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Journey to Outer Mongolia

By WILLIAM O. DOUGLAS

Illustrations by National Geographic photographer DEAN CONGER

Outer Mongolia became a member of the United Nations late in 1961, entering the current of world affairs for the first time in centuries.

Locked between Russia and China, Mongolia has long been a pawn in their struggle for domination. Centuries ago, Mongol warriors sacked Peking and Moscow. In turn, both Russia and China have held sway over the Land of the Blue Sky. Today the interests of the two largest Communist countries inevitably meet in Mongolia, and Russian advisers and Chinese work brigades play important roles in the life of the Mongolian People's Republic.

Associate Justice William O. Douglas of the United States Supreme Court is one of the few Westerners to visit Mongolia in recent years. Author of many distinguished books and a frequent GEOGRAPHIC contributor, Justice Douglas knows well the remote lands of Asia. He went to Mongolia as a private citizen, roamed freely, and brought back a graphic report of what he saw.

At a time when knowledge of Communist areas is vital to the West, his article casts a penetrating light into a hitherto obscure corner of the world—The Editor.

TO ME, MONGOLIA was long a magic word. As a boy, I read of Genghis Khan and his sons and grandsons, who put together an empire that extended from Peking to the Danube and touched Egypt in the south. These men, traveling on horseback, captured Moscow in the dead of winter.

The daring of the Mongol raiders was only exceeded by their ruthlessness—a fact that came home to me a few years ago as I stood on the heights above Bamian in Afghanistan. Not a living thing had remained in that peaceful valley after the Mongol army passed.

The Great Wall was built to keep northern barbarians from China's back door. When

China finally conquered Mongolia in 1691, she locked it up and closed the frontiers to foreigners. In the long intervening centuries, Mongolia became a land of mystery.

Pawn Between Powerful Neighbors

Meanwhile, the power struggle between Russia and China continued. Mongolia, completely surrounded by those two great powers, was an object of their rivalry. Russia wanted to keep China's millions from her own frontier. China needed Mongolia for expansion.

Though Mongolia won her independence from China in 1921, in the 40 years since then

she has had little contact with the outside world. But in 1961, when it looked as if the climate of opinion might change, I applied for visas for Mrs. Douglas and myself.

The summer had almost passed before word came from Ulan Bator, capital of the Mongolian People's Republic, that our visas could be obtained in Moscow. In less than a week we were on our way.

Land of the Ox That Grunts

"It looks just like Wyoming." NATIONAL GEOGRAPHIC photographer Dean Conger expressed the thoughts of us all, as we pressed our noses against the windows of the plane flying us to Ulan Bator.

Six hours in a Russian TU jet had carried us from Moscow to Irkutsk, Siberia. Now another Russian-built plane, an Ilyushin 14 of Air Mongol, was whisking us southward (map, pages 294-5). We had crossed Mongolia's northern border — wild, broken country, thick with conifers and dotted with blue lakes.

This was the heartland of the Huns and Turks and later of the Mongols. This was, and still is, the land of the yak — the ox known as *Bos grunniens* that grunts as it walks, that thrives on the scant vegetation and thin air of high mountains and plateaus.

As we flew south, the slopes became more gentle. The ridges and ravines were mantled with pine and tamarack, the latter orange and yellow, for fall had arrived. Most of the slopes and valleys were pastureland that stretched as far as the eye could see.

Mongolia covers about 600,000 square miles — roughly equal in size to Great Britain, Germany, France, Italy, and Portugal combined. The population is only one million. So, like Wyoming, the country gives the impression of being sparsely settled.

From the air we first saw the industrial town of Sühe Baatar (Sukhe Bator). As we continued south, there were no towns, only a few of the igloo-shaped tents called *gers*, or *yurts* as the Russians know them. They were usually near the heads of valleys. They seldom stood alone. Normally three, four, or five *gers* — an *ail*, they say in Mongolia — made up a community. Their white rounded domes against green grass and blue skies make a picture of most of Mongolia today — one that Genghis Khan would recognize.

Driving in from Ulan Bator's airport, however, we found the city's buildings new and modern. Some are marble; most are white stucco. An efficient electric-power station and a newly finished sewage disposal



Eyes Bright With Interest, Mongolians in a Lattice-and-felt-walled Ger, or Tent, Ponder Words From a Rare Western Visitor

"Come, be our guest." The invitation, extended time and again by herder and holy man, farmer and factory worker, brought the author face to face with the people of Mongolia.



KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Arriving on the eve of Mongolia's seating in the United Nations, Justice Douglas discovered that Ulan Bator (next page) epitomizes the pace at which the Mongolian People's Republic is advancing into the 20th century. New industries, from flour milling to movie making, call onetime nomadic herders to new skills. In the back country of this Communist state, the author met people

still living according to age-old patterns. But everywhere he found minds alert to change.

These Gobi dwellers—father, mother, sons (left), and neighbors—plied him with questions about the world.

Justice Douglas's article describes the dramatic contrast between old and new and gives an insight into the future of Mongolia.





ILLUSTRATION © NATIONAL GEOGRAPHIC SOCIETY

Ulan Bator, Capital of Mongolia, Rises Shining New and Gleaming White

A huddle of one-story shacks two decades ago, the city today has broad avenues and squares lined with government buildings and apartments, as well as the traditional gers (left foreground). Its mushroom growth reflects Mongolia's desire to catch up with the modern world. The road at left crosses the Tuula River and leads to the marble-columned capitol in Sukhe Bator Square. New sports stadium rises at right, old at center.

Welcomed into a home, the author (second from left) sips a bowl of fermented mare's milk with Mongolian jurist S. Choijamtse, at left, and their herdsman host, at right.

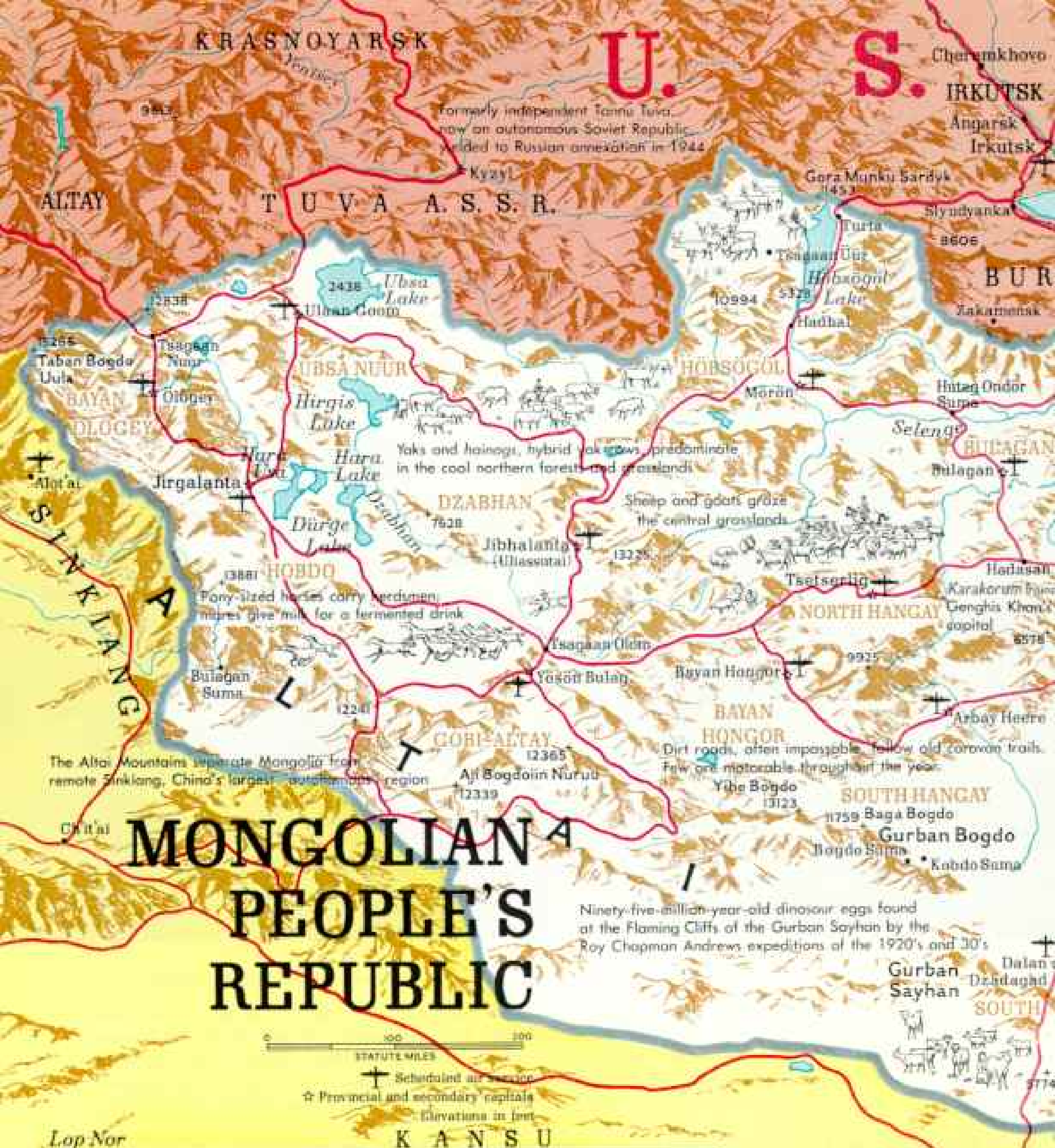
plant serve a population of some 160,000.

From the spick-and-span flour mill that towers in the west (page 342) to the massive movie studio in the east, Ulan Bator is a shining city that commands a huge grassy bowl rimmed by ridges. The Tuula River wraps a deep-blue ribbon around it.

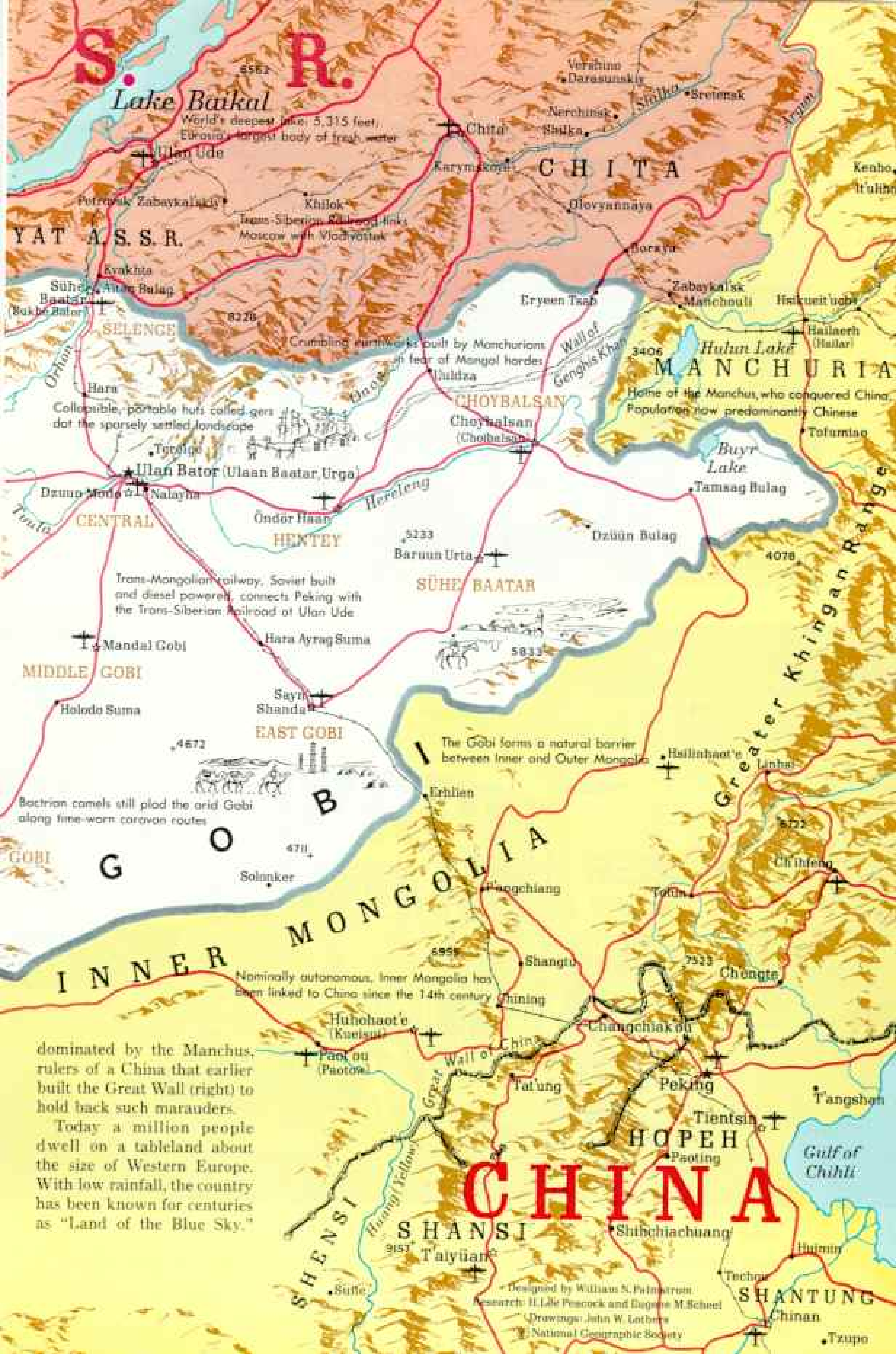
The airstrips are concrete, and the road into the capital is paved. The rest of Mongolia, however, is served by dirt roads. By jeep one can go almost anywhere (page 308).

If the road gets too rough, the grassland on either side makes smooth riding. Yet one does well if he makes 250 miles a day. There are streams to cross, gers to visit, gasoline to purchase, and many photographs to take.

The Russian jeeps are stout and serviceable. The other Russian cars, modeled after our own of 20 years ago, are sturdy and high-centered. Our Polish car, the Warsaw, which reminded me of our 1939 Ford, proved somewhat less reliable. It often had to be cranked



Heartland of Asia, a wedge between the U.S.S.R. and China, Mongolia once bred nomadic warriors who burst from their land like fire from a volcano. After 300 years, the nation began a slumber that lasted for centuries. Empires lost, the people were eventually



Lake Baikal

World's deepest lake; 5,315 feet.
Eurasia's largest body of fresh water.

Ulan Ude

YAT A. S. S. R.

SELENGE

Crumbling earthworks built by Manchurians
in fear of Mongol hordes.

Ulan Bator (Ulaan Baatar, Urga)

CENTRAL

Trans-Mongolian railway, Soviet built
and diesel powered, connects Peking with
the Trans-Siberian Railroad at Ulan Ude.

MIDDLE GOBI

EAST GOBI

Bactrian camels still plod the arid Gobi
along time-worn caravan routes.

G O B I

I N N E R

dominated by the Manchus,
rulers of a China that earlier
built the Great Wall (right) to
hold back such marauders.

Today a million people
dwell on a tableland about
the size of Western Europe.
With low rainfall, the country
has been known for centuries
as "Land of the Blue Sky."

SHENSI

SHANSI

HOPEH

SHANTUNG

C H I N A

Designed by William S. Palmstrom
Research: H. Lyle Pascock and Eugene M. School
Drawings: John W. Lathrop
National Geographic Society



REFERENCES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CORNER © N.G.S.

Ulan Bator's Pagodalike Temple Inspired a Modern Exhibition Hall

Built in 1905 at the price of some three and a half tons of silver, the Lamaistic shrine, with its flanking structures, today serves as a religious museum. Its name, Temple of Generous Mercy, appears above the portal in Manchurian, Mongolian, and Chinese. In contrast to the demon-decorated temple, the new glass-walled arena invites light and air.

by hand. Least reliable of all were the Chinese tires. The valves leaked, and the tubes were so fragile they always seemed on the verge of collapse.

With black hair and golden skin, high cheekbones and straight, prominent noses, most Mongolians remind me of the American Indian (page 290). Others have round faces with ruddy cheeks and buttonlike noses. Many Mongols are short and wiry, though some are a rangy six feet or more.

Mongolians are precise in dress. They are

neat and formal and look with disfavor on the informal sportswear of the Russians. Young boys traipse to school dressed in brown corduroy coats and pants. Young girls almost always wear long braids that fall to their waists over brown dresses. A pinafore—sometimes white, sometimes black—covers the dresses. Red neckerchiefs add a colorful touch to both costumes (next page).

Among adults, Western dress is accepted for office work. But the *del* (below), a long coat of wool or silk or padded fabric with a

Cooperative grocery in Ulan Bator offers canned goods from Russia and China and meats from Mongolian farm co-ops. Shopping housewives wear Western shoes with the *del*, a coatlike garment used by both men and women.





REPRODUCED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER SEAN CORSEY © N.G.S.

"Big Store," Ulan Bator's first department shop, compares favorably with any on Main Street, but patrons must climb stairs; there are no escalators or elevators. The emporium faces a plaza paved with bricks from a state factory. One shopper takes home a cumbersome purchase, a sheet-metal stove for his ger. Motorbikes, Mongolia's second horse, fill a rack.

Neatly garbed children play tag during recess at an elementary school (left) in the capital. Holding hands, they try to prevent a classmate within the circle from catching the runner at right. New apartments spread beyond the schoolyard. Making education compulsory for the first four grades, Mongolia claims 100 percent literacy of the younger generation.

Youthful chess players belong to the Young Pioneers group, identified by red sleeve patches. Both wear school uniforms: brown wool dress and black pinafore for the girl, and brown corduroy for the boy.



stiff, stand-up collar, is still conspicuous in Ulan Bator. It is commonly worn in the country by both men and women. On a dance floor the del is a gay costume; on the street it becomes an attractive overcoat.

A traveler who waves at a Mongol *arav* (herdsman) or villager always receives a return greeting, accompanied by a beaming smile that shows wonderfully white teeth. "Sain bainu!" ("How do you do?") brings a hearty smile in town or country.

"Russian" English With an Oxford Accent

Our interpreter, I. Ochirbal, assigned to us by the Mongolian Tourist Organization, was a short, wiry, round-faced Mongolian who learned English at the university at Ulan Bator. The course, eight hours a week for five years, is taught by a Russian.

"How come you have a British accent?" I teased Ochirbal.

"Perhaps my Russian teacher was trained

at Oxford," he grinned. "You Americans speak a different brand. Yes?"

Foreign languages, I discovered, preoccupy Mongolians. The university offers Tibetan, Chinese, Russian, Manchu, and English.

"How many take English?" I asked.

"This year 1961-1962," he answered, "one hundred study English."

We went to the State Library to find out what books in English a modern Mongolian could read. What I found made me sad.

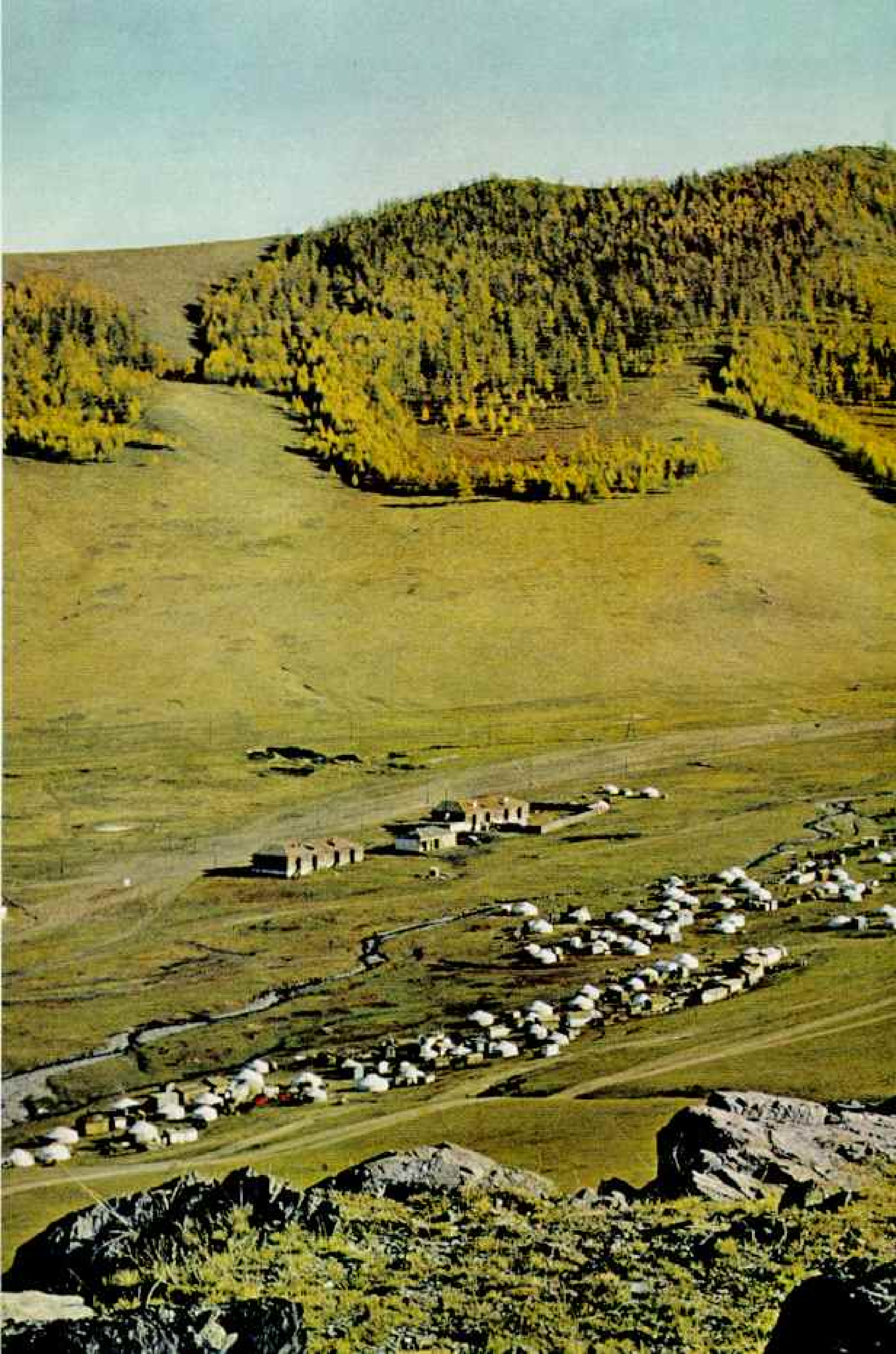
From America there were a few by Mark Twain, Jack London, John Steinbeck, Taylor Caldwell, and Theodore Dreiser. *The Old Man and the Sea* by Hemingway was available. From England, Dickens and Somerset Maugham, but little else.

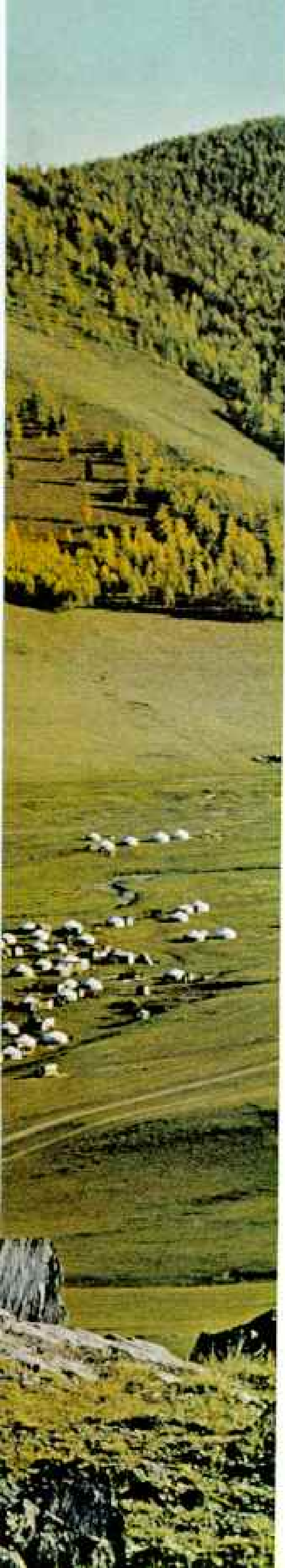
"Jefferson, Madison, Thomas Paine. Are these familiar?" I asked the librarian.

He shook his head.

"Carl Sandburg? Abraham Lincoln? Robert Frost?" The answer was again negative.







But Ochirbal quickly added, "Cooper. We know him. Is it James Fenimore?"

I nodded. "How about American movies?"

"The only American movies we have seen are about Tarzan," Ochirbal replied. My lack of enthusiasm was obvious. Ochirbal, noting my reaction, added with a sly smile, "Do you have better ones?"

My wife Mercedes changed the subject.

"What do you people think we Americans are like?"

Ochirbal replied, with a subtlety for which Mongolians are famous, "We hear your dentists are very good."

"What do you know about dentists?" Mercedes laughed. "Your teeth are gleaming white!"

As Marco Polo wrote, the diet of the Mongols has long been "flesh and milk." Perhaps as a result, their teeth are beautiful.

"I am 28 years old," said Ochirbal, "and I have not a single filling, as you say in America. Yes?"

"How about the youngsters?" Mercedes asked.

"That's different," answered Ochirbal. "Our dentists are worried. Long before Genghis Khan, Mongolian teeth were perfect. Now we have sugar, candy, ice cream. Yes? And our children's teeth need fillings. Yes?"

Yale Song Delights a Mongol Audience

Mongols love music and dancing. American music reaches them principally over the Voice of America. It is very popular. Jazz records are produced in the capital. "The Waltz of Ulan Bator" had just reached the market in the late summer of 1961. Members of the Academy of Science comb the country for folk songs and folklore.

The Mongols are graceful dancers; music seems to be in their blood (page 338). Mercedes did some folk dancing with one group. "The Mongolian men have such good timing it was easy to follow the most intricate steps," she said.

Mongolians also enjoy amateur musicales. At Terelge resthouse, a few hours northeast of Ulan Bator, I was asked to sing. The hour was late, and I selected Yale's "Whiffenpoof" song, which was first translated by Ochirbal to the crowd. My rendition was loudly acclaimed, and I could have had an all-night audience for American songs if I had not begged off.

Mongolian folklore expresses itself in endless variations of the "long song." This song is not long because of its duration. It gets its label from the way the singer's voice lingers over the vowels in sad or tragic words. The result is plaintive music that captures the loneliness of all vast prairie country.

The long song is usually sung with the *morin khour*, a two-stringed violinlike instrument with a long fingerboard and a sound box covered with python skin. In place of the customary scroll, there is a horse head carved in wood (page 339). The *morin khour* goes far back in Mongolian history. The legend is that a nobleman loved his horse so much that when the horse died, he was inconsolable. So he made the *morin khour*, using hairs taken from his horse's tail for the two strings and the bow.

A young man playing the *morin khour* in a musical ensemble in

Mongol suburbia: Homeowners two miles outside Ulan Bator prefer their gers to new concrete apartment houses (page 292). This group enjoys electricity. Tamaracks and pines crown the hill.

Ulan Bator sang of two white horses captured by the enemy and taken away. They longed for home and tried to escape. Only one succeeded. The words bore the sadness of the ages.

The Mongols also have the "short song," which is often longer than the long song. It is usually humorous or romantic and has a faster pace than the long song. The vowels are skimmed over, the consonants almost tumble. It is sung with the morin khour and the *shudraga*, a long-necked banjolike instrument with three strings, as well as the *kho-char*, a stringed instrument with a long neck and a small metal sound box.

The night the Ensemble of People's Folk Songs and Dancing performed for us, a man and woman sang a short song about the sly courtship conducted by a lama who was supposed to be a celibate. It ended with the lady giving two reasons why she had decided to reject the lama's overtures.

"First," she said, "you are a lama. Second, you are too old anyway."

The audience roared with laughter and demanded an encore by clapping in unison. So they sang a song about "Uncle Namsan":

*Riding on his bay horse,
Leaving her kinsmen
weeping,
Here comes Uncle Namsan
With a young girl he has
taken from her home.*

HE: *Wearing my lambskin robe
Do you feel like shivering?
With 80,000 sheep in my
flocks,
Are you worried about not
enough to eat!*

SHE: *In the gown of heavy
lambskin I feel shivery.
The Chinese brocade rubs
my skin;
The silken crepe is too soft.*

HE: *My triple-braided pigtail—
Do you reject it as too
welspy!*

SHE: *In the morning when I get
up and look at you,*

*Uncle Namsan, you are all drained of color;
When I sit leaning against your knee,
Uncle Namsan, I know you've had your day.*

HE: *True it is that I've grown old,
But I'm rich in goods and cash.
True it is my color and complexion are
only 10-10,
But I'll take you and make you my own.*

SHE: *Why should the wild duck lay its eggs
In the lone tree on the northern slope?
Eighteen years old, that's all I am—
You'll find me hard to take and hold.*

My host on our Mongolian journey was S. Choijamtse, a senior member of the Mongol Association of Jurists. Since the United States and Mongolia had no official relations, the
(Continued on page 309)





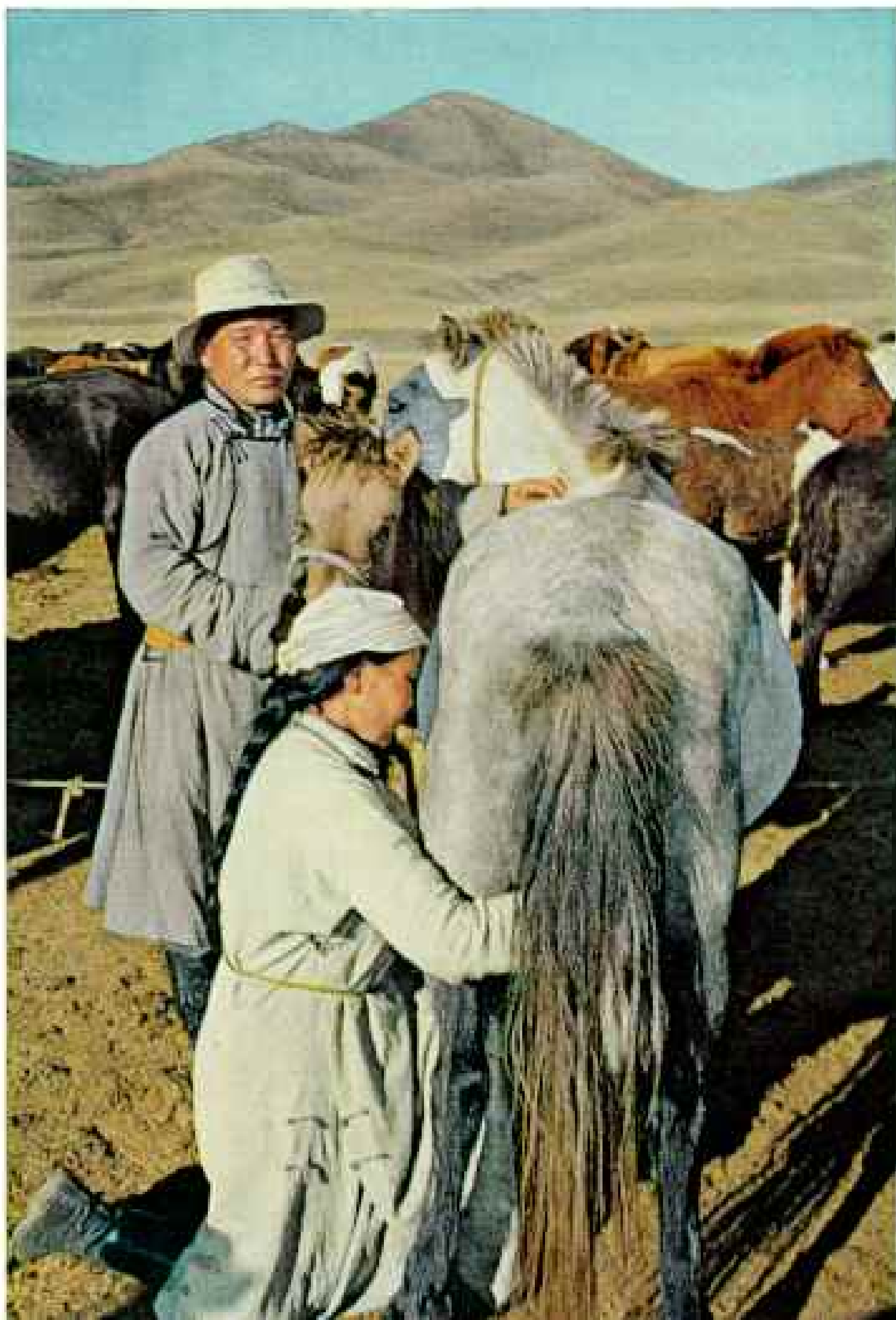
REDUCED FROM PHOTOGRAPHS BY JUSTICE DOUGLAS (OPPOSITE) AND DEAN CONGER (THIS PAGE) © NATIONAL GEOGRAPHIC SOCIETY

Milkmaid on the Gobi works at twilight amid the long shadows of her charges and her ger. Where cattle and sheep would starve, goats scratch a living from the gravel wilderness.

Like all gets, this one faces the south to protect the door from northern winds.

In Mongol style, NATIONAL GEOGRAPHIC photographer Dean Conger cuts a bite from a rib of mutton. Justice Douglas (left) carved the meat, as protocol demands of the honor guest. He first ceremoniously sliced gristle from the fat-decorated sheep's head at lower left, eating one slice and presenting the other to his host. Dipper floats in *tarag*, a yogurt made from the milk of goat, sheep, or camel.

To milk a mare requires teamwork and deception. A wife kneels to do the milking while her husband holds the colt within sucking distance to encourage the mare. Mongolians often sing to calm a nervous horse at milking time, a technique not unlike that of American dairymen who pipe music into cow barns.





Novelist Ts. Damdinsuren heads Mongolia's writers' union, which edits all books produced in the state.

Faces of Mongolia

Boys flash smiles despite a long, cold ride home from school. To get an education, some students travel 40 miles a day by horseback.

RESEARCHER BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CONGER © 1988



Proud mother introduces her cherubic son. Like other infants, he wears no diapers—a laundry saver. Knitted socks-pants rise from soft boots. Mother wears a del of brocaded silk. Mrs. Douglas brought home a similar garment to use as an evening coat.



New kind of woman does a new kind of job. This technician conducts experiments at the Agricultural Institute in Ulan Bator. She works in a scientific field formerly unknown to Mongolia and applies an education once rare among its women.

Mongolian science enlists the abilities of such leaders as historian B. Shirendyub, President of the Academy of Science.







Trucks of the desert, two-humped Bactrian camels raise silhouetted heads against the setting Gobi sun. Bactrians endure cold that would kill the single-humped dromedaries of Araby.

Lonely Stone Tortoise Marks the Site of Karakorum, Genghis Khan's Capital

Here in the 1200's stood a bustling market town. Chinese and Persian traders and craftsmen thronged Karakorum's busy streets, but the great khans' warriors disdainfully pitched their gers outside the mud-brick walls.

Karakorum flourished for only half a century. In 1260 Kublai Khan, Genghis's grandson, moved his capital to Peking, where Mongol austerity vanished amid luxuries. In 1382 a conquering Chinese army ground Karakorum into dust, and men forgot where the city had stood. Excavators verified its identity only in 1946.

Distant stupas, memorials to sanctified lamas, rose beside the ruins in 1586. Erdeni Dzuu lamasery stands untenanted save by a caretaker. An antireligious drive in 1937 scattered the monks.

Manchu overlords fostered Lamaism in Mongolia to turn chronic raiders into pacific monks.





RODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAR CONGEN © N.G.S.



Revered as the standard of Genghis Khan, the brass-and-silver trident mounted on a metal drum draws visitors to the State Museum in Ulan Bator. Once this and similar standards led warriors into battle or stood before the great khans' tents, Mongols believed their leader's soul inhabited the standard and under it they "would conquer all peoples for the Everlasting Blue Sky," as Genghis proclaimed.

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invitation was not Supreme Court to Supreme Court but from the Mongol Association of Jurists. And since I am an Associate Justice, not Chief Justice, the invitation came from the vice president, not the president, of the association. Thus do Mongolians stress protocol. But informality reigned supreme when we traveled the country with the charming Chojamtse and the bubbling Ochirbal.

China Sends Aid in Form of Labor

Our longest trip by car was to the Gobi. After several flat tires we reached Arbay Heere (Khere),* capital of South Hangay *aimak* (province), on a bitter cold night at 10 p.m. A comfortable two-story hostel run by the Mongolian Tourist Organization received us.

In the morning we saw from our windows a brigade of workers from China, dressed in blue tunics and trousers, doing their setting-up exercises in the courtyard (page 332). Sixty strong, they were engaged in construction work that included the building of an outdoor basketball court for schoolchildren.

I was told they were part of a corps of more

than 20,000 workers that China had sent to Mongolia as part of her foreign aid program. They received the Mongolian rate of pay and ate at their own mess. Most were young men in their early twenties. Some were married and had their families with them.

From Arbay Heere we set out across the steppe. Parts of it looked to me like northern Utah and southern Idaho, though greener to the eye. A few purple asters and dandelions were still in bloom. Pussytoes were abundant.

Many hawks and a few eagles soared in the sky. This is a land where a hawk sitting on a tuft of grass can see 15 miles or more in any direction. Distances are so great that faraway depressions, like faraway hills, have a purplish cast (pages 314-21). All that day Baga Bogdo—an 11,759-foot peak of the Gurban Bogdo range—loomed to the southwest.

There are some cattle in the steppe land. But the *hainag*—a first-generation cross be-

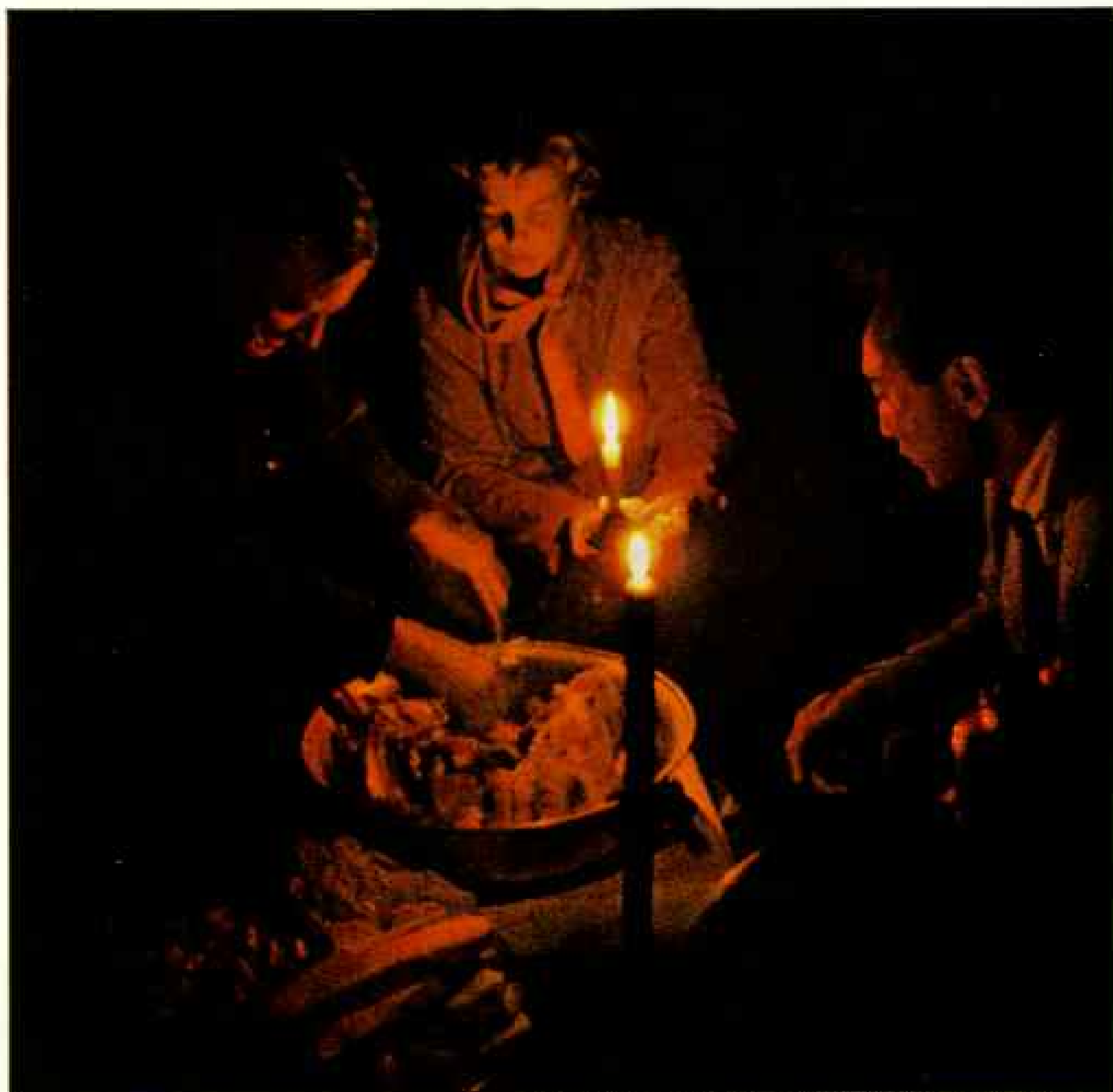
*Mongolian words are often hard to change from the Cyrillic to the English alphabet. The author uses phonetic spellings to approximate Mongolian pronunciation. Official transliteration is given for place names.



RESEARCHER © NATIONAL GEOGRAPHIC SOCIETY

Gravel desolation tests the staying power of Russian-made jeeps driven by the Douglasses on the fringe of the Gobi. Deepening ruts frequently force cars to blaze new paths. Mrs. Douglas returns to the lead jeep after a lichen hunt in the gorge.

To open roads! Half a day out of Ulan Bator, the Gobi-bound Douglasses toast their companions in Mongolian vodka. Meat pasties, eggs, bread, and Russian caviar complete the picnic. Cattle in background belong to a livestock cooperative.



AN EXTRACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CONGER © N.G.P.

tween a yak and a cow—has mostly taken their place, as it produces more milk and butter than either of its parents. Horses dominate the scene—horses and sheep, with some goats. The farther north one goes the more yaks there are; the farther south, the more camels and goats.

Courtesy Masks a Solemn Warning

Our destination, a camel-breeding station, lay well inside the Gobi. At Kobdo Suma, the last village before the desert, a local official tried to persuade us to spend the night.

"The road ahead is difficult," he said. "You will be uncomfortable."

We thanked him for his concern, but replied that we were used to rough travel. Before that long night ended, we all wished we had taken his advice, for the "difficult" road turned out to be almost no road at all, and we spent hours either bogged down in the sand or hopelessly lost. Too late we realized

that courtesy had prevented the village leader from saying flatly we would never make it.

The first part of the trip was uneventful. In five miles we reached the mountains separating the steppe from the Gobi. The pass across them leads through a narrow canyon between high black walls painted with burnt-orange and golden lichens.

"This mountain road is not so dangerous after all," I had said to Dean. We were, indeed, so casual and unsuspecting we stopped several times for photographs. At last we climbed out of this canyon to a low pass, descended 500 feet or more in several miles, and reached the apron of the Gobi.

This vast, mysterious land that had long been a magnet to me lay at our feet. The full moon was just rising; the sun had left a soft afterglow. The Gobi lay in purple twilight. The beauty of that first view was for me the most haunting of the many moods this strange desert land produced during our visit.

Guest of Honor Carves Lamb at a Candlelight Meal in a Ger

Visiting Mongolia during the fall butchering season, the Douglases feasted on fresh meat rather than the dried or frozen meat usually served in the winter. Mrs. Douglas and the interpreter await a serving.

Stirring mare's milk in goatskin bags, a youngster hastens fermentation of a potent brew called *airag*. This beverage, with the kick of beer, tickles the nose like ginger ale and tastes like buttermilk and champagne, Mrs. Douglas reports. Mongolians milk all their animals—sheep, goats, cows, camels, yaks, and mares—and convert the yield into yogurt, cakes, cheese, and alcoholic drink.

Instant portrait, taken seconds before by photographer Conger as a gesture of friendship, delights a girl and her brother, the family breadmaker. Boatlike loaves of wheat dough, stamped with a design, await frying.

ILLUSTRATIONS BY BERCEDES BOGALAS © N.S.S.



ILLUSTRATIONS BY DEAN CONGER © N.S.S.

After six hours we still had not found the camel station. So we sent out a scouting party. Ochirbal and I paced a knoll waiting for its return. The wind picked up in intensity. We explored several ravines, looking for a windbreak.

