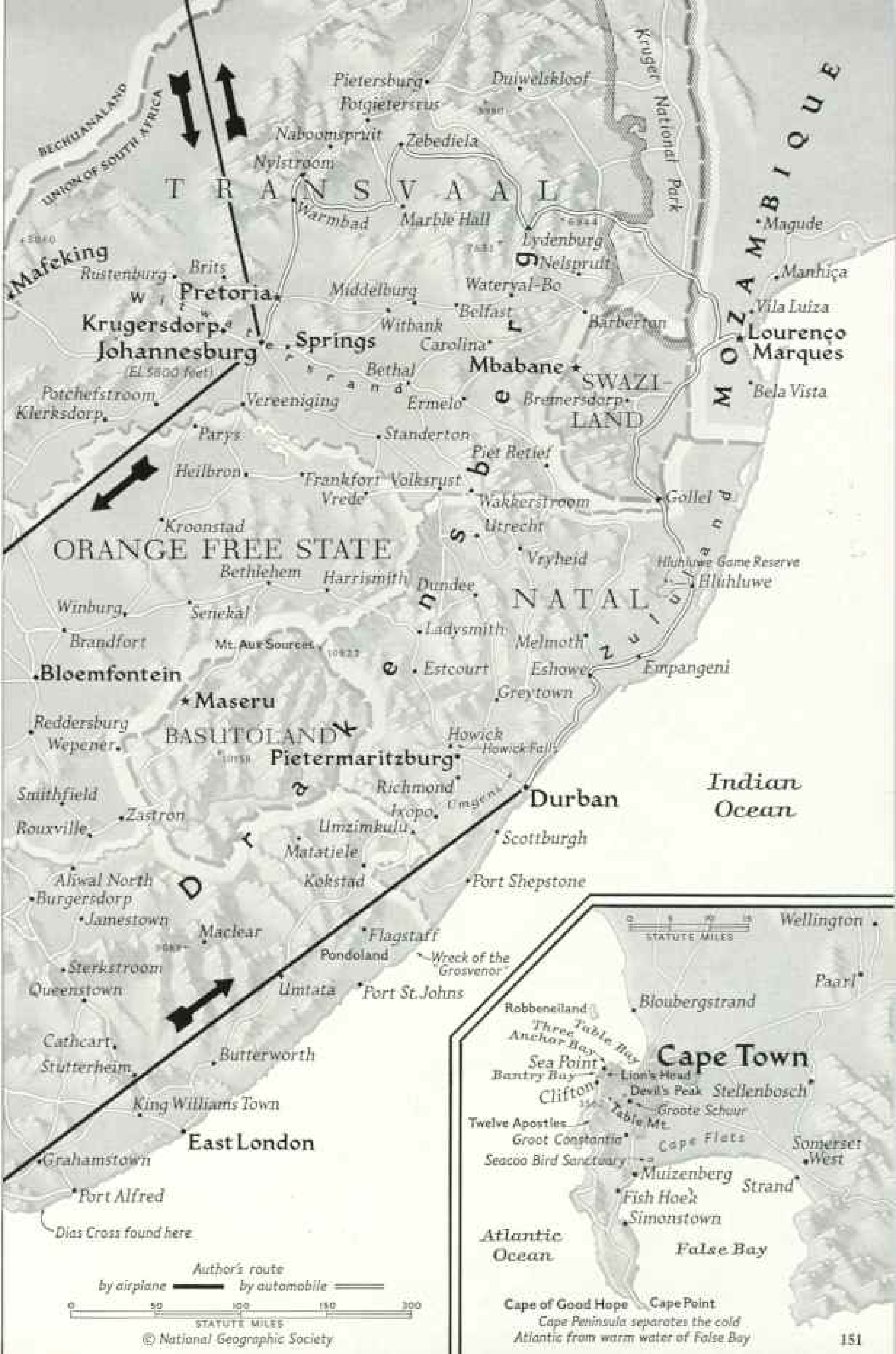
Africa, the second largest continent, covers 11,350,000 square miles. Most is governed by six nations: Britain, France, Spain, Portugal, Belgium, and Italy.

The author and her husband covered the vast land mass by taking to the air for the long trips and making shorter expeditions by car.

They watched scientists fight tsetse flies in Nigeria, photographed rhinos in Zululand and lions in Kruger National Park. By the time they got home they had traveled 30,000 miles.

Area of detailed Union of South Africa Map

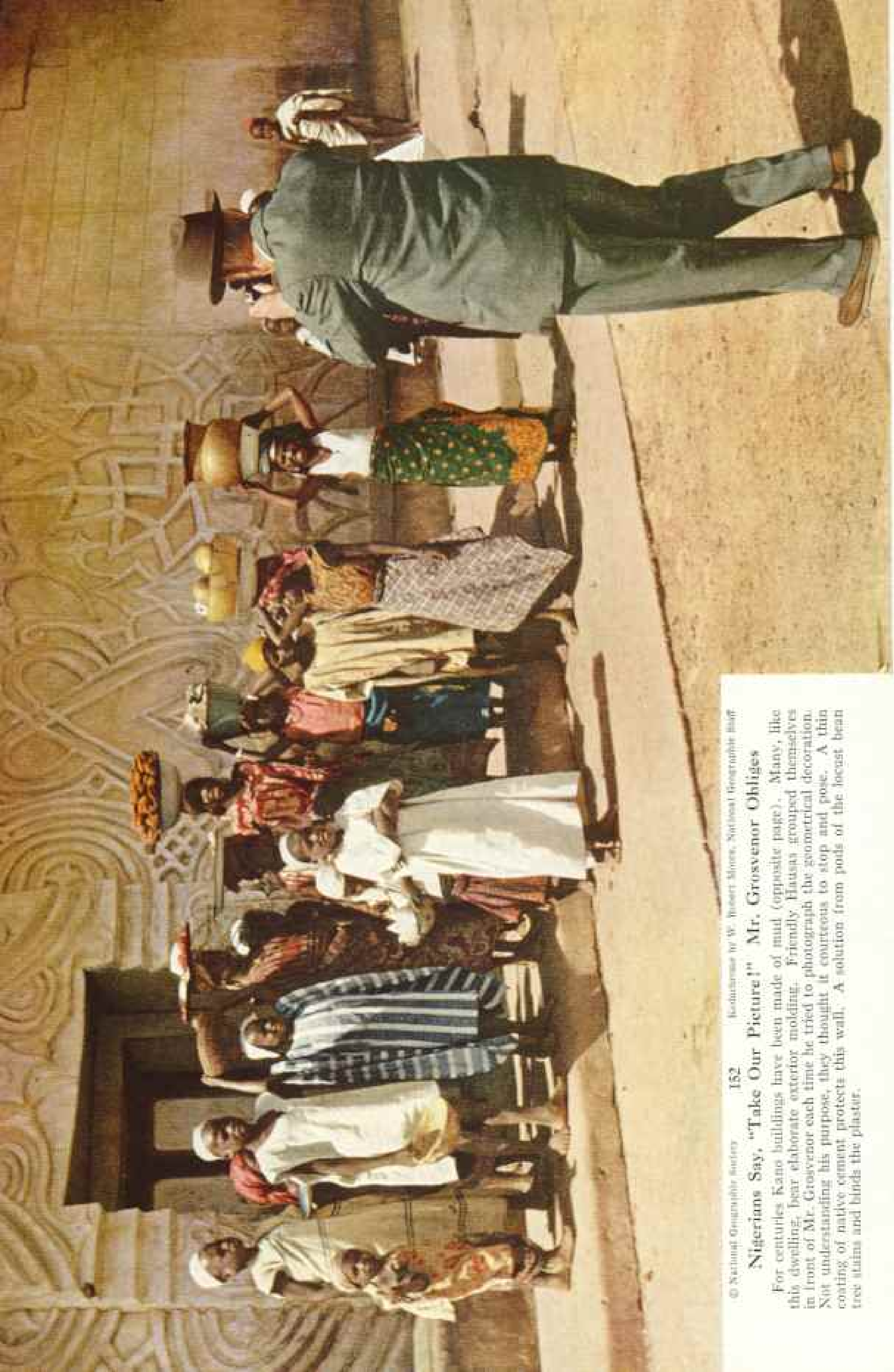




Author's route
 by airplane ——— by automobile ———

0 50 100 150 200 250
 STATUTE MILES

Cape of Good Hope Cape Point
 Cape Peninsula separates the cold Atlantic from warm water of False Bay



Nigerians Say, "Take Our Picture!" Mr. Grosvenor Obliges

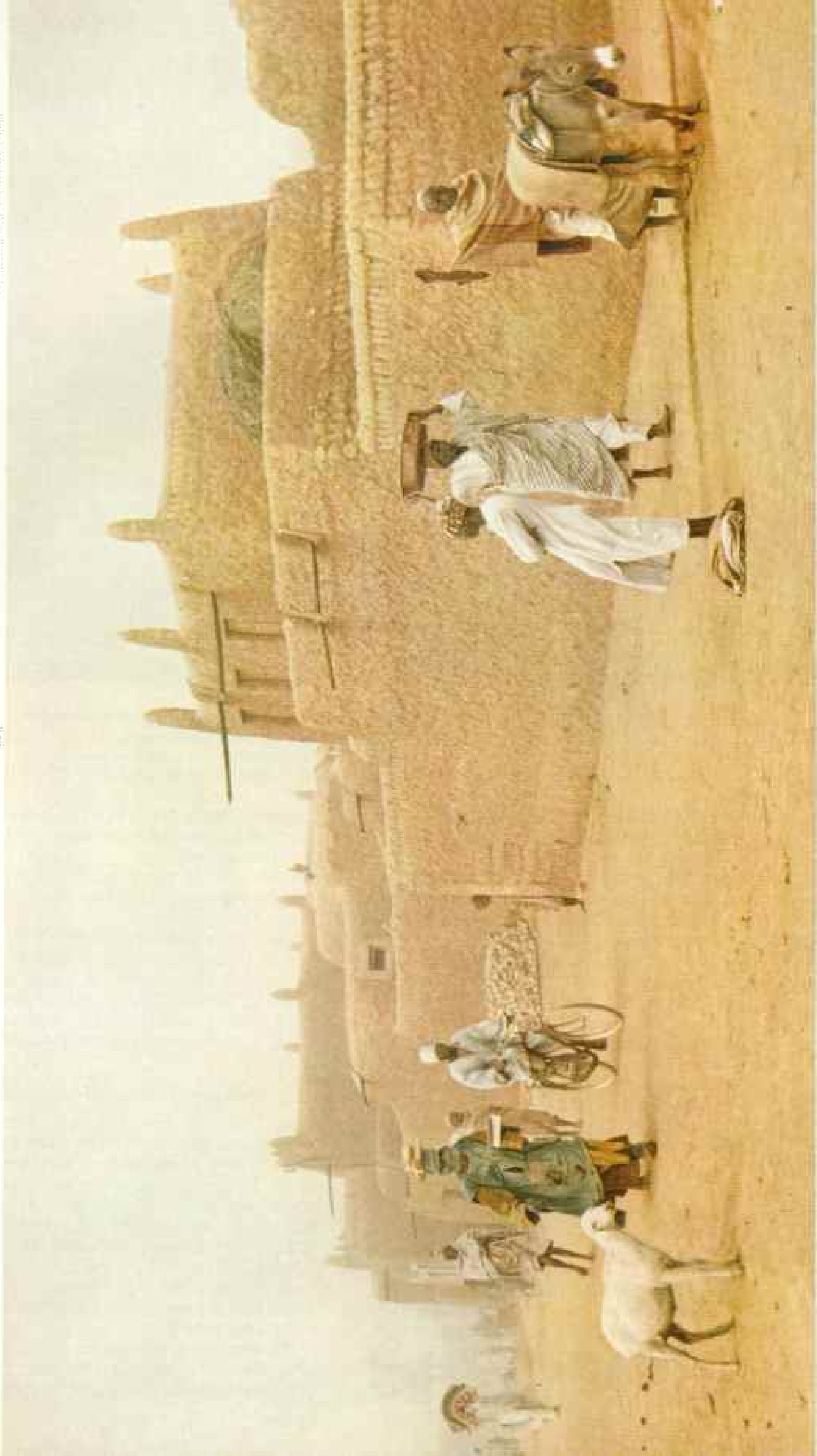
For centuries Kano buildings have been made of mud (opposite page). Many, like this dwelling, bear elaborate exterior molding. Friendly Hausas grouped themselves in front of Mr. Grosvenor each time he tried to photograph the geometrical decoration. Not understanding his purpose, they thought it courteous to stop and pose. A thin coating of native cement protects this wall. A solution from pods of the locust bean tree stains and blinds the plaster.

Kano Residents, Heavily Robbed Against a Dusty Wind, Stroll Past Mud Dwellings with Weathered Flaking Walls

Home builders in Kano dig soil from near-by "borrow pits" and fashion it into conical bricks. They lay the bricks many layers deep, using palm logs as reinforcement. Mud serves for mortar and plaster. Exteriors, if unprotected by a cement coating, need repair about every three years. These rain-etched walls are beginning to flake, exposing bricks (right). Tin drainage gutters project like guns from the flat roofs. A pile of bricks lies in the street.

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Reference to Gilbert Grosvenor





Peanut Pyramids Rise in Kano's Market Place. A Rail Strike Delayed Shipment South

At harvest time peanuts pour into Kano from all over northern Nigeria, two sacks to a camel, one to a human carrier. The total crop in a good year is more than 300,000 tons. In the market place men stack them bag on bag, climbing the sides of the pyramidlike steps with the heavy sacks balanced on their heads.

From Kano we were scheduled to fly to Zaria, 85 miles to the southwest.

Airline tickets? "See the sky maiden," we were told.

The sky maiden turned out to be a hearty, buxom Englishwoman who managed the West African Airways Corporation office in Kano. She would be glad to sell us tickets to Zaria or engage a charter plane for us, she said, but the real question was: Could the pilot find Zaria? On the trip north that morning the town had been completely hidden by the harmattan murk, and he hadn't been able to land.

We decided to chance it, and our luck held. We flew through and over a dense veil of dust all the way, but when we reached Zaria it cleared enough for us to land.

What Price for the Truth?

"You were lucky to make it," said our host, Mr. Conrad B. Williams, British Resident at Zaria. His wife, an American girl from Boston, told us that our sample of the harmattan was really a pretty mild one.

"Sometimes," she said, "we can't see across the street for the dust. It even blows out to sea and covers passing ships."

The ancient Moslem city of Zaria, like so much of Africa, is proudest of its modern

touches. Our hosts showed us a new printing plant which publishes a daily newspaper in the Hausa language. I thought its title, printed next to the price, was amusing. It is also indisputable: "The Truth Is Worth More Than a Penny."

We saw a missionary hospital where—a real sign of progress!—native women are venturing out of their homes to serve as nurses. Founded by the Church Missionary Society and run by a woman doctor, Theodora Mess, F.R.C.S., this hospital is rated one of the best in this area.

Nigerians Learn Self-government

But the real event of our visit was the historic meeting, in near-by Kaduna, of the first elective parliament in northern Nigeria (page 146). It took place in a shining new white parliament building, Lugard Hall, named for Lord Lugard. His article entitled "The New English Province of Northern Nigeria," published in the November, 1904, issue of the NATIONAL GEOGRAPHIC MAGAZINE, was one reason for our stopover in this interesting country.

We watched emirs, sultans, and tribal chieftains dressed in flowing silk and satin robes take the oath of office and swear fealty to

the British Crown in northern Nigeria's "upper house"—the House of Chiefs. Sir Eric Thompson (famously called "Tombstone"), then Lieutenant Governor of the Northern Provinces, presided over the ceremony from a throne-like chair.

The 1951 constitution provides for northern Nigeria a regional parliament somewhat like England's. The House of Chiefs is roughly equivalent to the House of Lords; the lower, or House of Assembly, members of which we saw sworn in the following day, is like the House of Commons. Members of the lower House are elected by the Nigerians themselves, except for a few appointed representatives of the British Government in Nigeria.

The congress at Kaduna would pass laws for the Northern Provinces only. Later, like the other two Provinces, they would send members to a national House of Representatives at Lagos, the capital of the whole of Nigeria.

In their dress the Nigerian dignitaries far outshone the British at the swearing-in ceremonies. Some of the chiefs' robes were almost blinding—heavily embroidered silk of bright green, white, yellow, blue, or lavender. The chiefs were nearly all tall, striking-looking men, many well over six feet. Most wore enormous turbans of different designs.

Spectacles for Decoration Only

Looking down from the visitors' gallery, I noticed that the chiefs had on huge dark-rimmed spectacles.

"Bad eyes?" I asked Mr. Williams.

"No," he smiled. "These people have superb sight. The glasses are for dignity."

Then I noticed that as each chief went to sign the register, he pushed the glasses up on his forehead and looked under them.

After the ceremony I met the Sultan of Sokoto, head of the Islamic church in Nigeria; also several emirs. As we shook hands, I wondered how long it would be before some of their secluded Moslem women would be permitted to share in the new political freedom.

"Many of the representatives of the lower House are from pagan tribes," Sir Eric said, when we had lunch with him and members of his staff at the British Residency. "Others are Moslems, and still others are Christians. One of Nigeria's big problems is this diversity of peoples in religions, customs, and even language."

Since our visit, bitter political rivalry between Moslem and non-Moslem has caused rioting and bloodshed in Nigeria.

In Kaduna we stayed with a brilliant British scientist, Dr. T. A. M. Nash. For 25 years Dr. Nash has been one of the leaders in the fight against Africa's greatest scourge, the

tsetse fly. This small insect, found only in Africa, has devastated vast sections of the continent, for it spreads human and animal forms of the dread disease trypanosomiasis, or sleeping sickness.

For generations sleeping sickness has struck terror across tropical Africa. It has killed hundreds of thousands of Africans and some Europeans, wiped out whole villages, and driven farmers from their land.

Tsetse Fly Blights Vast Areas

Today the fly still blocks progress in an area in Africa bigger than the whole United States. Vast areas of fertile farmland and pastures lie empty and deserted. Though in parts of Africa modern drugs have brought sleeping sickness in humans under control, nagana, an animal form, still destroys livestock and beasts of burden. A cow, an ox, or a horse bitten by an infected fly wastes away and usually dies.

"In Nigeria," Dr. Nash said, "most farmers have to carry their farm produce to market on their heads."

Much of the country's heaviest farm labor, including plowing, hoeing, and hauling, is done by hand, to a large extent woman's.

I saw many tsetse flies in Dr. Nash's laboratory, where he breeds them for experimental purposes and to study their habits and find out how best to attack them. They look innocent enough, rather like our own housefly except for their wings, which fold across their backs when at rest. But Dr. Nash keeps them carefully locked up, with metal screens on doors, windows, and cages. These, incidentally, were the only screens we saw in Africa, and they were used to keep flies in, not out.

Tsetse flies are strange insects. They never drink water and live entirely on blood, so that a whole stableful of guinea pigs has to be kept to feed those in the laboratory. The female fly produces only one egg at a time, which she both hatches and nourishes inside her body with milk glands until it is born.

Mother Tsetse's "Babies" Born Alive

The mother tsetse fly gives birth to a tiny white larva much as a woman gives birth to a baby.

The larva immediately buries itself an inch or more under the ground, where it turns into a pupa (chrysalis) and some weeks later into a fly.

One mating suffices the female for life. Starting about 20 days after mating, she produces one such larva every 10 days during her life span, usually about three months.

The young tsetse fly is not harmful at first. Not until it bites an infected person or animal does it pick up trypanosomes, the parasites



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Kodachromes by Gilbert Grosvenor

↑ Girls Let Shopping Go to Their Heads

Kano children learn to carry head burdens almost as soon as they can walk. Good posture is a by-product of the practice. Girls wear voluminous clothes, while the boy strolls in a loincloth.

↘ Big or Small, Your Fez Size Is Here

As soon as sold, many of these bright fezes in Kano market will disappear beneath turbans. Made of felt, the snug-fitting caps help keep cloth folds from slipping. A boy steadies a tray of cakes.



that cause sleeping sickness. But from then on it is dangerous as long as it lives.

There are 11 different varieties or species of tsetse fly in Nigeria; some feed chiefly on men, and other varieties prefer animals.

The tsetse fly has a sharp proboscis, resembling a tiny hypodermic needle, projecting straight out from its head. When the fly lights on a man, this proboscis pierces the skin, injects a non-blood-clotting substance, and then draws blood. At the same time it may deposit trypanosomes in the bloodstream.

Dr. Nash, who still is young and energetic after 25 years of battle against the fly, told us about the work he and other scientists are doing to bring it under control.

One weakness of some species of tsetse fly, he explained, is that they must have shade. They breed and live in thick undergrowth. Back in the 1930's Dr. Nash's research showed that by clearing only the undergrowth and bushes along streams the riverine tsetse could be eliminated. This partial clearing method was then employed on a large scale in the Anchau district. In a report on the project Dr. Nash wrote:

"Attention was first focused on the Anchau district of Zaria Province in 1934, when Dr. N. E. W. Anderson found that one-third of the population had sleeping sickness, and that in some hamlets half the population were infected."

Today the cleared area is a corridor in northern Nigeria 70 miles long and 10 miles wide. Here 60,000 people and their livestock live, healthy and fly-free. Old Anchau, the region's chief city, has been cleaned up, and new villages have been built.

How to Move a Spirit

With dry humor Dr. Nash tells some of the difficulties of this 10-year clearing and rebuilding job:

"When we first started clearing around Anchau, the presence of sacred trees in the streams caused much trouble, especially in one village area. The village head would suddenly give out that the work was reaching a place where any man would die who entered the grove; the labour gangs would not turn up next day and work would come to a standstill.

"The following method soon abated this nuisance. The village head, who was also the earthly leader of the spirit world, would be interviewed in front of all his people, and after much preamble told that the existence of these spirits was causing us much trouble, that unfortunately Europeans were quite incapable of making spirits change their abodes, but that it was rumoured that he had this amazing power: we could not believe it possible for any man to do such a thing, and con-

sidered it to be all lies, but, if he really had these powers, would he kindly remove the spirits on to a neighbouring hill.

"Invariably the old man would turn up next day saying that he had wrestled with the spirits all night, and that finally they had agreed to live on the desired hill. Everyone was happy, the old man's prestige was enhanced, and we got the streams cleared."

Eventually the work grew into far more than clearing and tsetse extermination. As tribesmen were resettled in cleared areas, whole new communities had to be planned from the ground up. Dr. Nash describes the new village of Takalafiya near Anchau:

"The roadways, all 100 feet wide, act as firebreaks, for which there is a great need.

Pink Flowers and Pure Water

"All the roads in Takalafiya have been planted up with avenues of mahogany, mangoes, figs, and the pink-flowered Cassia: a staggered spacing rate of 75 feet has been used in laying out the avenues"

Careful planning also went into locating and digging sanitary fresh-water wells and in providing drainage and elementary sewage disposal. A new elementary school has been built, and a 12-acre model farm demonstrates new methods and new crops, including soybeans and fruits.

Appropriately, the town's name, Takalafiya, means "Walk in Health."

But Africans will not walk surely in health until some way has been found to control nagana in broader areas. New medicines are being tried against the trypanosomes themselves. Cattle in the tsetse belt are being given injections of antrycide. But, so far, it has provided only a short-term immunity.*

The biggest reservoirs of nagana parasites left in Africa now are wild animals in the jungle. Many of them are tolerant to the disease but carry the parasites in their blood, like "Typhoid Mary." The tsetse fly bites one of them, picks up the parasites, and is dangerous from then on.

Dr. Nash told us that in certain limited areas where it is essential to reclaim land from the woodland tsetse for increasing herds of cattle, a policy of game destruction is advocated because these tsetse disappear if there is no game.

"Such a measure naturally brings a storm of opposition from conservationists, naturalists, hunters, and many others," he said, "but in such circumstances on ethical grounds man must come first."

One of the pleasantest hours I passed in

* See "Britain Tackles the East African Bush," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, March, 1950.



▲ Today, as for Centuries Past, Kano Craftsmen Dye Cloth and Skeins of Yarn in Earthen Vats Filled with Indigo

These men make blue dye by mixing indigo with ashes, locust-bean flour, and water. The process leaves a chalklike residue used as a cement coating for vats and houses (pages 157, 153). Though the dyers specialize in indigo, they sometimes brew a red color. Dyed fabrics dry in the sun.

♣ Indigo colors range from pale to darkest blue. Dyers control the shade by the length of time they soak the cloth. Wicker covers shield unused pits.



Africa was on Sunday morning in Kaduna. With Dr. Nash we went to a little Anglican church which has been put up by the English people of the community.

The church is built without side walls, so that it is almost completely open to the surrounding trees. From the sunlit green branches outside came a chorus of bird songs so loud and clear it all but drowned out the words of the service. There were bulbuls, nightingales, and many more, as sweet and melodious a choir as I have ever heard.

Skyscrapers Built on Gold

Three thousand miles southeast of medieval Kano lies Johannesburg, a modern city built on the profits from the Union of South Africa's fabulous gold mines. In a swift British plane we covered the distance in 15 hours, stopping only twice.

We touched first at Brazzaville, the sultry capital of French Equatorial Africa, and, during World War II, headquarters for the Free French. At Livingstone, in Northern Rhodesia, we landed again, this time in a tropical downpour. We flew on in a storm that tossed our big plane as if it had been a small boat.

On the long drive to town from the Johannesburg airport we frequently passed great pyramids of earth rising from the ground. The man-made mountains are the gold mine dumps that are Johannesburg's trademark. Less than 70 years ago neither they nor the city existed. There was only a treeless veld here in 1886, when the world's richest gold lode was opened.

Since then both trees and cities have sprung up along the whole 150-mile stretch of the treasure-bearing Witwatersrand, "Ridge of White Waters." Mines with local headquarters in Johannesburg produced about \$409,000,000 worth of gold in 1952.*

Johannesburg is now third only to Cairo and Alexandria among Africa's cities and is the largest south of the Sahara. Its streets are lined with skyscraper offices, streamlined apartment buildings, and luxury hotels. Prosperous mining companies and world-famous banks alternate with smart shops, theaters, and cafes. Nearly a million people now live in Johannesburg, and it is still growing.

Johannesburg, or "Jo'burg," as the South Africans call it, looks and feels youthful. Trees line its avenues; its suburbs bloom with flowers. Its 5,800-foot elevation makes the air seem clear and bracing, the sunlight sparkling.

Yet the city reaches farther down than it does up. Three gold mines inside Johannesburg's municipal area go more than 9,000 feet below the surface. Only the most modern scientific techniques and air cooling make it possible for men to work so deep underground.

Johannesburg's gold has produced more than skyscrapers and modern machinery. Four thousand students at the new University of the Witwatersrand are taking courses in the arts and sciences, medicine, postgraduate law, and engineering. The university was opened only a little more than half a century ago as a technical school.

We ate a pleasant lunch with the university's president, Dr. Humphrey R. Raikes, and Dr. John H. Wellington, dean of the Faculty of Science and professor of geography, on the terrace of the Country Club. Dr. Wellington had visited the National Geographic Society in Washington, D. C., several months earlier. Dr. Raikes, in addition to his work as a scientist, distinguished himself in the RAF during World War I; later he became chief instructor of the Oxford University Air Squadron.

During lunch we enjoyed the beautiful view from the terrace almost as much as the food. Next we were shown through the Witwatersrand library.

We saw a fascinating collection of maps, diaries, and other documents all dealing with the opening up of Africa. And again I was struck by the *newness* of this country we were visiting. Some of the papers, telling of expeditions into wild and unknown regions around Lake Ngami and the Zambezi River, were signed by David Livingstone.

"You can see how recent these discoveries were," said our host, pointing to another of the signatures. "This man was my grandfather."

Stone Cross Marks Landing by Dias

The library's prize possession is a great deal older. It is a 7-foot stone cross raised in 1488 by the Portuguese explorer Bartholomeu Dias on the southeast coast of Africa.

Dias, looking for a passage to India, was the first European to sail around the tip of the continent. He never got to India. His men rebelled and forced him to turn back; so, as evidence that he had gone this far, he landed and raised the cross.

"For centuries Portuguese writers mentioned the Dias cross," Dr. Raikes told us. "Then it was heard of no more. Not until 1938 did it come to light again. One of our research fellows found its fragments buried in the sands 60 miles northeast of Port Elizabeth. It was brought here and pieced together."

Three and a half centuries passed between Dias's first landing and the opening up of the southern part of Africa.

* See "The Cities That Gold and Diamonds Built," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, December, 1942.

(Text continued on page 177)



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↑ **Lions Bar the Path of the Author's Car in Kruger National Park**

South Africa's unfenced Kruger National Park, almost as big as Massachusetts, teems with wildlife (pages 185, 188). Lions, accustomed to cars, often laze in the roads. Haughty males hold their ground as the automobile drives slowly toward them.

↘ **Leo Walks Away with Regal Dignity; His Friend Is Too Lazy to Move**

Park lions do not attack automobiles. This drowsy pair, gorged from a recent kill, licked chops and paws and rolled in the dust like house cats. Horn blasts and shouts finally drove them aside. The photographs were made through an open car window.





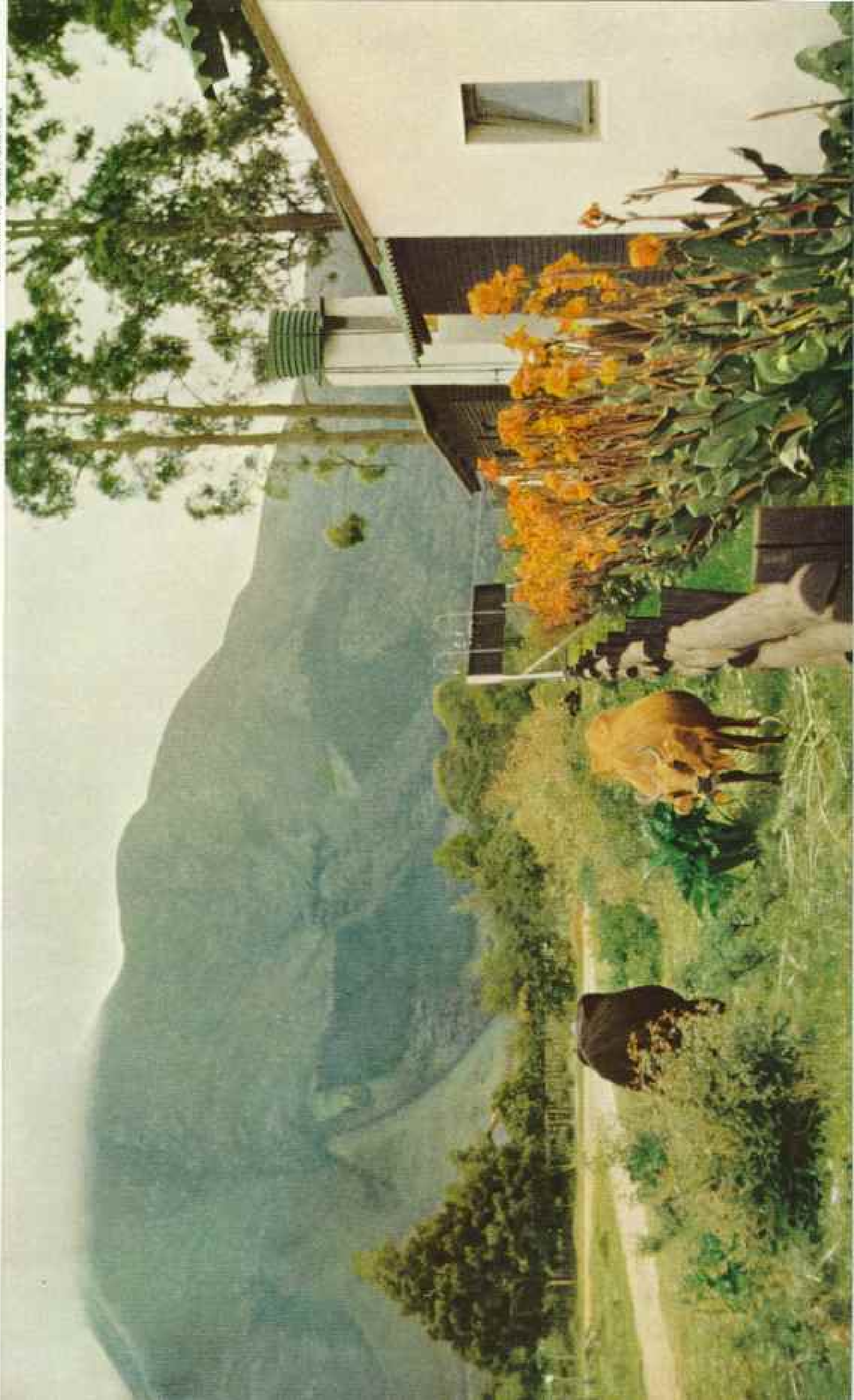
Clouds Cling Like a Snowy Cloth to South Africa's Table Mountain; Cape Town Lies at Its Base

Table Mountain's flat summit rises 3,567 feet above the sea. In good weather aerial cable cars shuttle sight-seers to the mountaintop. Devil's Peak (left) and sharp Lion's Head (right) flank the cloud-capped mesa. This beach adjoins the fishing village of Bloubaaistrand. Homes (left) overlook broad Table Bay.

The Forest Inn Welcomes Visitors to Tsitsikama Forest Reserve. Bright Cannas Are Used in Miss in Cape Province

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Kochheim by Gillhart-Grauert





Foaming Breakers Sweep the Sands of Muizenberg Beach near Cape Town

Muizenberg's gleaming strand, nearly 20 miles long, lies on the eastern side of Cape Peninsula. There the Agulhas Current warms False Bay. Seas are colder on the Atlantic side, where the chill Benguela Current flows.



Vacationers Bathe in the Surf or Stroll Beneath a Cloudless Sky

Before 1910 Muizenberg beach was an out-of-the-way spot with few visitors. Modern transportation changed it into a bustling resort crowded by thousands during the South African summer season, November through March.



Table Mountain Rises Like a Weathered Fortress Above South Africa's Houses of Parliament in Cape Town.

Young Afrikaners Enjoy the Kiss of Sun and Breeze at Muizenberg Beach. Gaily Painted Dressing Rooms Line the Sands

Muizenberg is busiest during the Christmas holidays. The resort boasts a large pavilion with restaurant and theater. Visitors rent these bathing boxes, similar to those found on English and Continental beaches.

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Illustration by Gilbert Grosvenor





Flowers Grow in Tall Profusion Under Stellenbosch's Sunny Sky

Veranda pillars of this Dutch colonial-style home support shade vines. The author admires the blossoms, among them blue agapanthus and Watsonia.

Young Zulus Grin with Delight as They Share the Author's Gift of Candy near a Roadside Village in Natal

Natal's Zulus warred bitterly against early white settlers. Today tribesmen are peaceful and content on a 10,000-square-mile reserve. Here all eyes center on the oldest boy as he distributes the candy. The youth wears an animal-skin loincloth. Ocher and ashen color several hairdos.

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Photographs by Gilbert Grosvenor





Hauling Produce to Market in Portuguese Mozambique, Tired Little Donkeys Plod Along a Highway Through the African Veld

▼ "Try It," Oudtshoorn Farmers Urged, So the Author Rides an Ostrich

Nearly 25,000 ostriches, raised principally for their valuable plumes, roam farms in South Africa's Oudtshoorn area. There the author sampled grated ostrich meat, crisp and salty, and bunched on rich ostrich-egg omelet. A wooden pen holds this male bird fast while Mrs. Grosvenor rides its back. Fluffy wings serve as reins. Heavy-clawed adult ostriches can rip a man open, but attendants (left) jog around the mud-walled corral on the tinner birds.

← "Is that mine?" A female admires her egg. In the nest are 11 more laid by the same bird. Female ostriches' dull gray feathers are used to make dusters,

Illustrations by Gilbert Grosvenor





★ Port Elizabeth: Its Hub Is Busy Market Square

The author found Cape Province's second city celebrating a new milestone in its progress—inauguration of an automatic telephone exchange. "Thanks to Mr. Bell," said a headline, followed by a tribute to her father, Alexander Graham Bell, inventor of the telephone.

Laid out as a town in 1820, Port Elizabeth early developed such industries as tanning, shoemaking, and food processing. Modern times have witnessed the growth of textile, tire, cable-making, and giant auto-assembly plants. Today this bustling modern seaport city boasts 400 industries and a population of 199,200.

Trees and shrubs in the Mayor's Garden (background) face City Hall. A statue of Queen Victoria overlooks the square.

← Party-bound Zulus Wear Gala Dress

These belles, on their way to a festive gathering, display their holiday best: bead headresses and necklaces, ear disks, and red robes embroidered with black. Beads decorate the girl's staff.

Kodakpress by Gilbert Grosvenor





Clifton's Sun-washed Bungalows Descend a Steep Hillside Above the Atlantic

Seaside Clifton in suburban Cape Town is a place of year-round residence. Winter temperatures rarely dip below freezing. Rugged bluffs of the Twelve Apostles (upper left) loom high above the town.



Natural Barriers of Wave-battered Rock Divide the Suburb's Bathing Beaches

At times, even in summer, the Cape Peninsula's Atlantic waters are uncomfortably chill because of a cold current (page 164). Here Clifton residents sun themselves on the sands; few venture into the surf.



Lion's Head Caps the Bald Summit of a Rocky Hill Above Sea Point

Sea Point is one of the most populous of Cape Town's suburbs. Its beach front, dotted with hotels, extends for two miles along the Atlantic shore from Three Anchor Bay to Bantry Bay. If the surf is too cold for swimming, holiday seekers throng Sea Point Pavilion's huge tiled open-air pool. Viewed from certain angles, the wrinkled knob, 2,175 feet high, resembles the head of a recumbent lion.

"Don't fly down to Cape Town," a fellow passenger warned us at Johannesburg. "It's a really rugged trip." In this southwest corner of Africa, he explained, cold and warm air come together violently; storms are frequent, and landing over Table Mountain is dangerous.

But to us it sounded even more "rugged" by train—28 hours and almost 1,000 miles over a torrid, semiarid mountain country. The plane trip, however bumpy, would be over in three hours. We decided to risk it; and, as it so often turns out, the passage was less rough than the warnings.

My first view of Cape Town from the air was worth the trip to me. Set close to the sea, the city seems to flow in red and white waves up and around the mountains behind it—Devil's Peak, Lion's Head, and the massive Table Mountain (pages 162, 166).*

Wisps of cloud floated over Table Mountain's broad flat top. Cape Towners call this the "tablecloth;" when a blustery southeaster blows this way, the cloud completely covers the surface of the table.

We found Cape Town in full bloom, for January, of course, is summer in this Southern Hemisphere. Parks and gardens were gay with blossoming trees and rainbow-colored African flowers (page 168).

Our suburban hotel was perched high on a cliff, overlooking the Atlantic where Dias once sailed. At dusk we climbed down a winding stairway—so many steps!—to the boulder-strewn beach below. Charming bungalows face the sea, their rock-garden terraces overgrown with geraniums, nasturtiums, and pinks. In the background, as unreal as a post card, towers the great sharp peak of Lion's Head and the range of the Twelve Apostles (page 174).

Where Mighty Oceans Meet

Pleasant homes like these, lovely resorts, and fishing villages line all the miles of beaches on Africa's southern peninsula, ending in the famous Cape of Good Hope and Cape Point (page 181).

Most of the resorts and fishing villages lie on the protected east coast, facing False Bay, which is near the Indian Ocean side. There the water is warmed by the tropical Agulhas Current. On the Atlantic side the cold Benguela Current chills the beaches.

Not far from our hotel we came to a huge swimming pool built along the very edge of the open ocean.

"It's not only rough and cold out there," a Cape Towner told us, pointing toward the sea, "but you're likely to meet a shark."

Cape Town is the oldest important permanent white settlement in Africa south of the

Equator. While we were there, the city was getting ready a big exposition ground to celebrate its 300th birthday. It was founded by the Dutch East India Company some 30 years after the Dutch West India Company had sent settlers to New Amsterdam and bought Manhattan from the Indians.

When you talk to Cape Towners about history, you hear again the name of Dias. They tell you about East Indiamen that sailed around the Cape for 160 years after Dias, their crews in too much of a hurry to get to the Orient, or home again, to stop here. Once in a while a vessel would pause briefly for water.

Then, in 1647, a Dutch ship was wrecked, and the survivors scrambled ashore at what is now Table Bay. From a salvaged packet of seeds they grew vegetables to keep themselves alive till rescue came.

From a Seed Packet, a City

The incident gave the Dutch East India Company an idea. In April, 1652, a company surgeon, Jan van Riebeeck, was landed at the site with about 100 settlers. His orders were to plant a vegetable garden for the benefit of the scurvy-ridden seamen of the East Indies traffic.