"If we can find camel chips," Ochirbal said, "we can have a fire."

It was easy to find camel trails. They are distinct even in moonlight. But after a long search we gave up the idea of a fire and turned our faces to the sky.

The Big Dipper hung low in the heavens and the North Star gleamed.

"Dipper?" asked Ochirbal. "To us it is the Seven Giants."

He went on to explain: In Mongolian folklore seven giants astride winged horses fought each other with fire. A god tired of their quarreling and exiled them in the sky.

"And the North Star?" I asked.

"It's the Golden Nail where the horses are

(Continued on page 315)



PHOTOGRAPHS BY JOHLEN KINCH (ARIEL) AND DEAN CONNER © NATIONAL GEOGRAPHIC SOCIETY

Prefab home, a ger goes up in less than an hour

COLLAPSIBLE GERS, or yurts, have served the nomadic herdsmen for centuries as warm, portable shelters against snarling blizzards that drop to 50° F. below zero. Some 85 out of a hundred Mongolians still cling to their gers, moving them even into the cities (page 342).

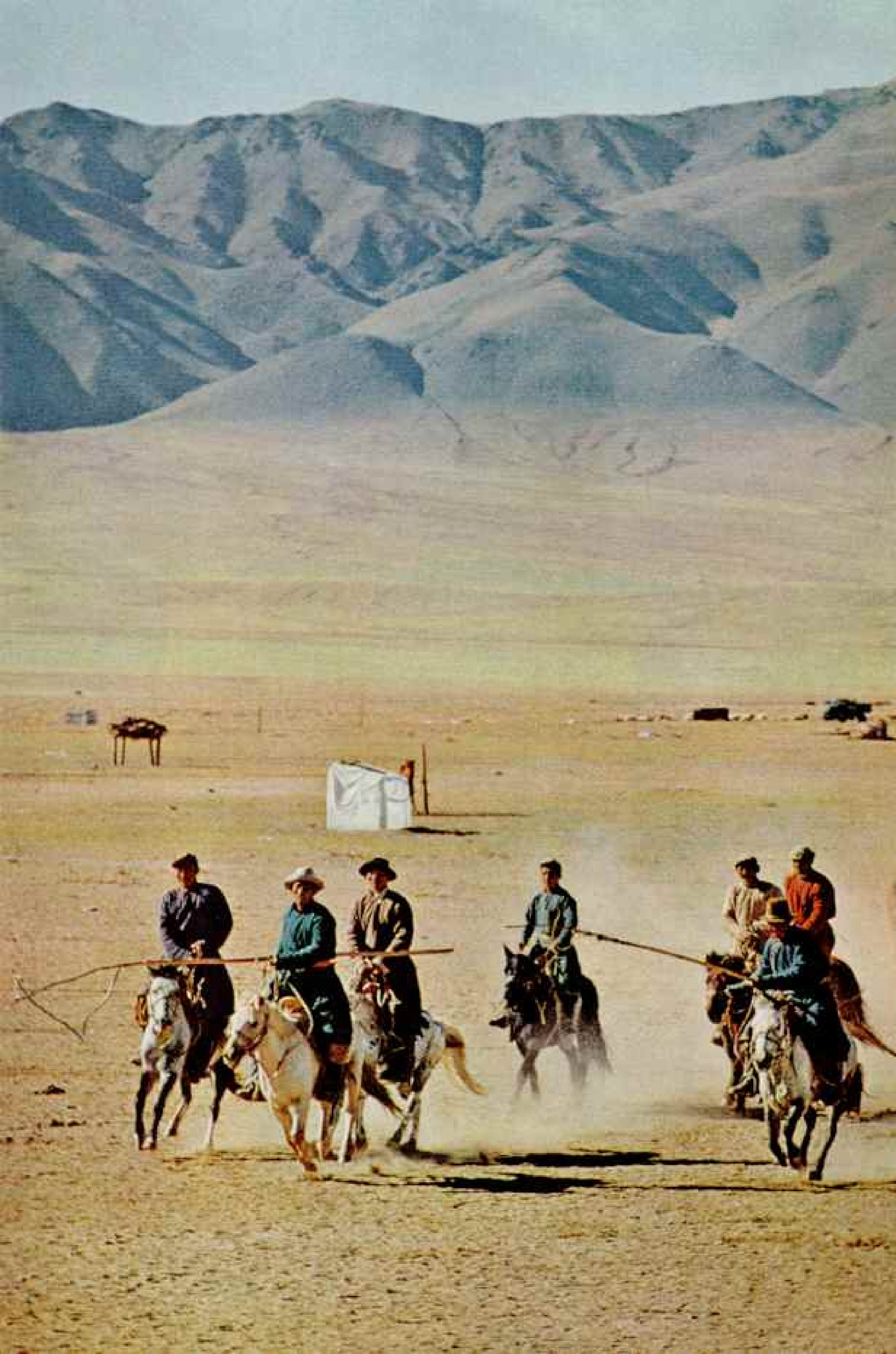
Here a popular factory-made model, assembled without nails or bolts, rises from the grass. Experienced hands set in place the expandable trellised wall at upper left. At right, they attach the ribs to a roof ring held up by two poles.

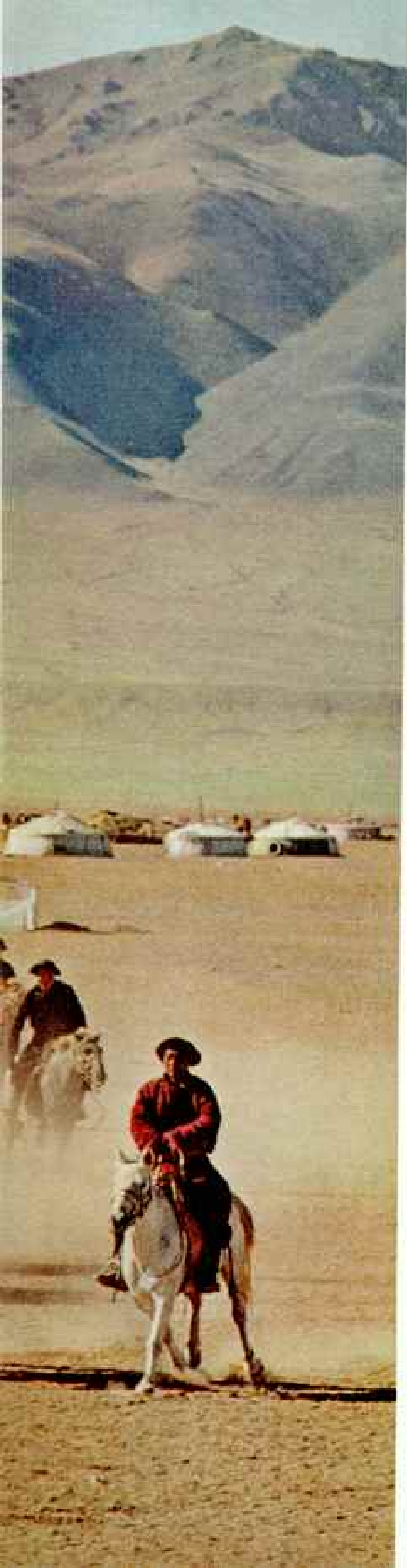
At center left, the frame stands ready for covering. Sheet of felt, a material invented in central Asia, goes over the spokes at right.

More sheets blanket the walls at lower left. Additional layers will go on as the weather grows colder. Canvas on top (right) shields the felt from rain. Two men with a pole raise a cover that controls light and air and permits passage of a stovepipe (opposite).

Protected by a felt-covered cocoon, a family enjoys the comforts of its ger. This truck driver's home stands permanently in Ulan Bator. Rugs cushion the wooden floor; electricity lights the lamp, and clear plastic covers the roof vent. Boy plays with a toy airplane; his Western suit contrasts with the traditional del of his parents.







BOB LANGRISH LEFT BY DEAR CORGIE AND ENTHUSIAST BY JORDEN BISHOP © R. S. S.



Bucking stallion meets his master. Hobble flying, stubby whip in action, the herdsman tames a mount. Heel-less felt boots cling to flat stirrups.

Cowboys Standing in Stirrups Ride With Nooses Knotted to Long Poles

Thirteen hundred families at Bogdo Suma cooperative herd 80,000 head of stock, including 20,000 horses. Grassy folds of the distant Gurban Bogdo mountains fence off the Gobi. Pole with noose, called an *urqa*, serves as a lariat (next page).

tied," he answered. "In America you would say it is a hitching post. Yes?"

I thought I saw a movement in the bushes a hundred yards distant and mentioned it to Ochirbal.

"Maybe it's Almas," he chuckled.

"Who is that?" I asked.

"Snowman of the Gobi," Ochirbal replied.

From his account, Almas is similar to the Abominable Snowman of the Himalayas—shorter in stature than a man, fur covered and elusive.

"Many have seen him," Ochirbal said. "But no one has captured him."

Our conversation turned to Genghis Khan and the empire he and his sons established from Peking to the Danube. From the 13th century we came down to 1691, when the Manchus conquered Mongolia.

"For more than 200 years Mongolia was locked up—

sealed off from the world," Ochirbal added. "Science, technology, medicines, modern inventions—all these were denied us."

The Manchu rule was harsh. Mongolians were mostly reduced to serfs. The border was sealed, largely to keep any foreign influence from penetrating the ancient kingdom.

The Chinese administration bore heavily on the people, Ochirbal said. Nine methods of torture were devised. These are on display at the State Museum in Ulan Bator. We had tried to take photographs of them, but permission was not forthcoming.

"It is a part of our history that we try to forget," the curator had told me.

One method of torture involved stretching the neck by gradually withdrawing thin boards on which the victim stood, until at last he swung free. Pulling the legs in opposite directions was another. Whipping with a cane was on the list. So was pouring hot metal on a shaven head. We talked of this torture in the Gobi.

"Was there no mercy shown?" I asked Ochirbal.

"In a sense," he said. "You see, if a man



passed all nine tests, he became immune."

"Immune from what?"

"Then the spirits were on his side," he laughingly explained. "He became a mighty criminal who could rob and steal and rape without hindrance."

That night as we walked the Gobi under a full moon, Ochirbal explained that Mongolia's Independence Day—July 11, 1921—marked the completion of her separation from China. I, in turn, was starting to explain our Fourth of July, when the light of the jeep that had gone scouting appeared.

We were filled with expectations of hot soup and a night's rest. But the news was disappointing. The camel station had been found, but it had been abandoned. No gasoline remained for further scouting.

We had no choice. Our caravan started its return at one in the morning. The interminable ravines and the mountain range had to be recrossed.

At about four o'clock in the morning we stopped at a small ger we had passed earlier, and got a few hours sleep. Then we set off again across the Gobi, this time by daylight.

STYLING: PHOTOS BY DEAN CONNER © 1988



Loop Around Neck, a Wild Horse Drags Its Captor Across the Steppe

Small and incredibly tough, the Mongolian horse can easily cover 60 miles a day. Its ancestors carried Genghis Khan's archers into Europe.

In the nation's animal currency, a horse may equal one cow, seven sheep, fourteen goats, or half a camel. Highway in the background leads from Ulan Bator to Sühe Baatar (Sukhe Bator).



Future jockeys eye the horses they soon may ride. Racing is a national sport. Boy and girl riders in the main event at the Naadam festival—all between 6 and 12 years—cover an 18-mile course. As many as 200 entries may start.





That part of the Gobi that lies in Outer Mongolia is a vast domain of about 175,000 square miles—two-thirds the size of Texas. Three aimaks (provinces) have been carved out of it, and two others reach into it.

Mongolians do not speak of “the Gobi” but of “a Gobi,” which means a hard, clay-like soil thinly strewn with flat gravel and sparse vegetation. The Gobi in its eastern limits has much sand, which in the spring sometimes fills the skies over Ulan Bator. The area south of Sayn Shanda (map, pages 294-5) produces enough oil to satisfy all of Mongolia's present needs.

The western Gobi, where we traveled, has only a little sand, that runs in narrow streaks for several miles. Most of this part of the Gobi is covered with vegetation. Water holes, where camels wallow, nourish grass that has produced a thick turf over the centuries. Most of the vegetation is as rough as our sagebrush but palatable to camels and to goats.

Tamarisks Turn the Gobi Pink

Three types of trees grow here—the zag, a white-barked tree that occasionally reaches eight feet or more; the turai (tora), which from a distance reminded me of our American live oak; and a low, brushy tamarisk that has pink blossoms and turns orange in the fall. This pink of the tamarisk is harmonious with a low, pink-toned succulent of the Gobi. The two of them give the desert a pink glow. Mercedes called it Gobi pink.

Unlike the Gobi, the steppe country has no trees. Almost the only fuel is dung that women collect in round wicker bushel baskets carried on their backs. A short-handled rounded wooden scoop that looks like a gardener's leaf rake is used to pick up the chips. A quick flip of the scoop sends the chip flying over the shoulder into the basket. The dung makes a blue, hot fire with little smoke, and is therefore ideal for use in a ger.

The people of the steppe country are predominantly herders, the arats. Their wealth is in horses, sheep, goats, cattle, and camels.

Lonely Gobi, land of ever-changing moods and colors, glows in afternoon sunlight as Justice Douglas and a guide examine the scant vegetation that tufts its vast expanse. Wild camels, horses, and asses graze where dinosaurs once roamed.

The plateau, broken by bald hills, blankets about one-third of all Mongolia and overlies rich oil fields and water reserves.



Cargo-laden camels pass a cluster of gers on the fringe of the Gobi. Short and woolly, the Bactrian serves as the nomad's beast of burden and provides wool for commercial cloth and homespun. Caravans crossing the treeless steppe cover as much as 40 miles a day.

Wandering herdsmen in broad-brimmed hats lash household goods to the back of a kneeling camel, preparing for a move to greener pastures. Other camels transport the disassembled poles and covering of the ger. Horse herds constantly roam Mongolia's grassy midlands.





REPRODUCED BY JORDEN BISH (CAMELS) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CONGER © N.G.S.

There are no individual operators; each family belongs to a cooperative. But private ownership still exists. In the north country a family in a cooperative can have 50 head of livestock to do with as they please, accounting to no one for their profits. In the steppe country and in the Gobi, individual ownership of 70 head is permitted.

Some who graze the steppe in summer and fall move into the Gobi for the winter. A few live the year round in the western Gobi. A brigade of 145 families—a unit of a large co-op in the steppe—permanently occupies the part of the Gobi we visited. They run 3,000 camels, 90,000 goats, and 40 horses. Six springs and two small creeks provide water. These, however, would not be enough without 120 wells recently dug.

Water Lies Close Underground

Gargal, a weather-beaten herdsman with thin chin whiskers who had been in the Gobi for years, told me:

"Gobi has much water. Two meters, three meters underground. Sometimes we go seven meters." His face lighted up. "It is cold, clear, sweet water."

Nowhere in the Gobi, according to the Hungarian engineers who are drilling wells, is it difficult to find water. Nine out of ten borings strike water less than 500 feet down.

The brigade of which Gargal is a member

roams a part of the Gobi that stretches 120 miles from east to west and about half that distance north and south. The brigade grazes the high ridges of the Gurban Sayhan in summer and moves for the winter into the Gobi lowlands, where the elevation is only about 3,000 feet. The Gobi blazes with flowers in April and May. Gargal's face was bright when he described them.

Natural Airstrips Dot the Gobi

Heavy rains come to the Gobi in July and August. Then the ravines often know flash floods. The rest of the year little moisture falls. A jeep can go almost anywhere.

Apparently no glacier ever moved across the Gobi.* Yet there are many rounded rocks. Pebbles are flat; some areas are packed so tight and smooth that a small plane could land and take off with ease.

There is much evidence of volcanic action. Remains of ancient lava flows are common; quartz crystals and gray, red, and bluish sedimentary rocks, all flat and highly polished, lie everywhere.

The Gobi is ever-changing. Low, rolling ridges, occasional isolated knolls a hundred

*In the 1920's and 1930's the famous explorer Roy Chapman Andrews roamed the Gobi for the American Museum of Natural History, in New York, and found dinosaur eggs 95 million years old at the Flaming Cliffs of the Gurban Sayhan. He wrote of his adventures in the June, 1933, NATIONAL GEOGRAPHIC.



feet or so high, a low hard backbone of what once was probably a mountain, a sharp-peaked cone, a stretch of tableland that drops gently to the plain. There is a diversity of scene in the Gobi that pulls a man on and on.

The area we traveled is a land of vipers and a wide variety of rodents, though we seldom saw snakes, and only a few rats showed. The bottomland had many antelope. We pursued some by jeep to measure their speed, but soon fell far behind in the rough terrain. This plains animal is about the size of the American pronghorn. Its tail is white and saucy, but its pelage is dark, not spotted, and well blended to the Gobi environment.

Many gazelles live in the Gobi. I saw their tracks, but they never came into view. I saw sparrows, and huge black vultures that had a wingspread of at least six feet.

Wild camels still roam here. This is the home of the wild ass and a wild horse. The wild horse is smaller than the Mongolian horse, which is a pony by our standards (page 316). The wild ass is larger than a burro and smaller than our mule. Its hoofs are more elongated than the horse's.

We visited a state farm 60 miles northwest of Ulan Bator, where stallions the size of a typical American saddle horse were being used to breed a taller Mongolian horse. Both wild horses and wild asses were also being bred with domestic stock.

Shifting Moods Light Gobi's Face

The Gobi at high noon seems flat and severe. The hot days of summer are grueling. But late afternoon on a clear day can produce magic effects. Yet never again did we see in the Gobi the deep purple that enveloped it our first night.

When shadows lengthen, the Gobi comes to life, changing its mood. Every five-minute interval produces a new effect. What was sharp becomes indistinct; what was blurred comes into focus; mystery and magic rule the desert.

One night the full moon came up at almost the precise moment that the sun set. The entire Gobi seemed impregnated with a soft

maroon light. Then the Gobi camels, all two-humped Bactrians, loomed larger and larger, and the people who tended them seemed smaller and smaller.

Tent Homes Dot Desert and Steppe

That night we were invited to join one family group in a nearby ger. The ger is as Mongolian as apple pie is American. It was in vogue when Genghis Khan put the Mongolian Empire together in the 13th century.

Its essential details are unchanged. The ger is round with a dome-shaped roof. A hole at the top vents the smoke when cooking is done over an open fire. These days most gers use a small round sheet-iron stove with a small stovepipe. Cooking is done in large round-bottomed pans that fit into the top of the stove.

The ger stands 20 to 30 feet in diameter. The lower wall is formed by a lattice of wooden laths a little more than four feet high. These side walls collapse like an accordion for packing on animals or in carts. Curved poles fastened to the circular walls, like the ribs of an umbrella, hold up the domed roof. The rib ends are socketed at the top into a wooden ring about three feet in diameter. A flap of felt can be drawn across this hole by ropes to control the light, keep out rain, or keep heat in (page 312).

These days a ger frame can be purchased in Ulan Bator. More commonly the frames are handmade. They are always painted bright colors.

Layers of felt cover the ger, more being added when the temperature drops. Over them lies white canvas. Every ger has a doorway about three feet high with a gay and distinctive design. When the door is closed and the roof flap is drawn, the ger is as snug and windproof as any house.

In summer a handmade mat of thick wool, known as a *shirdik*, covers the ground. For protection against heavy rains, a trench rings the ger on the outside. When fall comes, the *arat*, or herdsman, usually lays a wooden floor recessed about an inch in the ground. Then he is ready for the severest storm.

Kernels of Wheat Cap the Shaved Heads of Monks at Ulan Bator

Symbol of fertility, grain appears often in the rites of Mongolian Buddhists. Before 1921 half the nation's male population embraced the monastic life. Today priests number a few hundred, who dwell in two surviving retreats.

American guests at Gandan Monastery draw a sidelong glance from the chanting lama at left, who holds a ceremonial bell, the *ochir*, and prayer beads.

Solemn as a Jury, Lamas Weigh the Words of an American Judge

Eager to exchange views, priests listen intently as the interpreter at center poses their questions to Justice Douglas. Gombojab, the ranking lama, sits at the left of the altar, where butter-oil lamps cast a flickering light. Five associates range to his right in the order of their seniority. Soup, airag, cookies, and rock-hard cheese surround the guest of honor. The decor of this lavish reception ger at Gandan, Ulan Bator's monastery, repeats the vibrant colors of the monks' scarlet-and-saffron robes. All 100 members may comfortably convene here.

The ger, of course, has no running water. Toilet facilities are makeshift. The family gets its water from wells that have been drilled in great numbers since Mongolia won independence in 1921.

Inside the ger, one or two low chests, sometimes from China, sometimes homemade, hold clothes. Cots line the walls. Chairs are low footstools. A radio seems almost always present. And at Kobdo Suma the gers had electric lights.

Herdsmen Honor Russian Space Pilots

Pictures of Gagarin and Titov—Soviet cosmonauts—are common. Portraits of Mongolian leaders hang beside family photos. But it was Lenin whose picture was most conspicuous in the gers we visited. Once when I commented on this, an arat replied proudly, "We Mongolians feel close to Lenin. You see, he had Mongolian blood on his mother's side."

I recalled the old Asian saying: "Scratch a Russian and find a Tatar."

A goatskin bag or a tall wooden churn stands always by the low entranceway into the ger. It contains fermented mare's milk—the *airag* that is famous in Mongolian history and known to Russians as *koumiss*.

Gers are not confined to the country. Most employees of a flour mill on the edge of Ulan Bator live in gers pitched in a nearby pasture (page 342). A collection of them in a city, however, tends to become a slum. Gers in the countryside are not only beautiful, they maintain, as no mechanized society could do, the Mongolian tradition of hospitality.

Whenever we stopped by an ail, a group of gers, we were invited into one. If we accepted, we soon had an invitation from the neighbor. These are not casual invitations to be treated



in an offhand way. They are seriously tendered; and Chojamtse always was meticulous to save for another day the ones we did not have time to accept, in case we returned by the same route.

There are formalities on entering a ger. The traveler first says:
"How do you do?"
Then follow three questions to the host:
"Is your family well?"



RODRIGUEZ © NATIONAL GEOGRAPHIC SOCIETY

"Are the cattle [or livestock] fat?"

"Is the grass good this year?"

The answer of the host is always "yes," even if sickness plagues the family, the cattle are poor, or the pastures suffer from a drought.

These questions take care of protocol. Then the conversation becomes serious, and as it proceeds, the arat's wife serves tea (*tsai*). Airag follows—sometimes in a china bowl,

sometimes in a wooden bowl. This drink is ever-present. Mares are milked several times a day. New airag is always on the way, for it is highly perishable.

"The skies must be blue," one arat told me, "if the airag is to be good."

Marco Polo wrote that airag has "the qualities and flavor of white wine." But I like Mercedes' description—"the flavor of buttermilk mixed with champagne."

*October snows frost the mountains
and plains of northwestern Mongolia.
Lake Tsagaan Uur steams in the frigid air.
Single-engine biplane links the fishing
village of Tsagaan Uur with other
communities in this roadless region.*





One bowl of airag does not suffice. To show real appreciation, travelers must drink two or three or even more. The quality varies greatly from ger to ger. Perhaps it depends on the sun, perhaps on the skill of the wife, for good airag must be almost constantly churned or stirred the first two days. Or perhaps, as Dean Conger put it, some horses are "stronger" than others.

After the airag the guest is offered *tarag*, a sort of yogurt. Tarag made of camel's milk is extraordinarily nutritious, but goat's and sheep's milk are also used. Warm camel's milk works magic with an upset stomach. On our Mongolian journey we sometimes were offered the whole series.

Usually we were also offered *khuruud*, a

curd made from milk and thickened in the sun. It dries into a hard, gray substance. In Marco Polo's day *khuruud* was mixed with water every morning and put into a leather sack on the warrior's saddle.

"By their motion in riding," wrote the Venetian traveler, "the contents are violently shaken, and a thin porridge is produced upon which they make their dinner."

We had it only in the form of hard candy and found it difficult to enjoy.

One night in the Gobi the cooked head of a sheep was placed in front of me, a knife beside it (page 310). A layer of gristle runs along the lower side of each jaw. Protocol demands that the guest of honor cut both off, starting at the point of the chin. He eats



one slice and passes the other to the host.

Next comes a whole saddle of lamb. The guest of honor cuts thin slices lengthwise and gives one to every person in the ger. Airag and more airag is served. By then everyone is free and easy.

The son of the arat produced a morin khour and played a tune as sad and as plaintive as any people of the plains have produced.

As the young man played, the music grew in depth and feeling. The tune expressed the privations suffered by men and horses on the steppes, where the winds are fierce and there is no place to hide. The music conveyed much more — the Mongolian's love of the horse and his utter dependence on it.

I have said that Mongolian horses are the

size of our ponies. They are of all colors and markings, even the mottled pattern of our western Appaloosa. Their hoofs are small and compact; shoes are not used. Manes are bushy and tails long and uncut.

Mongolian Children Raised in Saddle

In the time of Marco Polo, the horses, cattle, yaks, and camels of the Mongolians were branded and grazed at large, there being no fences. Mongolia is still a land without fences. An arat may use wicker to form a small corral for a band of sheep, but that is an overnight arrangement.

The Mongolian is a good rider by the time he or she is five years old. Mercedes rode at every opportunity, though she had no del — the Mongol woman's usual riding habit — and found her skirt a problem. Whenever Mercedes was on a horse, racing across the grasslands, a woman rider always went in fast pursuit — as a matter of courtesy.

Mongolian horses have a wonderfully comfortable slow gait, a pace between a walk and a canter. Both legs on one side go forward and back together, whereas most of our horses trot — with the front leg on one side and the back leg on the other moving in unison.

Pacers streak across the Mongolian grasslands, the riders standing in the stirrups (page 314). When a group rides in close formation, the appearance is formidable.

"Every man in Genghis Khan's cavalry had twenty horses to ride," one official told me. When I asked why, he explained, "No Mongolian ever uses one horse for more than two consecutive days. After two days the horse gets two weeks' rest."

The horses are wiry; they can go far on a little food. But no Mongolian horse is ever gaunt or thin. None is a pet. None has a name. Yet Mongolians love their horses and are ten-



THE EXTREMES OF NATURAL GEOGRAPHIC SOCIETY

Snow-dusted Fishermen of Tsagaan Üür Wade Icy Water With Their Catch

Commercial fishing, a new industry to landlocked Mongolia, yields harvests destined for export. State officials seek to stimulate home consumption, despite the Mongol's preference for meat and milk products.

These villagers seine foot-long whitefish in a river feeding Lake Tsagaan Üür. They spread their catch on shore to freeze for shipment. To speed unloading, they follow a chilly course from the boat.



Archer takes aim during a tournament at Ulan Bator. Similar but more powerful bows armed the warriors of Genghis Khan's hordes.

der to them. Theft of a horse, according to Marco Polo, carried the death penalty in ancient days, just as it did more recently in our own American West.

The Kazakhs in the western part of the country, who number only 37,000, are the only Mongolians who eat horse meat. Most Mongolians would never dream of eating their horses. They are too valuable as transportation and as a source of milk.

Today the Mongolians use horses to herd sheep and goats and to round up livestock. Boys and girls ride horses to school. Horses bring couriers to remote places and are used in the hunt. But the foremost use is for milk.

How to Catch a Running Mare

Women do the milking, but it is a man's job to catch a horse. A lasso is not used. The Mongolian has a 15-foot birch pole with a leather loop at the end (an *urga*), which he slips over the running horse's head (page 316).

"He must be well back in the saddle," one *arat* told me, "or he'll be thrown."

Mongolian horses need little breaking and are gentle even to strangers—provided one approaches them on the left side. Like many American ranch mounts, an approach from the wrong side may bring trouble.

Modern Mongolia has a new use for her horses. While she has a favorable foreign trade balance, she imports more from China

Booted wrestlers in gaudy jerkins grapple in a gymnasium at Ulan Bator. A competitor loses when any part of his body other than his feet touches the plush carpet covering the floor.

48 EPITACHROME - YELLOW BY DEAN LINGER AND CATECHROME BY JAMES BISHOP © NATIONAL GEOGRAPHIC SOCIETY





PHOTOGRAPHS BY NATIONAL GEOGRAPHIC PHOTOGRAPHER DEAN CORNER © N.G.S.

Treasure trove for scholars, the Central State Library at Ulan Bator houses more than a million volumes. Curator Gonchigdorje displays the ornamental frontispiece of a priceless Tibetan tome and, at right, the title page of an encyclopedia in old Mongolian script. Loose-leaf works wrapped in cloth line the stacks.

than she sells there. Simple machinery—such as hand looms and irrigation gates—come from China. So do tires, tea, candy, spices, fountain pens, paper clips, cotton goods, and many more consumer goods. Mongolia pays for 85 percent of them by exporting horses to China.

India Shaped Mongolian Culture

In the broad sweep of history, India has had a great impact on Mongolian culture. Indian philosophy, Indian culture permeate the vast collection of Tibetan literature that fills the libraries and monasteries. Through Buddha and Buddhism, India spoke to Mongolia for centuries on end.

One night in Ulan Bator, Dr. Sh. Bira, a philologist of the Academy of Science, traced the history of Buddhism in Mongolia.

Buddhism, he said, came in three waves. The first impact was in the eighth and ninth centuries. Contrary to popular conceptions, Genghis Khan in the 13th century strengthened Mongolian Buddhism. But it was not

until China finally conquered Mongolia and sealed it off from the world that Buddhism, in effect, took over the country, blending church and state.

Under the Manchus, Mongolia's nearly 750 monasteries flourished. Half the male population was in these monasteries, the boys entering when they were five. The only schools were in the monasteries, and they were for lamas only. The only doctors were there, and they took care of the lamas only. The monasteries owned much of the land and most of the livestock. They catered to the lamas, not to the religious needs of the community.

The Buddhism they practiced was blended with shamanism, which has roots deep in Mongolian history. Most hills, most mountain passes had their spirits. They were given names and anthropological forms. Their faces were carved into masks, and the masks used in the famous *tsam*, which Westerners dubbed the "devil dance."

The *tsam* was kin to the morality play of medieval Europe. There were evil spirits



Bold-patterned blankets, still uncut, cascade in Ulan Bator from the looms of the nation's only textile mill. British-made machinery equips the factory. High-quality wool assures the excellence of Mongolian yard goods. Women, who constitute the majority of the plant's labor force, wear Western dress in preference to the del.

Chinese workers perform their morning calisthenics beside barracks in Arbay Heere. Young men lent by China to construct public works seldom mingle with Mongolians. Dean Conger encountered no opposition when he filmed this uniformed brigade, but later Mrs. Douglas, camera in hand, was bluntly shouted away.

PHOTOGRAPHS BY NATIONAL GEOGRAPHIC SOCIETY



and good ones; the struggle was eternal. The dances—which went on for days—had intervals of comedy relief. But the main theme was serious.

Good eventually triumphed, but the struggle was long. On the side of Good were Industry, Friendliness, and the gentler qualities; on the side of Evil were Greed, Lust, Selfishness, Deceit, and Anger.

Revolution Weakens Lamas' Power

At the time of the 1921 revolution, Mongolia was almost entirely pastoral. The industrial revolution had passed her by. One coal mine, using primitive methods, produced 1,500 tons a year. Two hand printing presses were in operation; they employed mostly Russians, though Sukhe Bator, the leader of the revolt against China, worked at one. The monasteries, the Chinese, and a few nobles owned all the wealth.

Thus, while the 1921 revolution was primarily against China, it was also against the monasteries which China had used to hold the country in a feudal vise. The government of Sukhe Bator did not, however, use force against them. A subtler method was chosen.

A law was passed making it necessary for a boy to have a grammar-school education before he could become a lama. This law, over a 20-year period, had the desired effect. The tradition of sending every second son to a monastery was broken.

By the late 1930's and early 1940's, open conflict existed between government and monasteries. Monasteries were raided, and supplies of Japanese arms were found. Some lamas were executed. But the cause cut deeper. Monasteries were an active political force.

"We wanted schools," our interpreter, Ochirbal, told us one day. "But the lamas were opposed. We wanted doctors—the lamas were opposed. They told the people that medicines were evil, that the radio was evil. They said the spirits would take revenge if women were treated as equals of men."

By 1961 only two monasteries remained in operation: Gandan Monastery in Ulan Bator and Gandan Chiltan in eastern Mongolia. We visited Gandan in Ulan Bator, attending services in two of its chapels.

Incense filled the air, and the chant of the lamas cast a spell (page 322). The drums, horns, and cymbals were Tibetan. The *dzas-püree*, 12-foot ceremonial horns, gave forth sounds that seemed to come from the bowels

of the earth. The service was in Tibetan; the liturgy followed the Tibetan pattern.

Even here, the intense interest of Mongolians in the outside world was evident. At a reception given by the senior lama (page 324), we were deluged by such questions as:

Is Buddhism spreading in the United States?

Why has the United States opposed the entrance of Mongolia to the United Nations?

Why does not the United States recognize Mongolia?

Why is there not an exchange of students and teachers between the two countries?

The senior lama gave the thoughts of his group: "At this point in history, exposure of Mongolia to the world is very necessary."

Today Mongolian lamas stand shorn of all political authority. They have gone their own way, maintaining the integrity of the religious order.

I was deeply moved by the earnestness of the lamas at Gandan Monastery. There the old order persists. The soul of man is not crushed. In spite of great adversities, dedicated men fulfill their spiritual needs in a time-honored way.

Outspoken Lama a Part of Folklore

Lamaism is still a vivid force in some ways, as evidenced by the oft-told adventures of Badarcha. Badarcha was a legendary lama, around whom many tales have gathered. Some are reminiscent of *The Arabian Nights*. One hears them in the gers.

Legend says that Badarcha once visited an inhospitable ger. At dinner he noticed that the family got the choice dishes, while he was offered scraps. The host asked the lama whether the livestock he had seen on his journey were fat or lean.

"Some of them," answered Badarcha, "were as affluent as the dish before you and your wife; and some were as poor as the dish you gave me."

Badarcha marches through modern Mongolia bringing wit and wisdom, counsel and comfort to all the country people.

Feudal Mongolia has been reorganized on the Soviet pattern. While the program started in the 1920's, most changes have come in the past 15 years. Every Mongolian has felt the impact of the machine age.

There are four-year schools in every *somon*, what we would call a county, and seven-year schools in most aimak centers (provincial

Woman on horseback herds piebald sheep on the fenceless steppe near Arbay Heere. In fields and factories Mongolian women work on a par with men. On the steppes, they wear the *del* even when riding astride; public opinion frowns on females in slacks.

Scheduled stop at Bulagan sees passengers strolling the field while porters unload freight. Rails and roads push slowly across the plateaus, but Mongolia's national airline connects its regional centers and flies to Peking and Irkutsk as well. Even large planes can take off and land virtually anywhere on the hard, turf-covered flatlands. Mongolians pilot this Russian-made Ilyushin 14.

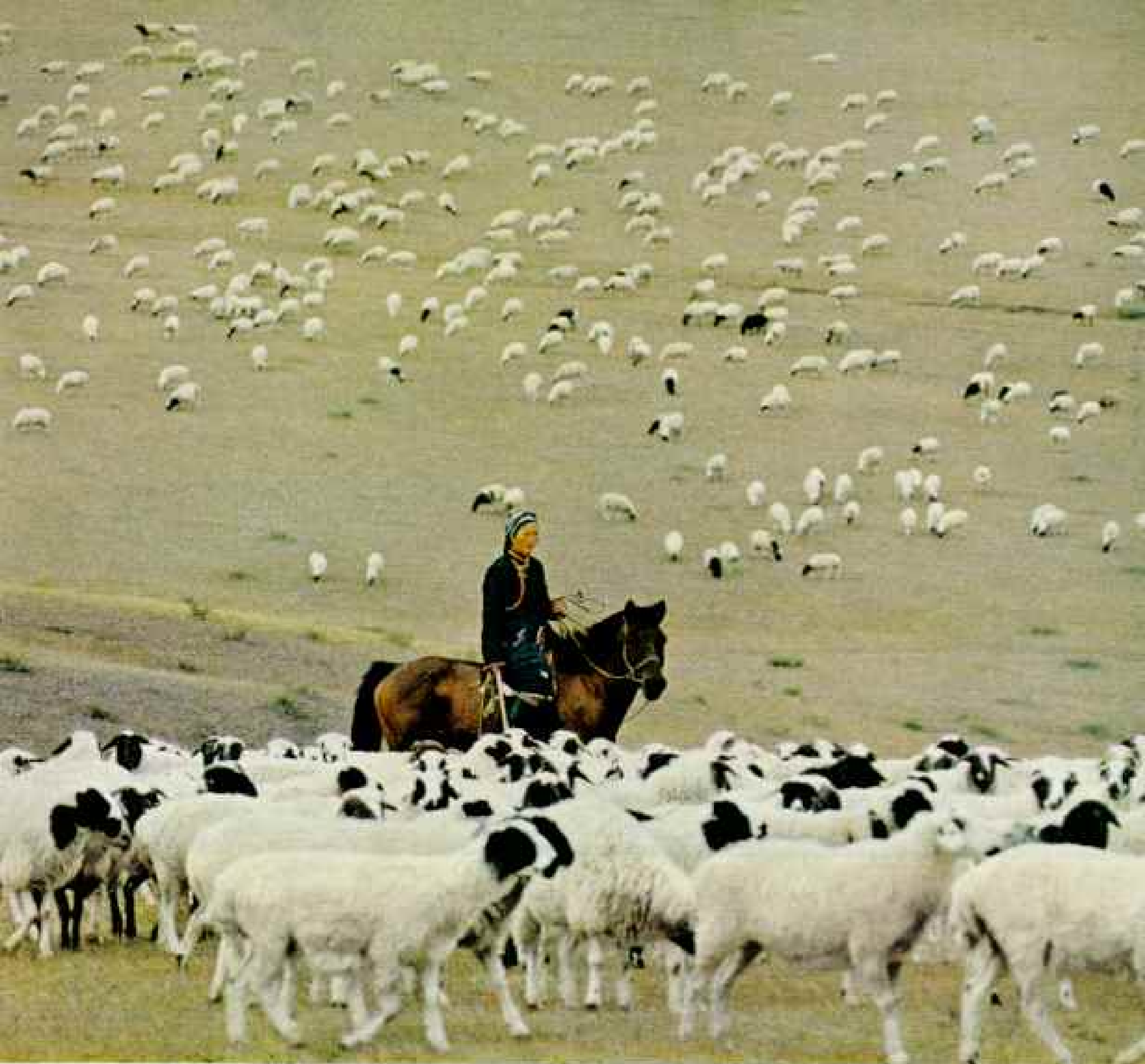


capitals). The five-year plan for 1960-65 calls for seven-year schools in every somon.

I was told that there is one doctor for every 1,000 Mongolians, and that every somon has its first-aid station and many have hospitals. All provinces have hospitals (page 336). Medical and dental services are free; small planes carry doctors and nurses to any point.

Hospital Gives Airag for Ills

We visited a sanatorium known as Hujirtu (Soda Place), south of Karakorum. The head doctor, Y. Avirmid, skillfully treated my persistent flu. Hujirtu has hot mineral baths to which 3,000 people a year come for their aches and pains.



KUDRICHONNEE © NATIONAL GEOGRAPHIC SOCIETY

Mongolia also has 19 tuberculosis sanitoriums. There, fermented mare's milk forms part of the treatment.

"After clinical therapy," Dr. Avirmid explained, "the patient is put on airag for one month. We find it very beneficial."

This called to mind another story about Badarcha, the legendary lama, in which he appears the buffoon rather than the hero. On one of his journeys he found a bottle full of some liquid. He put it in his pack. That night he reached the home of a nobleman who took him in, and who shortly asked him to attend his wife, who was very sick.

Badarcha, utterly ignorant of medicine, pretended to be an expert. He took the bottle from his pack and poured a spoonful. In the manner of the physicians of the day, he first tasted the medicine, then gave it to the wife.

Badarcha thereupon retired for the night.

Shortly the nobleman came running to him, shouting: "The medicine you gave my wife is driving her crazy. Do something about it."

"What can I do?" asked Badarcha. "I tasted just a little of it, and it's driving me crazy, too."

University Students Receive Pay

The government of Mongolia controls not only medicine and education but many other aspects of life. It fixes rents so that they do not exceed 4 percent of the family income.

The arat (herdsman) gets his milk, cheese, airag, and meat from his own herd, plus his share of the profits of his cooperative. The students at the university get a minimum stipend of 240 tugriks (\$60) a month. Books and tuition are free. Children of arats, sent to town for schooling, get free room and board at state hostels. Free nurseries and kinder-



Spotless operating room sparkles with Czechoslovakian equipment. Doctors and nurses prepare for surgery at the 110-bed Second United Hospital in Ulan Bator. Sliding glass doors shield an aide who awaits a signal for sterile instruments.

Needle puncture, a Chinese technique employed for thousands of years, vies with modern medical methods in the same hospital. Practitioners, pricking the patient with as many as 300 pins, seek to relieve the tension of throbbing nerves.



gartens care for children of working mothers.

When all the subsidies and indirect benefits are considered, the minimum standard of living seems as high as I have observed in Russia. Mongolians who have lived in Russia support this view.

Today's Mongolia is a far cry from Genghis Khan's empire. Two men whose names are scarcely known in the West, Sukhe Bator and Choibalsan, are today's national heroes.

Sukhe Bator, revered in Mongolia as the nation's liberator, is memorialized in Ulan Bator by a statue showing him on a prancing horse. The city's name, meaning "Red Hero," honors him. In the city stands his mausoleum. Choibalsan, the prime minister who in the 1930's shifted Mongolian policies away from Marxist extremism, lies buried beside him.

Memory Alone Honors Genghis Khan

Genghis Khan (A.D. 1167-1227) became king of the Mongols about 1206. He was, according to Marco Polo, a man "of approved integrity, great wisdom, commanding eloquence, and eminent for his valor." He conquered the Tatars and started the military conquests which, under his sons and grandsons, placed under Mongol rule that great expanse of the world from Peking to the Danube and from Lake Baikal to the Persian Gulf.

These military campaigns were launched out of vengeance, when emissaries of Genghis Khan were murdered by a distant ruler in a country that is now part of southeastern Russia. A Persian writer of the day described the assaults of the Mongolian cavalry: "They came, they sapped, they burnt, they slew, they plundered, and they departed."

Mongolians remember Genghis Khan. But in all Mongolia there is no memorial to him. No one knows the location of his grave. Most Mongolian chronicles concerning him have perished. The Chinese army did a thorough job when they destroyed Karakorum, traditional capital of the Khans, in 1382.

Standards said to be those of the great Khan are in the State Museum. One is a heavy round tub bound with copper bands, topped with a huge triple-pronged brass spear, decorated with silver (page 307). It is flanked by two taller standards—single-pronged, one with a heavy fringe of black horsehair, the other of white horsehair. The larger one in particular would take a mighty man to handle on horseback. It is beyond the capacity of most men to carry even while walking.

Karakorum lies 250 miles west of Ulan Bator. Marco Polo described the ancient capital 40 years after Ogatai Khan, Genghis's son, had rebuilt it into a great city. It was surrounded "with a strong rampart of earth," backed against mountains green with pine and tamarack.

Today no trace remains of the old city, except what a few diggings have revealed (page 306). Now a cluster of white stucco buildings stands against the hills, the administrative center of Karakorum State Farm, one of Mongolia's most prosperous.

The canals of Ogatai have been restored and extended. Twenty thousand acres are irrigated and planted, mostly to wheat. Here 42,000 sheep, 7,000 goats, and 1,200 mares graze on 500,000 acres of grassland.

This vast farm, with 500 permanent workers, is mechanized. Trucks, jeeps, and cars are Russian-made. Soviet tractors and 65 Soviet combines are maintained by a modern repair station. A diversion dam on the nearby Orhon (Orkhon) River furnishes irrigation water and generates 520 kilowatts of electricity. A flour mill processes 11,000 tons a year.

Most of the workers live in gers soon to be replaced by modern houses and apartments. A seven-grade school, a hospital, a recreation hall, and a movie house serve the farm.

Capital a Symbol of Change

Karakorum today is bright, modern, and prosperous—but not an imperial capital.

It is this new Karakorum—not Genghis Khan's Karakorum—that Mongolia honors, for it symbolizes her entry into the modern world of science.

One night we drew up a list of things that demonstrate that progress.

"Little squalor or filth," Dean Conger said.

"No children with skin diseases," Mercedes added.

"From city to countryside the faces of young and old are healthy," I commented. "Everyone seems to burst with energy."