From the sailors' "Tavern of the Seas" Cape Town grew into one of the world's famous ports. Today it is the capital of Cape of Good Hope Province and the legislative seat of the independent British Dominion, the Union of South Africa.

In the heart of town, now numbering half a million, the stately Houses of Parliament face the 12-acre Public Gardens (page 166). And where Van Riebeeck's vegetables once grew, I saw a show collection of thousands of varieties of flowers, shrubs, and trees from all over the world.

Among them are many species of Australian eucalyptus and wattle, tried out as part of South Africa's extensive forest-planting program. "First thing you know, we'll have more Australian trees in South Africa than they have in Australia," a Cape Towner laughed.

"We make mine props out of eucalyptus," he added, "and the wattle bark supports our big tanning business."

But if South Africa imports some of her trees, she more than pays for them with the native flowers she exports. So abundant and beautiful are the Cape Province's wild flowers that the area has been called "the floral province." Flowers originally native to South Africa are now cultivated in gardens all over the world. Among them are some of the love-

* See "Busy Corner—the Cape of Good Hope," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, August, 1942.



South Africa's Prime Ministers Live in Groote Schuur, Once Cecil Rhodes's Home

Cecil Rhodes willed Groote Schuur, his "Big Barn," to future prime ministers of the Union of South Africa, though the Union itself was not yet formed when he died in 1902. The original structure, built by early Dutch settlers for grain storage, burned in 1896. Rhodes had it rebuilt with 50 rooms, but only two baths. His own bathtub, cut from a single great block of marble, is still there.

liest species of gladiolus, lobelia, geranium, marigold, and the calla lily; African violets are among our most popular house plants.*

When the Mayor of Cape Town, the Honorable Fritz Sonnenberg, gave us a reception at City Hall, we noticed his rooms were paneled in a handsome light-brown wood, beautifully carved and rubbed to a satin finish.

Stinkwood Makes Fine Furniture

"What kind of wood is that?" I asked.

"It's stinkwood," said the Mayor. "It got the name because it really stinks when it's first cut. It's been used for fine furniture and decoration from the very beginning, but it's getting scarce now and very expensive."

The architecture of Cape Town's older houses, colonial Dutch and British Victorian, recalls the city's Dutch and English past. From here on I found the influences of both countries strong all through South Africa.

Many dialects are spoken in Cape Town, but the two official languages are English and Afrikaans, the latter a modified form of Dutch. Both are taught in schools and universities and are required of all Government office-

holders. They appear together on everything from stamps and street signs to airport regulations and dinner menus.

South Africa has yet to solve the political and social problems rising from its mixture of many races, colors, and religions. In Cape Town's streets, modern South Africans of British, Dutch, and French ancestry brush shoulders with native Basutos and Zulus, and with Malays and Indians.

Mosques and minarets rise above the Moslem quarter as reminders of Malay slaves brought in the first waves of settlement. Turbanned Indians pass veiled Malay women and Cape Coloured, a mixture so lightened that some seem white.

In all South Africa, in fact, the vital statistics tell a significant story: 2,600,000 whites and 10,000,000 native Africans and other dark races.

To me, parts of Cape Town had a distinct English flavor. I heard many Oxford accents; I ate English pudding; and above all I drank tea—tea for breakfast, tea at 10:30, tea for

* See "The World in Your Garden," by W. H. Camp, NATIONAL GEOGRAPHIC MAGAZINE, July, 1947.

lunch, tea at 4 o'clock—tea, tea everywhere! Fortunately, we like tea.

To the east and north of Cape Town the English influence is less dominant, giving place to Dutch and French. This is wine country. Here the mountain slopes and fertile valleys are covered with vineyards, and some of the wines are world-famous.

Land of Vineyards, Mountains

The Dutch settled here in the 1680's and found the rolling, sunlit countryside ideal for growing grapes. A little later an influx of French Huguenots added their centuries-old wine-making skill.

Paarl is the center of today's wine and brandy industry. A hospitable town, it drowsed in the sun as we drove along its 7-mile "Main Street." Despite the Dutch name, the whitewashed walls, tall, pointed cypresses, and talk of grapes and vintages made me think of southern France.

The first important vineyards in the area were planted by Simon van der Stel, one of the pioneer Dutch governors. We visited his home, Groot Constantia, which has been restored as a museum. It is a cool, white mansion with curved and curlicued Cape Dutch gables shaded by stately old oaks.

In the rear of the house we saw dark, cave-like rooms without windows, once used as slave quarters. Here the slaves were locked up at night. Near by ran a stream where they washed their feet when it came time to trample out the grapes.

Van der Stel's vineyards are still producing. The South African Government now operates the Groot Constantia homestead as a model wine-making center.

Another monument to Van der Stel is the near-by city of Stellenbosch, which he founded in 1679. From the University of Stellenbosch, center of Afrikaans speech and culture, have come three South African Prime Ministers, including the late Jan Christiaan Smuts.

Sight-seeing trips around the Cape Peninsula may turn up anything from granite temples to mischievous baboons.

The Temple on Devil's Peak

Skirting Devil's Peak, we drove south through land once owned by Britain's empire builder, Cecil Rhodes. He left a huge estate to the country he helped found. His own house, Groote Schuur, he bequeathed as the official residence of prime ministers of the then unborn Union of South Africa (page 178).

On the slopes of Devil's Peak above Groote Schuur the South African Government has built an impressive temple in his memory. Near by stands the University of Cape Town, housed in white classic buildings.

At the university we picked up a professor who was to show us a bird sanctuary in Cape Flats, a watery area north of False Bay.

On the way we had our first look at a South African bird that was to become very familiar—the tickbird, or cattle egret. It was perched on a cow, searching for ticks and other insects scared up as the animal walked along. Within the past year cattle egrets have been found in Florida and north to Cape May, New Jersey, and even New England.

The sanctuary is called Seacoo by the English, from the Dutch word *zeehoe*, which means "sea cow." The name goes back to a time when hippopotamuses (sometimes referred to by older South Africans as "sea cows") cooled themselves in its waters.

The hippos have long since been killed off, but we found the low, marshy land and cloudless sky dark with birds—pelicans (white with black wing tips), herons, gulls, terns, and egrets. There were coots, avocets, storks (both black and white), and many kinds of ducks and plover, as well as the swallows which we were to find all over Africa.

We were fascinated by the show, since for 40 years we have made our home outside Washington a sanctuary for North American birds.

We recognized one of the Seacoo visitors, the arctic tern, as an old friend and world traveler. Every year this bird flies from the tip of Africa and other southern areas to eastern Canada and greets us at our summer home at Baddeck, Nova Scotia. Its route, almost 11,000 miles, is the longest of any migratory bird.

Beware the "Friendly" Baboons

At the end of the spectacular Marine Drive, cut in spots through solid rock high above the breakers, we came to the Cape of Good Hope. There, on the great barren rocks that plunge 650 feet into the sea, a band of baboons, the "Cape clowns," stood between us and the open ocean. There were big, medium-sized, and little baboons, and some tiny ones clinging to their mothers.

They were curious and seemed friendly and even approached us to beg for food. But they are pranksters, and we were warned not to leave the car without closing the windows.

Not long before, baboons had torn the upholstery of an open car to bits.

Early one morning we flew from Cape Town to Oudtshoorn, center of the ostrich-raising industry. What gold is to Johannesburg, the ostrich is to this dry inland region. Before World War I, when the demand for plumes was at peak, this section of the Cape Province was known around the world.

Then Paris modistes decreed hats without

plumes. The bottom dropped out of the market and fortunes were lost, until Oudtshoorn's ostrich breeders learned to supplement their feather business with other activities—dairying, farming, and sheep raising.

Ostriches provide more than feathers, however. For morning tea under shady pepper trees at one ostrich farm, I tried ostrich-meat hors d'oeuvres, a form of biltong, grated and served on crackers. It was dark brown, crisp, salty, and slightly sandy.

One Egg Serves 24 People

For lunch we ate ostrich-egg omelet. Ostrich eggs are much richer than hens' eggs, but they provide the perfect answer in case of unexpected guests: one ostrich egg can serve 18 to 24 people!

"We use just about everything, from feathers to toenails," said our hostess. "The toenails and sometimes the feet are made into ashtrays. Even the skin makes excellent handbags and shoes. But only the males—and the best breeds—give us the valuable black and white plumes for capes, fans, and hats. The females' feathers are dull gray. We make dusters out of them."

There are now an estimated 25,000 birds on about 200 farms in the Oudtshoorn area. Dry, sunny conditions there and room for the ostriches to race about particularly favor the industry. But there are many tricks to this trade.

Ostriches can be annoying, undependable creatures. Mortality is high among the chicks, and adults tend to have accidents: they try to eat the inedible or they fall into holes and break their legs.

Ostriches do not mate until they are three or four years old. Incubation of eggs lasts six weeks. During this time the cock takes turns with the hen in sitting on the nest.

We saw hundreds of baby ostriches about the size of turkeys. Different age groups are kept in separate enclosures for the protection of the smaller ones.

When the time comes for plucking, farmers pull the big birds by their necks into a pen with a shepherd's crook. Extreme care must be taken to keep from breaking the ostrich's delicate neck. During the plucking process a cover is often slipped over the bird's head.

"No," someone answered my question. "It doesn't hurt the ostrich to pick his feathers any more than it does a man to get a haircut."

Though ostriches can't fly, they make good speed on the ground. They sometimes race around the corrals at 25 miles an hour or more.

Teased into dancing and flapping their stubby wings, they make a comic sight. But adult cock ostriches are far from harmless.

One we watched was particularly nervous and belligerent. When an attendant poked at him, he struck out suddenly with his powerful legs.

"They've been known to rip a man open with those heavy nails," the farm manager told us.

I noticed a man riding an ostrich around the corral.

"It's not hard," they told me. "Try it."

Climbing up on my steed, I found it rather precarious, with nothing to hold to but a handful of fluff (page 171).

On the other hand, it's something of an experience to pluck feathers (my haul was two handsome feathers, one black and one white) from one's mount.

Between Oudtshoorn's desertlike country and the lush coastlands along the Indian Ocean rise the Outeniqua Mountains. Outeniqua means, in Hottentot language, "Little Brown Man Who Brings Honey from the Mountains."

Across the high, narrow passes of this range many of the Boer pioneers managed somehow to drive their ox teams and heavily laden wagons into the open veld beyond. Like America's western settlers, these Voortrekkers endured great hardships in their search for land and freedom. Their daring was rivaled only by that of the engineers who later built magnificent highways over these same narrow passes.

Driving south, in a series of awesome turns and twists over Montagu Pass (page 186), we left the arid hinterlands behind to follow South Africa's "Garden Route."

This lovely stretch of coastal roads winds between the mountains and the sea. Here deep-green forests alternate with fields and gardens. Thousands of varieties of flowers and flowering shrubs line the way.

Farther along come panoramas of seaside cliffs, white beaches and blue lagoons, and ocean-fronting resorts, with bowling greens, golf courses, and tennis courts.

Honeymooners, retired Englishmen, and vacationists from the warmer African regions flock to the garden playground. We stopped at land's end, in the popular scenic resort hotel incongruously called "Wilderness."

The Rondavel—Africa's Motor Court

The proprietor, Mr. Owen Grant, has been a member of the National Geographic Society for 26 years. He came to South Africa from England in 1900 and was one of the engineers who helped build the country's mountain-climbing railways. He was a pilot in World War I and still flies his own plane. When he visited New York several years ago, he rented a small airplane to fly himself and Mrs. Grant around the eastern States.

While my husband played golf with him on



Cape Point's Rocky Finger Marked Vasco da Gama's Passage to India

At the very tip of Cape Peninsula loom the Cape of Good Hope and Cape Point (foreground). The calm water at right is False Bay. Warmed by a current from the Indian Ocean, it is lined with bathing resorts. On the left the stormy Atlantic, cold even in summer, breaks against the rocks.

a course near Africa's tip, I went swimming in the warm Indian Ocean with Mrs. Grant. And it was at Wilderness that we met our first African rondavel.

This is not some strange wild beast but a small guesthouse, built in the circular shape of a native hut (page 198). Luxury rondavels, with fine furnishings, electricity, and running water, rank with the best U. S. motor courts. South Africa has its share of those, too.

Through Vast Primeval Forests

On the Garden Route nearer to Port Elizabeth we drove all day through vast forest preserves. Some were stands of eucalyptus trees; others were the highly prized stinkwood and South African yellowwood. The city of Knysna, on the edge of the forest, is a busy lumbering center.

In the mysterious green depths of the woods live some of the largest elephants in the world. Only a remnant of the once mighty herd remains.

We saw no elephants, but in the near-by

forest we found the famous King Edward VII tree. It is a native South African yellowwood, 137 feet tall. Its age is estimated at between 16 and 17 centuries—surely one of the oldest living things in South Africa!

Port Elizabeth, 150 miles to the east, was named for the wife of an early British governor of the Cape Colony, Sir Rufane Donkin. Lady Donkin died in India without ever seeing Africa. After her husband laid out the new town in 1820, he had a small monument raised on a hill near the port.

"To the memory of one of the most perfect of human beings . . ." says the bronze plaque.

"Elizabeth Frances, Lady Donkin, died in the Upper Hindoostan of a fever on 21st August, 1818, aged not quite 28 years. She left an infant in his seventh month too young to know the irreparable loss he had sustained, and a husband whose heart is still wrung by undiminished grief. He erected this pyramid, August, 1820."

Port Elizabeth is a modern, fast-growing town of 199,200 (page 172). It has scores

← A Wary Kudu Stands
Poised for Flight in
Hluhluwe Game Reserve

In this South African wildlife sanctuary, 140 miles from Durban, visitors may view animals at close range. Among the species that roam the Natal reserve's 40,000 acres in the heart of Zululand are black and white rhinoceros, kudu, impala, buffalo, kudu, wart hog, wildebeest, waterbuck, zebra, bushbuck, duiker, klipspringer, steenbuck, and mountain reedbuck.

Hluhluwe's name is pronounced "shloo-shloowee." In Zulu vernacular it means "Land of the Thorny Climbing Plant."

Hunting with a camera, Mr. Grosvenor stalked this kudu and many other animals in both Kruger National Park and Hluhluwe Reserve, obtaining rare closeups (pages 161 and 185).

Graceful male kudus, with their long spiral horns, have been called the handsomest of antelopes. A thick fringe of hair hangs from the throat of this bull; chalklike stripes adorn its back.

Illustration by Gilbert Grosvenor

✓ "Waltzing Matilda"
Plows Through Brush

Hluhluwe Game Reserve in Natal is noted for its rhinoceroses, both the black and rare white variety (page 188). Australian soldiers gave this black bull rhino its feminine name in World War II.

© National Geographic Society

Illustration by Quentin Kerrin





of new industries, but shipping is the big business; it is South Africa's third largest port. Canned pineapple from here finds its way to the grocery store in our Nova Scotia summer home.

Along this coast, as in the West Indies, hopeful fortune-seekers are always fitting out expeditions to find lost treasure. Our morning paper told of a venture just getting under way between Port Elizabeth and Durban. Its object was to bring up gold from the East Indiaman, the *Grosvenor*, wrecked in 1782.

It would be well worth salvaging! The 800-ton *Grosvenor* sailed from Trincomalee, Ceylon, in January. Aboard was a fabulous treasure: gold, silver, ivory, precious stones, and coins, valued then at \$10,000,000. Besides these, the ship also may have carried two jewel-encrusted golden peacocks from the throne of the Great Mogul at New Delhi. The throne was once valued at \$35,000,000.

So loaded, the *Grosvenor*, a floating treasure chest, ran into bad weather off Pondoland, about 30 miles northeast of what is now Port St. Johns. Wedged in rocks only a few hundred yards offshore, she was broken up by heavy seas.

Since then, several attempts have been made to rescue the treasure. One group in 1906 tunneled under the sea bed to within 40 feet of the wreck, then quit for lack of capital. So far, only a few coins, some broken china, and some rusted guns have ever been found.

"Thanks to Mr. Bell"

Even more of a surprise than the story about the *Grosvenor* was another newspaper headline: "Thanks to Mr. Bell." By coincidence we had arrived just as the city was inaugurating a new automatic telephone exchange, to serve 3,000 new subscribers.

The "thanks" referred to my father's invention of the telephone 76 years earlier. With it was a page-long and unusually accurate biographical sketch.

My husband and I visited the editorial offices of the newspaper, the *Eastern Province Herald*, to thank its editors. It was mid-morning when we arrived, and we found them—of course!—having tea. After introductions they asked us to join them. The next day the *Herald* had another story with a picture and a three-column headline:

"P. E. Telephone Switch Coincidence: Inventor Bell's Daughter in City!"

But if dial telephones symbolize modern Africa, one sight I saw in Port Elizabeth was straight from the jungle. In the heart of town lies a shrub- and plant-filled pit where hundreds of live snakes writhe and crawl, coil and uncoil. We watched Johannes, a veteran native attendant, dressed in heavy

gloves and leggings, handle the puff adders, Cape cobras, boomslangs, green and black mambas, and other venomous snakes.

A job in Snake Park is not for the timid. Johannes and other men who go into the pit are often bitten. They survive only because of snakebite serum, quickly administered.

We had visited "snake parks" in other cities, including the famous ones in São Paulo, Brazil, and Miami, Florida. They are more than just tourist attractions. Port Elizabeth's reptiles are regularly "milked" of their poison for use in making antivenins. During World War II the serpentarium collected venom for serum to protect the lives of Allied soldiers.

Durban: Lonely Outpost to World Port

We flew next to Durban, South Africa's leading seaport, with a population of 475,000. It has many factories, and its wharves are busy and crowded; yet it has beautiful resort hotels along its water front, fine, clean beaches, and a wonderful warm sea wind.

Only 125 years ago it was a lonely British outpost. The land around it then was still ruled by Zulu kings whose fierce warriors, thousands strong, had fought bloody battles with the early settlers.

Here the South African street scene, familiar to me by now, changes. Small-featured Indian women walk by in gold and lavender saris. Exploring side lanes, I found descendants of Zulu warriors selling magic potions and charms along with mealies—native corn.

In a shed market we saw samples of the old Zulu crafts—beadwork, feathers, and basket weaving. Next to them were delicate ivory carvings made by the Indians, relative newcomers to Africa (page 190).

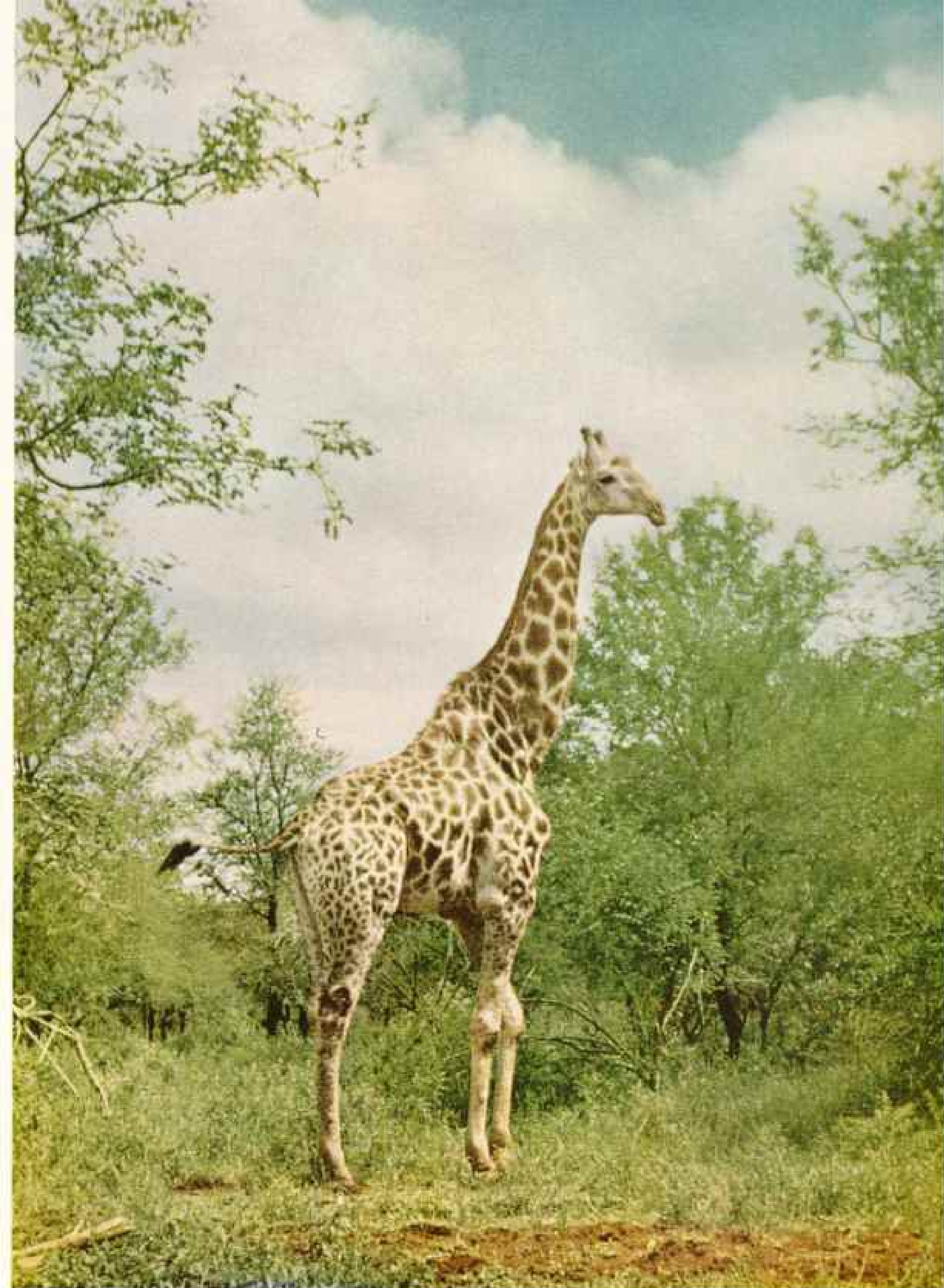
"We have the largest Indian community of any city outside India," a Durbanite told us. "It started in the 1860's, when the sugar growers began importing indentured workers from India for their plantations. Now we have Hindu temples, bazaars, and even fire walkers and snake charmers."

Substitute for Witch Doctors

In Durban we visited the McCord Zulu Hospital, one of South Africa's first hospitals exclusively for non-European patients.

Its founder was Dr. James B. McCord, an American medical missionary who came to Natal in 1899. The Zulus, when he arrived, still depended on witch doctors to cure their ills. Dr. McCord devoted the next 40 years to bringing them modern medical care.

Dr. Alan Taylor, who has headed the hospital since Dr. McCord retired in 1940, and Mrs. Taylor, who is a Canadian, proudly showed us through the modern 6-story wing. From a cottage clinic where Dr. McCord once



Bull Giraffe Takes a Lofty View from a Roadside in Kruger Park

Zulus call the giraffe *iedhulamite*, or "he that surpasses trees." Some adult males are more than 18 feet tall (page 194). The author and her husband had to shoo this ambulant skyscraper from the path of their car.



Modern Highways Cut Through Mountains Voortrekkers Crossed in Ox carts

Between South Africa's high inland plateau and southern seacoast the Outeniqua Mountains raise a forbidding mile-high wall. Boer pioneers, driving their cattle before them and hauling their household goods in ox carts, trekked northward over the rocky passes in search of more land. Now engineers have smoothed the way. The author drove over Montagu Pass in an American car assembled in South Africa.

successfully performed a brain operation on a kitchen table has come today's well-equipped hospital operated by trained personnel, native and white.

One of Dr. McCord's problems, especially in the early years, was the great diversity of native dialects, a difficulty found throughout most of Africa. His nurses, for example, to talk to all of their patients, had to know not only English but six different dialects spoken within 100 miles of Durban.

Everywhere we went, from the children's ward to the verandas, where men lay on the floor, Zulu style, patients and nurses listened raptly to Dr. and Mrs. Taylor's words.

"We accept not only Zulus," he told us, "but Indians and all other non-Europeans we can find room for. Not long ago the Durban Indians themselves collected funds for a Mahatma Gandhi Ward."

South Africa's Own Paul Revere

Twenty years before the first Indians came, the fate of the infant port of Durban hung in the balance. It was decided by an English Paul Revere.

We heard the story out at the city's Old

Fort. Here, at what is now a veterans' home and luxuriant gardens, the British set up a military camp in 1842.

A clash followed with the neighboring Boers, who had recently established their own headquarters at Pietermaritzburg. The Boers besieged the British garrison and hopelessly outnumbered it. An English settler at the fort, young Dick King, volunteered to ride for reinforcements.

His goal was Grahamstown, 600 miles away over the tortuous mountain and jungle trails of his time. Despite hostile natives, wild animals, and crocodile-infested rivers, he made it in 10 days. Durban was saved for the British, who pay their respects to King and his horse in an equestrian figure on the esplanade.

Motoring inland to Pietermaritzburg, now capital of Natal, we found the Dutch side of the struggle. The city itself is named for two stout Boer leaders, Piet Retief and Gert Maritz. In its Voortrekker Museum visitors can see relics of the Great Trek of the mid-1830's, when hundreds of Boers migrated north to escape British rule.

Northeast of Pietermaritzburg stretches

present-day Zululand, a 10,000-square-mile reserve of round beehive huts and cattle kraals. The once warlike Zulus have hung up their spears to follow peaceful pursuits. There are few men around the kraals, as they are employed in the neighboring cities. Zulu women as a rule stay home and grow vegetables.

Near the Zulu capital, Eshowe, we stopped at the primitive hut of a well-known native sculptor, Ntuli. This young man has refused tempting offers to come to the city and practice his art. He prefers to follow the tribal life of his ancestors. His models are Zulus and wild animals of veld and bush. His hut has no windows and no chimney. But with clay right outside his door and wives to cultivate his fields, he has everything he needs to make him happy. His statuettes sell for good prices, and he can sell all he makes.

"Physically, the Zulus are different from white people," he said. "Their legs and even their ears are shaped differently. I prefer to stay here and model my own people."

I saw primeval Africa, wild and unspoiled, at Hluhluwe Game Reserve, deep in Zululand.*

Hluhluwe (the name means "Land of the Thorny Climbing Plant" and is pronounced "shloo-shloowee") is a 40,000-acre reserve set aside by Natal Province. Wild animals roam through it just as they did before white men came to Africa.

As we drove along the winding road into the barbed-wire enclosure of the reservation, we counted 11 kinds of animals we had never seen before. It was near dusk, which, like dawn, is a likely time to find the beasts coming out of the bush to drink and feed.

Gnu Looks Like a Horned Horse

By the side of the road an ugly little wart hog trotted, its spiky tail held high. We passed a wildebeest, or gnu—familiar to crossword puzzle fans—which looked like a frolicking horse with horns. Then some antelopes, including an impala, tossing graceful lyre-shaped horns, and a big kudu, with narrow white stripes (page 182).

We caught a glimpse of a hyena or two slinking through the underbrush. A duiker, another kind of antelope, about 26 inches high, leaped across our road. A waterbuck gazed at us inquiringly and bounded away, his rear marked with a white circle as if he had sat down on a freshly painted toilet seat.

A little farther along we spotted a group of black rhinos quietly grazing. We were not fooled by their peaceful appearance; the black rhino, when disturbed, is unpredictable and extremely aggressive.

"If one of them should charge you when you're on foot," we had been warned, "it's a

good idea to zigzag as you run, like a ship when a submarine chases it. Rhinos have poor eyesight and can see only straight ahead."

Nevertheless, my husband decided to try for a picture. Stopping the car, he got out and edged closer to the great beasts while I looked on anxiously. Then, as he raised his camera, one of the larger rhinos turned toward him and moved ominously forward.

I shouted a warning from the car. He paused long enough for one more picture, then jumped into the car. The driver stepped on the accelerator and we sped away.

Hunt for a White Rhino

The animal we particularly wanted to see and photograph at Hluhluwe is one of the rarest in the world: the white rhinoceros. A few carefully protected groups are still left on these primitive acres.

"You can tell them easily from the black," said Capt. Harold Potter, F.R.Z.S., Zululand's lean and sharp-eyed Game Conservator. "The white ones are larger and heavier and somewhat lighter in color, though they're not really white; and they have a square jaw. The black has an overhanging lip. Also, the white rhino feeds on grass, while the black feeds on tree shoots."

The visitor's camp at Hluhluwe is a group of cottages and rondavels. A kitchen is provided, but guests have to bring their own food. A candle by the bedside is a reminder that the camp's electric lights go out at 10 p.m.

Hoping to see a white rhino, we were up and out at dawn. We had to depend on our chauffeur to find the animals, often only dimly visible in the bushy jungle.

Our car moved on to a road that was little more than a path, and finally into a tree-dotted valley.

"Look!" exclaimed the driver. "White rhinos under the thorn trees! Six of them!"

Again my husband had his camera ready, and he got an unusual picture, since white rhinos are seldom seen in groups larger than two or three (page 188). They are less aggressive than the black ones, despite the fact that they weigh about a ton more and have an almost armor-plate skin.

Some of the most interesting residents of Hluhluwe, to me, were the hornbills, large birds with great hornlike beaks and a very odd family life. There are several varieties, and most of them follow the same peculiar custom: at nesting time the female, with the help of the male, walls herself up with mud inside a hollow tree. Only a small hole is left, through which the male feeds her and the

* See "Roaming Africa's Unfenced Zoos," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, March, 1950.



← **Six White Rhinos,
a Rare Sight, Graze
Beneath Thorn Trees**

Natal's Hluhluwe Reserve is one of the few places in Africa where the white rhinoceros can still be found. It varies only slightly in color from the black species, but other differences are marked. White rhinos are far more bulky, have broad snouts, and eat grass. Blacks are easily recognized by their narrower muzzles and overhanging lip; they feed on tree shoots.

Unlike its smaller, ill-tempered cousin, the white rhino is not very aggressive.

Mr. Grosvenor's photograph records an unusually large number of the rare beasts. Normally they are found alone or in groups of two or three.

Below: Impalas are the most abundant antelope in Kruger Park. Fond of company, they often gather in troops of 100 or more. When frightened, the animals dash away with prodigious leaps, sailing effortlessly over bushes, rocks, and ravines. Here a large herd trots across the veld toward a favorite grazing area.

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Kodachromes by Gilbert Grosvenor





Indian Ladies Stroll Down a Portuguese Sidewalk in East Africa

Indians were first imported in large numbers as indentured laborers to work on sugar plantations, starting about 1860. Now, as farmers, traders, shopkeepers, moneylenders, and as workers in many other jobs, they form an important part of Africa's population. South Africa alone has 350,000 Indians (page 184); British East Africa, 200,000. These women walk in Lourenço Marques, capital of Portuguese Mozambique.

babies, sometimes for several months. Finally, when the young are ready to fly, the mother knocks down the wall.

Secretary Bird Wears a Quill Pen

Another odd denizen of Hluhluwe is the secretary bird, known only in Africa. It gets its name from stiff black head feathers that look much like quills worn behind the ear of an 18th-century clerk. To complete the illusion, it has black feathers covering its upper legs, like velvet knee breeches, and pink-"stockinged" lower legs.

The secretary bird is not so mildly clerk-like in its habits, however. Stalking veld and woods for its prey, it may swoop down on a snake, lift it high in the air, and drop it to the ground before closing in for the kill.

From Hluhluwe we took a side trip northward to Lourenço Marques, capital and seaport of the Portuguese Province of Mozam-

bique. Its Provincial Museum has a fine natural-history collection, realistically mounted and out in the open so children can touch the animals if they want to. Here we were able to identify many birds we had recently seen.

Particularly interesting was a small bird called the common honey guide, which co-operates with other animals in getting to the contents of the wild bees' nest. This bird cries and chirps to guide people or honey-eating animals to the sources of honey. Then, when the hive is opened, it gathers its share of the loot, both honey and wax.

The honey guide may possibly prove to be important to medical science, we learned later. Dr. Herbert Friedmann, Curator of Birds at the U. S. National Museum in Washington, D. C., is making a study of the honey guide's peculiar ability to digest wax.

This may provide a method of attacking the waxlike envelope that protects tuberculosis germs from medication.

Mozambique has been Portuguese continuously for four and a half centuries, though the early settlements were only scattered fortresses along the coast. Vasco da Gama, in March, 1498, sailed into the Arab-held port of Mozambique during his original historic trip to India around the Cape.

Don't Pat the Lions

"Don't bathe; there are often crocodiles in the smallest pools. Don't become alarmed if lions stand and stare at your car . . . The lion's nose tells him at once that a car is not good to eat . . . Don't imagine because the lions are passive . . . that you can go up and pat them."

Such are routine instructions for visitors to Kruger National Park, world-famous game

preserve. Without our steel-bodied car we would not have been admitted. Visitors, for safety, are forbidden from wandering about on foot, bicycle, or horseback, or after dark.

Kruger Park, on the eastern border of Transvaal Province, was started in 1898 through the efforts of the Boer statesman, Paul Kruger, who was then president of the independent South African Republic.

Here, in an area nearly as large as Massachusetts, wander elephants, giraffes, hippopotamuses, zebras, and antelopes of all kinds. Kruger's lions are famous but sometimes coy. Even for the British royal party in 1947 none made an appearance.

With our host, superintendent H. C. van der Veen, we set out one morning just as light was breaking. We passed a jungle scavenger, the jackal, and then a herd of antelopes grazing as peacefully as cows (page 188).

Honking at the King of Beasts

Suddenly a tawny shadow loomed ahead of us, and we almost drove over two blasé lions stretched out in the road. They had evidently just finished breakfast—perhaps on one of the herd we had just seen—and were too lazy to get up. They licked their chops and paws, looked at us superciliously, and rolled over in the dust. Finally, after we had photographed them, we shouted and honked our horn at them. They got up leisurely and moved to the side of the road and lay down again to finish their nap (page 161).

We turned a corner, and there by the side of the road stood a giant giraffe, battle-scarred and seemingly indifferent to traffic (page 185). But that was only a pose. He lumbered behind a tree and peeked out at us from the very top, first from one side, then the other.

"Sorry," said Mr. van der Veen as we drove on, "that you didn't see our sable antelope."

Almost as he spoke, several of these magnificent beasts loomed in the high grass, a study in black and white and arched horns.

Back at his attractive stone home we found that even in this wilderness modern inventions have their place.

"Malaria used to be a curse here at this time of year," he said. "Every year we sent our children away for six months. Now, with the daily spraying of DDT, we feel safe enough from the mosquitoes to keep even our two-year-old baby with us."

Across the Transvaal we drove through mile after mile of green and fragrant orange groves. These trees, well over half a million of them,

belong to Zebediela, one of the largest citrus estates in the world.

Zebediela owns and operates its own local railroad, factory, laboratories, and hospital. It hires more than 3,000 natives and 500 Europeans.

The venture grew out of the daring and imagination of the late I. W. Schlesinger, who came to Johannesburg from America as a penniless immigrant and started a chain of successful enterprises.

On an exploring trip into the Transvaal 30 years ago, he saw the possibilities of its rich and virgin soil—if it could be supplied with water.

Backed by vast sums of enterprise capital, the Schlesinger Organisation cleared the land, dammed near-by rivers, built irrigation channels, and bored deep wells.

A golden harvest was pouring forth when an epidemic of relapsing fever, carried by a soft-shelled tick (*Ornithodoros moubata*), broke out among the workmen. The disease threatened the very existence of the project. It was checked only by burning out the whole village, where thatched roofs and clay floors harbored the tick. Now the workers live in new tick-free houses made of concrete.

Zebediela's oranges are shipped to other parts of Africa and north to England and the Continent.

South Africa Has Three Capitals

On our way back to Johannesburg we stopped in Pretoria, capital of the Transvaal and administrative seat for all South Africa. Its tree-lined avenues and classic architecture reminded me of Washington, D. C.

The Union of South Africa, like the United States, has its government divided into three segments—administrative, legislative, and judicial. But, unlike our government, in South Africa each segment has its own capital city.

Pretoria is the home of South Africa's chief executive, the Governor General, of its Cabinet ministers and civil service; it is also the residence of foreign diplomats. Cape Town is the seat of the Legislature. And Bloemfontein, provincial capital of the Orange Free State, is the headquarters of the national judiciary.

Paul Kruger, the Boer fighter who founded Kruger Park, lived and is buried in Pretoria. The city has preserved his old homestead, a long, one-story building, just as it was in his time. There visitors can gaze at his personal belongings and recall the man, with his pipe, cane, and familiar top hat; his Bible, and his



knife with which he once amputated his own finger after a gun explosion had injured it.

Pretoria's huge granite Voortrekker Monument, unveiled in 1949, is one of the most impressive I have seen. The central structure holds statues and friezes showing the history of the Great Trek. Surrounding it is a defense circle of sculptured trek wagons. From behind their wagons the trekkers often fought it out with hostile natives, just as American pioneers battled with our western Indians.

Pretoria has roots in the past. But it is also the Union's largest steel producer and was the site of its first large-scale steel production.

"Jo'burg" Miners Dance Off Steam

During our second stop in Johannesburg we saw our biggest show. It comes on Sunday, when the native workers of the gold mines forget they're "civilized" and dance to the primitive rhythms of their old tribal life.

We watched the dancing from seats in a big stadium, similar to our own football bowls. There was room for an audience of three or four thousand people, with sections divided equally between native and white spectators, all admitted free. The arena was turned over to the dancers.

They wore a fantastic assortment of barbaric finery—leopard skins, beads, ostrich feathers, and leg rattles. Most of this adornment was simply superimposed on their European work clothing.

"It's the favorite amusement," said our host at the Rose Deep Mine on the edge of town. "But just to make sure that the fun doesn't get too violent, you'll notice the spears are wooden."

Each tribal group had its own special act, posturing, kicking, advancing by jumps, stamping, whirling, or throwing themselves on the ground. Some of the dancers carried rhinoceros-skin shields with their wooden spears, or poles ending in oxtails which looked like kitchen mops.

Others wore big, loose rubber boots. They kept rhythm with these by knocking them together or slapping them with their hands.

Musical instruments were quite ingenious. There were drumheads stretched across bar-

rels, tin whistles, and marimbas made of planks, copper tubing, and tin cans. One dancer rattled out his own accompaniment with stones in a shoeblacking can. A group of men in women's clothes chanted accompaniment, representing village women.

Mine workers are recruited from bush villages and signed to contracts ranging from nine months to two years. A beginner's pay is three shillings (about 41 cents) a day, but it goes up rapidly as he gains skill. Besides the wages, the company provides living quarters, hearty, nutritious meals, and free beer.

We saw the huge vats of beer from which the miners get their daily ration, and visited the dormitories where they sleep in bunks grouped around a central fireplace. Each tribal group lives by itself, as they sometimes fight, group against group, and when they do, it is always to the death. These fireplaces are used for cooking as well as heating, since each man receives three pounds of uncooked meat a week in addition to his regular meals.

A portion of the miner's money, we learned, may be withheld as a nest egg. With this the miner can go home as a man of consequence. Later he may want more money and return to the mines for another contract term. If he does, he keeps his old seniority and pay.

But often the retired gold miner uses his savings to set himself up for life, with land and cattle. He trades his cattle for a wife or wives, and settles down. In the South African backlands the price for a wife is five cows!

Smoke That Thunders

Flying over Victoria Falls, we were balked of our first look at the cataract by the mists that veil it.

"At certain seasons," our pilot said, "those mists are like a smoke column. We can spot it 80 miles away and set our course by it."

We didn't get a clear view of the "Smoke That Thunders," as the natives called the falls when Livingstone discovered them in 1855, until we flew over them again in a chartered plane. The bright sunlight pierced the mist, and we could see below us the placid Zambezi River take its dramatic 354-foot dive.