We talked about Mongolian folklore and superstitions of the people. A black cat crossing in front of a person is a bad omen in Russia but not in Mongolia. Here, however, it is lucky if a wolf crosses in front of a traveler.

The talk turned to Mongolia as it has appeared to other foreigners. The West, including Russia, has not always understood the East.

The great Swedish explorer Sven Hedin

on one of his journeys asked his guide the name of a peak in China. The guide replied, "Muztagh Ata," which went into Hedin's records. It means Ice-mountain Father. What Hedin did not understand was that the word "father" was addressed to him!

I recalled the story of an early Russian explorer in Mongolia who asked an arat the name of a mountain. The arat replied, "Don't know." And down it went in a notebook to plague future travelers.

We had our own encounters with delightful Mongolian place names one day on a hike near Terelge, in the mountains northeast of Ulan-Bator. At one point Ochirbal gestured toward a mountain in the northwest and said:

"The White Camel Is Going Away. That's the name of that mountain."

A flood of Asian place names came back to mind: He Hung Up a Saddle; The Wild

Ass Died; The Cradle Remained Behind.

"If the custom continues in modern Mongolia," I remarked to Ochirbal, "think of the interesting place names that will result. 'We Had a Flat Tire,' for example."

"The Car Turned Over," Dean Conger added.

"The Back Seat Driver Was to Blame," Mercedes suggested.

We all laughed as the list grew. There was a long silence and someone said, "The Old Order Changeth."

The old order has indeed changed. Yet old ways linger on.

Today, as in the days of Genghis Khan, August is thought to be the best month for roasting sheep or goats.

"Why August?" I asked an arat in the steppe country.

"By August most of the wild flowers have



bloomed," he explained. "A sheep or a goat that has eaten our flowers from spring to August has meat as sweet and tender as the flowers."

In many other ways the life of the arat in a cooperative is not basically different from his prior life. What the long-range change will be, no one knows. Nor does anyone know what changes Mongolia will experience now that she is officially a member of the world community.

Mongolia Holds a Strategic Position

Will Mongolia become the staging ground for great powers? Will Mongolia in the manner of other small nations use her strategic position between Russia and China to play one against the other?

Mongolia today appears innocent of any such design. She is meticulously circumspect

and proper. To me, her protocol seems simple and honest, not a cloak for intrigue.

Americans are a special concern to Mongolians, because of the United States' strained relations with members of the Communist bloc. It would be shocking to the Mongolian host if any harm befell his American guest, or if his American guest were in any way offended. Our hosts therefore kept a special watch on us to make sure that no untoward incidents occurred.

Once, as we came down from the mountains, I saw three Russian fishermen wading the Tuula River carrying great quantities of fish. I went forward to photograph them. Ochirbal hurried to reach them first, saying, "In case of foreigners, we must be sure to get their consent."

He asked in Russian if their pictures might be taken.



Young virtuoso of Ulan Bator performs on a *morin khuur*, with horse-head scroll and horsehair strings.



Homemade version of Mongolia's favorite instrument enlivens an evening in a Gobi ger.

Balancing wine cups on hands and head, folk artists perform an ageless dance of courtship. Costumes copy styles of the centuries when the Manchus ruled Mongolia.

"Pictures of the fish, yes," was the reply of one of the Russians.

"Will you hold the trout while I take the picture?" I asked.

Back came a thundering "Nyel."

As I have said, Dean Conger photographed without incident members of the Chinese brigade who were doing their setting-up exercises at Arbay Heere (page 332). So when we returned from the Gobi, Mercedes thought it would be proper to take pictures of the brigade at work.

But apparently word of the picture taking had reached the Chinese top command, who alerted the workers. So, as she took a reading with the light meter and raised her camera, a Chinese supervisor rushed forward, screaming. She retreated to the hostel.

The supervisor instantly filed a complaint with our host and interpreter and demanded

surrender of the roll of film. We explained that no picture had in fact been taken. The Chinese supervisor was reluctantly convinced.

But his last words as he left were, "We grant no favors to Americans, in view of America's attitude toward our country."

Regardless of the attitude of the Chinese, Mongolia enters the modern world with, it appears to me, a keen sense of what is proper and correct in the relations between nations and people.

The only living contact Mongolia has with the United States is the Voice of America, which comes in clear and strong from Okinawa. That program, however, has no monopoly in the English-speaking community. For the English-language broadcast from Peking is also clear and strong, slanting the news to the Communist viewpoint.

A nation that a generation ago was largely

Camels, one nibbling from the creaking two-wheel cart ahead, haul winter's supply of wild hay.



illiterate now teaches all its youth to read and write. Mongolia has abandoned its ancient script for official use; it has adopted a Cyrillic alphabet of 35 letters, as compared to Russia's 33. But the oncoming generation is not cut off from Mongolian history or ancient culture. Between the ages of eight and eleven, children still study the old Mongolian script in school.

"Moment Camera" Wins Many Friends

On my earlier journeys to the rural areas of Asian nations, I had always carried gifts for villagers who extended me hospitality. I had found that a ball-point pen was much appreciated. This time, however, Dean Conger had a happier idea. We packed a Polaroid camera, a large case of film, and a strobe flash. This camera with its instant pictures produced gratifying results.

On official visits in Ulan Bator, in offices in provincial centers, in *sumas* (villages) and resthouses, along the highways, on state farms and at cooperatives, in the gers—everywhere we went, the "moment camera," as Ochirbal called it, broke down barriers and created a trail of good will.

Whenever we stopped at an ail and took one picture, the word spread. A dozen people arrived, politely asking to be photographed.

When the pictures dried, they went up in the gers with those of Lenin, the Soviet cosmonauts, and Mongol heroes. Family-group pictures were most honored of all. For Mongolians, though in midstream of the 20th century and on their way to a mechanized society, have retained the basic values of the arat under Genghis Khan. Their pride in ancestry and offspring and the love of family are as strong as their passion for independence.

Herder wanders within the confines of her cooperative. Grass covers valley and hills

PHOTOGRAPH BY JÜRGEN BIEHL © NATIONAL GEOGRAPHIC SOCIETY





They have long memories, too. China once filled Mongolia with sharp traders who outwitted the Mongolians and exploited them.

"In those days, a pound of tea cost an arat one sheep or goat," a professor in Ulan Bator told me. "Silk for a del would cost six, seven, or eight sheep or goats. After a period of years, the Chinese owned most of the livestock, and Mongolians worked for their overlords."

"What about early Russian traders?" I asked.

"Oh, they were here too. But they were not as avaricious as the Chinese."

Mongolia Broke Chinese Hold

Then I asked, "What about Chinese merchants today?" I knew that formerly the Chinese had a virtual monopoly on restaurants and shops.

"We told the Chinese restaurant owner he could not get food for his restaurant unless he joined a cooperative," the professor said. "And so the restaurants became co-op affairs."

"And the shops?" I asked.

"Same thing," was the reply. "All retail stores are state owned or outlets of co-ops."

A few Chinese teachers serve on the faculty at the university in Ulan Bator, but they teach mostly their own language. As I have said, Communist Chinese brigades are active in construction work. Peking aid built a brick and tile factory, a paper mill, a glass factory, and a woolen textile mill. Yet it appeared to me that Chinese leverage on the Mongolian economy has been largely eliminated. Mongolians—while by no means disdainful of this aid—look to Russia for guidance. A rough measure of their reliance on Soviet skills is

Factory-built gers, standing like old-fashioned beehives, lie almost within the shadow of a new flour mill in Ulan Bator. Laundry and a hide (left) dry against the canvas covers.

Hoppers drop grain, cleaned and crushed, for reduction to flour. Operator works in mill above.





PHOTOGRAPHS BY MERCEDES DOUGLAS LARSEN AND PEARL COVER © NATIONAL GEOGRAPHIC SOCIETY

seen in the statistics of students abroad. In the current academic year 1,300 are studying in Russia, while only a tenth of that number are studying in China.

One official summed it up by saying: "China has much to offer in history, literature, and linguistics. But if Mongolia is to become modernized, she must look westward."

Railroad Built With Russian Aid

The connection with Russia is evident in intangibles. Some of the top officials in Ulan Bator have Russian wives. Prime Minister Yumzhagin Tsendenbal heads the list.

There has been no reluctance on Russia's side. She has shown eagerness to participate in every field. Russian engineers arrived in great numbers with blueprints for factories, plants, and cities. After World War II they built the diesel-equipped railroad that runs from Irkutsk to Peking (map, pages 294-5). This road, Russia's vital link with China, is Mongolia's gold mine.

On the railroad, as well as on the many industrial projects, Mongolians supplied the labor force, and Russians furnished the supervisors. But today the railroad is wholly Mongol staffed.

Russia provided Mongolia with an airline and trained her pilots. She also developed new food supplies, such as rabbits, pigs, and chickens.

Pigs did not have much place in Mongolia's old nomadic economy. With the arrival of state farms and sedentary farmers, piggeries have flourished; we saw quite a few of them. Chickens also were not raised by Mongolians before 1921. Now chicken farms are numerous.

Mongolia's clear rivers and lakes were always full of fish, but historically the Mongol was not a fisherman. Today a thriving fishing industry has been started (page 328), and Mongolia exports large quantities to Russia every year.

Mongolia's first engineers and machinists, her first physicists and chemists, were Moscow trained. Russia established the institutes where mechanics and technicians are taught their skills. She trained the laboratory workers, the linguists, philologists, botanists, doctors, and teachers.

Soviet experts helped to design the schools, the nurseries, the kindergartens, where children see many picture stories, including some that call to mind our own. One, for example, concerns four little goats and a wily wolf who huffed and puffed trying to blow their house down, but who did not succeed.

Most Machinery Is of Soviet Make

Specialists from the U.S.S.R. helped establish pioneer camps for children, state farms, cooperatives, ballet companies, opera companies, teachers colleges. Russian machinery and gadgets are everywhere—from elevators to bathroom equipment, from trucks to heavy machinery.

British machines have been used to equip a textile mill (page 332). Czechoslovakia built a tannery and a shoe factory. Other Eastern European countries have managed a few projects. But the imprint on factories, schools, and farms is primarily that of Mongolia's northern neighbor.

Only in government did we see no evidence of present-day Russian participation.

"Is Russian aid in the form of loans or grants?" I would ask officials of government departments.

"Always loans," was the reply.

"Is interest charged?"

"Yes, normally 2½ percent."

"Is Russia a severe creditor?"

"She often waives all interest. She has even turned a loan into a grant."

Sukhe Bator, who sparked the 1921 revolution, died in 1923 at the age of 30. Mongolians say he was poisoned by a doctor sent to care for him by the Supreme Lama, who then

had political as well as ecclesiastical power.

It was Sukhe Bator who in 1920 rode north to Russia with a secret message concealed in the handle of his whip. The message was a plea to Lenin for help.

Mongolia's political structure follows the Soviet pattern. There is but one party—the Mongolian People's Revolutionary Party—and it carries the Communist imprint. Party membership is small: Only 50,000 out of 1,000,000 Mongolians belong.

Classes in Marxism and Leninism are required in schools. There is some censorship



of mail; it is so heavy-handed that some people complain.

Authors are organized into a union, most of them giving only part time to writing. The writers' union decides what fields should be explored, what books prepared, and edits the finished product. Then it goes to the censor. If he rejects it, the union once more goes over it. Ts. Damdinsuren, Mongolia's most eminent living writer (page 304), whose novel *Woman Rejected* is now being produced as a movie in Ulan Bator, insisted that the union has the final say, even against the censor.

How doctrinaire the party members are is difficult to determine, unless one is in residence for months on end. Some I met blazed with indignation once a Marxist principle was challenged. Most are less committed.

No group placed a Marxist roadblock across our conversation, as is done in Russia, though we often stirred the coals of controversy. My statement, made again and again, that Karl Marx could not possibly have written *Das Kapital* if he had lived in the United States in the mid-20th century, was met with interest, not antagonism. The capitalism about which Marx wrote, I told them, was as long buried as their ancient capital, Karakorum.

Freedom of Spirit Urged in Speech

Once, at a dinner tendered by the Mongolian Bar Association, I was asked to state my views of Mongolia's progress. I answered that progress could not be determined merely by the amount of food production, factories, hospitals, and doctors—important as they were. Progress, I said, could be judged only by taking into account the spiritual values.

"I would judge a society by a poet's standard," I said. "Is the mind free? Is it allowed to explore all horizons? Or does some official say, 'This you shall not believe, that you shall not publish?'"

No torrent of denunciation descended on me, as it has on similar occasions in Russia. These people still appear to have open minds.

Yet the Mongolians are so far removed from Western culture, so distant from the influences of Judeo-Christian civilization, so unaware of the West's great books and humane letters, that if they long remain in an isolated pocket between the Soviet Union and China, they may evolve into ideological puppets.

If that should happen, it would be a tragedy, not only for a warm and stouthearted people but for the free world.

Justice Douglas Expounds Freedom to a Socialist Student Audience

Invited by the University of Mongolia at Ulan Bator, the author stands at the lectern and explains the ideals of the West. Marx, Engels, Lenin, and Stalin appear in one frame as if the four were contemporaries. Marshal Choibalsan, Prime Minister of the Mongolian People's Republic from 1939 to 1952, is portrayed above the door. Mrs. Douglas stands among the officials at left.



REARRANGED BY DEAN CONGER © R.S.S.



Whale by the tail! Noosing a nine-foot beluga, the author in a diver's foam-rubber "wet suit" wrestles his catch in the chill, murky waters of Kvichak Bay, Alaska. Using a strap, he holds the animal's tail out of water, making it virtually helpless.

Three Whales That Flew

By CARLETON RAY, Ph.D.

Associate Curator, New York Aquarium, New York Zoological Society

Photographs by W. ROBERT MOORE, National Geographic Staff

THE OLD WHALING CAPTAINS of New England would have thought ours one of the oddest expeditions ever to set out in quest of whales. Instead of harpoons we had nylon nets and hypodermic needles; instead of flensing knives we carried vitamin pills and whale eye lotion; in place of blubber vats we took foam-rubber mattresses.

Yet in the end we were going to do something that would have astonished Captain Ahab, Moby Dick's adversary. We, too, were after a white whale—but not a sperm whale, and we didn't want its oil. We wanted the whole whale alive. And when we got him—or them, for we needed three—we were to fly them, still alive, 3,700 miles from Alaska to New York, where we hoped they would live happily ever after.

Why did we want white whales in the first place? Oddly enough, the answer lies 200 feet directly beneath Coney Island—in the form of cold, subterranean sea water. It is this water, with a constant temperature of 53° F., that supplies the wells and tanks of the New York Aquarium and helps to make it one of the finest showplaces of live arctic marine mammals in the world.

Being arctic creatures, white whales, or belugas, had long headed our "Wanted" list. So when Director Christopher W. Coates of the Aquarium received an offer of help and advice on catching belugas, he asked





me to lead an expedition to capture three of them. The offer came from James Brooks of the Alaska Department of Fish and Game.

Among whales, the beluga (*Delphinapterus leucas*) is something of a pygmy.* Five to six feet long at birth, even adult bulls rarely exceed 16 feet in length.

Belugas change color from a dark gray at birth to ivory when full grown, with dark borders only on the flippers and tail. The term "beluga," in fact, derives from the Russian word meaning "whitish." Early fishermen may have confused the mammal with the huge white river sturgeon of northern waters.

Belugas have another peculiarity — a supple neck. In most other cetaceans the seven neck vertebrae are fused as a single bone. In belugas these are separate, which helps to give the animal a maneuverability that any whale hunter can attest to.

Still another striking feature among whales is the beluga's docility. Although it has powerful flukes and a set of very serviceable teeth, it displays none of the aggressiveness of the sperm and killer whales. It can even be trained,

we now know, to eat gently from a keeper's hand, much in the manner of a porpoise.

A creature of the arctic and subarctic, the beluga roams such northern waters as the Arctic Ocean, Davis Strait and Hudson Bay on the Atlantic side, and the Sea of Okhotsk and Bering Sea on the Pacific. Eskimos and European fishermen still hunt it for its soft hide (sometimes sold by dealers as "porpoise leather"), for blubber and meat, and for oil.

The beluga is primarily a fish-eater, following such prey as smelt and salmon up rivers where they go to spawn. It also feeds on squid, shrimp, and other invertebrates.

"Sea Canary" Whistles as It Swims

There is evidence that the beluga, like porpoises — and, in a sense, like bats — may have its own sonar system for navigation and hunting. While traveling submerged, it frequently emits a series of squeaks, squawks, and whistles from its blowhole. Some of these sounds are audible, and others are of such high fre-

* See "Whales, Giants of the Sea," by Remington Kellogg, NATIONAL GEOGRAPHIC, January, 1941.



EDERICHORSE © NATIONAL GEOGRAPHIC SOCIETY

Spray-drenched helmsman Alex Tallekpalek smiles his pride at boating two white whales in a day. Many Eskimos hunt the beluga for oil, leather, and meat.



Hunters chase a whale in Halfmoon Bay. Slaps of the oar against the water startle the



Success! Author Ray leaps overboard to tail-strap a young whale enmeshed in the net. The beluga is a warm-blooded, air-breathing mammal. It can survive out of water for a day or two, provided its skin remains wet and it lies on soft bedding. At maturity it may weigh more than a ton and reach a length of 16 feet. Dr. Ray's Alaskan expedition captured three white whales for exhibit at the New York Aquarium, marine showplace of the New York Zoological Society (page 357).



animal and help to drive it into the shallows. Here the beluga breaches briefly. When it submerges,

the peaked bow wave and tail ripples enable pursuers to follow its course beneath the surface.

quency that the human ear cannot detect them. The audible sounds have earned the beluga its nickname, "sea canary."

The theory runs that waves from these sounds bounce back from small fish in the beluga's path and that auditory organs pick up the echo and lead the foraging whale to its dinner.

Whatever the truth, I have seen belugas—all the while whistling and squeaking—stalk and catch darting fish in the Aquarium without ever using their eyes (page 356).

Weight Imperils Whales out of Water

More than one aquarium before us had brought belugas back alive, but the difficulties are enormous. I myself had taken part in two expeditions, and I knew some of the problems.

Belugas, like all other whales, are air-breathing mammals, and they will drown if kept too long under water. On the other hand, they cannot survive more than a day or two

out of water either, for their own great bulk presses down on the lungs and they suffocate. There are other dangers, too, in shipping belugas, including heat exhaustion, damage to the soft hide or the eyes, and rapid temperature changes that bring on pneumonia.

All these things we had provided for as best we could when we set out by air from New York for the Bristol Bay region of Alaska. First, we had arranged for a converted B-17 bomber from World War II to be waiting for us at the town of King Salmon, Alaska, when the time came to fly the whales back.

With us we had eye ointments and antibiotics to combat infection, foam-rubber mattresses to support our live cargo on the return flight, some oversized hospital stretchers for the loading and unloading, and 25 yards of muslin to cover the whales' backs and keep them wet and cool in transit, so that the hide would not crack.

As a final measure on the flight home, we planned to keep the whales in padded and





Ponderous Bertha slides down a board, tumbling men like terpins. Foam-rubber mattresses cushion her.

Harnessing a whale, Dr. Ray (in water) and Charles F. Wilson strap its thrashing tail. Charles Young (in bow) holds the beluga's blowhole above water lest it drown.

Coverlet of wet muslin prevents the whale's skin from drying during the trip ashore. To calm the animal, Dr. Ray petted her with gentle, soothing strokes, as he would a colt. She made no effort to bite.





plastic-lined wooden tanks partly filled with water, so that they would not suffocate from their own great weight.

Four members of our expedition were as ready as whale hunters could be: Charles Young, the Aquarium's senior tankman; W. Robert Moore of the National Geographic Society; Seward Johnson of Princeton, New Jersey; and I. Now all we had to do was find and catch the whales. For that we needed Charlie Wilson.

Wilson is a wizard with small boats, and he is the only man I know with skill enough to net a beluga almost every time it comes within casting range. Wilson and I had worked together on my two previous Alaska expeditions, and the Alaska Department of Fish and Game had arranged for him to help us again. We met him at the town of Levelock after a day's stopover in Anchorage.

I told Wilson that I hoped for three belugas, as insurance against mishaps on the flight back to New York. How long did he think it would take us to get them?

Wilson frowned. "Not too long, I guess," he said. "Maybe three good days."

I asked how the weather had been.

"We've had only two stretches of good weather, about a day each, all summer long."

Our hunting ground would be the Kvichak

River and Bay, at the head of Bristol Bay on Alaska's southwest coast. Belugas swim up the Kvichak on its 13- to 24-foot flood tides—among the highest in the world—to feed on the salmon, smelt, and herring.

Traveling upstream, the whales follow the channels, but on the ebb they drift down close inshore. It was then that we hoped to spot them, driving them into the shallows and trapping them with large salmon nets. We had two outboard-powered skiffs to use as chase boats, just as the old whalers used their whaleboats for close-quarter work. The only difference was in the weapons: We carried nets instead of harpoons.

High Hopes and Deep Mud

When we set out in Wilson's 32-foot fishing boat *Ann* for our base at Copenhagen Creek, a tributary of the Kvichak, we ran into a third stretch of good weather. Across the sunlit sky, jaegers, gulls, and terns darted.

Our hopes were high as we pulled up to the old riverbank cabin we had used on the earlier expeditions. Luckily it was still usable, and we found a temporary home for any belugas we might catch—a fresh-water pond cupped in the tundra nearby.

As we neared the bank, Young jumped ashore—and immediately began to sink.



EDDIE HOBBS (2) NATIONAL GEOGRAPHIC SOCIETY

Hip-boot brigade drags an 800-pound female named Charlie on a plywood sled. It took an hour of backbreaking labor to move her 300 yards to a holding pond in the tundra (above).

Flukes flap wildly as Dr. Ray tightens the tail strap on a netted whale in the holding pond. This fresh-water lake kept belugas alive until a plane arrived, but meant that they had to be caught twice—at sea and later in the pond.

New York-bound Bertha, lifted from the pond, lies on her stretcher, as docile as a lamb.

353





"Help!" he yelled. "I never saw mud like this!"

Stepping more gingerly, and with the help of Wilson and his Eskimo friend Alex Tallekpalek (page 348), we unloaded our gear into the cabin. We soon had a fire going in the stove. After supper we held a strategy session.

"It's no good hunting on windy days," Wilson began, and I had to agree. The Kvichak River is thick with sediment, and the only way to spot a whale in such water is by the animal's bow wave, by its tail puddles—the small eddies it leaves behind—or by its breaching for air.

Given a calm day and contact with a pod of belugas, our plan was simple. Keeping always to the deepwater side of the whales, we would use the skiffs to drive them toward the shallows, cutting out the beluga we wanted. Then we would rev the engine to frighten the whale toward shore. There, cornered in a few feet of water, it would give us a chance to use our nets.

Not every beluga would do. We must look for light-gray ones, the immature calves not yet turned white, for they would be of the size we could handle and would best survive the long flight to New York.

Marine Acrobat Dodges Capture

The first day of hunting we got a demonstration of the beluga's talent for quick maneuvering. Just outside Copenhagen Creek, we sighted what looked, from the light-gray color, like a two-year-old.

Keeping it always to landward, we worked our way closer and closer to the flats. We kept revving the engine and slapping the water with oars in an attempt to frighten the beluga into a manageable depth.

The only trouble was it wouldn't frighten! Blithely it ignored the skiffs, swimming slowly on down the channel. Nothing we did would make it head into the shallows.

At last, as though tired of the game, it made a tight turn, sounded, and vanished.

Young was dumbfounded. "They sure can disappear," he said. His words were prophetic, for during the next days the few belugas we saw pulled similar stunts on us.

The weather constantly took a hand—against us. The wind rose every afternoon, cutting short our precious hunting hours. Then we could only roam the beach and tundra, searching for tusks of prehistoric mammoths, or gathering ripe salmonberries. The latter we either ate on the spot or took home for *agooduk*, an Eskimo delicacy of berries mixed with sugar and lard that Alex and Wilson showed us how to make.

Except for whales, there was no shortage of wildlife. Sandpipers, cranes, gulls, geese, and teals filled the skies and marshes around the cabin. Occasionally we saw porcupines, and often there were signs of bears, moose, and wolves. But we had come for belugas, and the season was running out.

Man vs. 800 Pounds of Whale

The day arrived at last when our luck changed. Dawn broke cloudy and drear, with the wind steady out of the northeast. Hardly perfect weather, but ever-ebullient Alex Tallekpalek was somehow confident. "We'll catch one today," he sang, to an improvised tune.

Hoping he was right, we set out and cruised all morning without seeing a whale. Then, just as we started back, we sighted a dozen adults. Scanning the pod, we spotted a light-gray shape among the white ones.

"Keep your eyes on them!" Wilson shouted, and the chase was on.

Wilson steered the lead skiff, and he took no chances. Herding the beluga gradually toward the shallows, he kept a sharp eye out for an end run by the whale. Slowly the depth dwindled—seven feet . . . six . . . five . . . four . . . It was here that the very first beluga had turned and bolted under the skiff. Would this one stand its ground? It did. Finally, after endless maneuvering, there was our beluga, in three feet of water.

Flying Whales, Partly Afloat in Cushioned Boxes, Ride a B-17 to New York

"Take-off from King Salmon, Alaska, started a sleepless 24-hour vigil," recalls the author. Belugas lay with heads under water in half-filled tanks that kept them semibuoyant and prevented suffocation from their own weight. But the water covered the blowholes, so whale-sitters constantly checked to make sure the animals raised their heads above water to breathe. All efforts to prop heads on pillows proved fruitless.

Here Dr. Ray douses Alex with water. The young 450-pound male scarcely stopped swimming all the way home. He cried as plaintively as a baby; occasionally all three whales blended squeaky voices in a choruslike sound that suggested communication.

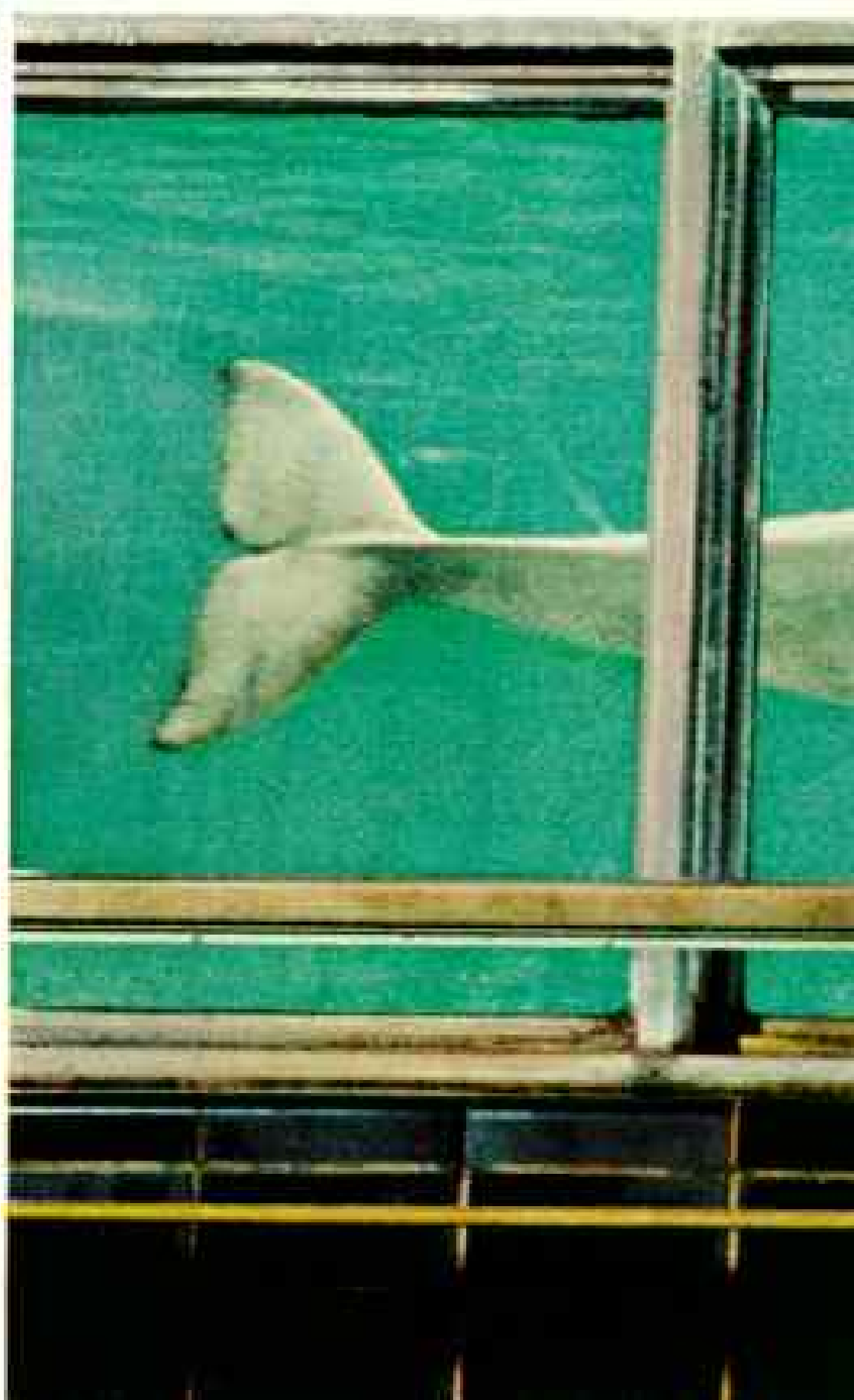
Beluga homes in on a killifish, though the morsel lies outside its range of vision. Scientists speculate that belugas, like porpoises, may possess a remarkable sonar ability. When swimming under water, the whale emits high-pitched squeaks and whistles from its blowhole. Waves from these sounds may bounce back from small fish in the animal's path and enable it to find and catch darting prey in murky Alaskan waters.

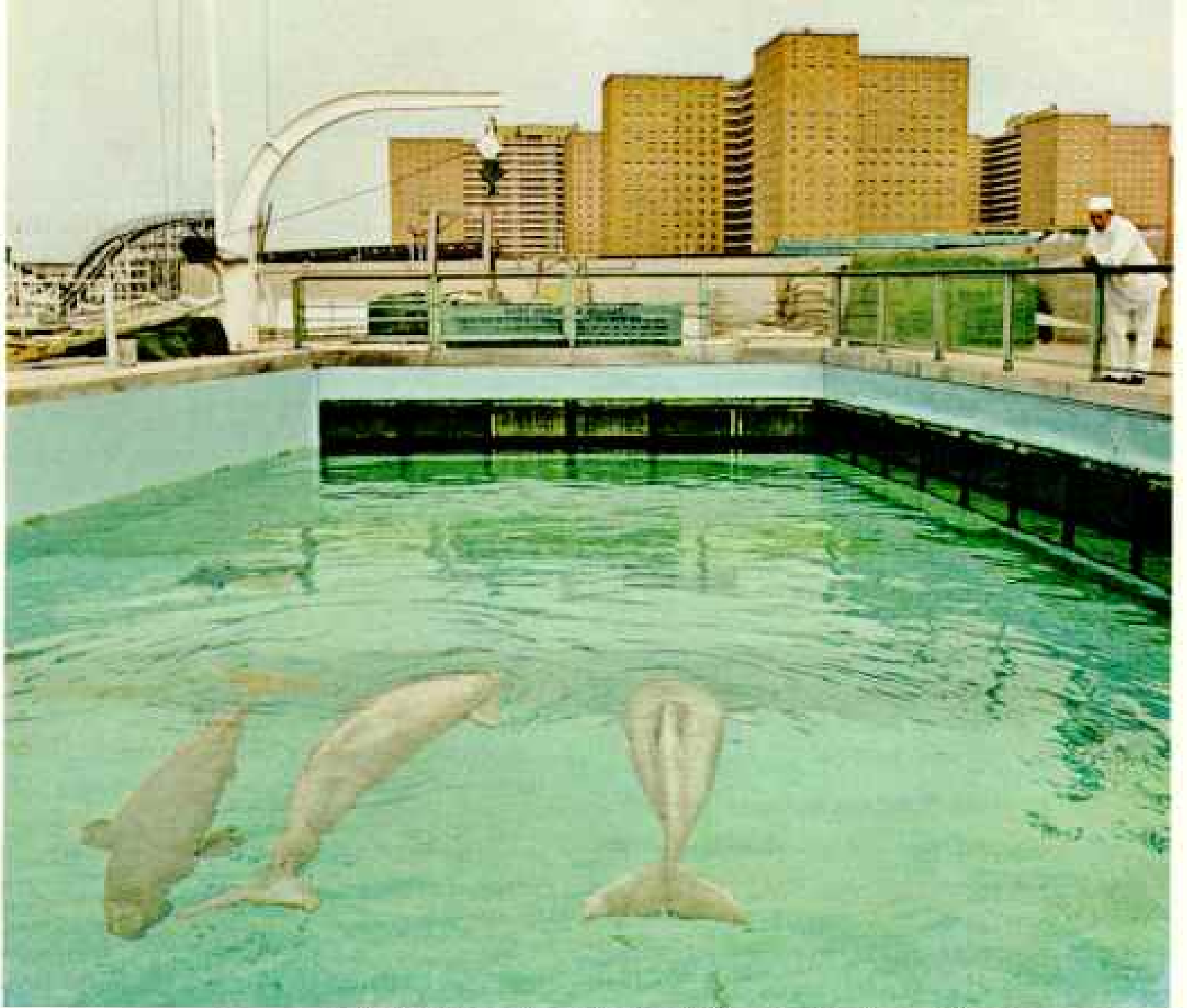


Wide eyes mirror the fascination of a four-year-old Aquarium visitor seeing his first whale.

Gray-skinned adolescent, nine feet of supple softness, can turn around in less space than its body length, and even swim backward. The three belugas have adjusted to clear water, glass walls, and admiring crowds.

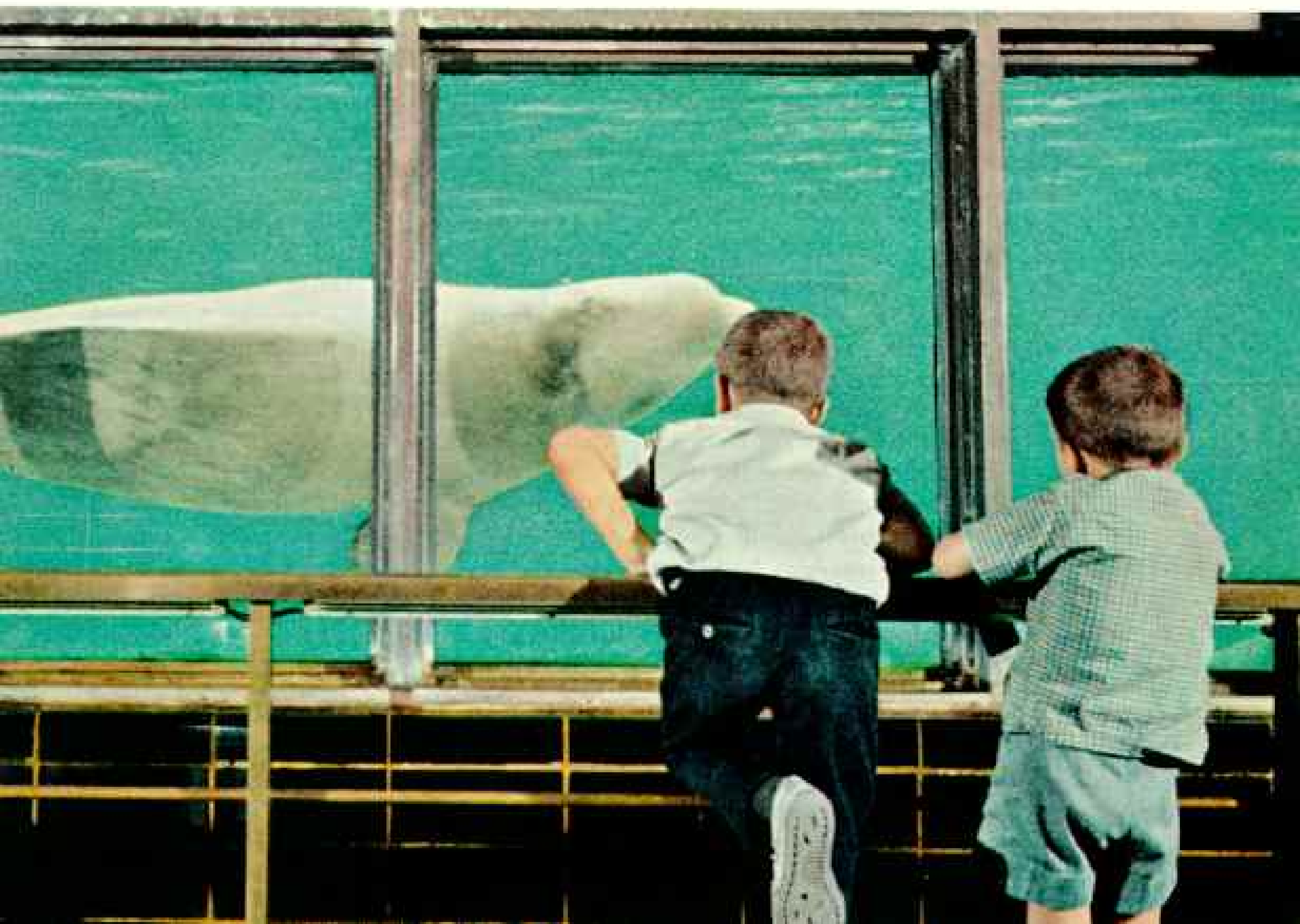
Soon after the whales' arrival last August, custodians injected doses of liver extract, and the captives began eating heartily. Now stewards stuff vitamin pills into the animals' food fish.





EDUCATIONAL PURPOSES AND NO EXTRA CHARGES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER WINFIELD PARRETT © N.G.S.

Transplanted Alaskans, Alex, Charlie, and Bertha laze at the New York Aquarium, Coney Island



"Now," Wilson nodded, and gunning the engine, paid out the net as he circled the calf.

Everything happened fast then. Wearing a diver's "wet suit," I jumped overboard and joined the beluga in the net. I grabbed for the flailing tail and managed to get a strap around it (page 346). Young joined me in the water, clothes and all, and we got another strap around the flippers. I was amazed again that belugas never seem to bite at such moments, but soon give up once the straps are on.

Alex brought the large skiff up and we rigged a makeshift gangplank of plywood (page 347). We hoisted and shoved the catch aboard and padded it with pillows. It was a fine specimen, a female nine and a half feet long and weighing perhaps 800 pounds.

We had our first beluga!

Sled Ride to Captivity

We made for the holding pond then. The tide had dropped, leaving 300 yards of mud flat between pond and river. There was nothing to do but carry the beluga — by now named "Charlie" in Wilson's honor, despite her feminine gender.

Transferring Charlie to a stretcher, we took our positions at the handles and heaved. The whale hardly budged. I looked up, and there we all stood, driven into the mud by the weight, as though cut off above the ankles!

Finally we shifted Charlie to an improvised sled of plywood and dragged her to the pond (page 352). There, after a few thrashes, she contentedly settled down to swimming in leisurely circles.

Now came the critical part of our hunt. It would take Charlie time to get used to eating in captivity. The longer she remained in the fresh-water pond, the thinner she would become. We had to get our other two belugas as fast as possible.

But the wind blew, and for a week we were shorebound. To make matters worse, the B-17 had arrived at King Salmon and was waiting.

The break came one noon while I was warming soup on the stove. Alex had been standing whale lookout on the roof, and he suddenly hurried down.

"Whales coming downriver!" he yelled. "Looks like a couple of dozen."

Within minutes we were off, the two skiffs slipping cautiously out of the creek.

Considering our past troubles and failures, it was almost too simple. Less than a mile from the cabin we spotted a light-gray beluga

and began to trail it. When we caught up with it near shore, it cooperated beautifully and made for the shallows. There was no fuss as the net swept around it, and I went over the side again. In what seemed no time at all, 9-foot-2-inch-long "Bertha" — named in honor of Wilson's wife — had joined Charlie in the holding pond. Two down, one to go.

Luck is a strange thing. When it's against you, nothing seems to go right. When it's with you, one can do no wrong.

No sooner was Bertha captured than a friend of Wilson's, bush pilot Guy Groat, paid us a visit in his small float plane. He had seen a pod of belugas downriver and offered to be our aerial spotter.

Once more we pushed off in the skiffs, our eyes glued to Groat's little plane aloft. Fifteen miles downriver it began to circle ahead of us.

"There they are," Wilson pointed. Before us a big herd appeared, a hundred glistening white backs and feathery spouts showing above the gray water.

We spotted a yearling calf with its mother and started driving it toward shore. The cow would not be separated from her offspring, even when the pair reached two and a half feet of water. There was only one thing to do: Net them both.

Baby Whale Squeals on Capture

Again Wilson's touch with the net was perfect, and I found myself in the ring with not one, but two belugas. I went for the calf and we hoisted it aboard. It was our first male, and it measured just over seven feet. It seemed in good shape — fat, active, and vocal.

Yes, vocal. Once aboard, it began making a variety of noises ranging from loud squawks and mellow whistles to high, plaintive squeals. From the movement of its blowhole, we knew it was making other sounds so high we could not hear them.

We tried desperately to get the 1,600-pound mother into the skiff with her calf, for we did not want to separate the two. It was no use, and we had to let her go. Reluctantly we slipped the strap and watched her swim off toward the herd through only 18 inches of water.

By late afternoon Charlie, Bertha, and "Alex," the young male, swam lazily in the pond. We had our three belugas. Now all we had to do was transport them alive and unharmed some 3,700 miles by stretcher, skiff, fishing boat, and converted bomber to the

waiting tank in New York. Here was our second major challenge.

How we got a ton of live belugas aboard *Ann* and moved the 25 miles to the U.S. air base at King Salmon would be a story in itself. But the moment came when a score of ready hands lifted our three strapped and padded prizes through the hatch of the waiting B-17 and into the half-filled wooden water tanks.

A hurried long-distance call to Director Coates at the Aquarium in New York gave him our arrival time. Then we followed our precious cargo into the plane. A wave to Charlie Wilson, and we were off.

Few things for me will ever match the strain of those hours with our airborne belugas (page 354). The young male must have thought he was back in the river, for he never stopped swimming in his box the whole flight. He called continually, and the others would answer, all three occasionally joining in a whistling, squeaking chorus.

We weren't worried about Alex. He was small and seemed to travel well. But Charlie had lost weight, and Bertha seemed lethargic. Seward Johnson, Young, and I took turns watching to see that they lifted their heads out of water regularly to breathe and that their blowholes remained clear. Except for the squeaking and an occasional wriggle, they gave few signs of life. We never closed our eyes during the whole 24-hour flight.

Somehow we all survived, and late one Sunday last August we landed at Idlewild. The Aquarium's truck backed up to the B-17's hatch. Shortly after midnight, we slipped Charlie, Bertha, and Alex into our big oceanic tank, and the expedition was over.

In the months since then, our trio of star



AN EXTERIOR BY NATURAL GEOGRAPHIC PHOTOGRAPHER WILFELD PAPP © N.G.S.

Rubber-tipped window squeegee makes a squeaking noise. Curious Bertha swims over to investigate what the keeper is doing.

attractions has delighted visitors to the Aquarium (pages 356-7).

We still have one problem to solve—the problem of diet. Far from languishing and refusing to eat, our three belugas insisted at first on quantities of live fish. Later they graduated to frozen killifish. Eventually we hope to wean them to more plebeian fare, perhaps dead mackerel or herring.

One hope we all share at the Aquarium—that Charlie, Bertha, and Alex will be with us long enough to turn white with age.

Touring the Nation's Historic Shrines

NOW READY: A COMPANION TO *AMERICA'S WONDERLANDS*

EVER SINCE the National Geographic Society published *America's Wonderlands* two and a half years ago, the Society's Book Service has been engaged in an even more ambitious project.

Wonderlands presented the beautiful face of the Nation as revealed in its scenic national parks and monuments.

How appropriate it would be, we thought, to create a companion volume that would catch the spirit of the Nation by telling the story of the United States in terms of the places where great events occurred. It could link American history and geography as never before.

Such a book would capture the meaning and character of America and remind our people of their heritage in these times when the mettle of lovers of liberty is once again being sorely tried. To other nations it would

convey a better understanding of our national purpose and the fiber of our people.

Now at last we can announce the result of our efforts: *America's Historylands, Landmarks of Liberty*, a big book of 576 pages with 192 paintings and drawings, 38 maps, 382 color photographs, and the vivid words of an array of writers headed by poet-historian Carl Sandburg.

Mr. Sandburg contributes the keynote chapter, and after seeing the volume in proof he declared, "There has never been a book like it. It is gorgeous and richly educational with color photographs having historical value."

In a hushed marble hall in the Nation's Capital we regard the rugged countenance of Abraham Lincoln. Amid the colonial splendor of restored Williamsburg, Virginia, we walk with Patrick Henry and George Mason,



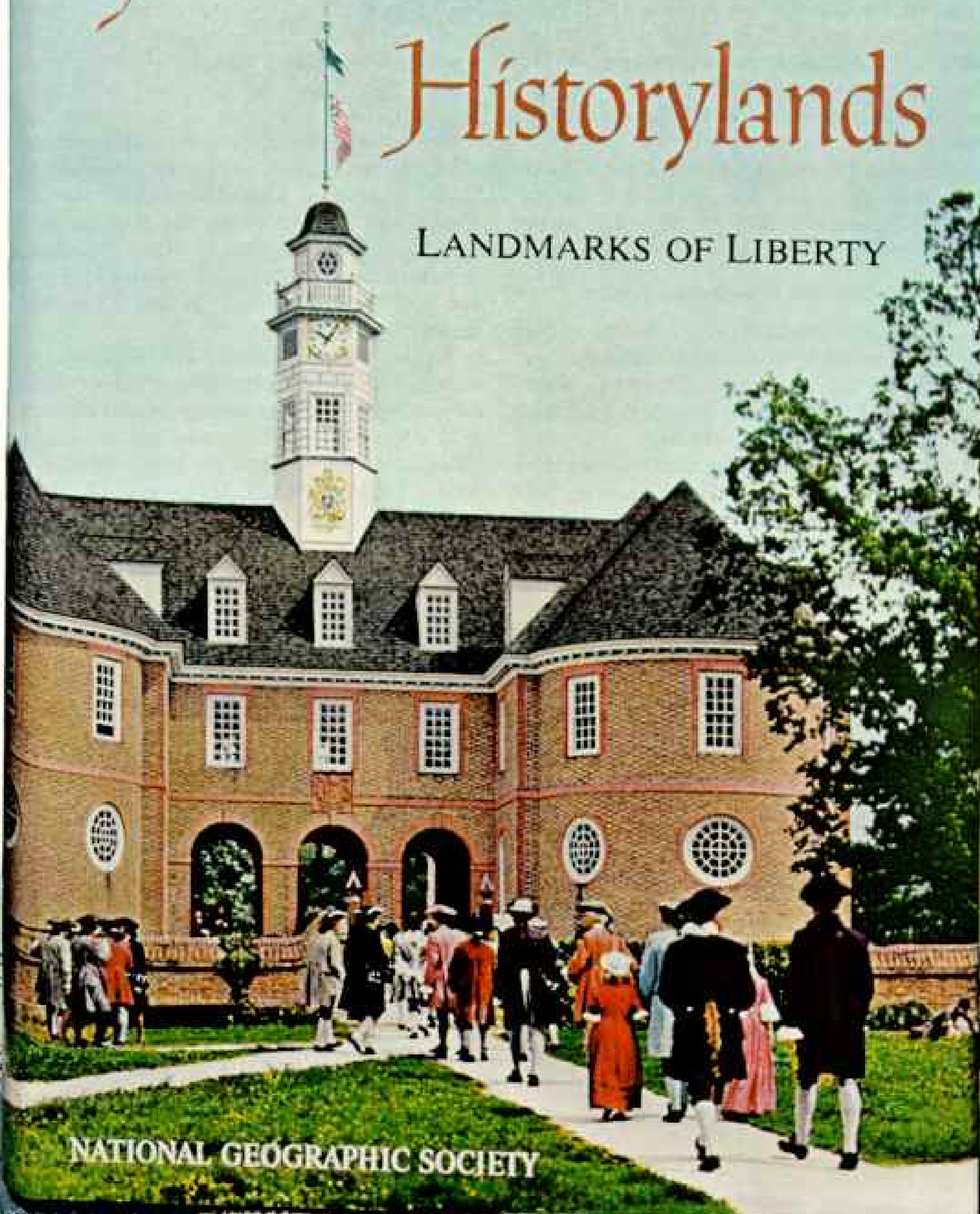
Lincoln Memorial in Washington, D. C., drew three million visitors in 1961.

Williamsburg's capitol, symbol of Virginia's colonial heritage, dresses the jacket of *America's Historylands*, a companion volume to the Society's popular *America's Wonderlands*.



America's Historylands

LANDMARKS OF LIBERTY



NATIONAL GEOGRAPHIC SOCIETY

America's Wonderlands

NATIONAL
GEOGRAPHIC
SOCIETY

who sowed the seeds of America's cherished freedom.

This unique book takes its readers to the places where history happened. Every page brings the past to life with historic scenes we can see for ourselves on our next vacation.

The Jamestown settler, the Minuteman, the Alamo defender, the Oregon pioneer, the sodbuster's wife on the lonely plain, the immigrant family glimpsing the Statue of Liberty—all these are our forefathers, yours and mine. Their story and the landmarks they left are the book's enthralling theme.

Exciting to read, it tells the story of America from close up—the Revolution, for example, not merely as dry facts and dates but as if seen by a Colonial who fought in it.

Pathfinders Who Built a Nation

"We follow explorers and colonists as they secure footholds on a virgin continent," explains the introduction by Conrad L. Wirth, Director of the National Park Service, which cares for many of these shrines.

"Always we picture the land through their eyes. We pioneer where they pioneered, fight beside them where they fought, triumph where they triumphed. Finally we stand with

our own contemporaries and face the limitless challenge of the Space Age."

For *America's Historylands* the National Geographic Book Service staff, under its able chief, Merle Severy, has distilled the essence of diaries, explorers' journals, and biographies. Editors did not overlook the small, intimate touches: that George Washington's false teeth sometimes locked in the middle of a speech; or that Ben Franklin, who counseled "early to bed and early to rise," habitually stayed up late.

Ten noted American writers and historians interpret this pageant of the past—Spaniards at St. Augustine; Englishmen at Plymouth; Dutch and Swedes along the Hudson and Delaware; lonely settlers in North Carolina, described in 1666 as an ideal marriage ground for "any Maid... if they be but Civil, and under 50 years of Age."

Writer-historian Donald Barr Chidsey recreates the world of the New England militiamen who fought at Lexington and Bunker Hill. Dramatic paintings and picture maps reconstruct the struggle for independence—Valley Forge, Saratoga, Yorktown.

The Civil War blazes across 57 pages of the book, from the first storm clouds over

Junior gunslinger rides a toy stagecoach. Frontier museum in Custer State Park, South Dakota, brings the Wild West to life again.

WATER LITTLEHALL © 1962





"OKLAHOMA RUSH" BY ROBERT W. LYNDERG, UNIVERSITY OF OKLAHOMA © ILL. S.

Pandemonium on the plains. When Indian lands in Oklahoma were thrown open in 1889, thousands staked claims in a day. *America's Historylands* recounts the saga of the sodbusters who defied droughts, blizzards, and hostile Indians to till the prairie.

slavery to the death struggle in Virginia. After Appomattox, the scene shifts to the lusty West—to hawling longhorns and the Pony Express, the discovery of gold at Sutter's Mill and the rush to San Francisco, Tombstone, and Deadwood.

Stewart Holbrook spotlights the men who sparked America's gigantic industries: William "Crazy" Kelly, the Kentucky kettlemaker who first turned dull iron ore into bright steel by blowing cold air into the molten mass in a furnace; Edwin L. Drake, who drilled the world's first productive oil well, at Titusville, Pennsylvania; the brawny brawlers of the logging camps. Readers behold the laboratories of Edison and Bell, Ford's Greenfield

Village, and atomic research at Oak Ridge.

Chances are that a day's drive will bring you to one or many of the fascinating places that spring to life in *America's Historylands*. To help you plan your trip, the book includes an invaluable supplement—a newly revised historical wall map of the United States, with 912 explanatory notes.

America's Historylands offers rich rewards: For children, a new and livelier appreciation of history and geography—perhaps better marks in school. For every American, a new identification with men and events that made the Nation great. For others, a new understanding of the United States of America and the ideals for which it stands.

America's Historylands, Landmarks of Liberty—the biggest, most ambitious volume the Society has produced. To ensure a first-edition copy, order promptly from National Geographic Society, Dept. 98, Washington 6, D. C., requesting later billing if desired. 576 pages, 676 illustrations, 463 in color. Gold-lettered, buckram-and-linen-bound in two-toned brown. \$11.95 per copy, postpaid.



At its sea gate the Hudson (left) meets the East River;

Henry Hudson's River

THE U.S. COAST GUARD patrol boat danced under my feet at every Atlantic swell, brushing the lightship now and again with a discouraging crunch. My timing, the sound suggested, had better be exact. I swallowed my reluctance, chose the moment, and leaped for the Jacob's ladder.

A ponderous vise of steel plates ground

By WILLARD PRICE



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its valley and harbor mouth channel the commerce that raised Manhattan's towers

shut inches beneath my heels as I scrambled aboard Ambrose Channel Lightship. Chief Boatswain Max Trepeta, in command, apparently did not notice a tremor in my knees.

"Glad you came on a good day," he said cheerily. "In bad weather, you know, getting aboard can be a little tricky!"

Open ocean stretched away from us to the horizon. This gently heaving vessel, anchored

some 10 miles offshore to mark the sea approach to the Port of New York, suddenly seemed an odd place to begin a tour of one of America's most vital and colorful rivers, the history-steeped Hudson.

But I had decided that we should explore this river as Henry Hudson did more than 350 years before—we would begin at its seaward end. Mr. Trepeta agreed.

Photographs by WAYNE MILLER, Magnum



Evening exodus empties Manhattan of the multitude of suburbanites who work in the city. Trains traversing the Hudson's water-level route siphon off thousands of northbound commuters. Since the mid-1800's the rails that line the riverbanks have greatly augmented the flow of passengers and freight up and down the natural artery. These commuters pause at Tarrytown.

Flanked by funnels, the Statue of Liberty seems to ride the superstructure of the *Queen Elizabeth*. Pictured from Governors Island, the vessel streams past Liberty Island toward her Hudson River berth. World's largest liner, the 83,673-ton *Elizabeth* stretches 1,031 feet — seven times longer than the statue is tall. The new *France* is four feet longer but registers only 66,000 tons.



Haze shrouds the lofty spires and busy docks of Manhattan as seen from Jersey City, New Jersey, across the Hudson. New York Harbor, at the river's mouth, handles one ship every 20 minutes. Tugs assist liners, push barges, and tow garbage scows to ocean dumps. The Hudson flows 315 miles to the sea from its source in a wilderness pond.



"Ambrose is the first major light met by ships coming in to New York Harbor," he said. "They can't see it, of course, but the Hudson Valley is right down there on the bottom."

He led me to the bridge and spread out a navigation chart showing depths and contours.

There it was, the sharply defined Hudson Channel, carved ages ago by the river through what is now submerged continental shelf. The gorge scars the sea floor for more than 100 miles into the Atlantic. In places it is two miles wide and 120 feet deep, beneath as much as 400 feet of rolling ocean (diagram, next page).

Up the Hudson From Sea to Source

During the next four months my wife Mary and I were to fulfill an old dream: to follow the 315-mile length of the river that had carved this canyon. Tugboat, barge, paddle-wheel steamer, auto, plane, and canoe would carry us from the fabulous towers of Manhattan, past grand castles of another day, through moody, legend-pervaded Highlands, to Adirondack wilds and a high, gemlike tarn named Lake Tear of the Clouds.*

But first, there was Ambrose Light. We climbed the curious tripod foremast to the platform and looked in at the great lamp.

"Two and a half million candlepower," said Chief Boatswain Trepeta. "Visible for 13 miles at this elevation."

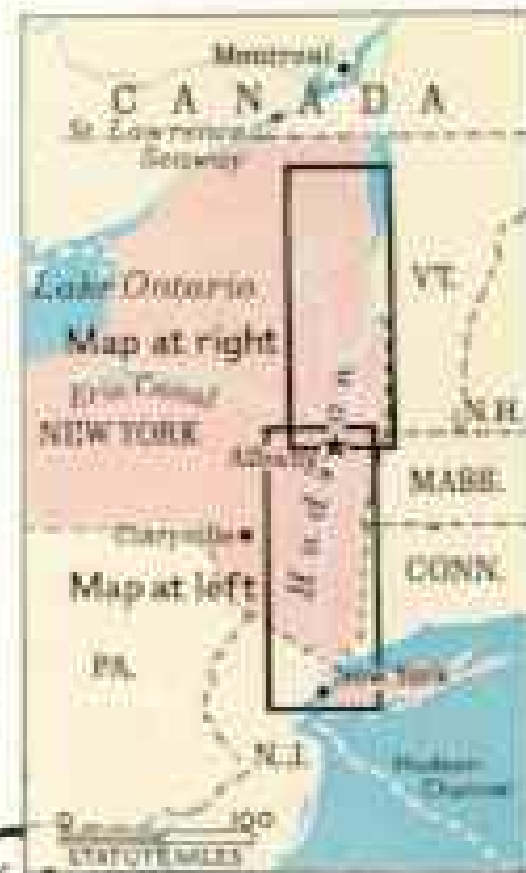
We went through the crew's quarters. They were comfortable, as they have need to be, for every man must live on board for two weeks at a stretch. He

*See "The Mighty Hudson," by Albert W. Atwood, NATIONAL GEOGRAPHIC, July, 1948.





An arm of the sea for half its length, the Hudson has tides in the fiordlike stretch below Troy, head of navigation. Despite its width and importance, the river is relatively short. More than 60 others in the U.S. exceed it in length.



The Hudson

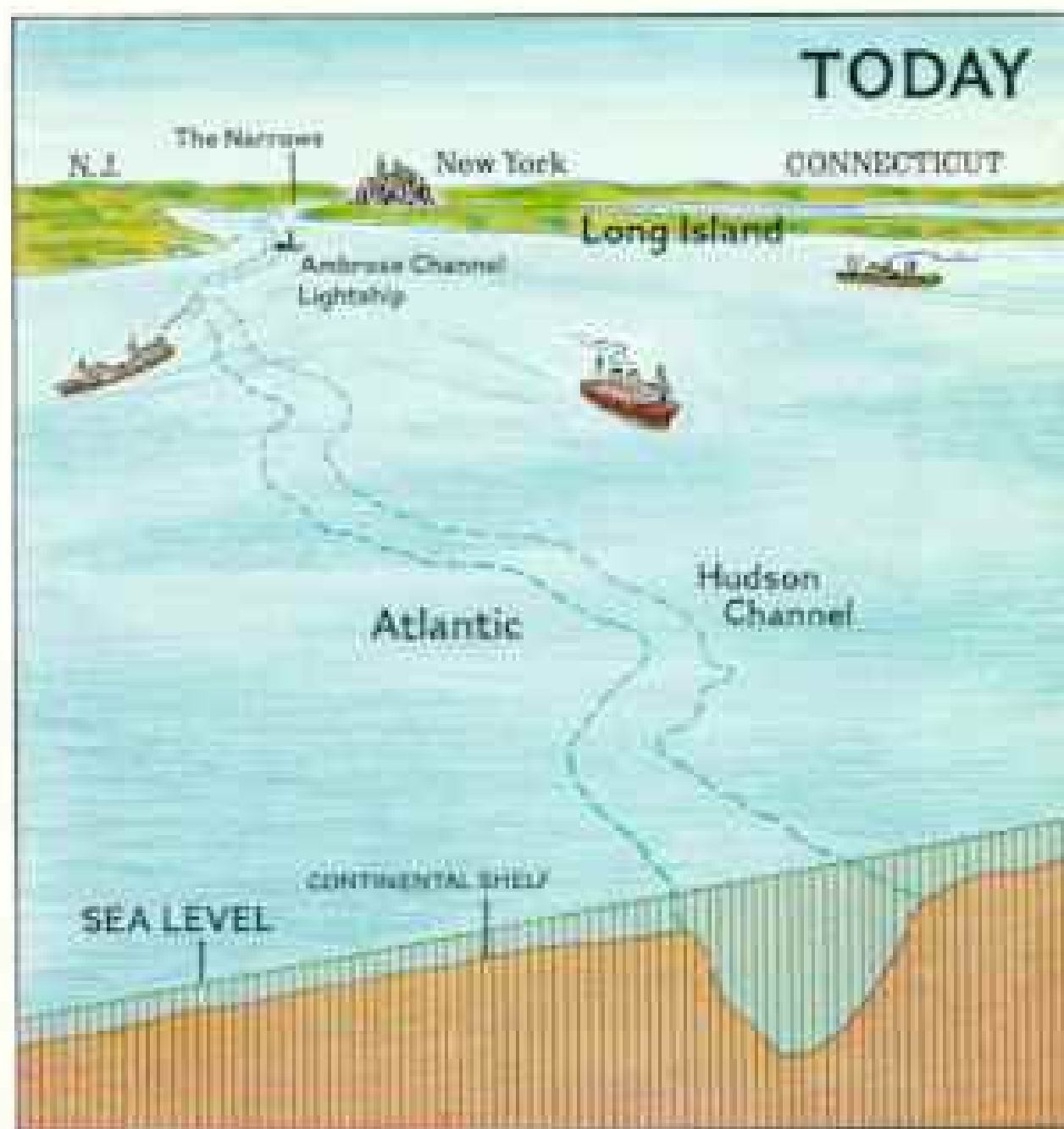
← Lower & Upper →

has the third week off ashore. I saw television and radio sets all over the ship.

And books! My host opened closet after closet, stacked from top to bottom with books. A newspaper story had stated that this was what the men on Ambrose wanted most—books—and they had arrived in an overwhelming flood.

I thanked the hospitable Coast Guard chief warrant officer and clambered down to the waiting boat with new-found agility. On the way back to New York Harbor, I reflected on

Undersea channel of the Hudson, two miles wide and a hundred feet deep, extends halfway across



the unique character of the river I had begun to explore.

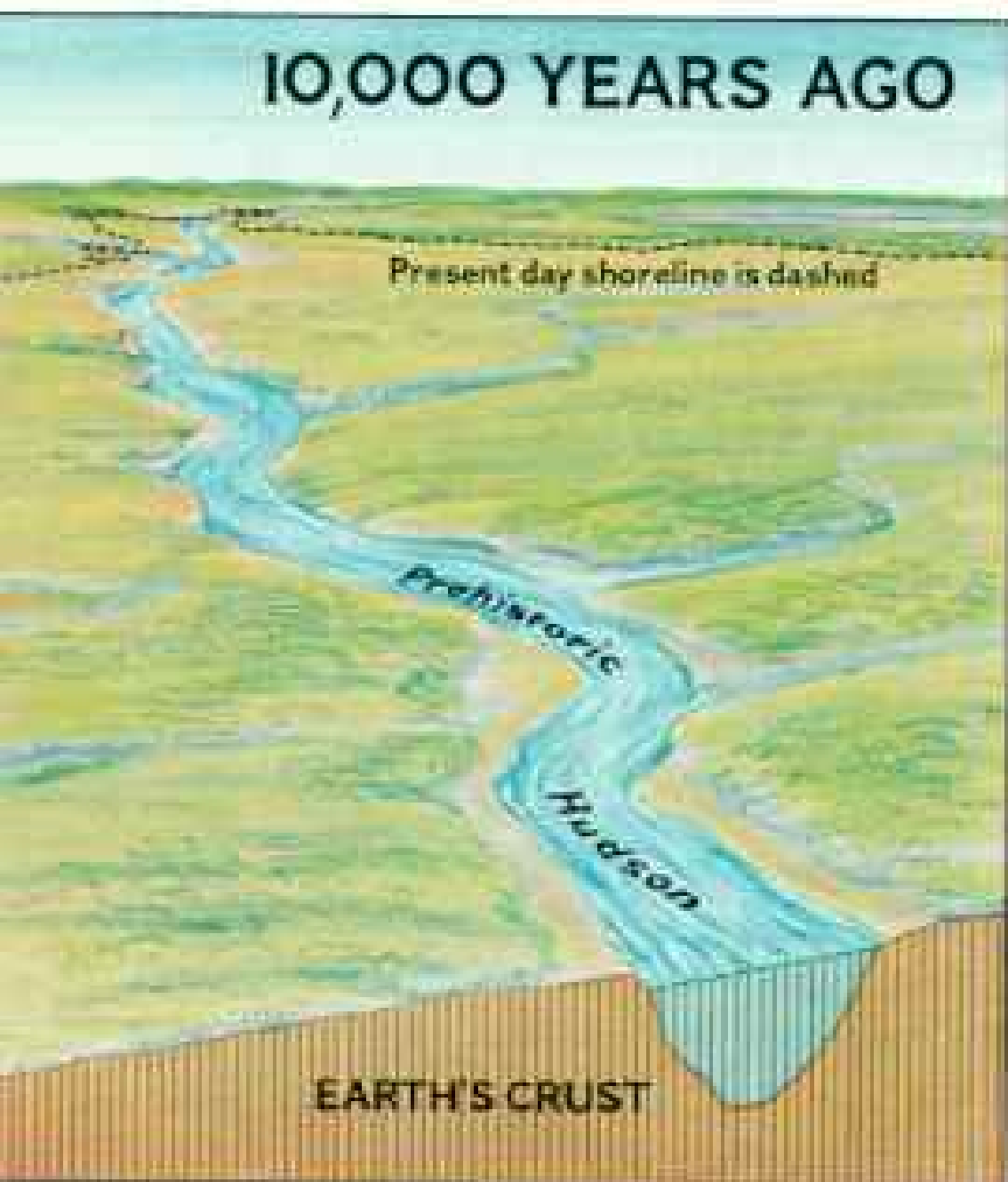
Its source lies cupped more than 4,000 feet high in the Adirondacks; its valley ends 500 feet beneath the Atlantic. Yet it accomplishes this dive without apparent effort. It has its rapids and waterfalls, but they are not extraordinary (page 398). The river as most people know it is broad, deep, and so placid that it scarcely knows which way to go; half the time it runs upstream. Algonquian Indians called it "the river that flows two ways."

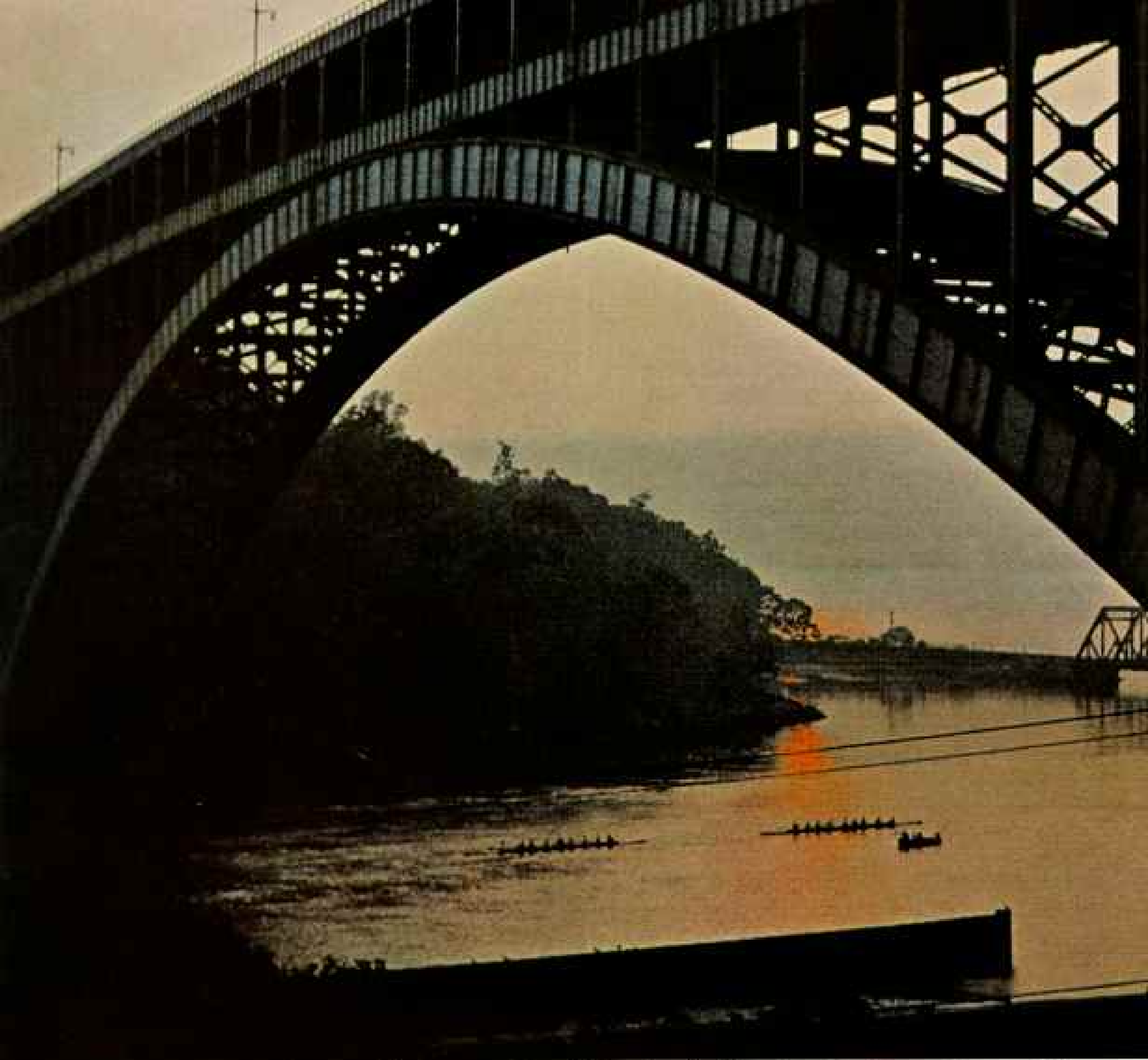
Ocean tides sweep up to Troy. In this 150-mile stretch the Hudson really is no river at all but an inlet of the sea. At Albany's docks ocean vessels rise and fall on a 4½-foot tide.

Few rivers of North America equal the Hudson as a corridor of history. On its shore was founded what was to become one of the world's three largest cities, rivaled today only by Tokyo and London. Three wars bloodied the Hudson-Champlain Valley, stretching from New York to Montreal: the French and Indian War, the Revolution, and the War of 1812.

Here, in the War of Independence, the British made their unsuccessful attempt to divide the rebellious Colonies; here the war reached its turning

the continental shelf. From a plane, the channel shows as a dark stripe in the sea.





Sunset gilds Spuyten Duyvil Creek and silhouettes the Henry Hudson Bridge.

point, in Gen. John Burgoyne's surrender at Saratoga on October 17, 1777.

With peace, a tide of immigrants flowed from Europe to New York. Many looked westward and found that the easiest road west was *north*—up the Hudson to Albany by boat, then westward by oxcart through the valley of the Mohawk.

Waterway West—the Erie Canal

"Clinton's Ditch," the Erie Canal, finally gave Albany a water link with the Great Lakes, and the westward trek swelled to a massive migration. The Hudson-Erie route became not only the chief highway of trade to the frontier, but after 1825 made New York City beyond question the most important port on the North American continent.*

We had lived some years before in New

York City, and had since visited many of the world's other great seaports. I hoped this time to view with detachment the huge, restless complex of marine commerce that sprawls at the Hudson's mouth (page 364).

For a week we roamed its piers and crisscrossed its turbid waters by tug, ferry, and sightseeing boat. But as before, I turned away baffled. The immensity of New York Harbor simply eludes the mind's grasp.

We can say that more than 40 million tons of foreign cargo, worth 11 billion dollars, annually funnels through its warehouses and piers; that it handles 13,500 ocean ships each year, one entering or leaving every 20 minutes; that tens of thousands of smaller craft, from railroad barges to water taxis, ply its waters.

*See "Here's New York Harbor," by Stuart E. Jones, NATIONAL GEOGRAPHIC, December, 1954.



Columbia University racing shells skim below



Statue of Henry Hudson, who explored the river in 1609, stands in a Kingston park.

Sailing upstream in the *Half Moon* on the "great river of the mountains," Henry Hudson met Indians with whom he traded knives for tobacco and corn. An unidentified artist depicts the voyage on a stage curtain in the Hudson, New York, home of the Daughters of the American Revolution.

REPRODUCED BY WAYNE MILLER, WAHNGO, AND WILLARD PRICE (BELLEVILLE) © R.S.S.







PAINTING BY JOHN QUIDOR, WELLMAN COLLECTION, AND AN ETALAGE (IMAGE SUPPORTED) BY WAHNE MILLER, MARRIOTT © N.G.S.C.

Returning after a 20-year sleep, Rip Van Winkle finds his village changed beyond belief. Legend-maker Washington Irving peopled the Hudson Valley with comic Dutchmen, a headless horseman, and bowling gnomes. John Quidor (1801-81) immortalizes Rip's return on a canvas hanging in the National Gallery of Art, Washington, D. C.

Sinking sun sets the sky aflame above the Catskills near Kingston. In these rolling mountains, Rip met a company in "old Dutch dresses playing at nine-pins in the hollow of the mountain... the sound of their balls, like distant peals of thunder." Summer storms, Irving wrote, still call to mind Henry Hudson and his crew at their game.

But still this massive port parries efforts to comprehend it. More than a hundred thousand vehicles drive *under* the Hudson every day... Thirty men take three years to paint the George Washington Bridge, then four years later start over again... Harbor-cleaning barges each year scoop up 30 million cubic yards of silt, mud, and debris, including such mysteries as a floating grand piano and, once, the carcass of a giraffe....

One could live ten lifetimes in this harbor the Hudson has wrought and still not know it all. Manhattan's concrete-and-glass cliffs on the river's east shore would confound Henry Hudson if he should return today.* But the Palisades across the way are about as he found them in 1609.

They were built to last, forged in fire 200

*See "Henry Hudson, Magnificent Failure," by Frederick G. Vothburgh, NATIONAL GEOGRAPHIC, April, 1939.

million years ago, when lava boiled up into an immense crack in the sandstone. The lava cooled and crystallized into a diabase wall some 40 miles long and up to 800 feet high. The sandstone on the river side gradually crumbled away, exposing magnificent many-sided columns like those of the Giant's Causeway in Northern Ireland and Fingal's Cave in the Hebrides.

Even the first Indians saw the brooding Palisades much as we see them today. Beyond lay the land of the spirits—now, less poetically, New Jersey. From the cliffs and hills the goddess Minnewawa hurled down thunder and lightning upon wicked mortals.

The Great Spirit himself had thrown up this rampart to keep meddlesome man out of the gardens of the gods. On its edge Manitou

still stands guard. Or so it seemed to us as we viewed the Indian Profile, a great stone face with aquiline nose and sharp-jutting chin, keeping a stern vigil on Yonkers across the river (opposite).

That city's name may not seem musical, but it does reflect a certain nobility. It derives from *jonge heer*—"his young lordship"—referring to Adriaen van der Donck, first patroon of this region.

Yonkers Gave Rise to the Elevator

Few realize that Yonkers, overshadowed by Manhattan, is actually the fifth largest city in the Empire State. Even less appreciated is the fact that here, in 1852, inventor Elisha Graves Otis developed a safety device that led to the modern passenger elevator—and thus made New York's skyscrapers a feasible form of architecture.

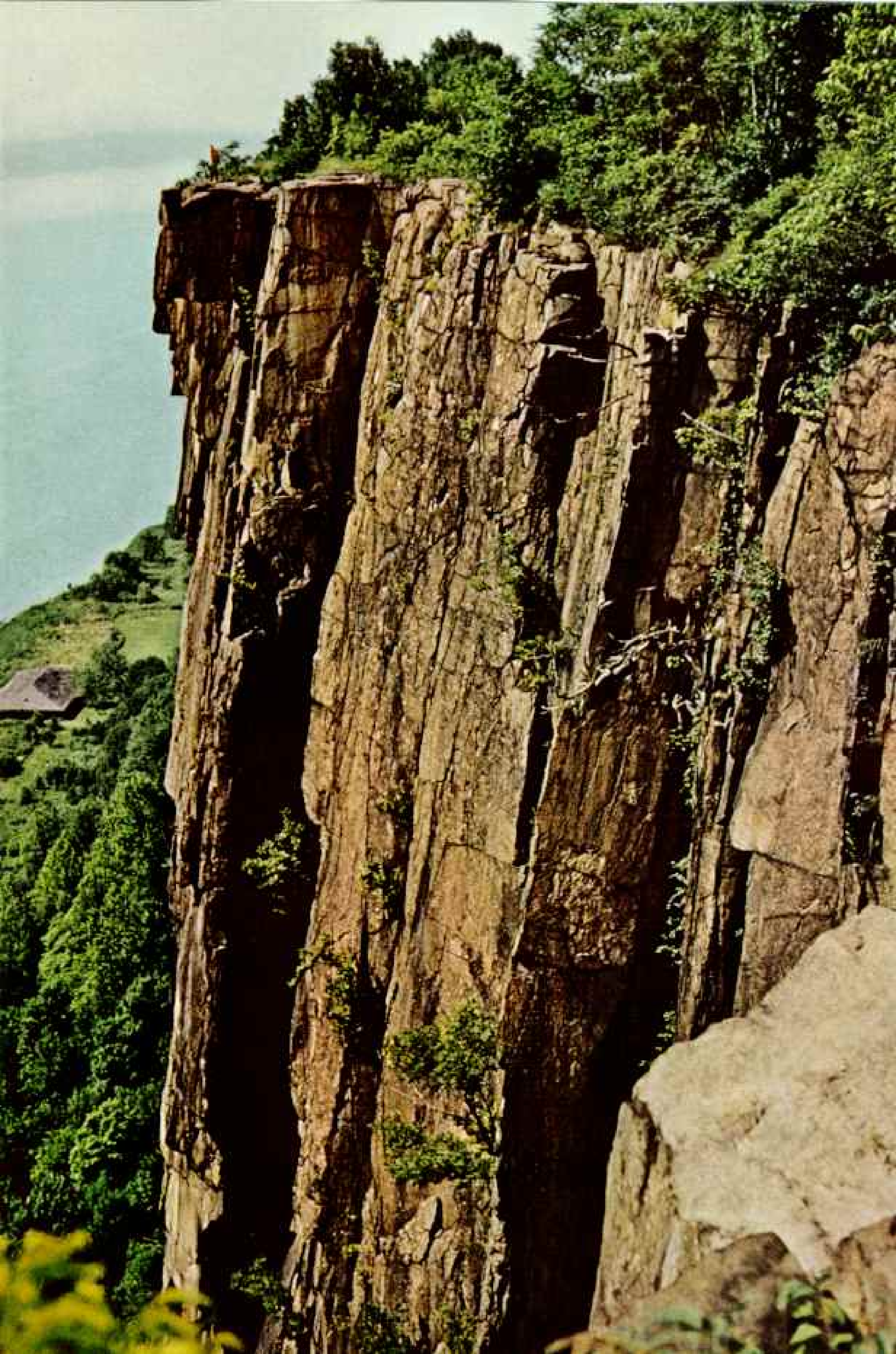
North of Yonkers, beyond fine old riverside mansions, we came to Dobbs Ferry. Jeremiah Dobbs was a colonial boatman who, sometime after 1698, began shuttling passengers back and forth across the Hudson at this point in a hollowed-log canoe. His ferry has long since disappeared into history, but its name lives on in the town.

The Hudson's western wall hereabouts towers as an enduring monument to many generous private gifts, as well as public funds

Indian Profile, a 525-foot rock formation on the New Jersey Palisades opposite Yonkers, peers into the Hudson Valley. The name Palisades marks the cliffs' resemblance to the log walls of early forts. Once threatened by quarriers, the bluffs survive as part of Palisades Interstate Park, whose several sections in two States front the river for 24 miles. The bounty of John D. Rockefeller, Jr., the elder J. Pierpont Morgan, Mrs. E. H. Harriman, and other benefactors helped save the park's wild scenery from despoliation. Visitors enjoy hiking, camping, boating, swimming, and winter sports.

Stony Point Light surmounts a bluff that juts dangerously into the Hudson. A clock switches on the 13,000-candle-power lamp at dusk and turns it off at dawn. Author Willard Price (in red shirt) joins a light tender on the tower. Side-wheel excursion steamer *Alexander Hamilton* paddles downstream.





and laws that stopped the defacement of the cliffs by quarries and made possible the Palisades Interstate Park.

We drove leisurely up the beautiful parkway that stretches 38 miles from the George Washington Bridge to Bear Mountain. It runs through woodland so wild that road signs warned us of deer crossings—this within sight of a city where people live and work as much as a hundred layers deep for lack of room.

Ghost Ship Plies the Tappan Zee

We reached Nyack in time to watch nearly a hundred sailboats racing on historic Tappan Zee. Here the river broadens and slows. It seemed a docile thing, flecked with white canvas and straddled by the slim, curving Tappan Zee Bridge that carries the New York State Thruway across the Hudson.

But the Tappan Zee, I knew, is a highly temperamental stretch of water. Many old-time sloops and early steamers foundered here. During every gale, they say,



Ballooning spinnakers and main-sails trap the breeze at Nyack. Sign in foreground identifies docks of the Nyack Boat Club. Narrow channels and swift currents, sometimes running as high as four knots, hamper sailing on most stretches of the Hudson. Here the river flows between banks two miles apart.

Shedding his shoes, a weekend boatman wades into the basin at Margaret Lewis Norrie State Park to wrestle his craft onto a trailer. Sling at right, fashioned from a fire hose and hooked to a winch, helps lift heavy craft.



PHOTOGRAPHS BY WILLIAM PRICE CARROLL AND BAYNE MILLER, BALTIMORE © NATIONAL GEOGRAPHIC SOCIETY

the ghost of the *Storm-ship*—a river version of the *Flying Dutchman*—scuds across this unruly sea; woe betide the vessel that fails to give her way.

This broad and moody reach of the Hudson was bound to nurture such tales, for it was here, in the village of Tarrytown, that the great romancer Washington Irving made his home. Just above rise the hills where Ichabod Crane sang in the Old Dutch Church, courted Katrina Van Tassel, and fled before the terrifying headless horseman.

Around Tarrytown, history and legend intertwine. The old church was, and is, very real. Ichabod never lived, of course. Yet, while wandering among the slumbering tombstones of Sleepy Hollow Cemetery, one of them Irving's own, I found myself listening.

"There are peculiar quavers still to be

heard in that church," Irving's tale solemnly assures us, "and which may even be heard half a mile off, quite to the opposite side of the mill-pond, on a still Sunday morning, which are said to be legitimately descended from the nose of Ichabod Crane."

Sing Sing—"Stony Place" by the River

Ossining means "a stony place," a musical Indian name of odd prophecy. It not only suits this attractive city, but also the grim walls of the State prison that occupies 55 riverside acres below.

It is almost as hard to get into Sing Sing, I discovered, as to get out. I was questioned by a guard at the gate, questioned again through the barred entrance of the administration building. More guards instructed me to sign a register, then made certain I was



**Mothballed Ships Await the Bosun's Pipe
While Riding at Anchor off Jones Point**

Stacks smokeless, decks silent, the ghostly fleet could head back to sea in case of national emergency. Freighters, America's lifeline in wartime,



CONSTRUCTION BY WALTER BAKER, WASHINGTON, D. C. (REUTERS) COURTESY, EDISON

serve as storage bins for surplus wheat. Caretakers keep the craft well preserved. Electric current fights underwater corrosion. Upstream, the Bear

Mountain Bridge leaps the Hudson. Consolidated Edison Company's \$100,000,000 atomic power plant nears completion at lower right.



carrying no weapons. I handed over my cameras and film.

"If one of your pictures showed a prisoner's face, he'd have a legal right to sue the State," a sergeant explained.

He led me through three iron gates, each unlocked by a guard and locked behind us.

Trades Taught Behind Prison Walls

My most striking impression on the tour of Sing Sing was of its schools. Here inmates were training for after-prison life, working in a well-equipped machine shop, an automobile shop, a radio and TV department, a print shop, a typewriting class, and other classrooms for academic courses.

"Learning to read and write is compulsory

here," said the sergeant. "No inmate remains illiterate for long."

Nor is recreation overlooked. I saw radio earphones in every cell; two first-run movies are shown each week in cold weather. In spring and summer, prison baseball teams play outsiders on the large recreation field within the walls.

It seemed to me like a small town—many buildings, open spaces, shade trees, and plots of flowers. I saw a small marker that read "Chowder at rest," honoring the memory of a prison cat.

Not an unpleasant place at all, I thought. Then I looked again at the grim concrete wall and changed my mind.

My wife was chuckling when I met her



Decks a-swarm, the *Hudson Belle* and *Peter Stuyvesant* take sightseers to Bear Mountain State Park.

Robert Fulton's *Clermont* ushered in the age of steam on the Hudson by thrashing from New York to Albany in 1807 at nearly five miles an hour. In their heyday scores of paddle-wheelers plied the river. Most passenger travel is now by road, rail, or air, but the Hudson still carries a heavy flow of cargo.

Bear Mountain Bridge, a 2,257-foot suspension span, arches 155 feet above the water just upstream of the excursion-boat landing.

Happy holiday-goers crowd the *Alexander Hamilton*. Upper deck offers a superb view of the river.

outside the last iron gate. As we drove away, she told me why. During my absence she had been chatting with another woman, who had a relative inside the prison.

"Waiting for my husband," Mary had explained. "He'll be out soon."

"That's nice," the woman beamed. "Paroled for good behavior?"

Dunderberg's Goblin Summons Storms

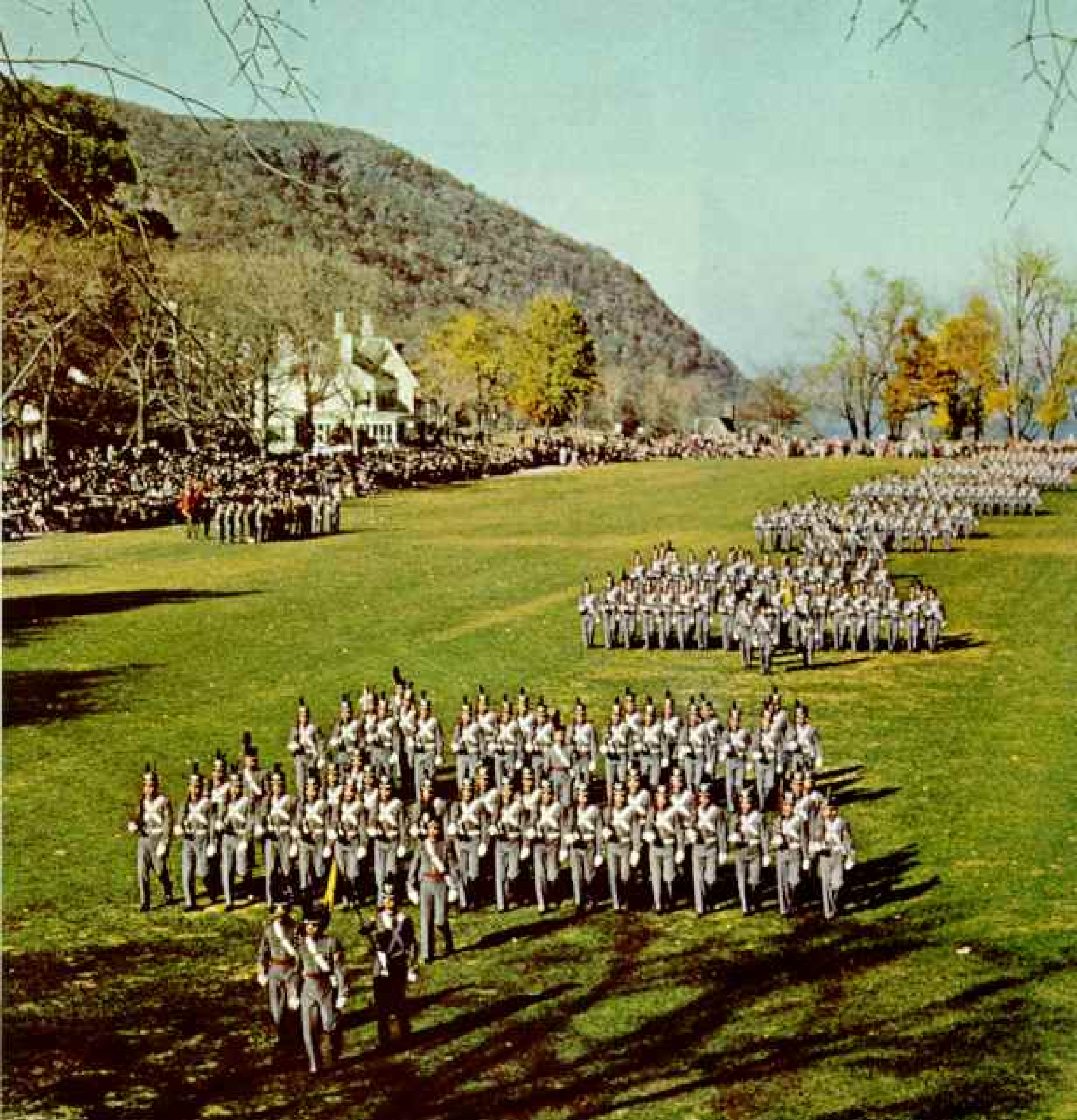
Above Ossining sprawls Haverstraw Bay, the broadest and perhaps handsomest of the Hudson's varied reaches. The town of Haverstraw looks down to it on one side and Croton-on-Hudson on the other. Croton Point Park attracts thousands of summertime picnickers and bathers. We watched pleasure boats furrow its surface, their captains unmindful that they skimmed an enchanted sea.