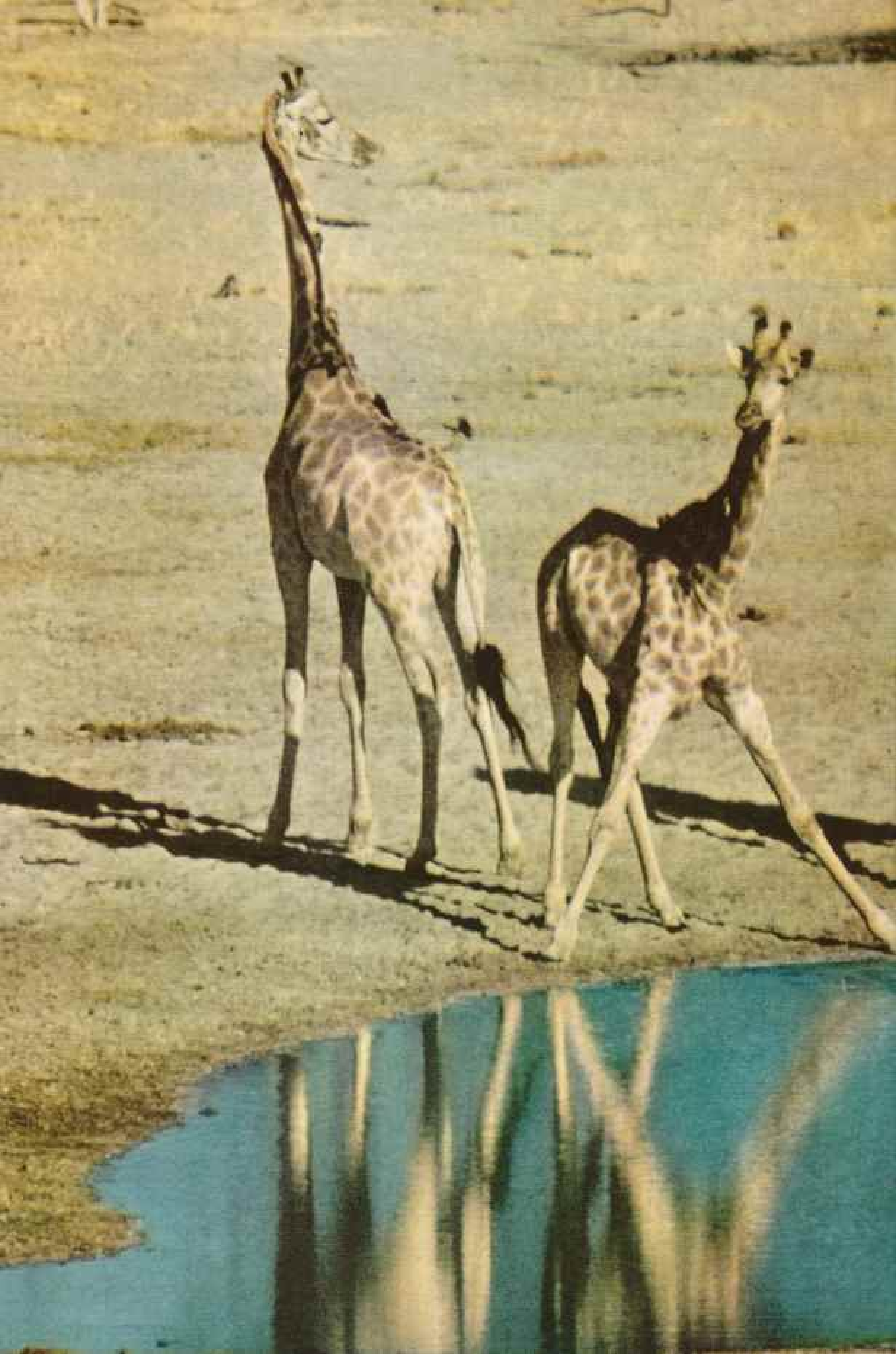
"Mission accomplished," we flew to Southern Rhodesia's Bulawayo, a young city in the still-young country fathered by Cecil Rhodes.* Near by, at the crest of the granite-faced Matopo Hills, stands Rhodes's grave, surrounded by massive boulders.

But Rhodes, who died only in 1902, belongs to Africa's present. We had a date with the past, at the site of one of the world's great mysteries.

* See "Rhodesia, Hobby and Hope of Cecil Rhodes," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, September, 1944.

← Foaming Waters of the Umgeni River Plunge 365 Feet Down Howick Falls

This lacy cataract, more than twice the height of Niagara Falls, lies only 15 miles northwest of the heart of Pietermaritzburg, Natal's provincial capital. Howick Falls, like Niagara, has been retreating for many centuries, leaving below it downstream a narrow walled gorge along the Umgeni. Thousands of visitors view the falls each year. Near by are sylvan picnic spots and handsome resort hotels.





Giraffes, Gawky Legs Spread Wide, Drink at a Water Hole in Southern Rhodesia

With its slope-backed body, stiltlike legs, and 7-foot neck, the giraffe has been the butt of many a jest through the centuries. Romans guffawed at a captured giraffe in the days of Julius Caesar. Lorenzo de' Medici exhibited one for the amusement of Florentines during the Renaissance.

But the gentle giraffe's bizarre appearance is not without purpose. Long legs and periscopic neck enable the animal to reach the limbs of acacia trees, from which it strips leaves and tender shoots, the mainstay of its diet, by means of an extensible tongue.

Giraffes are the tallest of mammals. Bulls tower as high as 18½ feet from hoof to crown; females measure 15½ to 16 feet. It is not unusual for an old male to weigh two tons. The hide alone, exceptionally tough and nearly an inch thick, exceeds 100 pounds.

Despite its bulk and awkward look, the adult animal can gallop an estimated 35 miles an hour for short distances. At a lesser pace it shows greater endurance than the gamest horse. Since the giraffe moves fore and hind legs simultaneously on one side of the body, it runs with a peculiar rolling motion, tail upcurled and stiff neck bobbing up and down.

Giraffes, like their relatives, the antelope and deer, are peaceable creatures. But, if cornered and attacked, they rain deadly blows with their cloven hoofs. Adults have but one natural enemy, the lion. Usually it takes two or three of the big cats to pull down a giraffe.

Old bulls often battle for herd supremacy. They not only lash out with pile-driver kicks, but swing their necks like baseball bats in an effort to knock each other off balance.

The giraffe cannot drink when standing upright. Its long neck contains no more bone joints than that of a hippopotamus and cannot be lowered very far.

Here two giraffes bend on spraddled forelegs while a third acts as sentinel. Oxpeckers perch on the mottled backs.

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Illustrations by Quentin Keyser



Zimbabwe's Great Elliptical Temple Is a Mystery from Africa's Dark Past

The ruins, found in 1868 in Southern Rhodesia, baffle archeologists. The temple's outer walls are 800 feet around and 36 feet high in places. Crumbling inner walls, right, divide the temple into a maze of passages (opposite page).

"You can't make it," they told us. "The roads are washed out. There's no through train, no air service."

We managed, though. Our pilot back at Victoria Falls had simply arranged with a colleague for us to hire a plane, one of those numerous flying taxis that are available today throughout much of Africa.

Thus 150 miles east of Bulawayo (finishing by car over partially paved road) we came to Zimbabwe, the ruins of a city built by an unknown people at an unknown time. Even the name is a puzzle. It may combine two Bantu words meaning "stones" and "houses."

The massive structures which make up the "Great Zimbabwe" are built of hand-hewn stone skillfully fitted together without mortar. They were laid out carefully in a geometric pattern. At one end is a vast and roofless Elliptical Temple. Its thick inner and outer walls enclose platforms and two towers.

Who Lived in Zimbabwe?

Near by are the scattered stones of a Valley of Ruins where people may once have lived. Beyond rises the Acropolis, a hill crowned by obvious fortifications. Here the granite walls were so constructed as to merge with and make the greatest defensive use of the giant boulders already on the spot.

Wandering about, I was reminded of Machu Picchu, in Peru, where another vanished race has left similar ruins of mortarless stone.*

But Machu Picchu is linked with the Inca and pre-Inca peoples. Zimbabwe lacks authentic records or inscriptions and has few relics to hint at a long-lost past. Not even burial grounds identify its people.

There are clues to what their occupation was: old crucibles for melting gold have been found in the ruins. Medieval Arab and Portuguese explorers once told of some such fabulous gold-mining center in the interior.

Archeologists have argued about Zimbabwe ever since Adam Renders, American hunter and trader, found the ruins in 1868.

Early investigators thought the settlement had been in existence thousands of years. Some suggested that ancient travelers, perhaps the Phoenicians or Sabians, had built the city. Others theorized that it was in the Biblical land of Ophir; that it was the source of gold for Solomon's Temple and of the gifts brought by the Queen of Sheba.

Modern archeologists make no such claims of antiquity, but the detective work goes on. Since we were at Zimbabwe, U. S. physicists have examined a piece of wood from one of the temple walls. Using archeology's newest yardstick, the Geiger counter, they have measured the radioactivity of the wood and estimated its age: about 1,350 years!

The gold that once helped support Zimbabwe is still important in Southern Rhodesia's economy. Last year nearly half a million ounces were taken from big and little mines scattered over the country. Many of them dig into the same veins worked by the early race of unknown miners.

"We know the ancients worked our mines," said Mrs. Bill West, who with her husband owns and operates a gold mine near Zimbabwe. "We've found their crude implements in the old mine shafts. One of the theories about the many abandoned diggings found around here is that the miners gave up each time they struck water. Since they didn't know how to pump it out, they had to move on."

We too were moving on. We were scheduled to make another gigantic air hop into the depths of Africa, depths until recently penetrated only by men pushing on foot through swamps and jungles.

From Zimbabwe back to Bulawayo the air miles flowed by. We flew on to Salisbury, Southern Rhodesia's capital, and from there over the tip of Portuguese Mozambique and the high plateaus and mountains of the British protectorate, Nyasaland.

We crossed Lake Nyasa and the game lands of southern Tanganyika, to stop at the Indian Ocean port, Dar es Salaam. Its Arabic name means "Haven of Peace," belying a stormy German-British history.

Finally, 400 miles farther, we landed at inland Nairobi, the lively capital of Britain's Kenya Colony and Protectorate. Europeans in Kenya number only about 30,000, less than one percent of the Negro population. During our stay there, however, we could see little trace of the racial unrest which was to erupt less than a year later into a series of bloody massacres by the Mau Mau, a Communist-inspired organization of Kikuyu tribesmen.

Hints for Travelers

From Kenya we visited Uganda, Belgian Congo, Ethiopia, the Sudan, and Egypt.

We found travel in Africa pleasant and easy for the most part, the scenery fabulously beautiful, the hotels and inns good as a rule. The food was uniformly excellent. But for travelers who expect to follow our route, I can offer this advice:

Take clothes for all climates. Even in equatorial Africa it's cool on the plateaus, 6,000 or more feet up, and a coat is useful. At Zanzibar and Dar es Salaam, on the other hand, the thinnest, lightest things in the wardrobe are the most comfortable.

Be careful addressing your mail. When

* See "Peru, Homeland of the Warlike Inca," by Kip Ross, NATIONAL GEOGRAPHIC MAGAZINE, October, 1950.



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Rondavels, Copied From Natives' Circular Huts, Are Africa's Own Tourist Cabins

Simple in design and comfortable, these thatched round houses also fit admirably into the landscape. They are rented to travelers in many parts of Africa. Some are luxuriously furnished, with electricity and running water. Here the author inspects a rondavel in Zululand's Hluhluwe Game Reserve.

sending letters home to the United States, don't, for a city such as Richmond, put "U. S. A." after it, or it will probably be delivered to Richmond, Natal, in the Union of South Africa. There are many towns whose names duplicate ours, and "U.S.A." are the initials in common use for the Union of South Africa as well as for the United States of America.

Be sure to make hotel reservations in advance. Hotels and inns, with few exceptions, are small and are often full.

Keep your passports, visas, and medical records with you at all times. Traveling in much of Africa, you are moving only from one part of the British Commonwealth to another. Just the same, you will be asked to show your papers at each airport.

This is because each political subdivision has its own government: Nigeria is a colony and protectorate; the Union of South Africa is a dominion consisting of four Provinces; Northern Rhodesia and Uganda are protectorates, and Southern Rhodesia a self-governing colony; and so on. In some cases, of course, as in the Belgian Congo, Ethiopia, and Egypt, you are moving under a different flag entirely.

For the same reason, it is wise not to take too much of one kind of money with you, as the money and postage stamps, of course, change at each border. Also, each time you

cross a frontier you have to give account of the money in your possession.

Members of the National Geographic Society may be interested to know there are 8,000 fellow members in South Africa alone. They welcomed us in every city we visited.

Barefoot Waiters and Jungle Drums

Everywhere we went in Africa we found the strange contrasts and contradictions of a continent in transition. Here air-conditioned hotels, model farms, and dial telephones exist side by side with jungle drums, wild elephants, and mischievous baboons. In excellent new hotel restaurants you are startled to find your meals served by a barefoot, white-robed waiter wearing a cummerbund around his waist and a fez on his head—the prevailing waiter's garb from Cape Town to Cairo.

Invariably we were impressed by the work British colonial governments are doing in the vast sections of Africa which lie under the British flag. Most of this work in modern times is devoted to improving the status, not of the English settlers but of the Africans; to eradicating disease, improving agriculture, and introducing new industries.

Schools, universities, and hospitals have been built; more are going up. And there is great consciousness that the long-range objective is to teach Africans to govern themselves.

BY SAMUEL W. MATTHEWS

National Geographic Magazine Staff

TWELVE miles from downtown Washington, D. C., is a farm that breaks all the rules. Cows take heat baths. Weeds are planted in greenhouses. Fruit trees are sprayed with ground glass and disease germs, and cockroaches are raised in pampered colonies.

The farm employs 2,000 hired hands—hundreds with scientific degrees—yet grows nothing for market. But from such day-by-day activities the American taxpayer reaps bounteous returns. The harvest of the United States Agricultural Research Center at Beltsville, Maryland, is knowledge.

Farm Magic in the Making

Crossbred cows swelter in artificial tropics so that a few years hence dairy herds in hot southern States will give more milk. From greenhouse weed beds come better chemical weed killers for farms and lawns of tomorrow.

Orchards will be more resistant to blights because Beltsville infects trees with disease through tiny gashes cut by flying glass. With supercockroaches, immune to present poisons, scientists test new chemical killers.

Because of Beltsville and experiment stations like it in all 48 States, a revolution is taking place on the American land. The farmer's world has changed more in a single lifetime than in all the previous centuries man has cultivated the earth.

Today's farmer operates machines, unknown to his grandfather, that till his fields, fill his silos, mend his fences, and milk his cows. He plants seeds from which grow foods and fibers unheard of in this country a few decades ago. He raises streamlined pigs that arrive in larger litters and give more ham and bacon, and sheep with longer, finer wool.

Spray Bombs and Midget Turkeys

Agricultural science affects the daily life of us all. What we eat tastes better, is more plentiful and more nutritious. Much of what we wear lasts longer and costs less. Life is healthier and safer. Look at a few examples:

The first tests of DDT in this country were made at Beltsville following its discovery in Switzerland. The aerosol spray bomb, credited with saving thousands of lives in World War II by preventing insect-borne diseases, sprang from the ingenuity of two Beltsville scientists (page 218). The spectacular weed-killing powers of a chemical named 2,4-D were discovered on a dandelion-choked lawn at the Research Center.

Few such achievements bear Beltsville's name. Until "Beltsville turkeys," plump with white meat, began appearing in stores a few years ago, most city housewives had never heard of the place.

But through the pages of scientific journals, wherever men are seeking new horizons in farming, the sprawling experiment station on the outskirts of the Nation's Capital is fast becoming world-famous.

"Many farmers in my country can tell you where Beltsville is," a foreign visitor told me one day. "The name is as well known to them as any town in the United States."

This was a man who had traveled 6,000 miles to see the Research Center. An official of the Turkish Ministry of Agriculture, he had come for a six-months nationwide training course under the Point 4 technical assistance program.

On tours arranged by the Departments of State and Agriculture nearly 10,000 visitors went to Beltsville in 1952. Farmers arrived from Denmark's green dairyland and from the golden wheat country of the Dakotas. Agricultural students signed in from universities in Greece and land-grant colleges of the Great Plains. County agents came from rural offices in India and Indiana.

Green Grows "The Combination"

Those who cannot go to Beltsville telephone or write. In one office I noticed a cardboard carton piled high with papers and pushed under a table.

"Our filing space gave out," a scientist said. "There are 10,000 letters in that box, all received in the past three months and all requesting advice about lawn grass."

This same man walked me across a springy carpet of fantastic new turf developed at Beltsville. "The Combination," he called it.

"This grass won't lose color in midsummer heat," he said. "It thrives in poor soil without watering, crowds out weeds and crab grass, and resists diseases and insects. It's so tough that on a golf course it is virtually divot-proof."

Secret of The Combination is a remarkable strain of grass that came originally from Korea. Its name, Meyer *zoysia*, commemorates a Department of Agriculture plant explorer, Frank N. Meyer, who died mysteriously in China after sending home many strains of the *zoysia* family.*

* See "A Hunter of Plants," by David Fairchild, NATIONAL GEOGRAPHIC MAGAZINE, July, 1919.

Planted with a new bluegrass discovered growing on the Merion Golf Club course near Ardmore, Pennsylvania, a few years ago, Meyer zoysia forms an almost perfect turf by the rigorous standards of the United States Golf Association (page 210).

Meyer zoysia is not yet available in seed form, but a few enterprising nurserymen sell plugs and blocks of Meyer sod, which may be set into an existing lawn. Under good conditions they spread and join in two summers. The new grass has been planted thus in the lawn of the White House.

I paid \$5 for a square foot of Meyer sod from a near-by nursery and sawed the green-haired cake into 48 small blocks with a bread knife.

Following directions, I spaced the blocks a foot apart in a corner of my yard. Occasionally I watered and fertilized them.

By Labor Day lush green tufts marched along the fence in geometric procession. From each tuft new runners spread like spokes.

When my zoysia is re-plugged into the rest of the lawn, Merion bluegrass must be seeded also. Merion grows best in the cool months of spring and fall, whereas the Meyer thrives in summer's hottest weather. Together they provide green cover almost all year.

Uncle Sam—Farmer

Beltsville is the Nation's largest agricultural experiment center.

Its fields and forests, barnyards and laboratories stretch across 11,000 acres of rolling Maryland countryside.

Within the station, nine miles from one end to the other, are 950 buildings. In following the Center's 53 miles of roads I found an airport, a granary, a coalyard, and gleaming acres of greenhouses.

At the Plant Industry Station, on U. S. Route 1, I talked with a botanist about the miracles being achieved there in the breeding of new hybrid crops (page 202).

"In any research," he said, "a scientist must ask three questions: How can it be made better? How can it be made cheaper? Can something new be made?"

Today American farmers grow an additional three-quarters of a billion bushels of corn each year by planting hybrid seed. They raise golden tobacco far sweeter, milder, and lower in nicotine content than the leaf of Sir Walter Raleigh's day. Scientists at Beltsville are now producing Easter lilies as big as the bell of a trombone, and snapdragons and carnations half again as large as the usual variety. There are potatoes selected especially for potato chips.

Using well-known laws of genetics, plant breeders now transfer superior traits from one plant to another, much as farmers produce

a mule by breeding jackass and mare. The result is increased vigor, greater yield, and healthier, better adapted crops.

Hybrid corn has many things in common with the mule. The offspring of two different strains outproduces either parent. Yields jump spectacularly, just as a mule's work capacity is greater than that of either parent.

Four Bushels of Corn Replace Three

The first 10 bushels of hybrid seed corn were put on the market in 1922, and a spark was struck in the Corn Belt. By 1943 more than half of all U. S. corn grew from hybrid seed. Today the figure is above 80 percent for the Nation and virtually 100 percent in the Corn Belt.

As Dr. Albert H. Moseman, chief of the Plant Industry Bureau, put it: "The extra bushel in every four which hybrid corn gave us is worth enough each year to pay for all the research ever done by the Department of Agriculture."

To learn how closely agricultural research affects the average American, I set out to see how Beltsville is improving the Great American Meal—steak and potatoes, tomatoes, apple pie and cheese.

In a paddock at the animal husbandry barns I found cattle that had never eaten green grass, nor had their forebears for five generations. Kept on concrete and bare earth, they live on precise test rations, Low-quality hay, plus grain and cottonseed, linseed, or soybean meal, control their vitamin A and protein intake.

"The idea," I was told, "is to find out whether prevailing notions of raising and feeding range cattle are valid. We have found several new ways to improve their nutrition."

Thus Beltsville helps ensure the quality and availability of tomorrow's beefsteak.*

Science Transforms the Spud

A potato specialist showed me how science works at Beltsville to give the common spud princely qualities. In a single year 50,000 hybrid potato seedlings may be grown in greenhouses. From these, breeders may get one new potato variety promising enough to christen with a name and release to field stations for further tests.

To breed a disease-resistant potato, scientists do not begin by planting sections or whole seed potatoes as do farmers. They work from the "fruit" of a potato plant, which many farmers, particularly where growing days are normally hot, never see.

Neither, I learned, had one red-faced radio commentator. One day at breakfast time he

* See "America's 'Meat on the Hoof,'" by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, January, 1952.



"Amazing!" President Eisenhower Marvels at Beltsville's Egg Sorter

The President, inspecting the Research Center, was fascinated by the electronic machine which separates eggs by shell color (page 215). A onetime farm boy, he showed keen interest in the Center's projects. At his right stands Secretary of Agriculture Ezra Taft Benson. The cage holds a Beltsville Small White turkey.

devoted much of his program to describing, in great excitement, the wonderful plant that grew in his garden near Washington.

"It has potatoes on one end and tomatoes on the other," he announced.

Almost before the broadcast ended, the studio telephone began to ring. Soon the commentator called Beltsville.

He learned to his embarrassment that what he had seen was not a two-crop miracle, but a potato plant forming green seed balls, like miniature unripe tomatoes (page 209).

By giving potato plants long, cool days under artificial conditions, Beltsville's breeders force these seed balls to form. Each contains up to 200 seeds, which carry the traits of both parent potato plants used in the cross-pollination.

New potato varieties keep far better than any ever did before. At Beltsville I saw them

being boiled, mashed, baked, and French fried after storage at various temperatures for different lengths of time.

"Try this batch," said a scientist in a kitchen devoted solely to potato chips.

"Each new variety of potato is tested for chipping quality by matching the color and cookability of its chips against a standard scale. These chips are almost perfect."

Hot and crisp, they were.

Tomatoes Win Against Wilt

Beltsville's unending battle against plant diseases has brought to the American table tomatoes larger and less expensive, redder and juicier.

A disease named fusarium wilt caused incalculable loss to tomato growers before World War II, despite the use of semiresistant plants. Scientists had long searched the world



Sunlight and Science Make the Plant Industry Station Uncle Sam's "Green Thumb"

Here, in laboratories, greenhouses, and Maryland fields, scientists work the year round with virtually everything that grows. They test soils, fertilizers, weed killers, and hybrid plants. This station is part of the 11,000-acre Agricultural Research Center, which stretches seven miles beyond U. S. Route 1 (top right).

for a tomato that would grow unharmed in soil infested with fusarium fungi.

Finally, a wild relative of the tomato was discovered growing near Trujillo, Peru. Its fruit grew only a quarter of an inch in diameter, but in soil artificially infected with wilt its foliage "stood out like an emerald" among brown and withered domestic strains.

A breeding program began in 1936 which ran through hundreds of selections and tens of thousands of plants. In 1940 a new tomato family, large in fruit and highly resistant to fusarium wilt, was released from Beltsville. Its name, now famous wherever tomatoes are grown, is the Pan America.

Even healthier tomato plants, resistant to more than one disease, are now being bred at Beltsville. Others, touched by strange new growth regulators, produce huge fruits, some with no seeds (page 211).

Growth chemicals contribute to the apple pie as well as to the salad. Sprays containing a single teaspoonful in 100 gallons of water hold ripened apples on the tree until they are ready for picking. Orchards lose less fruit to bruising falls.

In cold-storage chambers and model kitchens Beltsville follows the apple from tree to pie. A tempting aroma of baking pastry led me to a laboratory of the Bureau of Human

Nutrition and Home Economics, where racks of golden-brown pies were just coming from a gleaming electric oven.

Scientific tasters were sampling the pies for appetite appeal. The recipe, if approved, would be offered to thousands of hospitals, restaurants, and factory cafeterias.

Most American-made Cheddar cheese that tops off our pie is made from pasteurized rather than raw milk by a process worked out by Department of Agriculture dairy scientists. Pasteurization improves the average grade of cheese and makes it more uniform in quality, in addition to killing harmful bacteria.

Hormones Speed Growth or Slow It

Each improvement in the things we eat results from long years of basic research into mysteries of soil and sun and growing plants, for all life depends finally upon that which springs from the earth.

Among the most startling of Beltsville's plant experiments are those with the so-called "plant hormones," the growth regulators.

Quantities that can be held on the point of a toothpick may be considered heavy doses. Plant hormone men work with millionths, even billionths, of a gram of these organic chemicals with tongue-twisting names. Made radioactive, they can be followed



Beltsville's Prize Bulls Walk Miles for Exercise Without Leaving the Barnyard

A 2,300-pound Holstein (farthest from camera) is yoked to pull the merry-go-round exerciser. Other bulls follow tethers on spokes. Humped Red Sindhis (foreground) from India cross bloodlines with Holsteins and Jerseys for hybrid dairy cattle with high heat resistance (pages 206 and 214).

through a plant with Geiger counters. Toothpick doses are sometimes so powerful their effects can be traced to the second or even the third generation.

In Beltsville's hormone greenhouses I saw beanstalks with stems that climbed in strange twists and turns. Other plants grew from double and triple root systems.

Some growth regulators cause fruit to ripen early. In spring they can make blossoms "stick" longer on the tree, as with the Japanese flowering cherry trees in Washington, D. C. Other sprays reverse the process, thinning blossoms in orchards to prevent trees from developing more fruit than can be nourished to good size.

Plant-growth scientists work as well with the wonder drugs of modern medicine, the antibiotics. They find that these organic compounds, which inhibit or destroy disease-producing bacteria, viruses, or fungi, will move through a plant somewhat as through the human body.

New antibiotics have been discovered in many plants. Beltsville chemists have isolated a crystalline substance from the tomato plant that stops the growth of certain fungi harmful to plants and animals. They have found active antibiotic agents in the sweet potato and the banana, cabbage and cactus, cucumber

and celery, broccoli, lettuce, and muskmelon.

From tomatidine, a chemical made from tomato leaves and roots, medical researchers have produced the sex hormones progesterone and testosterone. Even the complex hormone drug cortisone may someday be made from the tomato, shunned as poisonous little more than a century ago.

Scientist Takes Pills of 2,4-D

The potent weed poison 2,4-D, which snuffs out the life of broad-leaved weeds without harming grass, was discovered first as a growth regulator.

Somehow the chemical stimulates plant growth when applied in microscopic amounts. But larger doses so overstimulate most broad-leaved plants that they burn up their food reserve in leaves, stems, and roots and literally starve to death.

When scientists at Beltsville first discovered 2,4-D's weed-killing powers, they tested it thoroughly on near-by golf courses and experimental plots. They were still not sure, however, whether it could be used safely around farm animals or man.

For 106 days a cow was fed grain with enough of the plant poison in it to kill a tree. Blood samples were taken and applied to seedlings. The plants showed there was

2,4-D in the blood, but the cow was unharmed and the chemical did not appear in her milk.

Then Dr. Ezra J. Kraus, a Department of Agriculture scientist, since retired, took capsules of pure 2,4-D every day for three weeks. He suffered no ill effects, proving that the new miracle spray could be used safely. In 1945 it was released to the public. Some 30,000,000 pounds a year are sold.

Even newer weed killers are now being tested. I saw selective plant poisons applied to soil from which corn, wheat, and soybean seedlings would grow unharmed, but never a weed. Using such "pre-emergence" soil treatments, farmers may one day mix weed killers with fertilizer and watch crops grow in weedless fields.

Mystery of the Flowers

For 33 years scientists have known that the changing length of day and night is a basic regulator of plant life. The phenomenon is called photoperiodism. But how it works is still a mystery.

Some plants blossom only in the lengthening days of spring. Others require more darkness than daylight and bloom in the fall when the nights are becoming longer.

Beltsville discovered that darkness, not light, times the miracle of flowering. When the night shortens or lengthens to a certain span, an unknown trigger mechanism tells plants that it is the season to blossom.

Sometimes if a plant's normal night is broken by even a short flash of light, it can be fooled into reacting as if there had been two short nights rather than one long one. Greenhouse operators already use this principle to withhold the blossoming of chrysanthemums and poinsettia until late in the fall, producing flowers timed to football crowds or the Christmas holidays.

In a dark basement laboratory I watched plant physiologists study photoperiodism. At the end of a long narrow room a rainbow suddenly appeared. In a swath of multicolored light stood a line of potted plants. A scientist in shirt sleeves moved into the light, shifting plants across the beam (page 212).

"Different wave lengths of light cause plants to behave in different ways," the experimenter said. "A few minutes under a certain light band sometimes can start a plant's blossoming process. Given another type of light, the same plant will not bloom at all.

"There seems to be a pigment, or set of pigments, in plants which reacts only to a particular wave length. But how this trigger mechanism induces flowering, we don't know."

Evidence has been found that a photoperiod mechanism also operates in animals and birds. It tells them when to change the color of fur

or feathers, and when the mating season arrives. A difference of only 20 minutes in night length has induced snails in a Beltsville laboratory to begin laying eggs.

Crop Speed-up Fights 15-B Rust

Beltsville plant breeders vary light and darkness to force grain plants and vegetables into flowering in the middle of winter, producing an extra crop each year.

The time thus saved, by telescoping a couple of growing seasons into one and more quickly finding a resistant variety, could mean the difference between winning or losing a race against a plant disease.

Hard-pressed grain breeders at Beltsville and at cooperating State experiment stations are now racing one of the most dangerous new strains of an old disease ever to attack the wheatlands of North America. In 1950 a new stem rust, Race 15-B, suddenly became a grave menace.

Beltsville has 13,000 different wheat varieties, gathered from all parts of the world. By the end of 1952 every one had been screened for germ plasm resistant to the scourge. The tests include sending new strains of wheat to South America, where even more virulent rusts are raging.

Plant diseases may be caused by fungi, virus infections, bacteria, or nematodes.

Nematodes that prey on plants exist in the soil as microscopic wormlike organisms. Some types are beneficial to man, such as those that attack insect pests and others that help break down animal and vegetable matter in the earth. But others are highly destructive—for example, the golden nematode, dreaded by potato growers.

Infesting fields, harmful varieties attack plant roots, sap their strength and vitality, and leave crops stricken (page 217).

Nematodes are among the hardiest and most numerous living things in the world. In laboratory tests some can survive temperatures approaching absolute zero, 459.69 degrees below normal zero on the Fahrenheit scale. They have been found in Antarctic moss. Others have been held dormant up to 39 years, then heated almost to the boiling point. Still they survived.

New Crops from the Wild

Yet in recent years basic research at Beltsville and other U. S. nematode laboratories has resulted in commercial development of new soil chemicals able to control these minute enemies of the farmer.

Plant diseases sometimes bring an entirely new farm crop into being. Chestnut trees of the United States once provided the leather
(Text continued on page 213)



Boston Likes Brown Eggs, New York Prefers White; a Beltsville Gadget Sorts Them

Science works for better living on the Department of Agriculture's 11,000-acre experimental farm in Maryland. This machine simplifies the problem of uniform packaging: its photoelectric cells select eggs according to color.



The Heat's on Bossy: She Breathes into a Respirator to Aid in the Search for Climate-resistant Cattle

Department of Agriculture breeders produced this animal by crossing a Jersey with a Red Sindhi from India. Their goal: better milk producers for Gulf coast regions. During 6-hour exposures at 105° Fahrenheit, instruments record the hybrid's reactions. Thermocouples attached to chalked-off areas reveal skin temperature.

Temperature Tells How Vegetables Fare in Showcases

Science's responsibility does not end with the creation of an improved plant or animal. Using refrigerator cars and trucks, a mock ship hold, and a complete cold-storage plant, Beltsville researchers devise better shipping and marketing techniques to ensure that food reaches your table in good condition.

Below: With temperature-indicating thermocouples buried in vegetables, a technician tests a modern merchandising rack for grocery stores.

Right: Many first-generation species hybrids are sterile. Beltsville agriculturists have discovered that such crossbred plants, if treated with the drug colchicine, may not only produce larger, healthier flowers, but bear seeds. Here giant colchicine-stimulated lilies, crossbreeds themselves, give up their pollen to Dr. S. L. Emsweller for further crossbreeding experiments.

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Kodachromas by National Geographic Photographers John E. Fischer, Donald McKeim, and David S. Horst.



U. S. DEPT. OF AGRICULTURE





Science vs. Insects: Researchers Test Airborne Spraying Equipment for Fighting Forest Pests

Stakes support small aluminum plates. Dye-colored insecticides, loosed from the Agriculture plane, settle on the plates and indicate coverage and concentration. A man (center) contacts the pilot by radio; colored smoke shows wind direction. Insects destroy as much timber annually as forest fires.

Apartment Dwellers Welcome Beltsville's Small White Turkeys

Below: From egg to succulent roast fowl, Uncle Sam's scientists strive constantly to improve poultry. Housewives applaud the plump, meaty turkey specially bred for small ovens, small refrigerators, and small families. Here four Beltsville turkeys have been cooked under controlled conditions to study yields of meat. Tangled wires lead from thermocouples thrust in the fowls to measure cooking temperatures.

Right: Ever see a potato fruit? Here Dr. F. J. Stevenson squeezes the green, tomato-like globes into a beaker of water. Each contains about 200 tiny seeds. Cloth bags keep ripe fruit from falling to the floor. In this photograph are potatoes, potato flowers (visible near exposed tubers), plants, fruit, dried potato seeds, and freshly harvested seeds.

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Kolicherman in National Geographic Photographers John E. Fisher and Donald McBurn





Tough, Disease-resistant, and Almost Divotproof, This New Grass May Be the Answer to the Golfer's Dream.

Developed from a Korean strain, Meyer zoysia has been planted with Pennsylvania's Merion bluegrass to form "The Combination." In a tug-of-war, scientist-golfer Fred V. Gray (left) and the author demonstrate the strength of the thick, springy turf. Employed by the United States Golf Association, Dr. Gray worked with Boltsville agriculturists in developing the new grass for links and lawns.

Flies Work for Science in Onion- breeding Tests

← In crossbreeding onions, scientists at Beltsville resort to a phenomenon as old as time. Dr. Henry A. Jones, who directed development of these hybrid giants, has released flies from a screened cage (foreground) into a cheesecloth enclosure tied around the blossom clusters of two seed plants. The insects, in their quest for food, unintentionally transfer the pollen, which clings to their feet and bodies.

Right: Wonder drugs of the plant world are growth regulators, also called "plant hormones." Famed weed killer 2,4-D is a growth regulator. In heavy doses it so overstimulates many plants that they "commit suicide" by recklessly burning up their food reserve.

Here biologist William H. Preston applies a hormone tincture to the stalk of a tomato seedling. Larger, redder, tastier tomatoes may result. Glass trays and beakers (foreground) hold hormone-treated sand and liquids.

Experiments by National Geographic
Photographer John E. Clatsbar





♣ **Atomic By-products Find Peacetime Uses in Agricultural Research**

This underground growth chamber duplicates sunlight artificially. By following the movement of "hot" tracers—radioactive isotopes—absorbed with fertilizers, scientists can analyze the feeding and growth processes of plants.

♣ **Light, Visible and Invisible, Controls the Life Cycle of Plants**

Beltville learned that the varying duration of darkness and the color of light control plant behavior. Using a giant spectrum, H. A. Borthwick (left) and S. B. Hendricks discovered that red light retards the flowering of some plants; infrared promotes it.



industry with ample tannin, the basic chemical used in curing animal hides. But the native chestnuts are gone, wiped out by a nationwide blight. Even dead chestnut trees are disappearing into the tanner's vat.

A wild desert plant called canaigre, which grows across dry wastelands of the Southwest, may take the chestnut's place, scientists told me. In canaigre's thick knobby roots, which look like gnarled sweet potatoes, a rich source of tannin has been found.

To enable farmers in dry regions to grow canaigre, high-yielding plants are being selected from the wild and domesticated. In effect, Uncle Sam's plant breeders are doing what the first farmers started with corn and wheat perhaps 3,000 years ago—developing a new cultivated crop—but in a few years instead of thousands.

A wild relative of cotton found in the mountains of Arizona has opened the way for cotton breeders to develop a new three-way hybrid with fibers unlike any other cotton now grown in this country. I saw these fibers tested at Beltsville; they are 50 to 75 percent stronger than standard upland varieties of the Cotton Belt, and 20 percent stronger than Egyptian long-staple cotton.

Plants Travel the World

Today there are few domesticated plants anywhere in the world that have not been tested in this country for their agricultural possibilities, a Beltsville official told me. Explorers still search the globe for wild strains whose germ plasm might improve crops here at home. But most traffic is the other way.

"Nowadays," the scientist said, "Uncle Sam sends 10 plants abroad, to be planted by farmers in other countries, for every one we find overseas and bring home."

The amazing power of the drug cortisone against rheumatoid arthritis has sparked a world-wide search for a plant from which the medicine might be made. So far, cortisone has been made for commercial use from an acid found in the bile of cattle, a source far too limited for the demand. But plant material may soon be used.

At the Glenn Dale, Maryland, U.S. Plant Introduction Garden near Beltsville, exotic vines and other leafy immigrants from Africa, Mexico, and South America grow in long greenhouses painted white to shield plants from the full summer sun.

"Chemists now get cortisone from materials found in many plants," my guide explained. "Our problem is to find one economically profitable for farmers to grow."

Soybeans were virtually unknown in this country until plant explorers brought new strains from the Orient. Now grown on

15 million acres in the United States, they yield vegetable and industrial oils, animal feeds, flour, plastics, and even the foam used in fighting chemical fires.

Korean lespedeza, introduced in 1919, ranks as a multimillion-dollar forage crop across the south-central farm region of the Nation. Ladino clover from Italy, crested wheat grass from Siberia, durum wheats from southern Russia (imported years ago before the Iron Curtain shut off exchange of plants with Soviet lands), tung nuts, avocados—the list of valuable gifts which far-traveling American plant explorers have brought to this country is almost endless.*

Agriculture is built on grass. The great food crops of the world are grass—corn, wheat, rice, millet, barley, oats, sugar cane. Grass means also the vast variety of meadow and pasture crops which sustain grazing animals.

Dairy Research Pays Dividends

In a scrubbed, clean-smelling calf barn I was initiated into Beltsville's dairy research.

"Our most valuable possession is not what we put down in scientific reports," a cattle breeder told me, "but what we have in our barns."

For 33 years a prize herd of Holsteins and Jerseys has been built, using seven generations of bulls with proved ability to transmit high-milking potential. From the experiment have come new standards for choosing dairy sires. Today's nationwide artificial breeding programs are based largely upon the proved-sire principle.

Crossbreeding of dairy cattle began at Beltsville in 1939, in the wake of the spectacular success stories of hybrid corn, swine, and poultry. To many dairy farmers, proud of their pedigreed herds, crossbreeding a cow still seems like rank heresy. But Beltsville's crossbreeding has produced amazing results, measured in higher milk yields and hybrid vigor.

Hump-shouldered cattle are common on the range, but not in U. S. dairy barns. At Beltsville, however, I found a bull of a foreign milking breed that may well revolutionize southern dairying. Housed near a huge Holstein, he seemed almost a midget. But his burnished red-black coat and high, skin-folded hump marked him as a true aristocrat far from home—a zebu bull, prince of the sacred cattle of India.†

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "How Fruit Came to America," by J. R. Magness, September, 1951; and "Our Vegetable Travelers," by Victor B. Boswell, August, 1949.

† See "The Taurine World: Cattle and Their Place in the Human Scheme—Wild Types and Modern Breeds in Many Lands," by Alvin Howard Sanders, NATIONAL GEOGRAPHIC MAGAZINE, December, 1925.



Ed. Reibauer

Scientists Follow California Grapes from Vine to Market

Transportation experts from Beltsville, riding produce trains coast to coast, keep continual check on temperatures during shipment. Thermocouples transmit readings to dials plugged in on the roofs of refrigerator cars.

"This is a purebred Red Sindhi," I was told. "Because summer heat holds down production of milk herds in the South, we brought in four heat-resistant Sindhis. By crossbreeding we're trying to get a strain of dairy cattle that can stand the sweltering summers of the Gulf States."

A special heat chamber tests Red Sindhi-Jersey and Red Sindhi-Holstein offspring for resistance to scorching weather. Six hours at a time, at 105° F. and in 60-percent humidity, their reactions are measured. Among other accessories the cows wear respirators like gas masks and tangled wiring leading to automatic temperature recorders (pages 203, 206).

"The dairy cow has been dubbed the foster mother of the human race," a scientist told me. "But a famous Wisconsin editor once said that the darkest place on earth is the inside of a cow."

What the editor meant, of course, was that science still knows little about the life processes that take place inside farm animals. At the Research Center physiologists, bacteriologists, and chemists constantly seek new ways to throw light into this darkness.

They study bovine reproduction—what causes sterility in cows, what effect hormones have in calving and milk production.

Twin Calves Equal a Herd

One heifer calf in every three that farmers feed to adulthood fails to pay her keep. Never producing enough milk, she might better have been turned into veal. Beltsville scientists hope to find a way of foretelling heifers' fortunes by measuring the immature mammary glands of calves even as young as four months.

Beltsville's herdsmen often "see double"—and it's no illusion. Since 1950 farmers have been asked to sell Uncle Sam identical twin calves to serve in feeding and nutrition experiments.