Bold precipices line the western shore, leading up to High Tor and higher Dunderberg Mountain. Between Dunderberg and the peak called Anthony's Nose, the river narrows into a dangerous channel subject to sudden storms—called down, it is said, by a bulbous-bottomed Dutch goblin who sits atop Dunderberg, shouting orders through his speaking trumpet to the winds. Only by dropping the peaks of their sails in homage to the goblin could sloop masters hope to pass safely.

Why did the Dutch, usually so practical, people the Hudson with monsters, goblins, and ghosts? Probably because, after the flat landscape they had known in Holland, the precipitous mountains, deep gorges, dark forests, and thunderbolts hurtling from peak to peak bred mystery and spurred imagination.

RESEARCH BY WELLES PRICE © NATIONAL GEOGRAPHIC SOCIETY





ASSOCIATED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS WEBB

As one goes north into the Hudson Highlands, the mountains multiply, and so do the legends. Viewed from Bear Mountain, the ridges march northward on both sides of the river, like a double procession of elephants.

From Bear Mountain to Anthony's Nose, the river is spanned by a suspension bridge 155 feet above the river, so delicate a mesh of cables that on a misty day it looks as insubstantial as a cobweb.

In the shadow of Bear Mountain Bridge on a summer Sunday dock no less than three great passenger boats, bringing thousands of excursionists from New York City for a holiday in Bear Mountain State Park.

It is well to look twice at this phenomenon, for nowhere else on the Hudson, and at no other time, will you see three of these splendid riverboats together. Indeed, within a few years they may well have vanished forever.

Law Ends Hazardous Steamboat Races

The first of their breed on the Hudson was not so graceful. With her paddle wheels exposed and her awkward machinery much in evidence, she excited derision and contempt.

When Robert Fulton's *Clermont* first snorted and puffed and clattered its way upriver from Manhattan on that historic summer day in 1807, the craft was aptly described as "the



MAYNE MILLER, MAGNUS ÖRTENGREN © N.C.S.

West Point's Long Gray Line Marches in a Proud Tradition

West Pointers have made their mark in every United States war since the inception of the U.S. Military Academy 160 years ago. Graduates include Lee and Grant, who led opposing forces in the Civil War; Pershing, MacArthur, and Eisenhower.

Here, on last Veterans Day, some 20,000 visitors ring the Plain to watch the Corps of Cadets pass in review. The Hudson gleams beyond the trees.



Spit-and-polish discipline holds plebes in a "brace"—exaggerated attention. Cadet lieutenant adjusts the pompon on a "tarbucket," or dress hat.

June Week "drags," as cadets call their dates, dance against a background of captured cannon that decorate West Point's Cullum Hall.





devil in a sawmill." Fulton, said his critics, had a notion he could go "to Albany by teakettle." And even when he did it, they dismissed his feat as a freak: Sails were better and always would be.

Teapots Take Over the River

But the side-wheelers were soon outstripping the fastest sloops. In time they became the floating palaces of the Hudson, boasting plush carpeting, crystal chandeliers, private parlors, and great dining salons. Their steam calliopes made the deep gorge of the Highlands resound with "The Belle of Mohawk

Vale" and "Columbia, the Gem of the Ocean."

Queen of the fleet after the Civil War was the *Mary Powell*. She had three hundred feet of clean, sweet lines and was the fastest thing on the Hudson. Rival captains claimed her builders must have mixed whale's grease in her paint to make her slip so easily through the water.

Competition became intense. The passenger fare between New York and Albany dropped to ten cents. Boats began racing one another as speed rivalry grew. Steam gauges were plugged, safety valves were tied down—and boilers exploded.



REPRODUCED BY WARE, WILLEN, BAEHR © N.Y.C.

Parading daisy chains escort graduating Vassar seniors, who leave commencement exercises with diplomas in hand. Outstanding sophomores form the links. Last year the women's college near Poughkeepsie observed its 100th anniversary.

Young standard-bearers await the call to colors for a July 4th parade at Poughkeepsie.

Public protests reached a peak when the racing *Henry Clay* caught fire and was run aground. Panicked passengers leaped from her decks into the river, and scores drowned. Finally, a little more than a century ago, a Federal steamship inspection act brought an end to such dangerous races.

During the past hundred years side-wheeler travel on the Hudson has been swift, safe, and lovely. Yet the steamboat has been superseded by the automobile, and the Hudson waterway by the New York Thruway. The lone survivors of the river's steamboat era lay below us as we looked down from Bear Mountain.

Only two of them, the proud and lovely *Alexander Hamilton* and the slightly smaller *Peter Stuyvesant*, were strictly Hudson River craft. These white swans are the last of the Hudson River Day Line. The third boat, the yellow-painted *Hudson Belle*, had come from its normal run between Manhattan and Long Island Sound for the Sunday excursion (pages 380-81).





F.D.R. welcomes a crew-cut admirer to Hyde Park. Bronze head of the 32d President by Jo Davidson stands in the Franklin D. Roosevelt Library.

Columned Portico Distinguishes Vanderbilt Mansion at Hyde Park

Built at the turn of the century by Frederick W. Vanderbilt, the house dominates a 212-acre estate. Dozens of fine homes of old families stand along the riverbanks, reminders of a more expansive age. Many now house schools, medical institutions, and religious groups.

Mrs. Eleanor Roosevelt (right) chats with visitors at Val-Kill, her cottage near the ancestral estate at Hyde Park. The Roosevelt home, like the Vanderbilt Mansion two miles away, is now a national historic site.



The Night Line from New York City to Albany was discontinued in 1940. The Day Line quit service to Albany in 1950, although it still runs daily as far as Poughkeepsie.

We later made a journey downriver on the *Alexander Hamilton*. The big ship seemed like a floating carnival. The snack bar and dining salon were continuously busy. Youngsters crowded the bow, where they got all the wind and excitement. Teen-agers danced to a rock-'n'-roll orchestra in the ballroom. Older folk lined the sides and stern to watch an ever-changing panorama of history, as mountains and towns slid by and handsome bridges passed overhead.



WASHINGTON AND HIS RETAINERS BY JEFFREY M. SPERRY © NATIONAL GEOGRAPHIC SOCIETY

Different eras live close together on this Hudson River. I stared reflectively at a grim promontory once regarded as the "Gibraltar" of the Highlands.

"Can you storm Stony Point?" George Washington asked "Mad Anthony" Wayne.

"I'll storm hell, sir, if you will plan it," replied the impulsive young general.

"Better try Stony Point first," said Washington. Wayne took the nearly impregnable stronghold with bayonets, in one of the most daring night attacks in history.

Scarcely a mile above this Revolutionary battleground we had passed the mothballed fleet of almost 200 World War II vessels—

Liberty and Victory ships; most of them—anchored at Jones Point. And across the river at Indian Point workmen were building an atomic power plant that soon will help light New York City and vicinity (pages 378-9).

Hudson Highlands Guard West Point

The *Hamilton* herself has tried to bend to newer ways. In the pilothouse I saw her great wheel standing unattended. Instead, an occasional touch on a small wheel controlled the boat through a steering engine.

"It takes four men to handle that big wheel, but we still use it when the power steering fails," said Capt. Dewitt Robinson, a river

skipper for half a century. Then, more to himself, perhaps, than to me: "It can't be long now. Getting uneconomical to operate these boats; fewer passengers every year. A pity. I still think it's the nicest way to travel."

Nowhere is river travel finer than through the Hudson Highlands. The Highlands are not actually very high but seem majestic, for they rise directly from sea level with every foot visible from water to sky. Their crests are crowned by castlelike mansions and private schools.

In the heart of the Highlands, the stone walls of the United States Military Academy at West Point look sternly down upon one of the sharpest and most hazardous bends of the river. It was here that a great chain of two-foot iron links spanned the channel to bar the northward progress of British ships during the Revolution.

Washington called this contorted defile "the most important post in America." If Benedict Arnold had succeeded in his plot to surrender West Point to the British, the story of America might have been quite different. But the plot failed; West Point was held.

Bargain From a Mountaintop

"Will you sell me all the land I can see?" asked Francis Rombout in 1683. The Indians agreed, and a price was fixed. Then the wily Rombout, so the story goes, climbed Mount Beacon, where his view encompassed 85,000 acres. The Indians, though indignant, kept their promise.

The mountain did not get its name until later, after beacon fires on its summit warned of approaching British in the Revolution. Now an inclined railway climbs steeply to a height of 1,200 feet, where visitors dance and dine in a large casino.

A doomed ferryboat carried us across the river to Newburgh. The ferry service, first chartered by King George II in 1743, will give way to the Newburgh-Beacon Bridge, planned for completion in 1963.

The ferry was old even when George and Martha Washington made their home in Newburgh for more than a year. After Cornwallis's surrender at Yorktown, Washington prudently kept his army ready here, pinning the British down in New York until the peace treaty was signed in 1783.

We visited the stone house where the general renounced "with abhorrence" a plan to make him king of the new Nation. No palace, this, I thought. The plain, severe rooms were warmed in winter by fires built on an open



Whoops of joy ring out at a swimming hole

stone hearth; smoke found its way out by way of a chimney hole in the ceiling.

In 1850 the property became the first State historic site in the United States; near the house stand a noble statue of George Washington and another of the colonial Minuteman. An excellent museum retells the story of the Revolution.

At the Newburgh dock the trim, 103-foot cutter *Beech* took me aboard. The U. S. Coast Guard had granted my request for a tour of "the aids to navigation" — the buoys, bells,



WE ESTABLISHED © NATIONAL GEOGRAPHIC SOCIETY

that time forgot. Rondout Creek typifies the idyllic streams that feed the Hudson

lights, and lighthouses that make Hudson River travel as far as Albany safe even for ocean vessels.

"We call this a buoy tender," said the skipper, Chief Quartermaster Walter A. Lewis, inviting me into the wheelhouse. Here he showed me the most modern equipment — radar screen, radiotelephone, shore telephone for use at docks, echo-sounding gear.

We sailed downriver to Worlds End. It actually appears on the chart under that name, and boasts the Hudson's deepest water (map,

page 368). The depth indicator registered more than 200 feet beneath the *Beech's* bow.

We approached a shoreline light tower for a test of its automatic fog bell. If a boat groping through fog blows its whistle, Lewis explained, the blast actuates a switch that starts the bell ringing for ten minutes.

At least that is the way it *should* work. The *Beech* blew a terrific blast, but the bell did not answer. Again — no effect. Lewis sent two of the cutter's 12-man crew ashore in a skiff to adjust the bell's sensitivity control. In 20

minutes they were back, and the *Beech* blew her whistle again. The bell responded with a satisfying clangor.

The *Beech* maneuvered alongside a can buoy and hoisted it up out of the water. Crewmen made minor repairs, while skipper Lewis checked the buoy's position with a sextant.

"Buoys don't just stay put and keep working," he said. "They keep us busy. A passing barge sometimes hooks one and drags it out of position. A freighter's propellers, even floating ice, can do a lot of damage to a lighted buoy. And some fools along the river deliberately shoot out the lenses."

The cutter serviced several of these light buoys on the run back to Newburgh, giving me a look at their ingenious mechanism. Each houses four lamps; if one goes bad, another automatically turns into position.

Ice Floes Tilt Esopus Light

A bit of telephoning got us an appointment at the old Hudson lighthouse near Esopus. This is no iron tower, like most, but a frame house topped by a light tower. The three young men stationed here were good cooks—we could testify to that after having had dinner with them.

"This is a bad stretch of the river," Boatswain's Mate 2/C John F. Monahan told me. "The ship channel is on the east side of the lighthouse, but smaller yachts sometimes try the shallow west side and get themselves grounded."

In every room he showed us yawning cracks, some of which had developed only during the past few days. The whole house listed like the Leaning Tower of Pisa.

"That happened in 1958," said Monahan. "The ice piled up 15 feet high against it and pushed it out of plumb."

The historic old lighthouses must disappear, but, thanks to more modern equipment, the U. S. Coast Guard, and the U. S. Army Corps of Engineers, the Hudson has never been so hazard-free as it is today.

Where two great bridges dominate the river—a cantilever railroad span and the sus-

pension towers of the Mid-Hudson highway bridge—the traveler comes to "the reed-covered lodge by the little water place" (*apokeep-sinck* in the Mahican tongue). We know it as the busy city of Poughkeepsie.

In 1778, I learned, the young State of New York made Poughkeepsie its temporary capital; here ten years later it voted to ratify the United States Constitution.

Here, also, two brothers named Smith—William and Andrew—whose bearded faces are familiar to anyone who has ever had a tickle in his throat, pioneered in the cough-drop business. And a wealthy brewer, Matthew Vassar, built himself an enduring monument—the first well-endowed college in the United States offering women an education equal to that available to men (page 384).

Chief gem of the beautiful Vassar College campus is Sunset Lake, with an open-air theater on its shore. Nearby, the Shakespeare Garden abounds in the flowers mentioned in Shakespeare's plays. While some of Vassar's buildings are designed in the centuries-honored style of Oxford and Cambridge, the campus also has buildings by contemporary architects such as the late Eero Saarinen.

Homes of Famous Men Line the Hudson

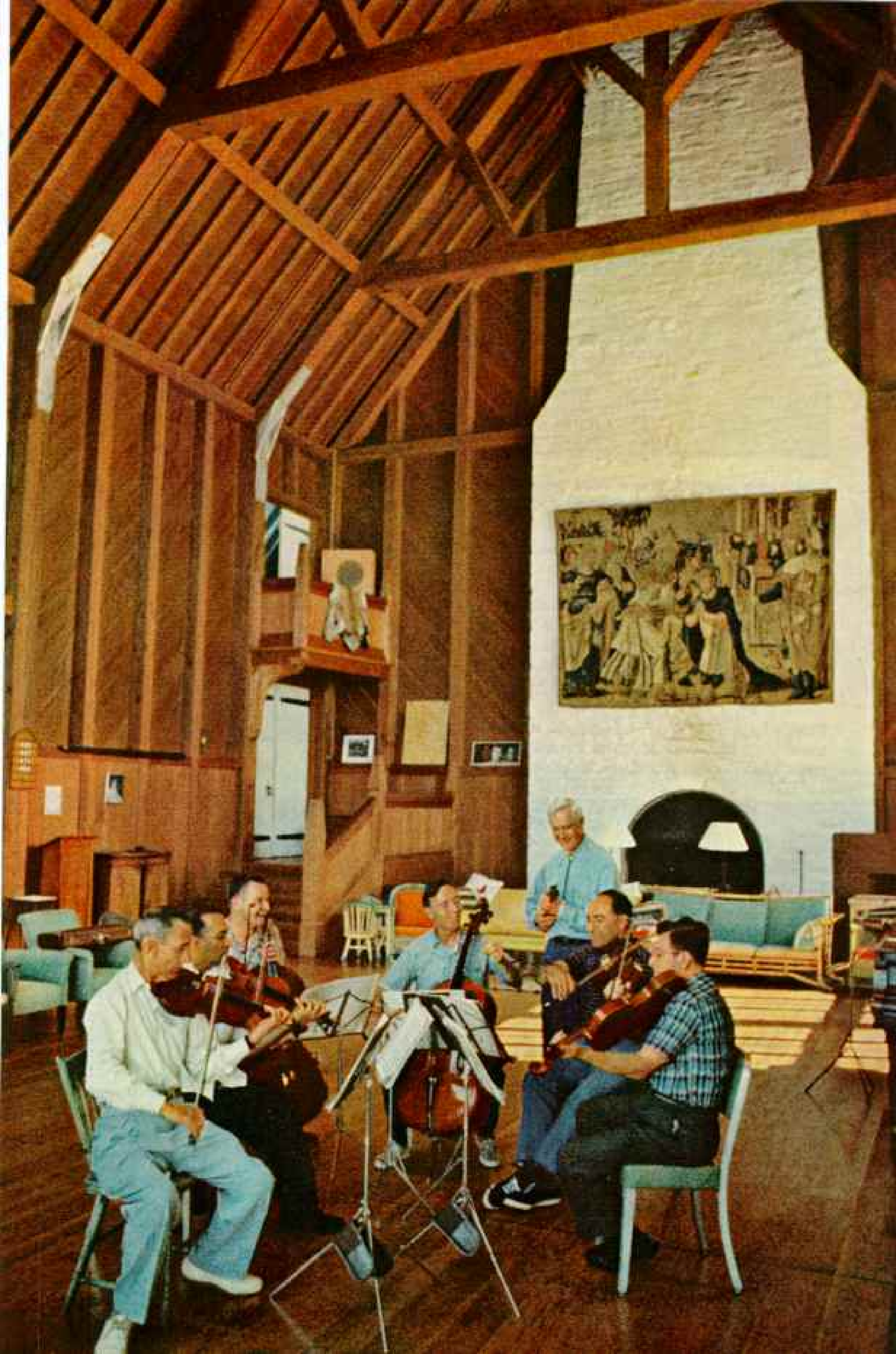
I swung our car and its rooftop canoe northward again; three-fourths of the Hudson still lay ahead. In Hyde Park we found the Franklin D. Roosevelt home open to visitors. A plain eight-foot-long block of white marble, eloquent in its simplicity, marks the resting place of the former President. Mrs. Eleanor Roosevelt now lives in a woodland cottage close by; her former home has become a national historic site.

Also open to visitors is the proud palace erected by millionaire Frederick W. Vanderbilt (page 387). On the opposite shore of the Hudson, the house of naturalist John Burroughs reveals the difference between two celebrated men—one home filled with costly treasures, the other that of a man who revered a leaf, a bird, the art in nature.

Not far west of the river sparkle two of the

Impromptu Concert Makes the Rafters Ring at Glen Tonche, Near Kingston

To his mountaintop summer home, music patron Raymond Pitcairn (standing), lawyer, architect, and philanthropist, invites noted musicians. Here the Curtis String Quartet from Philadelphia, a renowned chamber-music ensemble, plays rare old instruments with two other guests. Tapestry depicts David's anointing by Samuel. Nearby towns of Woodstock and Byrdcliffe offer summer theater, an opera company, and art colonies.





Nibbling a handout, a European fallow deer at Catskill Game Farm near Cairo delights a young naturalist.

Carefree children race a barge along a headland once known as Kinderhook – “children’s point” – for the youngsters who gathered on the shore here when early trading boats went by. Dutch settlers took the name with them when they moved the town five miles inland. Plodding barges headed westward leave the river at Cohoes; canals link the Hudson with the Great Lakes, Lake Champlain, and the St. Lawrence Seaway.

Flaxen-haired rider on a Catskill slope near Claryville learns the trails in one of America’s most popular resort areas. Visitors camp, hike, ride, and fish.





HE EXTENDING (ARROW) AND KIDNAPING BY WAYNE MILLER, WARREN © NATIONAL GEOGRAPHIC SOCIETY

loveliest small lakes in America, Mohonk and Minnewaska, both overlooked by old Quaker hotels. And at Rhinebeck the oldest hotel in America in continuous operation, the Beekman Arms, still amuses weary travelers with a regulation dating from its days as a colonial hostelry: "No boots to be worn in bed." Parts of the hotel date from 1700.

Bridge Honors Legendary Slumberer

Kingston, across the river from Rhinebeck, has long since forgotten the days when pioneers were forced to work for the Indians. Colonists appealed to Governor Stuyvesant:

"The savages compel the whites to plow their maize land, and when they hesitate, threaten, with firebrands in their hands, to burn their houses."

Northward, the New York State Thruway cuts a modern streak across a region that wears a rich patina of age.* In Saugerties, in a fine old stone house above the Hudson, John Paul Remensnyder proudly showed us one of the largest collections of early Ameri-

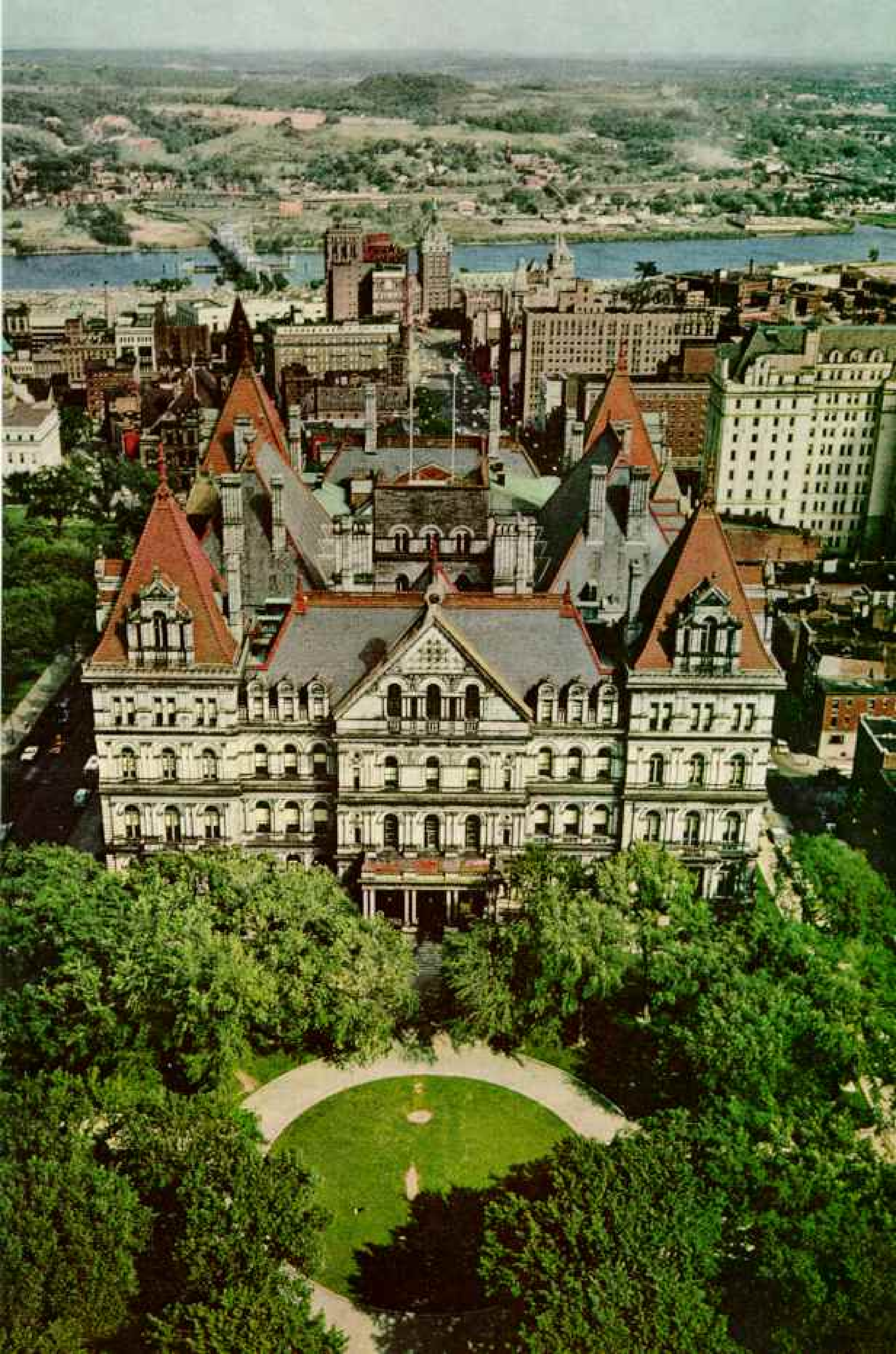
can pewter. And a block away, as we admired the Schoonmaker residence built in 1727, the owner told us that his is the ninth generation of Schoonmakers to live in this house.

The shade of Rip Van Winkle, unruffled by sounds of merrymaking in modern resort hotels in the mountains, still hovers over the town of Catskill (page 373). We paused here to drink in the spectacle of the Hudson's Rip Van Winkle Bridge, silvered by the magic of a rising moon.

Across the bridge and upriver a few miles lies a town founded upon an industry that now seems unlikely for these parts — whaling.

Nantucket and Martha's Vineyard whalers, hard hit economically by the Revolution, sought a mainland port after the war and found it here, 120 miles from the sea, at Hudson, New York. More than a score of whaling ships berthed at this river town in its heyday; a few sailed from Hudson until whale oil bowed to petroleum in the mid-19th century.

*See "New York State's New Main Street," by Matt C. McDade, NATIONAL GEOGRAPHIC, November, 1956.



Ships, of course, had sailed past this point long before Hudson's bright, brief whaling era. Henry Hudson was the first, in 1609, when the *Half Moon* pushed eight leagues farther upstream. His search for a passage to India died in the shallows beyond, but five years later Dutch traders reached his anchorage to establish Fort Nassau, later to be succeeded by Fort Orange and finally by Albany.

Ocean-going Ships Dock at Albany

Destined to become New York's capital, Albany already wore an air of maturity in Revolutionary times.

"The young people, I believe, are born old there," said the visiting Frenchman La Rochefoucauld-Liancourt in 1795.

But the city has more than kept up with the times, as we saw in the busy port of Albany (pages 396-7). Now one of the largest inland ports in the United States—the Atlantic lies 150 miles away—it berths some two hundred ships a year and handles annually about \$75,000,000 worth of cargo. We counted 13 ocean-going vessels at its piers.

"Step aboard," came a shout from the bridge of the freighter *Andros Citadel*. We climbed to the captain's cabin and enjoyed sweet sedimentary Greek coffee with Capt. S. Sarris and Chief Officer K. Makris.

Here was a good example of the international character of Albany's contacts. The coffee cups were decorated with paintings of Japan's Mount Fuji, the two officers were Greek, the vessel was a Liberty ship built in New Orleans, it flew the star and stripes of Liberia, and it was unloading lumber from British Columbia!

With Capt. Frank Dunham, Jr., general manager of the port, we went to see Albany's chief import, blackstrap molasses, being piped ashore into huge steel tanks.

"We can handle some 17 million gallons of molasses at once," said Captain Dunham. "It comes from the West Indies, to be mixed with grain for cattle feed."

At another pier, asphalt was pouring ashore

in hot, fluid form. It would be kept in insulated tanks and delivered, still hot and flowing, to customers. A tanker with four black tentacles reaching to the dock was piping off four different kinds of oil at the same time. And an enormous grain elevator was swallowing railroad carloads of grain at the rate of one every six minutes.

Some predict gloomily that the St. Lawrence Seaway will divert much of the midwestern cargo that formerly reached the sea through Albany.* But others maintain that the port's best days are just ahead, for the 27-foot Hudson channel, completed in 1932, is being deepened to 32 feet to permit any but the largest of the world's cargo ships to sail all the way upriver to Albany.

Water Routes Meet Above Port

Ten miles north of Albany, at Troy, the river traveler finds one of the most remarkable meetings of waters in the world. Here six routes converge—the Hudson and Mohawk Rivers; the old Champlain Canal, now abandoned; the modern Champlain Canal, which for more than half its way follows the upper Hudson; the old Erie Canal, used now only as a spillway; and the modern Erie Canal, a section of the New York State Barge Canal.

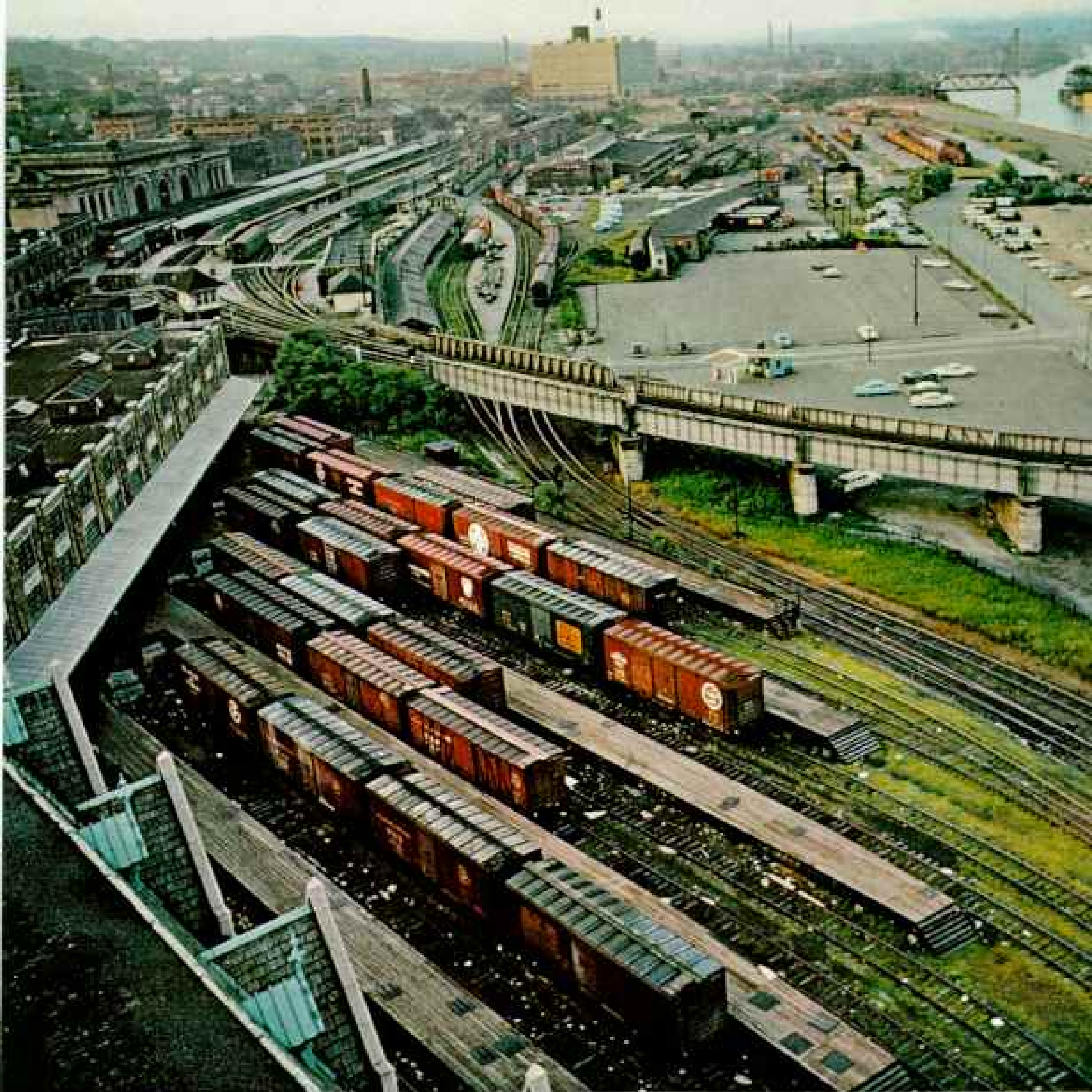
Tugs and barges transport cargo to and from the Great Lakes via this last waterway. Others ply the Champlain route northward to the St. Lawrence. Although ocean vessels cannot penetrate the Hudson beyond Albany, some of the river's finest scenery invites smaller craft.

The Hudson becomes steadily more wild and wonderful as one presses up through the Adirondacks. This is a land of lovely lakes: superb Lake George, the long finger of Lake Champlain, and Lake Luzerne, which, instead of resembling Switzerland's Lucerne, looks quite Japanese when the mists roll down from the mountains into the tall pines.

*See "New St. Lawrence Seaway Opens the Great Lakes to the World," by Andrew H. Brown, NATIONAL GEOGRAPHIC, March, 1959.

Chateaulike Capitol Dominates Downtown Albany and the River at Its Feet

Settled as a trading post, Albany claims the title of "Cradle of American Union." Here in 1754 Benjamin Franklin proposed a plan for unity among the Colonies. In 1797 the city became the seat of State government. An outer wall more than 16 feet thick at the base encloses the ornate capitol. Its construction began in 1867 and continued more than 30 years. Three governors who occupied the executive chamber went on to the White House—Grover Cleveland, Theodore Roosevelt, and Franklin D. Roosevelt.



65 EXTENDING BY WADE MILLER, MADISON 1991

One of the prettiest lakes is man-made. This is the 27-mile-long Sacandaga Reservoir, dammed in 1930 for power and flood control. Below it the Hudson no longer goes on rampages as it did in 1913, inundating part of Albany and leaving in its ebb boats stranded on a riverside street.

Bears Turn to Housebreaking

Pushing farther north into Adirondack State Park, we talked with Ranger Chuck Severance, who told us of his bear problems.

"Sometimes it seems there are more bears than people in these parts now," he said, "even though hunters are allowed to kill one apiece each season. They're big blacks—up to 600 pounds—and they sure can wreck a va-

cant summer cottage. Just recently one pried a couple of planks off a house, barged in, and left a big pile of broken beds, chairs, lamps, and kitchen cabinets on the floor."

Coyotes, too, have been multiplying, despite a \$25 bounty on each. "They gang up like wolves on deer," said the ranger. "And bobcats—the bounty of \$25 isn't enough to keep them down."

One of the cares of every ranger, of course, is to protect all animals, including bears, coyotes, and bobcats. But to preserve the right proportion of each to offset the imbalance caused by man is a problem for a Solomon.

We came upon the trail of Theodore Roosevelt at Aiden Lair Lodge. This has been a restful mountain retreat since the 19th cen-



AND EQUIPMENT BY WILLARD PRICE © N.Y.S.

Railroad and river run side by side in Albany, last deepwater port on the Hudson. A 27-foot channel, now being deepened to 32 feet, permits seagoing vessels to dock with oil, grain, lumber, molasses. Here the main line of the New York Central turns west. Railroad bridge in distance no longer carries trains; it stands idle, with drawspan open.

Catwalk splits the deck of the *Mobile Power*, a 29,173-ton tanker docked in Albany. The vessel unloads petroleum products from Texas. Crew members operate a maze of valves and lines.

ture, but Vice President Roosevelt had scant rest there in the early morning of September 14, 1901.

Roosevelt was on a vacation climbing trip on Mount Marcy when word came that President McKinley, felled by an assassin's bullet at Buffalo, was sinking fast. The Vice President, careering through the night in a buckboard, paused at Aiden Lair after 3 a.m. to change horses. Mike Cronin, the proprietor, took over as driver.

Roosevelt's wild ride through the darkness brought him to North Creek's railroad station at dawn, where he learned that McKinley had died. T.R. was already President.

Mike Cronin's daughter Rose invited us into the lodge. On every wall hung mementos of that famous night, including a horseshoe definitely *not* one of those worn by the team that made the final dash.

"The story is," said Rose, "that my father did a big business with those eight horseshoes — sold barrels of them. But the truth





KODACHROME AND HIS ESTABLISHED FRIEND





© WAYNE MILLER, MAGNUM © NATIONAL GEOGRAPHIC SOCIETY

Part-time cataract boils over a dam at Glens Falls. In dry periods the river often drops below the crest of the dam, and water flows through spillways only.

Spring-fed waters entice vacationers to island-studded Lake George. Armies of summer visitors invade the hotels, cottages, and camping sites of this battleground of colonial days.

Manes flying, hoofs pounding, trotters battle for position at Saratoga Raceway. For a century racing has drawn thousands yearly to Saratoga Springs. Races and mineral waters made the spa a synonym for elegance in the 1800's.

In 1777 the turning point of the Revolution occurred a few miles away, when American Gen. Horatio Gates defeated British Gen. John Burgoyne.

is, he never sold any; he loved a joke and started the story himself."

Roosevelt's journey had begun where ours was to end—at Lake Tear of the Clouds, the highest pond feeding the Hudson.

There are, of course, other sources. Motorists see a sign at Newcomb proclaiming this to be the "Source of Hudson River." Canoeists and hikers can trace other beginnings 10 to 20 miles farther back into the mountains.

We came to one of these at Elk Lake, a little-known gem sprinkled with islets and set in the wilds of the High Peak region of the Adirondack Mountains (next page).

The loon has disappeared from many Adirondack lakes, but we heard its strange and lonely laugh-cry above Elk. And the sound, I felt, belonged here amid the mystery of woods and waters little invaded by man.

We glided over a still mirror as dusk deepened into night, not daring to speak, plying the paddles in complete silence without lifting them from the water. The spell of the luminous lake and the velvet-black islands against the lighter gray of high mountains transformed the experience into a dream, an unreality that might be shattered by one

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bump of our paddles against the gunwale.

Reluctantly, we broke the spell to move still deeper into the mountains. If the highest body of water feeding a river shall be considered its true head, then the Hudson's is Lake Tear of the Clouds (page 403).

This remote tarn lies cradled 4,322 feet up in the crater of a triangle formed by Mounts Marcy and Skylight and Gray Peak. Mount Marcy, dean of the High Peaks, towers 5,344 feet—highest in the State.

Water Journey Ends on Opalescent River

From tiny Lake Tear flows Feldspar Brook, which tumbles into the Opalescent River; this, in turn, joins the Hudson.

We paddled up the Opalescent until our keel and the riverbed met. Through the glass-like water, the bottom seemed set with jewels

—hornblende, mica, and feldspar sparkling in the sun. But this glittering road has to be abandoned for a brown woodland trail punctuated by lean-tos, if you would reach Tear of the Clouds. And after you get there, it is a pond like a hundred others.

To appreciate its wild setting among the peaks, one must look at it from above. Returning to Albany, we made a flight to the peaks and back in an amphibious Otter, by courtesy of the State Conservation Department. Pilot Roy Curtis faithfully followed every bend of the Hudson, giving us a new perspective on its character and beauty.

Above the town of Luzerne the river alters dramatically. No longer tranquil and slow, it falls steeply, swiftly, swirling around great boulders, twisting through a gorge between steadily rising mountains.



ADIRONDACKS (ABOVE) AND IN EXTREMITY BY WILLARD PRIDE © NATIONAL GEOGRAPHIC SOCIETY

Jewel of the Adirondacks, Elk Lake drains into the Hudson. A solitary canoeist skims the mirrorlike surface. Cloud-wreathed peaks and lofty conifers frame the scene.

Riding white water, the author and his wife paddle close to Bakers Falls. Elsewhere they traveled by tug, barge, yacht, freighter, side-wheel steamer, and Coast Guard cutter.





Sparkling like a diamond, a raindrop lingers on a balsam branch before splashing into Lake Tear of the Clouds.

I traced our route on U. S. Geological Survey maps. Lumberjacks named many of the landmarks of this region, and no other breed of men has more fertile imagination.

We flew among mountains named Deer Leap, The Three Sisters, Kettle, P Gay, Baldhead, Bad Luck. Deep in the glens shone gems of water: Mink Pond, Dunk Pond, Stony-step Pond, Big Bad Luck Pond, Whortleberry Pond, Squirrel Pond, and O K Slip Pond, which empties into O K Slip Brook!

More and more water, until the mountains were interlaced with it.

Lake Tear Hides Among High Peaks

Now the real excitement began. We headed up into the High Peaks. More than 40 Adirondack summits soar over 4,000 feet. Most of them cluster right here in the heart of Adirondack State Park. This—the largest park, state or national, in the country—grants its mountains ample room; it sprawls across some six million acres.

No roads snaked beneath us; no lodges,

nothing but an occasional lean-to offering shelter to mountain climbers in this wildest, least accessible region of the State.

On the left I identified Henderson Lake, one of the Hudson's recognized sources, and on the right, Elk Lake, where we had tingled to the cry of the solitude-loving loons.

But where was Lake Tear of the Clouds? Little more than a small pond, it easily escapes detection. We flew low to search it out.

It might seem a simple matter to follow the Opalescent River and Feldspar Brook straight to Lake Tear. But both streams lie buried deep in evergreens. Lake Tear lies southwest of Mount Marcy, but which of these peaks was Marcy? The highest, of course, but it is not easy to pick the highest when you are not far enough away to see them in perspective.

Finally, Roy nodded positively and pointed. That one. That was Mount Marcy, the "cloud splitter" of the Indians. We circled it a mile away, still searching.

Then we saw it—Lake Tear.

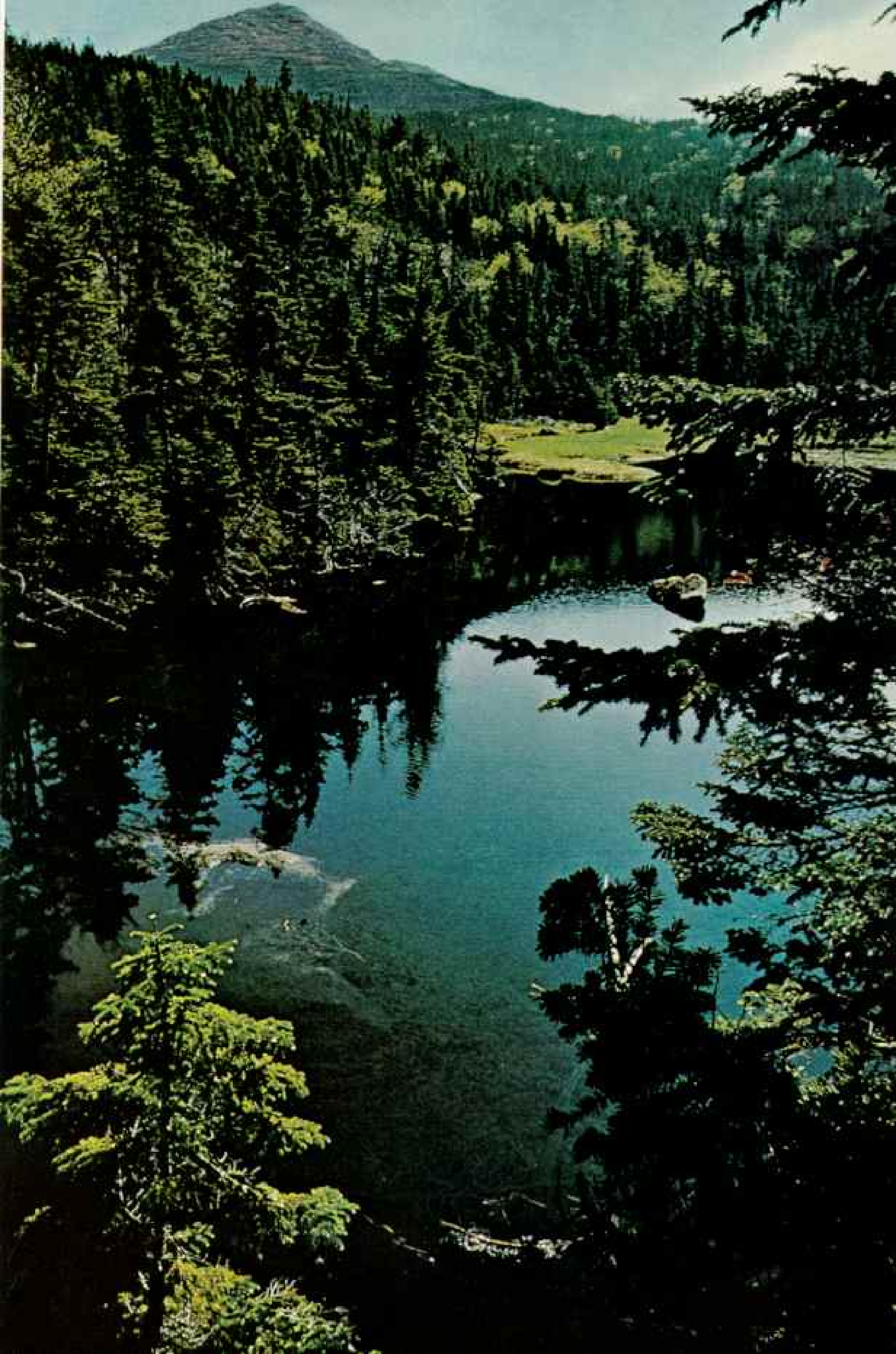
Conifers shaded its low shores, and its eastern end shone a brilliant green. From it descended a sparkling stream, soon lost in the trees. That would be Feldspar Brook, flowing down to the Opalescent. Closely guarding the lake towered Gray Peak and Marcy on the north; other giants of the High Peaks crowded it from east and west.