Such experiments have a practical use. When western ranges are deep under winter snows, stranded cattle find little grass for weeks or even months. Far behind normal growth when spring comes, how should they be fed to put meat on their ribs quickly?

Geneticists say that one pair of identical twins, whose birth may occur only once in one to two thousand calvings, is as useful experimentally as 25 less closely related calves. With identical twins all inherited character-

istics are the same; any differences in growth must be due to environment or feeding.

I saw one twin that was big and handsome, while his brother was a scrawny runt. The first had been fed a full ration, while the other received only enough to stay alive.

After six months the second calf is full-fed. Scientists then measure how much time and feed it takes to bring the animal up to weight.

Streamlined pigs grow in Beltsville swine barns. Seven new strains have been developed there by selective breeding through the past 18 years.

Six of the new strains are based upon crosses with the Danish Landrace breed. Each is longer, leaner, and more meaty than the American hog of old, yielding less unwanted lard and more pork, ham, and bacon.

Breeders have even produced dark-skinned sows that won't sunburn. Their appetites stay keen and their weight up, even in the hottest summer sun.

In one barn hogs may eat as much as they want, 24 hours a day. Contrary to the cliché that condemns "eating like a pig," scientists find that the hog never overeats.

Tailor-making Beltsville's Turkey

Beltsville is perhaps best known for its undersized turkey bred to answer housewives' demands for a bird that would fit today's apartment-size refrigerators, small ovens, and small families (page 209).

The compactness of the Beltsville Small White turkey is the secret of its success. Although it grows to little more than half the weight of large gobblers, its breast is broad and heavily fleshed, and the drumsticks are both short and plump. Its quick-maturing qualities and good breeding record make it popular with growers.

The inside of an egg is of top importance to poultrymen. Devotees of poached eggs want a thick white to cover the yolk uniformly. But if the housewife finds a blood spot, she shies like a frightened horse.

Egg candling is still done by dexterous packers who twirl each egg in front of a powerful light. At Beltsville I saw a new electronic candler, still under development. High-intensity filtered light is shot through the egg. If a blood spot is present, an electric eye "sees" it, and the offending egg is discarded.

Another tireless machine developed here in 1952 automatically separates eggs by the slightest variation in the color of their shells—from pure white through various shades of brown (page 201).

The machine got confused only when engineers ran through a few light-blue eggs of the Araucana chicken of Chile. The eggs were

whisked into the light-brown basket—not a serious mistake, since chickens which lay naturally colored Easter eggs are a breeders' rarity in this country.*

A Secret of Growth from Chicken Feed

In long, low poultry houses at Beltsville ultraviolet lights burn all night. Installed originally for their germ-killing power, the dim blue tubes were soon found to be boosting egg production. Scientists still aren't sure why. This ultraviolet "prodding" is distinct from the egg-laying stimulus of ordinary incandescent light, a technique long familiar to poultrymen.

Researchers know by recent experience that startling discoveries sometimes come from such small clues. A few years ago the hunt for a better chicken feed put scientists on the trail of a new vitamin with amazing power to promote growth.

During World War II, animal-protein feeds such as fish meal or slaughterhouse scraps became scarce. Soybean-oil meal, rich in protein, was substituted on poultry farms. It made a nourishing feed, but something was missing. If no animal protein was present, the hatchability of eggs dropped, and chickens grew too slowly.

Because the first stomach of a cow is known to manufacture vitamins, experimenters added a little dried cow manure to the feed. Suddenly birds thrived. Chemists found a growth factor in the manure, but it was none of the known vitamins.

At that point a pharmaceutical firm, Merck & Co., announced its discovery of vitamin B-12. The ruby-red crystals could greatly stimulate growth, it reported. Beltsville tried B-12 on chickens, and it was found to be the missing factor.

As little as 18 billionths of an ounce of B-12, injected into the fertile egg of a hen fed a diet deficient in the vitamin, produces astonishing results in newly hatched chicks. At the age of five weeks they are nearly twice the size of brother and sister chicks hatched from untreated eggs.

Battling Animal Ailments

More recently, researchers in many laboratories discovered that some of the miracle-working antibiotics stimulate animal and poultry growth. Today aureomycin, terramycin, and penicillin are being added to feeds in minute quantities. Baby chicks and young pigs grow faster and fatter on such wonder-drug feeds.

An early task of the Department of Agri-

* See "Easter Egg Chickens," by Frederick G. Vossburgh, NATIONAL GEOGRAPHIC MAGAZINE, September, 1948.

culture was to fight livestock diseases, many of which could be transmitted to man. At Beltsville's Animal Disease Station, on a hill-top ringed by a high fence, the worst plagues known to American farms are studied.

Brucellosis, for one, causes the loss of some 325,000 calves and a billion pounds of milk each year. In human beings the illness is known as undulant fever.

Ring Test Spots Bang's Disease

At the disease station I watched a technician make the milk-ring test, most widely used procedure on whole milk for detecting brucellosis, also called Bang's disease. In about two hours a purple ring formed at the top of the test tube, showing the milk had come from cattle infected with the disease. With this simple test receiving depots can check dairy herds by taking samples from cans of their combined milk. If the test is positive, blood-sampling the herd isolates the diseased cow.

In another laboratory vaccines were being prepared and tested. There is no known cure for Bang's disease, but immunization of cattle with such vaccines as Beltsville's Strain 19 is helping to stamp it out.

Beltsville's Zoological Division battles the multitude of parasites that prey on animals—protozoa, nematodes, tapeworms, lice. From work done there 15 years ago has come a revolutionary drug named phenothiazine. First tested as an insecticide, it is now so widely utilized to control internal parasites of farm animals that four million pounds of it are used annually in the United States.

Man appeared to have gained a victory over insect pests when DDT burst like an atomic bomb in the insect world. But the enemies did not give up. Today there are flies, mosquitoes, and cockroaches that laugh at doses of DDT and other new insecticides which once would have meant their death.

New Weapons for Farm Warfare

Men who study insect immunity at Beltsville say it is not merely a matter of the survival of the fittest, with each new generation resulting in flies of greater resistance. They are certain that some basic physiological change or mutation takes place in insects, making them immune to once-deadly doses.

Against such acquired hardiness newer and more potent insecticides have joined man's battle to protect his food and fiber.

I watched a worker in a gas mask applying parathion to a field of strawberries at Beltsville. Behind a bright-red tractor white dust billowed like a smoke screen.

Users of the new phosphorus sprays and dusts such as parathion must wear gas masks

and protective clothing under hazard of illness or death. These poisons, beneficial by-products of World War II research in Germany, are closely related to the so-called "nerve gases."

"We use live insects inside glass tanks to test breathing filters," said a scientist who designs and checks protective masks. "Often it's the only way to detect extremely small amounts of poison in the air."

Other new insecticides, safer for use in homes and gardens, are coming from Beltsville. One is a substance similar in chemical properties to the active ingredients of the pyrethrum flower, among man's oldest insect killers and still one of the most effective. Allethrin, the man-made product, is now on the market.

China Sends Its "Thunder God"

Even newer is a family of potent insect poisons isolated at Beltsville from roots of China's "Thunder God" vine, *Tripterygium wilfordii* Hook. They knock out test colonies of agricultural pests at a strength of only one pound to 2,000 gallons of spray solution. Thunder God is already being grown at the Glenn Dale Introduction Garden; it may be another U. S. crop of tomorrow.

In Beltsville's greenhouses I saw plants that can bite back at insects. So-called "systemic insecticides," the newest weapon of entomologists, are absorbed from the soil into the sap stream. Tiny sucking insects attacking such plants are poisoned by the very leaves on which they feed.

Flowers, ornamental shrubs, and cotton plants have been made largely insect-proof with these new compounds. So far, because these systemic poisons break down slowly, they cannot be used on food crops.

Agricultural science does not stop at the farmyard gate; research reaches grocers' shelves through study of better transportation, storage, and marketing methods. It touches our daily meals, our clothes in the closet, the refrigerator and washing machine, even the soap used in the washing machine.

Nutrition scientists study long-term effects of various diets on health by feeding different foods to rats. They duplicate human digestion in test tubes and beakers to learn how the body utilizes proteins.

At Beltsville are the chief Government laboratories studying textiles and clothing, foods, cookery, and home canning. Housing specialists design better farmhouses.

Beltsville experts ride produce trains from ocean to ocean across the United States, checking how fruits and vegetables respond to various methods of protection and packing as they travel through the bitter cold of a Dakota

winter or the broiling heat of a Texas summer (page 214).

Laboratories duplicate the inside of cold-storage plants, refrigerator cars and trucks, and the holds of ships. In one laboratory I saw a complete grocery store where the shelf life of fruits and vegetables is studied (page 207). In another, foods for canning are injected with spoilage organisms and then cooked varying lengths of time, measuring the efficiency of different canning methods.

"Use Plenty of Cow Manure"

Beltsville's soil is far from perfect, but that very fact has brought benefits.

When the decision to establish a Federal experiment station near Washington was made 43 years ago, Department of Agriculture agents went out dressed as farmers to avoid a sudden inflation in rural real estate.

They looked at land near Beltsville, which then was far out of Washington but near a railroad.

"Not fertile enough," they reported. "The land is cheap, but it's worn-out."

The Secretary of Agriculture, James Wilson, blew up. "Anyone can grow a crop on good land!" he roared. "Buy it, and use plenty of cow manure!"

His wisdom paid dividends. From Beltsville's once poor fields and pastures have come better crop-rotation, soil-improvement, and fertilizing practices.

The plant and soil scientists use 1,700 acres to test new ways of working land without losing it to eroding water and wind. Erosion-resistant plants from foreign lands are studied.

On huge cartographic layouts, aerial photographs are translated into soil survey and conservation maps for farmers.



National Geographic Photographer Hutan Littichales

Nematode-infested Soil Plays Havoc with a Healthy Carrot

Parasitic nematodes, or roundworms, prey on both plants and animals (page 204). Dr. Gotthold Steiner, Beltsville nematologist, studies a microscopic root-knot nematode that causes galls to form on carrots.

A few years ago, when scientists of the Monsanto Chemical Company discovered the remarkable soil conditioner called Krilium, they took the pale-yellow powder to Beltsville. It was tested at field stations in California, Alabama, Tennessee, Pennsylvania, and Wisconsin.

Chemical "Humus" Changes Soil

On hard-baked alkali flats and in thick, gummy clay the tests proved Krilium acts as effectively as organic matter in keeping soil in a crumbly state.

The conditioner turns heavy, "difficult" soil into loose, easily worked earth that shows



Aerosol Sprays, Beltsville's Invention, Battle Insect Stowaways from Abroad

A Public Health Service officer shows Pan American World Airways stewardesses proper bug-killing procedure. Beltsville entomologists, who gave the world the push-button spray can, now are developing a method of distributing insecticides through aircraft air-conditioning systems.

striking improvement in seed germination and crop yields. Today several soil conditioners give greener thumbs to millions of American garden lovers.

In U. S. timberlands today insects rank with fire as destroyers of forests. Beltsville's insect fighters seek better weapons to control forest pests.

Air Sprays Rout Timber Thieves

From the Beltsville airport NATIONAL GEOGRAPHIC photographer Jack Fletcher and I took off with a forester-pilot in a bright-yellow Department of Agriculture aerial survey plane.

We flew across the experimental forest which covers 3,000 acres of the Research Center. Below us, barely above the trees, flew a yellow biplane.

Suddenly a purple cloud burst behind it. The mist settled slowly, trailing out behind like an unrolling carpet.

"DDT," our pilot shouted over the engine

roar. "For experimental purposes colored dyes are added to show where the spray goes. The goal is to apply as little as possible and still kill insects."

Both planes swung back toward the airport, turning into a spray path marked by orange balloons bobbing on 50-foot lines. Colored insecticide spray drifted down across a grid of aluminum test panels on wooden stakes. Scientists learn the size and diffusion of the droplets by checking glass microscope slides on the panels (page 208).

Such constant and careful research at Beltsville has no end. Pressed by all the will, ingenuity, and boundless curiosity of agricultural science, the experiments of this huge outdoor laboratory guard the Nation's priceless forests and farms, its food and clothing, and its future health.*

* For additional articles on agriculture, see the two-volume NATIONAL GEOGRAPHIC MAGAZINE Cumulative Index, 1899-1957.

Landing by Plane on a Glacier, Climbers Pioneer a Western Approach to North America's Loftiest Peak

BY BRADFORD WASHBURN

With Illustrations from Photographs by the Author

"BELT fastened tight?" shouted Dr. Terris Moore above the sputtering of the airplane's idling engine. I nodded. "Okay, here we go!" Our little two-seated single-engine craft started bumping down the gravel runway of the airport at Chelatna Lake, 100 miles northwest of Anchorage, Alaska.

In another moment we were off on an adventure which already had my heart pounding with mixed feelings of excitement and, I must admit, a certain amount of apprehension.

Ahead of us, though invisible in a blanket of fog, towered the 20,300-foot snow-capped cone of mighty Mount McKinley, loftiest peak in North America.

McKinley was named in 1896 for the Republican presidential nominee of that year by W. A. Dickey, who was prospecting in the vicinity. Long before, the Alaskan natives had called it, more appropriately, Denali, the Great One. It had been climbed only six times before our 1951 assault.

Mountain Climbing by Airplane

We were going to try what time after time had been declared impossible—to climb McKinley's rugged West Buttress (page 230). More exciting still, we were going to try to do at least a third of the climb by airplane.

To accomplish this, Terry Moore would have to land his tiny plane on the unexplored surface of Kahiltna Glacier. This huge ice river writhes down McKinley's slopes between rock cliffs thousands of feet high.

Our expedition had a threefold purpose: first, to test my theory that McKinley's West Buttress actually offered a shorter, safer way to the top than the usual route up the northeast side; second, to study the geology of this tremendous mass of rock; and third, to do essential survey work for a new large-scale map of the area immediately around Mount McKinley. Part of this map is published for the first time in this issue of the NATIONAL GEOGRAPHIC MAGAZINE (pages 236-237).

Our undertaking was sponsored by the University of Denver, the University of Alaska, and Boston's Museum of Science.

McKinley's distinction as our continent's highest mountain alone would justify making a map of it. In addition, it is the main feature of Mount McKinley National Park, which is

attracting increasing numbers of visitors now that the famous Alaska Highway has made the country accessible by automobile.*

Important, too, is the fact that McKinley's height and position, only 250 miles south of the Arctic Circle, make it an ideal laboratory for many kinds of scientific research.

Arctic Equipment Tested Here

During World War II three military expeditions used its high slopes to test clothing, equipment, and food for troops and plane crews operating in extremely cold climates.

McKinley's heights also provide a lookout for observing cosmic rays, which constantly bombard the earth from outer space.†

It furnishes a fine opportunity for weather observations, tests of the effect of a decrease in oxygen on the human body, and high-frequency radio research.

It was to make this great natural laboratory easier to reach that we were seeking a better route to the top of McKinley and preparing a detailed map of its slopes and glaciers.

Terry Moore, who was going to try to land me on Kahiltna Glacier, is not only an experienced bush pilot but was also president of the University of Alaska (he retired this summer). If we could land successfully, he was to leave me there with a small radio, camped on a smooth snow plateau. After this it should not prove too difficult to fly in to the glacier camp my first three companions, Dr. Henry Buchtel, James E. Gale, and Capt. William D. Hackett. With the radio I could tell them before they even took off what the weather was like at my end of the line.

Kahiltna Glacier is one of the largest in the Alaska Range and one of the roughest. To help us find our way up it, we had with us a

The Author: Dr. Bradford Washburn is a noted mountain explorer and director of the Museum of Science in Boston, Massachusetts. He has reached the summit of Mount McKinley three times, and Mrs. Washburn is so far the only woman to have climbed it. For other mountaineering articles by Dr. Washburn, see the two-volume NATIONAL GEOGRAPHIC MAGAZINE Cumulative Index, 1899-1952.

* See "Wildlife of Mount McKinley National Park," pages 249-270 in this issue.

† See "Trailing Cosmic Rays in Canada's North," by Martin A. Pomerantz, NATIONAL GEOGRAPHIC MAGAZINE, January, 1953.



A Rubber Mountain Shows the Way to Lofty Camps on Mount McKinley

As a guide to Air Force pilots in dropping supplies to climbers high on McKinley's rugged slopes, Bradford Washburn and his teen-age daughter made this model. Despite the precaution, one drop almost proved disastrous (page 225). Here at Chulitna, 50 miles southeast of the big peak, the author explains to an Eskimo audience his plan to approach McKinley's western face by plane.

series of aerial photographs of Mount McKinley which I had taken for the National Geographic Society and Harvard University in 1936-38, and 1947 and 1949.*

Beneath us as we flew, the surface of the ice was at first so broken that nothing could possibly have landed there, not even a helicopter. The glacier's snout was buried under masses of rock and gravel. Some boulders were as big as bungalows, piled helter-skelter in heaps more than a hundred feet high.

Glittering Snow Peak Unveiled

The valley walls, sheer rocky ridges, towered above us on both sides. We flew between a rough floor of glacial ice and a solid ceiling of dark, gloomy fog 2,000 feet above us. It was like flying through a gigantic tunnel. However, the cloud ceiling seemed nearly level, while the glacier climbed steadily. If the two met, we would be out of luck. Ahead, the valley made a sharp bend to the right.

As we turned the rocky corner, a great rift split the clouds as if by magic. Before us soared the thrilling virgin peak of Mount Hunter, white beneath a mantle of fresh snow. Looking back, we could see the dark, evil tunnel from which we had just emerged.

The valley floor below was now much higher, and a snow blanket covered the rough ice. We were flying about 2,000 feet above the glacier, but our altimeter showed us to be 5,500 feet above sea level.

Ahead the valley twisted abruptly to the left, the turn hiding the spot where we hoped to land. Every minute or two Terry swung the plane a bit so we could check our avenue of retreat. Until we sighted good landing snow we could not afford to let our black tunnel close up behind us.

As we neared the turn, Kahiltna Glacier

* See "Over the Roof of Our Continent," by Bradford Washburn, NATIONAL GEOGRAPHIC MAGAZINE, July, 1938.



A Daring Bush Pilot and University President Flew the Explorers In

On a glacier landing strip at 7,700 feet, Dr. Terris Moore (left) stands before his little plane with Buchtel, the author, Hackett, and Gale. Later the flyer dropped in for tea at 10,100 feet, returning in time for a faculty meeting at his University of Alaska in Fairbanks (page 227). Daylight temperature here varied from slightly above freezing to about 90° F. Buchtel solved the clothing problem with parka, long underwear, and galoshes. Anti-sunburn cream whitens his lips.

became a veritable cataract of ice, two miles of it so rough it would have been utterly impassable on foot except along its edges.

Then the fickle weather took a turn for the worse. I glimpsed 17,395-foot Mount Foraker's icy cone, known to natives as "Denali's Wife," towering up between masses of clouds. Then the mists rolled in and a solid wall of fog blotted out the valley ahead. Our progress blocked, we circled impatiently.

Spotlighted to a Landing

Without warning the break came. A tiny patch of blue sky appeared above, and a shaft of sunlight began to move slowly across the glacier toward the spot where we wanted to land. We followed it, circling, for it was moving only half as fast as we were. As this "spotlight" crossed the valley, we took our chance.

The snow below us appeared perfect—no bumps, no hollows, no crevasses. Terry Moore cut the throttle, lowered the flaps, and before I could believe it we were skimming the glacier. Then we settled for a perfect landing.

No sooner were we down than the sun was gone again. It was 6 o'clock, exactly one hour from Chelatna. There was no time to lose.

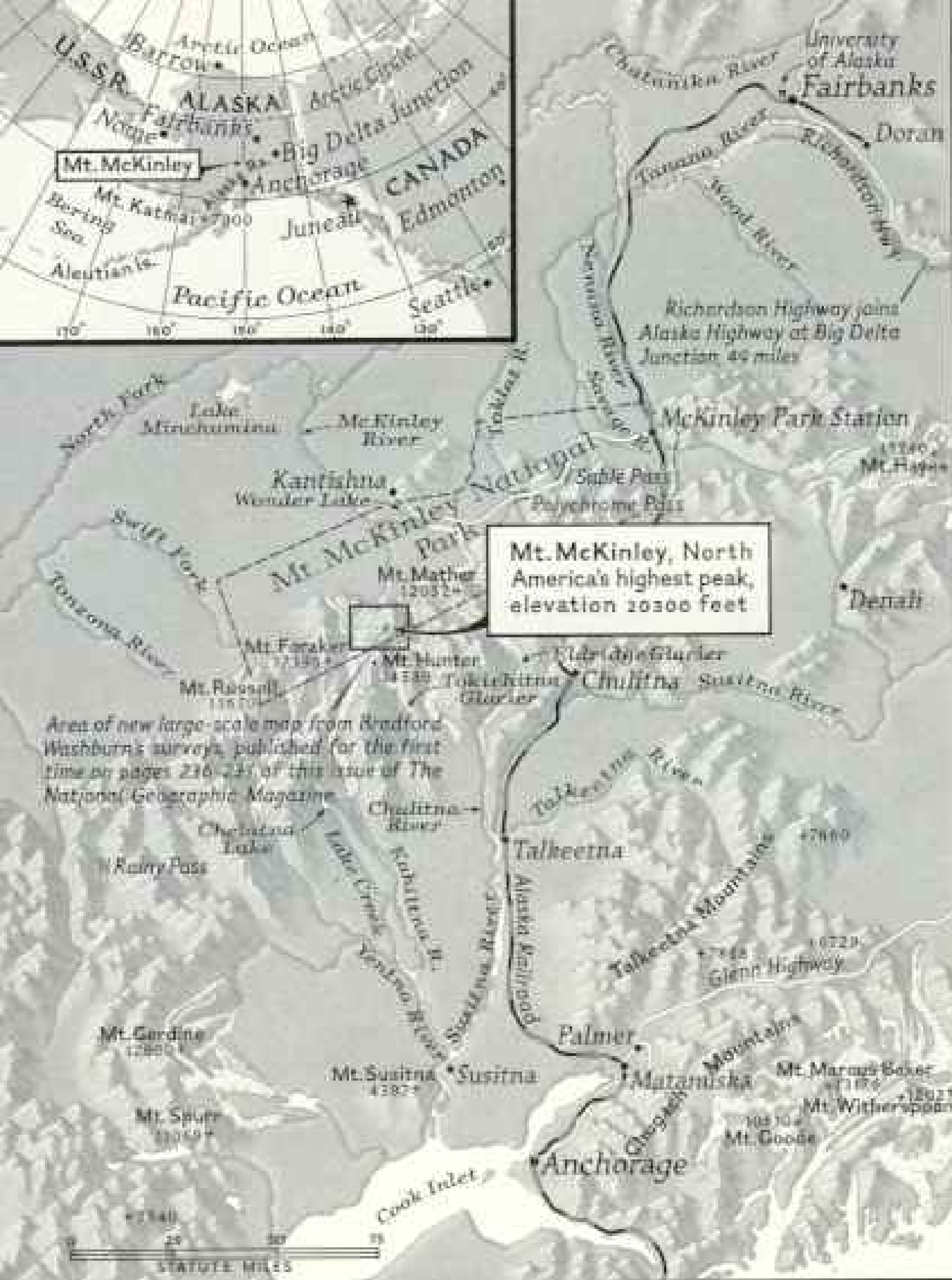
We pitched my supplies out on the soft snow, lifted the plane's tail around, and faced the craft down the gentle slope.

With a hasty handshake and a "So long, partner," Terry climbed aboard. A roar and a swirl of snow and he was off. I heard the drone of the motor for a minute or two; then it died away, and I was alone. 7,700 feet up in the heart of the Kahiltna amphitheater, close under McKinley's flanks. It was so quiet I could hear my heart beat.

It began to snow lightly. The rocky spurs faded into the fog, and everything about me on all sides, above and below, was white. An hour before I had been 40 miles away at Chelatna Lake; now here I was a third of the way up Mount McKinley!

All this was possible because Terry Moore's plane was equipped with aluminum skis that could be raised hydraulically above the wheels for take-off on the gravel at Chelatna Lake, then lowered for landing on the snow.

A large shovel is a necessity in a glacier camp. With mine I had in half an hour a level spot dug out for my 7-by-7-foot tent. Meanwhile, I set snow melting over a gasoline stove. For a month our only fuel would



Among National Parks Only Yellowstone Is Larger than McKinley

A broad reach of wilderness was set aside in 1917 to form Alaska's great wildlife refuge, now more than 3,000 square miles in extent. Statehood for Alaska would shift honors from California's Whitney (14,495 feet) to 20,300-foot McKinley as highest mountain in the United States.

be gasoline and our only source of water melted snow. Unfortunately, snow water is so flat in taste that drinking it is a real effort.

Need More Liquids on Heights

At high altitudes climbers must double or triple their intake of fluid to offset the dehydration that results from breathing deeply the extremely dry air. The need for liquids grew constantly more pressing the higher we climbed. We carried powdered fruit juice to dissolve in our water to make it more palatable, and also drank large quantities of frozen fruit juice dropped later by plane.

After a bite to eat and some hot tea, I turned off the stove to save gasoline, even though the temperature was only 10° F. As

its roar died, I was instantly greeted by the gentle patter of snowflakes on the tent. In the total silence of the heights even feathery snowflakes make a perceptible sound falling on tent roofs. Poking my head out the drawstring entrance, I was astonished to see the rocky cliffs of McKinley quite clearly, with Kahiltna Valley visible downward for at least five miles. The sun had disappeared behind the clouds, but the long twilight of the Alaskan summer still lingered.

I busied myself marking our little airport with all available dark objects. This is essential for landing a plane on snow when there is no sun, no shadow, and the visibility is poor. Otherwise, everything appears an even, shapeless white. All depth perception is lost, and as a pilot nears the ground he has nothing with which to gauge his height.

As the weather slowly cleared, I heard Terry faintly on my radio, talking to the Government station at Talkeetna, some 60 miles to the southeast: "This is N-1088-A," he was saying. "My position is now five miles north of Chelatina Lake, heading for camp on upper Kahiltna Glacier."

At 8:45 Terry's voice boomed out loud and clear: "N-1088-A to KW034. Can you see or hear me? I'm flying through drizzling snow about five miles below your camp." He was on his way back with Henry Buchtel.

I crawled out the door and looked down-glacier behind the tent. There he was. I could barely hear the plane's feeble little hum. I reported, "Landing conditions marginal, ceiling 300-500 feet, absolutely calm. I've marked a runway."

Two minutes later the little craft roared over camp and came to a perfect landing.

This time the sky looked as if it were really going to snow in earnest. We unloaded Henry's gear in a jiffy, and with a cheery



Footprints in Reverse Mark Explorers' Route Across an Alaskan Pass

Weighted by 80-pound packs, Bradford Washburn and his party crushed two feet of snow beneath their boots as they crossed 18,200-foot Denali Pass. Next day wind cleared the pass of its loose snow, and this pattern was left standing four to five inches above the hard surface.

"See you soon," Terry was off again into the gathering gloom. Thirty minutes later we heard him report that he was preparing to land at Chelatna. Without his skill and determination as a bush pilot we could not have been where we were.

Weather-bound on a Glacier

The weather closed in tight, and Jim Gale and Bill Hackett were snowbound at Chelatna. The day Buchtel and I flew in, the last four members of our party, Dr. John Ambler, Dr. Melvin Griffiths, Jerry More, and Barry Bishop, were on the Alaska Railroad, riding from Anchorage to McKinley Park, 80 miles northeast of the mountain. The next day they were to drive to Wonder Lake, on the opposite side of the peak from us.

While our 4-man team was establishing the main base camp near 10,300-foot Kahiltna Pass and carrying out our survey program, the others were to circle the mountain by pack train from the north, studying the geology as they progressed. They planned to meet us at

base camp on June 30 (pages 230 and 241).

McKinley's core is a huge batholith, or mass of granite, which oozed into place in the earth's crust in molten form. It then cooled to form a beautiful pink crystalline rock, finally exposed at the surface by erosion of the crust. Near the top can be seen the point where the molten material met an overlying layer of black slate, once the bottom of a prehistoric sea.

Earthquakes frequently shake McKinley, starting stupendous avalanches, but whether they represent the dying gasps of the forces that built the mountain or the beginning of new uplifts, no one knows.

Red Sky at Midnight

For two days Kahiltna Valley was buried beneath a dense sea of fog and drizzling snow. Then the skies cleared abruptly, and Terry Moore made two more swift relays to our lonely little camp to bring in Jim Gale and Bill Hackett (page 221).

Next day we worked until midnight breaking trail up the vast, smooth slopes of the



glacier to Kahiltna Pass, 10,500 feet high. We were the first persons in history ever to set foot on this lofty, snow-covered saddle (page 233).

Even at midnight the northern sky was still a deep red as twilight slowly merged into dawn. Between turns at the shovels, digging a firm base for our tent in the deep, loose snow in the pass, we stood catching our breath and looked up at the towering pink cliffs of McKinley. Massive granite walls of the West Buttress, more than a vertical mile above us, rose so near that they hid McKinley's summit, 4,300 feet still higher and five miles farther away.

The temperature was 9° above zero. Not the slightest sound broke the eerie silence of the heights except our voices and the steady thudding of the snow as we shoveled. On our first radio call we picked up the CAA station at Talkeetna, 60 miles away and squarely behind the huge mass of Mount Hunter. The signals came through loud and clear. It was a great relief to know that our base camp was assured of reliable communication with the outside world.

We asked Talkeetna to telephone the 10th Res-

Surveying in the Snow Is No Joke

Top: The author sights through a Wild theodolite at Kahiltna Pass. Expedition member Hackett takes notes. Difficulties of high-altitude surveying include wind, glare, cold, and the effects of anoxia—deficiency of oxygen. Umbrella shades the instrument.

← To steady the theodolite, water is poured around tripod legs; ice forms quickly and holds them firm.

cue Squadron of the Alaskan Air Command in Anchorage. Tell them, we said, that our weather was perfect for the prearranged aerial drop of the equipment we had left with them.

Scarcely had we crawled into our sleeping bags, it seemed, when a distant hum awakened us. It was 6:30 in the morning, the sun was high in the cloudless sky, and there, down the valley, was the approaching Air Force plane.

Jim turned on the radio and at once picked up a voice: "Air Rescue to KW034 . . . Calling camp on Kahiltna Glacier . . . Are you reading our signal?"

"KW034 to Air Rescue," he replied. "We're reading you loud and clear."

Back came the voice from the plane: "We'll be over you in about two minutes. Give us a call after we have finished the first drop and report how we did."

Supplies Hit Wrong Target

As the big C-47 roared down only 200 feet above us, the pilot somehow missed the red cloth marker laid out on the snow 100 yards away. We realized with sudden horror that bundles and boxes flying out the open cargo door were streaking directly for our tent! They showered around it, one making a deep crater less than five feet from the tent in which Jim Gale was talking on the radio. It was his own bag of personal equipment!

This near tragedy was over so quickly we scarcely realized what had happened. As the plane disappeared over the pass, Jim was yelling into the radio, "Hey, for heaven's sake, watch where you're throwing that stuff! Throw it at the *marker*, not the tent!"

"Mighty sorry, fellows," came the reply as the plane circled beyond the pass and flew back toward us. "We see the marker now. It won't happen again!"

This time supplies came thudding down at a safe distance: tent poles, survey markers, a fresh king salmon, nylon rope, tent pegs, birch-wand trail markers, extra clothes, tents, and sleeping bags. Then came five loads of breakable supplies by parachute: radio batteries, film, an alarm clock, stove, gasoline, survey gear, even a small plywood sled.

It had been a breath-taking half-hour. We had not yet had breakfast, but more than a ton of supplies had already been delivered at our front doorstep from a warehouse 130 miles away. In the old days it would have taken a 20-horse pack train and three wranglers weeks to move this load from Anchorage to the lower end of the Kahiltna Glacier, 44 miles below our camp. From there to where we sat, it would have been such a prodigious job of back packing to move these same supplies that we shuddered even at the thought.

Included in the equipment dropped to us

were 500 pounds of Birdseye frozen foods, which we promptly buried in a natural deep-freeze cave just outside our front door. Forty-eight loaves of bread, each packed in a paper bag, rained down all over our "lawn"; they too were buried and frozen. We took loaves to bed with us when we wanted to thaw them out. On the trail we often carried small cans of frozen meat inside our clothing to thaw them for lunch.

Fats Indigestible at Altitude

Our diet was strong in protein, which we got from lean frozen hamburger and ham. An ample supply of fresh vegetables and fruit helped us forget the almost total lack of fat in our diet at the highest camps. This was important to our efficiency on the mountain, for decrease in oxygen above 15,000 feet causes great difficulty in digesting fats.

Members of the Parker-Browne expedition of 1912, not realizing this, took quantities of pemmican, rich in energy but also very fatty. This diet caused them such acute distress above 15,000 feet that they could scarcely eat, lost strength, and unhappily had to turn back in a heavy storm only a few hundred feet from McKinley's top.

A few days after the supply drop we all set out to scale previously unclimbed "Peak Z," a snow dome that rose southwest of camp. It was an easy climb up a rounded ridge buried under hundreds of feet of perpetual ice and snow. On top we built an igloo a few yards from our survey instrument so we could dodge in for shelter and a cup of hot tea when our fingers grew too cold to work the theodolite (page 227). Meanwhile, however, it grew absurdly warm, 40° F. in the sun, and we actually worked in our shirt sleeves.

Jets Play Hide-and-Seek

As we busied ourselves reading angles on the instrument, I heard a curious swooshing sound far off toward Mount McKinley. Above the tip of the great peak several tiny silver flies were playing hide-and-seek against the deep-blue sky. Then another appeared, and another and another, till we counted 10 little specks. They were jet fighter planes from Anchorage taking afternoon exercise above the monarch of North America (page 240).

As we stood watching this extraordinary show, I was reminded of John Gillespie Magee, Jr.'s inspiring poem, *High Flight*:

I've . . . wheeled and soared and swung
High in the sunlit silence. Hov'ring there,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air . . .
I've topped the wind-swept heights with easy grace,
Where never lark, or even eagle, flew . . .

Two of the planes left the others and dived

toward us at terrific speed. I took out a pocket mirror and flashed it as they swept by a mile or two away. One wheeled suddenly toward us, and I flashed him again as he passed between the sun and us. He wobbled his wings slightly, then headed away for a minute, apparently talking to his companion by radio.

Planes Buzz Camp at 600 Miles an Hour

Climbing almost out of sight, they turned lazily and headed back. Approaching at a staggering speed—probably 600 miles an hour or more—they screamed over us scarcely 100 feet above our heads. We could clearly see the pilots waving.

Gracefully they swung upward to the east. Barely a minute later they had rejoined their comrades, seven miles away and more than 8,000 feet above us. That effortless minute's climb was soon to take us seven days and nights of nearly constant toil.

As the afternoon wore on, black thunderheads over the lowlands to the north began to rumble ominously, and we saw gray streamers of rain pouring down beneath them into the darkened valleys below. A breeze broke the stillness, and, our survey done, we hesitated in front of the igloo, worried lest the storm catch us during our descent.

The breeze grew to a wind, the wind to a gale, and then the storm hit us with terrific violence. We were far above the lightning and rain, but the crest of the turbulent mass of cloud flung a furious blizzard at us. We retreated into our igloo and at the very height of the howling tempest enjoyed a tranquil afternoon tea.

An igloo is a wonderful shelter. It's cool and shady on a sunny day; warm, cozy, and quiet in the wildest storm; and it doesn't flap in the wind. Constant flapping of our tents at night on previous trips had caused us to lose many hours of much-needed sleep.

For an hour and a half the blizzard buffeted our retreat. Then, as suddenly as it came, the great cloud drifted peacefully off, the sun burst out, and the wind died down to a gentle breeze.

Quiet Beauty Follows Blizzard

As we started homeward, the fresh snow glittered all about us. Evening shadows reached across the western buttresses. To our left the emerald lowlands twinkled with myriad tiny lakes and streams reflecting the low rays of the sun. In the distance we could hear occasionally the rumble of avalanches.

At base camp we spent several days in survey work for the new map of McKinley. This map began to take shape in 1945 during World War II, while I was a member of an Army Air Forces expedition on some of the

peaks near McKinley. There we tested emergency food, shelter, and clothing for use in the Arctic. To help pass the time, we had our supply plane drop us a surveyor's transit to measure the angles between a number of points and to determine locations and heights of many unmapped peaks.

Two years later, in 1947, RKO Radio Pictures, Inc., asked Boston's Museum of Science to help obtain motion pictures of mountain scenery at high altitudes on Mount McKinley for use in a forthcoming film. At the same time they agreed to support our survey program and other scientific work there.

In cooperation with us, an Air Force B-29 made vertical mapping photographs of the entire area from 32,500 feet, while we did ground survey work on McKinley's upper slopes to tie the pictures together. The U. S. Coast and Geodetic Survey lent us two powerful Zeiss theodolites.

Surveying from McKinley's North and South Peaks had been no joke. On the South Peak it was 20° below zero. Often a gust of wind bumped my face against the theodolite eyepiece. Then I had to carry out the observation all over again after making sure the instrument had not been thrown out of level and position.

Surveying on Brink of Disaster

The North Peak culminated in a narrow point of snow where there was barely room to clear away a level triangle three feet on a side to set up the theodolite. One careless step would have plunged me down the frightening Wickersham Wall, 14,000 feet high.

In aerial mapping, two pictures of the same area are taken a few seconds apart. Viewed through a stereoscope, they appear as one, in three dimensions, with slopes, heights, and depths so vividly evident that accurate contour lines can be drawn directly from the photographs.

Using all available data to fix positions and altitudes, and stereoscopic pictures for topography, the U. S. Geological Survey mapping office at Denver, Colorado, produced a map on a scale of 3.9 miles to the inch. The data to be obtained by the U. S. Coast and Geodetic Survey and a new Museum of Science party during 1953, with that gathered during our 1951 climb, will provide information for several mile-to-the-inch quadrangle maps. Some of this mapping has already been done, and about 120 square miles of the central portion are shown on the map accompanying this article (pages 236-237).

No complete large-scale map of Mount McKinley has ever been made before.

On the evening of June 30, while we were returning from a reconnaissance of McKinley's



One Bedroom, No Bath: Low-cost Housing Comes Easy for Mountain Explorers

Taking a tip from the Eskimos, expedition members "sweat out" bad weather in compact stormproof igloos. At the 7,700-foot camp, Jim Gale built this one in about an hour with shovel and compass saw (thrust in snow). Shaped building blocks are fashioned from hard-packed snow. Loose snow piled on outside provides extra insulation. Rose-colored glasses guard Gale's eyes against snow blindness.

lower slopes, we saw two infinitesimal specks approaching our camp 2,000 feet below. Behind them another pair of dots inched over the crest of Kahiltna Pass and started down the steep hill into camp. Our other four companions had arrived.

An hour later we snowshoed in and found a reunion dinner already on the stove. It was actually only a few days since we had seen Mel, John, Jerry, and Barry, but somehow it seemed as if we had been separated for months.

They had been drenched by our blizzard-thunderstorm, plagued by swarms of blood-thirsty mosquitoes, and had almost lost a pack horse in a bottomless bog. Also, they had marked two key survey stations for us, one of them on the summit of 10,600-foot Peters Dome, which Barry and Jerry had climbed for the first time in history.

Letter from Boston Only 3 Days Old

Two days later, Terry Moore landed at our 10,100-foot-high camp and taxied off the "airstrip" right up to the cook tent with mail, film, and other supplies; one of the letters had been mailed in Boston only three days

before. This was the highest airplane landing ever made in Alaska up to that moment.

As it turned out, it was safe enough for Terry to have landed here instead of lower on the glacier in the first place. But, not having checked ground conditions at the pass, we played it safe.

Terry lingered while we read our mail and chatted over tea, jam, and crackers. Suddenly he exclaimed, "Good night! It's 5 o'clock. I have only two hours to get back to Fairbanks for a faculty meeting!"

His meeting was 160 miles away and 9,650 feet below us on the other side of Mount McKinley. In a jiffy he was off over the pass and out of sight. Later we learned he made it in plenty of time to shed his heavy clothes and parka, have a shower, and don a summer suit.

Food sorted, survey work completed, and our party reunited, we focused our attention on Mount McKinley. The route by which we intended to breach its western barriers started just behind our camp.

We had carefully planned it to avoid huge crevasses and avalanches, the two major dangers of the old route up the other side of the

mountain. At first we followed the bottom of a broad hollow filled with hundreds of feet of drifted, wind-packed snow. When a big crevasse began to block our way, we climbed sharp slopes to the crest of the ridge which paralleled our route to the left.

Actually we encountered only two crevasses, small in comparison to those on the northeast approach. Above, the grade was not steep, but in one place we struck a patch of blue-green ice as slippery as an inclined skating rink and had to take off our snowshoes and strap on iron creepers, or crampons.