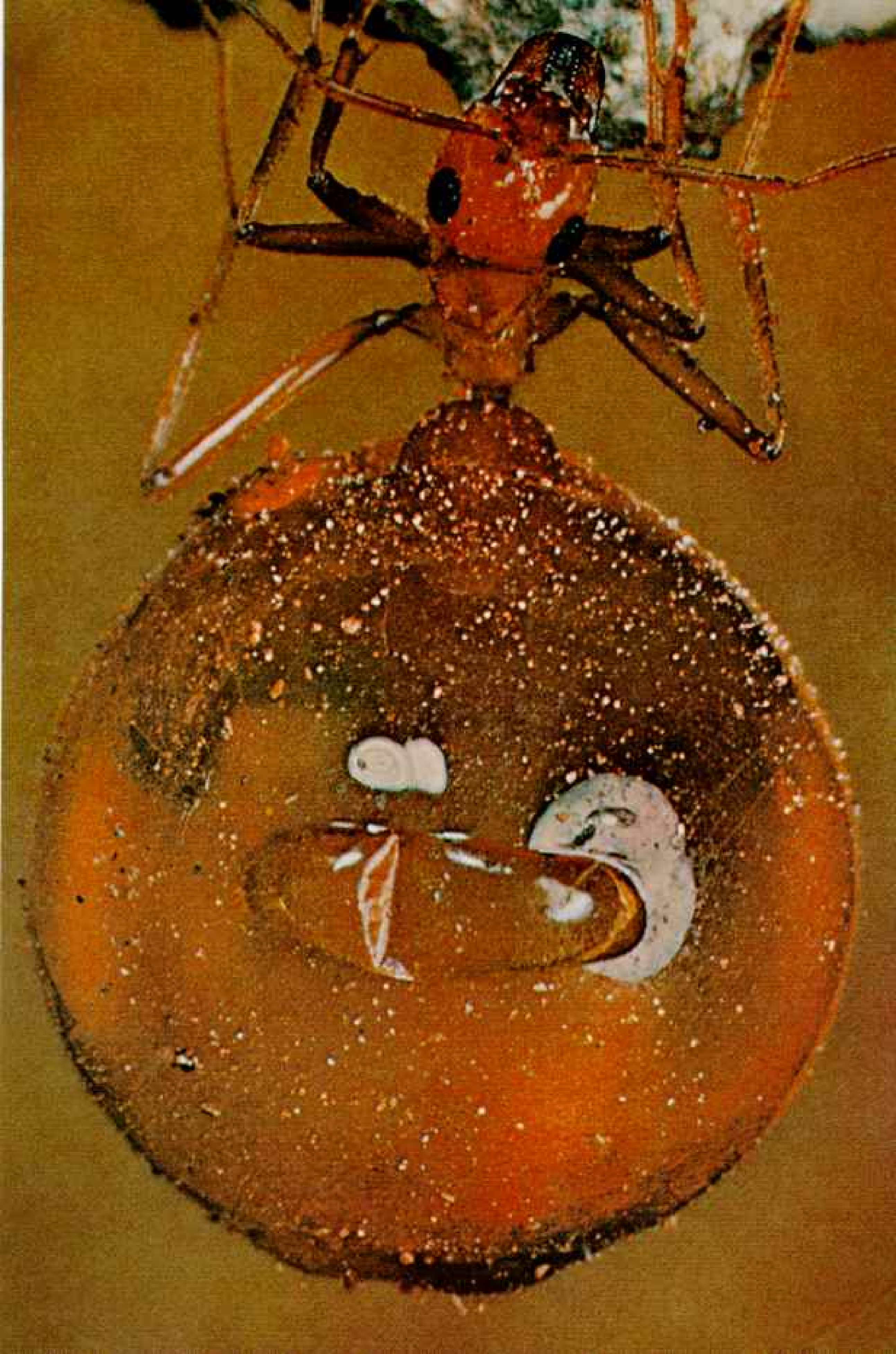
So there it was—the mountain teardrop that spawns the lordly Hudson.

I winged back toward Albany feeling no regret at a journey's end. I knew it was not really over, for this is a river that calls you back, again and again, as it did Washington Irving.

"The Hudson," he wrote, voicing the affection of those who know it well, "is in a manner, my first and last love; and after all my wanderings and seeming infidelities, I return to it with a heart-felt preference over all the other rivers in the world."

Highest pond feeding the Hudson, Lake Tear of the Clouds fills a hollow on the slopes of 5,344-foot Mount Marcy (background), loftiest of the Adirondacks.





TWINKLING LIGHTS of Manitou Springs, Colorado, spread out below us. To the west, in the moonlight, the great mountain mass of Pikes Peak pushed more than 14,000 feet into the night sky.

All around us in the dusk stood huge sandstone figures. We were on a ridge in the Garden of the Gods, a park owned by Manitou's near neighbor, Colorado Springs. It is a region where nature has sculptured great upthrust sandstone slabs into weird shapes—cathedral spires, figures from mythology, grotesque camels, an outsized turtle.

But my wife Annie Laurie and nephew Jan McClanahan and I had not journeyed here to view the scenic wonders. We had come instead to study and photograph a rare and remarkable insect. Thousands of people visit the Garden of the Gods each year, never dreaming that beneath their feet live some of the world's most unusual ants.

Honey Casks Feed Ant Colonies

Honey ants, of the genus *Myrmecocystus* ("sac ants"), survive from late fall until early summer by storing liquid food—not in hives or holes, but in the bodies of special workers. These living storage tanks, fed to the bursting point by their fellows, grow to the size and shape of amber pearls (lower right). With sacs fully swollen, the ants become immobile, never to walk again. Sometimes they burst.

We arrived at Manitou Springs in early afternoon and drove immediately to the Garden. Honey ant colonies are far from abundant, and we expected difficulty in finding one suitable for our photographic work.

But luck was with us. Annie Laurie quickly spotted a small sandy crater about six inches in diameter, with an entrance hole at the center. It was a typical tunnel into the subterranean nest of a honey ant colony.

Better still, it was on a hillside. This meant

Living Honey Jars of the Ant World

Article and photographs by
ROSS E. HUTCHINS, Ph.D.

that if I dug carefully from the lower side, I could expose and photograph the underground habitations of the ants. But before disturbing the colony, we wanted to observe the nocturnal activities of its inhabitants. We went back to our motel and awaited the darkness.

About 8 p.m. we returned. There were no ants in evidence. We turned out our flashlights and sat down to wait.

I recalled that, according to the writings of the Reverend Henry C. McCook, a scientifically minded Presbyterian minister who first studied these ants in 1879, they should already be streaming forth from their nests to harvest sweet honeydew from galls on the nearby shin oaks. Perhaps the night was too cool for the colony's collectors and they wouldn't come out at all.

After a while I turned my flashlight on again and—behold! The ground surrounding the little crater was covered with slender yellow ants. They were streaming out of the nest in droves and scurrying toward the small shin

The Author: Member and senior entomologist of the State Plant Board of Mississippi, Dr. Ross E. Hutchins also heads the Department of Zoology and Entomology of Mississippi State College. He has written five books and numerous articles on little-known aspects of plant and animal life.

Ballooning honey ant, one of the world's most remarkable insects, stores in her elastic abdomen eight times her weight in honeydew. Unable to make wax cells as bees do, honey ants use sterile females, called "repletes," as living reservoirs to feed the colony from autumn to summer. Tiny claws on the feet suspend this immobile vat from the ceiling of her underground nest. In such a position she spends her life. Magnification shows her 16 times larger than life; true size is less than half that of the penny at right.





ROCKY MOUNTAINS BY KATHLEEN BEYTS JUDGE (ARIZONA)

oaks a few yards away. As if on signal, the worker ants had set forth from their underground nest to gather food.

We followed the hurrying insects as they made their way to the oaks, and we watched them collect the liquid honeydew that exuded from globular swellings, or galls, on the twigs.

Tiny cynipid wasps make these galls. They lay eggs in the twigs; young wasps developing inside the plant tissues irritate them to the point of malformation.

Inside the galls, sugars are produced. The excess is secreted onto the outside surfaces in small droplets, the nectar that draws honey ants. It is an interesting relationship between two entirely different insects.

The worker ants moved from one gall to

another. As time passed, we could see their abdomens slowly becoming swollen with honeydew. Like many others of its family, every honey ant has a community, or pantry, stomach in which food may be stored and then regurgitated to feed others.

Workers Take Honeydew Home

When their bellies were full, the ants hurried back toward the nest. The abdomens were quite transparent, filled with amber nectar.

My wife trailed another foraging column to a wild rosebush and found a second source of honey ant food. This group was "milking" a herd of aphids, or plant lice. The honeydew secreted by special glands on these ant



PHOTO BY D. HUTCHINS © NATIONAL GEOGRAPHIC SOCIETY

Colorado's Garden of the Gods offered the author a dramatic setting for honey ant study. Sandstone slabs spike the skyline.

Foraging worker scouts a shin oak leaf for honeydew droplets.



cows is collected by most sweet-eating ants.

"What do the ants do with the honeydew?" Jan asked. The answer is what makes their story so extraordinary.

When the foraging ants return to their underground nest, they pass their collected sweets on to certain other workers. How these latter are selected for the special duty they are to assume is unknown to biologists. Perhaps they volunteer.

Swollen "Repletes" Stay at Home

At any rate, back in the nest, the honeydew is regurgitated from the crops of the foragers and drunk by the chosen workers. In time the abdomens of these living casks become so distended that the ants can no longer move about in a normal fashion, but remain suspended from the arched ceilings of the subterranean chambers by the tiny claws on their feet (page 404).

We call these individuals "repletes." Once embarked upon their careers as community reservoirs, they never again leave the nest. Like clusters of small glossy grapes, they remain suspended month after month in total darkness.

Now and then, in the dry season, a hungry worker ant approaches a replete and solicits food by placing her mouth against the other's.

Shrublike shin oaks yield much of the ants' sugar harvest. Tiny wasps lay eggs in the twigs, and galls form around the larvae. Honey ants collect their year's food when the galls exude nectar in midsummer. At times the ants "milk" aphids and coccids for honey.

The author's nephew Jan McClanahan opens a gall to inspect a wasp larva.



A droplet passes between them (painting below). The worker, in turn, may pass the honey on to other laborers of the colony, to the queen, or to immature ants.

Biologists believe a replete lives about two years. When it dies, it is usually dismembered and carried off to a "cemetery chamber."

Ants Must Store Honey or Die

I find the use of living tanks for the storage of food an interesting solution to a difficult problem. Honey ants occur in dry parts of the hemisphere, from Mexico City north to southern Idaho, usually at altitudes between 5,000 and 7,000 feet. Only in brief rainy seasons during summer and early fall is there honeydew to collect. The ants must store it or die. Not having wax-making machinery like the honeybee, which faces a similar problem, they become their own storage reservoirs.

Indians of our Southwest and of Mexico once munched honey ants like syrup-filled candies. In New Mexico the Indians made a drink of the stored liquid—half an ounce of it to six ounces of water.

Ants that use the same food-storage techniques occur in the arid sections of Australia and in many other parts of the world. Some look very much like ours.

We came back the next morning, but there was no activity outside the ant colony. If, however, one looked down into the relatively large entrance tunnel, the head of an ant could occasionally be glimpsed. These were guards stationed at the gate to prevent the entry of enemies—spiders or foreign ants.

The morning sun was hot, the sandstone soil hard as we began excavating. We had to



Fallen Ants in a Honey Pantry Have Grown Too Fat to Walk

Dislodged by the author's digging, transparent honey casks lie like soap bubbles on the floor of the cave. Frantic workers rush about to defend the nest or try to hoist their sisters to safety. As many as 300 repletes may dangle from the ceilings in a colony's galleries.

Tapping a living cask, a hungry worker, mouth to mouth, takes a drop of nectar from a bulbous replete clinging to the chamber roof. The painting mirrors the actual appearance of a honey gallery (above).



6 TIMES LIFE SIZE

PHOTOGRAPH BY BOB E. HUTCHINS © NATIONAL GEOGRAPHIC SOCIETY

dig very carefully, since there was no way of knowing in which direction the underground passages extended.

After an hour's careful work, my trowel at last broke through the wall of a tunnel about six inches beneath the ground level. I could see that it was a chamber devoted to the rearing of young. Several dozen gray pupal ant cases were present, as well as a number of worker ants that seemed more than ready to defend their home against invasion.

Deeper Vault Holds Hanging Vats

Honey ants use chambers near the surface, where the sun's warmth can penetrate, for the rearing of their young. We had found from previous excavations in the Garden of the Gods that repletes live several feet deeper.

The ants store their food at depths where the ground stays cool in summer, yet never freezes in winter. The entire colony is always on or near the top of a well-drained ridge; moisture could cause the growth of molds injurious to the inactive repletes.

More digging, and I broke into one of the galleries occupied by repletes, a chamber less than an inch high and eight inches across. Dozens of the swollen ants, suspended from the vaulted ceiling, glistened in the morning sun like polished marbles. Their ranks extended far back into the dark tunnel.

Normal-sized worker ants sallied forth with jaws open to defend the nest. It was a sight relatively few naturalists have had the privilege of seeing.

Cautiously, I enlarged the opening into the



10 TIMES LIFE SIZE

BOB SCHROEDER © NATIONAL GEOGRAPHIC SOCIETY

Magnified monster climbs an oak gall on a night raid. Gathered nectar will swell her abdomen until she delivers it to a replete in the nest.

Marblelike galls stud an oak twig; punctures mark the spots where maturing wasps emerged.



gallery, and then began setting up camera and electronic flash equipment to record the ant colony on film. The disturbance caused a number of repletes to drop from their positions on the ceiling. They lay helplessly waving feet and antennae in the air (page 409). Occasionally we saw a normal worker apparently attempting to hoist a rotund sister back to her overhead perch.

Elastic Armor Swells Into Sac

I carefully picked up one of the replete ants with a pair of tweezers and told Jan to look at it under a hand lens. Under magnification the details of the enlarged abdomen became visible, as well as the means by which it had been so greatly stretched.

The abdomen of a normal ant is covered with a number of sclerites, or hard plates; these are joined together by hidden membranes. Under the lens the plates that had once covered the abdomen were now mere islands on the globular surface. Most of the distended abdomen now had for covering only the membrane, stretched to extreme thinness (opposite page).

One replete had burst in falling. With a

finger, I tasted the honey. It was sweet, but I think bee honey has better flavor.

The repletes are females, like all the other workers. All ant societies are matriarchies, centering about a queen. In our excavations we did not locate the queen or her chamber, but Dr. McCook describes one he found:

"Besides the queen the room contained a large number of naked grubs . . . honey-bearers, and workers. . . . A single gallery [was] about eighteen inches long, three-fourths inch wide and one-fourth inch deep."

Workers Keep Their Queen Prisoner

Here in this royal chamber, more than two feet below the surface, dwells the queen, surrounded by her guard of worker ants who continually feed and clean her. In a manner of speaking, she is a prisoner in her own realm. If she strays out of the royal chamber or attempts to leave the nest, the workers grasp her legs and gently tug her back.

This solicitous care is, of course, instinc-

tive. If the queen were to die, the colony would be doomed, since ants of the worker caste cannot lay fertile eggs.

The queen deposits eggs in tiny clusters of about 25, each egg oval and with a yellowish tint. The workers carry the egg clusters away and care for them until hatched, after which the young grublike ants are fed until fully developed and ready to assume their roles in the colony's labor force.

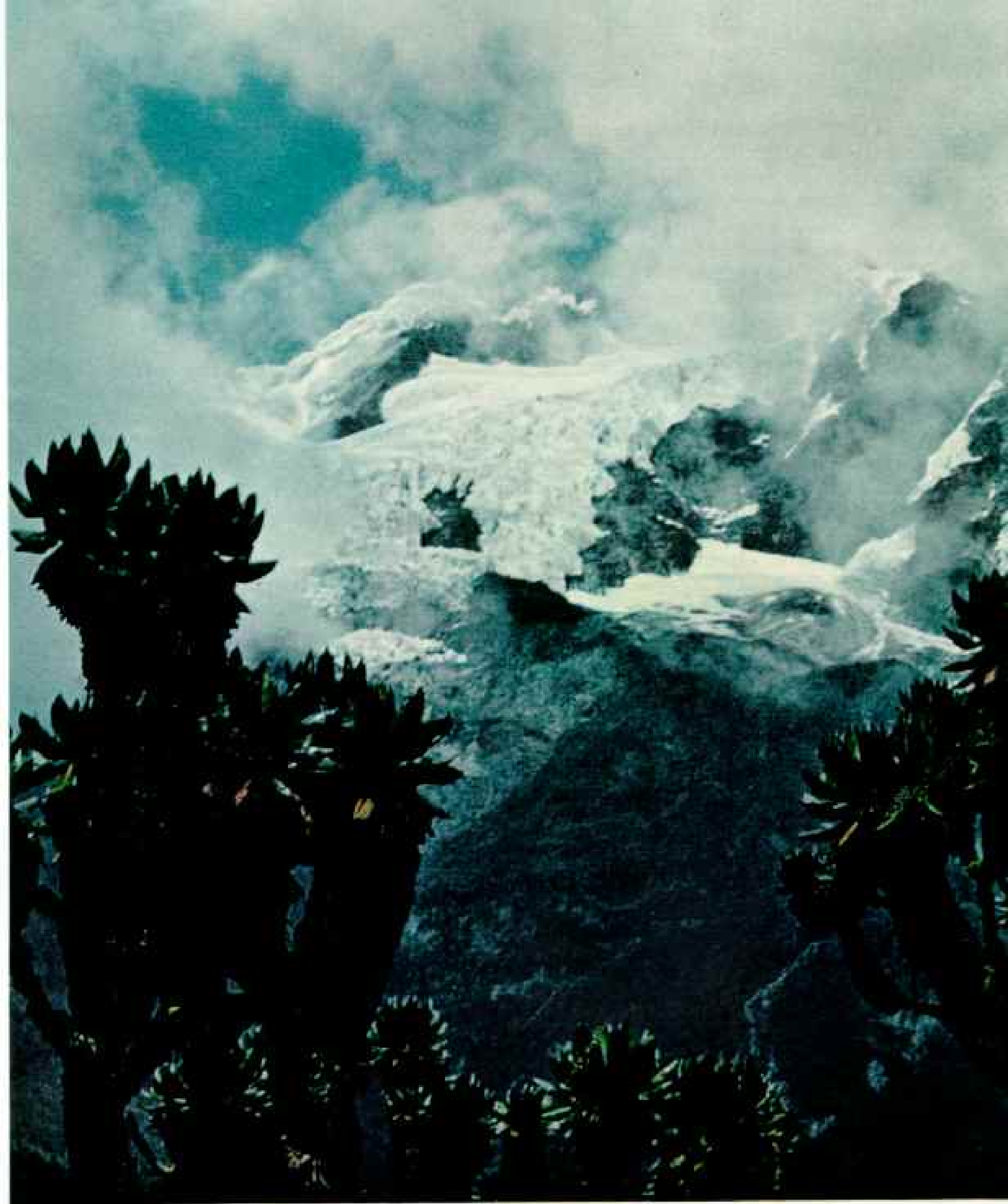
Some eggs will produce queens, others males, or drones, all winged. These fly away and mate. Then each new queen digs a nest, severs her own wings, and starts laying eggs.

At first, of course, she does all the work herself, but later she has her offspring to help her. When they have everything in hand, the queen stops working and does nothing but lay eggs and eat.

"What a dull life," said Annie Laurie, as we packed our cameras and made ready to leave the Garden of the Gods. "The things some females will do for security!"

Fallen honeypot clings to an opened gallery; an anxious worker eyes her plight. One of her abdominal plates stands out like an island on the fragile, distended membrane it once helped to cover. Bluish patch reflects the camera lights.





Herbs as tall as trees, hoofed "rabbits," ice sheets on the Equator . . .

MOUNTAINS



402249096 © NATIONAL GEOGRAPHIC SOCIETY

By PAUL A. ZAHL, Ph.D.
National Geographic Senior Staff

Photographs by the author

NO MAN LIVES in the Mountains of the Moon, the eerie Ruwenzori.

Properly dressed and housed, one could stand the everlasting cold and mist and drip and gurgle of water. But I think the silence, the sight of ordinary plants and bushes grown to outlandish sizes, the dank smell of fungi, the knowledge that in the muck of the jungle floor burrow worms three feet long—eventually all would chill the soul and drive one from these otherworldly heights to the sunny warmth of the East African lowlands.

Danger From a Falling Flower

I saw these mountains at work upon a man's spirits. With a hunting knife I cut off the spike of a lobelia. It was not the familiar plant you and I know as a cardinal flower. This lobelia was as tall as a tree, and I jumped aside as it toppled to earth, lest the blue-flowered mass knock me down.

"I need a porter to carry this specimen," I said to Jim Coggins, only European in our expedition who could speak the local tongue, Lukonjo. "It's the best I've seen."

But the porter refused to touch it, although it was not poisonous and he knew it, for his Bakonjo tribe has lived for generations below the snowy peaks of the Ruwenzori range.

"No go," said Jim. "He says it would be death to carry it—and he doesn't want you to carry it either, because he likes you. He'll carry anything else you want him to, but not a *mulumbu*."

I weighed the alternatives: I could lose a chance to study a rare botanical specimen, or

Shifting winds rip the cloud canopy that normally cloaks the Ruwenzori. For a shining moment, the fabled Mountains of the Moon stand revealed in snow-clad majesty.

scientists climb the weird Ruwenzori to study the secrets of Africa's

OF THE MOON



I could flout a tribal superstition. I swung the 15-pound spike over my shoulder and went on. Nothing serious happened, though I had some strange dreams that night. The Bakonjo looked surprised, maybe even a little disappointed, when I emerged hale and hearty from my sleeping bag in the morning.

Thrusting up from the Equator where western Uganda borders the Republic of the Congo, the Ruwenzori are massed on a base some 60 miles long and 30 across. Even the ancients had intimations of their existence. Nineteen hundred years ago the geographer Ptolemy ascribed certain *Lunae Montes* (Mountains of the Moon) vaguely to central Africa. Still earlier, Aristotle mentioned a "silver mountain" there, and in 500 B.C. Aeschylus wrote of "God's great garden [the Nile Delta], fed by distant snow."

Mystery Mountains Fascinated Stanley

Henry M. Stanley, who found Dr. David Livingstone in 1871, applied the native name Ruwenzori (Rainmaker) to this mysterious range in 1888, noting that during 300 days of the year the peaks are hidden under a mantle of brooding clouds. Watching from afar during one of the unpredictable clear periods, Stanley observed a sky-piercing whiteness which "assumed the proportions and appearance of a vast mountain covered with snow." An African boy in his party, having no knowledge of snow, said that the whiteness on the summit was a huge amount of salt.

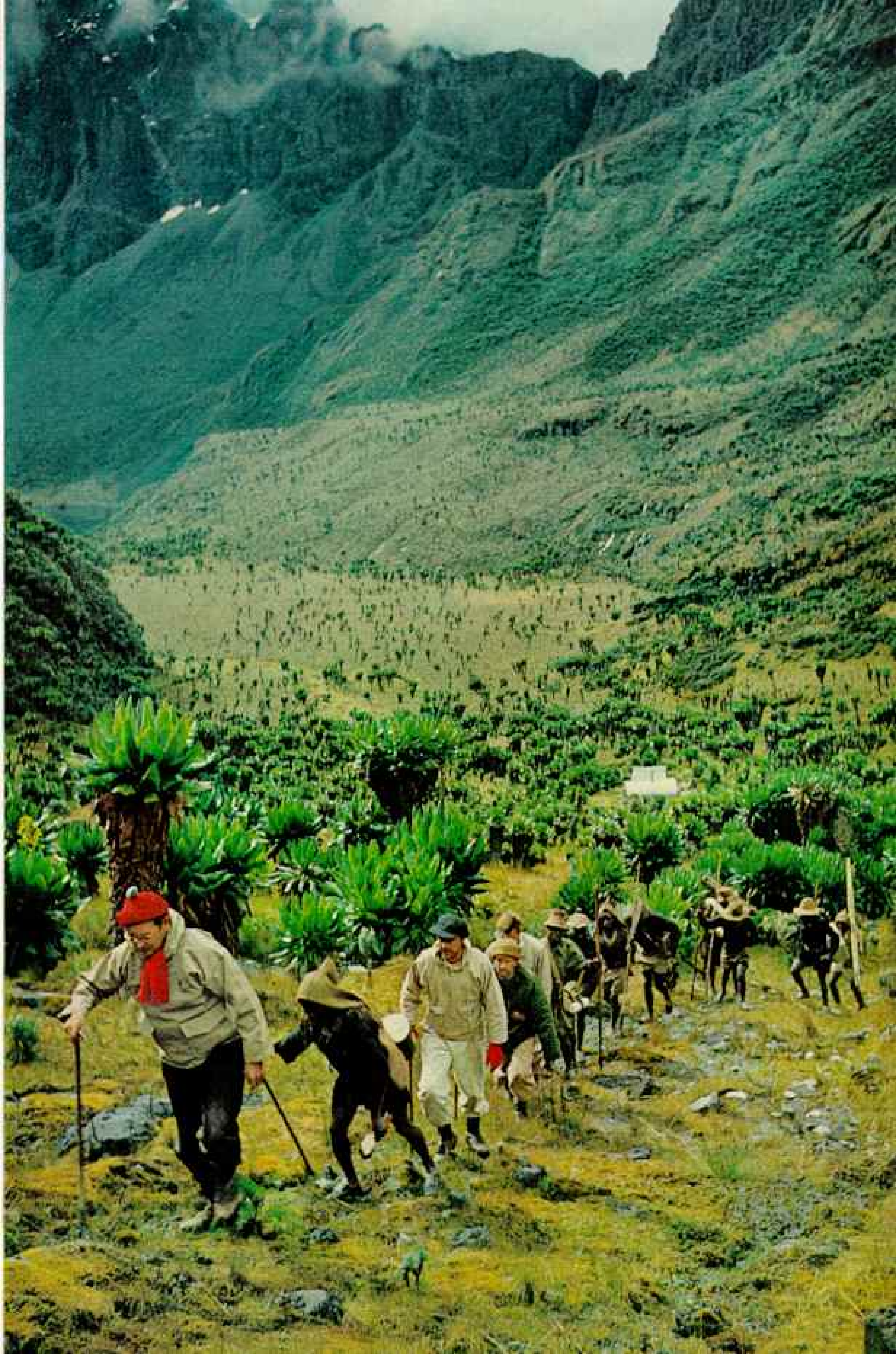
"Peak after peak," Stanley wrote of a later view, "struggled from behind night-black clouds . . . until at last the snowy range, immense and beautiful . . . drew all eyes and riveted attention, while every face seemed awed." No doubt the clouds soon closed in again, and the peaks of "salt" were gone.

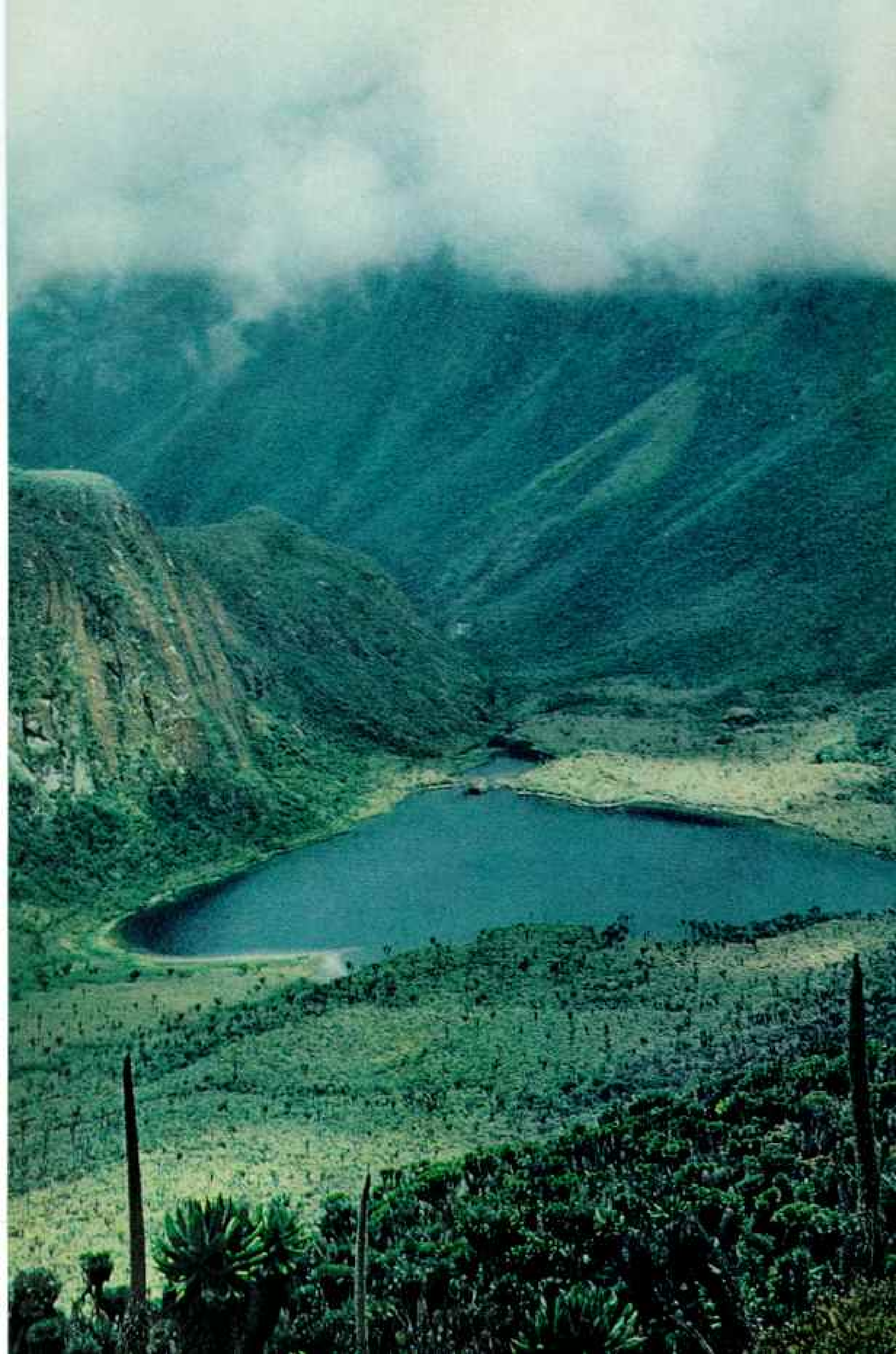
The Italian Duke of the Abruzzi, Luigi Amedeo di Savoia, first climbed, mapped,

Skirting a Grove of Giant Groundsels, Explorers Trudge up Moss-slick Slopes

An expedition from Makerere College, in Kampala, Uganda, climbs from Lake Bujuku (far left) below the gaunt cloud-capped flanks of Mount Baker.

The Ruwenzori Mountains form part of the boundary between Uganda and the troubled Republic of the Congo (map, left). Snow-crowned 16,000-foot peaks lie less than 30 miles north of the Equator. Beneath the storm-spawning heights spreads an unearthly landscape where strange animal life and even stranger vegetation thrive.







High above Lake Bujuku, scientists and porters survey a bizarre 13,000-foot-high bowl, where flowering lobelias throw up lancelike spikes and swollen groundsels lift fleshy tops. "Not of this world," French mountaineer Bernard Pierre described the Ruwenzori.

FORCHIONE © NATIONAL GEOGRAPHIC SOCIETY



and photographed the range's vaulting peaks, nine of them over 16,000 feet high, in 1906.

In the years that followed, many another expedition and climbing party, approaching from either Uganda or the Congo, has probed into the Ruwenzori, sloshing through the marshy valleys, suffering in the cold of glistening ice fields, marveling at the giant plants whose counterparts in Europe and North America grow only a few feet high.

Never, however, has anyone solved all the mysteries of the Ruwenzori, and there is always work for the next expedition. In December and January of 1958-59 I joined one of these scientific parties, an International Geophysical Year research group from Makerere College, in Kampala, Uganda.

Leader of the expedition was Pat Henderson, Edinburgh graduate in geology. Tony Shepherd, Oxford M.A., served as geographer and surveyor; Jim Coggins, British electronics man, as interpreter and technician; Cliff Ball, a recent Cambridge Ph.D., as geophysicist; and Bob Eden, an East African government weather man, as meteorologist. These physical scientists were concerned mainly with ice flow and general glaciology.

As a naturalist, I would busy myself with animals and bizarre botanical forms. Since I joined the party too late to make extensive preparations, I worked mostly with my cam-

eras, and I think I left enough unsolved mysteries behind me to keep the next expedition quite happily occupied.

Two days after Christmas we parked our cars and station wagon at road's end in the foothills 40 miles south of Fort Portal, Uganda. Here, near Bakonjo tribal headquarters in the Mubuku Valley, we hired 52 strong tribesmen as porters.

A sweater and blanket, together with cassava flour, groundnuts (peanuts), salt, sugar, and other essentials, were issued to each man. The sweater-blanket practice, begun half a century earlier by the Duke of the Abruzzi, is still honored by all expeditions entering the Ruwenzori from the east.

Elephants Roam in Valley Swamp

By midmorning a ton of provisions and equipment, mostly rainproofed in sealed four-gallon tins, was hoisted to those impressively strong backs and secured there with fibers of twisted banana leaf. Without fanfare the party set out up the valley.

An hour or so later found us deep in a swamp overgrown with grass as high and twice as dense as Iowa corn in August. This was the first of many swamps and bogs we would have to cross, for almost every Ruwenzori valley and depression is choked with silt deposited there by runoff from rain or

Lichens Hang Like Ghostly Shrouds in a Moss-carpeted Rain Forest

No trails cut through this luxuriant growth, midway up the misty slopes of the Ruwenzori. "Its thickness has to be felt to be believed," says the author. "Here time stands still. As we hacked our way through, I would not have been surprised to meet a browsing dinosaur or a soaring pterodactyl."

Defiant serval, a native cat snared by Bakonjo porters, snarls at its captors. Animal life is sparse in the mountains. Elephants roam groves of bamboo up to 8,500 feet; leopards and antelopes venture as high as the 15,000-foot snow line. Oddest inhabitant is the rock hyrax, which suggests a rabbit with hoofs but is zoologically akin to the elephant and rhinoceros.

REPRODUCED BY PAUL A. EHL (RIGHT)
AND EHL, SCHULTHEIS, BLACK STAR © N.M.S.



glaciers, and kept ever-wet and soggy by continual mist.

"Elephants love this swamp," Jim Coggins had informed me. "The Africans will grow quiet and apprehensive in the tall grass; you wait and see."

It was true. Talking and joking had virtually ceased among the carriers, when suddenly Benezeri, head porter and our chief guide, signaled that he had spotted fresh elephant spoor. In total silence now and on the slippery double, we stumbled through the towering *Pennisetum* grass. We saw many tracks but no elephants. I, for one, breathed easier half an hour later when we emerged and could see where we were going.

Now we began climbing in earnest. Our party caterpillared up slopes densely covered with bracken and stinging nettles, then abruptly broke into a zone luxuriant with mixed evergreens, *Cyathea* tree ferns, and wild bananas. Later, at 7,000 feet, stands of high, feathery bamboo created a light-diffusing screen above our heads.

Beside the bamboo trail we found a tiny structure like a doll's house, freshly made. Leaves covered its frame of arched twigs. Through the open front I saw a spoonful of sugar on a leaf.

"So!" said Tony Shepherd. "The porters are nervous. That's an offering to the forest and mountain spirits."

Fifteen minutes later Pat Henderson suddenly dropped to his knees to study something in the trail.

"Leopard tracks on top of the porters' tracks," he said. "Means there's a genuine forest spirit between us and our gear."

But mountain leopards aren't likely to attack an expedition. They may follow it all right, attracted by noise and man-scent, but they know this game is too big for them.

During the expedition of the Duke of the Abruzzi, a leopard often came into camp. They shot him finally, but only after he began stealing the porters' meat beside the campfires.

"Rock Rabbit" Has Tiny Hoofs

The only animals in the Ruwenzori capable of doing a man real harm are leopards and elephants. We saw no snakes whatsoever. The elephants usually stay in the tall grass of the foothills. The leopards range high, but not into the snow.

There are troops of black-and-white *Colobus* monkeys in the writhing vegetation. Tiny antelopes called duikers roam from lowlands to snow line. There is a chameleon like some sort of prehistoric monster, with three horns sprouting from its forehead.

The porters, always hungry for meat, set little snares every night. One morning they brought in a small spotted feline. At first we thought it a young leopard, but then realized it was a serval, a native cat of the Ruwenzori (preceding page).

The porters set traps mainly to catch hyraxes, which come to peanut bait. This is the strangest creature of the Ruwenzori. It looks somewhat like a rabbit, so it is usually called "rock rabbit." Its voice is a shrieking whistle, something like the call of a guinea pig. It has hoofs instead of claws, making it an ungulate; it is definitely not a rabbit.

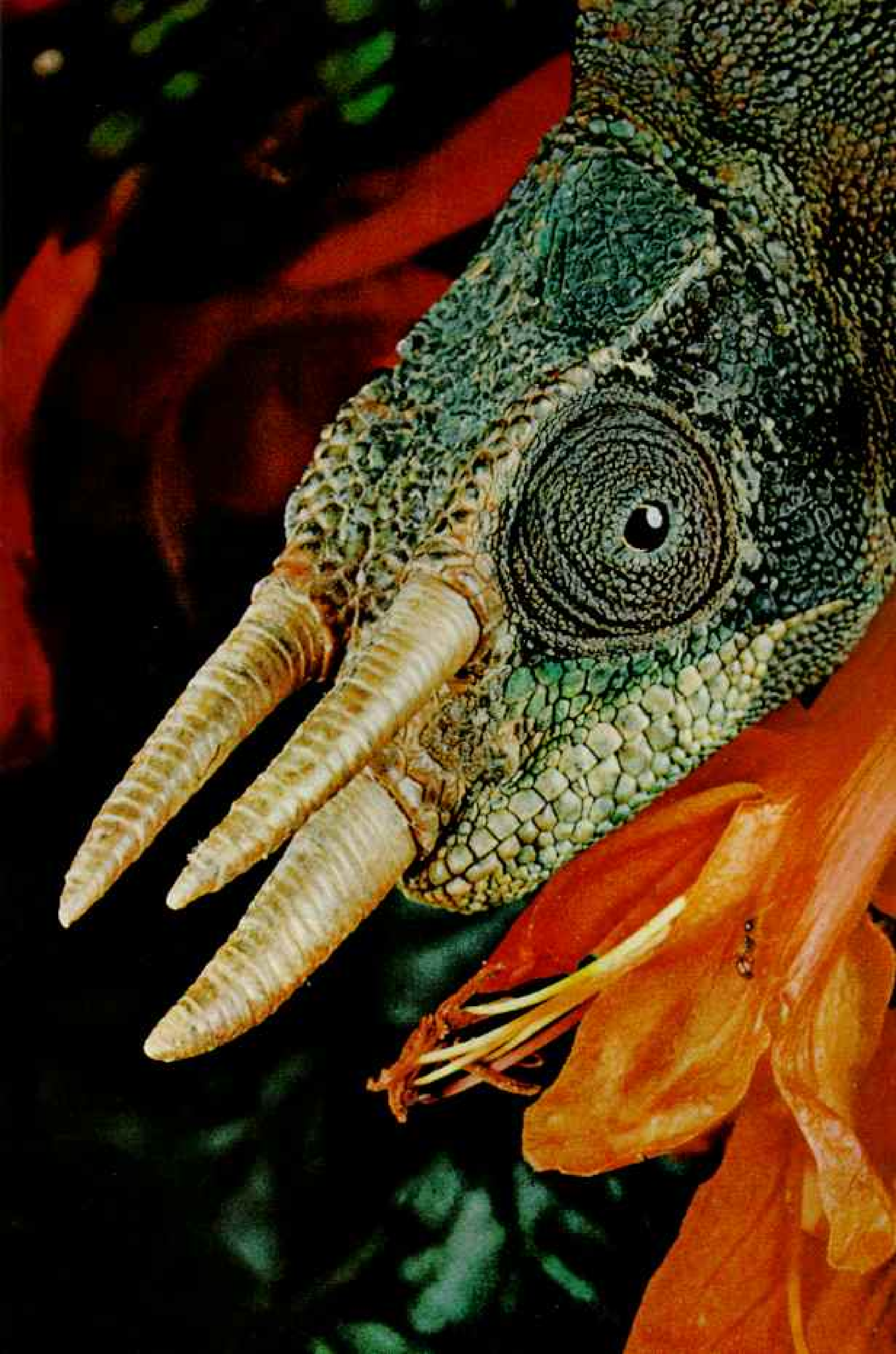
Actually, it is a distant cousin of both the
(Continued on page 426)



Miniature Dragon Grows Triple Horns

Dr. Zahl, who photographed this five-inch chameleon in the Congo, offered a reward to expedition porters for a live one in the Ruwenzori. But Bakonjo tribesmen fear the reptile as an ill omen and will not touch it.

Scaly skin and spurlike horns give *Chamaeleo johnstoni* the look of a rooster's foot. Heavy-lidded eye swivels in a revolving socket.



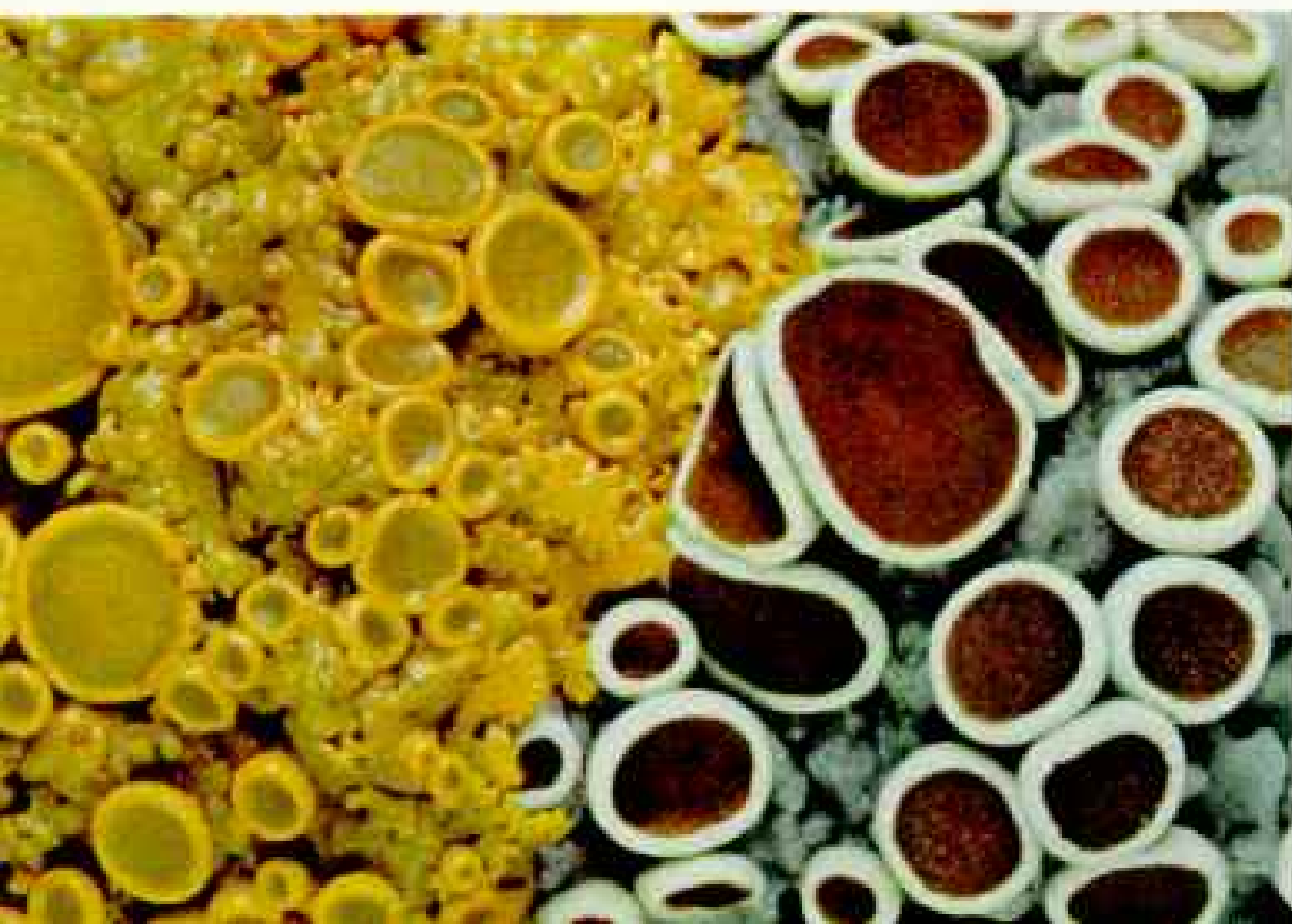


Fringed cups, the fruiting bodies of a lichen, thrive in the wet, cold Mountains of the Moon. Two distinct organisms, a fungus and an alga, combine to form the humble plant. Algae supply carbohydrates by photosynthesis; fungi provide salts and water storage. Unlike most other plant life, the lichen possesses no seeds, roots, stems, or leaves. Some species secrete an acid that can dissolve the hardest rocks.

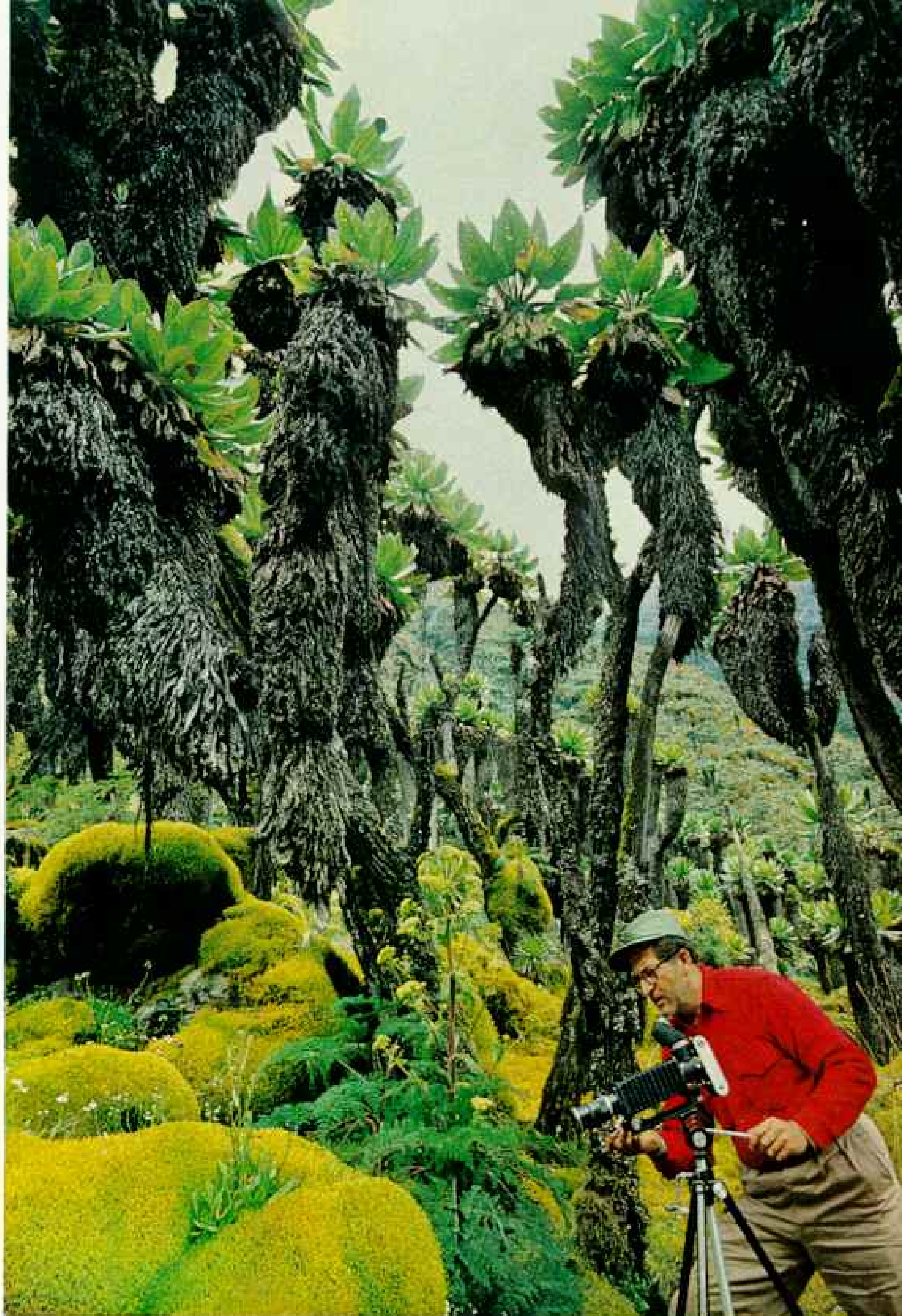
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Groundsel flowers unfold atop towering trunks shaggy with dead leaves (opposite page). One of the world's largest flowering plant groups, the groundsel, or senecio, normally grows no higher than a foot. In the Ruwenzori, it seems determined to become a tree. Scientists suggest that its gigantism results from the damp, cool climate, acid soil, and intense ultraviolet light at high altitude.

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Like lily pads on a pond, delicately tinted lichens dress a boulder. Though slow growing, they prove virtually indestructible. Botanists believe that some colonies have lived more than a thousand years. In arctic lands the plants serve as fodder for caribou and reindeer. In times of famine they have been ground into meal and baked in "lichen bread." Some historians speculate that the "manna" eaten by the Israelites in the wilderness, as told in Numbers 11:9, may have been lichens.



PHOTOGRAPH BY NATIONAL GEOGRAPHIC SOCIETY

Writhing Groundsels, Crowned With Cabbagelike Leaves, Dwarf the Author

Golden mosses and green ferns upholster the rocks in a forbidding forest near Lake Bujuku. Dr. Zahl moves in for a close-up of fruiting lichens (opposite).



Candlelike blossoms adorn the spike of a *wollastonii* lobelia. In the Ruwenzori the plants soar three times as high as a man; elsewhere they rarely exceed 12 inches. These blooms, approximately life-size, near fullness.



KIDDERHORN © NATIONAL GEOGRAPHIC SOCIETY

Feathery Papyrus Graces a Swamp in the Foothills of the Ruwenzori

In ancient times the Egyptians utilized masses of stately *Cyperus papyrus* growing wild along the banks of the Nile. The stalks and their inner pith, eaten raw or cooked, provided a staple food; stems were woven into boats, sails, and cloth; and the roots, when dried, could be burned as fuel. We derive our word "paper" from papyrus, which the Egyptians cut into strips, pressed together in either parallel or crisscross pattern, and dried into sheets of writing material.

Even today tribesmen on the shores of Lake Victoria weave the reeds into sleeping mats, fish traps, and crude nets.

Tiny golden-brown flowers tip green threadlike shoots atop six-foot stems.

Like freshly baked tarts, lichens cover the trunk of a fallen tree. In the upland rain forests the author saw others shaped like goblets, funnels, bowls, disks, and knots. This close-up is five times life-size.



elephant and rhino. In the language of science, the hyrax of the Ruwenzori belongs to genus *Procavia* of the order Hyracoidea, which was widely represented eons ago. Ten fossil genera are known. But *Procavia*, as we find him today, dates from recent geological times. The little beast makes a fairly tasty dish when boiled with a pinch of salt.

We saw ducks on a mountain lake and iridescent sunbirds (the African counterpart of hummingbirds) sipping from lobelia blooms. Once we spotted a white-necked raven soaring through the peaks at 15,000 feet.

Three-foot worms? We found one squirming in the mud at trailside after a heavy rain. Thick as a man's thumb, it was simply an oversized earthworm. It would have made enough bait for a fortnight of fishing.

Peaks Tower Above Great Rift Valley

The animals gave us no cause for concern, but the weather did, as it has done everyone who came to these heights before us. The weather is bad, partly because of something that happened millions of years ago—the formation of the Great Rift Valley.

In a series of gigantic fractures in the earth's crust that continued for 100 million years, a chain of depressions appeared, extending 4,000 miles—from the Jordan Valley in the Holy Land, southward under the Red Sea, through Ethiopia, Uganda, Kenya, and Tanganyika, to Mozambique and the Rhodesias.

Some sections of the earth sank thousands

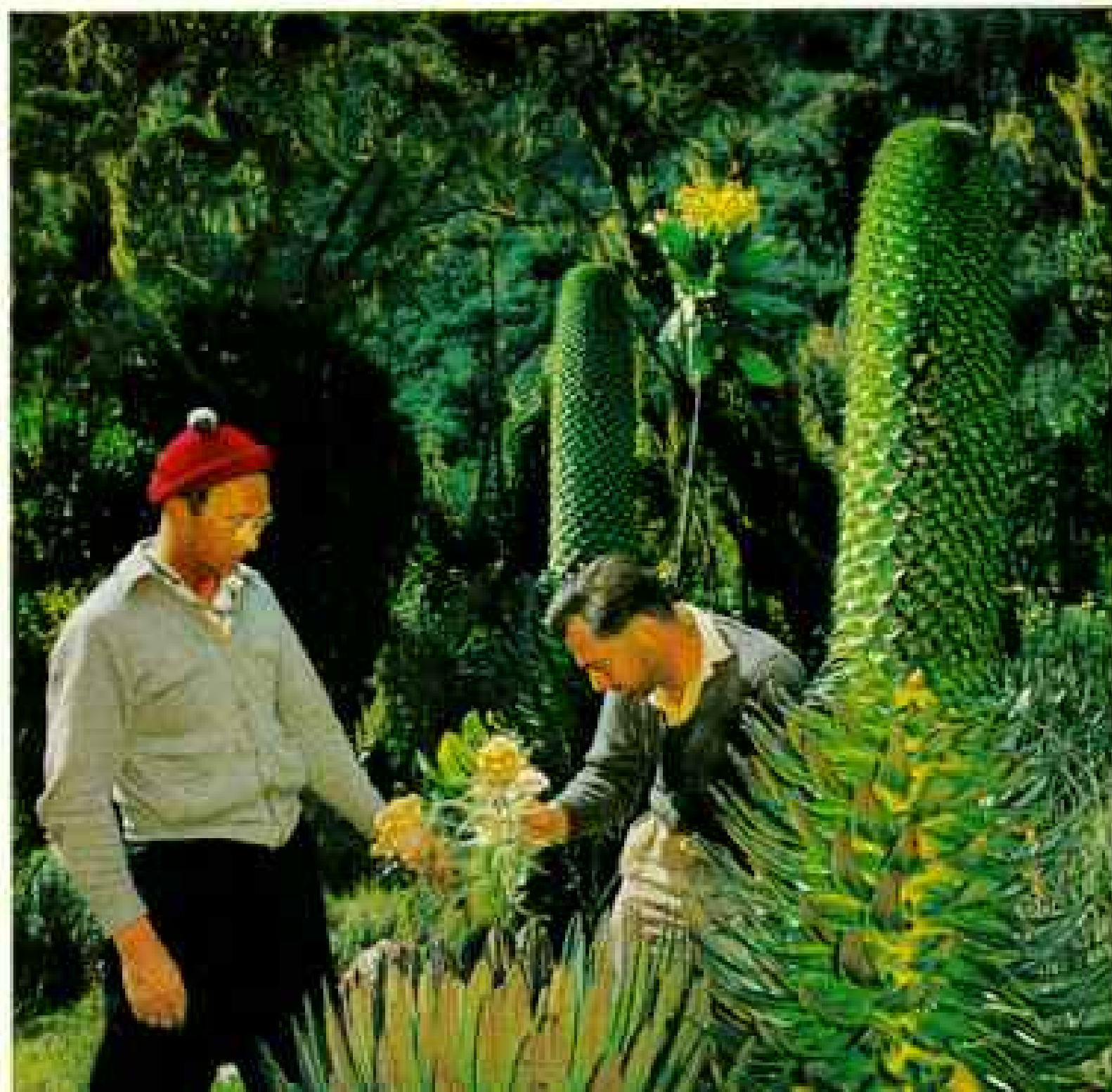
of feet; others heaved skyward. Sometime later, the Ruwenzori country tilted at an acute angle to thrust massive peaks of Archean rocks into the cold sky.

The resulting mountain range leaps abruptly from a high plateau. Hot winds of the lowland strike it and bounce upward. Where hot and cold currents meet, such violent weather is bred that you can hope for clear skies only twice a year—late December through January and late June through July.

The course we followed that late December was the one originally established by the Duke of the Abruzzi as best for approaching the peaks from the east—that is, up the Mubuku Valley to its junction with the Bujuku River, then on to the river's source, Lake Bujuku (map, page 414), which drains the Speke Glacier and part of the Stanley ice sheet. In all, it is about a three-day climb.

By nightfall of the first day we had attained a site known as Nyinabitaba, at 8,400 feet. Here I felt like giving three rousing cheers for the Mountain Club of Uganda, some of whose members a few years earlier had managed by dint of sheer endurance to transport the wherewithal for constructing a modest aluminum shelter here and at several other key locations higher in the mountains.

We were not yet in the zone of sleet and snow, but the air was biting cold as we gulped down a quick supper and, dog-tired, crawled into our sleeping bags. The porters huddled round a log fire built where a huge overhang-



Giant Lobelias Sprout Yucca-like Spikes

Reaching for the sun, *bequaertii* grows at an altitude of 11,000 feet on a mountainside usually enveloped in swirling mist.

Here, in a rare moment of fair weather, Jim Coggins (left) and Pat Henderson inspect a waist-high bush of everlasting flowers amid the lobelias.

Sunlit lobelia flowers shine with frosty radiance. Blue beaklike blossoms and mauve-pink bracts of a *wollastonii* appear four times life-size.



ing rock afforded some protection against wind and rain.

Next day we waged another slugging match with raw nature, and the day following came up for more. Our plan was to establish field headquarters slightly above 13,000 feet, on the lower moraine slope of the mountains' largest glacier, named Speke after the famous British explorer who in 1858 discovered Lake Victoria and what he thought was the source of the Nile. From the Speke, we could proceed in any selected direction for technical work.

Darkness falling on that third murderous day saw 52 Bakonjo breathing heavily and the rest of us nearly exhausted. The last mile was the most difficult. Preoccupied as I had been with the day's physical effort and totally fagged, I have only a vague recollection of the transition farther back from bamboo to heath-tree, then to the weird forests of lobelia and senecio. I dimly remember skirting the sullen mirror of Lake Bujuku during the final darkening hour (page 416).

A night of profound sleep in the Mountain Club's Bujuku Hut at 13,000 feet did much to restore my sensibilities. At dawn I emerged from my arctic sleeping bag, pulled on a fur-lined parka, and stepped outside.

Before me lay nature as she is to be seen nowhere else in the world. Rising on three sides of the Bujuku cirque were the Rainmaker's giants—Mounts Stanley (16,753 feet), Speke (16,042), and Baker (15,889)—their highest pinnacles mist covered, as I had come to expect they always would be.

From Stanley's crags hung an overwhelming ice cornice that seemed ready at any moment to crash into the valley. Out of a cloud ceiling suspended halfway up Mount Speke's great south wall cascaded a fraying ribbon of water, and against the slowly brightening sky the rocky inclines of Mount Baker carved out fantastic profiles.

The Mountain Club's little hut with its shiny roof of corrugated aluminum sat here like civilization's lost child, pressed from all sides by the strange trees that should have been bushes. I have already mentioned lobelias 20 feet tall or more; these are mostly the spiked unbranched, or "tree," species *bequaertii* and *wollastonii* of the family Lobeliaceae, named after the Flemish botanist Matthias de Lobel (pages 424, 426, and 427).

Except for the few species of giant lobelias here and elsewhere in the world, the 350 members of the genus, to which the cardinal

flower (*L. cardinalis*) belongs, are ordinary-sized herbs of tropical or temperate climes.

With the lobelias grew senecio plants tall as a telephone pole (page 423). *Senecio* is one of the world's commonest flowering plant genera, numbering some 2,000 species. We know it best in the United States as groundsel, a foot-high weed disliked by farmers.

Another behemoth of the Ruwenzori is the heath-tree that reaches 40 feet, despite a smothering moss that clings to every branch. The well-known heather of Scotland rarely grows taller than shoulder high.

Science Cannot Explain Gigantism

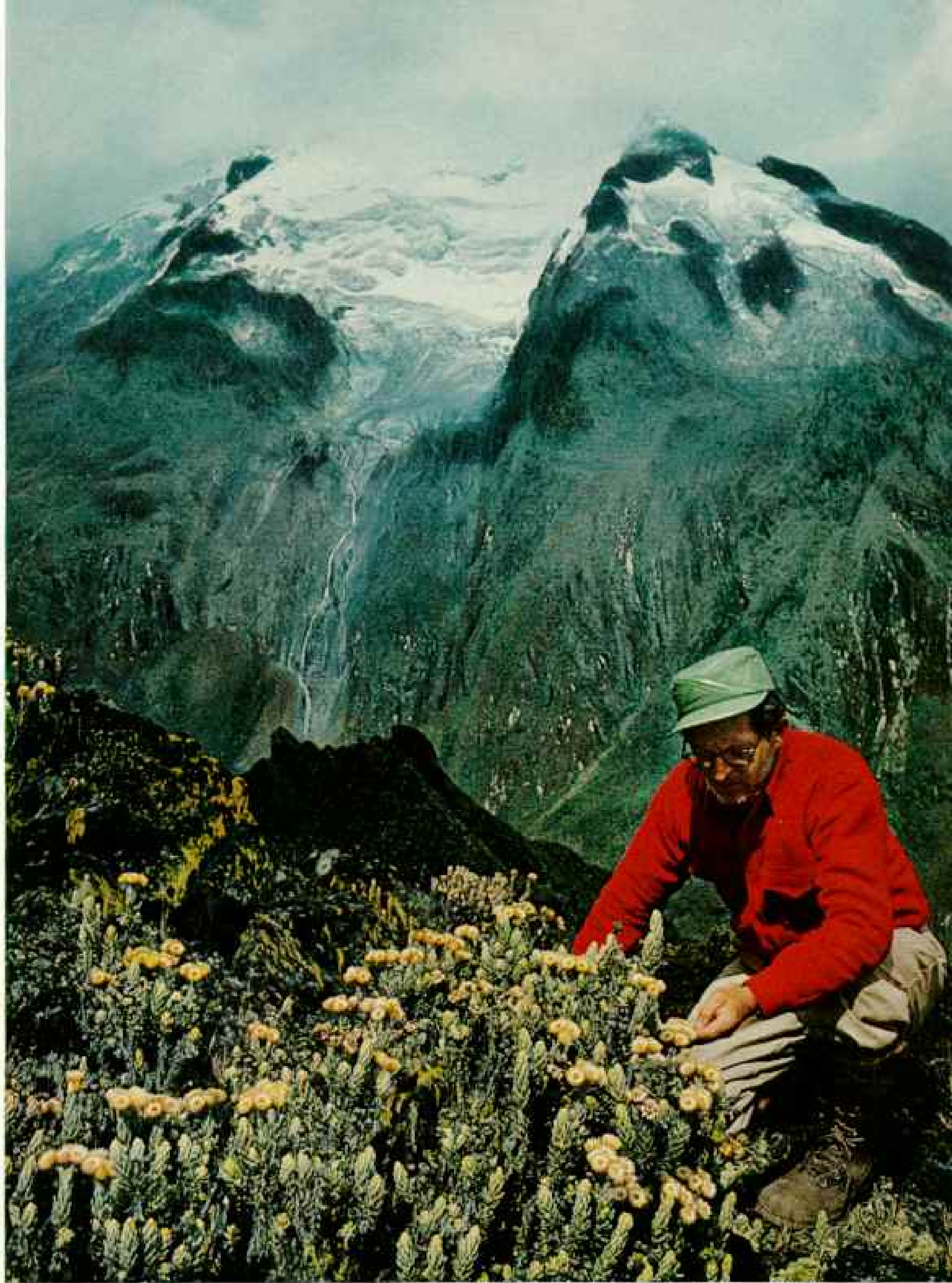
Why, here in the mountains of central Africa, do so many little plants try to be trees?

Certainly the isolation of Ruwenzori's peaks and valleys must have something to do with it. But there are isolated high mountains and deep valleys elsewhere in the world. Intense ultraviolet radiation, perennial wet and cold, and an acid soil rich in minerals have been suggested as causes by some botanists. But again, others point out that such conditions are not exclusive to these parts, and even cause dwarfing in some species.

The issue—gigantism in plants—is actually an aspect of the greater problem: What causes size differences anywhere in the biological world? One might wonder why, only

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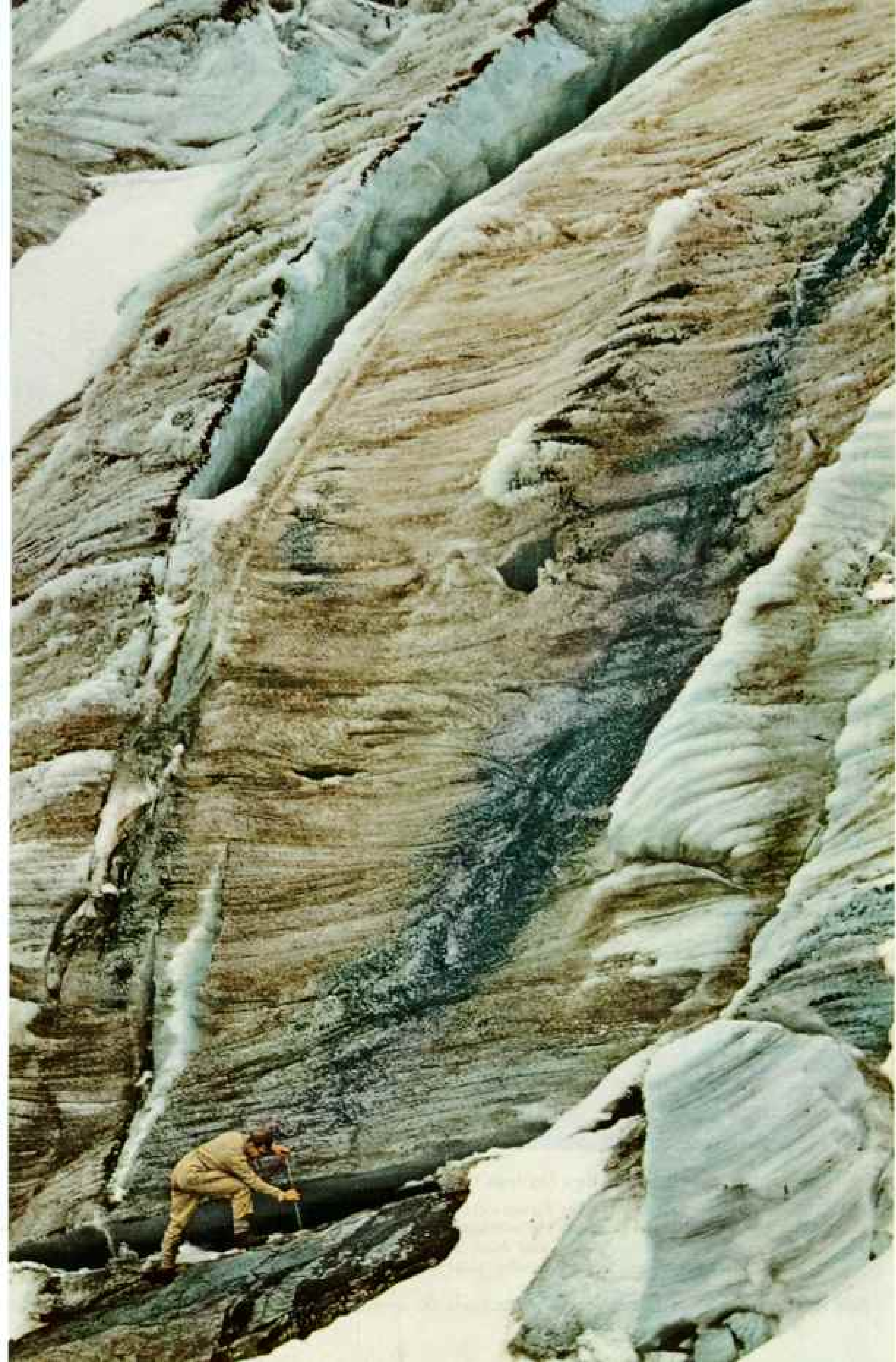


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Everlastings Mantle a Sky-high Glen. Delicate Hues Belie Their Hardiness

Too chill and bleak, the Ruwenzori lack alpine meadows that blaze with wild flowers in spring and summer. The everlasting, or straw flower, blooms despite the range's strange weather. Picked and dried, *Helichrysum* stays lifelike for months; hence its common name. Across the valley, 16,042-foot Mount Speke wears a glacial bonnet.

Pale coral petals unfold in sunlight. With darkness, the everlasting closes tight.



Bands of Soot and Dust Mark Elena Glacier, a Frozen Slice of Time

Each dry season in central Africa, fires burn off thousands of miles of grassland. Swept up by the wind, dense smoke and dust clouds deposit thin but clearly visible layers on the ice. Each layer represents a six-month cycle. This glacial tongue on Mount Stanley lies nearly three miles above the plateau.

Taking a glacier's temperature, scientist Tony Shepherd records readings at the edge of Elena. Coronation Glacier, named in honor of Queen Elizabeth II's crowning in 1953, appears in the distance. Studies indicate that Rwenzori ice fields are shrinking.

in California, members of the sequoia group reach the tremendous height and bulk of a General Sherman or a General Grant tree.

The same question in reference to animals might be, in its simplest form: Why is the elephant big and the hyrax small? Clearly growth-promoting forces are more powerful, or less inhibited, in some species than in others. Today biologists are keenly interested in this fundamental problem, but many of the basic answers are still not known. And so it was that on that cold misty morning, nearly three miles up in the sky of Equatorial Africa, I could marvel but not explain.

After helping to unpack and sort provisions and gear, Tony Shepherd, Cliff Ball, and I climbed the glacier moraine directly behind the shelter to a point where the runoff from Mount Speke's ice first becomes a stream. Here a large wooden plank, installed during an IGY expedition six months earlier, was examined and adjusted for use.

Notched Plank Measures Glacier Melt

A deep V notch, cut into the center of the plank's upper edge, was calibrated with a series of numbers. Later someone was assigned to visit this flow-gauge daily at specified morning and evening hours to record the level at which water passed through the notch. Obviously, after a night of freezing temperatures and little meltage, the glacier runoff would be weak; in the evening, on the other hand, especially if there had been sun, the rivulet would become a torrent.

Data accumulated by means of this simple measuring device gave the glaciologists a



EDSCHWONES © NATIONAL GEOGRAPHIC SOCIETY

fairly accurate approximation of melt conditions on Speke Glacier. Such information would be compared against weather data for the same period.

Half the porters, paid in shillings and permitted to keep the sweaters and blankets issued earlier, were dismissed to return to their villages in the foothills. Signed for the expedition's duration, the remaining twenty-odd bivouacked under a beetling rock half a mile eastward. Here they camped in a cave on the edge of the bog that, choking the entire cirque floor, gave rise at one extremity to Lake Bujuku.

Pat Henderson assumed the duty of dispensing pills, ointments, and bandages, a job he took seriously for both the porters and ourselves. A man had fallen ill and died during the last IGY expedition, and Pat looked after us all like a mother hen.

The porters thus found him an easy mark



On a Rare Cloudless Day, Mount Stanley Rewards a Conqueror With a Dazzling Vista

Crampons biting ice, a bronzed climber stands atop 16,753-foot Margherita Peak, apex of the Ruwenzori. Mount Stanley has eight separate pin-



© GEORGE HEYER. PHOTOGRAPH BY HEINRICH HARRER. © NATIONAL GEOGRAPHIC SOCIETY

nacles, all above 16,000 feet. Geologists are still not certain how or when these equatorial mountains were formed. Unlike Kilimanjaro and Kenya,

the peaks are not volcanic but consist of ancient rocks squeezed up long ago. Great Rift Valley, a cleft 1,500 feet deep, parallels the range.

and developed a special fondness for aspirin tablets, which they thought would cure anything. One day Pat found a 1,000-tablet bottle, full the night before, nearly half empty.

"This little mystery," he said grimly, "will solve itself."

And sure enough, later Benezeri came running to say that one of his men was ill. Pat prescribed a strong cathartic for an aspirin overdose reaction. The man, who had taken only a handful, was all right next morning. The demand for aspirin took a drastic drop.

How Fast Does a Glacier Flow?

Ball, Shepherd, and Henderson went off to work on Elena, a glacier flowing southward off Mount Stanley. Jim Coggins and I joined them next day. By midafternoon, we were at an altitude of nearly 15,000 feet, on the ice river's east bank.

Bleakly perched on a boulder were two tiny aluminum shelters. Outside on a heavy tripod stood a theodolite, a standard surveying instrument used for measuring angles and determining locations. Around the huts lay a miscellany of ice axes, crampons, climbing ropes, and provision boxes, together with some one-gallon buckets of bright-orange paint.

Not far off we spotted the glaciologists constructing rock cairns and driving orange marker posts into the ice. Their precise position would be established with the theodolite and recorded. Months or even years later, an observer could redetermine their positions and see how far the glacier had flowed, how much it had folded, cracked, expanded, or shrunk. To prepare both the Elena and Speke ice fields for later study was one of the expedition's principal aims.

My companions told me that the Ruwenzori glaciers were shrinking. One day, unless general weather trends change, these mountains may lose their great ice tongues and the "salt" on their peaks. A warming trend is world-wide these days.

Ruwenzori ice contains dark bands or striations (page 430). These come from the smoke and dust that overlie central Africa every dry season, when the people burn the far-

flung grasslands. Like the botanist who can tell a tree's history from the nature and number of its growth rings, the glaciologist counts the soot rings in a glacier and knows its age.

Here in the Ruwenzori, meteorologist Bob Eden was in his glory.

"We're not just watching weather," he exulted, "we're in the factory seeing it made."

A blast of wind laden with what I can best describe as solid mist stung our faces.

"That's a rainstorm for the low country in process of assembly," said Bob. "Humid air from the Congo and a moist easterly hit the Ruwenzori, shoot upward, and meet where we're standing. The cold of the heights condenses the moisture in the winds."

The Ruwenzori's annual precipitation, including rain, mist, snow, sleet, and hail, is difficult to measure, because much of it sweeps horizontally over the range. Sometimes the weather factory works quietly, as on this day of soft cloud stuff swirling, streaming, dissolving, forming anew.

But one night, shortly after we had turned in, thunder roared, rolled, and rumbled, shaking the very ground. I thought of Rip Van Winkle and the game of bowls he saw in the lightning-wracked Catskill Mountains of New York. [See pages 372-3 of "Henry Hudson's River" in this issue.]

Clouds Lift on Last Day

We lived for two weeks in the Mountains of the Moon, and by most men's standards that is long enough. Still, when the day for leaving came, we were disappointed, because we had not yet seen the highest peaks. We struck camp and started down, and I happened to look back as we passed out of the Bujuku Valley.

There, at last, stood Mount Stanley and two of its pinnacles without their mantle of clouds. Gloriously white, regal as the queens of Italy and England for whom they were named, Margherita Peak and Alexandra Peak rose against a sky of blue.

We had barely time to focus cameras before royalty's moment in the sun was over, and the mist closed in again over the Ruwenzori.

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As one of the privileges of membership in the Society, an index for each six-month volume of the NATIONAL GEOGRAPHIC will be mailed upon request to members who bind their issues as works of reference. The index to Volume 120 (July-December, 1961) is now ready.

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◀ COVER: Mongolians crowd a tentlike home to meet a distinguished American visitor (pages 290-91).

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Morton can supply customers anywhere in the country because it is the only nationwide salt company. It offers service from ten salt sources, through thirty sales offices and warehouses. You never need worry about delivery "bottlenecks" endangering your plant's continuous operation, because Morton can guarantee two or more sources for any grade of salt you require. This coast-to-coast organization may save you thousands of dollars every year!

MORTON SALT
INDUSTRIAL DIVISION



COMPANY

110 NORTH WACKER DRIVE, CHICAGO 9, ILLINOIS
TELEPHONE: FINANCIAL 8-1300



Cruise south for a spring tonic

Unwind...Cruise away south this spring for a week—or a month—of rejuvenation aboard America's newest and finest luxury liners, ss Argentina and ss Brasil. Moore-McCormack has designed, refurbished, and staffed these proud "resorts-afloat" to cater to your complete relaxation. Come—let the bronzing sunshine and tropical trade winds waft away your winter weariness. You owe it to yourself. Your travel agent can assist you in arranging the cruise that suits your schedule. Or write to us directly at 2 Broadway, New York 4, N. Y.

Spring Caribbean Cruises From New York: April 27—six days, May 1—eight days, May 4—ten days, May 10—thirteen days, May 15—fourteen days, May 24—seventeen days.

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COVERS AS STRIKING AS THEIR CONTENTS!

Chances are, you save your GEOGRAPHICS. Cleofas Calleros of El Paso, Texas, goes a step further. He *binds* his—in such rare materials as mink, original paintings, and Pancho Villa's saddle blanket.

The Calleros collection spans all GEOGRAPHIC issues from 1907. Each of the 110 volumes has a different cover: lace, feathers, brass, silks . . . sheepskin (white fleece at right) . . . a printed towel ("Fish, Cry") . . . hides of bear, moose, and camel. The two volumes shown above feature an American Indian design in polished stone on wood and a binding of diamondback rattlesnake skin.

Someday the collection will belong to the El Paso Museum of Art, where Mr. Calleros (right) is a trustee.

Give your friends the chance to collect their own GEOGRAPHICS. Use the form below to nominate them for membership in the Society.



NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

CHECK ONE

THE SECRETARY
mail to: NATIONAL GEOGRAPHIC SOCIETY
 WASHINGTON 6, D. C.

I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.)

(GIFT MEMBERSHIP) I nominate and enclose \$_____ for dues of the person named at left. Send gift card

I DESIRE INFORMATION concerning membership and the NATIONAL GEOGRAPHIC. (Fill in at left.)

NEW MEMBER'S NAME

(PLEASE PRINT)

STREET

CITY, ZONE, STATE

MY NAME

(PLEASE PRINT)

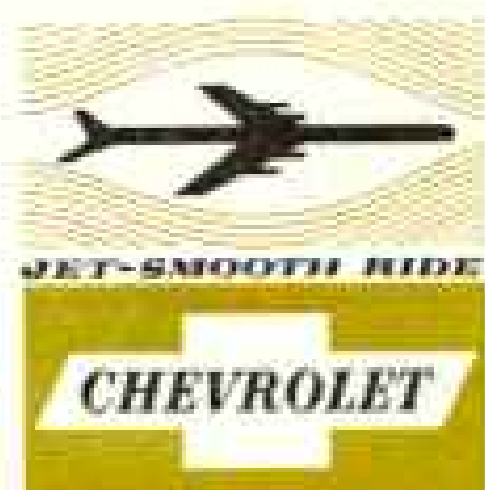
STREET

CITY, ZONE, STATE



HERE'S A LUSTY TRAVELER WITH LOADS OF TOTIN' SPACE

Faraway places calling you? Or ones closer to home? What a beautiful answer you have in the new Jet-smooth Chevrolet. Plenty of relaxin' room for you, family and/or friends. Plenty of packin' room. Plenty of comfort, too—the kind that brings out the zest in you. And, with all Chevrolet's conveniences and refinements at work for you, even the long journeys feel more like short, happy jaunts. The Jet-smooth ride gives you gentle journeying. The comfort-high seats make rubbernecking easy. The new V8 vitality keeps your timetable honest. The richly styled Body by Fisher interiors take the wear and tear of travel and come up looking as fresh as you do. See your Chevrolet dealer before your next attack of wanderlust. Then go, man, go.



Jet-smooth '62 CHEVROLET

Corvaire Monza Station Wagon



SPORTS-CAR SCAT, FAMILY STYLE

This one's quicksilver steering and "git" will have you inventing reasons for driving. The rear-engine traction clings to the road like a burr on fur. The engines are full of scoot, yet so thrifty you'd think they make their own gas. And, for such a trim car, there's lots of people room. Try it on for affection.

'62 CORVAIRE monza



Chevrolet Impala 4-Door Sport Sedan



Chevy II Nova Convertible

the new
Chevy II

EASY TO PARK, PACK AND PAY FOR

Easy to be proud of, also, because Chevy II brings you a beautiful blend of luxury and liveliness at its likeable low price. Just switch on a frisky 4 or sassy 6 (your choice in most models)—and off you go in Body by Fisher comfort and roominess. That restful ride comes, in part, from the unique Mono-Plate rear springs. And know why you couldn't fill the trunk? It's a fat 25.5 cubic feet! See your dealer for a Chevy II powwow... Chevrolet Division of General Motors, Detroit 2, Michigan.

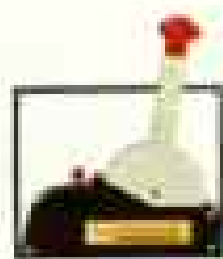
NEW **ELECTRAMATIC DRIVE** by Johnson



Visit the All-Family Boat Show March 9-18 at your Johnson dealer's.

He's driving "the Sea-Horse that shifts for itself"

(the gears get the word electrically!)



Even if you've never been aboard a boat before, you can drive one in minutes with Johnson's exclusive new *Electramatic Drive*. This new kind of Sea-Horse motor shifts for itself... electrically, automatically. One single-motion lever controls both gas and gears—thanks to a revolutionary new electric clutch. Ahead for forward. Back for reverse. Boating is smoother. Docking is easier.

Sea-Horse Electramatics... either 40 or 75 hp. And the remote control comes with the motor (there's no extra charge)! See all ten new models—the 28, 18, 10, 5½ and 3 hp, too—at your Johnson dealer's now. He's in the Yellow Pages.

Free 1962 catalog, Johnson Motors, 1229 Pershing Rd., Waukegan, Ill. Div. of Outboard Marine Corp.

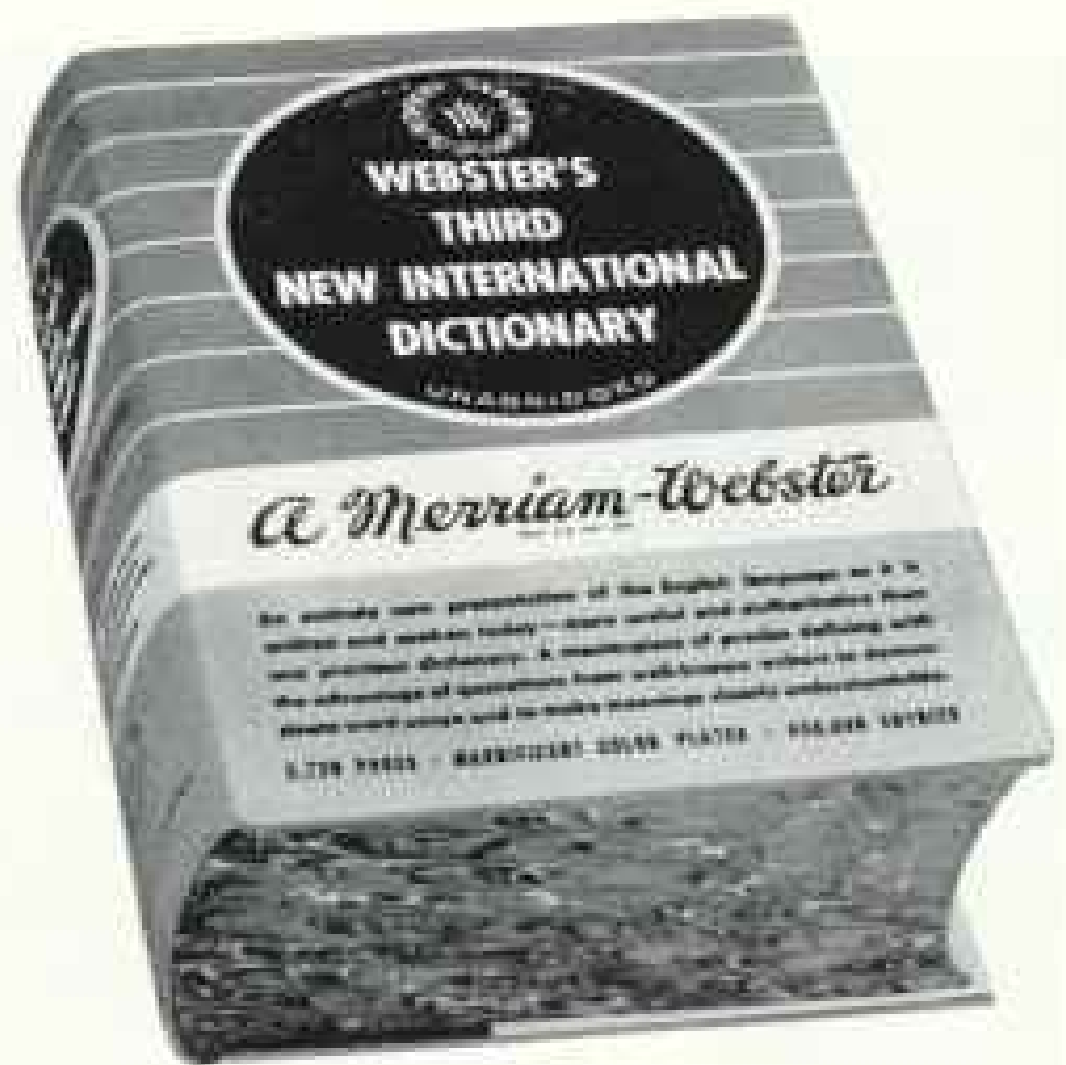
Well over two million quiet Sea-Horse motors prove

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DEPENDability

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Contains defatted wheat germ—10 essential minerals and vitamins, 40% high-quality protein, yet 99% free of the fat found in many other high-protein foods. Ready to eat and good to eat!

You can't stop the clock or the calendar. But you can help keep that old-time vigor—by observing a few simple rules for sensible living, such as watching your diet.

That's where Kellogg's Concentrate comes in. One ounce of it, for instance, gives you more protein than an egg and 2 strips of bacon; as much

iron as 2 ounces of beef liver; and as much vitamin B₁ as 3 ounces of ham. (And, a one-ounce serving with 4 ounces of skim milk and a teaspoon of sugar contains only 166 calories.)

Most folks eat Concentrate as a cereal or added to other cereals. But you can also enjoy it sprinkled on casseroles, salads, fruits and desserts; or mixed in meat loaves and patties.

So if you lead an active life and want to keep it that way, a daily ounce of Kellogg's Concentrate may be a big help. Look for it in your grocer's cereal section.

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Treat your heart to a
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Here, in Nova Scotia, scenery as stirring as the pipes that welcome you at the border; fun as exhilarating as the surf that breaks on the sun-swept beaches of Canada's ocean playground; sky and water blue as Nova Scotia's own tartan. Here are peaceful valleys and snug harbours, the Highland Games, a Gaelic mod, fairs and festivals.

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COMB THE BEACH WHERE ROBINSON CRUSOE LANDED. Friday left his footprints here, off Chile's Pacific coast. From this lush island come the giant lobsters you'll eat in Valparaiso's seaside cafés. They're Chile's answer to Argentine beefsteak.