Three thousand feet above camp these snow-and-ice slopes ended abruptly in a massive granite shoulder that rose with dramatic steepness 3,000 more feet to the 16,000-foot crest of McKinley's great West Buttress.

Here, in the very shadow of the cliff, we set up our first advanced camp. We had reconnoitered this route and marked it with birch wands stuck in the snow several days before. The entire 8-man party tackled it for the first time with 60- to 90-pound packs on the Fourth of July.

A Night at "Windy Corner"

As we struggled up to our camp site late that afternoon, the wind hissed through the granite ledges at our feet. The sky was gray with lowering mist. A sea of clouds filled the valleys below, and snowflakes were already beginning to fall. That night five of us stayed at "Windy Corner," as we called it.

Mel, Barry, and Jerry returned to base camp after hauling up three loads of equipment. For the next week they would continue Mel's geologic exploration several thousand feet below us, around the base of the upper peak.

Camp was set on the snow about 100 feet from the rocky crest of Windy Corner so we could find snow blocks for building an igloo and a windbreak wall to protect our cook tent. We built a long tunnel entrance on the lee side of the igloo to help keep out the wind.

There is no real shelter anywhere on this west side of McKinley. The big storms are almost always southwesterers, which originate out toward the tip of the Aleutian Islands and strike the peak with tremendous violence. This route has one advantage, however: buffeting winds were at our backs instead of cutting our faces, as they do on the northeast side.

After a cozy, peaceful night in our igloo, where our body heat and breathing kept the inside temperature up nearly to freezing, we had a real job digging our way out to breakfast. The entrance to our tunnel was drifted in solid with fresh snow.

From our snug and calm shelter we emerged into a roaring storm, with 60-miles-per-hour gusts, dense fog, and a wild blizzard. It took an

hour to excavate the half-buried cook tent, re-tighten the guy ropes, and get inside.

As John Ambler crawled into the tent, his beard white with frost and icicles, he said with some disgust, "This kind of climbing is about 90 percent trying to stay alive and warm, and only 10 percent climbing!"

Gale Blows 80 Miles an Hour

A storm of increasing violence lashed camp all that day. We ventured out in relays during the afternoon and built another igloo, connecting it to the first one by a small doorway. By suppertime the gusts were hitting 80 miles an hour (measured by anemometer), and the temperature was down to 14° above zero. Snow fell so thickly we could not see a thing. Luckily, it was blowing so hard the snow could not accumulate. It simply whirled off out of sight into the valley over the 2,000-foot cliff in front of camp.

On July 6 the wind died down and the skies cleared rapidly. This day and the next we carried a week's supplies up to 14,000 feet, along a broad, gently sloping snow shelf at the side of the cliffs.

Climbing higher, we tied knotted rope around our snowshoes to keep us from slipping backward on the steepening slope. Jim and I started ahead of the others and rapidly got into trouble. Here the snow from the recent storm lay drifted deep all up the hillside.

At first we made fair headway with our 60-pound packs, but then we began to slide backward several inches at every step. I took off my snowshoes and promptly broke through the crust up to my waist. I put them on again, took the shovel out of my pack, and started carving large flat steps ahead of us.

Then, at 15,000 feet, the slope steepened again and the surface snow was crusted just enough so that snowshoes would not hold on it. The spot where we wanted to make our next camp was still 1,000 feet above.

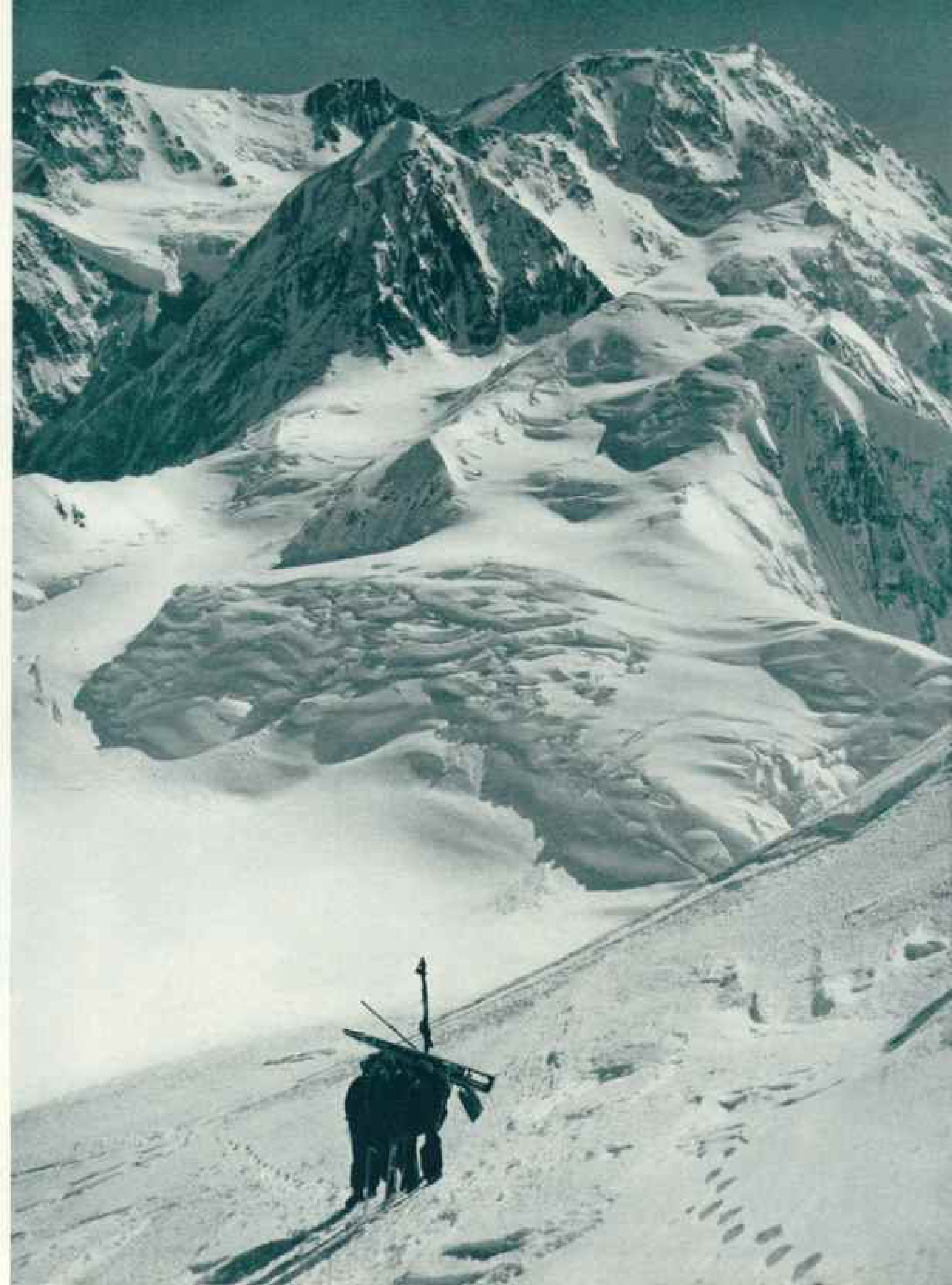
Digging a Path with Shovels

We had only two choices: wait two or three days until wind and cold hardened the slope so we could walk on it without snowshoes, or shovel a trail up the mountainside to an ice shelf about 400 feet above. Our time was running short, and, also, it might snow again. We chose to shovel.

When I got so tired I couldn't lift another shovelful, Jim took a turn at it. After an hour's work I looked back at my pack; it was only 100 feet behind us.

In another hour conditions began to improve. After that grueling uphill struggle we walked and slid back to our packs in about three easy minutes. We reached the 15,400-

(Text continued on page 245)



New Maps of Alaska Mountains Owe Much to the Author's Explorations

Key survey point for Washburn's party was "Peak Z" (map, pages 236-237). Here, at 12,000 feet, climbers pack equipment up its slopes. Behind them McKinley's western face soars another 8,000 feet into the sky.



North Peak
19450

16600

Northwest Buttress

West Buttress

Route hidden from view from
here to Windy Corner

Kahiltna Pass

10300

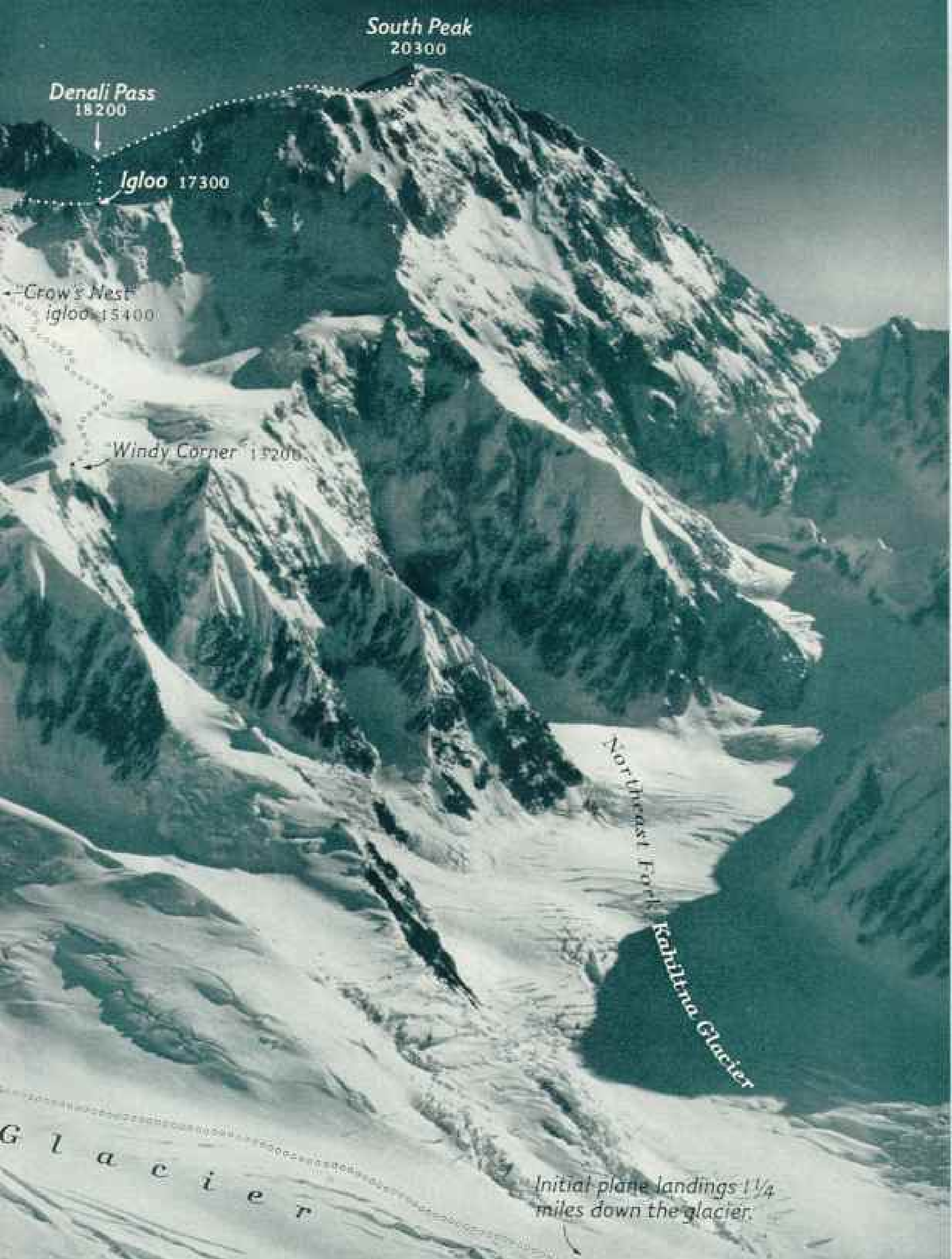
10100 Base Camp,
1951

A ton of supplies airdropped;
small plane landed here with
mail and to fly out party.

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Mountain Climbing by Air: an Innovation of the Author's 1951 Ascent

A light plane carried the explorers a third of the way up McKinley. From there the struggle was as it has always been: men on foot against cold, fatigue, storm, and diminishing oxygen. The plane landings at 10,100 feet were the highest ever made in Alaska to that time.



South Peak
20300

Denali Pass
18200

Igloo 17300

"Crow's Nest"
igloo 15400

Windy Corner 15200

Northwest Fork
Kachiltina Glacier

G
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a
c
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e
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Initial plane landings 1 1/4
miles down the glacier.

Mount McKinley's South Peak Provides a Lofty Site for Cosmic Ray Studies

More of these powerful rays reach the earth's surface near the Poles than elsewhere; they are best studied at high altitudes (page 219). One object of the author's 1951 trip was to pioneer a route (marked) by which this great natural laboratory would be more accessible to scientists.

Unclimbed Alaskan Peaks Still Await "Discoverers"

Aerial surveys have made possible detailed maps of places where man has never set foot. Though Mount McKinley has been scaled nine times in the 40 years since Archdeacon Hudson Stuck's party reached the top of South Peak in 1913, lesser mountains remain to challenge climbers. By generally accepted custom, the first man to conquer such a mountain often has the privilege of naming it, though not for himself.

◀ Sunset bathes the unclimbed slopes of 14,580-foot Mount Hunter (distant center); a smaller peak, unclimbed and unnamed, shares the spotlight (right). Dwarfed in the gathering shadows, a tent of the expedition's first landing camp is pitched on snow-covered Kahlitna Glacier.

▶ Capt. Bill Hackett cautiously tests the overhang at Kahlitna Pass to see how far he can safely advance; Washburn, Hackett, and Jim Gale were the first humans to reach the pass. Clouds throw shadows on crevasse-checked Peters Glacier.







Dwarfed by Snow-mantled Giants, a C-47 Circles Before Dropping Supplies

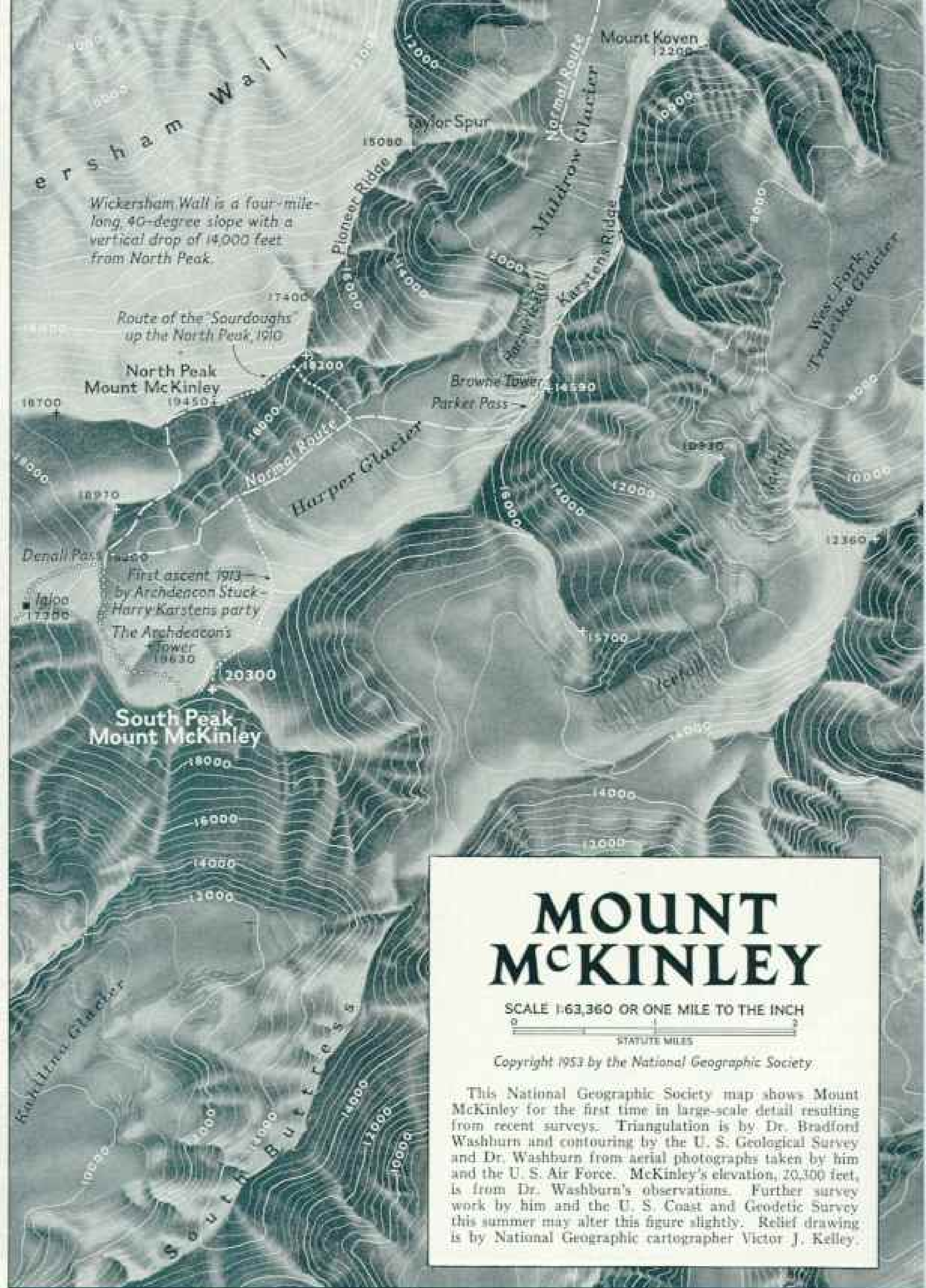
What appears to be a bird (right center) is actually an Air Force C-47 cargo plane with a wingspread of 95 feet. Towering far above it is 12,051-foot Mount Mather, named for the first director of the National Park Service.



No Place for a Misstep on These High, Snowy Slopes. It's a Long Way Down!

The head of Eldridge Glacier, one of the largest in the Alaska Range, lies 4,000 feet below (right). The sharp 11,000-foot peak (top-center) is unnamed, unclimbed. Mount Mather has been climbed but once, in 1957.





Wickersham Wall is a four-mile-long, 40-degree slope with a vertical drop of 14,000 feet from North Peak.

Route of the "Sourdoughs" up the North Peak, 1910

First ascent, 1913—
by Archdeacon Stuck-Harry Karstens party

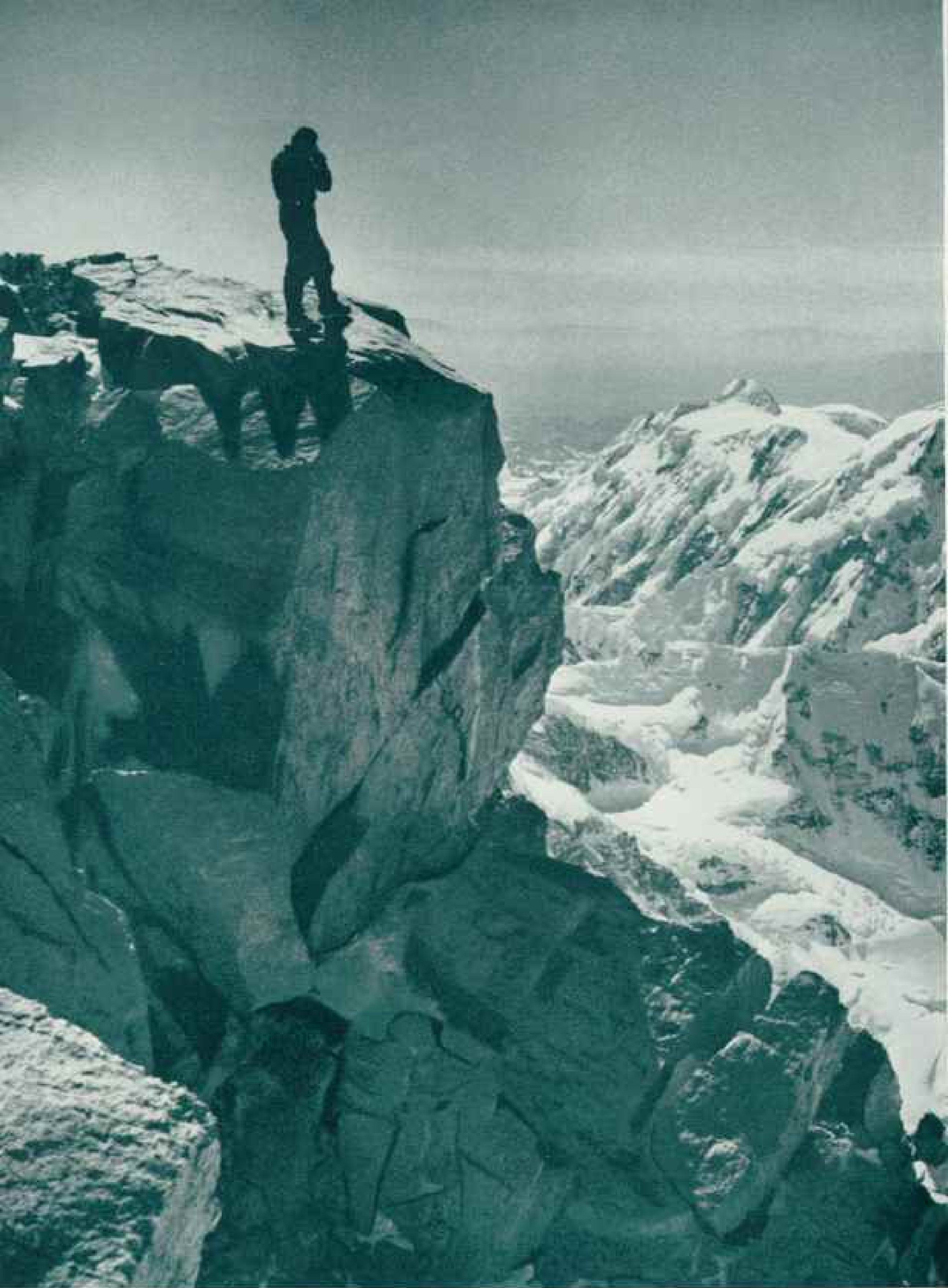
MOUNT MCKINLEY

SCALE 1:63,360 OR ONE MILE TO THE INCH



Copyright 1953 by the National Geographic Society

This National Geographic Society map shows Mount McKinley for the first time in large-scale detail resulting from recent surveys. Triangulation is by Dr. Bradford Washburn and contouring by the U. S. Geological Survey and Dr. Washburn from aerial photographs taken by him and the U. S. Air Force. McKinley's elevation, 20,300 feet, is from Dr. Washburn's observations. Further survey work by him and the U. S. Coast and Geodetic Survey this summer may alter this figure slightly. Relief drawing is by National Geographic cartographer Victor J. Kelley.



Mount McKinley's Front Porch Offers a Spectacular View—but Don't Fall Off!

From a perch above McKinley's West Buttress, Jim Gale looks across to Mount Hunter's twin peaks. Taller of the two (right) reaches 14,580 feet. Near here the expedition's highest camp was set up (page 246).



Though 130 Miles Away, Mount Spurr Shows Plainly Through the Cold, Dry Air

Kahiltna Glacier (right) flows like a vast sluggish river. Beyond in the distance looms 11,069-foot Mount Spurr. As far away, but hidden by haze at the left, is sea-level Anchorage, Alaska's largest city (population 11,254).

Age-old Mysteries Yield to Airborne Explorers

← In an hour this swift jet of Alaskan Air Command (USAF) covers routes that would take months afoot. Below the plane winds the evergreen-blackened course of the Tokichitna, "the River That Comes from Where There Are No Trees." Forty miles away, three of Alaska's huge peaks form a breath-taking backdrop: Mount Foraker (17,395 feet), Mount Hunter (14,580 feet), and (extreme right) Mount McKinley. The author watched jet fighters from Anchorage at play high above North America's loftiest peak (page 225).

U. S. Air Force, official

Below: From base camp at 10,100 feet (foreground) Mount McKinley is concealed behind the rugged mass of its West Buttress (left center). Though dwarfed by distance, the highest point visible in this photograph is the dark cloud-capped peak at extreme left. High clouds warn of a gathering storm.

To this camp supplies and mail came by a ski-equipped plane; heavier materials were airdropped (pages 225 and 230). Next overnight stop was at Windy Corner, the skyline notch at right center.









**Uncle Sam's Rooftop Lies Under
a Year-round Blanket of Snow**

The "foreground" of this photograph spans 40 miles of rugged Alaska Range to Chulitna River (dark band near top). Arrow marks South Peak of Mount McKinley, highest point in North America.



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To Weary Climbers This Slope Was "Slippery as Greased Glass"

Alaskan Indians know Mount McKinley as Denali—the Great One. Behind Hackett (left) and Gale, inching up the icy West Buttress, looms 17,195-foot Mount Foraker—"Denali's Wife"—13 miles away.

foot shelf at 2:45 p.m., utterly exhausted and dripping with perspiration.

Up there, three miles above the sea, we began to feel the insidious effects of anoxia, or deficiency of oxygen. Anoxia increasingly impairs a climber's judgment, alertness, and will power the higher he gets. He becomes apathetic, careless, and tends to put off doing important tasks, or does them sloppily. Worst of all, though he realizes his companions are affected by it, he is convinced that he himself is perfectly normal.

Oxygen Lack Causes Errors

Once in 1947, when an Air Force plane dropped a load of supplies to us, I told them by radio that everything had landed all right. Actually one important box had smashed; anoxia had made me too careless to walk around and check everything.

Our writing became less legible, and we began to make elementary errors in arithmetic. For this reason we carefully double-checked our surveying figures. Once, because of anoxia, we set up the theodolite tripod so high I had to stand on tiptoe to see through it. And anoxia made me so apathetic that I used it in that awkward position and made several silly errors, which fortunately were corrected later.

Anoxia's ill effects can be reduced if a climber works slowly and rhythmically, without wasting energy. If, carrying a heavy pack, he chances to stumble, it is often better for him to go ahead and fall than to expend strength in a stubborn effort to retain his footing. There is no known cure for anoxia except bottled oxygen, which is far too heavy and clumsy to use on McKinley.

So perfect was the weather that after a good lunch we goaded ourselves into action and tackled one of the real enigmas of McKinley's west face—the last steep slope leading to the crest of the West Buttress. It rose directly 600 feet above our shelf at an average angle of more than 60° (measured by clinometer).

The final obstacle, now also clearly in sight, was the broken, rocky crest of the ridge leading from the top of the 16,000-foot shoulder to a broad snow plateau at 17,200 feet. From there to the summit aerial photographs clearly showed no unusual difficulties: simply 3,100 feet of steep, wind-packed snow slopes.

The mountain face above our "Crow's Nest" camp at 15,400 feet was in just as evil shape as the hill we had fought all morning a few hundred feet below. From 4 o'clock till 7 Jim and I took turns chopping steps in the most wretched snow imaginable.

On the surface there was a thin, breakable crust; under it a layer of granular snow about like buckshot; then another thin crust, then a

few inches of powdery snow, and finally a solid mass of hard blue ice, all sloping much more than the average roof.

We wore crampons and were tied to opposite ends of a 120-foot nylon rope. The man who was not chopping steps constantly watched the rope in case of a slip. Neither of us spoke. We just chopped and chopped.

Below the top of the shoulder the going became so steep, and sandwiched layers of fluffy snow and thin ice so treacherous, that we cut off to the right and vainly tried to find better going in steep rock ledges.

The wind was rising again, and, despite the fact that the ridge was now only a stone's throw ahead, we decided to retreat to camp and return to our task in the morning. It is not wise to climb on so steep a pitch when one is cold, exhausted, and hungry.

As we descended, we drove three 5-foot oak pegs into the snow and strung a length of sturdy hand line all the way down to camp.

It was late that night before Jim, Bill, and I finished building an igloo beneath an overhanging ice cliff at the Crow's Nest. Henry and John, after helping us carry up supplies, had returned to the Windy Corner camp. Knowing our time was limited, they generously agreed to let us go up first. They would follow us to the summit later.

A furious westerly gale roared over camp all night. When we awoke, the sun was high and the wind had died to a breeze. Beautiful cirrus clouds topped the summits of McKinley, Foraker, and Hunter (page 240).

We breakfasted and rested until noon, then tackled the big slope with 40-pound loads. What a contrast to our first trip! Fresh drifted snow now filled our steps, but this was easy to brush away. We climbed upward slowly but steadily, pulling on the hand line at each step.

Looking 8,000 Feet Down

In a scant hour we reached the top of the fixed rope. This time we were fresh and rested. Another hour of chopping brought us to firm rock, up which we scrambled easily to the very crest of the great West Buttress. Peering over its other side, we looked almost straight down 8,000 feet to the upper basin of Peters Glacier.

The ridge ahead was a granite knife edge, studded with angular boulders. As we neared 17,000 feet, the grade lessened and the rock changed abruptly from granite to slate at the geologic contact between the peak's granite core and the inky-black cap rock.

The wind blew on our backs in gusts of 30 to 40 miles an hour. In the lulls we could hear the gale roaring through the jagged ledges of the North Peak, half a mile away.



Past 20,000 Feet and Still Going Up: Climbers Ascend South Peak's Crest

The actual summit of North America's highest peak is about 50 to 60 feet of hard-packed snow. Here Bill Hackett (ahead) and Jim Gale, of the 1951 expedition, toil up the final slope, completing the first ascent from the west. An 8-foot bamboo pole (upper right), placed by the author's 1947 party, marks their goal. It was still riding out the gales last year when Hackett again made the climb.

As we topped the final crag of the ridge, a level snow field stretched ahead to the foot of Denali Pass.

The weather was worsening. The warm west wind could bring us nothing but trouble, and we dared not linger long in this desolate and exposed spot. We cached our loads and weighted them down with rocks, then hurried back down the ridge, collecting rock specimens set aside on the way up.

Next morning, we climbed back up with 55-pound loads. The clouds grew so dense that when we reached our 17,200-foot cache it was impossible to see 100 feet ahead.

We had to push on to find firm snow for building our last igloo. After 15 minutes of aimless groping we found ourselves back near our cache. We had walked in a circle.

Lining up our direction with the rocks, I

poked one of the birch trail markers into the snow 50 feet out from the edge of the ledges, then proceeded to the end of the rope. Jim beckoned me a bit to the right until I was in line with the first wand. Then I stuck in another. An hour later, surveying ourselves forward across the plateau through the dense fog, we saw sharp chunks of rock protruding from the icy snow at the foot of McKinley's final cone. This was the spot we had chosen for our last camp site, at 17,300 feet.

Suddenly a patch of blue appeared overhead, our shadows became visible on the snow, and the clouds cleared away like magic. Hours later, as the sun slipped behind the great cliffs of the North Peak, a sea of golden clouds filled all the valleys below us. Only Denali and Denali's Wife rose above them like two enormous islands (page 244).

July 10 dawned without a cloud. When I crawled out of the igloo tunnel to check the weather at 8 a.m., it was 10° above zero with a brisk south breeze; yet inside it was 25° above.

We ate breakfast hurriedly and set aside things needed for a trail lunch. Today packs would be light — only the inevitable extra clothing, a good supply of trail markers, food, cameras, and film.

Off for the Summit

As we hoped, the last 1,000-foot slope leading to Denali Pass was relatively easy, covered with hard snow, packed like ice in some places by the winds. Just after noon the grade suddenly lessened, we began to see familiar ledges, and a shapeless bundle appeared ahead. I gave a shout of joy.

This was the cache of cosmic ray apparatus that was left there by our 1947 expedition, which had climbed the other side of Mount McKinley. It was still neatly covered with the yellow rayon cargo parachutes with which it had been dropped to us by the 10th Rescue Squadron four years before.

We ran toward the cache but, panting and puffing, had to slow our pace at once. Finally we reached it, out of breath and speechless. We shook hands heartily. At long last McKinley's western face had been climbed!

We noticed a shovel lying in the snow a hundred yards east of the pass. As Jim walked over to it, Bill and I went to a near-by spot where we had left a large cache of food, fuel, and equipment at the close of the 1947 expedition.

Recording Thermometer Shows —59°

A shocking scene of confusion met our eyes. The party which had climbed McKinley in 1948, probably in desperate need of supplies, had ripped off the tents and parachutes with which we had covered the cache, and left it unprotected. Snow and ice, driven by scream-



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Old Glory Signals the Victory over McKinley's Western Slopes

Hackett (left) and Gale raise the Stars and Stripes on the wind-whipped summit of South Peak. The date: July 10, 1951. The flagpole is the same one barely visible in the photograph on the opposite page. GI arctic clothing was necessary in the subzero midsummer temperature.

ing gales, had penetrated every crack and cranny. The whole heap was frozen into a solid, rigid mass. Only about a third of the supplies remained.

In a near-by pile of rocks we found the American Alpine Club's minimum-recording thermometer, also left there in 1947. It registered 59° below zero, the coldest temperature since it was last adjusted, presumably in 1948. Actually this was a surprisingly warm record for that altitude, 18,200 feet.

Suddenly Jim leaned over with an exclamation and picked up a tiny bird, a little redpoll, which lay frozen dead in a crack between the rocks.

In 1947 we had found another redpoll and a Lapland longspur near the pass in the same condition. Every year thousands of these migrating birds must be swept to their deaths

far up on McKinley by warm spring gales.

Though our main objective had been attained, one goal still beckoned. All three of us had stood on the summit of McKinley before; yet we now had a compelling desire to climb to that snowy crest just once more.

To the Tiptop of a Continent

A plumelike cloud coursed over the tip of the peak, but we knew it would vanish in the chill of late afternoon. As we climbed, the cloud dropped lower, and at 19,000 feet we were inching forward through dense fog. But now that we knew the way, every undulation of the snow was like a familiar tree or signpost, for McKinley's upper dome changes scarcely at all from year to year.

At 5 p. m. the clouds melted away, and the summit of McKinley rose directly ahead, magnificent in a fresh coat of silver frost. We worked upward over the corniced drifts, fingers numb from taking pictures. Forty-five minutes later we topped the final drift of McKinley's South Peak, and the whole amazing panorama to the east burst upon us.

It was almost cloudless in every direction. Mount Hayes, sharp and clear, cut the horizon 140 miles to the east. To the southeast lay the Chugach Mountains and the misty gray haze which we knew must hide Cook Inlet and Anchorage. The huge white masses of the Kahlitna and Muldrow Glaciers wound toward the lowlands through a staggering sea of jagged peaks.

Most impressive of all was the deep emerald green of the lowlands to south and west. River after river sparkled in the afternoon sun, twisting off into the distance. As Archdeacon Hudson Stuck said after his first ascent of McKinley 38 years before, it was like looking out the very windows of heaven.

As it grew later, the temperature dropped rapidly below zero, and the gusty wind cut our faces like a knife. Despite heavy clothing we began to feel the intense burning cold of great altitude.

Panorama of 100,000 Square Miles

Yet we hated to leave. Each of us knew he might never see this marvelous sight again, a cloudless panorama stretching nearly 400 miles from horizon to horizon, 100,000 square miles of Alaska visible in a single sweeping glance!

At 6:15 we tied a bit of orange bunting to the tip of the 8-foot bamboo survey marker that still remained on the summit from our 1947 trip (pages 246 and 247). Then we headed downward to our last igloo, shivering uncontrollably from the bitter cold.

Descending next day, even with heavy packs, was almost pathetically easy compared

with the rigors of the long and grueling ascent.

On the trail we passed the other members of our party in two groups, upward bound in high spirits. On July 13 and 14 they too reached the summit. We went to bed at midnight in Kahlitna Pass, making the entire retreat from our highest camp in a single day.

But our thrills were not quite all behind us. We radioed to Terry Moore that the vanguard of the party was ready to be flown out, and he replied, "Will come this evening."

The sun had dropped behind Kahlitna Pass when we heard a faint hum. It grew louder, echoing from the cliffs. Two minutes later, Terry was taxiing safely toward the tents.

"Gee, that was a tough one! No more landings tonight!" were his first words as he climbed out. "The camp looked as if it were floating in a bottomless sea of gray milk. I'll take only one man out tonight."

It was agreed that I would go on the first trip. It was a thrilling take-off. High clouds aflame with sunset covered the sky. Every peak about us was pink with alpine glow.

Back to the Soft, Fresh Lowlands

I caught a final glimpse of Jim's and Bill's worried faces as we started moving. We passed the end of the runway and headed down the steep, smooth snow slope of the glacier. Suddenly I realized we were in the air. Terry's eyes twinkled triumphantly. "We made it, pard!" he shouted.

The sun was slipping behind the vast Yukon lowlands to the northwest as we flew over Wonder Lake and glided into the little Kantishna airfield. I'll never forget the lush green of that valley, the beauty of the spruces, and the smell of grass and flowers that came in the plane windows even before we touched the ground. The whole world down there seemed soft, fresh, and delicious after the cold, icy desolation of the heights.

At daybreak on July 13 Bill and Jim were flown safely out, and 10 days later the others followed.

McKinley had been climbed from the west, safely and speedily, in only seven days from Kahlitna Pass. We had proved that airplanes, loaded or unloaded, could land and take off halfway up that side of the peak. Mel Griffiths had completed his geologic work. My survey was done and checked. Not even a minor accident had occurred.

Our new route up McKinley's "impregnable" western face had turned out to be even shorter than I had hoped it might be when I had first seen it on our NATIONAL GEOGRAPHIC photographic flights 15 years before. It was proved to be an ideal avenue of approach for future scientific work atop the roof of North America.

Wildlife of Mount McKinley National Park 249

Predators and Their Prey Live Unmolested by Man in Alaska's Arctic Refuge,
3,000 Square Miles of Spectacular Wilderness

BY ADOLPH MURIE

Biologist, National Park Service

With Paintings by Walter A. Weber, National Geographic Magazine Staff Artist

IN the creek ahead we saw a dark object that reached almost from shore to shore. We stopped for a better look. A grizzly bear lying in the creek was enjoying the cool play of the current on its skin. A cub frolicked at the big animal's side.

"It's probably Nokomis," I said as we scrambled from the rattletrap truck. "She's the only grizzly in the area with one cub."

Walter A. Weber, NATIONAL GEOGRAPHIC naturalist and artist, had come to Mount McKinley National Park to paint and study Alaskan wildlife (map, page 222). He especially wanted to see grizzlies. Here, on our second day in the field, we had found one, and under unusual circumstances. Bears bathe quite often, but men rarely see them doing it. We set up our cameras to record the scene.

Suddenly the old bear, 80 yards away, stood up and eyed us. I thought she was standing up to stretch.

Our confidence vanished when the grizzly nervously "chomped" her jaws together several times. We could see her yellowed teeth. Probably she was trying to scent us.

A bedlam of squalls and barks erupted behind us. Another grizzly cub was pacing back and forth on the hillside directly above us. Unnoticed, it had been playing there when we arrived.

Between a Grizzly and Her Cubs

My mistake was evident. This was not Nokomis at all. Our bathing bear must be Old Rosy, mother of *two* cubs. Now we found ourselves between an irate grizzly and her frightened cub—a classic example of the wrong place to be.

"I don't like the looks of this," Walter said, as the bear dropped onto four feet.

We grabbed our cameras and sprinted down the road. Branches snapped and crackled behind us as Old Rosy plowed through the brush toward her second cub. We jumped into the truck and drove away.

Seconds later the grizzly broke out onto the highway. She gave us a sidelong glance and continued uphill, trailed by cub number one. Stopping at a safe distance, we watched the little family's reunion.

Walter later watched Old Rosy through binoculars and made the sketches he wanted. The painting (page 263) shows her in a less belligerent mood as she shepherds her two cubs across a sweeping plateau.

Color Films Supplement Sketches

To ensure accuracy, artist-naturalist Weber supplements his own memory and notes with sketches and motion pictures he makes on the spot. Later, at The Society's headquarters in Washington, D. C., he projects the color films above his easel, stopping their motion with a push-button arrangement to study a creature in characteristic pose (page 270).

Kodachrome slides of typical park plants and landscapes aid him in painting backgrounds. Specimens from his own collection or from museums round out his original source material.

Walter Weber and I are old friends, and it was my pleasant duty to act as guide during his stay in Mount McKinley National Park. For a month we roamed an unspoiled wilderness, enjoying the same majestic scenery and far-north environment that trail-blazing Charles Sheldon, the hunter-naturalist, explored in 1906 and again in 1907-08. It was largely because of Sheldon's observations and accounts that part of the Alaska Range was set aside in 1917 as a national park.

Today the park covers 3,000 square miles and is the Nation's second largest national park; 120 species of birds and 36 species of mammals have been identified within its boundaries.

Crowning glory is lofty Mount McKinley, highest peak in North America. The eroded monarch reaches an altitude of more than 20,000 feet above sea level. It alone surpasses the park's wildlife as an attraction for the growing influx of visitors.

An excellent highway runs through the refuge, providing ready access to wildlife areas. The large animals, such as sheep and caribou, often can be seen from the road.

After a few days in the eastern section we drove 88 miles westward to Wonder Lake, near the base of Mount McKinley, and set up headquarters in a lonely 5-room bungalow.

The little frame dwelling had an unhappy



Adolph Murie

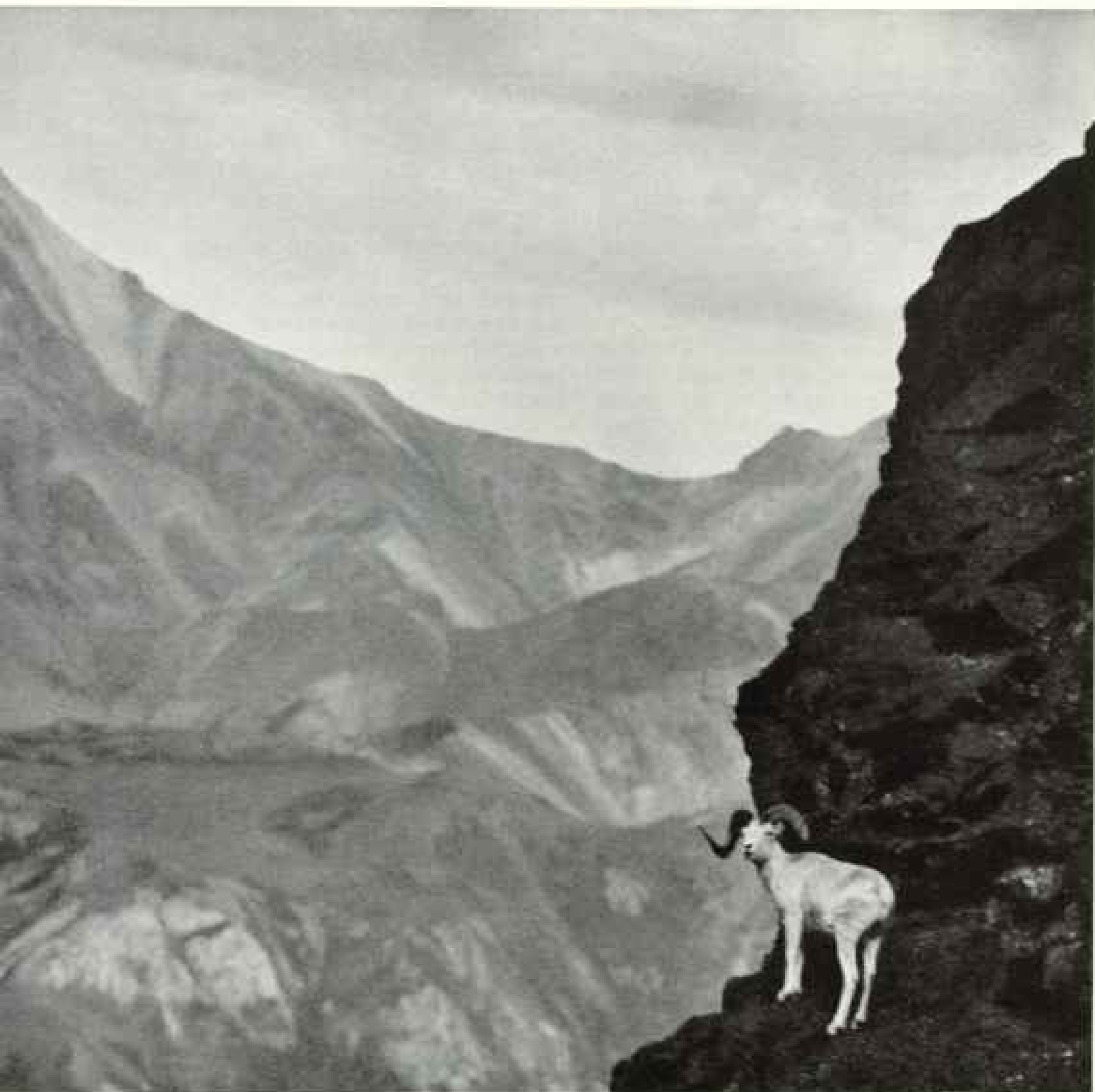
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Far from Civilization's Threats, Mount McKinley National Park Presents an Outdoor Museum

Alaska's Dall sheep (right) is white instead of sandy brown like its cousin, the Rocky Mountain bighorn; also, its horns are more slender and wide-spreading. In the park visitors can sometimes approach quite close to these mountain sheep. Dalls particularly frequent the north side of the Alaska Range, where snow is lighter and feeding grounds are swept bare by the winter winds. This dignified ram perches safely on a crag near Sable Pass (pages 268, 269).

The willow ptarmigan (left), an arctic grouse found in willow thickets, excites more curiosity than any other bird in the park. This male wears fashionable brown and white for the breeding season; his winter plumage is white. If alarmed, he cackles loudly like an alarm clock running down (pages 256, 269).

Mount McKinley's beavers thrust butt ends of green wood into the mud for food when ponds freeze. This specimen gnaws a meal of aspen bark.



reputation. Built for park personnel, it had recently been subjected to a series of house-wrecking raids by a hungry grizzly.

Repairs had been made, but huge paw marks, printed in mashed chocolate, still formed patterns on the floor, and perfect nose-prints showed on window glass.

Fortunately, the bear left us undisturbed during our stay in the cottage.

Caribou, Nomads of the Arctic

Early the next morning we set out afoot to stalk those handsome relatives of the domesticated reindeer, the caribou.

No product of an artist's license, page 253 shows caribou as Walter actually saw them—silhouetted against the dramatic backdrop of Mount McKinley.

Caribou are restless, migratory animals. The pattern of their wandering is uncertain.

It may be the same for a period of years, then it may change drastically.

Alaska has several caribou herds. One herd spends part of each year in the park. In spring the animals enter from the west and northwest, usually in relatively small bands of 100 to 200. After traveling across high glaciers to the south side of the Alaska Range, they recross in late July, when they gather and stream westward again.

I have counted as many as 4,500 in a single band, a large part of the entire park herd.

We found many small, scattered groups of caribou. Once we stalked two fine bulls with sweeping angular antlers. Both were adults, but only one had attained the glistening white neck, low-hanging white mane, and the whiteness spreading over the shoulders and along the flanks that are characteristic of the fully developed fall coat.

Circling downwind, we approached the animals as they grazed among scattered spruce trees. Slowly we set up our cameras. The caribou's eyesight is anything but keen; only sudden movement would betray us.

The bulls looked our way a few times as if suspicious. After a while they lay down contentedly. Then, for no apparent reason, both jumped to their feet and dashed off.

Fly Tormentors Spoil a Picture

Our comments were sulphurous. Probably the animals had been set upon by nose botflies or warble flies. The latter deposit eggs on the legs and flanks of the caribou. After hatching, the larvae penetrate the leg and by the following spring have burrowed through to the back, where they emerge as fat grubs. The grubs drop to the ground, where they change into tormenting flies.

It was now late August. Hill and tundra blazed with brilliant shades of crimson, yellow, and gold. Against this vivid background the lordly male caribou seemed the epitome of wilderness splendor.

Some sparred with their antlers, tuning up for serious fights later in autumn when each adult male would attempt to round up and defend against all rivals a dozen or more cows.

Caribou are the chief source of food for the big timber wolf.* Unfortunately, we failed to sight one of these powerful predators, but I did point out a river-bluff burrow where I had observed wolves often. Lounging by the den, I told Walter the story of its tenants.

I had discovered the wolves' hideaway one May morning while following telltale pad marks in light snow. Two adults ran from the entrance when I approached. Crawling inside, I found six dumpy, blunt-nosed puppies, their eyes still closed. I wrapped one of them in my parka and carried it home.

The little captive, a female, grew rapidly on canned milk. She became a friendly pet, beloved by my wife and 5-year-old daughter Gail. Because of the wolf's good-natured tail waving, Gail named her Wags.

Wolves Call on the Family Pet

Wags was kept on a chain outside our cabin, where she received visits day and night from neighborhood wolves. Their boldness made us fearful for Gail's safety, but despite misgivings we kept our pet for a year. Finally we gave her to the rangers at park headquarters.

From a near-by ridgetop I watched the wolf family from which I had abducted Wags and made daily notes on their habits.

It had always been thought that a den of wolves consisted only of parents and young.

* See "Canada Counts Its Caribou," NATIONAL GEOGRAPHIC MAGAZINE, August, 1952.

To my surprise, I discovered that in addition to Wags's mother and father there were two other adult males and a female living at the den. Three years of observation indicated that these additional wolves were not young of the previous year, as might be assumed.

All the adults were friendly with one another and amiable toward the pups. Before leaving for a night hunt the wolves often engaged in ceremonious tail wagging and shoulder rubbing; occasionally they enjoyed a playful romp. Several times the unattached female sat with the puppies while their mother joined the night hunt.

Undoubtedly the animals had some quarrels, but I observed a side of their nature that has not entered into wolf tradition.

On one occasion, secure in my ridgetop hideaway, I watched the five wolves stage a memorable battle royal with a big male grizzly. The bear got a strong whiff of caribou meat, cached by the wolves in a thicket, and headed straight for the site.

Grizzly Meets His Masters

Too late he realized his mistake. The pack, which had been resting under cover, dashed out to attack. The grizzly turned and ran, but he was soon overtaken and encircled. The wolves slashed at his flanks. As he turned on one tormentor, another rushed in. The nimble attackers easily avoided his lunges.

The battle lasted 10 minutes, but its outcome was never in doubt. The overmatched bear retreated slowly. Eventually the wolves permitted him to lumber off.

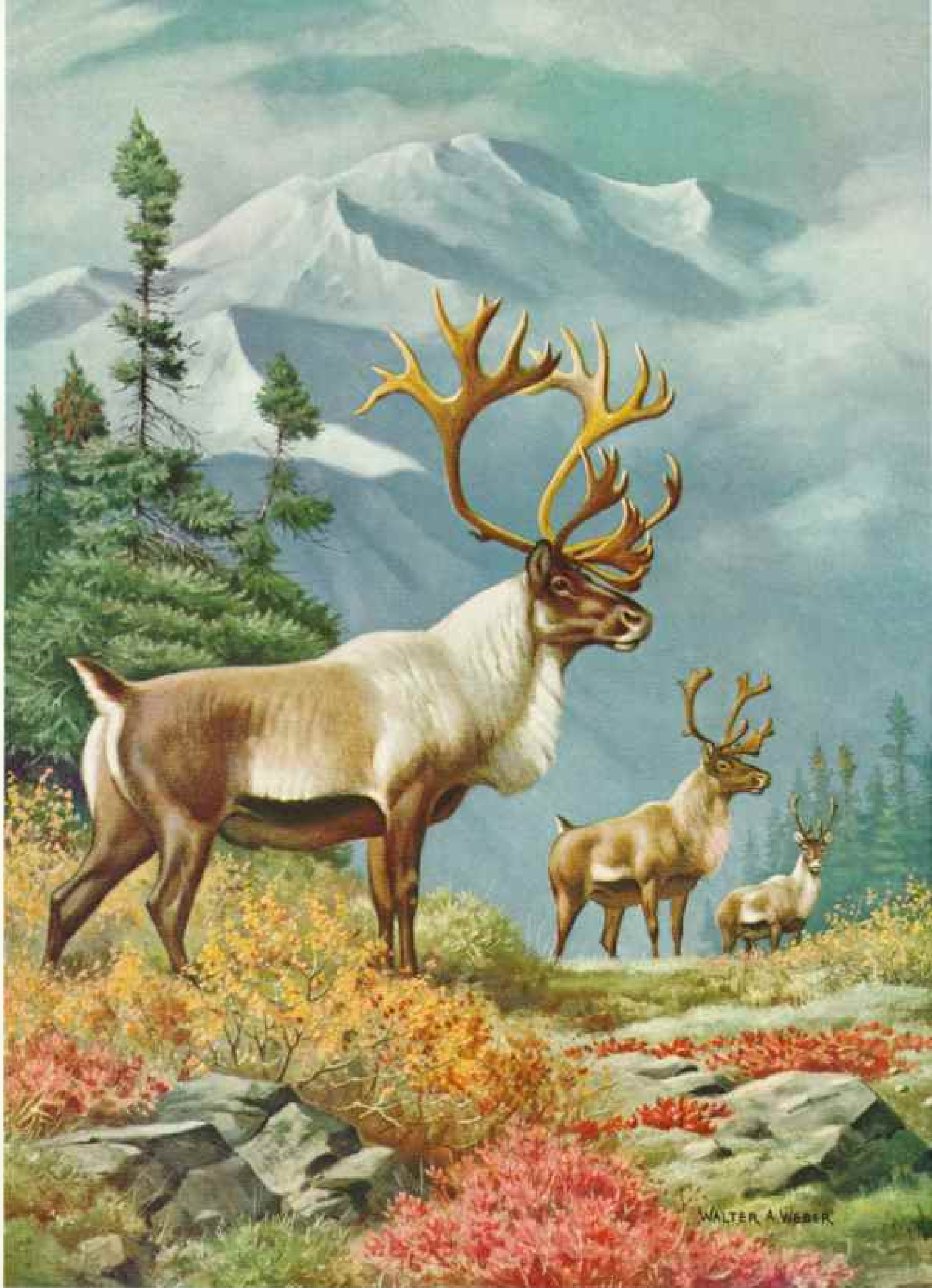
Walter took notes as I described the episode. Later he reconstructed it in a wonderfully realistic painting (page 259).

The lynx is a perfect example of an animal whose fate closely depends on a prey species (page 262). When the snowshoe rabbit is abundant, the lynx prospers. Periodically, however, the rabbits die in large numbers. Deprived of their main food source, the big cats become enfeebled and dwindle in number until rabbits again become plentiful.

Foxes, too, are sometimes affected by population cycles, though to a less degree than the lynx. McKinley Park's red foxes maintain themselves in good numbers (page 255). When their staple food such as squirrels, rabbits, mice, and ptarmigan is scarce, many foxes survive by feeding more extensively on crowberries and blueberries.

Ornithologists visiting the park invariably inquire about two of its most elusive residents, the wandering tattler and the surfbird (pages 264 and 265).

In 1921 a downy young surfbird was discovered in the Fortymile River country, in
(Text continued on page 269)



Caribou Scent the Wind for Danger as They Cross a Ridge Beneath Mount McKinley

Artist Walter A. Weber composed 16 paintings to illustrate the wildlife he observed in Mount McKinley National Park. A mature **Stone's Caribou** bull leads a young male (center) and female. Both sexes grow antlers.



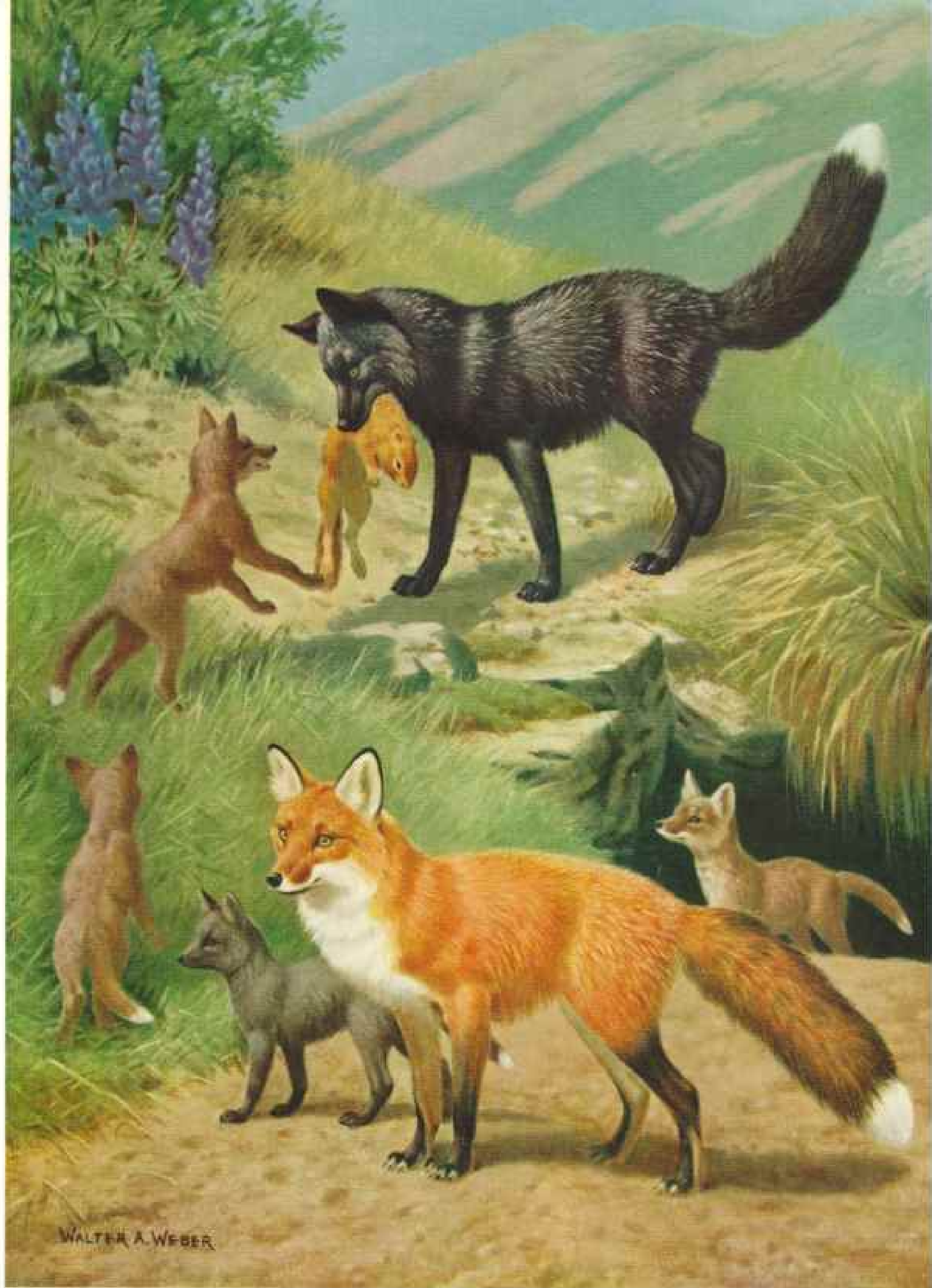
WAYNE S. WEAVER

© National Geographic Society

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A Golden Eagle Sinks Daggerlike Talons into a Favorite Prey, the Hoary Marmot

Ground squirrels are another staple of the Golden Eagle's diet. The Hoary Marmot, alpine cousin of the woodchuck, lives above timberline. This unwary rodent was caught at the entrance of his rock den.



Father's Return from the Hunt Brings Mother Fox and Hungry Pups from Their Den

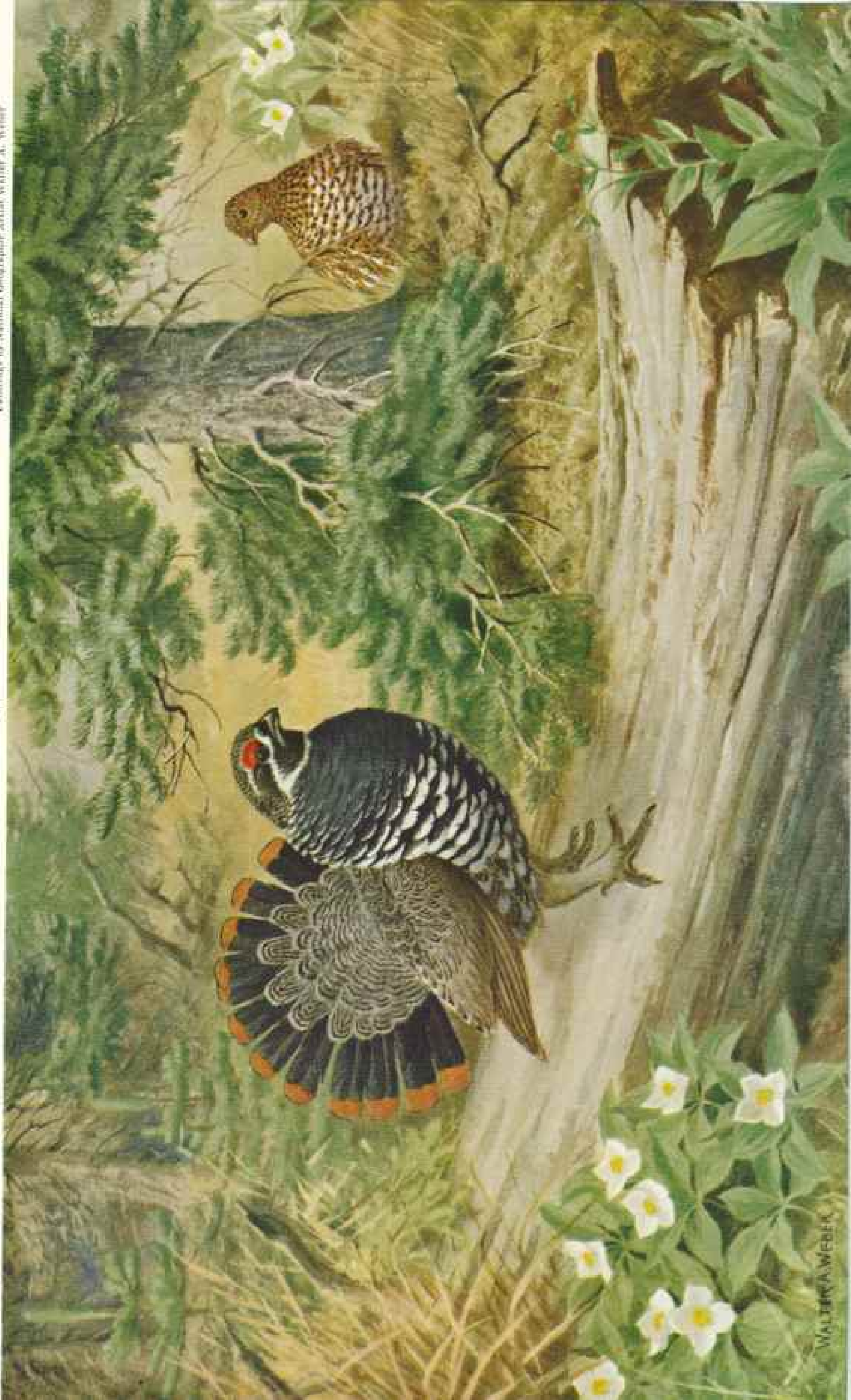
Foxes become fairly tame in the park sanctuary. Some will even take food from visitors' hands. The male, carrying a **Ground Squirrel**, is an **Alaskan Red Fox**, like his mate. His black coat is a color phase.



A Male Spruce Grouse, Courting a Hen, Spreads Tail Feathers and Struts with Puffed Chest; Bunchberry Blossoms at Left and Right

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Paintings by Optimal Geographic Artist, Walter A. Weber



WALTER A. WEBER



WALTER A. WEBER

Elusive Timber Wolves Nip at the Flanks of an Enraged Grizzly Bear Caught Raiding the Pack's Near-by Food Cache

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Paintings by National Geographic Artist Walter A. Weber

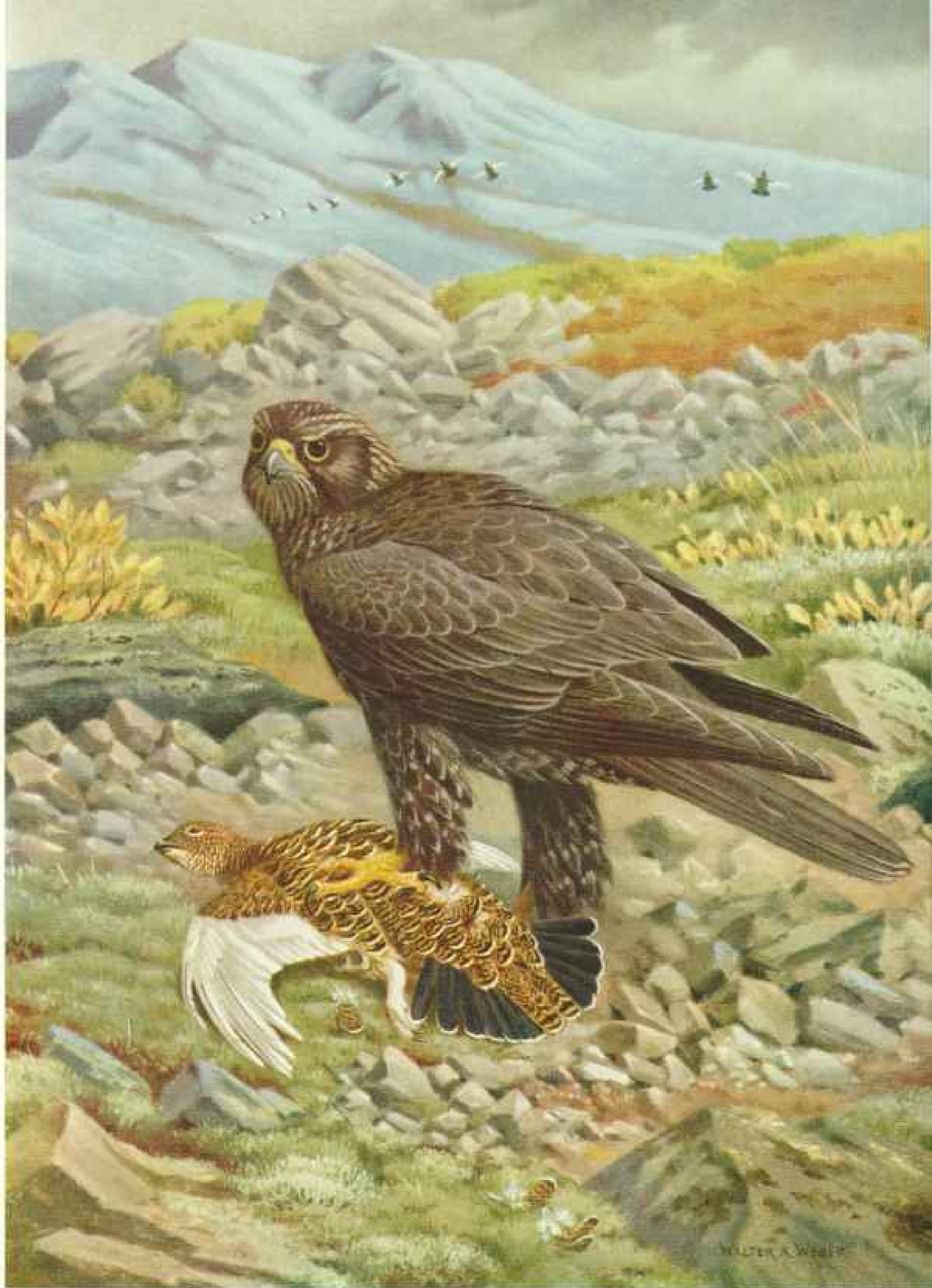


WALTER A. WEBER



Racing for Safety, a Toklat Vole Eludes Its Arch Enemy, the Hawk Owl, by Inches

Day-flying **Hawk Owls** subsist largely upon these **Voles**, or field mice, whose name stems from association with Alaska's Toklat River area. A dwarf birch holds grass harvested by the mice for winter food.



A Gyrfalcon Clutches the Body of a Rock Ptarmigan, Struck in Mid-air

Gyrfalcons are the type of hunting hawk most prized by falconers. These powerful birds swoop like dive bombers on their victims. The **Rock Ptarmigan** is smaller than the willow ptarmigan (page 256).

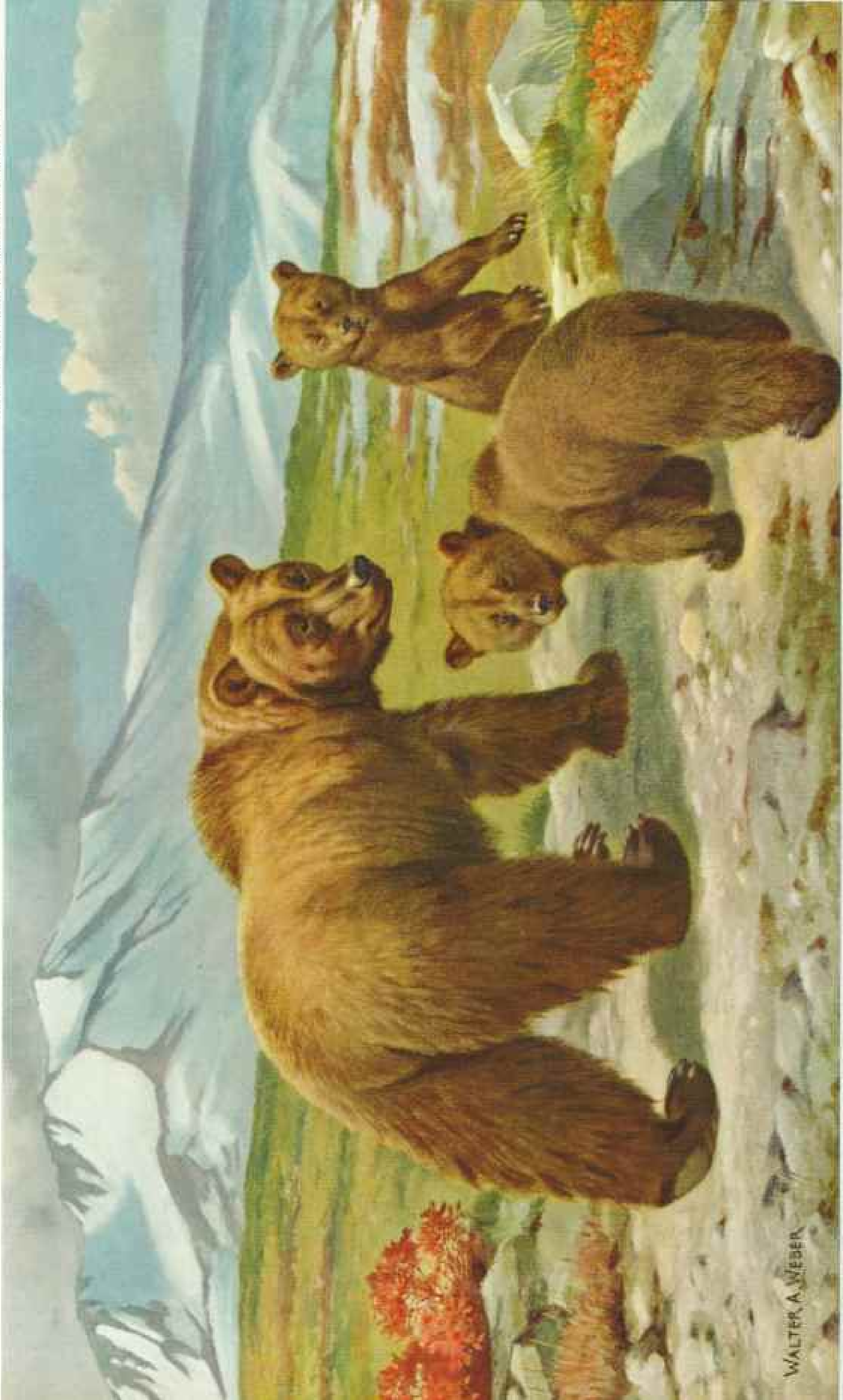


Bold Alaska Jays, Attracted by the Prospect of Meat Scraps, Scold a Lynx. Snowshoe Rabbits Are This Cat's Staff of Life

Old Rosy the Grizzly, a Familiar Sight to Park Rangers; Shepherds Her Cubs Across a Wind-swept Plateau.

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Paintings by National Geographic Artist Walter A. Weber



WALTER A. WEBER



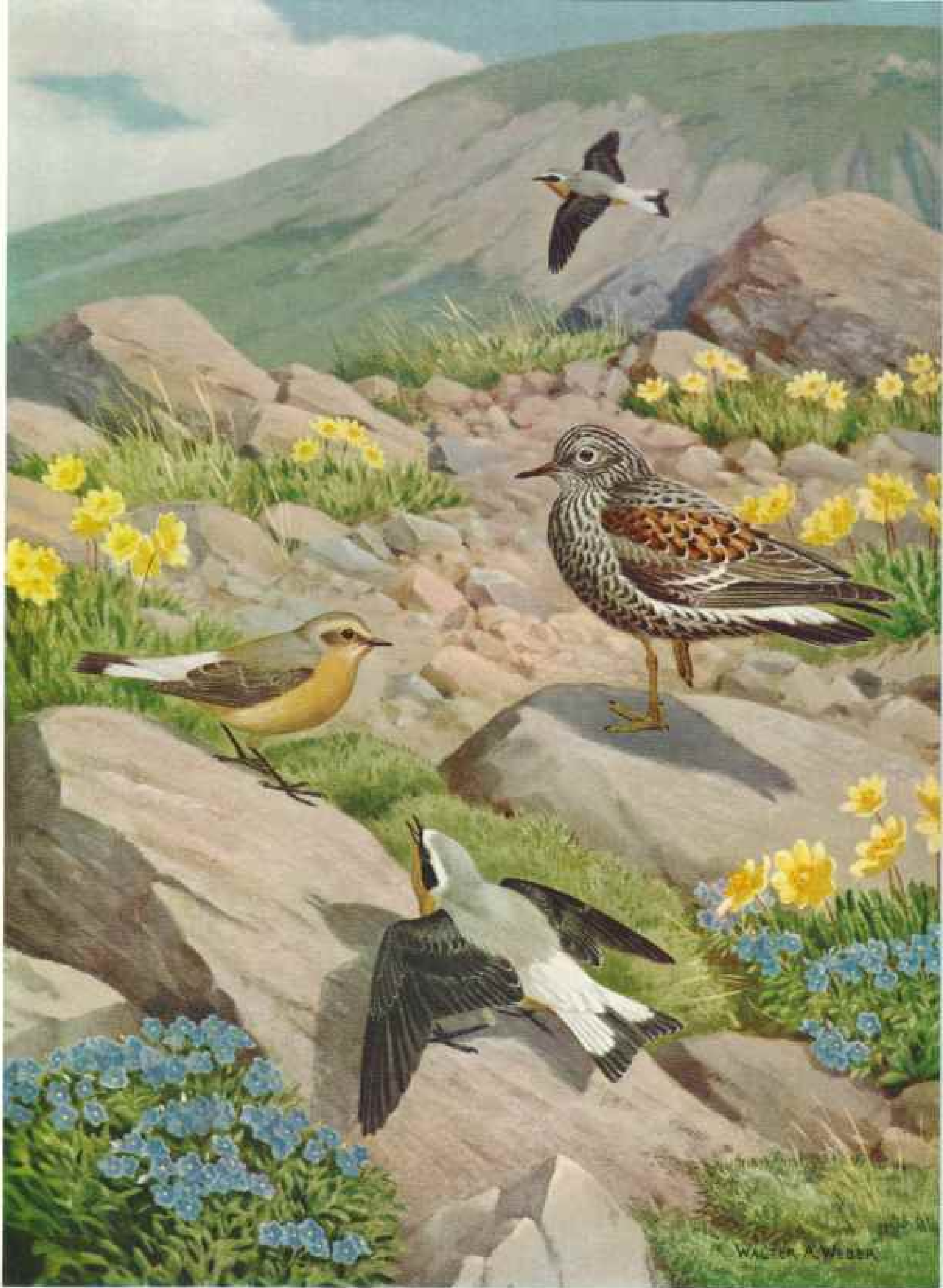
WALTER A. WOOD

© National Geographic Society

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Wandering Tattlers, Disturbed near Their Nest, Chirp a Loud and Excited Protest

Tattlers are known to nest on gravel bars, but only two sets of their protectively colored eggs have ever been discovered. Both finds were in Mount McKinley National Park. A **Golden Plover** stands on the farther shore, Fireweed nods beside Alaska's Savage River.



WALTER A. WEBER

A Plump Surfbird Ignores the Courtship Antics of Small Neighbors, the Wheatears

With spread wings and fluttering flight, male **Wheatears** woo a female (left). **Surfbirds** live by the sea most of the year, but rear their young in Alaska's mountains. Only one nest with eggs has been found. Yellow dryas and blue alpine forget-me-not grow among these rocks near Polychrome Pass.



WALTER A. WEBER

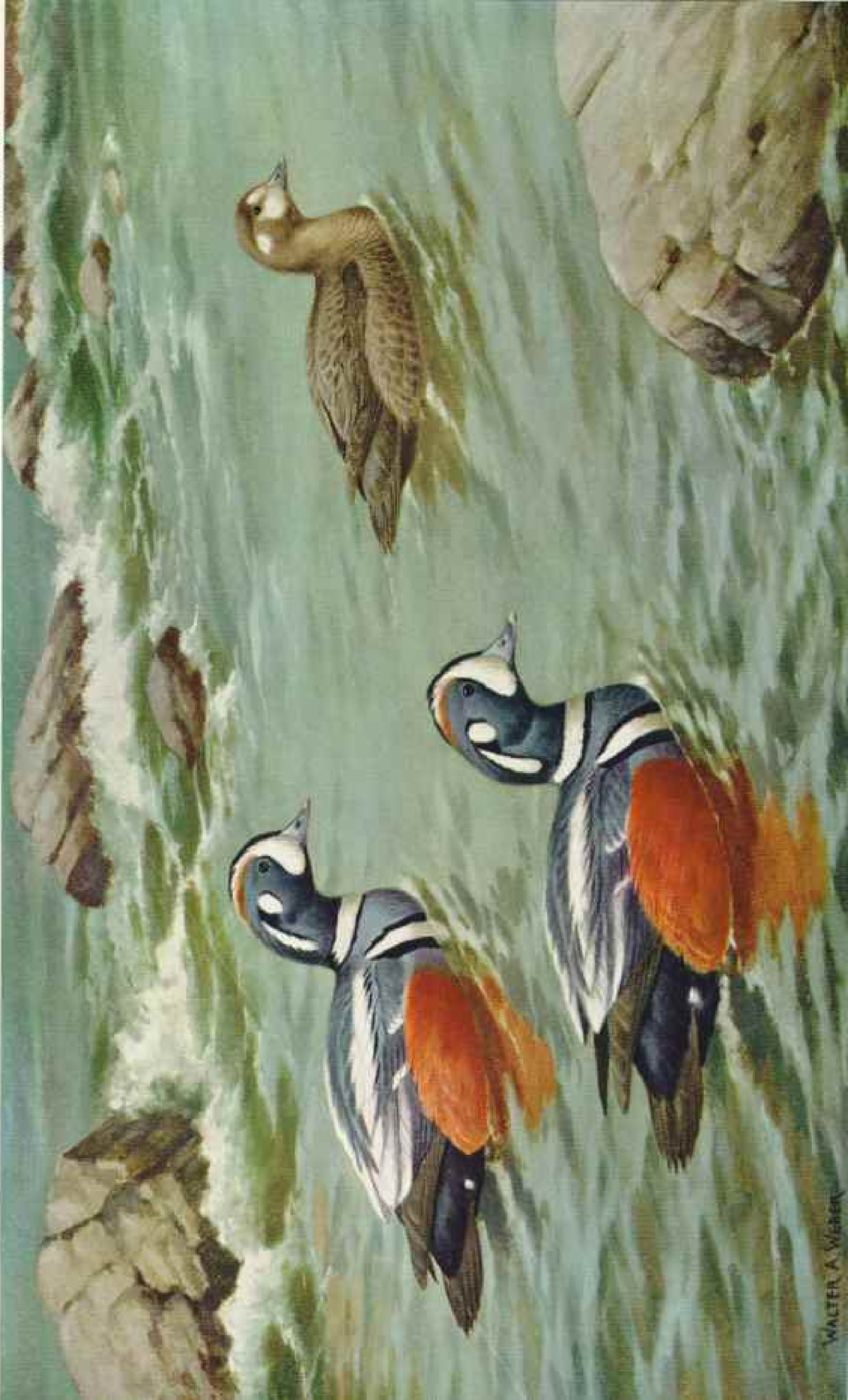
© National Geographic Society

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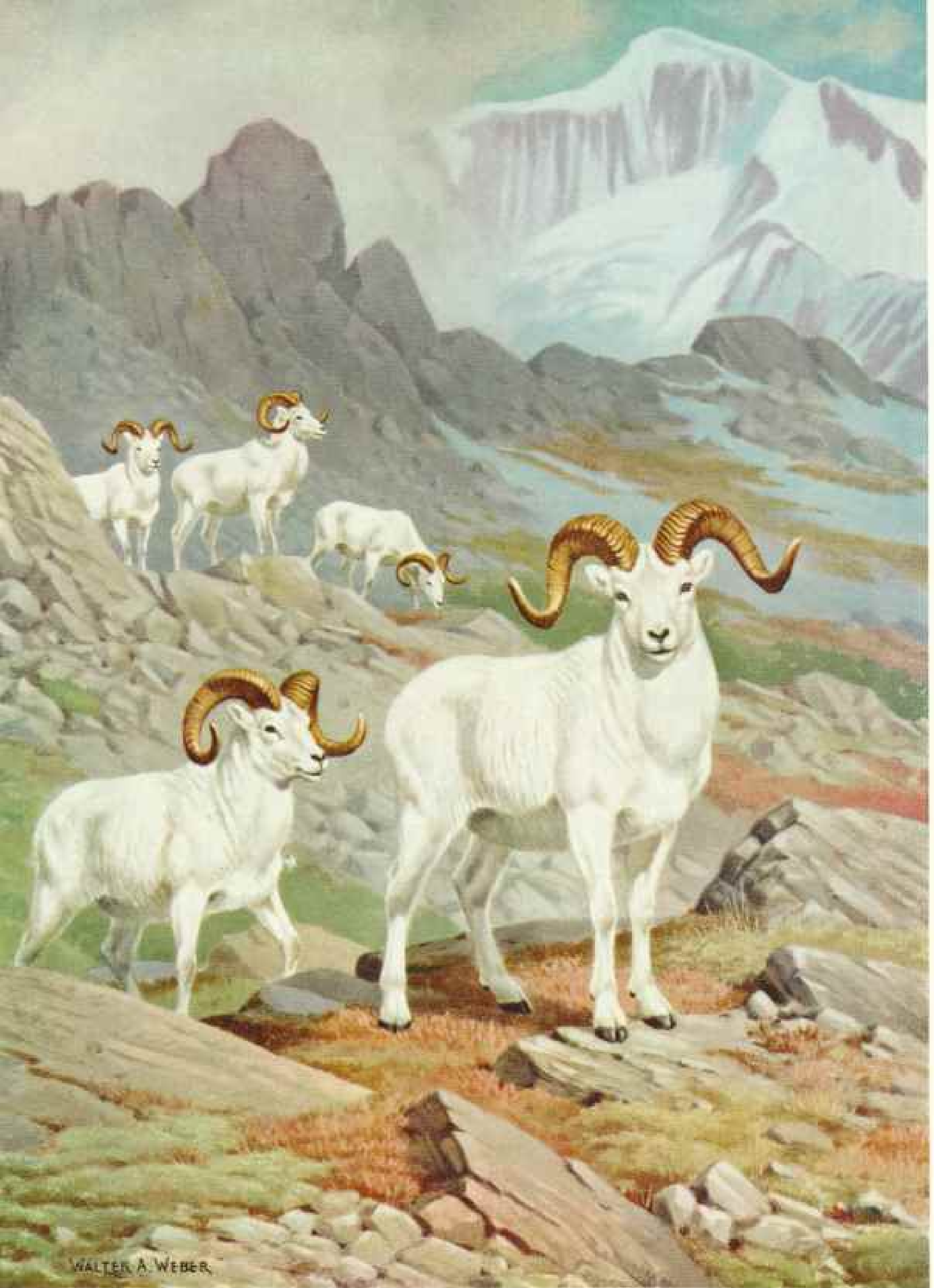
A Fearless Little Pigeon Hawk (Right) Breaks Up an Aerial Dogfight Between Ravens and Goshawk, Forcing a General Retreat

Harlequin Ducks Swim with Ease Up the Swift Savage River. Males in Gaudy Breeding Plumage Trail a Sober-hued Female

Paintings by National Geographic Artist Walter A. Weber



WALTER A. WEBER



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Painting by National Geographic Artist Walter A. Weber

Keen Eyes Search for Danger as Dall Sheep Rams Cross a Rocky Hillside

Old males generally keep to themselves in small flocks during summer. They are smaller than Rocky Mountain big-horns. Dark ridges among the horn wrinkles mark annual growth cycles.

another part of Alaska. But it was not until May 28, 1926, that the first and only surfbird nest known to science was found within the McKinley Park area by George M. Wright. He and Joseph S. Dixon were walking across a rocky ridge when a nesting surfbird exploded into the air from beneath Wright's feet.