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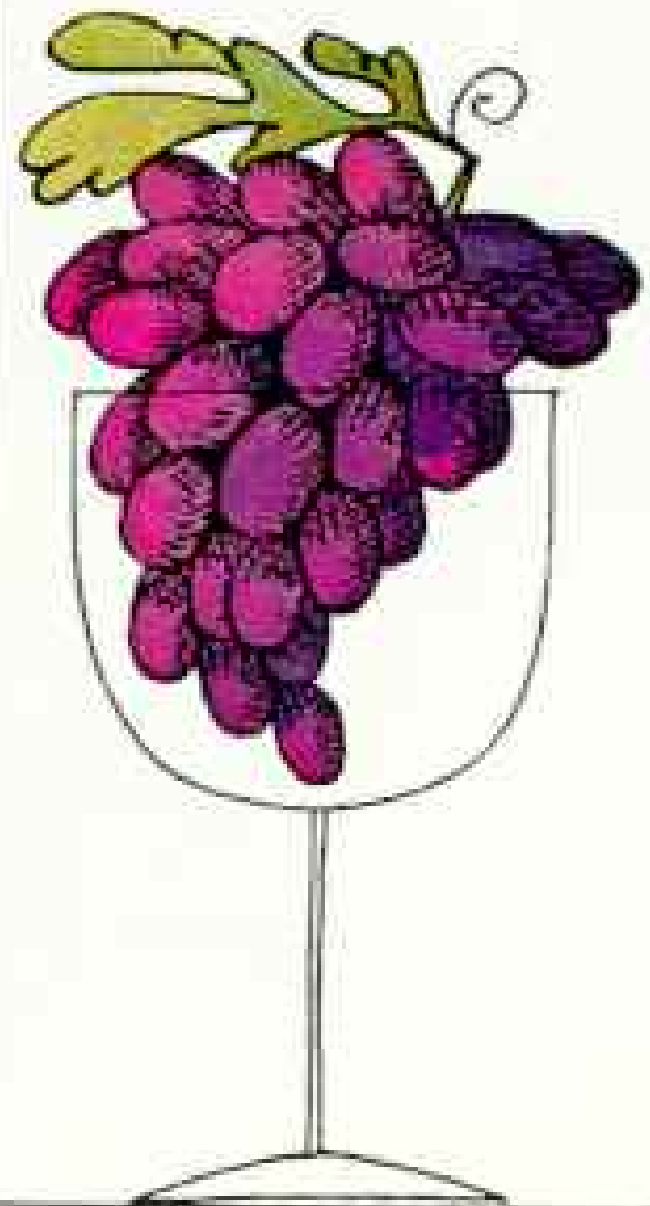
*including up to 7 other cities at no extra cost.

See your travel agent, or call Pan Am, sales agent for Panagra.

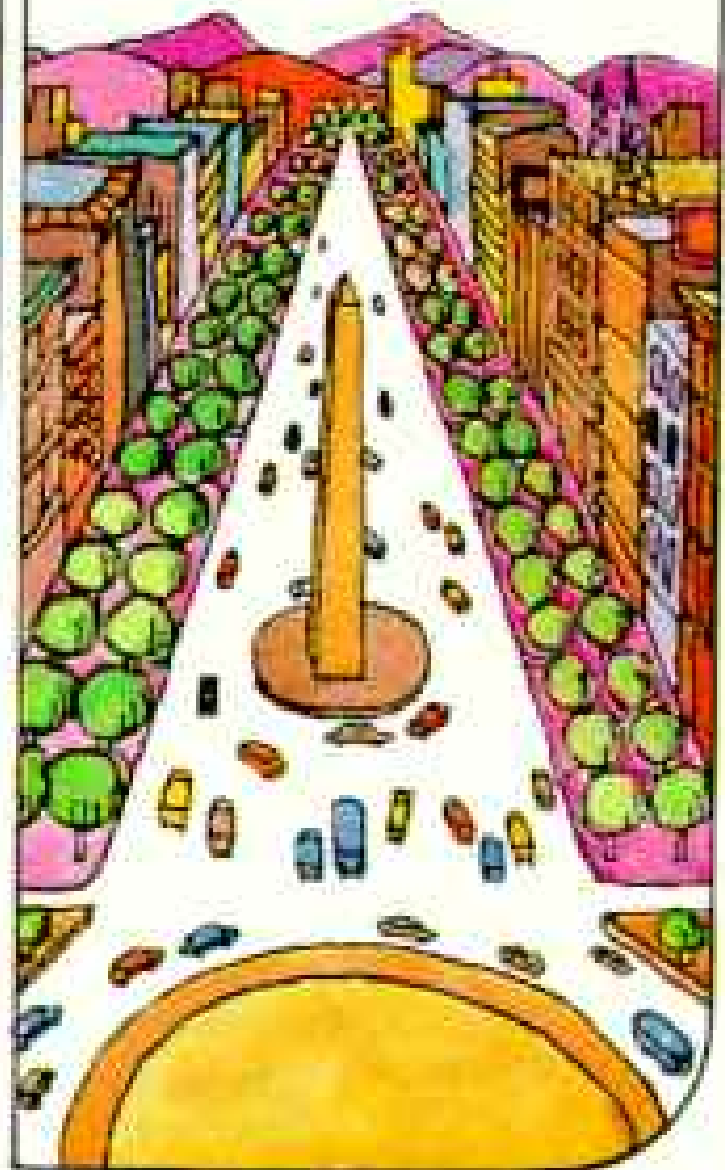
For Panagra's new 130-page book, "How to Get the Most Out of Your Trip to South America," send 25¢ to Don Wilson, Room 4460, Chrysler Bldg., New York 17.

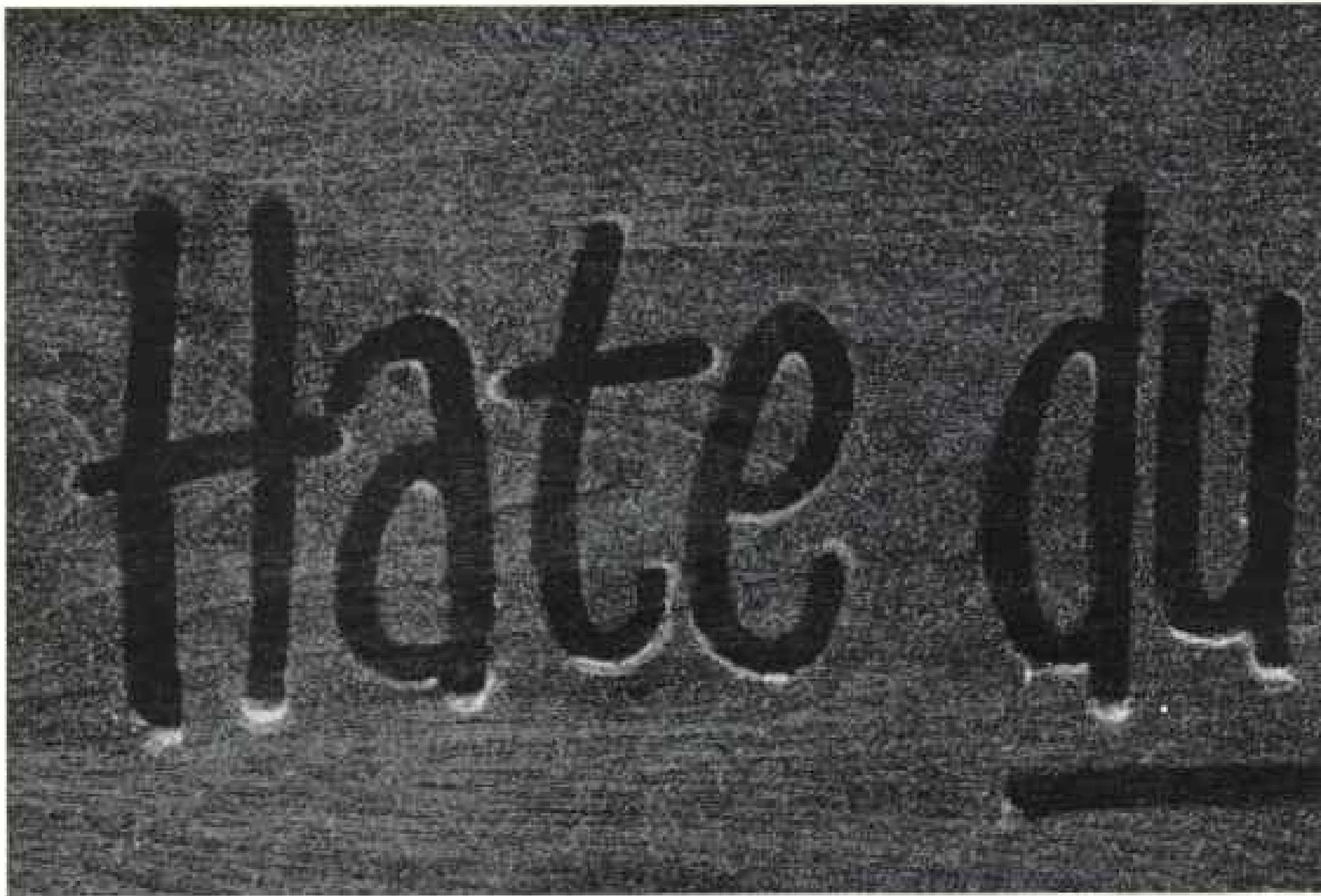
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WHIRL DOWN THE WORLD'S WIDEST STREET. Buenos Aires has it—Ninth-of-July Avenue. Here, too, is one of the world's most tantalizing streets—Calle Florida, where vicuñas and alligators often turn up as coats and shoes.





Now clean your entire home of dust & pollen automatically— with new Electronic Air Cleaner from Honeywell

Now your home can be virtually dust-free with the new Honeywell Electronic Air Cleaner. It fits in the return air duct work of any forced air heating, ventilating or air conditioning system. With powerful electronic-magnet action, it removes up to 95%* of airborne dust and other irritants from the air passing through the system—air not from just a single room—but from *all through the house*.

It catches the millions of particles so tiny that they pass right through ordinary filters (the kind you probably have on your present heating or cooling plant).

And these tiny particles—bits of smoke, grease and grime—carry most of the soiling power to smudge your furnishings, begrime your curtains, put a dingy haze over your windows, mirrors, crystal.

The principle of electronic air cleaning has been proved for years in hospitals and other buildings where clean air is vital. Now the

same benefits are available to you in a system of practical home-size and price. On a 3-year FHA loan, it costs as little as \$14.38 a month, installed. It's a natural companion for your heating system—even better with air conditioning.

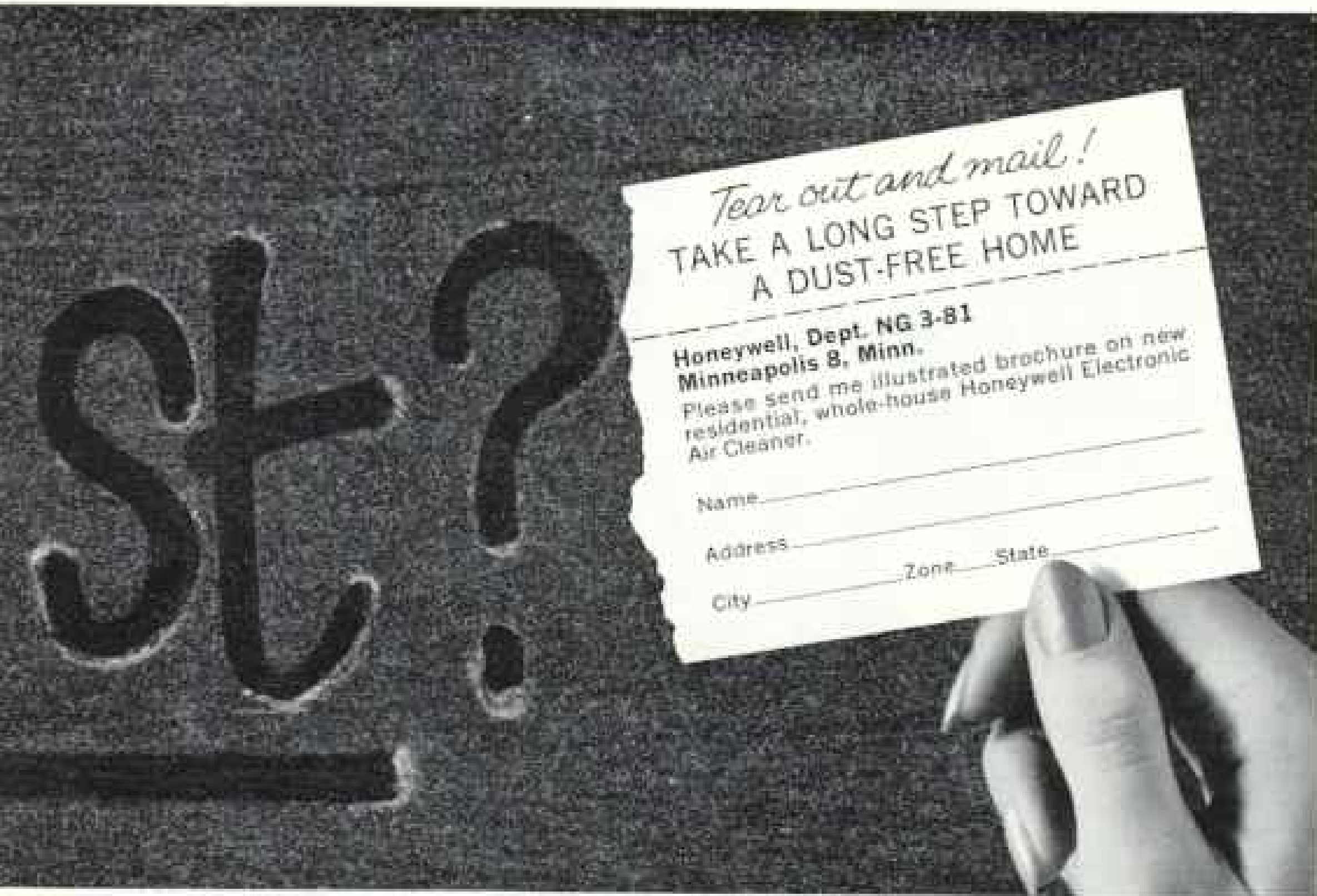
What a wonderful difference! Air passing through the system is freed of up to 99% of the pollen that aggravates allergies†—cleaned of tobacco smoke and odors, other irritants. Dusting is cut to a fraction. Mirrors and crystal stay sparkling—draperies and slip-covers, fresh and clean much longer. You cut cleaning and decorating bills.

And even if you don't have a forced air system in your home, you can still enjoy cleaner air in *single* rooms with the Honeywell Portable. Also, ideal for your office.

So why dust and polish all the time when there is now such a practical way to trap the dust *in the air*? The coupon above makes it easy to take a long step toward a dust-free home.

*As measured by National Bureau of Standards Dust Spot Method.

†Electronic air cleaning is a preventive measure, not a treatment. Be sure to consult your doctor. Ask him what it may do for you.



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**TAKE A LONG STEP TOWARD
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Please send me illustrated brochure on new
 residential, whole-house Honeywell Electronic
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HANDSOME CONTROL PANEL in living area shows air cleaner is working at peak efficiency, signals when it needs cleaning. System installs easily with little interruption of heating or cooling.



EASY TO CLEAN. Three or four times a year usually is enough. Surprisingly, system uses no more current than a 40-watt bulb. System is backed by Honeywell, home comfort leaders for more than 76 years.

New whole-house **Honeywell** 

Electronic Air Cleaner

traps the tiny bits of grime that ordinary filters miss





Photo by Ewing Krainin

This is the way to see Jaipur—from a golden howdah atop a painted elephant.

From New York, you can take a jet to Delhi, an air-conditioned train or chauffeur-driven car to Jaipur, but once in Jaipur, choose a maharajah's palace for your hotel, and an elephant to see the sights. Just as his ancestors have borne Rajput princes, so will "Hathi" take you up the winding hillside road to Fort Amber.

You will literally see the world below through rose-colored glasses. For all Jaipur is sculptured from soft pink sandstone. Visitors affectionately call it the Pink City. Architects call it the most

beautiful city in the world. Its people will recount to you romantic tales of chivalry of the proud Rajputs who chose to die in defense of their honor.

When you can bring yourself to leave Jaipur, fly south to Udaipur with its floating palaces, to Mount Abu with its marble temples, south to cosmopolitan Bombay.

For brochure on Jaipur see your travel agent or write Dept. NG

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India

Tourist Office

NEW YORK: 19 East 49th Street

SAN FRANCISCO: 685 Market Street

TORONTO: 177 King Street W.

Come to Jaipur. Sooner or later most world travellers do.

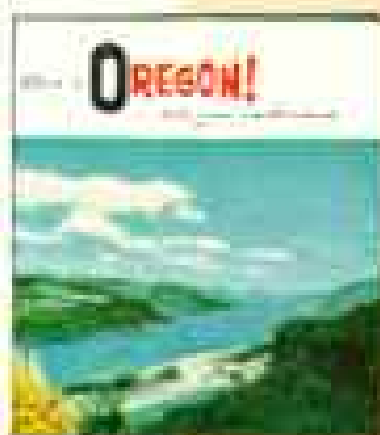


*Relax in a state
of excitement...*

OREGON

Come stand atop the rocky, wave-washed doorstep where America meets the western sea...a panorama of sound and sight that staggers your senses. Cape Perpetua, above, was named in 1778 by Captain James Cook when he sighted this towering sentinel on the Oregon coast. Pictured is only a fragment of this spectacular ocean boundary that offers 400 miles of enchanting seacoast. It is but one instance of the excitement you'll find in Oregon—land of infinite variety. *Come soon.*

For helpful directions on what to do and see while you are in Oregon, inquire at the nearest Chamber of Commerce or other source of reliable information as soon as you enter the Beaver state.



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blink!

The human eye blinks several times a minute with no conscious interruption of continuous viewing. The instant-return mirror in the Honeywell Pentax camera works the same way. In its "down" position, it lets you look right through the lens. You know exactly what picture you'll get, because you see what the film will see. When you press the shutter release, the mirror blinks—it moves up as the film is exposed, then down again instantly to give you uninterrupted viewing for following action, changing focus, rearranging composition.

The reason the single-lens reflex cam-

era is the most popular type in the world today is due, more than anything else, to the Pentax-invented instant-return mirror. Naturally, everyone has copied it. But so far no other cameras approach the Honeywell Pentax H-1 and H-3 in the combination of clean design, quality features, and reasonable price that make them the outstanding values in the field. See them at your Authorized Honeywell Pentax Dealer's.

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Honeywell

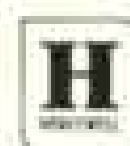


Photo Products



Viewland. From up on Palos Verdes, see Los Angeles, the beach cities, the Santa Monica Mts.



Missionland. One of ten missions in Southern California.



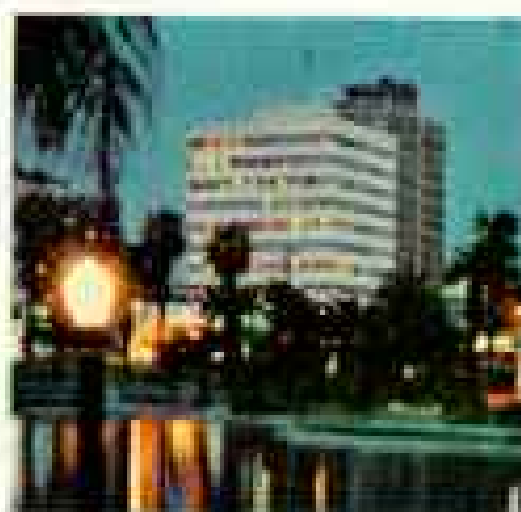
Islandland. Visit Avalon at Catalina Island just off the coast.

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Camelliland. Descanso Gardens has 100,000 camellias.



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Surf-land. Wade in the Pacific surf—it is salty!

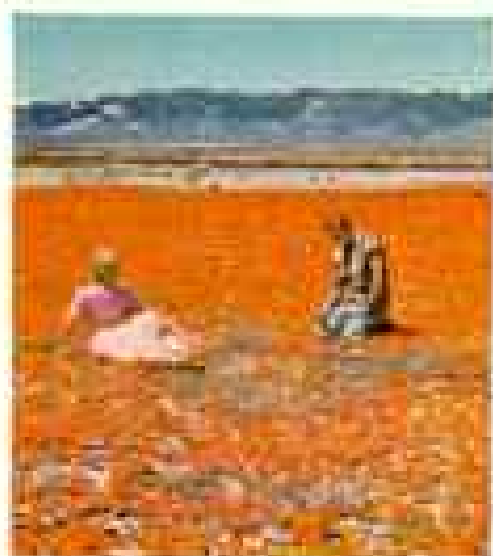
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Starland. See movie stars' footprints in the sidewalk.





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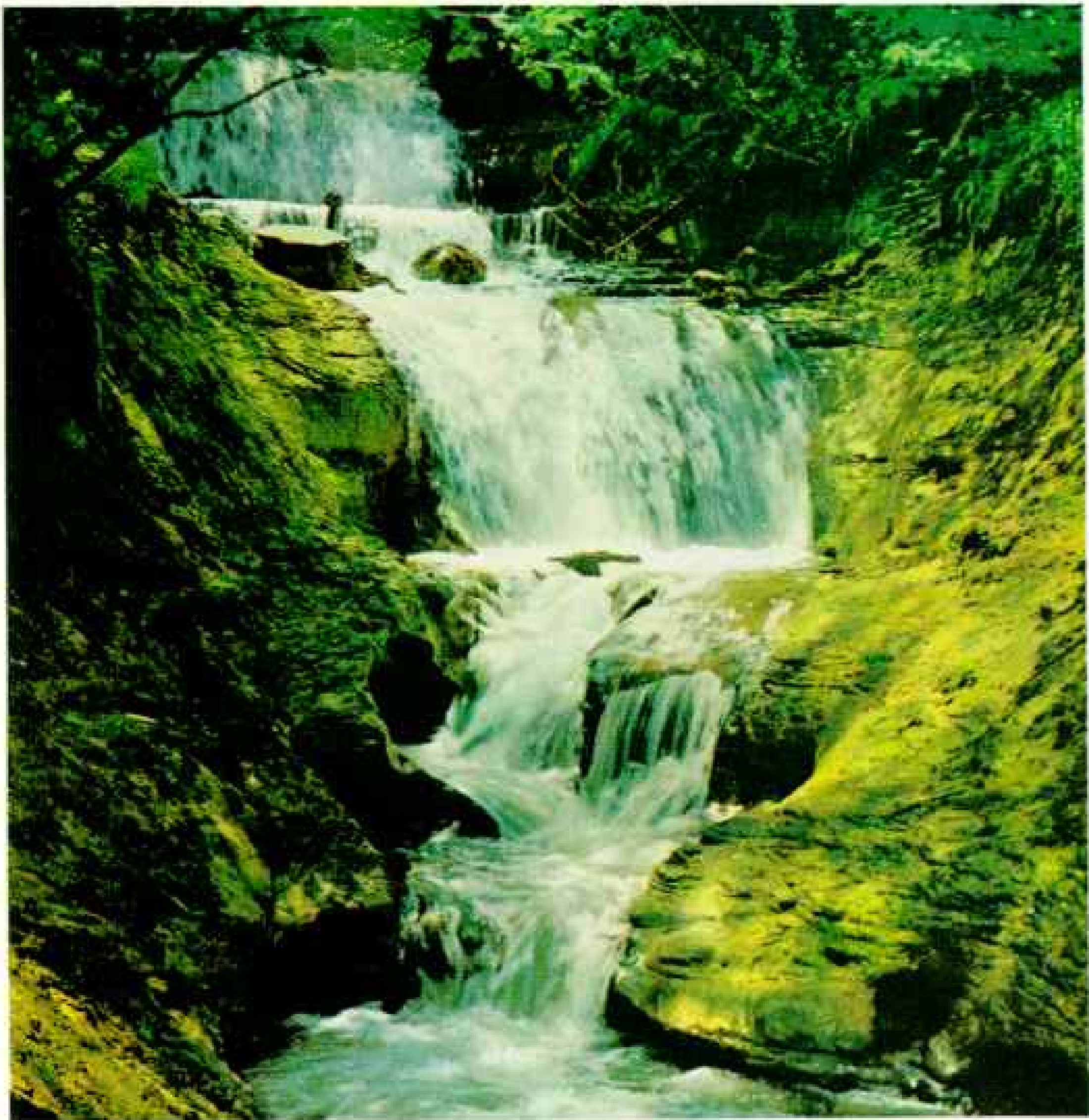
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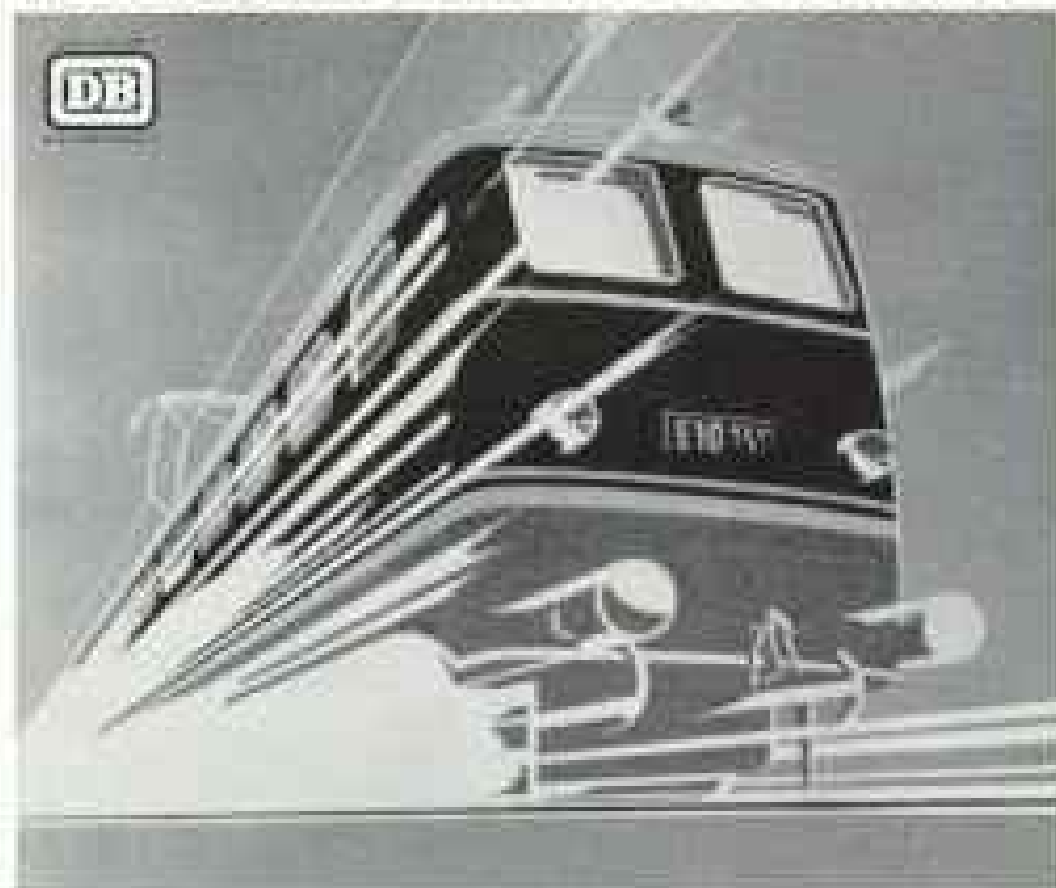


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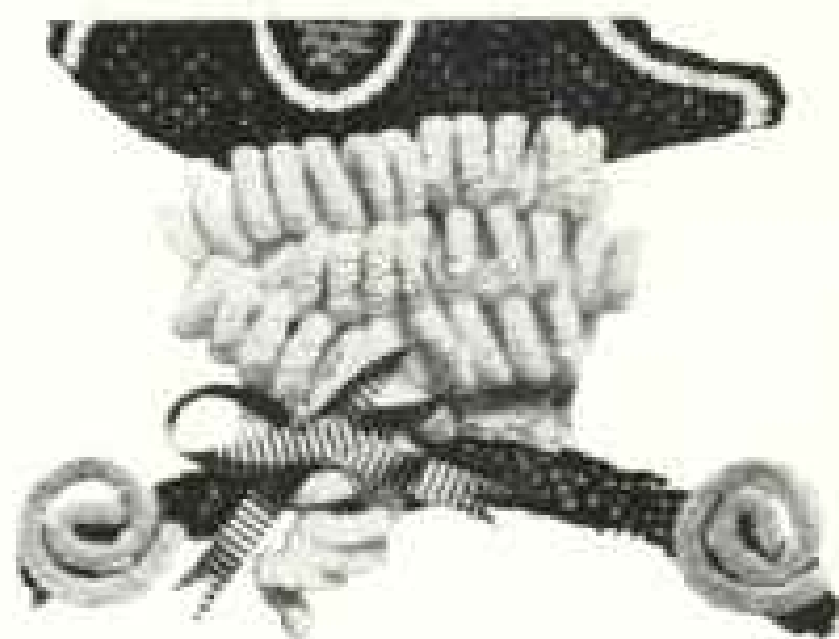
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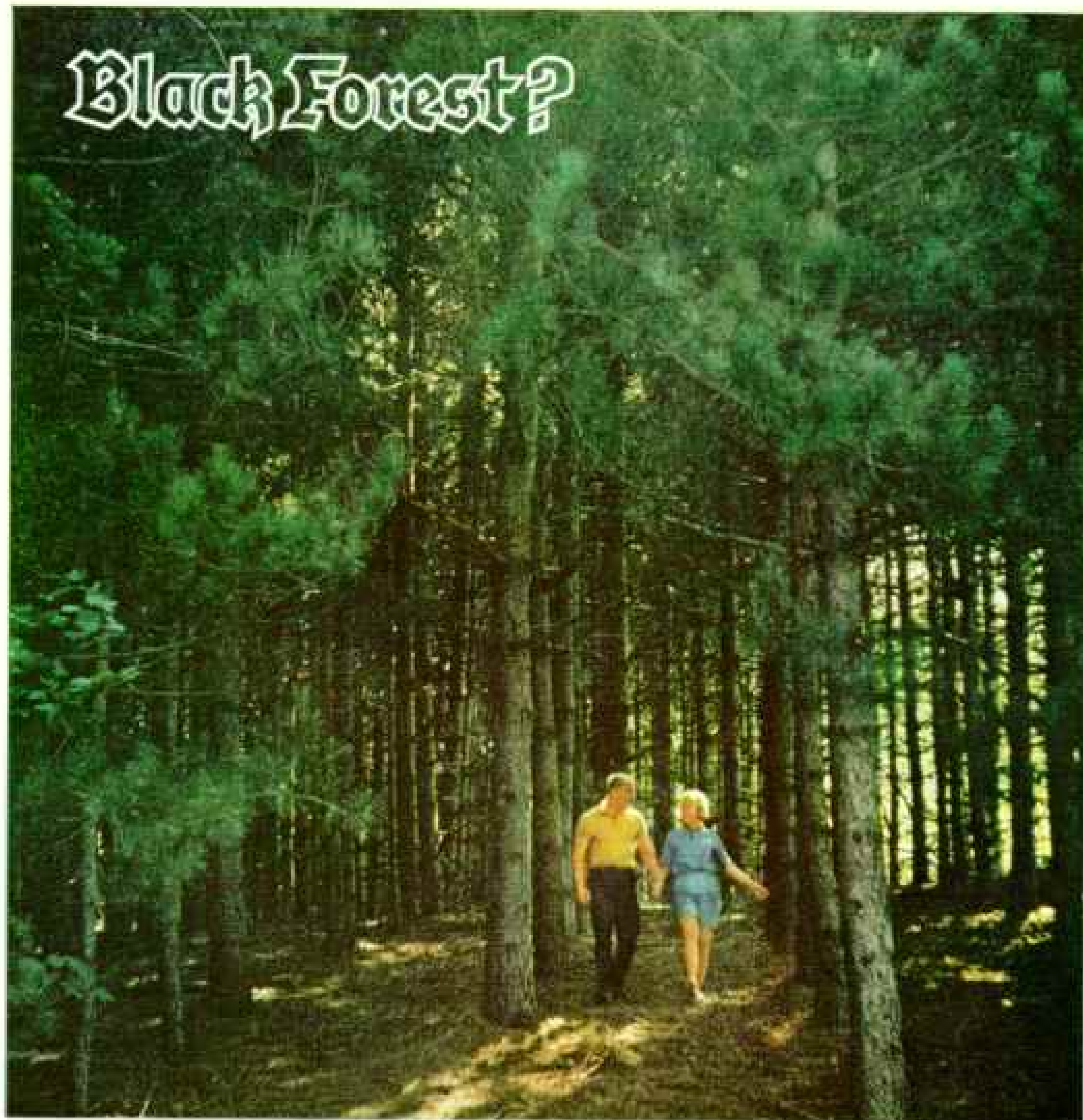
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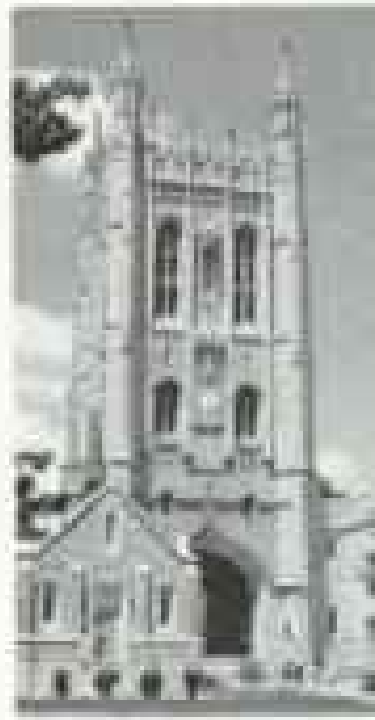
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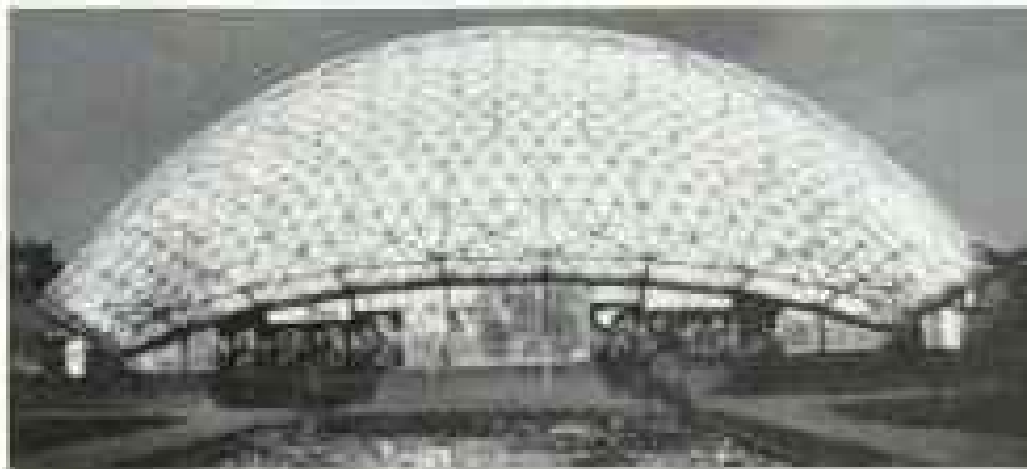
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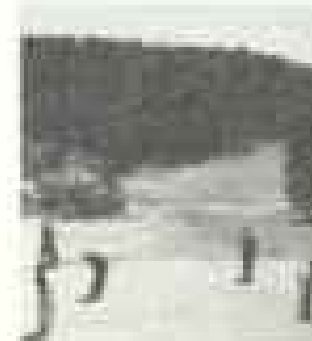


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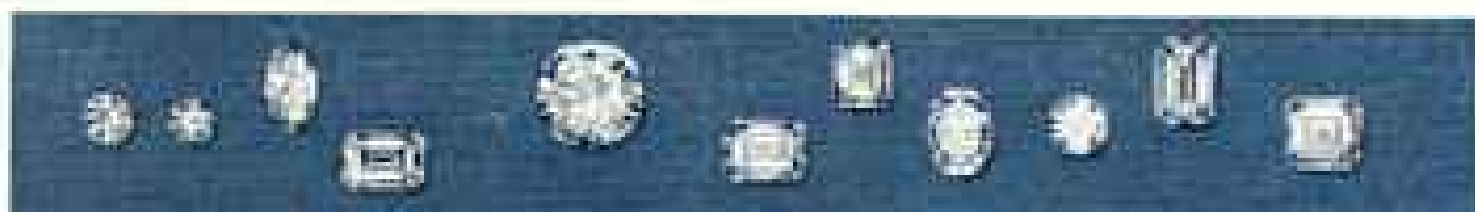


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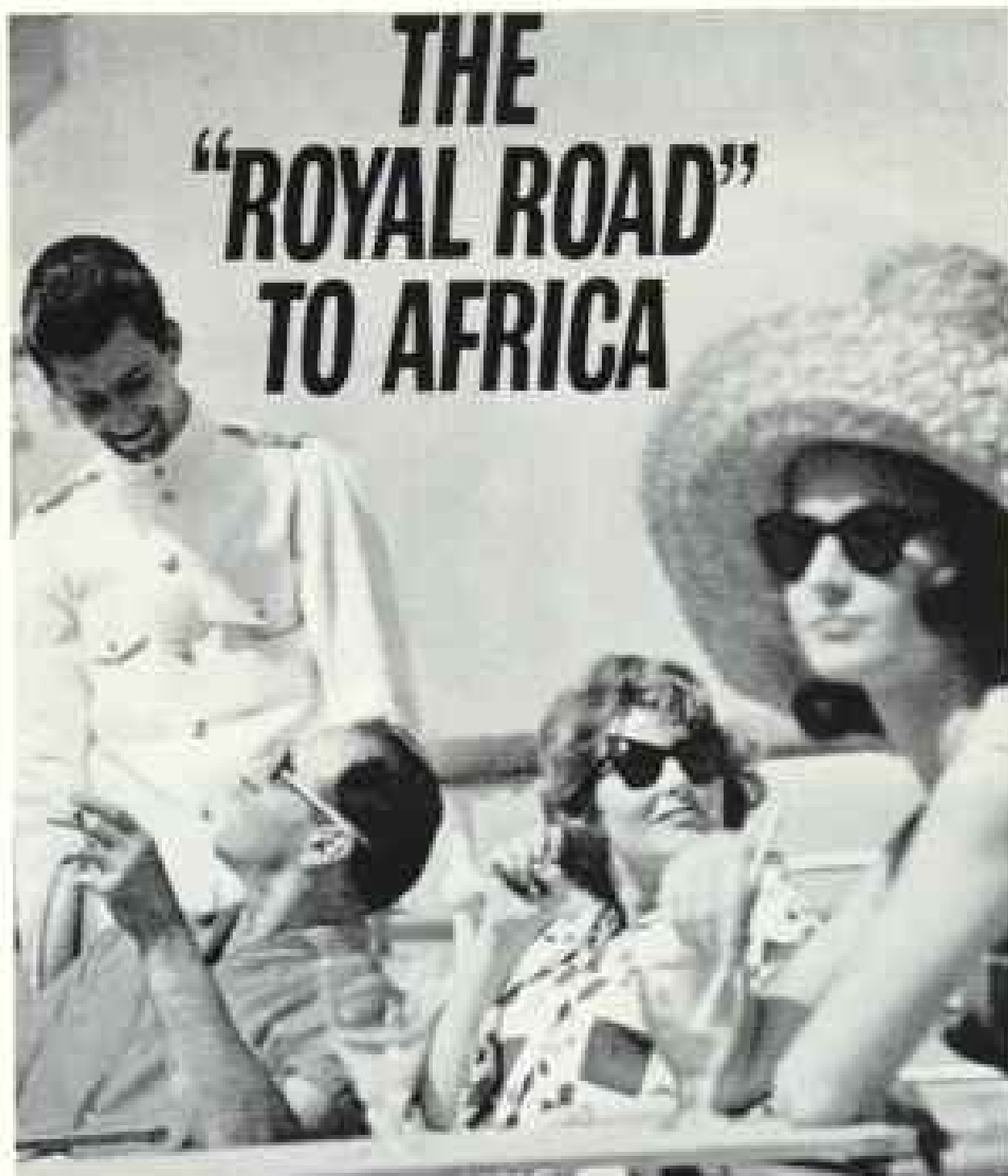
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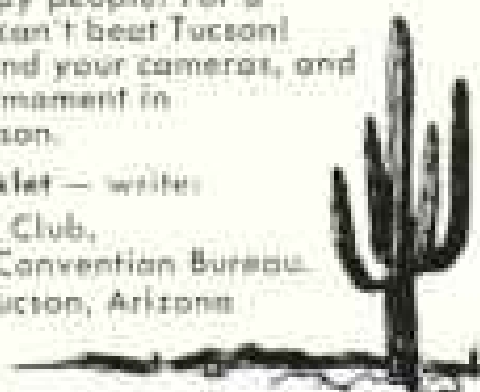
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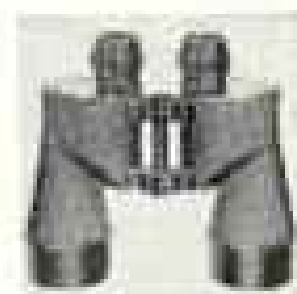
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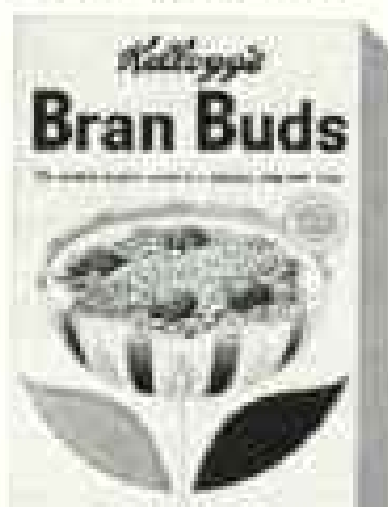
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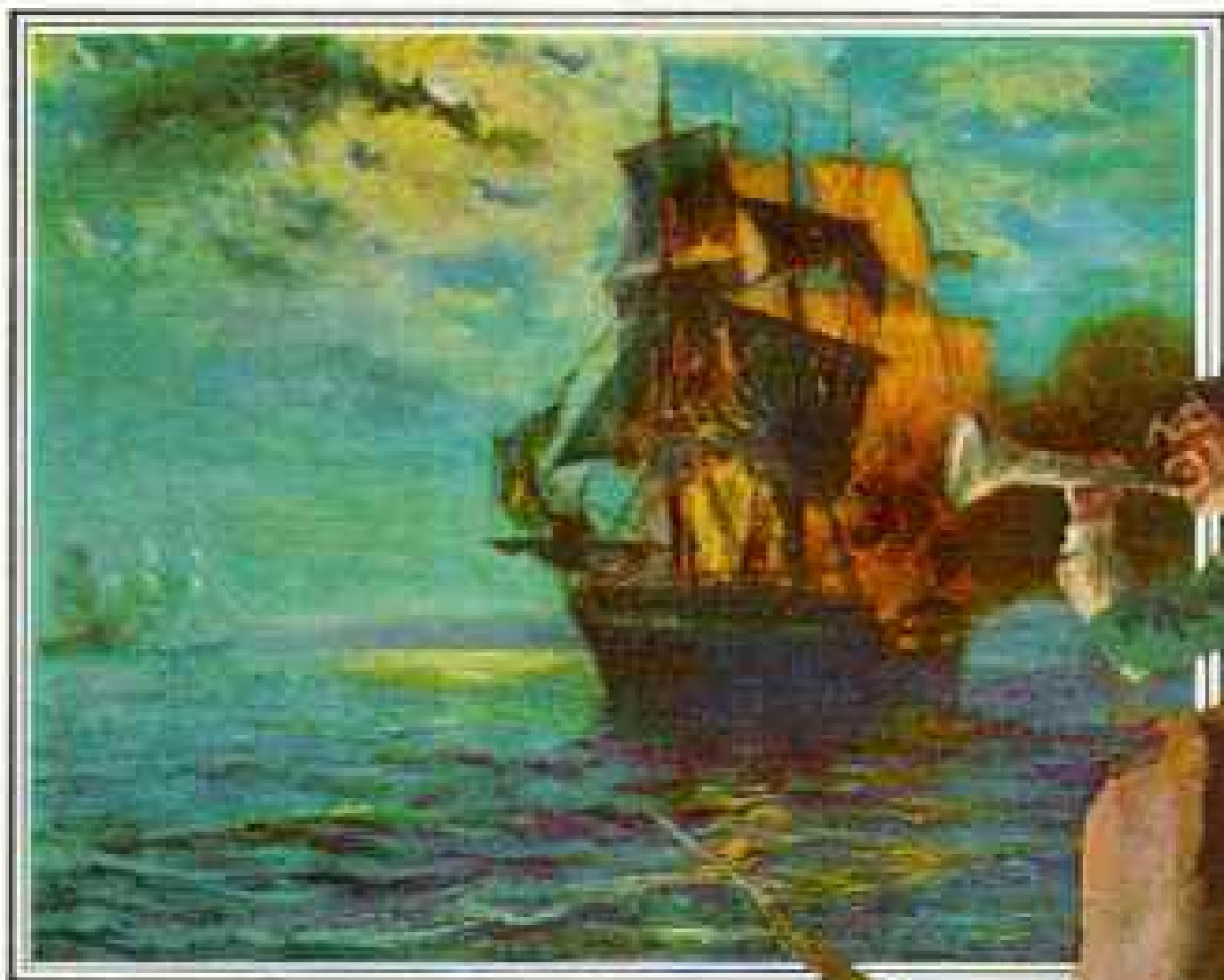
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