This sudden bursting-into-flight serves to startle mountain sheep and thus keeps the nests from being trampled.

We know now that the surfbird raises its family in the high country above timberline in Alaska's interior. It winters along rocky Pacific coast beaches as far south as Chile.

First Wandering Tattler Nests

On July 1, 1923, my brother Olaus and I were driving a team of horses on a gravel bar of Alaska's Savage River. Suddenly a wandering tattler burst into the air just ahead of us. Near a wheel rut we found its nest.

In 1939 I discovered a second nest. They are still the only ones recorded, although the bird itself is common enough in the Alaska Range. It winters along the Pacific coast of the United States, in the Hawaiian Islands, and in faraway New Zealand.

To me the powerful golden eagle, with its wingspread of more than seven feet, is one of Nature's most splendid creations (page 254). Some years ago the park eagles were suspected of preying widely upon the lambs of mountain sheep, so I turned detective.

Visiting many cliffside nests, I gathered pellets of undigested bones, feathers, and fur, which the eagle regurgitates after a meal. Examination of the pellets revealed that more than 90 percent of the bird's diet consists of ground squirrels and hoary marmots. A few lambs are undoubtedly taken, but the effect on the sheep population is insignificant, I was happy to report.

The bird that perhaps best typifies the North is the willow ptarmigan, an arctic representative of the grouse family (pages 250, 256).

We met many of these birds prospecting for gravel along the road. They proved so tame and confiding, clucking softly or crying *come-ere, come-ere, come-ere*, that frequently we were able to herd them toward our cameras.

Ptarmigan Dress for the Season

Also present in the park are two other ptarmigan species, the rock (page 261) and the white-tailed. The rock ptarmigan's call is low and guttural, somewhat like the croak of a bullfrog. The white-tailed, tamest of the three, utters a high-pitched scream, not at all in keeping with its personality.

All three species change dress with the seasons, matching winter's snow with white out-

fits, donning brown-and-gray plumage in spring when the snow melts. In late summer and fall they display snowy underparts and brownish feathering above, as in the color plate on page 256.

While camping in a spruce woods we studied the activities of a winsome little field mouse, the Toklat vole, named for Alaska's Toklat River.

Like the squirrel, which stores nuts for the future, the Toklat vole is a provident creature. Each summer it harvests hay to feed upon during winter. Great care is taken to keep the hay dry.

Near our cabin we found many miniature haystacks, usually piled between the basal branches of dwarf trees or bushes and on exposed roots of spruces.

Some of the vole's burrows have an ingenious construction, a series of small chambers connected by narrow passages, so that a burrow resembles a pearl necklace. Connecting passages are so narrow that the vole can just squeeze through. A pursuing enemy, such as the weasel, would have to stop and enlarge each passage.

Scanning the spruce tops, we discovered several hawk owls, beautiful northern birds that do much hunting in daylight. The painting of the owl swooping on the Toklat vole reproduces a scene I witnessed (page 260).

From a hilltop we saw also a pigeon hawk break up an aerial dogfight between a goshawk and some ravens (page 266). The scrappy little pigeon hawk, highly maneuverable, chased his larger opponent all over the sky and finally drove him from the area.

We Stalk a Herd of Rams

Soon mid-September was upon us, and there was time for only one more camera hunt. We set out for the high, craggy ridges in search of Dall sheep (opposite and page 250).

These mountain sheep are among the handsomest animals of the Mount McKinley region. In summer they appear to be pure white. Against the snow a slight yellowish tinge is apparent. The rams have graceful, curving horns, decoratively wrinkled. A good-sized male will stand about 39 inches at the shoulders and weigh approximately 200 pounds.

For 60 miles the park highway passes through sheep range. In spring, lambs may be seen frisking along the cliffs and ledges, developing their legs, already strong a day or two after birth.

Rattling along the highway in our truck, we sighted 20 rams in the cliffs high above us. A dry river bed promised an approach. Afoot we began a slow, laborious climb.

The park sheep, though they possess excep-



National Geographic Photographer Bates Littlehales

Artist Weber Checks Printer's Proofs of His Paintings for Color Accuracy

The National Geographic artist-naturalist looks down a tunnel-like motion-picture projector above his drawing board. A flick of the switch (left) stops the picture on any frame he wants to study. Here he reviews films of the golden eagle used for lifelike reference while painting the portrait before him. At right Weber holds a printer's color proof of the picture appearing on page 254 of this issue.

tionally keen eyesight, can often be stalked in the open. They seem to feel at ease so long as they keep you in view. Disappear for a moment and the animals are likely to bolt.

Climbing slowly, we carefully remained in sight of the rams at all times.

As we neared our ridgetop goal, the sunlight, which had been brilliant, began to grow dim. Soon the entire ridge was bathed in a curious, wan half-glow.

To add to our woes, a stray ram jumped from behind a rock and stampeded the herd. The animals vanished over a rise to reappear on a distant crag.

"What Happened to the Light?"

"We spend four hours reaching these sheep," Walter grumbled. "We finally get here. Then no luck and no light. I never saw such a queer day. The sun is out, but what happened to the light?"

Returning disconsolately to camp, we soon learned the answer. For our sheep hunt we had picked, of all days, the one on which an 82-percent eclipse of the sun occurred.

But luck, and the sun, favored us a few days later. We maneuvered to within 40 yards of another band of rams and spent several hours photographing them.

It was Walter's last day in the park. As we clambered down the mountainside, I noticed how his gaze lingered on the magnificent sweep of horizon, the dark, tumbled ridges, the jagged crags, and the aloof, snowy hood of distant Mount McKinley.

He seemed to be etching the scene in his memory. I knew what he was thinking.

Here, thanks to man's foresight, is a true wilderness, a splendid refuge where God's lesser creatures can follow their natural destinies in a special area of human good will.

May it never change.

Tracing Lost Indian Civilizations, an Archeologist and His Wife
Narrowly Escape Disaster on the Isthmus' Wild North Coast

BY MATTHEW W. STIRLING

With Illustrations by National Geographic Photographer Richard H. Stewart

WESTWARD for 130 miles from the busy world crossroads of the Panama Canal extends one of the most isolated and inaccessible coastal stretches of the Western Hemisphere.

This almost-forgotten region, where primitive ways of life still survive, is the jungle-matted north shore of Panama which faces the Caribbean Sea between the Canal Zone and the Laguna de Chiriquí (map, page 275).

All year winds sweep the coast, ridging the sea with huge rollers that beat against the shore in a booming surf. There are no harbors and few anchorages, even for small craft. The rough mountains of the isthmus, cloaked with tropical forest and drenched by soaking rains most of the year, extend down to the sea.

This wild land is sparsely peopled in the interior by Indians in direct bloodline from the aborigines of pre-Columbian times, and along the seacoast mostly by Negroes, many of whose ancestors probably were escaped slaves. These inhabitants have virtually no contact with the outside world.

A few small launches periodically visit the coast to pick up cargoes of bananas; ill-marked and difficult jungle trails twist across the mountains.

Yet it was in this area that Columbus, on his fourth voyage to the New World in 1502-03 first found in any quantity the gold he sought. Here he established the first Spanish colony on America's mainland, at the mouth of the Río Belén. Along this coast, too, he encountered the greatest difficulties with storm and surf of his entire career.

In the Footsteps of Columbus

On a gray January dawn my wife Marion and I arrived off this inhospitable shore at the mouth of the Río Coclé del Norte on one of the semimonthly banana boats.

We had come, under the joint auspices of the National Geographic Society and the Smithsonian Institution, not to seek gold but to hunt for pottery, arrowheads, stone axes, ancient graves, and other remains of the Indians who lived here during and before the time of Columbus. We hoped to gain from a study of such relics a better understanding of the rise of prehistoric Indian civilizations in the New World.

All night long on the voyage from Colón, in the Canal Zone, our little craft had pitched and tossed in heavy swells, fully living up to her name, *Tumbaita*, the Little Tosser. As we rose stiffly from fitful sleep on the hard deck, we could see white breakers underlining the base of lonely green-clad mountains.

Explorers Have Shunned the Area

Ever since the time of Columbus explorers have shunned this forbidding land. For centuries it has defeated those who sought the gold reported in Columbus's accounts.

We were to face far greater difficulties and dangers here than on any of our previous expeditions to study the archeology and prehistory of Middle America.*

This first visit to the Coclé del Norte was a scouting trip for later explorations, for we had been unable elsewhere to find reliable information about the interior. Almost nothing has been published about this area since the accounts of Columbus's voyage 450 years ago.

As the wind whipped the waves and *Tumbaita* labored in the heavy sea a mile offshore, we were reminded of a passage written by the great explorer of this very coast:

"... The storm recommenced, and wearied me to such a degree that I absolutely knew not what to do... never was the sea so high, so terrific, and so covered with foam; not only did the wind oppose our proceeding onward, but it also rendered it highly dangerous to run in for any headland, and kept me in that sea which seemed to me as a sea of blood, seething like a cauldron on a mighty fire... All this time the waters from heaven never ceased descending, not to say that it rained, for it was like a repetition of the deluge..."†

Though we did not realize it then, these words were strangely prophetic of what was to happen to us.

Accounts of Columbus's voyage tell that the Spaniards found the Indians wearing gold ornaments in the shape of disks, frogs, and

* For titles of previous articles on researches in Panama and Mexico by Dr. Stirling, who is Director of the Bureau of American Ethnology, Smithsonian Institution, see the two-volume Cumulative Index to the NATIONAL GEOGRAPHIC MAGAZINE, 1899-1932.

† From *Select Letters of Christopher Columbus*, translated by R. H. Major, published by the Hakluyt Society, London, 1847; page 179.



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Solemn Brown Faces Reflect the Wonder of Music from the Air

None of the youngsters had heard a radio before; the little boy seems awe-struck. The man with the pipe visited the expedition's camp on the upper Río Indio to ask if he might bring his family to call, since they had never seen people like the Stirlings. Guests came to the concert over jungle trails despite darkness and heavy rain.

eagles. They persuaded a chief to lend guides for a trip to the mines.

The wily Indians guided the white men far into the interior to the roots of some huge trees where they said the gold was found, a place actually in the territory of an enemy of the chief. The eager Spaniards, without having to use tools, gathered a handful of gold each. One is inclined to suspect that the Indians had salted the locality with gold to satisfy the Spaniards.

Columbus's settlement at Belén was short-lived. Rebelling against the white men's ill-treatment, the Indians killed many of them and threatened to exterminate the rest. Short

of food and pounded to exhaustion by the sea, Columbus abandoned the settlement.

Gold is still found in small quantities in this region, particularly in the Concepción, Belén, and Coelé del Norte Rivers. Natives pan for it with shallow wooden trays, as the aborigines did. A hard day's work produces about three dollars' worth.

Legends of "Lost Mines" Persist

The large quantity of gold the Spaniards found was the accumulation of many years of labor, rather than the output of rich mines or deposits. Nevertheless, legends of fabulously rich "lost mines" still persist.



Where a Rock Dike Blocks the River, Natives Haul Up a Dugout by Main Strength

This obstruction at El Chorro de la Iguana waterfall on the Rio Cascajal forced the expedition to unload canoes and skid them to quiet water above (page 288). Pejibaye palms (left) produce fruit which has been a staple food for Indians since pre-Columbian days. Near this point mountains of the Continental Divide form the backbone of the Isthmus of Panama.

None of today's natives could conceive that we were looking for anything but gold. In one sense we were, as a guide to archeological sites. Indians of the interior still occasionally find gold ornaments made by aborigines. Usually such finds indicate the sites of ancient towns, and several times aboriginal jewelry guided us to important diggings.

From *Tumbaita's* deck we watched a dugout canoe and its straining paddlers, stripped to the waist, labor toward us through the surf with a load of bananas. After the ponderous bunches of fruit were transferred, we started for shore in the dugout, the 5-man crew valiantly battling the waves. Suddenly, as we

rode the crest of one huge roller, the paddlers lost control, we turned broadside, and the comber broke over the canoe, deluging us all. This was the first of three times that we were to arrive at Coclé del Norte soaking wet!

Once ashore, we sought out Vidal Gonzales, store clerk and acting mayor of the village of Coclé del Norte, for advice on negotiating the river into the interior. Several Indians in the store told us of places along the river and in the jungle where broken potsberds and stone axes indicated aboriginal settlements.

Returning to the banana boat waiting offshore, we were drenched twice, first by a breaking wave and then by a pounding rain-



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An Outboard-driven Dugout Plies the Swollen Rio Indio

Marion Stirling, archeologist (left), and Dr. Shirley Gage, physician, ballast a heavily laden canoe. Two days of hard rain made it possible to ascend the shallow stream to El Uracillo (map opposite). There the Stirlings found archeological riches and Dr. Gage conducted a medical clinic for the primitive Indian villagers (pages 276, 285).

squall. Soon all the passengers were completely seasick. Once more we lay on the deck in wet clothes and managed to sleep most of the night on the return trip to Colón.

From there we drove back to our headquarters near Salud, 15 miles west of the Canal Zone, where we had begun digging at the sites of several ancient houses.

Here we rejoined Richard H. Stewart, staff photographer of the NATIONAL GEOGRAPHIC

MAGAZINE, and Dr. Robert Rands, now of the University of Mississippi, my archeological assistant.

We had come to Panama to trace the ebb and flow of ancient Indian cultures between the two great centers of American Indian civilization, culminating in the Aztec and Maya realms of Mexico and Central America and the Inca Empire in South America.

Cultures Predate Christian Era

In each of these areas, several centuries before the Christian Era, high cultures developed, based on agriculture, weaving, and pottery making, with metallurgy added later. Archeologists are trying to determine how these cultures were related. Where did the arts originate, and in which direction did ideas flow?

In many ways the civilizations of Mexico and Peru were similar, indicating a common origin in prehistory. For example, they both raised corn, beans, and squash and made monochrome pottery female figurines symbolizing fertility.

They both made peculiar pottery jars with stirrup-shaped spouts, the water flowing out through two channels that converge into one. Others are so fashioned that air makes a whistling sound as it enters to replace the outpouring water. Earth mounds for religious structures are common to both cultures, and each

used similar forms of stone carvings.

Recent archeological discoveries indicate that the cradle of American Indian civilization was in northwestern South America, not in the Valley of Mexico as formerly believed. The art of metalworking is much older in South America; agriculture, too, may have been first practiced in Peru.

The Incas and their predecessors excelled in metalworking, ceramics, and government; the

Maya of Central America were skilled in architecture, mathematics, and stone sculpture. Ideas were constantly borrowed and exchanged. Obviously these exchanges must have passed through the Isthmus of Panama; it was logical to search here for evidences of them.

On two previous trips we had studied the archeology of Panama's Pacific coast, and now, during this third season in 1951, we hoped to explore the little-known north coast and complete an archeological cross section of the isthmus. As in previous years, our old friend Dr. Alejandro Méndez, director of the Panama National Museum, assisted us.

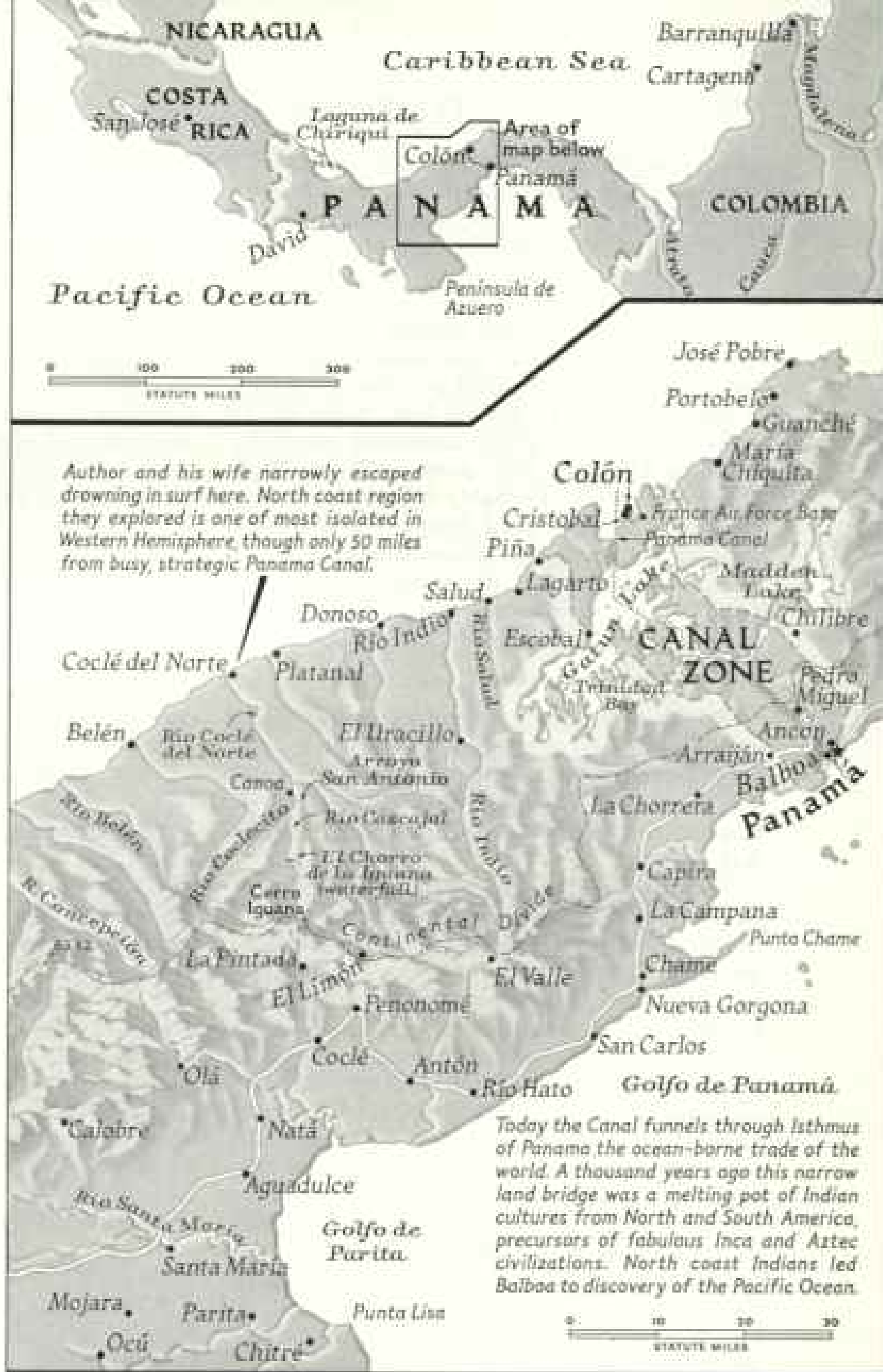
Back of Beyond

Now we were ready to set forth into the isolated country along the Rio Indio and the Rio Coclé del Norte. No vestige of a road extends westward beyond the Rio Salud.

We decided to tackle the Indio first. Since its mouth was only a two hours' walk along the beach beside the surf, we organized what we jokingly called a "surfari" of 18 carriers, who transported our boxes and bundles.

Dr. Shirley Gage, a vacationing woman physician from New York State, joined us for a trip up the Indio. She had done several years of medical work in China and wished to study a region which modern medicine had not reached.

Approaching the town of Rio Indio (pages 277, 287), we saw that most of the men there, all Negroes, were dressed for a fiesta. They wore tall conical hats decorated with flowers and bright-colored feathers. They had painted their faces red, white, or blue, and talked backwards or in a strange gibberish that said the opposite of what they meant. The celebration is known as the "Congos" or "Congo," perhaps in reference to their African ancestry.



Scientists Probe Panama Wilds Shunned Since Columbus

The discoverer found gold inland from the Caribbean in 1503. At the mouth of the Rio Belén he set up the New World's first mainland Spanish colony. Up the neighboring rivers Coclé del Norte, Indio, and Salud, National Geographic-Smithsonian scholars 448 years later traced ancient Indian cultures at modern and long-buried village sites.

No sooner had we arrived than it seemed this unfriendly land was taking revenge upon us for daring to probe its long-hidden secrets. That time of year, January to April, was supposed to be the dry season; yet it rained in torrents almost constantly. The rain was so frequent that often we were not dry for two or three days and nights in a row.

We slogged over muddy trails and made short excursions by canoe to archeological

sites, questioning the natives as to possible new locations. An old man, who several years ago had found a gold frog and a gold "pencil" (probably a rod worn as an earring) while clearing his field, led us to the place, high on a ridge.

Fragments of broken pottery were strewn about, where they had lain undisturbed since before the days of Columbus. We unearthed a massive floor 19 by 10 feet, made of 15 slabs of a hard green sandstone carefully fitted as a mosaic, each about 10 inches thick and 5 feet wide. Probably it was all that remained of an aboriginal temple. Around the floor we uncovered quantities of pottery, stone axes, and fragments of stones for grinding corn. As in all the sites we had found, the pottery was unpainted and undecorated.

Piled Potsherds Locate Doors

Potsherds were a sure clue to ancient house sites. Locations were easy to spot, being the only level places in otherwise hilly terrain. We could even place the door of a house; it was where the pile of discarded broken pots was largest.

Excavating archeological specimens calls for painstaking care, both to prevent breakage and to record their exact location. Scale diagrams are made of each trench. On these each specimen is entered, showing at a glance its relation to other objects found above and below it.

Collecting thousands of fragments of broken potsherds may not sound exciting, but the archeologist depends largely on pottery types to distinguish various cultures and to establish their chronological order. In the same way one might trace the development of life in various countries by successive types of lighting fixtures used: first, pine-knot torches, then candlesticks, oil lamps, gaslights, and finally electric bulbs. Pottery, because it is more or less imperishable, survives where many other artifacts disappear.

Apart from helping to solve prehistoric problems, much Panamanian pottery, particularly that of the Pacific slope, is beautifully designed and decorated. It makes easier an appreciation of the Indian civilization that so impressed the Spaniards of the early 16th century. Many of the bowls with tall pedestal bases would make decorative additions to any room even today. They are embellished with strange conventionalized designs representing birds, insects, animals, and reptiles.

We next set out for the rough country of the upper Rio Indio in a large canoe pushed by our own outboard motor (pages 274, 277). About a mile above the mouth the stream narrowed; here and there the tops of giant trees touched overhead. Many fallen trunks lay in the stream, and our guide worried lest

our propeller foul on barely submerged logs.

Rounding a bend, we came upon two Indians fishing from a canoe with bows and arrows, the latter fitted with three branching points. Bow-and-arrow fishing requires skill, for refraction of light by the water distorts the position of the fish, and the arrows penetrate only about a foot below the surface.

The fishermen agreed to pilot us through the maze of logs. We took their canoe in tow, while one of them stood in the bow of our craft and indicated the course by arm signals. For six hours we wove in and out among the logs, the river becoming more and more shallow. Finally our guides told us we could go no farther by water.

It was raining hard. We pitched camp in the mud atop a steep, slippery clay bank about 40 feet above the river. It was still raining in the morning when the owner of a near-by house came to inquire whether he might bring his family to our camp.

"They have never seen people like you," he told us (page 272).

He volunteered to guide us to a "house of sandstone" back in the jungle. Sloshing over ill-marked trails, we came to a fantastically eroded ravine. It ended in a natural cave cutting through a sandstone formation for about 50 yards, like a large tunnel. A cluster of bats hung from the roof. This was the "casa de laja" which, according to tales we had heard on the coast, was the towered ruin of a masonry castle!

Our guide led us to a near-by place where his uncle had found a gold alligator. Everywhere potsherds were scattered, evidence of a large population in the days before Columbus. We excavated until the rain became a deluge.

River Rises 8 Feet Overnight

All the second night the downpour continued. Morning revealed a river risen eight feet, an angry torrent of yellow water.

Since the water was now more than deep enough for the outboard motor, we moved on upstream to the village of El Uracillo, on the first large fork of the Indio. Here ancient Indians had terraced slopes to support their village. The modern inhabitants, taking advantage of these ready-made house sites, cleared the area and built today's village, the only one in this part of the interior.

A new schoolhouse was under construction, with a cement floor and corrugated-iron roof. We received permission to occupy it. While the rain thundered down on the roof, we spread our blankets and clothing to dry.

We soon discovered that the entire village clearing was one large archeological site. Here we unearthed pottery painted in red, black,

(Text continued on page 285)



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Expeditions by National Geographic Photographer Richard H. Stewart

✦ **Into the Unknown: the Expedition Starts Up Panama's Río Indio**

This little town, named Río Indio after the river, was the starting point of a two-week trip into country little changed since the days of Columbus. An out-board motor propelled the 24-foot dugout until rapids stopped it. Houses stand on stilts to escape floods.

✧ **Canoe men on the Río Coelè del Norte Waded as Often as They Rode**

Shooting a rapid on the way downstream, one heavy canoe struck a snag and overturned. Cameras and lenses sank to the bottom of the channel. Boxes and suitcases bobbed on the current. Passengers, drenched and exhausted, barely reached safety on a sandbar.





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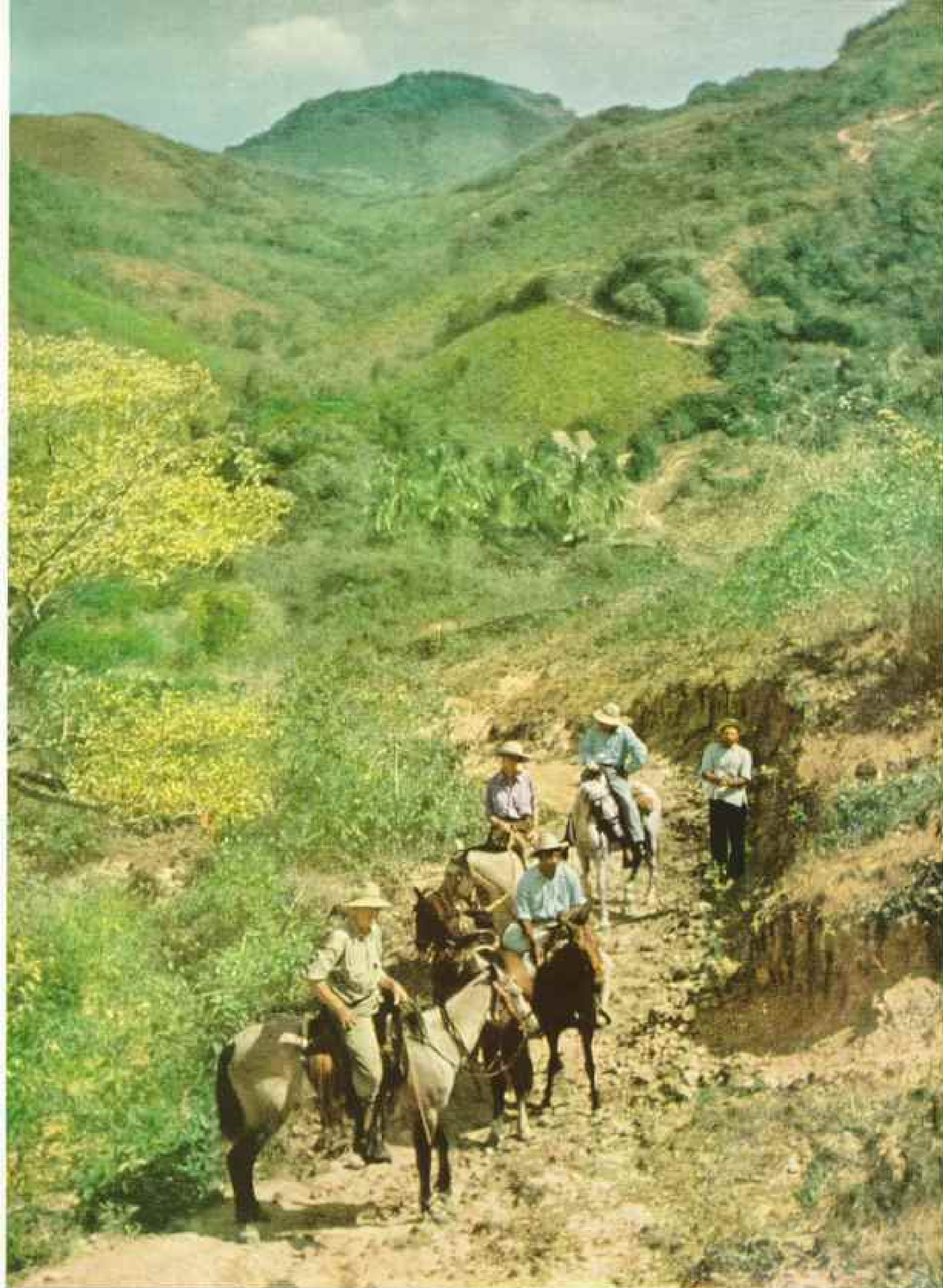
↑ **Archeologists Trailing Prehistory
Camp in the Jungle at Canoa**

On one of the "dry" season's rare sunny days, Dr. Stirling makes notes on his discoveries and Mrs. Stirling cooks dinner. To avoid flooding, they keep house well above river level. Flags represent the National Geographic Society and Society of Woman Geographers.

↓ **Repairing Pots Broken 500 Years Ago
Takes Patience and a Delicate Touch**

In camp at Mojara, Marion Stirling cements ceramics dug up by the expedition's workmen; they will give clues to bygone cultures. The figurine with a hollow head was worshiped as the jaguar god. All fragments are numbered and labeled the day they are found.





Expedition Members Take a Rocky Trail to a Mountaintop Burial Ground of the Ancients

Simcón Conte, local landowner, guides archeologists to a site near El Limón. Conte is the farthest horseman. Here were unearthed tall cylindrical vases with incised designs, a type not previously noted in Panama.



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↑ **A Hole Sunk 15 Feet in This Ridge Revealed a Prehistoric Burial**

Indians of Panama's south coast entombed their dead in deep chambers. Dr. Stirling surveys a site found by Alejandro López (sitting), an amateur archeologist. Mrs. Stirling seeks shade from the 100-degree heat. Brush fires have cleared the land for crops.

✚ **Indians Watch the Excavation of an Ancestral Tomb**

Dr. Shirley Gage (center) treated native ill at El Uracillo. She scored a professional triumph by pulling a tooth for the jealous but pain-racked medicine man (bareheaded at center right). A large pot (left) held food and drink for the dead man's spirit.





A Lantern in Broad Daylight? Dr. Stirling Carries It to Light Cave Tombs in the Canyon

Distant Penonomé stands in a valley which the Indians made a population center long before Spaniards arrived. The modern town dates from the days of the Conquistadors.



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↑ **Aboriginal Man Centuries Ago Carved His Sacred Designs on Volcanic Rock near La Pintada**

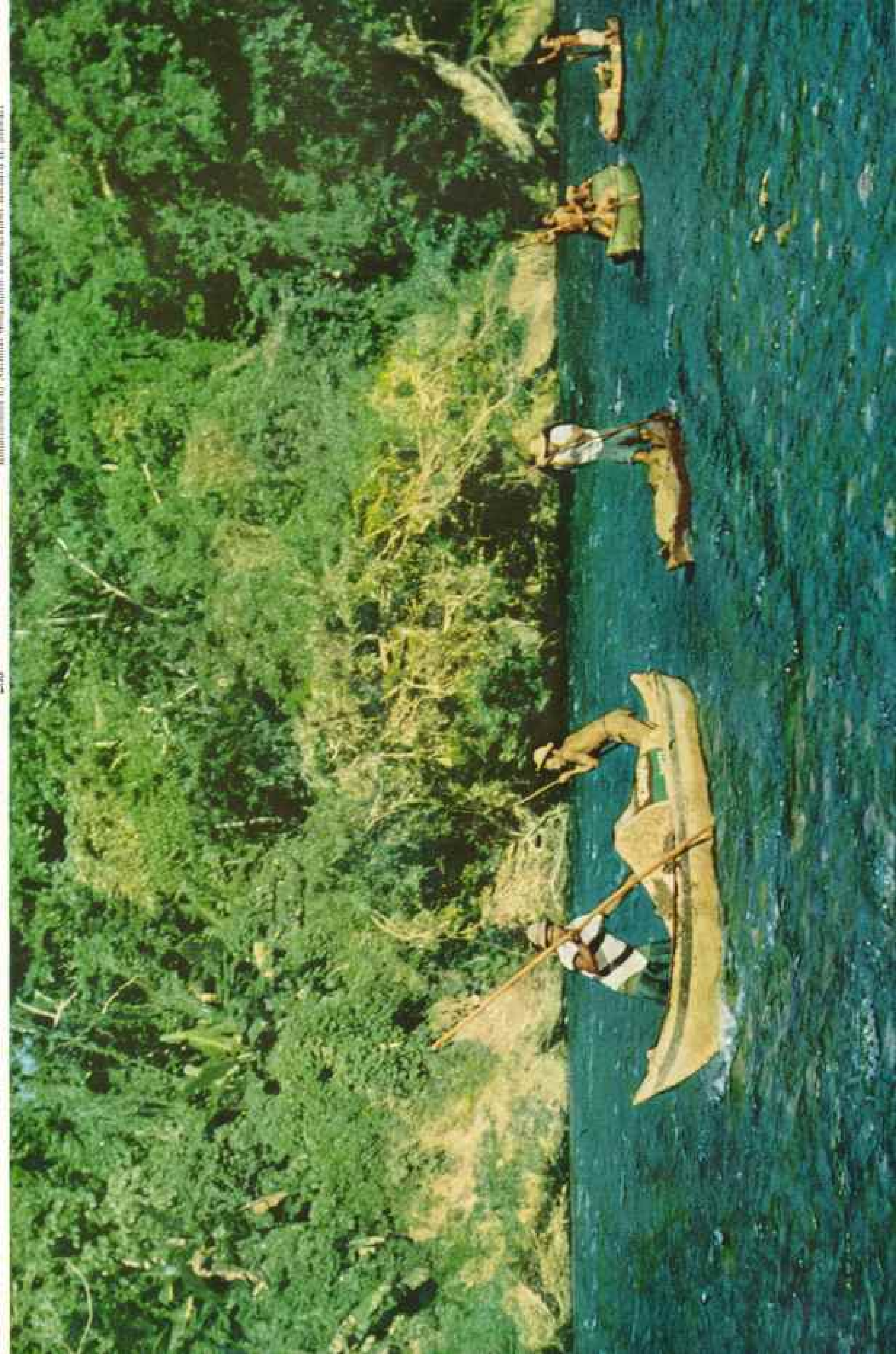
These petroglyphs, outlined with chalk for the camera's benefit, bear resemblance to decorative figures still used by Panama's San Blas Indians. Dr. Stirling, whiskbroom in hand, lays bare a stylized insect. Mrs. Stirling (picture at right) examines an apparent insect or alligator and a geometrical design.



✓ **Poles Serve Where Paddles Will Not Go. Canoes Push Up the Swift and Shallow Río Coelé del Norte**

Rivers provide the only practical routes into the jungle-clad interior from Panama's north coast. This stream was so powerful that one poleman had to hold the canoe while his partner pushed ahead; paddles made no headway against the swift current. Rocks on the river bottom are visible only 18 inches below the surface.

The smaller canoes had so little freeboard they carried only objects that could stand a ducking. The Coelé del Norte was a succession of deep stretches and rapids. In deep water an outboard motor propelled the "Queen Mary," which towed the other craft. In rapids crewmen had to wade, pushing and pulling the heavy dugouts.





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Kodachrome by National Geographic Photographer Richard H. Stewart

▲ **If It's the Photographer's Birthday,
He Can Get in the Picture**

Scientists and friends celebrate with Richard H. Stewart (left), National Geographic cameraman, near La Pintada. He has accompanied the author on 11 expeditions to Mexico and Panama. Mrs. Betty Bentz, a friend of the Stirlings, launches a balloon.

▼ **Zippering Shut the Mosquito Net
Is Bedtime Ritual in the Jungle**

In established camps the expedition members slept on canvas cots with air mattresses, but on jungle trips they carried army hammocks. Roars of howler monkeys and chirps of insects and frogs punctuated Mrs. Stirling's night at this stop on the Rio Cascajal.



and purple, with designs that clearly showed connections with the rich cultures that once existed across the mountain divide. It contrasted sharply with unpainted, simpler pottery we had found nearer the coast.

Polished stone axes and arrowheads in abundance resembled the coastal types, but a strong blending with the cultures on the Pacific coast also was evident.

The ancient tribes living on the Pacific slope were quite advanced and knew, for instance, the art of gold plating base metals. They manufactured beautiful polychrome pottery, carved handsome ornaments of whale ivory, stone, and bone, and mounted emeralds and semiprecious stones in gold settings. Their lavish use of gold led to their early destruction by the Spaniards.

Competition for the Medicine Man

Dr. Gage set up a medical clinic in the schoolhouse. Suspicious at first, the natives finally began bringing their children for treatment. The women followed, and at last came the men, some from a day's journey away. Intestinal worms and aching teeth were the most common complaints, plus goiter, yaws, and infirmities of old age.

The local medicine man, who charges for his magic and herb remedies, was jealous and suspicious of this free service by an outsider. Dr. Gage's final triumph came, however, when this local "medico" also presented himself for treatment for an ulcerated tooth.

When we had acquired as large an archeological collection as we could carry, we canoed downriver and retraced our hike along the coast to the Río Salud. The next day we reached Colón, bade farewell to Dr. Gage, and loaded our equipment aboard *Tumbaita* for the trip to the Coclé del Norte.

Heavy seas at first forced us back, but the next day we arrived off our destination. Dick and Marion got safely ashore with the first canoe-load of baggage, but Bob Rands and I were not so lucky. Crossing the bar in the heavy surf on the second trip, the canoe twice veered sideways and heavy combers broke over us, half swamping the craft.

We hired a native, Domingo Santana, to guide us and started upriver in two large canoes rented from Vidal Gonzales, the storekeeper. The larger craft, fitted with an outboard motor and named the "Queen Mary," took the other in tow. To help with our digging, we hired three of Vidal's men, Eusebio, Santiago, and Marcilio. About noon we encountered the first rapids and could no longer tow the second canoe.

From this point onward we spent more time out of the canoes than in them, poling, pushing, and towing them through one series of

rapids after another (pages 277, 283). The river was a succession of rapids and deep stretches. In the latter we used the outboard, and in the former we used main strength.

Fig-eating Fish

Many huge wild fig trees grow along the riverbanks. When a gust of wind came, green figs almost the size of tennis balls fell into the water. Immediately the surface was churned by the rush of large fish. Domingo told us they were tarpon, which fairly swarm in the river during the season the trees are bearing. The natives use wild figs as bait.

I was naive enough to throw out a plug at one of these spots. A fish took it almost immediately. Although the brake was on, the line screamed off the reel. Almost before I knew what had happened, all I had left was an empty reel and a blistered thumb.

That afternoon we reached Canoa, a single thatched house where lived an old woman who reputedly knew of a prehistoric burial place. She led us up the riverbank to a terrace. After poking about in the jungle for half an hour, she halted and announced that we stood on the exact place.

The site did not look promising, so we asked for more details. Thirty years ago, it came out, she and her family had lived in a house on this spot. At night she heard noises under the ground that sounded like the clinking of coins. Ghosts of ancient inhabitants buried there were obviously counting their gold!

We asked why they had not dug it up themselves. She replied that they were afraid.

This was but one of many such wild-goose chases we experienced in our searches.

Hidden in the jungle near Canoa, up the Arroyo San Antonio, we came upon remains of old Spanish gold workings. Tunnels dug probably by Indian slaves were still visible, though long since collapsed. A few large millstones lay covered with undergrowth.

Meat from the Jungle

Our guide shot game for us. Our favorite was "painted rabbit," or paca. This large rodent, weighing about 20 pounds, has a delicious flavor resembling pork. Even tough tapir steaks became palatable when treated with a tenderizer and cooked Swiss-style.

We also shot an occasional deer or curassow, the latter a bird related to the wild turkey. Usually we were able to purchase rice and bananas from the natives and now and then some eggs and chickens. Palm nuts were abundant and palatable. Our only imported foodstuffs were dehydrated soups, a little canned fruit, cheese, and similar luxury items.

We explored the Río Coclecito to the head of canoe navigation, which was take-off point



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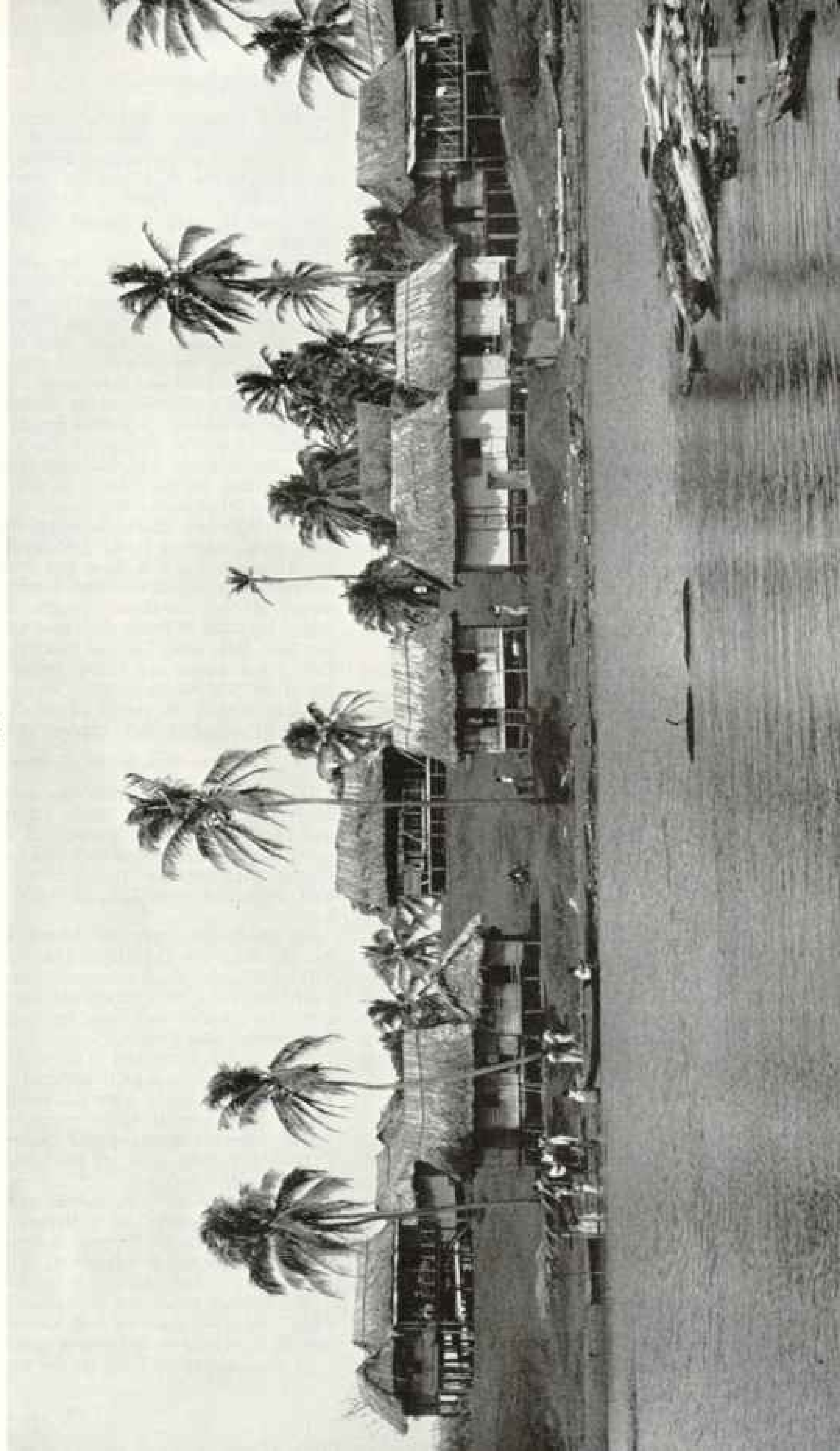
Crossing a Stream Where It Enters the Caribbean Sea, the Party Wades Through Surf

Dr. and Mrs. Stirling and Dr. Robert Rands (left) lead native carriers along the debris-littered beach of the north coast of Panama on a two-hour hike from the Rio Salud to the Rio Indio. Later the party came close to disaster in similar rollers when waves nearly swamped an overloaded canoe (page 289).

Feathery Palms Wave over Rio Indrio, Remote North Coast Village Settled by Negroes

Here the Stirlings hired canoes to ascend the river (page 177). They found the stilt-house dwellers celebrating a festa called the "Congo," supposed to have originated in Africa. Only approach to the village is by boat or by a two-hour hike along the beach from the end of the nearest road. Sea breezes keep the site free of mosquitoes.

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for a difficult two days' trail across the mountains to La Pintada and Penonomé, settlements we reached later by another approach. Three small native children were so afraid of us they hid at first. We gave their mother some hard candy, which they tried to swallow whole. The choking which resulted did not increase our popularity.

Ascending the Cascajal, we found it so full of rapids that our two large canoes could not be fully loaded. We therefore hired two additional small craft manned by Indians whose front teeth were chipped to sharp points. They do this by placing one stone behind the tooth and pounding with another. The practice probably originated in Africa. These Indians think it not only adds to their good looks but also helps preserve their teeth (opposite).

Waterfalls, rapids, and fallen trees often blocked our progress (page 273). Eventually the stream opened into a deep, calm lake, and we made camp, dry for once, on a hilltop.

From here we could see the Cerro Iguana (Hill of the Iguana), about 2,000 feet high, which marks the Continental Divide. In four days' work we obtained a good collection of pottery fragments and stonework.

It began raining the afternoon of the final day and poured all night. We got up at 5 a.m. and broke camp in the dark and the deluge. At a house a little distance downstream we picked up our outboard and other extra equipment left there on the upstream pull.

To help carry our collections, we hired a small canoe manned by two Indian boys and loaded it with picks and shovels, food, and archeological materials in rubber sacks.

Guiding it downriver, the boys had a fine lark, fishing as they went. One specimen they caught must have weighed 10 pounds. We did not see how they got through the rapids in their leaky, overloaded canoe, which had only about an inch of freeboard.

With the worst obstacles behind us and our archeological work accomplished, it was time to relax and enjoy the trip downstream. Had we known what lay ahead, we would not have been so carefree!

Trouble in the Rapids

Early in the afternoon we came to the last bad rapid. Here the river forks past an island. The right branch is shallow, and the main body of water follows the left channel. The water drops about 10 feet in a distance of 150 feet at the apex of the rapid, where it makes a right-angle turn.

Squarely in the angle of the turn protruded the skeleton of a large tree. The number two canoe, needing less water than the big one, took the right channel; the swift current made hauling it through shoal water fairly easy.

Domingo elected to take the "Queen Mary" down the left-hand, deeper channel.

As we came to the angle, the force of the water was greater than Domingo expected, but by thrusting against one of the limbs of the fallen tree he barely prevented the bow from sweeping under it.

Suddenly disaster struck. An eddy caught the canoe and swung it like a cracking whip against the tree. Eusebio and Dick were swept off by a limb, and the stern was forced under. The men managed to hang onto the limb, which was over the swiftest part of the rapid, but the craft filled and overturned.

Marion, in a raincoat and big sun hat, swam out into the current. A poor swimmer, I clung desperately to the bottom of the canoe. I could not hold my grip, but the current was so swift that, by the time I slipped off, the canoe and I had been carried down to a sandbar in midstream where the water was only waist-deep. Marion found footing alongside me, clutching Bob's suitcase and typewriter.

Boxes, bags, and cartons were floating downstream all over the place. Eusebio and Domingo managed to beach the canoe on a shallow bar. Bob, Marcilio, and Santiago hauled their canoe ashore and hastily began gathering in the floating equipment. Domingo and Eusebio worked an empty canoe along the bank and picked up Dick, Marion, and me.

Cameras Sink to the Bottom

Our outboard motor, badly damaged, would not start. Dick's small movie camera, two still cameras and extra lenses, and a heavy movie camera had disappeared. We urged the men to hunt for them, but they were pretty well exhausted and felt the effort would be futile.

Only Santiago carried out the search, probing and diving in the deeper channel. After half an hour he found one movie camera 200 yards below the point where the canoe went over. In another half hour he located the still cameras and lenses.

Santiago also found two of our most important sacks of archeological material, thereby salvaging many of the scientific results of the upriver trip. Everything, of course, was saturated, even the things in tied rubber sacks. Cartons fell apart, and our food, except for canned goods, was ruined.

We finally reloaded the canoes and drifted downstream, pausing for a supper of wet cheese and crackers. The rain stopped before dark and there was a half-moon. The lower river was calm and beautiful in the pale light.

We reached Coclé del Norte before midnight, the third time we had arrived there, and the third time we had arrived soaking wet!

In the morning we hung up our equipment

to dry and spread our notebooks on the grass. Unfortunately all the film in the cameras was ruined.

Early that morning we heard the sound of a motor overhead and were surprised to see a helicopter coming down to land. The pilot proved to be Capt. Hal J. Basham of the U. S. Air Force's First Rescue Squadron at France Air Force Base in the Canal Zone.

Captain Basham had come to investigate a human skull and bones found in the interior by rubber hunters, who thought they might be the remains of an American pilot lost during World War II. A reward had been posted for information about his fate.

After examining the skull, I was able to identify it as that of a middle-aged native woman.

Since Dick was anxious to wire Washington, D. C., for new cameras and to air-mail the exposed film not spoiled in the river, Captain Basham flew him to the base.

Next morning *Tumbaita* arrived from Belén, and her captain kindly agreed to take us back to Colón again. There were more than 100 bunches of bananas to be put aboard, two heavy loads for the big 30-foot canoe.

Now, it seemed, our troubles were over. But how wrong we were!

When the men returned from taking out the second load of bananas, they said they were tired and would make only one more trip. Therefore all our baggage, plenty for two trips, was put aboard. A native passenger and a crate of live chickens were added.

We had misgivings when one of the men told us that bucking the surf was so hard that one trip through it was worse than a full day with pick and shovel.

Mendoza, the store owner, fortunately decided at the last minute to go out with us. Marion and I sat on top of the cargo.

Three of the crew were stationed aft and two forward. Each had a long, heavy pole-to



Teeth Chipped to Points Are a Mark of Male Beauty

An Indian workman employed by the expedition in the jungle of northern Panama grins proudly in a display of his good looks. The effect is achieved by holding a rock behind each tooth and pounding with another. Only the front teeth are pointed. The man is eating a palm nut and wears a genuine "Panama" hat, locally made.

use in crossing the bar and a paddle for the deep water. We did fairly well at first, got clear of the river mouth, and bucked the breakers for about 400 yards. The canoe rode deep in the water and was very sluggish.

Waves Nearly Swamp Canoe

We had just turned parallel to the surf to reach a spot where the waves were less heavy, when a big comber hit us, pouring a dangerous amount of water into the dugout.

Mendoza bellowed, "We're too low! Work!" He took command, shouting orders.

In a few seconds another wave struck, knocked Marion and me off our seats down into the open part aft, and washed Marion partly overboard. In the nick of time she was pulled back.

The dugout was almost awash. One of the crew threw down his paddle and started bailing frantically, and I joined him. Our bails were plastic army helmet liners.

Mendoza was magnificent, not only plying his paddle but shouting orders, keeping the crew working together and straining. At first we seemed to make no progress in bailing, but at last the level began noticeably to go down.

Finally Mendoza said, "We are moving ahead again! Keep working!" After what seemed an interminable time we passed the last line of breakers and reached the big rollers of the open sea. We were safe, but all the chickens were drowned.

Linked by Sea Baptism

As the transfer to *Tumbaita* was completed and the canoe was about to return to shore, Mendoza said, "You must be sure to write to me. We all belong to the same family now, as we have been reborn together!"

Had one more breaker hit us, we would have been swamped. To swim in the heavy surf would have been impossible. We never should have embarked with such a heavy load, but did not realize how badly overloaded the canoe was.

Missing the boat would have meant a two-week wait until *Tumbaita's* next trip. Furthermore, the wind had been rising all morning and the surf was heavier than on the two earlier trips.

Safely back in the Canal Zone, we again spread out our things to dry, this time at Ancon in the yard of old friends, Paul and Betty Bentz. Our water-soaked watches and radio had to be restored to working order. The archeological collections, after drying out, went into the Bentzes' basement for temporary storage.

Now we were ready for the last leg of our trip across the mountains from the unfriendly land that had so nearly defeated us. There we hoped to find remains of ancient cultural connections between that upland region and the country we had just explored on the one hand, and the better-known cultures of Panama's Pacific lowlands on the other.

Goats Move Out, Explorers Move In

In La Pintada, a picturesque village northwest of Penonomé (page 281), we rented an earth-floored, tile-roofed adobe house from the local Chinese storekeeper, who obligingly drove out the goats and cattle living there.

Marion gathered sweet-smelling orchids known locally as *Semana Santa* (Holy Week) to counteract somewhat their odor.

In the near-by mountains volunteers from La Pintada helped us locate caves that were aboriginal tombs. Some of these were dangerously placed on the faces of high cliffs, up which the bodies were carried. This method of burial has not been previously reported from Panama, nor is it mentioned in early accounts.

With the memory of our recent narrow escapes still vivid, I felt as I climbed up to them somewhat like the cat which already had lost eight of its nine lives.

Two wide expanses of bare rock, one on the side of a high hill and the other in the middle of a stream, were covered with spectacular and mysterious petroglyphs (page 282).

Old friends, the Conte family of Penonomé, led us to a tomb site near a place called El Limón in the mountains (page 279). There Don Miguel Conte had discovered a fine collection of new-type pottery, which he presented to us for the U. S. National Museum.

Last Find Richest of All

We next moved to Mojara, on the Peninsula de Azuero, pitching our tents not far from the town of Ocu. Here we found the richest of all the sites we worked that season in Panama. It yielded a magnificent collection of polychrome pottery representing a new variant of the high Coclé culture of the Pacific slope (page 278).

One of the practices of civilized tribes in Middle America was the burning of copal, or resin incense, in their religious ceremonies. At one place in the Mojara site we found a cache of more than 200 spoon-shaped incense burners with about 100 little hourglass-shaped stands made for them to rest upon after heating, when the incense was smoking properly.

Archeological material thus far excavated in Panama generally demonstrates a relation with South America. Gold ornaments in the form of frogs, birds, and other animals and the method of plating copper with gold are characteristic of northwestern South America. The method of burying the dead in deep chambers hollowed at the base of a vertical shaft is also typical of both regions.

Our excavations in Panama up to the present support the belief that the pre-Columbian Indian civilizations there were mainly developed from South American origins.

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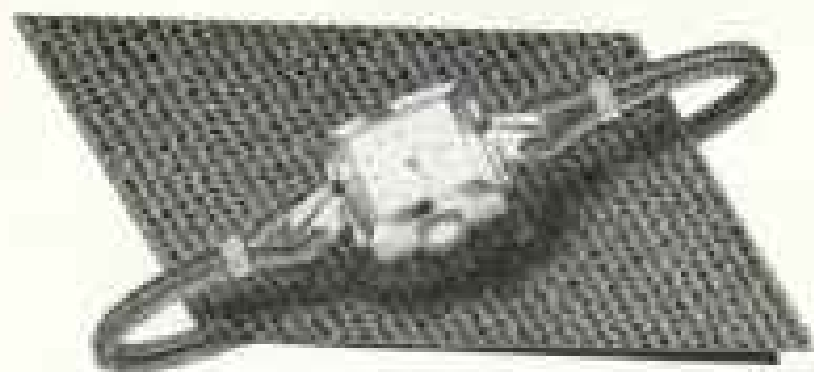
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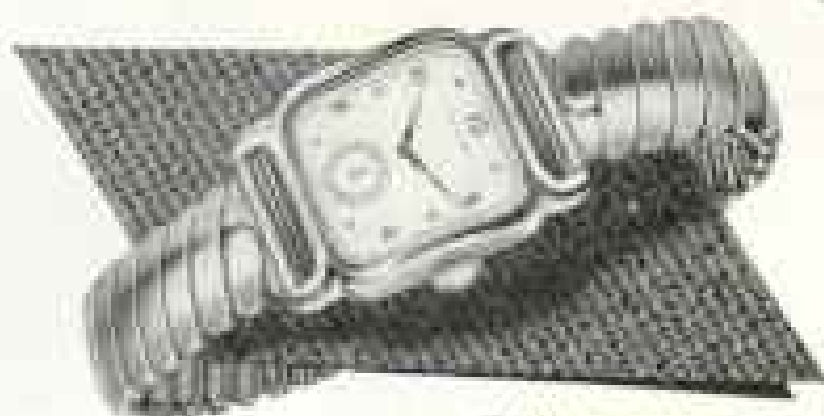
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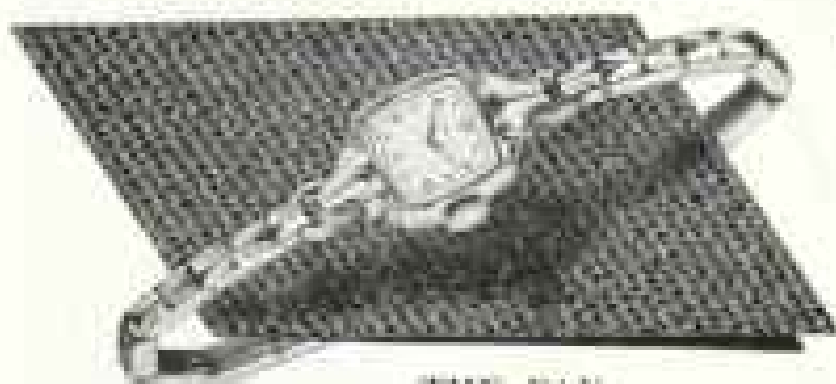
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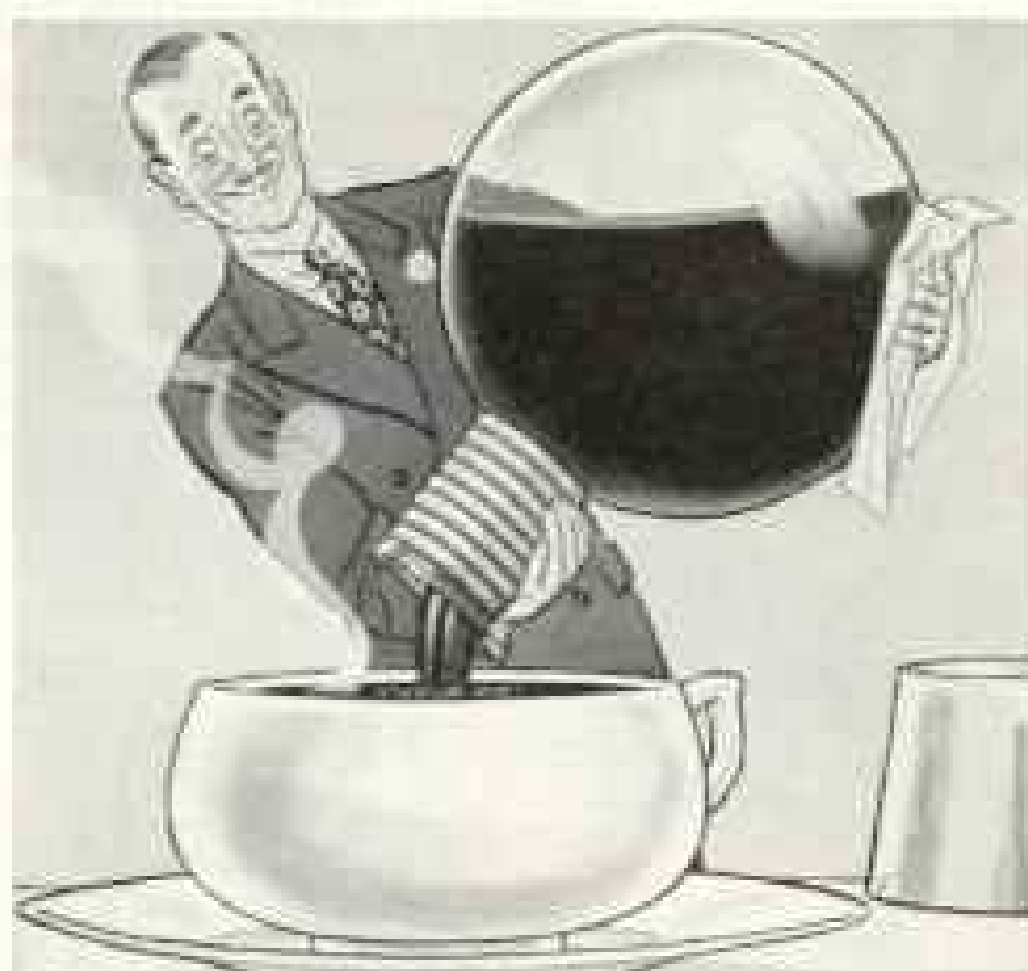
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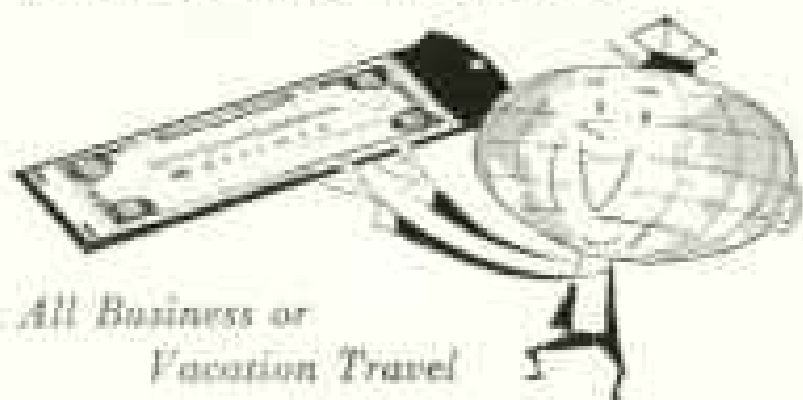
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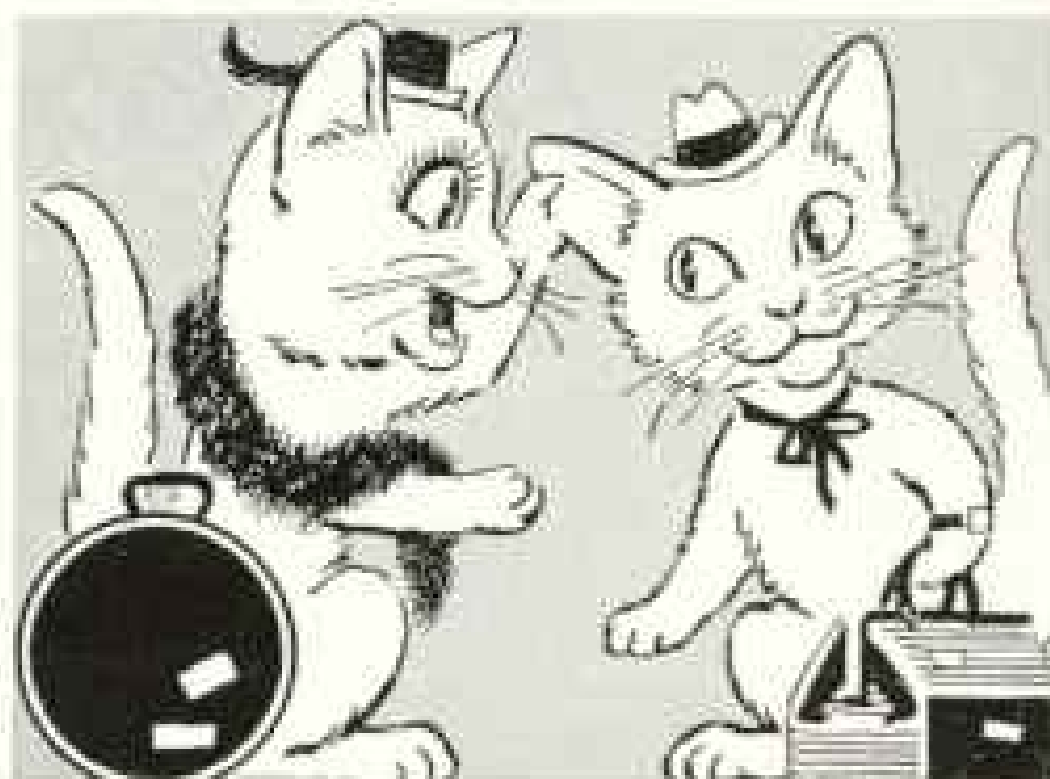
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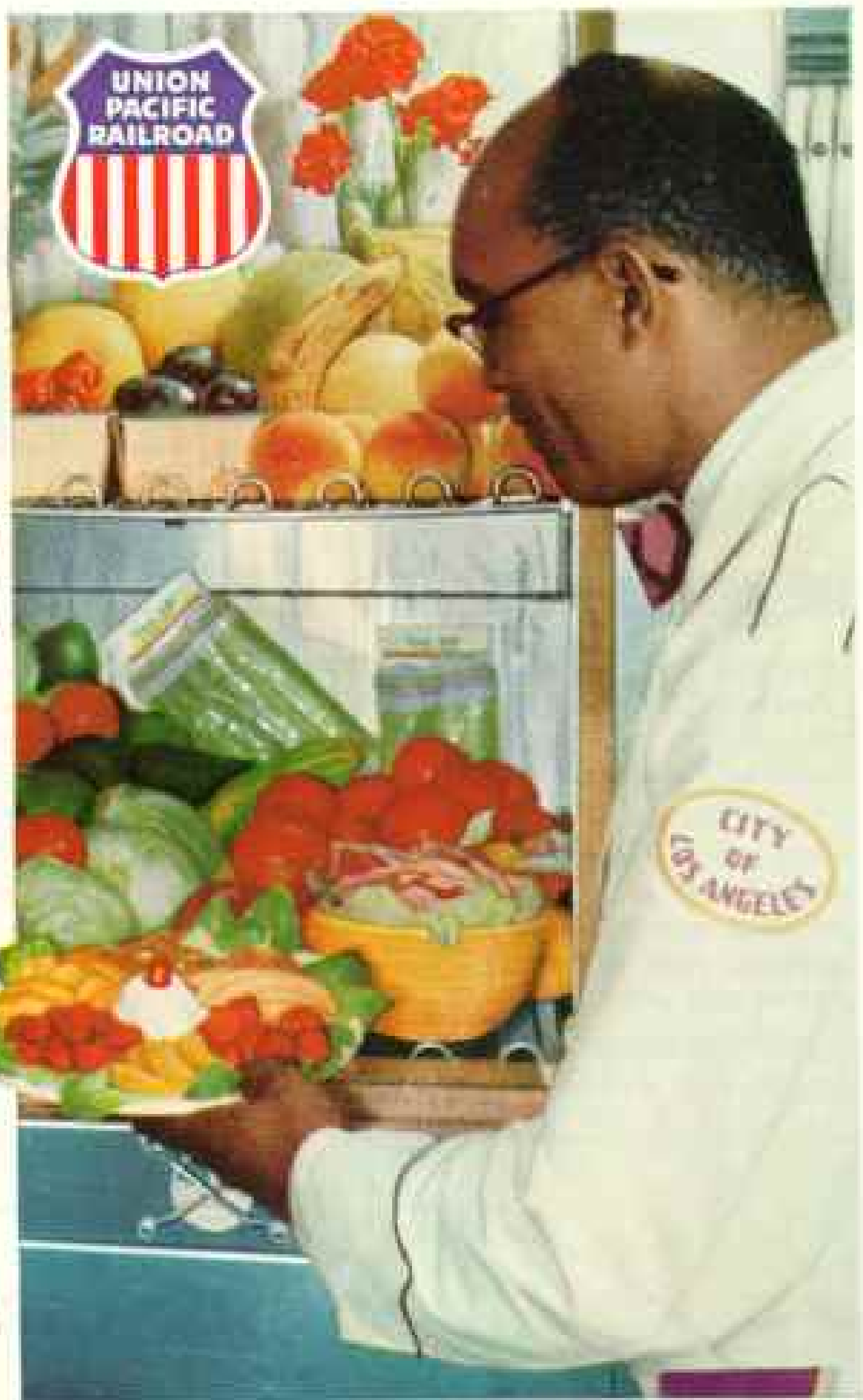
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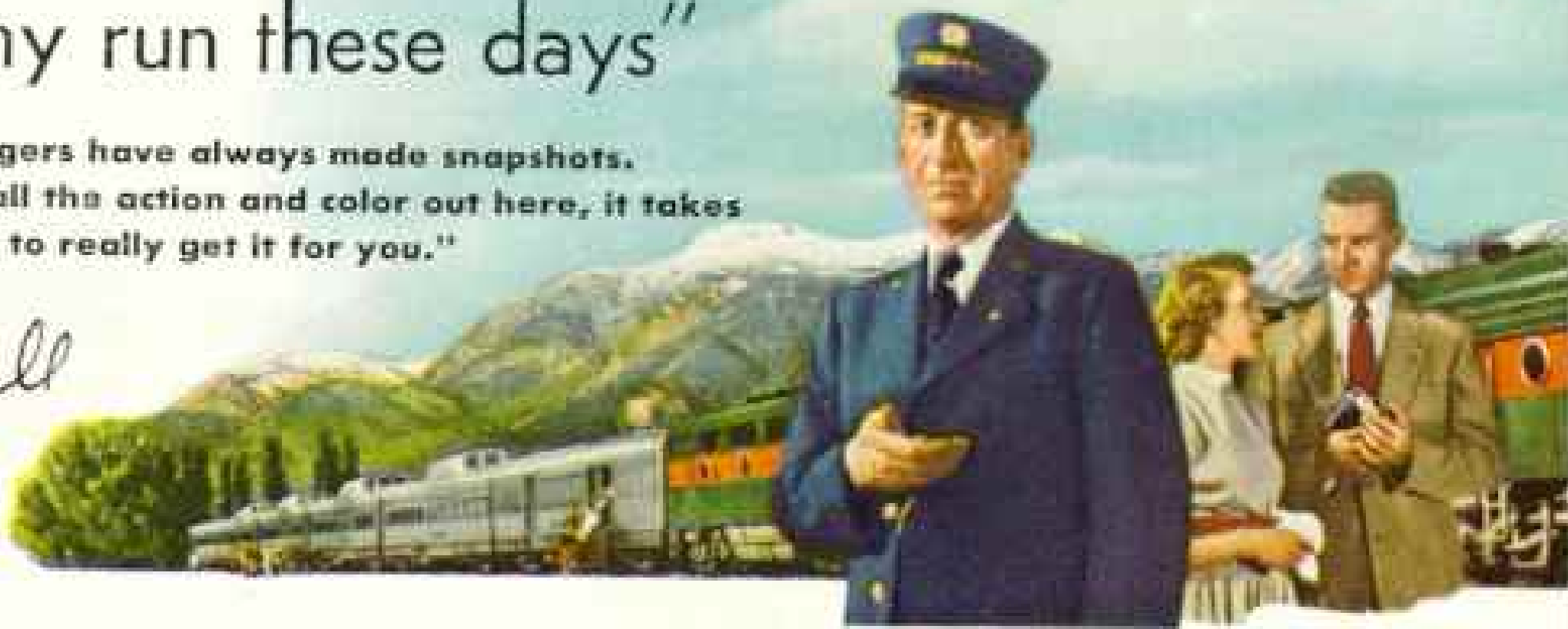


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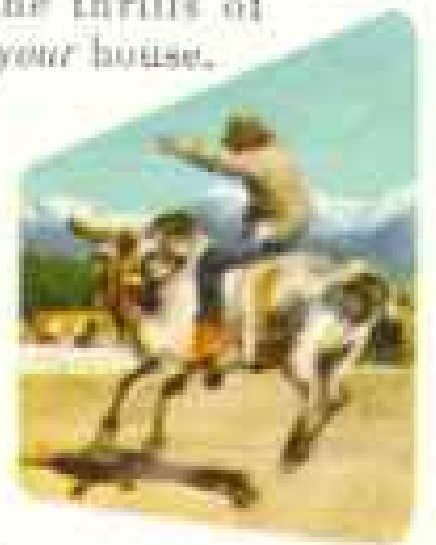
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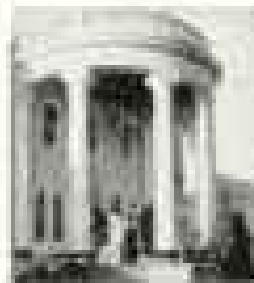
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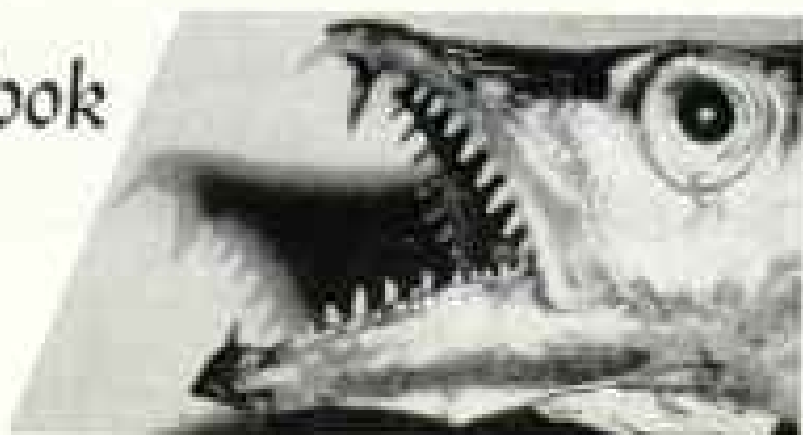
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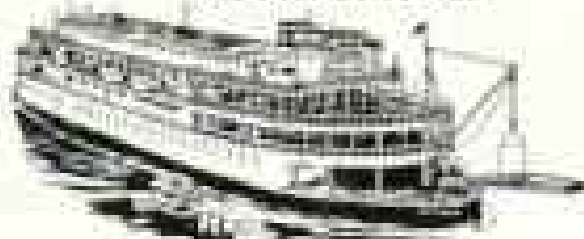
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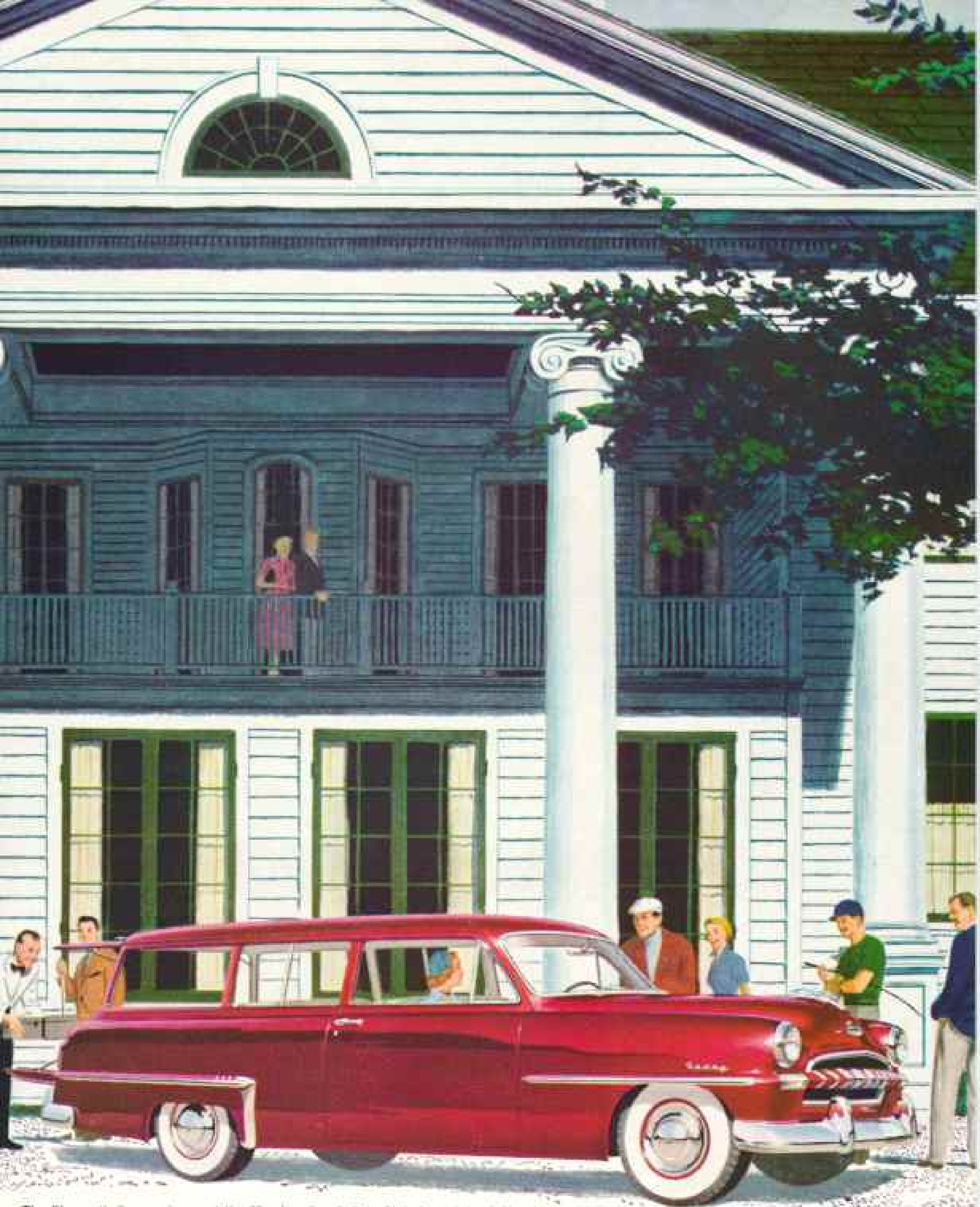
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